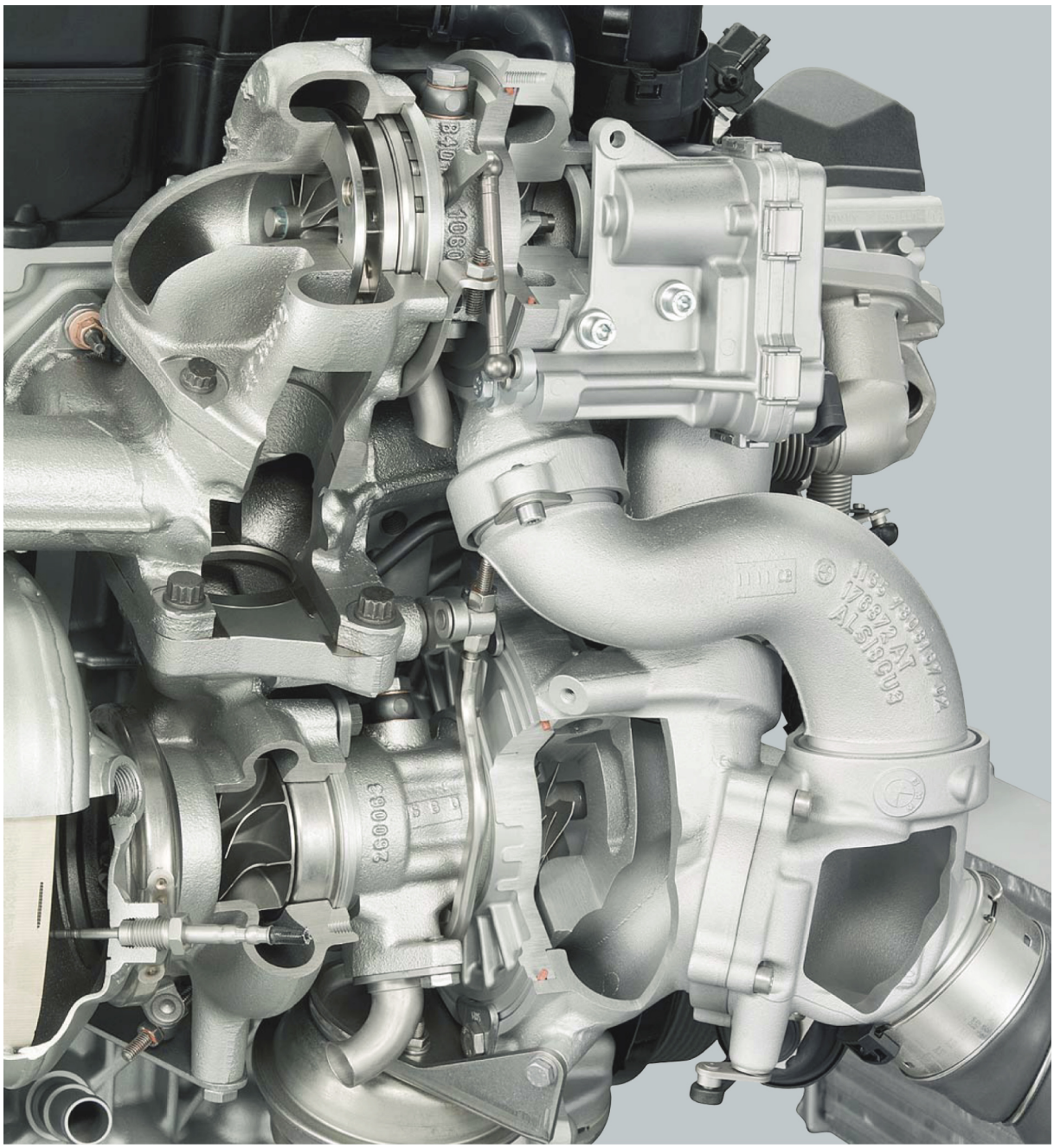
Technical training.
Product information.

N57 TOP engine.



BMW Service

General notes

Symbols used

The following symbol / representation is used in this document to facilitate better comprehension and to draw attention to particularly important information:

Contains important safety information as well as information that is necessary to ensure smooth system function and must be adhered to.

Information status and national variants

Vehicles of the BMW Group conform to the highest safety and quality standards. Changed requirements in the areas of environmental protection, customer benefits and design lead to continuous enhancement of systems and components. Consequently, this may result in deviations between the content of this document and the vehicles available in the training course.

As a general principle, this document relates to left-hand drive vehicles with European specifications. Some controls or components in right-hand drive vehicles are arranged in different positions to those shown on the graphics in this document. Further differences may arise as the result of the equipment variants used in specific markets or countries.

Additional sources of information

Further information on the individual topics can be found in the following sources of information:

- the Owner's Handbook
- the Integrated Service Technical Application.

Contact: conceptinfo@bmw.de

The information contained in this document is part of the technical training of the BMW Group and is intended for trainers and participants. Refer to the latest information systems of the BMW Group for any changes/supplements to the technical data.

Status of the information: **July 2009**
VH-23/International Technical Training

N57 TOP engine.

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N57 TOP engine.

1. Introduction.

1.1. Multi-stage turbocharging with VNT exhaust turbocharger

1.1.1. General

This Product Information is designed to provide you with information on the structure and function of the N57 TOP engine. This Product Information is designed as a work of reference and complements the seminar material prepared by BMW Aftersales Training. The Product Information is also suitable for studies on your own. The Product Information provides insight into the new N57 TOP 6-cylinder diesel engine. Technical and practical prior knowledge of the current BMW diesel engines will make it easier to understand the systems and functions presented here.

1.1.2. "The best in its class" N57 TOP engine

The N57 TOP engine will be deployed for the first time in 09/2009 in the 740d. The N57 TOP engine will also successively replace the M57TU2 TOP engine in the other model series. The basis for the N57 TOP engine is the N57 engine. The decisive difference between the N57 engine and the N57 TOP engine is in the multi-stage turbocharging. This means that the high-pressure stage is implemented for the first time by means of a VNT exhaust turbocharger. As in the case of the M57TU2 TOP engine, two different sizes of exhaust turbocharger are placed in succession. This resolves the conflict of objectives between response characteristics and utilisation of power output.

1.1.3. Technical data

	Unit	M67D44O1 (E65/745d)	M57D30T2 (E64/635d)	N57D30T0 (F01/740d)
Type / V angle		V8 / 90°	R6	R6
Displacement	[cm³]	4423	2993	2993
Bore / stroke	[mm]	87.0/93.0	84.0/90.0	84.0/90.0
Power output at speed	[kW / bhp] [rpm]	242/330 3800	210/286 4400	225/306 4400
Power output per litre	[kW / l]	54.71	70.16	75.18
Torque at speed	[Nm] [rpm]	750 1900 - 2500	580 1750 - 2250	600 1500 - 2500
Cutoff speed	[rpm]	4800	5000	5600
Compression ratio	[ε]	17.0	17.0	16.5
Valves per cylinder		4	4	4
Combustion chamber peak pressure	[bar]	170	180	180
Fuel consumption complying with EU	[l / 100 km]	9.0	7.2	6.9
CO_2 emissions	[g / km]	239	190	181

N57 TOP engine.
1. Introduction.

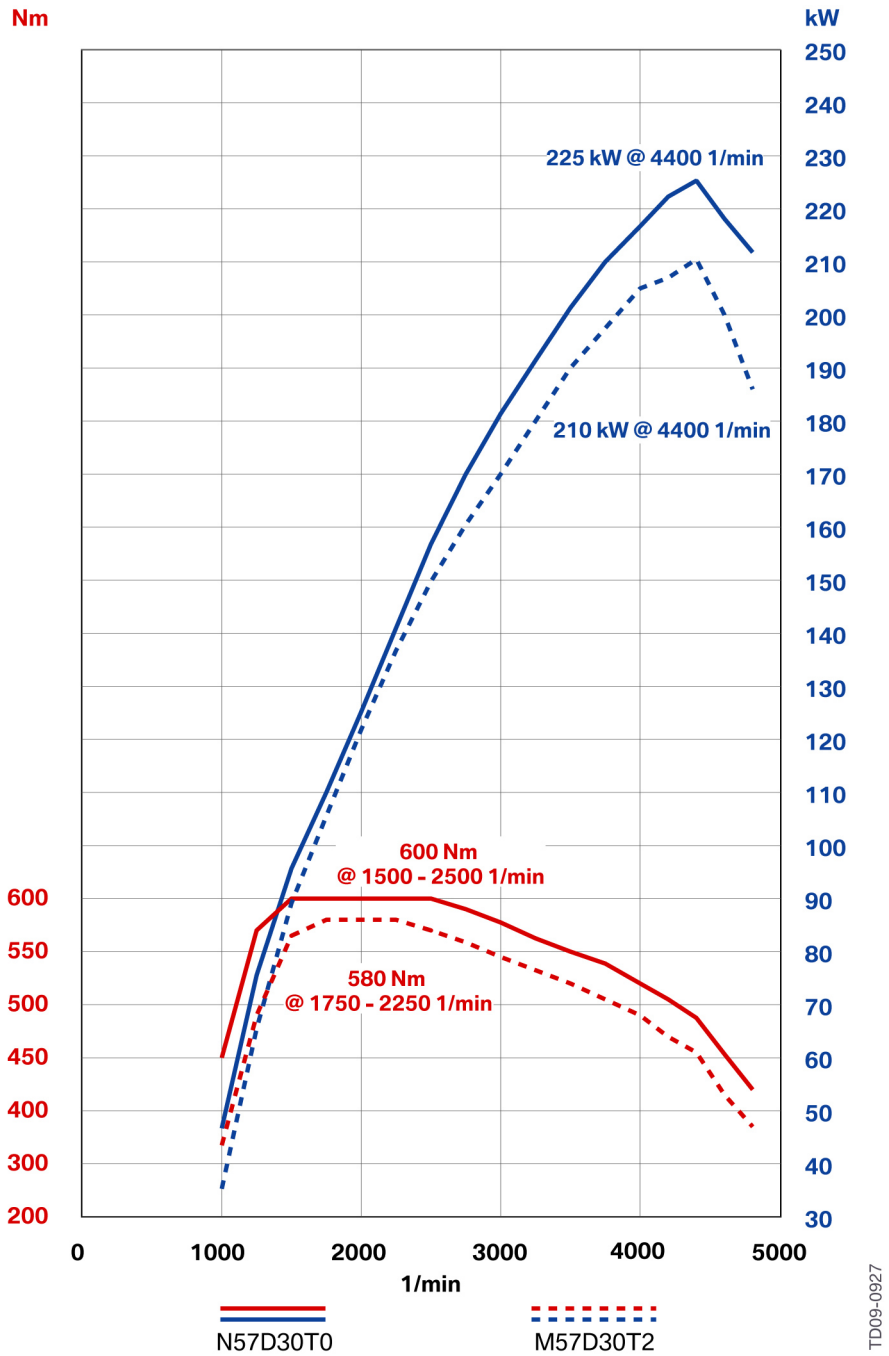
	Unit	M67D44O1 (E65/745d)	M57D30T2 (E64/635d)	N57D30T0 (F01/740d)
Digital diesel electronics		DDE6.3	DDE6.2.6	DDE7.3
Exhaust emission legislation EURO		EURO 4	EURO 4	EURO 5
Engine oil specification			BMW Longlife-01 BMW Longlife-01 FE BMW Longlife-04	
Maximum speed	[km/h]	250*	250*	250*
Acceleration 0 – 100 km/h	[s]	6.6	6.6	6.3
Vehicle kerb weight DIN/EU	[kg]	2040/2115	1860/1935	1875/1950
* = Electronically regulated				

