FLIGHT HANDBOOK

USAF SERIES

F-84F-25 and Later Aircraft

PUBLISHED UNDER AUTHORITY OF THE SECRETARY OF THE AIR FORCE

COMMANDERS ARE RESPONSIBLE FOR BRINGING THIS PUBLICATION TO THE ATTENTION OF ALL AIR FORCE PERSONNEL CLEARED FOR OPERATION OF SUBJECT AIRCRAFT.

THIS PUBLICATION INCLUDES SAFETY OF FLIGHT SUPPLEMENTS T.O. NO. 1F-84(25)F-1E THRU 1CL.



THIS PUBLICATION REPLACES T.O. NO. 1F-84(25)F-1 DATED 30 DECEMBER 1954

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30 JANUARY 1956

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IMPORTANT

In order that you will gain the maximum benefits from this handbook it is imperative that you read this page and the following page carefully.

This Flight Handbook is applicable to F-84F-25 and subsequent airplanes designed by Republic Aviation Corporation and Manufactured by both Republic Aviation and General Motors Corporation. Unless otherwise specified, information is applicable to all airplanes. However, where information applies to specific airplanes, these airplanes will be identified by code letters which appear at the top right corner of the paragraph. The code letters assigned to aircraft series are as follows:

BLOCK DESIGNATION CODE

Code	*Model*	*Ser. Nos.*
A	F-84F-25RE	51-1621 thru 51-1760
	-25GK	51-9357 thru 51-9409
B	-30RE	51-1761 thru 51-1827
	-30GK	51-9410 thru 51-9454
	-30RE	52-6355 thru 52-6422
C	-35RE	51-17061 thru 51-17088
	-35GK	51-9455 thru 51-9503
	-35RE	52-6423 thru 52-6522
		52-7018 thru 52-7049
D	-40GK	51-9504 thru 51-9547
	-40RE	52-6523 thru 52-6642
		52-7050 thru 52-7089
	-41GK	52-8767 thru 52-8834
E	-45RE	52-6643 thru 52-6812
		52-7090 thru 52-7114
	-46RE	52-7115 thru 52-7126
	-46GK	52-8835 thru 52-8982
F	-50RE	52-6813 thru 52-6907
	-51RE	52-7127 thru 52-7191
	-51GK	52-8983 thru 52-9128
G	-55RE	52-6908 thru 52-7007
	-56RE	52-7192 thru 52-7228
		52-10510 thru 52-10538
		52-7008 thru 52-7017
H	-61RE	53-6532 thru 53-6715
J	-66RE	53-6716 thru 53-6835
K	-71RE	53-6836 thru 53-6955

NOTE: The suffix letters RE identify airplanes manufactured by Republic Aviation Corporation while the suffix letters GK identify airplanes manufactured by General Motors Corporation.

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SCOPE

This handbook contains all the information necessary for safe and efficient operation of the RF-84F. These instructions do not teach basic flight principles, but are designed to provide you with a general knowledge of the airplane, its flight characteristics, and specific normal and emergency operating procedures. Your flying experience is recognized, and elementary instructions have been avoided.

SOUND JUDGMENT

The instructions in this handbook are designed to provide for the needs of a crew inexperienced in the operation of this aircraft. This book provides the best possible operating instructions under most circumstances, but it is a poor substitute for sound judgment. Multiple emergencies, adverse weather, terrain, etc., may require modification of the procedures contained herein.

PERMISSIBLE OPERATIONS

The Flight Handbook takes a "positive approach" and normally tells you only what you can do. Any unusual operation or configuration (such as asymmetrical loading) is prohibited unless specifically covered in the Flight Handbook. Clearance must be obtained from ARDC before any questionable operation is attempted which is not specifically covered in the Flight Handbook.

STANDARDIZATION

Once you have learned to use one Flight Handbook, you will know how to use them all – closely guarded standardization assures that the scope and arrangement of all Flight Handbooks are identical.

ARRANGEMENT

The handbook has been divided into 10 fairly independent sections each with its own table of contents. The objective of this subdivision is to make it easy both to read the book straight through when it is first received and thereafter to use it as a reference manual. The independence of these sections also makes it possible for the user to rearrange the book to satisfy his personal taste and requirements. The first 3 sections cover the minimum information required to safely get the airplane into the air and back down again. Before flying any new aircraft these 3 sections must be read thoroughly and fully understood. Section IV covers all equipment not essential to flight but which permits the aircraft to perform special functions. Sections V and VI are obvious. Section VII covers lengthy discussions on any technique or theory of operation which may be applicable to the particular aircraft in question. The experienced pilot will probably not need to read this section but he should check it for any possible new information. The contents of the remaining sections are fairly obvious.

YOUR RESPONSIBILITY

These Flight Handbooks are constantly maintained current through an extremely active revision program. Frequent conferences with operating personnel and constant review of UR's, accident reports, flight test reports, etc., assure inclusion of the latest data in these handbooks. In this regard, it is essential that you do your part! If you find anything you don't like about the book, let us know right away. We cannot correct an error whose existence is unknown to us.

PERSONAL COPIES, TABS AND BINDERS

Each flight crew member, except those attached to an administrative base, is entitled to have a personal copy of the Flight Handbook. Air Force Regulation 5-13 specifically makes that provision. Flexible, loose leaf tabs and binders have been provided to hold your personal copy of the Flight Handbook. These good-looking, simulated-leather binders will make it much easier for you to revise your handbook as well as to keep it in good shape. These tabs and binders are secured through your local contracting officer.

HOW TO GET COPIES

If you want to be sure of getting your handbooks on time, order them before you need them. Early ordering will assure that enough copies are printed to cover your requirements. Technical Order 0-5-2 explains how to order Flight Handbooks so that you automatically will get all revisions, reissues, and Safety of Flight Supplements. Basically, all you have to do is order the required quantities in the Publication Requirements Table (T.O. 0-3-1). Talk to your base supply officer – it is his job to fulfill your Technical Order requests. Make sure to establish some system that will rapidly get the books and Safety of Flight Supplements to the flight crews once they are received on the base.

STATUS OF SAFETY OF FLIGHT SUPPLEMENTS

You can determine the status of Safety of Flight Supplements by referring to the Index of Technical Publications (T.O. 0-1-1) and the Weekly Supplemental Index (T.O. 0-1-1A). The title page of the Flight Handbook and the title block of each Safety of Flight Supplement should also be checked to determine the effect that these publications may have on existing Safety of Flight Supplements.

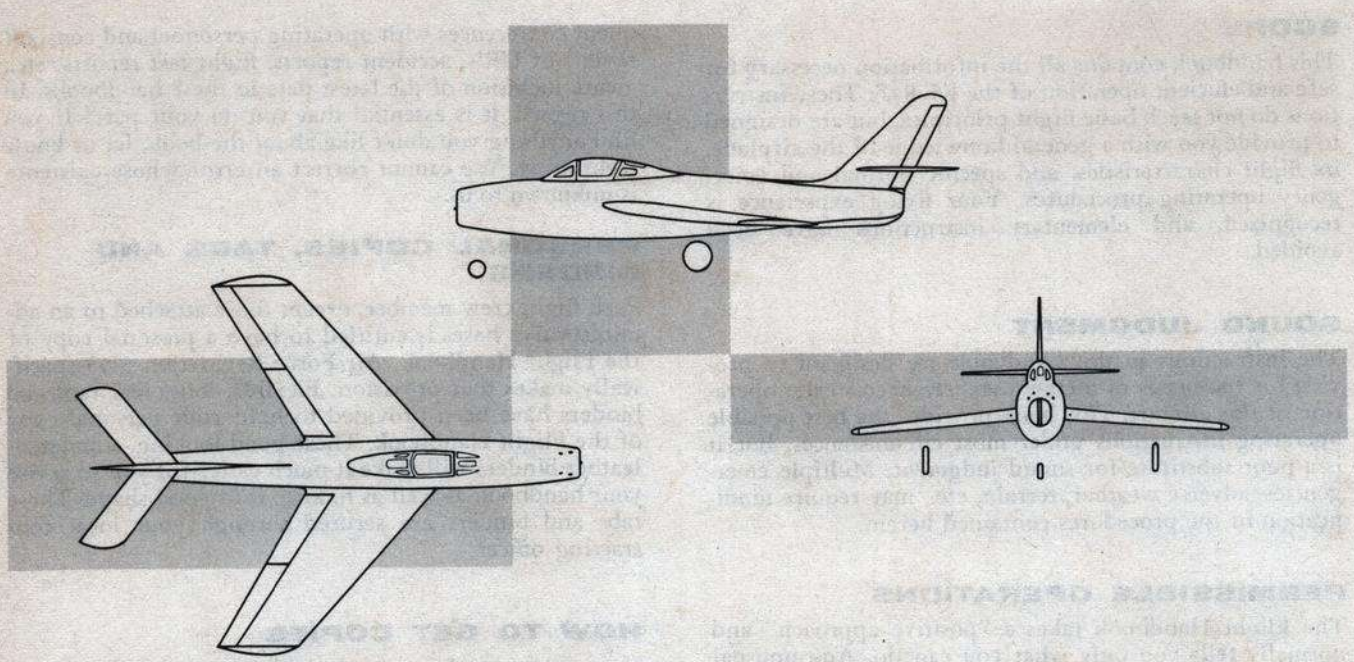
WARNINGS, CAUTIONS, AND NOTES.