1.1.4. Full load diagram

In comparison with the M57 TOP engine, the N57 TOP engine features significantly higher overall power output and a more rounded torque curve.

N57 TOP engine.

1. Introduction.



Full-load diagram N57 TOP engine (N57D30T0) in comparison with M57 TOP engine (M57D30T2)

1.2. New features, changes and special features

The following table provides an overview of the changes to the N57D30O0 engine and/or M57D30T2 engine. Here, a distinction is made as whether a new component is involved or whether a component or system has been adapted. The following document describes exclusively the major changes of the N57D30T0 engine to the N57D30O0 engine and M57D30T2 engine.

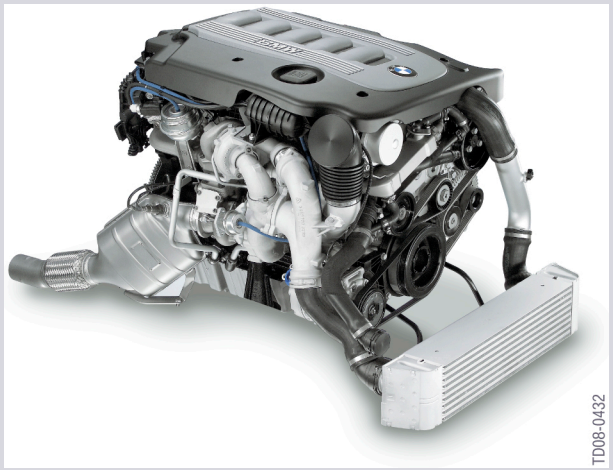
N57 TOP engine.
1. Introduction.

Assembly	Component	New development	Identical in concept	Comment
Engine mechanical system • Engine housing • Crankshaft drive • Camshaft drive	Crankcase		●	Adapted for multi-stage turbocharging.
Intake air and exhaust system • Intake air system • Exhaust system	Charge air cooling	●		Efficiency of intercooler has been increased.
	Exhaust turbocharger	●		Multi-stage turbocharging with new and optimized VNT exhaust turbocharger.
Vacuum system • Structure	Activation of exhaust turbocharger		●	Revised, as the VNT exhaust turbocharger is electronically activated.
Engine electrical system • Vehicle electrical system connection • Functions • Sensors • Actuators	Digital Diesel Electronics (DDE)		●	Adapted on the N57 TOP engine with additional actuators.

N57 TOP engine.
2. Models.

2.1. TOP diesel engines

Engine	N47D20T0
Model series	E81 E82 E83 E84 E87
Models	123d
Power output in [kW / bhp] at [rpm]	150/204 4400
Design and number of cylinders	Row 4
Cylinder capacity in [cm³]	1995
Bore / stroke in [mm]	84/90
Compression ratio	16:1
Valves per cylinder	4
Deployment period	9/07 to date
Engine management system	DDE7.1



Engine	M57D30T1
Model series	E60 E61
Models	535d
Power output in [kW / bhp] at [rpm]	200/272 4400
Design and number of cylinders	Row 6
Cylinder capacity in [cm³]	2993
Bore / stroke in [mm]	84/90
Compression ratio	16.5:1
Valves per cylinder	4
Deployment period	9/04 - 3/07
Engine management system	DDE606

N57 TOP engine.
2. Models.

Engine	M57D30T2
Model series	E60 E61 E63 E64 E83 E70 E71 E90 E91 E92
Models	335d 535d 635d X3 3.0sd X3 xDrive35d X5 3.0sd X5 xDrive35d X6 xDrive35d
Power output in [kW / bhp] at [rpm]	210/286 1750 - 2250
Design and number of cylinders	Row 6
Cylinder capacity in [cm³]	2993
Bore / stroke in [mm]	84/90
Compression ratio	17:1
Valves per cylinder	4
Deployment period	9/06 to date
Engine management system	DDE626

N57 TOP engine.

3. Engine mechanical system.

3.1. Engine designation and engine identification

3.1.1. Engine identification

In the technical documentation, the engine designation is used to ensure unambiguous identification of the engine.

The technical documentation also contains the short form of the engine designation N57, which only indicates the engine type.

Item	Meaning	Index / explanation
1	Engine developer	M, N = BMW Group P = BMW Motorsport S = BMW M GmbH W = non-BMW engines
2	Engine type	1 = R4 (e.g. N12) 4 = R4 (e.g. N47) 5 = R6 (e.g. N57) 6 = V8 (e.g. M67) 7 = V12 (e.g. N73) 8 = V10 (e.g. S85)
3	Change to the basic engine concept	0 = basic engine 1 to 9 = changes, e.g. combustion process
4	Working method or fuel type and possibly installation position	B = petrol, longitudinal installation D = diesel, longitudinal installation H = hydrogen
5	Displacement in litres	1 = 1 litre +
6	Displacement in 1/10 litre	8 = 0.8 litres = 1.8 litres
7	Performance class	K = Smallest U = Lower M = Middle O = Upper (standard) T = Top S = Super
8	Revision relevant to approval	0 = New development 1 – 9 = Revision

Explanation of the N57 TOP engine designation

Index	Explanation
N	BMW Group Development
5	6-cylinder in-line engine
7	Direct fuel injection and exhaust turbocharger
D	Diesel engine, longitudinal installation

N57 TOP engine.
3. Engine mechanical system.

Index	Explanation
30	3.0 litres cylinder capacity
T	TOP performance class
0	New development

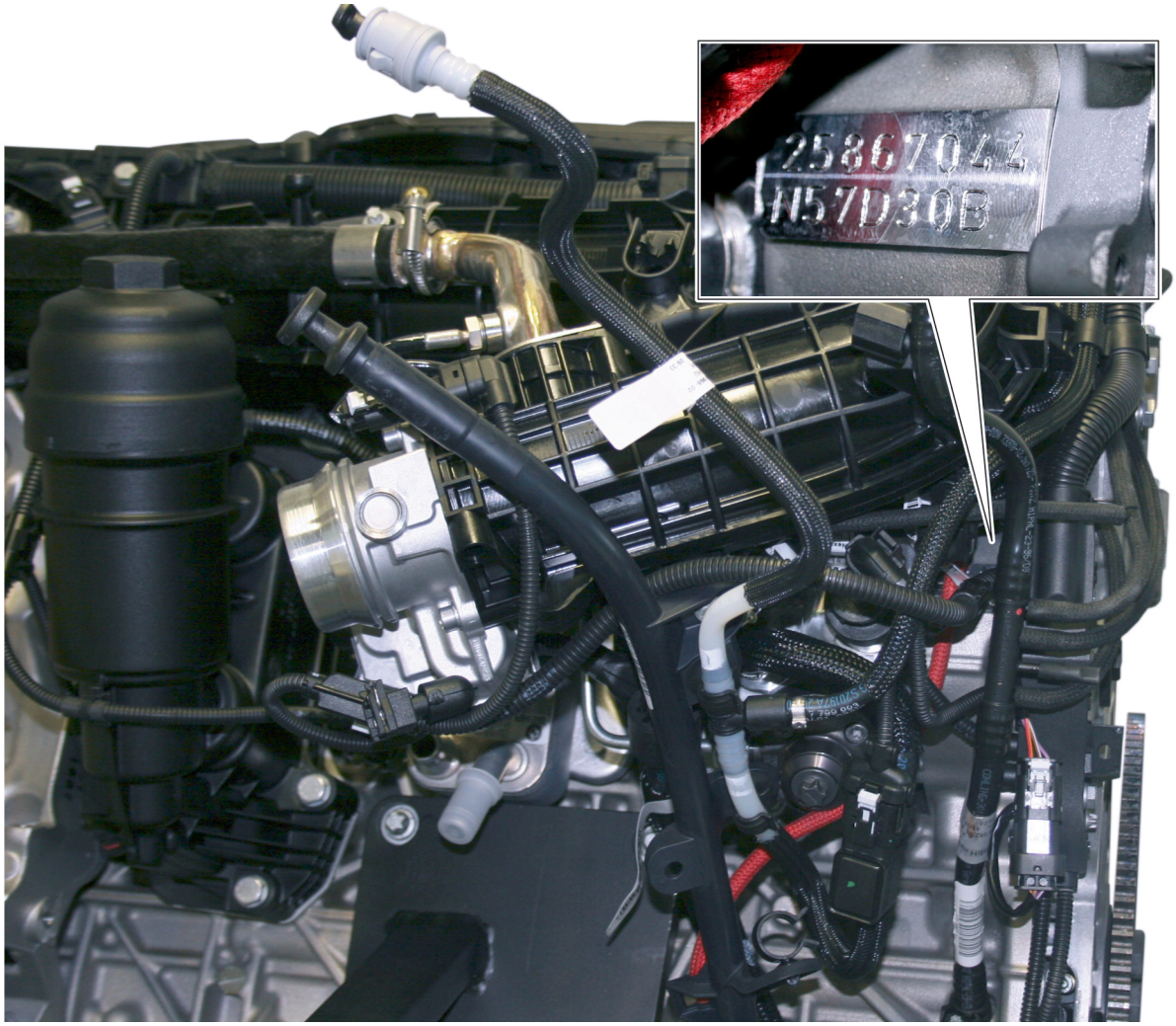
3.1.2. Engine identification

The engines have an identification mark on the crankcase to ensure unambiguous identification and classification. This engine identification is also necessary for approval by government authorities.

With the N57 TOP engine, this identification is developed and reduced from what used to be eight to seven positions. The engine number can be found on the engine below the engine identification. This consecutive number, in conjunction with the engine identification, permits unambiguous identification of each individual engine.

Item	Meaning	Index / explanation
1	Engine developer	M, N = BMW Group P = BMW Motorsport S = BMW M GmbH W = non-BMW engines
2	Engine type	1 = R4 (e.g. N12) 4 = R4 (e.g. N47) 5 = R6 (e.g. N57) 6 = V8 (e.g. M67) 7 = V12 (e.g. N73) 8 = V10 (e.g. S85)
3	Change to the basic engine concept	0 = basic engine 1 to 9 = changes, e.g. combustion process
4	Working method or fuel type and possibly installation position	B = petrol, longitudinal installation D = diesel, longitudinal installation H = hydrogen
5	Displacement in litres	1 = 1 litre +
6	Displacement in 1/10 litre	8 = 0.8 litres = 1.8 litres
7	Type test concerns (changes that require a new type test)	A = Standard B - Z = depending on requirement, e.g. RON 87

N57 TOP engine.
3. Engine mechanical system.



N57 TOP engine, engine identification and engine number

Index	Explanation
2526704	Individual consecutive engine number
N	Engine developer, BMW Group
5	Engine model, R6
7	Change to the basic engine concept, direct fuel injection and turbocharging
D	Working method or fuel type and possibly installation position, diesel, longitudinal installation
30	Cylinder capacity in 1/10 litre, 3 litres
B	TOP engine

N57 TOP engine.

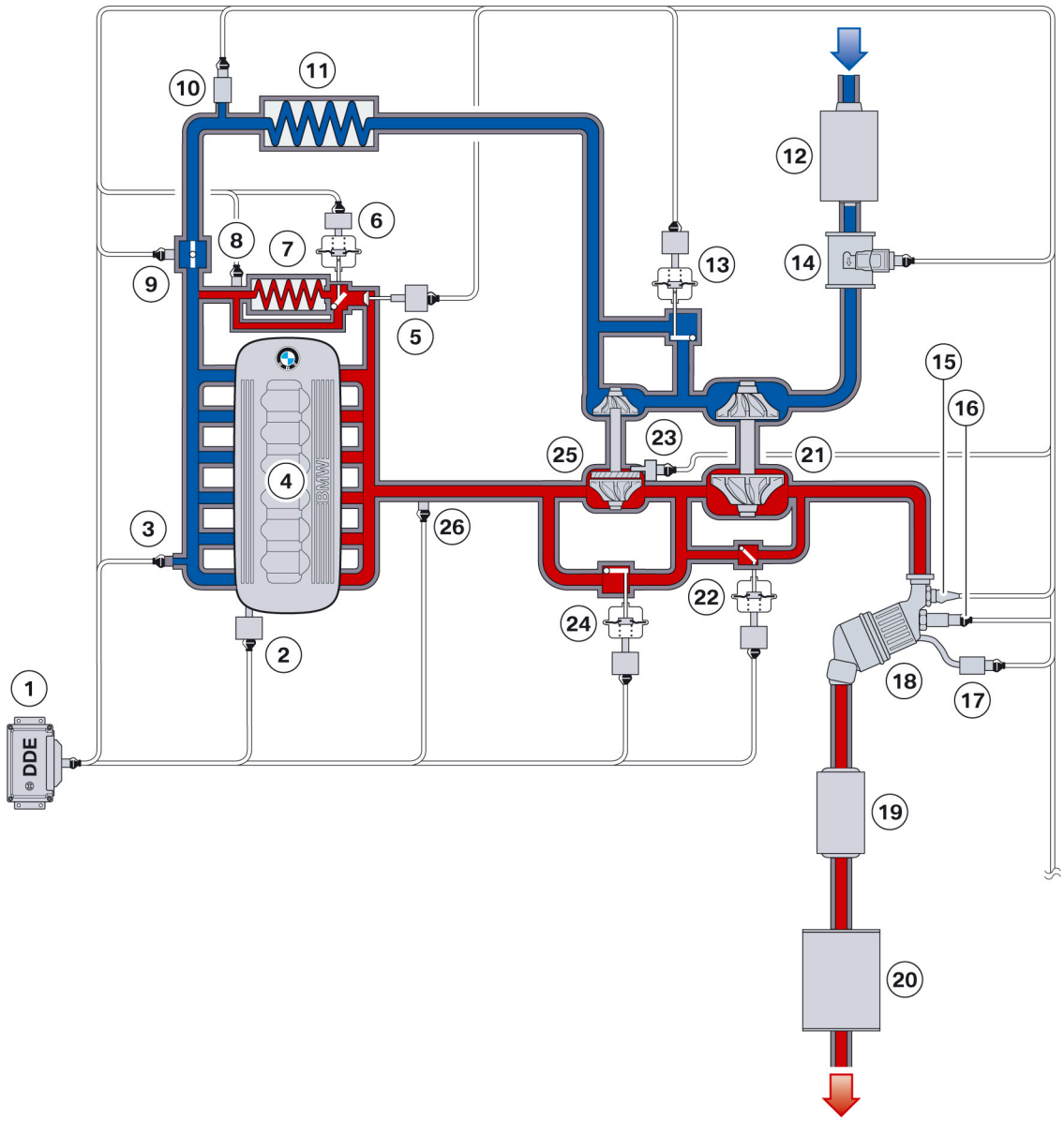
4. Intake air and exhaust system.

The N57 TOP engine is equipped with two-stage turbocharging, already familiar from the N47 TOP engine and M57 TOP engines. This unit has been optimised with regard to flow properties and the space requirement. A worldwide innovation is that the high-pressure stage (small exhaust turbocharger) is designed as a VNT exhaust turbocharger. The rest of the intake air and exhaust system corresponds to that in the N57D30O0 engine for the most part. One difference in the exhaust system in comparison with the N57 engine is that silencers are used. Here, the vehicles with each engine are equipped differently, as shown in the following table. The illustration on the following page shows an overview of the intake air and exhaust system of the N57 TOP engine.

	N57 engine	N57 TOP engine
Front silencer	●	
Centre silencer	●	●
Rear silencer		●

N57 TOP engine.

4. Intake air and exhaust system.



Intake air and exhaust system, N57 TOP engine

Index	Explanation
1	Digital Diesel Electronics DDE
2	Swirl-flap actuator
3	Charge-air pressure sensor
4	N57 TOP engine
5	EGR valve with position sensor
6	Bypass flap
7	EGR cooler

N57 TOP engine.
4. Intake air and exhaust system.