For your information, the following connotation will be applied to these items:

WARNING – Injury to personnel
CAUTION – Damage to equipment
NOTE – Information requiring emphasis

COMMENTS AND QUESTIONS

Comments and questions regarding any phase of the Flight Handbook program are invited and should be addressed to the attention of RDZSTH at Wright-Patterson Air Force Base, Ohio.



F-84F-25
& LATER AIRCRAFT



Figure 1—1. F-84F-25 and Later Aircraft

SECTION 1 DESCRIPTION



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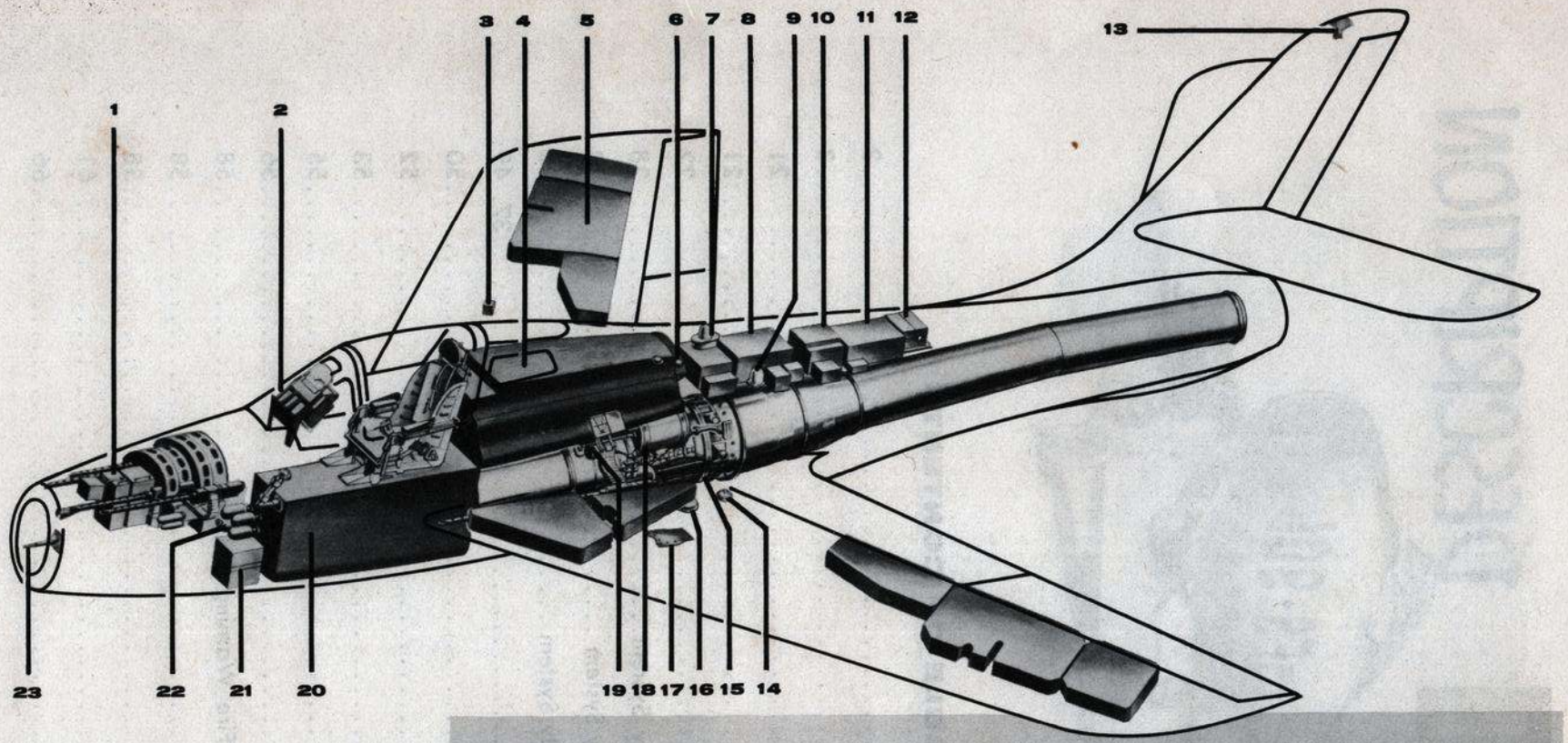


GENERAL

ARRANGEMENT DIAGRAM

1 Radar Equipment
2 Gun-Bomb-Rocket Sight
3 External Power Receptacle
4 Main Fuel Tank
5 Wing Fuel Tank
6 Alcohol Tank
7 Radio Compass Loop Antenna
8 Command Radio Equipment
9 Slaved Gyro Compass Equipment
10 Identification Radio Equipment
11 Auto-Pilot Equipment
12 APW-11 Radar Equipment
13 Command Radio Antenna
14 Radar Antenna
15 Jet Engine
16 Radio Compass Antenna
17 Refueling Receptacle
18 Oil Tank
19 Hydraulic Reservoir
20 Forward Fuel Tank
21 Batteries
22 Oxygen Bottles (up to F-84F-35)
Liquid Oxygen Converter (F-84F-35 & up)
23 Pitot Tube

Figure 1—2

AIRCRAFT.

The Republic Aviation Corporation F-84F-25 is a single place, swept-back fighter designed for flight in the subsonic and sonic speed ranges at high altitude. It is powered by a high thrust turbojet engine and lends itself readily to fighter-bomber and long range characteristics. It can carry exceptionally large external loads and yet retain its high speed performance and stability. Outstanding design features are air refueling, automatic pilot, pneumatic-type emergency landing gear system and hydraulic actuator controls. Pilot comfort is assured by providing greater quantities of air at comfortable temperatures and cabin pressurization at lower effective altitude. Visibility is improved by use of a double wall canopy and a dry air circulating system for anti-fogging purposes and a flat front windshield.

AIRPLANE GROSS WEIGHT.

The gross weight of the airplane averages from 18,500 lbs for the clean airplane to 25,380 lbs for the clean airplane plus four external tanks.

AIRPLANE DIMENSIONS.

Approximate overall dimensions of the aircraft are as follows:

Length (Incl stabilizers)	43.3 ft
Wing Span	33.6 ft
Height (to top of fin)	
UP to F-84F-40	14.5 ft
F-84F-40 and UP	15.00 ft
Tread	20.4 ft

ENGINE.

The airplane is powered by an axial flow jet propulsion engine, AF Model J65-W-3, B-3; W-7 or B-7. The J65-W-3 and B-3 engines are rated at 7200 pounds thrust while the J65-W-7 and B-7 are rated at 7800 pounds thrust. Air enters an intake, in the nose of the airplane and through a 13 stage compressor. After compression the air passes into the combustion chamber where it is heated by the combustion of fuel. The hot exhaust then passes through a two stage turbine producing a high velocity jet in the tailpipe. An ignition and a fuel priming system is provided for starting the engine. The air inlet to the engine compressor is provided with a retractable screen to prevent foreign objects from entering the compressor during ground operation. Supplementary thrust, for take-off, is supplied by externally hung ato units.

ENGINE FUEL CONTROL SYSTEM.