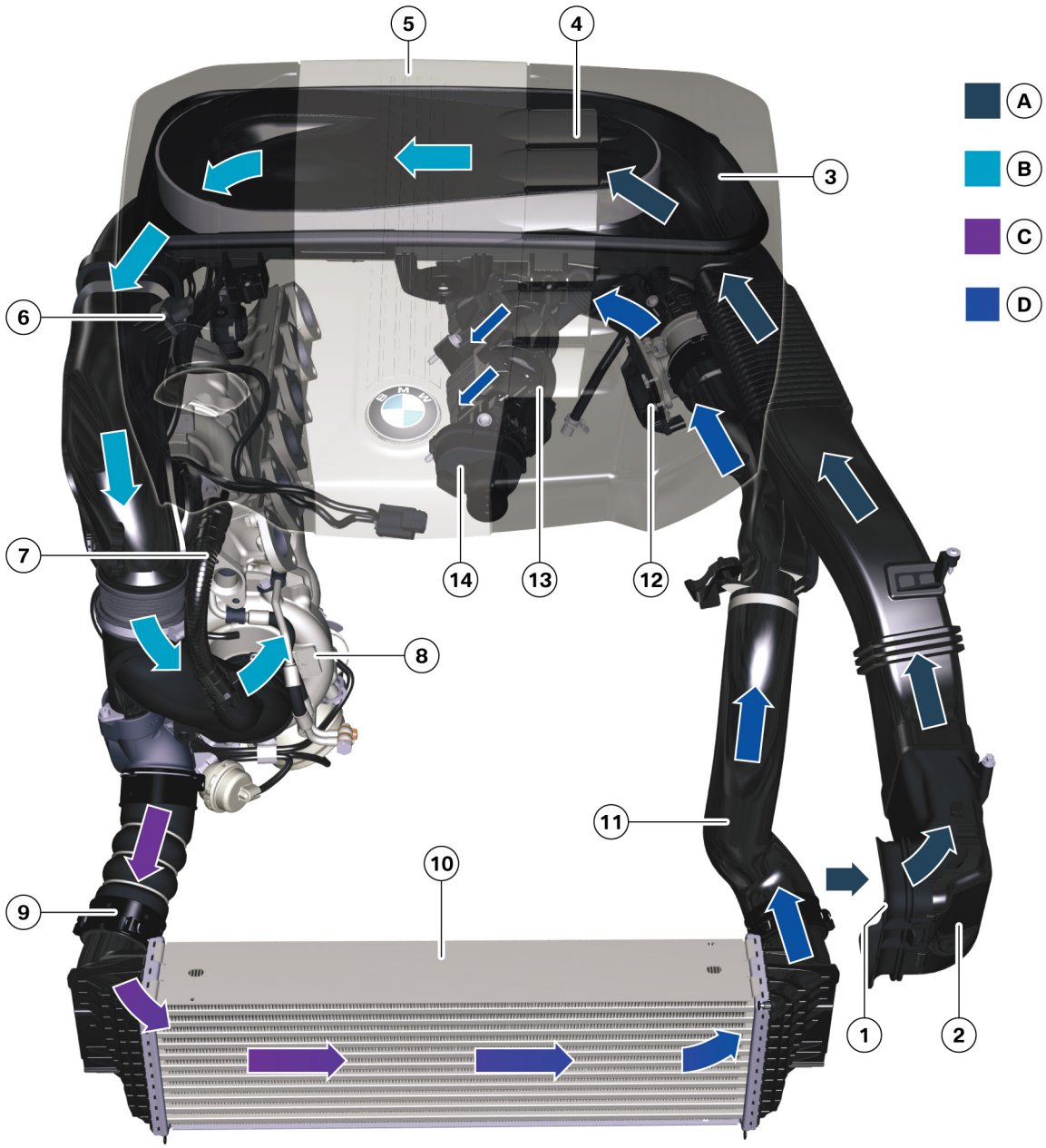
Index	Explanation
8	EGR temperature sensor
9	Throttle valve
10	Charge-air temperature sensor
11	Intercooler
12	Intake silencer
13	Bypass plate
14	Hot-film air-mass sensor
15	Exhaust gas temperature sensor
16	Lambda oxygen sensor
17	Exhaust backpressure sensor
18	Oxidation catalytic converter and diesel particle filter
19	Centre silencer
20	Rear silencer
21	Low-pressure stage
22	Wastegate valve
23	Actuator drive (VNT)
24	Turbine control flap
25	High-pressure stage
26	Exhaust backpressure sensor before exhaust turbocharger

N57 TOP engine.

4. Intake air and exhaust system.

4.1. Intake air system

4.1.1. System overview



Intake air system, N57 TOP engine

N57 TOP engine.
4. Intake air and exhaust system.

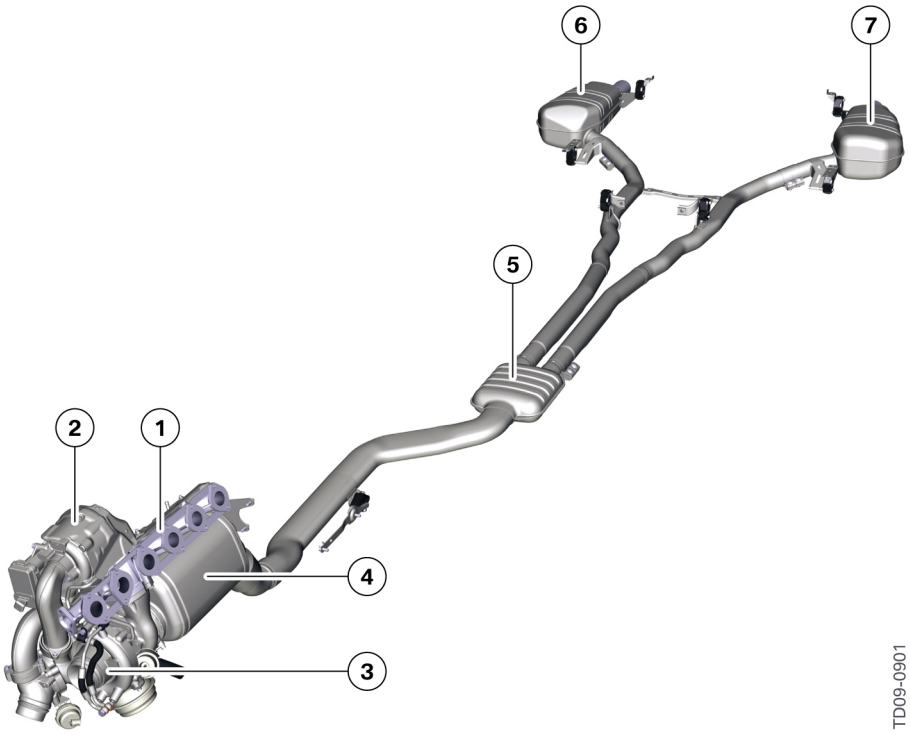
Index	Explanation
A	Fresh air
B	Purified air
C	Heated charge air
D	Cooled charge air
1	Rough screen / suction pipe
2	Intake neck
3	Fresh air area, intake silencer
4	Filter element
5	Cover, intake silencer
6	Hot-film air-mass sensor
7	Connection for blow-by gases
8	Exhaust turbocharger
9	Charge air pipe
10	Intercooler
11	Charge air pipe
12	Throttle valve
13	Intake air collector
14	Swirl-flap actuator

N57 TOP engine.

4. Intake air and exhaust system.

4.2. Exhaust system

4.2.1. System overview



Exhaust system, N57 TOP engine

Index	Explanation
1	Exhaust manifold
2	Exhaust turbocharger, high-pressure stage
3	Exhaust turbocharger, low-pressure stage
4	Catalytic converter and particle filter
5	Centre silencer
6	Rear silencer, right
7	Rear silencer, left

4.3. Exhaust turbocharger

4.3.1. Operating characteristics

The operating characteristics of an exhaust turbocharger are described in a characteristic map. The pressure ratio is indicated via the volumetric flow. The usable characteristic-map range of the exhaust turbocharger is limited by:

- the pump limit
- the choke limit
- the maximum permitted exhaust turbocharger speed.

Pump limit

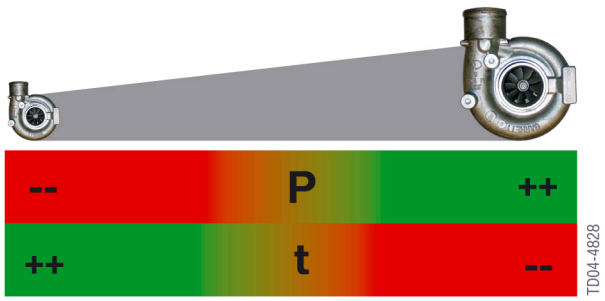
If the volumetric flows are too low and the pressure ratios too high, the flow separates from the compressor blades. This interrupts the delivery procedure. The partial vacuum on the intake side means that the air flow backwards through the compressor until a stable pressure ratio is re-established and the air once again flows forwards. The pressure builds up again. The operation repeats itself in rapid succession. The noise that is generated is where the term ”pumping” comes from.

Choke limit

The maximum volumetric flow of the exhaust turbocharger is limited by the cross section at the compressor entry point. Even with the speed rising to any degree, the flow rate cannot be increased beyond a certain value. This value is reached when the air in the wheel entry point reaches the speed of sound.

4.3.2. Multi-stage turbocharging

As a result of the operating characteristics described above, the configuration of an exhaust turbocharger always means a conflict of objectives. A small exhaust turbocharger responds quickly and ensures rounded torque even at low speeds. However, its utilisation of the power output is limited, as it reaches the pump and choke limit at an early stage. Although it can generate high pressures, its size means the volumetric flow is limited. A large exhaust turbocharger is able to generate high power output at high speeds. However, it responds sluggishly and does no achieve high charge-air pressure at low speeds. One solution to resolve this conflict of objectives is the so-called variable turbine geometry (or Variable Nozzle Turbine, VNT) that is used in most BMW diesel engines. Adjusting the guide vanes of the turbine wheel adapts the flow cross section to the engine operating point. However, this system also has its limits, which means that it is not possible to cover the entire operating range of the engine. The optimum would be two exhaust turbochargers: a small one for rapid response characteristics and a large one for maximum utilisation of power output.



Advantages of two-stage turbocharging

Index	Explanation
P	Engine output
t	Response characteristics

N57 TOP engine.
4. Intake air and exhaust system.

This is precisely what is achieved by the BMW TOP diesel engines. Two inline exhaust turbochargers are used. A small exhaust turbocharger forms the high-pressure stage; a larger exhaust turbocharger forms the low-pressure stage. What is new is that the exhaust turbocharger for the high-pressure stage is designed for the first time as a VNT exhaust turbocharger. The low-pressure stage has a rigid turbine geometry without adjustable guide vanes.