The engine fuel control system (figure 1–15) is designed to automatically maintain constant rpm during normal operation; however, during emergency operation, all compensating fuel circuits are by-passed, and the system then does not automatically maintain constant rpm. The engine fuel control system consists mainly of an engine-driven, constant-output, dual fuel pump, and a main fuel pump regulator. The failure of either pump will not affect the operation of the remaining pump and sufficient fuel will be available from the single pump for 100 per cent rpm operation at sea level on a 100°F day. The emergency fuel system in aircraft prior to F-84F-55RE may be selected directly by the pilot or alerted so that the emergency system will take over if the fuel pressure across the engine fuel distributers falls to approximately 80 per cent of normal requirements for full thrust at sea level on a 100°F day. On F-84F-55RE and later aircraft ony manual selection of the emergency fuel system has been provided. An indicator light is provided to show when the engine is operating on the emergency fuel system.

Note

Emergency operation is possible only when electrical power is available from the primary bus, since its selection is dependent on solenoid valves.

MAIN FUEL CONTROL.

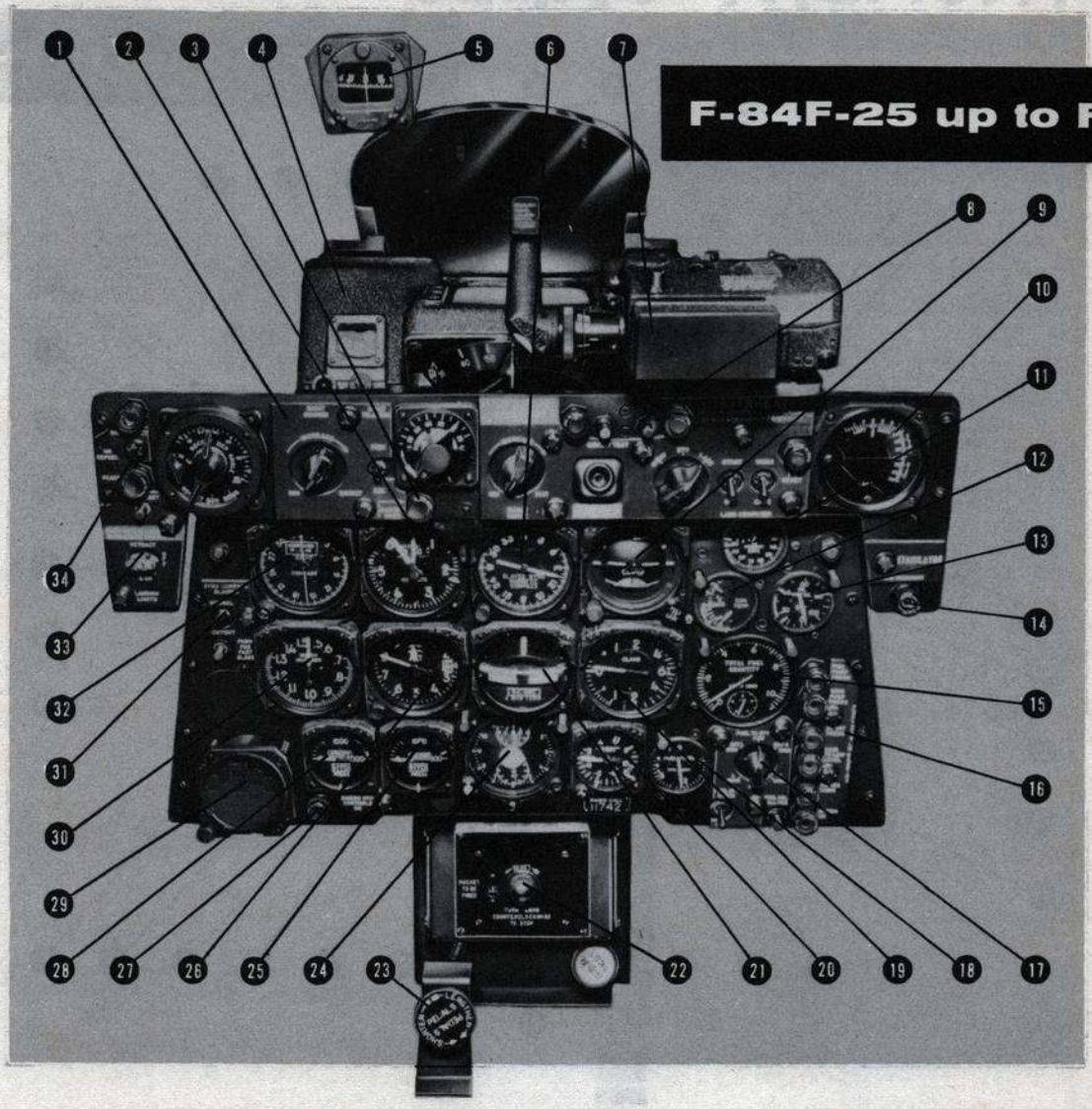
The fuel control is basically an engine speed governing control, which by-passes main fuel pump output when necessary, so as to maintain a fixed engine speed for a given throttle control position. The control prevents overspeeding beyond the maximum governed speed, preserves constant engine speed by compensating for changes in air density with changes in altitude, provides increased fuel flow during acceleration at such a rate as to avoid surge and prevent excessive exhaust temperatures, limits fuel flow during engine deceleration to avoid flame-outs, and provides a means for selection of emergency operation whenever a failure occurs in the main fuel control system. As engine rpm tends to exceed prescribed limits the speed governor metering valve acts to restrict further fuel flow. A metering valve is also actuated by altitude and air temperature sensing bellows to provide correct fuel flow for these variables. A main fuel pump by-pass valve which permits excessive fuel to return to the fuel pump is also provided; this by-pass valve operates from two sources. From one source, it protects against excessive compressor pressure rise by sensing inlet and outlet compressor pressures, which are balanced against a spring load. When compressor section pressure rise is excessive the main fuel pump by-pass opens to permit fuel "runaround" reducing the flow of fuel to the engine. From the other source, the main fuel pump by-pass will also open to permit excess fuel "runaround" to compensate for changes in engine

	ENGINE	STARTER	FUEL SYSTEM	LANDING GEAR	FLIGHT CONTROLS	TRIM	CANOPY	WINGS AND EMPENNAGE	GUN SIGHT	BOMB RACKS
F-84 B	J35-A-5 J35-A-15	Electrical	Toggle switches up to F-84B-21RE Emergency fuel system provided.	Hydraulic shrink struts	Conventional with hydraulic aileron boost	Trim tabs	Sliding — Jettisonable	Straight — Fixed Stabilizer	K-14B	Fixed Pylons
F-84 C	J35-A-13	Electrical	Rotary switch F-84B-21RE up to F-84C-11RE Emergency fuel system provided.	Hydraulic shrink struts	Conventional with hydraulic aileron boost	Trim tabs	Sliding — Jettisonable	Straight — Fixed Stabilizer	K-14B	Fixed Pylons
F-84 D	J35-A-17 Derated J35-A-29	Electrical	Manual fuel tank selector. F-84C-11RE and up. Emergency fuel system provided.	Mechanical shrink struts	Conventional with hydraulic aileron boost	Trim tabs	Sliding — Jettisonable	Straight — Fixed Stabilizer	A-1C	Fixed Pylons
F-84 E	J35-A-17	Electrical	Manual fuel tank selector. Emergency fuel system provided.	Mechanical shrink struts	Conventional with hydraulic aileron boost	Left aileron and elevators tabs only	Sliding — Jettisonable with canopy remover	Straight — Fixed Stabilizer	A-1C with APG-30 provisions	Jettisonable Pylons
F-84 G	J35-A-29	Electrical	Manual fuel tank selector. air refueling, single point ground refueling. Emergency fuel system provided.	Mechanical shrink struts	Conventional with hydraulic aileron boost	Left aileron and elevators tabs only	Sliding — Jettisonable with canopy remover	Straight — Fixed Stabilizer	A-1C up to F-84G-5RE A-4 on F-84G-5RE and up APG-30 on all	Jettisonable Pylons
F-84 F 1 UP TO 25	YJ65-W-1 or YJ65-W-1A	Electrical	Manual fuel tank selector. air refueling, single point ground refueling. Emergency fuel system not provided.	Mechanical shrink strut nose wheel only	Conventional with hydraulic aileron elevator and rudder actuators	Adjustable spring capsules and adjustable horizontal stabilizer	Clamshell — Jettisonable	Sweptback wings and adjustable horizontal stabilizer	A-4 with APG-30	Jettisonable Pylons
F-84 F-25 AND UP	J65-W-3 J65-B-3 J65-B-7 or J65-W-7	Combustion	Manual fuel tank selector. air refueling, single point ground refueling. Emergency fuel system provided.	Mechanical shrink strut nose wheel only	Conventional ailerons and rudder, one piece stabilator. Spoilers F-84F-45 and later aircraft. Hydraulic actuators on all controls. Emergency hydraulic and electrical stabilator actuator up to F-84F-70 tandem actuators F-84F-70 and later aircraft.	Adjustable spring capsules	Clamshell — Jettisonable	Sweptback wings and stabilator. Drag chute provided F-84F-65 and later.	A-4 with APG-30	Jettisonable Pylons