Engine	Charge-air pressure (absolute) [bar]
N57 TOP	3.05
N57	2.65
N47 TOP	3.0
M57TU TOP	2.85
M57TU2 TOP	2.98

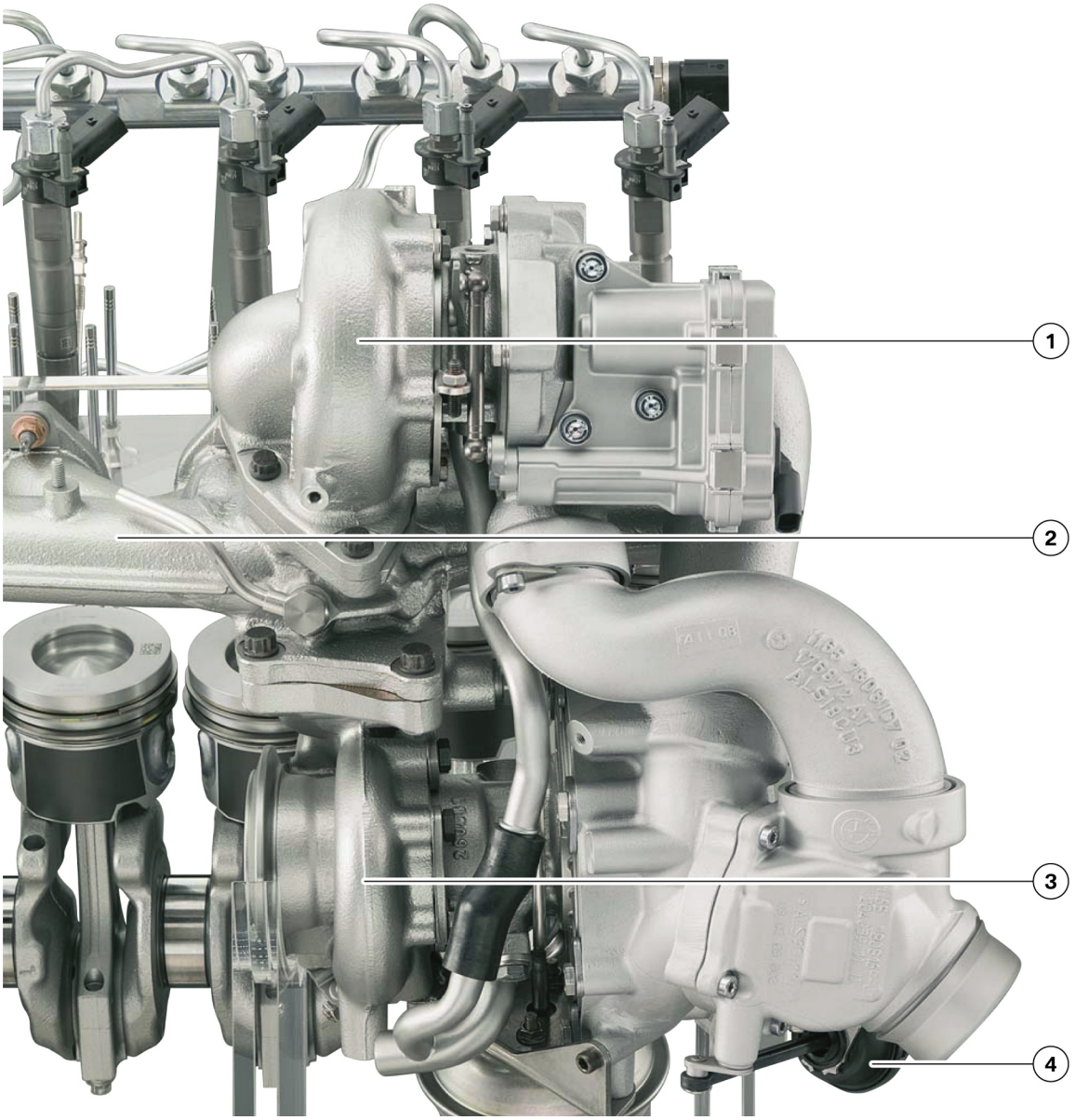
Various combinations of the two exhaust turbochargers are possible. This optimises the entire operating range. The interplay is enabled by various flaps and the VNT.
These are:

- Turbine control flap (on exhaust gas side)
- Bypass plate (on air side)
- Wastegate valve (on exhaust gas side)
- VNT (on exhaust gas side).

N57 TOP engine.

4. Intake air and exhaust system.

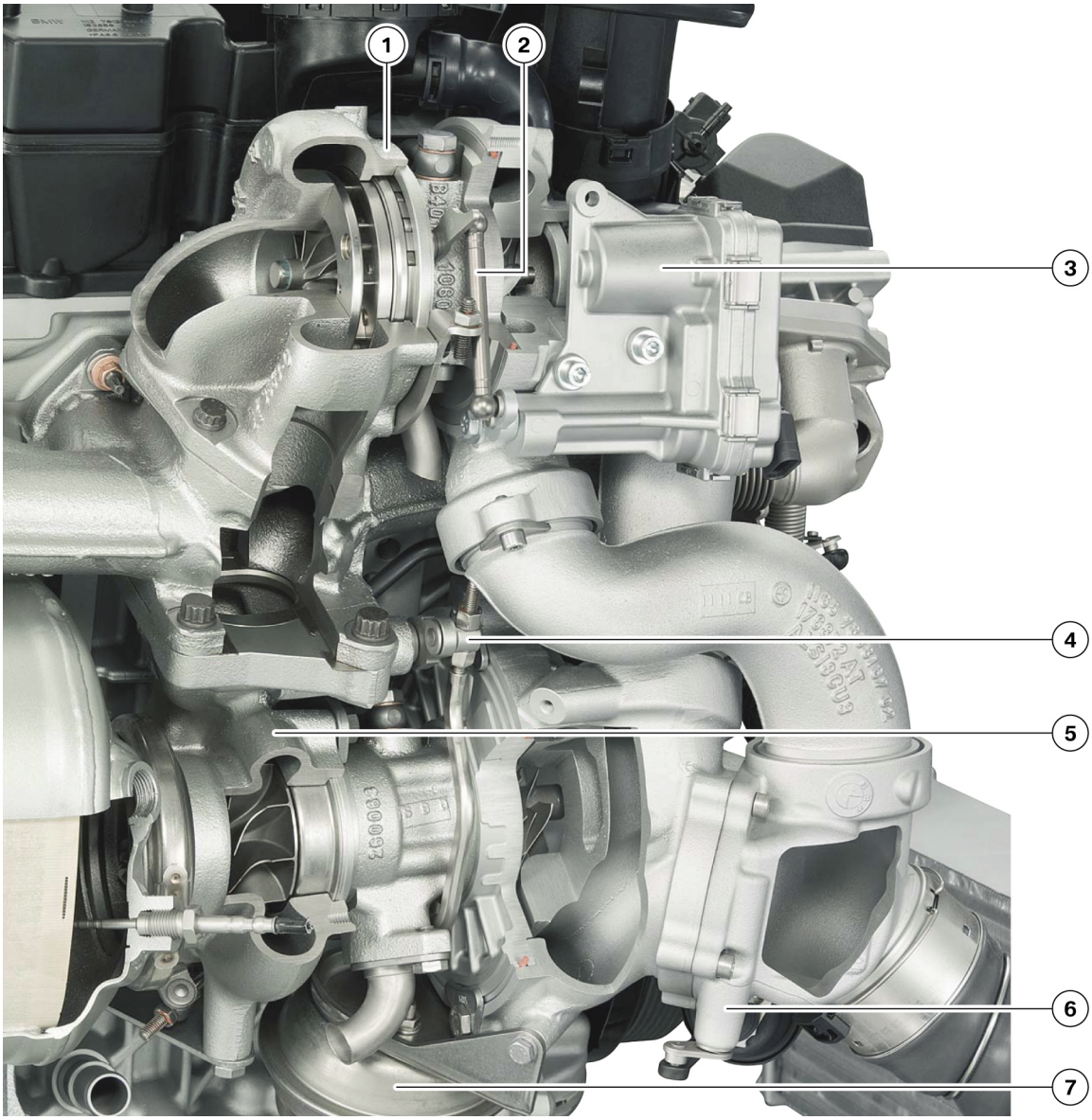
Overview



N57 TOP engine multi-stage turbocharging

Index	Explanation
1	High-pressure stage (VNT exhaust turbocharger)
2	Exhaust manifold
3	Low-pressure stage
4	Bypass plate

N57 TOP engine.
4. Intake air and exhaust system.



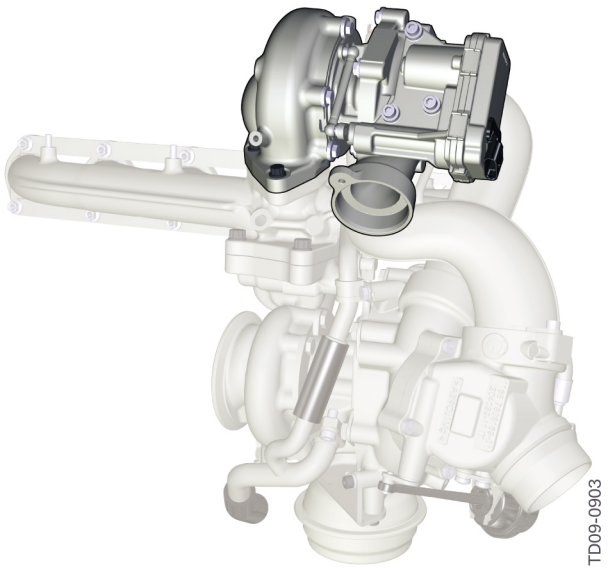
N57 TOP engine multi-stage turbocharging

Index	Explanation
1	High-pressure stage (VNT exhaust turbocharger)
2	Control rack
3	Actuator drive
4	Control rack, turbine control flap
5	Low-pressure stage
6	Bypass plate
7	Partial-vacuum canister, turbine control flap

N57 TOP engine.
4. Intake air and exhaust system.