MAIN DIFFERENCES TABLE

Figure 1-3

INSTRUMENT PANEL

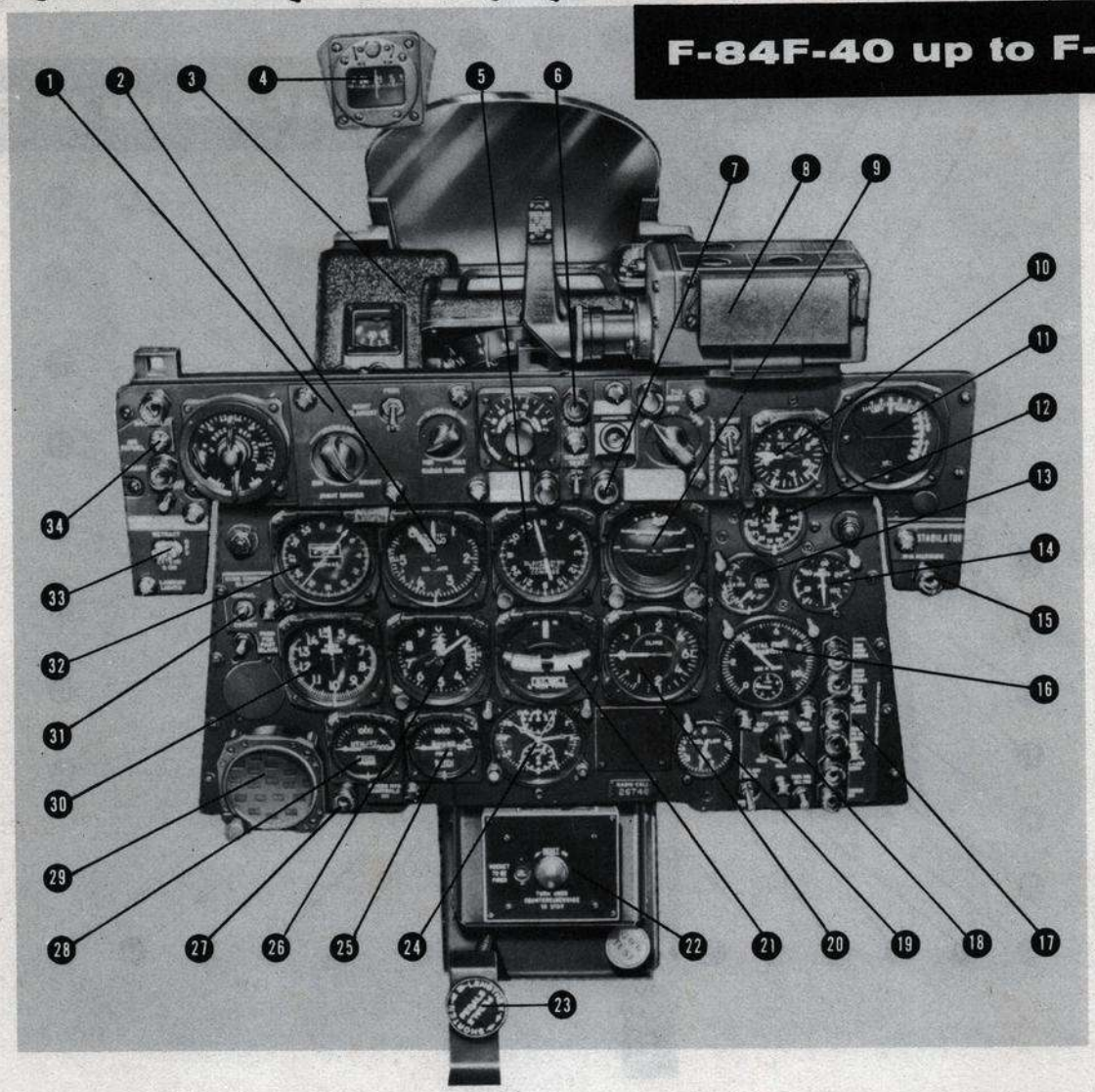


1 *Gun-Bomb-Rocket Sight Control Panel (See figure 4—22)*
2 *Airspeed Indicator*
3 *Canopy Open Indicator Light*
4 *Gun-Bomb-Rocket Sight*
5 *Magnetic Compass*
6 *Slaved Gyro Magnetic Compass Indicator*
7 *Gun Camera*
8 *Engine Overheat and Fire Warning System (See figure 1—37)*
9 *Attitude Indicator*
10 *Dive and Roll Indicator*
11 *Engine Tachometer*
12 *Engine Exhaust Gas Temperature Indicator*
13 *Engine Oil Pressure Indicator*
14 *Stabilator Mechanical Advantage Indicator*
15 *Fuel Quantity Indicator (See figure 1—23)*
16 *Fuel System Warning Lights (See figure 1—22)*
17 *Fuel Quantity Selector Switches (See figure 1—23)*
18 *Fuel Flow Indicator*
19 *Rate of Climb Indicator*
20 *Accelerometer*
21 *Turn and Bank Indicator*
22 *Rocket Release Control (See figure 4—28)*
23 *Rudder Pedal Adjusting Knob*
24 *Clock*
25 *Hydraulic Pressure Gage-Boost System*
26 *Altimeter*
27 *Emergency Hydraulic Controls On Indicator Light*
28 *Hydraulic Pressure Gage-Utility System*
29 *Flight Command Indicator*
30 *Machmeter*
31 *Slaved Gyro Compass Controls (See figure 4—17)*
32 *Radio Compass Indicator*
33 *Landing Lights Switch*
34 *Air Refueling Controls (See figure 4—13)*