High-pressure stage

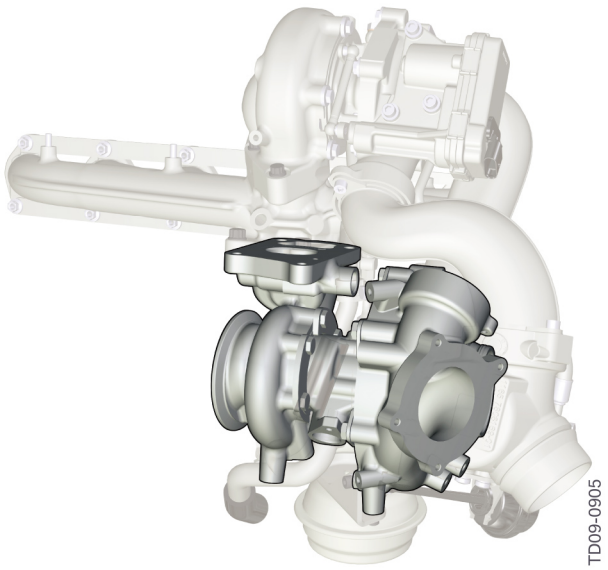
The high-pressure stage is the smaller of the two exhaust turbochargers. It is bolted onto the exhaust manifold with a triple bolt connection two V-ring seals. The high-pressure stage is no connected to any flaps. An oil supply and oil return line ensure the necessary lubrication and cooling of the mounts in the bearing housing. A VNT exhaust turbocharger is used. The expression VTG - Variable Turbine Geometry - is also used here.



High-pressure stage

Low-pressure stage

The large exhaust turbocharger accommodates the turbine control flap and wastegate valve. It is attached to the exhaust manifold and is also supported by the crankcase. The low-pressure stage also has a separate oil supply for the mount / bearing system.

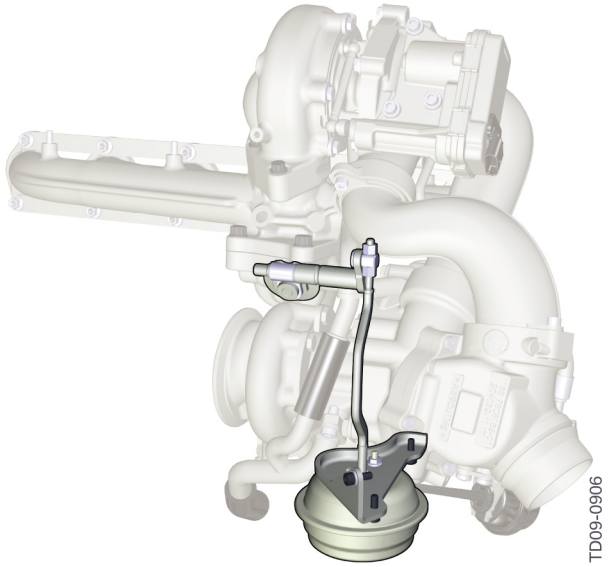


Low-pressure stage

N57 TOP engine.
4. Intake air and exhaust system.

Turbine control flap

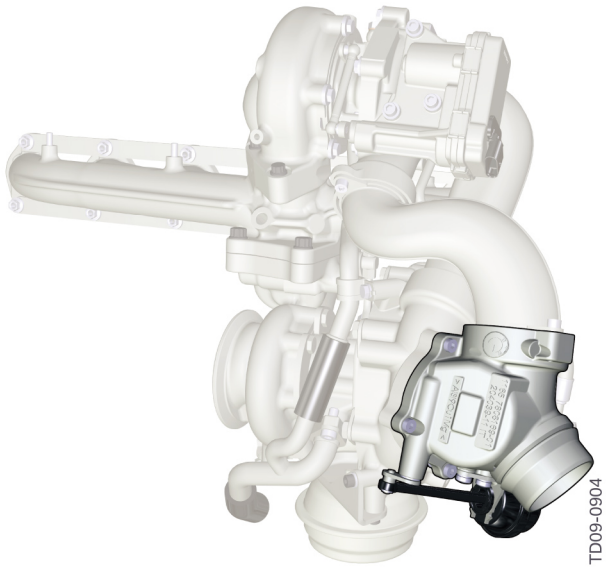
The turbine control flap on exhaust gas side opens the flow port to the low-pressure stage, thus reducing the flow of exhaust gas past the high-pressure stage. It is operated pneumatically by a partial-vacuum canister and can be adjusted variably. A partial vacuum is applied to the partial-vacuum canister is by an electropneumatic pressure converter (EPDW) which then closes.



Turbine control flap

Bypass plate

The bypass plate on air side enables the high-pressure stage to be bypassed. It is operated pneumatically by a partial-vacuum canister. The bypass plate is either fully opened or fully closed. An electric changeover valve applies a partial vacuum to the partial-vacuum canister which then opens.

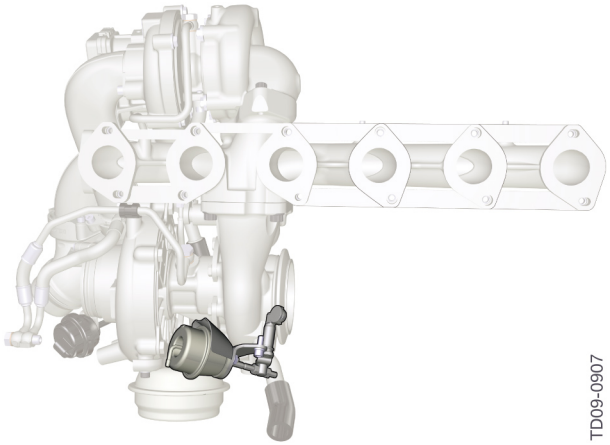


Bypass plate

N57 TOP engine.
4. Intake air and exhaust system.

Wastegate valve

When the rated engine output is reached, the wastegate valve is opened to prevent excessively high charging and turbine pressures. A portion of the exhaust gas is fed via the wastegate valve to the turbines of the low-pressure stage. It is operated pneumatically by a partial-vacuum canister. The wastegate valve can be adjusted variably. A partial vacuum is applied to the partial-vacuum canister is by an electropneumatic pressure converter (EPDW) which then opens. The function of the wastegate valve is implemented by a flap.

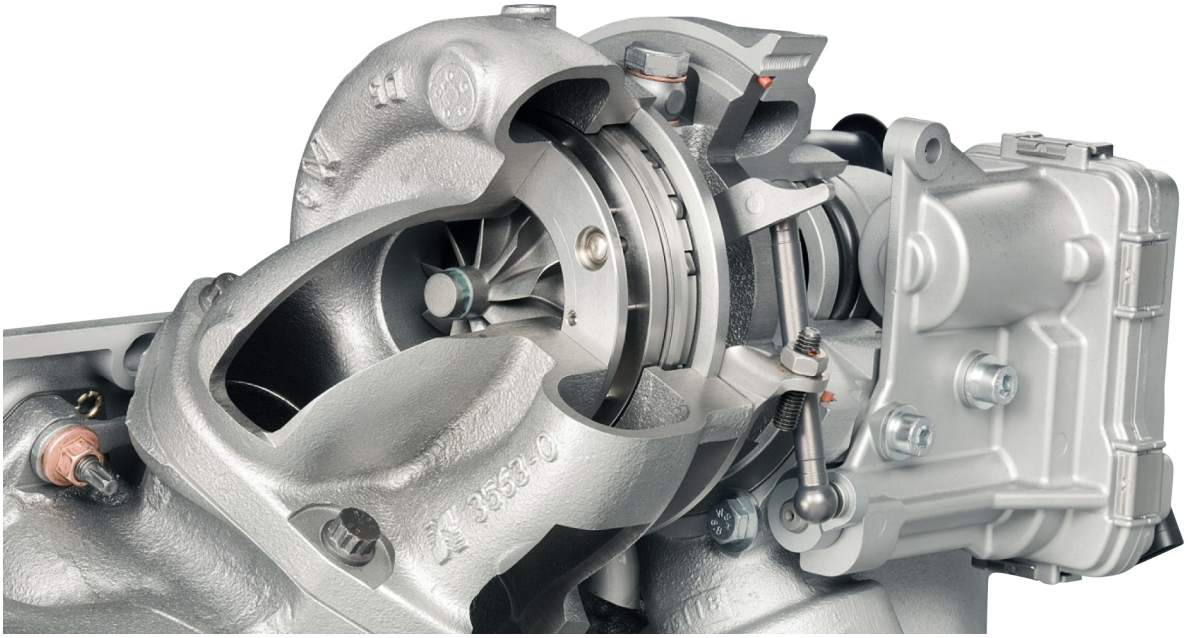


Wastegate valve

Actuator drive (VNT)

The VNT exhaust turbocharger enables regulation that particularly well in line with requirements, as the operating principle with the variable turbine geometry of the high-pressure stage enables even better and more precise regulation. The VNT exhaust turbocharger for the high-pressure stage in combination for two-stage charging is a worldwide innovation. The VNT exhaust turbocharger responds even at low engine speeds and can be adapted to the exhaust flow by adjusting the guide vanes. The entire exhaust gas energy can be used until it is taken over by the low-pressure stage.

N57 TOP engine.
4. Intake air and exhaust system.