Figure 1—4

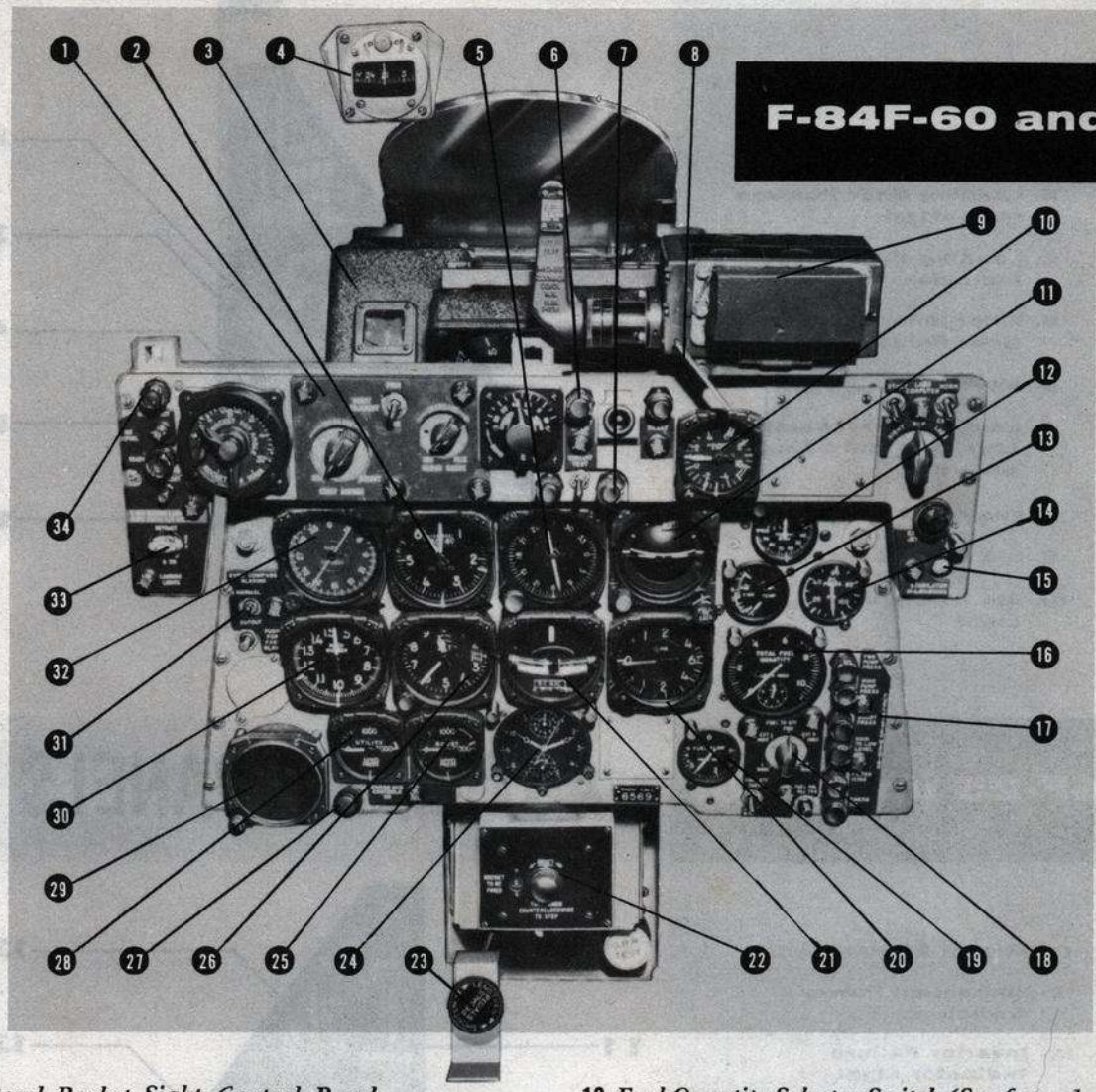
INSTRUMENT PANEL

F-84F-40 up to F-60



1 *Gun-Bomb-Rocket Sight Control Panel (See figure 4–23)*
2 *Airspeed Indicator*
3 *Gun-Bomb-Rocket Sight*
4 *Magnetic Compass*
5 *Slaved Gyro Magnetic Compass Indicator*
6 *Canopy Open Indicator Light*
7 *Engine Overheat and Fire Warning System (See figure 1–37)*
8 *Gun Camera*
9 *Attitude Indicator*
10 *Accelerometer*
11 *Dive and Roll Indicator*
12 *Engine Tachometer*
13 *Engine Exhaust Gas Temperature Indicator*
14 *Engine Oil Pressure Indicator*
15 *Stabilator Mechanical Advantage Indicator*
16 *Fuel Quantity Indicator (See figure 1–23)*
17 *Fuel System Warning Lights (See figure 1–22)*
18 *Fuel Quantity Selector Switch (See figure 1–23)*
19 *Fuel Flow Indicator*
20 *Rate of Climb Indicator*
21 *Turn and Bank Indicator*
22 *Rocket Release Control (See figure 4–28)*
23 *Rudder Pedal Adjusting Knob*
24 *Clock*
25 *Hydraulic Pressure Gage-Boost System*
26 *Altimeter*
27 *Emergency Hydraulic Controls on Indicator Light*
28 *Hydraulic Pressure Gage-Utility System*
29 *Flight Command Indicator*
30 *Machmeter*
31 *Slaved Gyro Compass Controls (See figure 4–17)*
32 *Radio Compass Indicator*
33 *Landing Lights Switch*
34 *Air Refueling Controls (See figure 4–13)*

INSTRUMENT PANEL

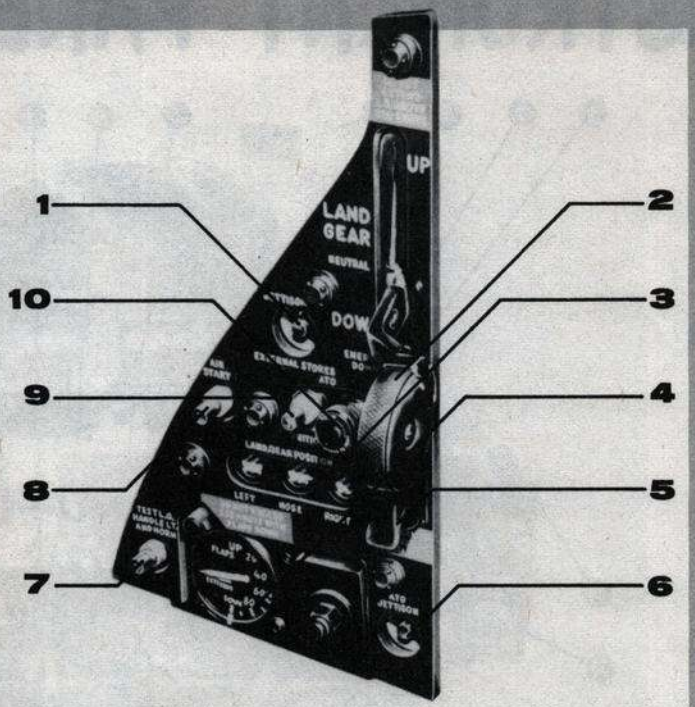


1 *Gun-Bomb-Rocket Sight Control Panel (See figure 4—24)*
2 *Airspeed Indicator*
3 *Gun-Bomb-Rocket Sight*
4 *Magnetic Compass*
5 *Slaved Gyro Magnetic Compass Indicator*
6 *Canopy Open Indicator Light*
7 *Engine Overheat and Fire Warning System (See figure 1—37)*
8 *Gun-Bomb-Rocket Sight Mechanical Caging Lever*
9 *Gun Camera*
10 *Accelerometer*
11 *Attitude Indicator*
12 *Engine Tachometer*
13 *Engine Exhaust Gas Temperature Indicator*
14 *Engine Oil Pressure Indicator*
15 *Stabilator Mechanical Advantage Indicator*
16 *Fuel Quantity Indicator (See figure 1—23)*
17 *Fuel System Warning Lights (See figure 1—22)*
18 *Fuel Quantity Selector Switch (See figure 1—23)*
19 *Fuel Flow Indicator*
20 *Rate of Climb Indicator*
21 *Turn and Bank Indicator*
22 *Rocket Release Control (See figure 4—28)*
23 *Rudder Pedal Adjusting Knob*
24 *Clock*
25 *Hydraulic Pressure Gage-Boost System (Power System)*
26 *Altimeter*
27 *Emergency Hydraulic Controls on Indicator Light — Prior to F-84F-71RE*
28 *Hydraulic Pressure Gage — Utility System*
29 *Flight Command Indicator*
30 *Machmeter*
31 *Slaved Gyro Compass Controls (See figure 4—17)*
32 *Radio Compass Indicator*
33 *Landing Lights Switch*
34 *Air Refueling Controls (See figure 4—13)*

Figure 1—6

LEFT PANEL

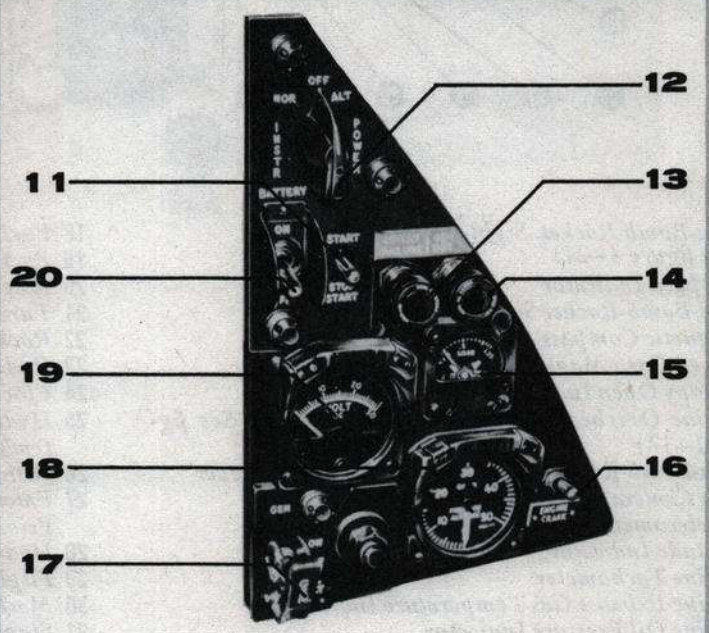
1. Jettison External Stores Switch
2. Landing Gear Selector Handle
3. Landing Gear Position Indicators
4. Landing Flap Position Indicator
5. Emergency Landing Gear Release Switch
6. Ato Jettison Switch
7. Landing Gear Warning Light and Horn Test Switch
8. Engine Air Start Switch
9. Ato Ignition Switch
10. Ato Ready Warning Light



F-84F-25 up to F-61

AUXILIARY PANELS

11. Engine Starter Switch
12. Instrument Power Switch
13. Inverter Failure Indicator Light
14. Generator Out Indicator Light
15. Loadmeter
16. Engine Crank Switch
17. Generator Switch
18. Cabin Altimeter
19. Voltmeter
20. Battery Switch

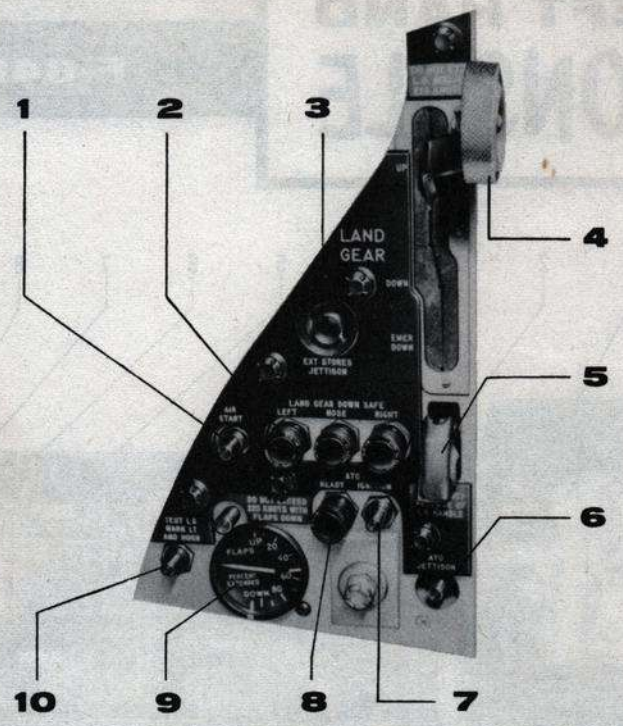


RIGHT PANEL

Figure 1—7

LEFT

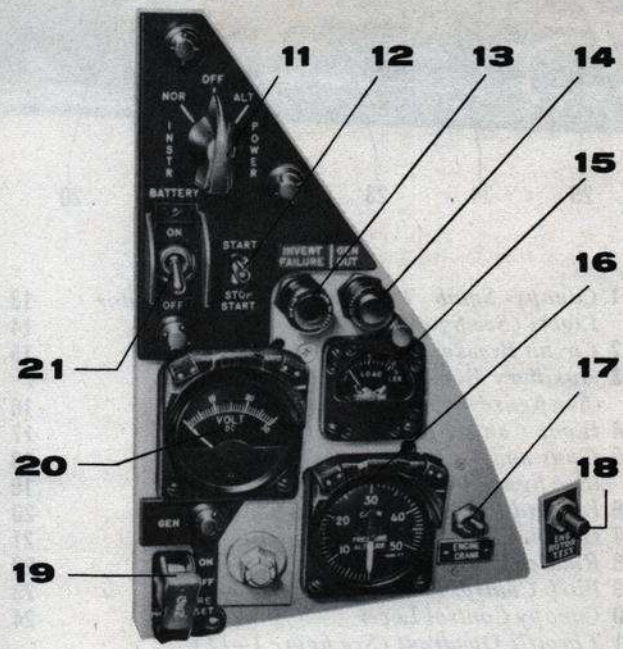
1 Engine Air Start Switch
2 Landing Gear Position Indicators
3 External Stores Jettison Switch
4 Landing Gear Selector Handle
5 Emergency Landing Gear Release Switch
6 Ato Jettison Switch
7 Ato Ignition Switch
8 Ato Ready Warning Light
9 Landing Flap Position Indicator
10 Landing Gear Warning Light and Horn Test Switch



F-84F-60 and up

AUXILIARY PANELS

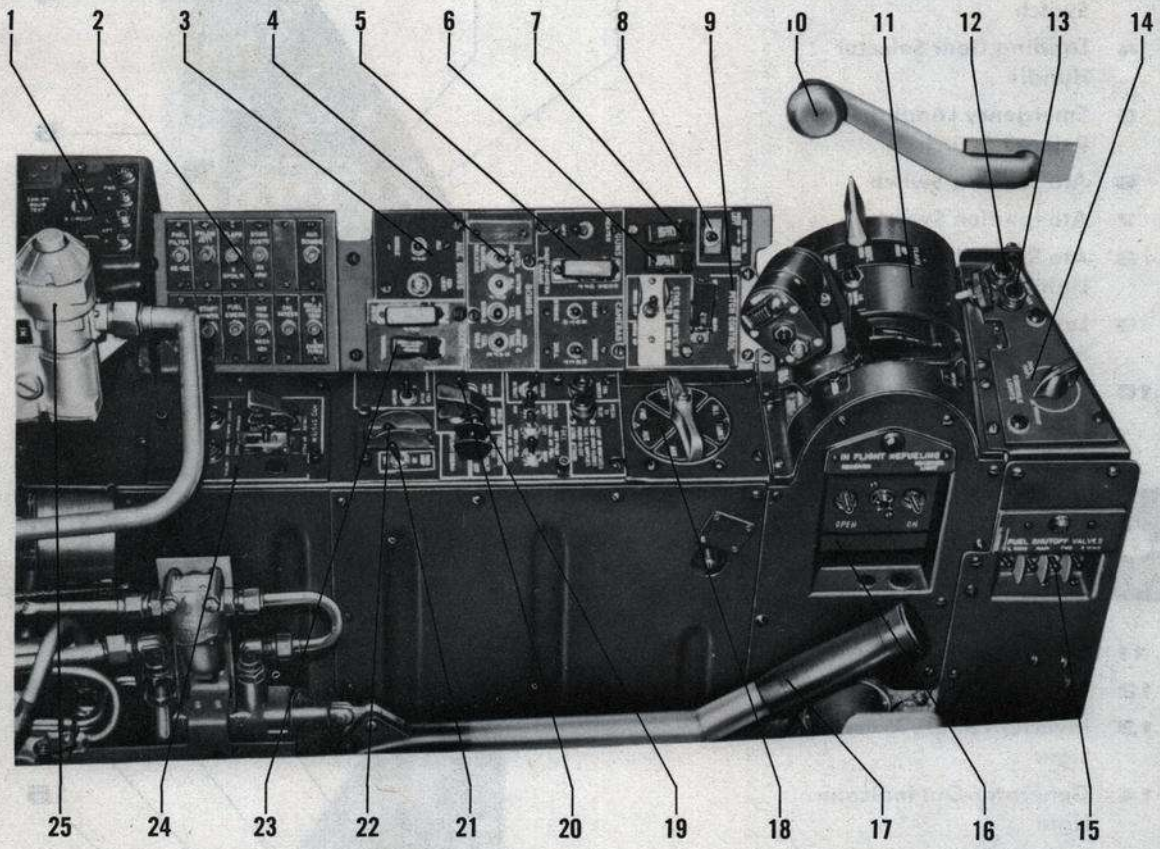
11 Instrument Power Switch
12 Engine Starter Switch
13 Inverter Failure Warning Light
14 Generator-Out Indicator Light
15 Loadmeter
16 Cabin Altimeter
17 Engine Crank Switch
18 Engine Rotor Test Switch
19 Generator Switch
20 Voltmeter
21 Battery Switch