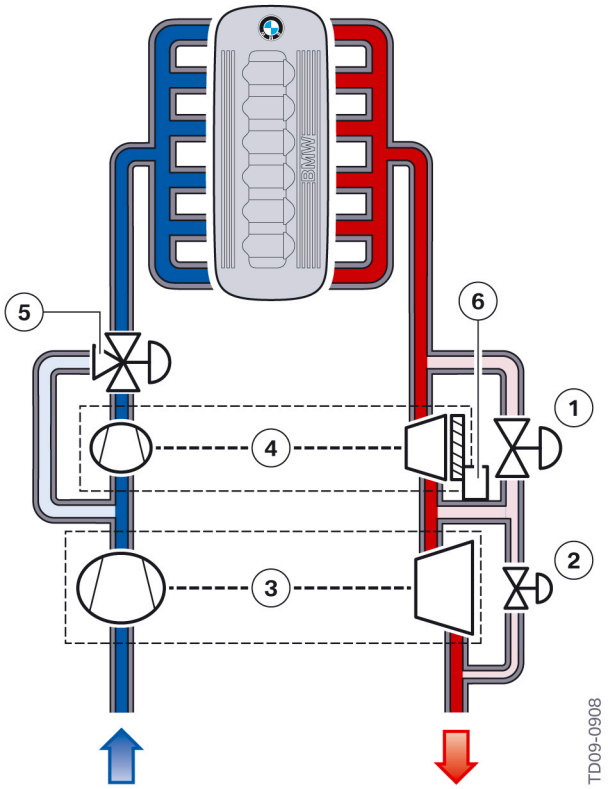
N57 TOP engine high-pressure stage (VNT exhaust turbocharger with actuator drive)

4.3.3. Switching points

For optimal charging over the entire operating range of the engine, the flaps are controlled by the DDE. The switching points are stored in a characteristic map that comprises above all the engine speed and load. There is a flowing transition between the switching points. A hysteresis also ensures that there is no nervous switching back and forth at the switching points. The (greatly simplified) diagrams show the different switch positions of the multi-stage turbocharging at full load.

N57 TOP engine.

4. Intake air and exhaust system.

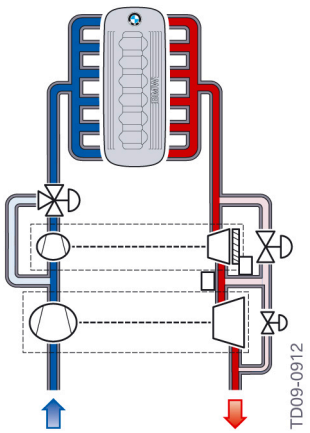
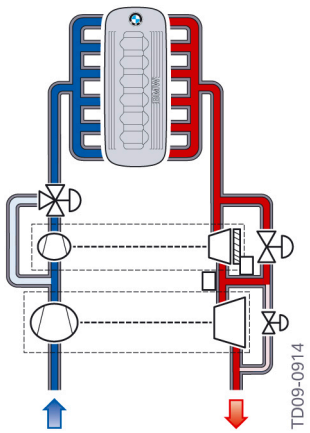


Simplified diagram of turbocharger system, N57 TOP engine

Index	Explanation
1	Turbine control flap
2	Wastegate valve
3	Low-pressure stage
4	High-pressure stage
5	Bypass plate
6	Actuator drive (VNT)

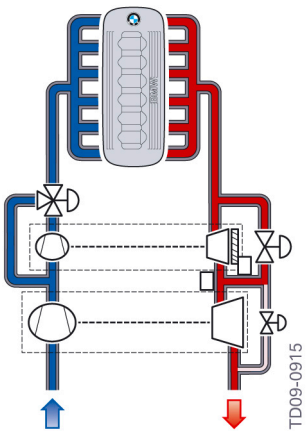
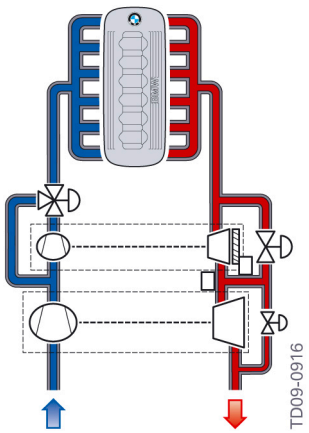
N57 TOP engine.

4. Intake air and exhaust system.

	Lower engine speed range (up to 1500 rpm)	Middle engine speed range (1500 to 3000 rpm)
Flap position	• VNT guide vanes are opened continuously • Turbine control flap closed • Bypass plate closed • Wastegate valve closed.	• VNT guide vanes are opened continuously • Turbine control flap opens continuously with increasing engine speed • Bypass plate closed • Wastegate valve closed.
Description of the charging	The exhaust flow is fed via the turbine wheels of the high-pressure stage and low-pressure stage. At this low speed, it is above all the high-pressure stage that is working; it charges the engine. With rising speed, the guide vanes are adjusted to optimise regulation of the charge-air pressure. The low-pressure stage idles at this time.	With rising speed, the high-pressure stage is bypassed to an increasingly by the exhaust flow. In this engine speed range, both stages charge the engine. The higher the speed, the greater the proportion handled by the low-pressure stage.
Operating characteristics of the exhaust turbocharger	The high-pressure stage works here in its optimal operating range.	Here, the high-pressure stage reaches the pump limit. The turbine control flap also functions like a wastegate valve for the high-pressure stage. However, the exhaust gas that is fed past is not lost, as it is fed back into the normal exhaust flow before the low-pressure stage.
Diagram		

N57 TOP engine.

4. Intake air and exhaust system.

	Upper engine speed range (3000 to 4000 rpm)	Rated speed range (as of 4000 rpm)
Flap position	• VNT guide vanes completely opened • Turbine control flap opened • Bypass plate opened • Wastegate valve closed.	• VNT guide vanes completely opened • Turbine control flap opened • Bypass plate opened • Wastegate valve opens with increasing engine speed.
Description of the charging	For the most part, the high-pressure stage is bypassed by the exhaust flow. The charge air is fed past the compressor of the high-pressure stage. The engine is charged exclusively by the low-pressure stage.	For the most part, the high-pressure stage is bypassed by the exhaust flow. A portion of the exhaust gas is also fed past the low-pressure stage. The charge air is still fed past the compressor of the high-pressure stage. The engine is charged exclusively by the low-pressure stage. This limits the turbine speed, and thus also the charge pressure.
Operating characteristics of the exhaust turbocharger	The high-pressure stage is at the choke limit, which is why the air is fed past it. If this were not to occur, the possible volumetric flow of the charge air would be limited. The low-pressure stage works here in its optimal operating range.	In this range, the low-pressure stage also reaches its speed limit. This is why surplus exhaust gas is fed off by the wastegate valve.
Diagram		

Emergency operation

If the vacuum system fails, spring force moves the turbocharge group to the following position:

- Turbine control flap opened
- Bypass plate closed
- Wastegate valve closed.

The corresponds to the position for the middle engine speed range (1500 to 3000 rpm), i.e. the range in which a diesel engine is normally operated. Although this contradicts the BMW strategy of establishing the conditions for maximum power output during emergency operation, it makes good sense in this case, as the vehicle remains in a state in which it is much easier to drive. Another reason is to ensure speed limitation for the high-pressure stage. A position for maximum power output would lead to overspeed in the high-pressure stage.

N57 TOP engine.

5. Vacuum system.

For activation of the turbocharge group, the vacuum system of the N57 TOP engine contains the following components:

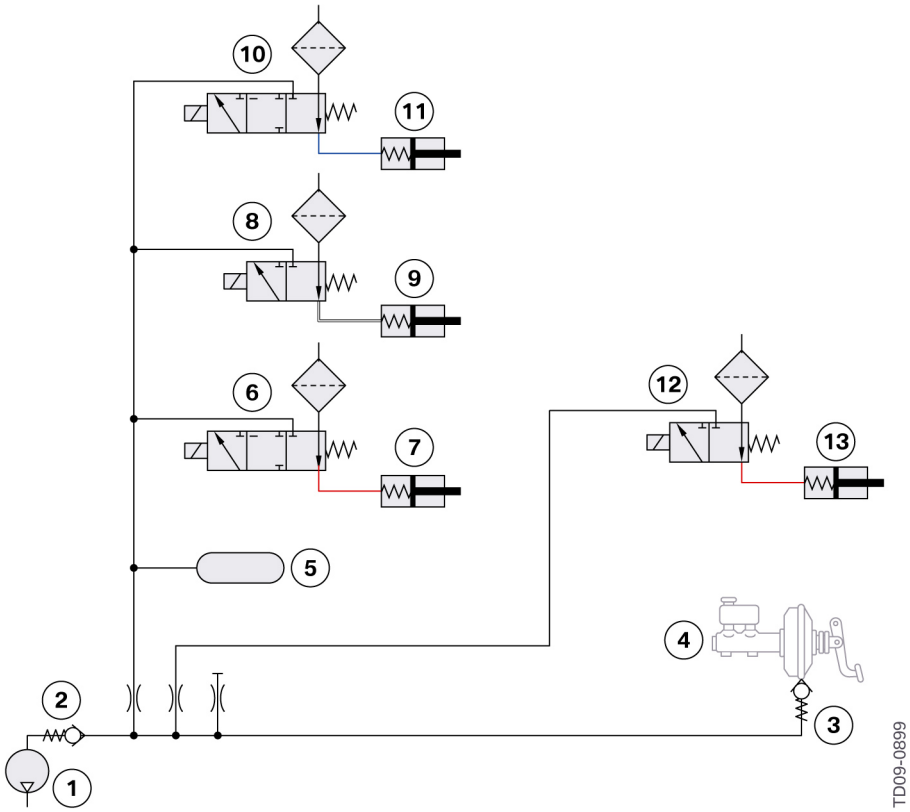
- Partial-vacuum canisters for:
  - Turbine control flap
  - Bypass plate
  - Wastegate valve
- Electropneumatic pressure converter for:
  - Turbine control flap
  - Wastegate valve
- Electric changeover valve for:
  - Bypass plate
- Vacuum reservoir.

There are throttles at the junction point from the main vacuum line to the consumer units. All of the junctions that are used have a throttle with a diameter of 0.8 mm. A junction with 0.5 mm is unused and fitted with a rubber cap. The delivery lines from the solenoid valves (EUV and EPDW) to the partial-vacuum canisters are marked by coloured fabric hoses.

Component	Colour
Turbine control flap	blue
Bypass plate	white
Wastegate valve	Red
EGR bypass valve	red

N57 TOP engine.

5. Vacuum system.



Vacuum system, N57 TOP engine

Index	Explanation
1	Vacuum pump
2	Non-return valve
3	Non-return valve
4	Brake booster
5	Vacuum reservoir
6	Electropneumatic pressure converter
7	Partial-vacuum canister, wastegate valve
8	Electric changeover valve
9	Partial-vacuum canister, bypass plate
10	Electropneumatic pressure converter
11	Partial-vacuum canister, turbine control flap
12	Electric changeover valve
13	Partial-vacuum canister, EGR bypass valve

N57 TOP engine.

5. Vacuum system.

5.1. Electropneumatic pressure converter (EPDW)

In addition to the exhaust gas recirculation valve, electropneumatic pressure converters are used in the N57 TOP engine to control the turbine control flap and wastegate valve. The EPDW uses the partial vacuum in the system and the ambient pressure to create a control pressure (mixed pressure), which it then applies to the partial-vacuum canister. This enables any variable position between opened and closed to be set. The DDE delivers the electrical signal on which the control pressure setting is based. This means that the turbine control flap and wastegate valve can be variably adjusted.

5.2. Electric changeover valve (EUV)

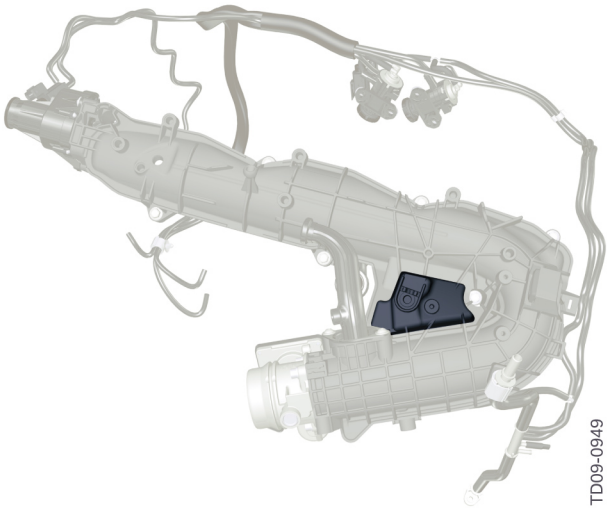
Alongside the electric changeover valve for the EGR bypass valve, an additional changeover valve is used for the bypass plate. In contrast to the pressure converter (EPDW), no control pressure is set here; the partial vacuum in the system is merely switched through to the partial-vacuum canister. No regulated position of the bypass plate is enabled; the positions are merely opened or closed.

5.3. Vacuum reservoir

A new feature compared to the N57 engine is the vacuum reservoir. If the partial vacuum in the system drops, this means that the turbine control flap and bypass plate can still be controlled. If this were not the case, an immediate power loss of the engine could be noticed. Such a drop in the vacuum system can occur if the brake booster consumes a great deal of partial vacuum. The vacuum reservoir is equipped with a non-return valve that prevents the partial vacuum from escaping towards the brake booster.

Without this vacuum reservoir, the vacuum pump would have to be significantly larger. There would then be sufficient partial vacuum available to control the turbocharge group if the brake booster were working to the maximum. However, the capacity of such a pump would only be required very rarely. A vacuum reservoir is therefore the more efficient option to cover the maximum partial vacuum requirement.

The vacuum reservoir is integrated in the intake air collector, with which it forms a component.



Vacuum reservoir

N57 TOP engine.
6. Engine electrical system.

6.1. System overview

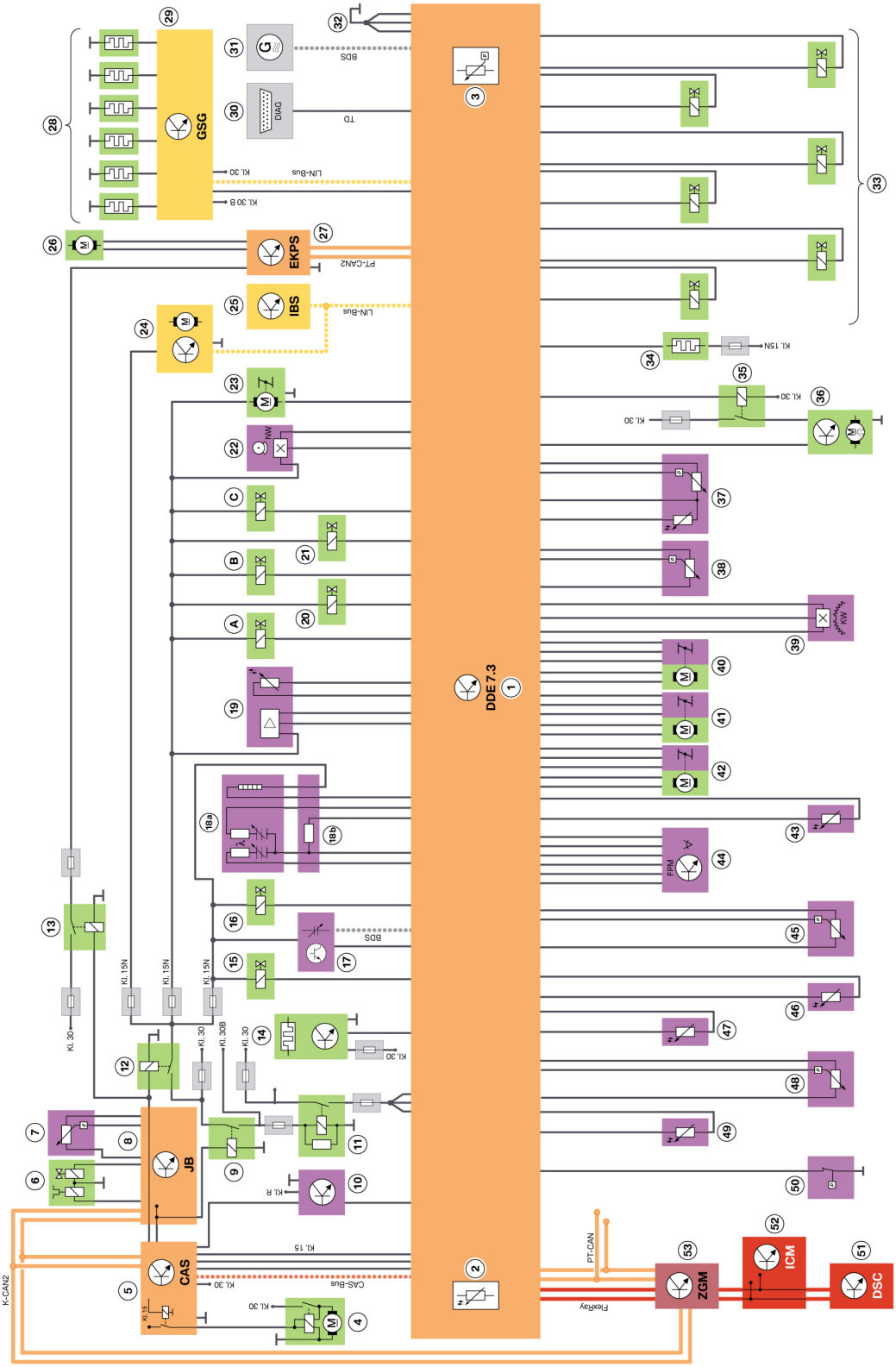
The N57 TOP engine differs from the N57 engine with regard to the connection to the vehicle network and in the system overview only in respect of three components:

- Electropneumatic pressure converter for turbine control flap
- Electropneumatic pressure converter for wastegate valve
- Electric changeover valve for bypass plate.

The familiar layout from the N57 engine and the connection are the same.

N57 TOP engine.

6. Engine electrical system.



System overview of N57 TOP engine in the 740d

N57 TOP engine.
6. Engine electrical system.

Index	Explanation
A	Electropneumatic pressure converter for turbine control flap
B	Electropneumatic pressure converter for wastegate valve
C	Electric changeover valve for bypass plate
1	DDE control unit (Digital Diesel Electronics)
2	Temperature sensor in the DDE control unit
3	Ambient-pressure sensor in the DDE control unit
4	Starter motor
5	Car Access System (CAS)
6	Air-conditioning compressor
7	Refrigerant pressure sensor
8	Junction box
9	Terminal 30B relay
10	Clutch module
11	DDE main relay
12	Terminal 15B relay
13	Terminal 15B relay
14	Fuel filter heating
15	Electric changeover valve, engine mount
16	Electric changeover valve, EGR bypass flap
17	Oil condition sensor
18a	Lambda oxygen sensor (control sensor with constant characteristic curve)
18b	Connector for Lambda oxygen sensor
19	Hot-film air-mass sensor
20	Rail-pressure regulating valve
21	Flow regulating valve
22	Camshaft sensor
23	Charge-air pressure actuator
24	Air flaps
25	Intelligent battery sensor
26	Electric fuel pump
27	Electronic fuel pump control
28	Glow plugs
29	Preheating control unit
30	Diagnosis connector (only speed signal)
31	Alternator

N57 TOP engine.
6. Engine electrical system.

Index	Explanation
32	Earth connection
33	Piezo injectors
34	Engine ventilation heating
35	Relay for electric fan
36	Electric fan
37	Fuel pressure and temperature sensor
38	Rail-pressure sensor
39	Crankshaft sensor
40	EGR valve and exhaust recirculation sensor
41	Throttle-valve actuator and throttle-valve sensor
42	Swirl-flap actuator and swirl-flap sensor
43	Coolant-temperature sensor
44	Accelerator pedal module
45	Exhaust backpressure sensor before exhaust turbocharger
46	Exhaust gas temperature sensor before oxidation catalytic converter
47	Charge-air temperature sensor
48	Charge-air pressure sensor
49	Exhaust backpressure sensor after oxidation catalytic converter
50	Oil-pressure switch
51	Dynamic stability control
52	Integrated chassis management
53	Central Gateway Module

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