RIGHT

LEFT HAND CONSOLE

F-84F-25 up to F-60

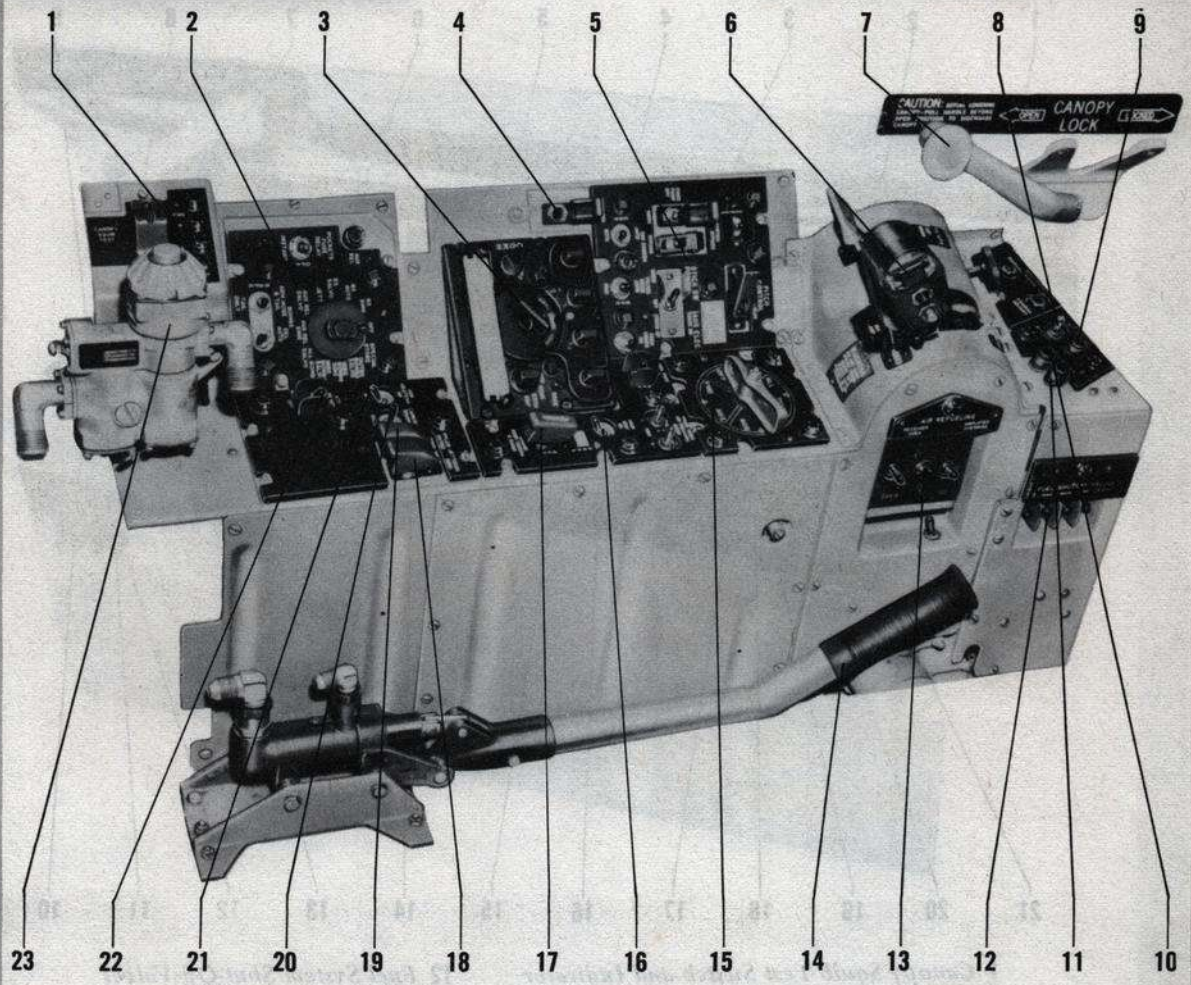


1 *Canopy Squib Test Switch and Indicator Lights (See figure 1–39)*
2 *Circuit Breaker Panel (See figure 1–25)*
3 *Auxiliary Bombs Control Panel (See figure 4–26)*
4 *Bomb Control Panel (See figure 4–25)*
5 *Guns and Camera Control Panel (See figure 4–20)*
6 *Inboard Pylon Jettison Switch*
7 *Outboard Pylon Jettison Switch*
8 *Rudder Trim Switch*
9 *Pitch Control Panel (See figure 1–33)*
10 *Canopy Control Lever*
11 *Throttle Quadrant (See figure 1–17)*
12 *Aileron Neutral Trim Indicator Light*
13 *Rudder Neutral Trim Indicator Light*
14 *Console Lights Rheostat*
15 *Fuel System Shut-off Valves (See figure 1–21)*
16 *Air Refueling Switches (See figure 1–21)*
17 *Hydraulic Hand Pump*
18 *Fuel System Control Panel (See figure 1–16)*
19 *Spoiler Shut-off Switch (F-84F-40 and later)*
20 *Pitot Heater Switch*
21 *Pneumatic Compressor Switch*
22 *Ato Ready Switch*
23 *Rocket Control Panel (See figure 4–27)*
24 *Flight Control Hydraulic System Switches (See figure 1–33)*
25 *Anti-g Valve*

Figure 1-8

LEFT HAND CONSOLE

F-84F-60 up to F-70

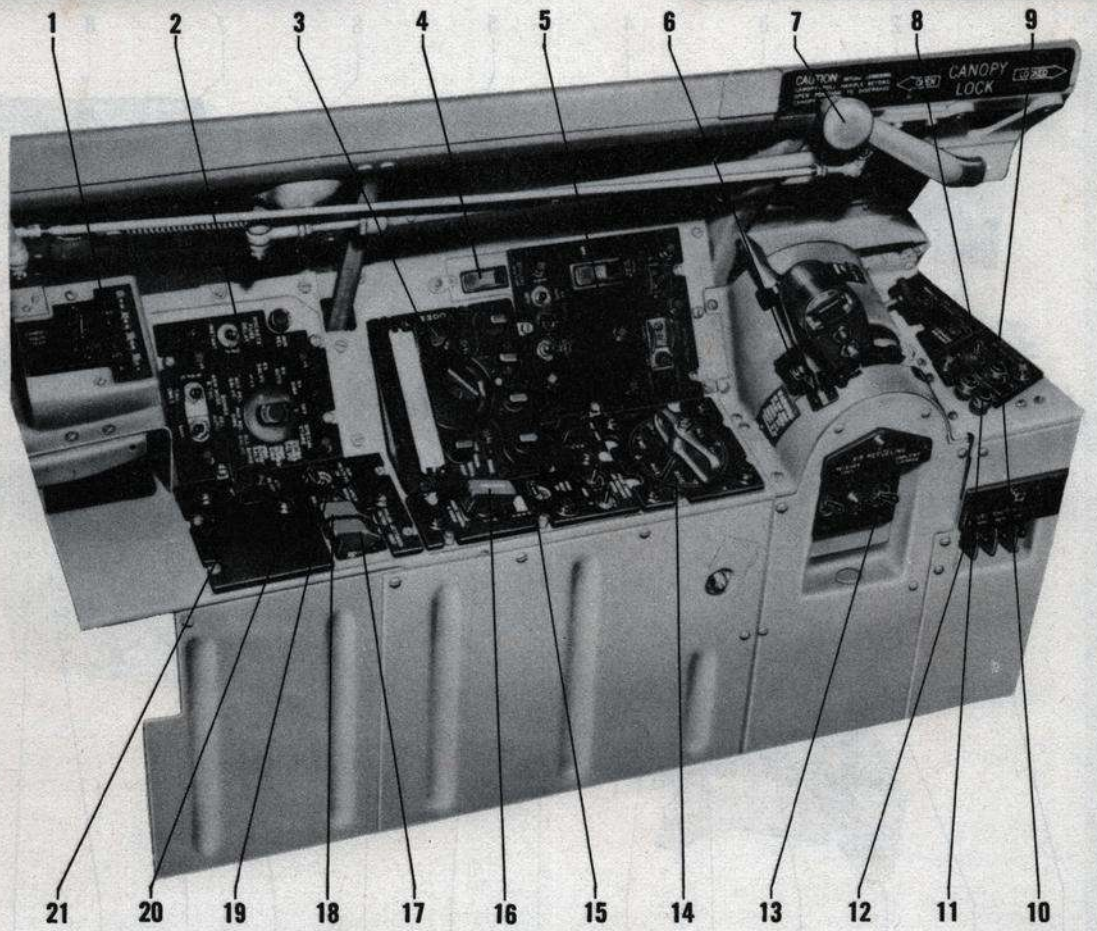


1 *Canopy Squib Test Switch and Indicator Lights (See figure 1–39)*
2 *Armament Control Panel*
3 *Command Radio Control Panel – AN/ARC-34 (See figure 4–6)*
4 *Spoilers Shut-off Switch*
5 *Flight Controls Panel*
6 *Throttle Quadrant (See figure 1–17)*
7 *Canopy Control Lever*
8 *Jettison Circuit Breaker Check Switch*
9 *Jettison Circuit Breaker Check Light*
10 *Aileron Neutral Trim Indicator Light*
11 *Rudder Neutral Trim Indicator Light*
12 *Fuel System Shut-off Valves (See figure 1–21)*
13 *Air Refueling Switches (See figure 1–21)*
14 *Hydraulic Hand Pump*
15 *Fuel System Control Panel (See figure 1–16)*
16 *Pitot Heat Switch*
17 *Gun Arming Switch*
18 *Inboard Pylon Jettison Switch*
19 *Outboard Pylon Jettison Switch*
20 *Gun Camera Switch*
21 *Gun Heater Switch*
22 *Ato Ready Switch*
23 *Anti-g Valve*

Figure 1–10

LEFT HAND CONSOLE

F-84F-71 and up

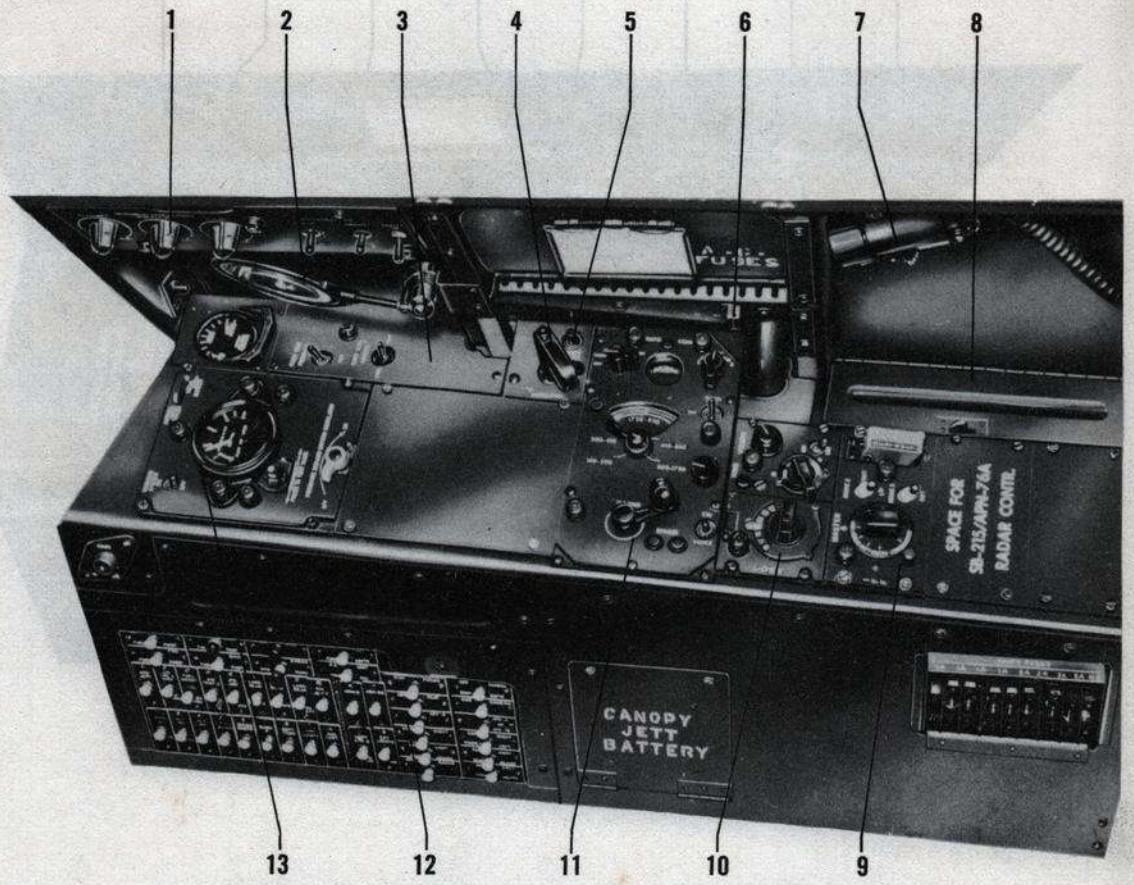


1 *Canopy Squib Test Switch and Indicator Lights (See figure 1–39)*
2 *Armament Control Panel (See figure 4–21)*
3 *Command Radio Control Panel – AN/ARC-34 (See figure 4–6)*
4 *Spoilers Shut-Off Switch*
5 *Flight Control Panel (See figure 1–33)*
6 *Throttle Quadrant (See figure 1–17)*
7 *Canopy Control Lever*
8 *Jettison Circuit Breaker Check Switch*
9 *Jettison Circuit Breaker Check Light*
10 *Aileron Neutral Trim Indicator Light*
11 *Rudder Neutral Trim Indicator Light*
12 *Fuel System Shut-Off Valves (See figure 1–21)*
13 *Air Refueling Switches (See figure 4–13)*
14 *Fuel System Control Panel (See figure 1–16)*
15 *Pitot Heat Switch*
16 *Gun Arming Switch*
17 *Inboard Pylon Jettison Switch*
18 *Outboard Pylon Jettison Switch*
19 *Gun Camera Switch*
20 *Gun Heater Switch*
21 *Ato Ready Switch*

Figure 1–11

RIGHT HAND CONSOLE

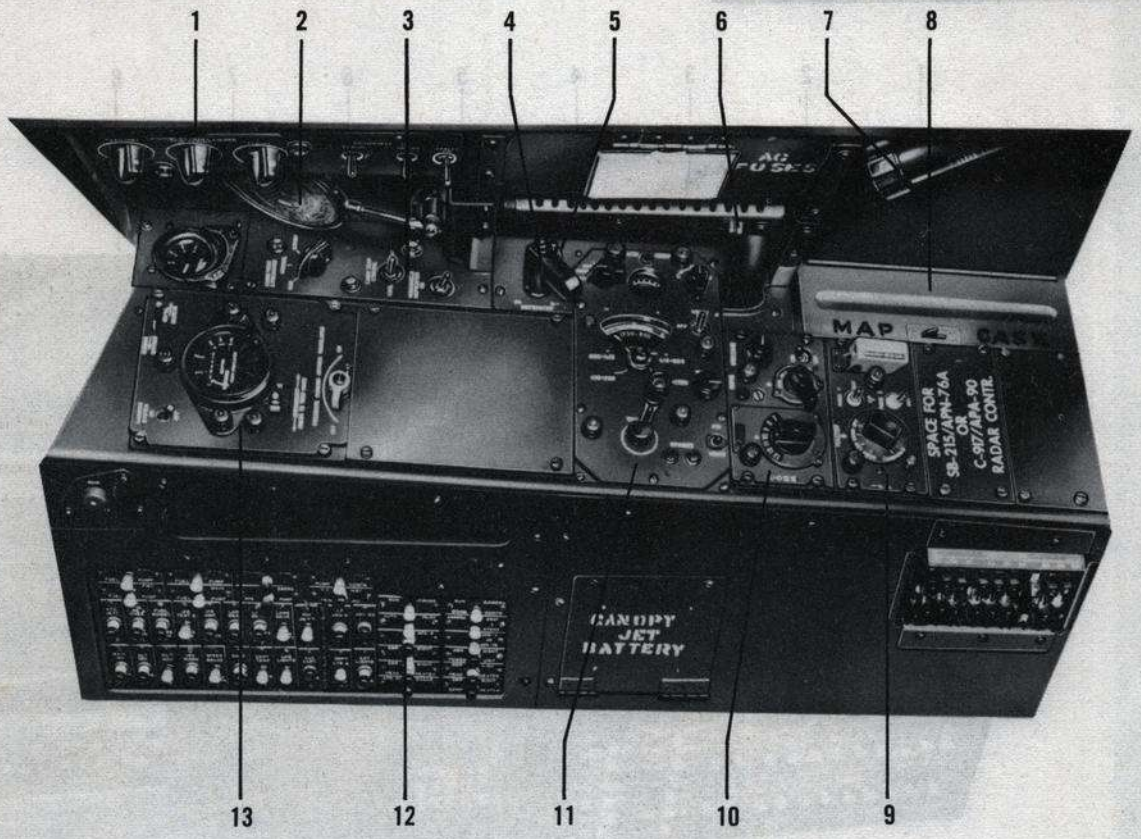
F-84F-25 up to F-40



1 *Interior and External Lights Control Panel (See figure 4–9)*
2 *Batori Computer*
3 *Cabin Temperature and Pressure Controls (See figure 4–3)*
4 *Defroster Control*
5 *Canopy Dry Air Switch*
6 *Side Air Outlet Shut-off*
7 *Cabin Light*
8 *Map Case*
9 *Radar Control Panel AN/APX-6 (See figure 4–7)*
10 *Command Radio Control Panel – AN/ARC-33 (See figure 4–5)*
11 *Radio Compass Control Panel – AN/ARN-6 (See figure 4–8)*
12 *Circuit Breaker Panel (See figure 1–25)*
13 *Oxygen Regulator (See figure 4–10)*

RIGHT HAND CONSOLE

F-84F-40 up to F-60

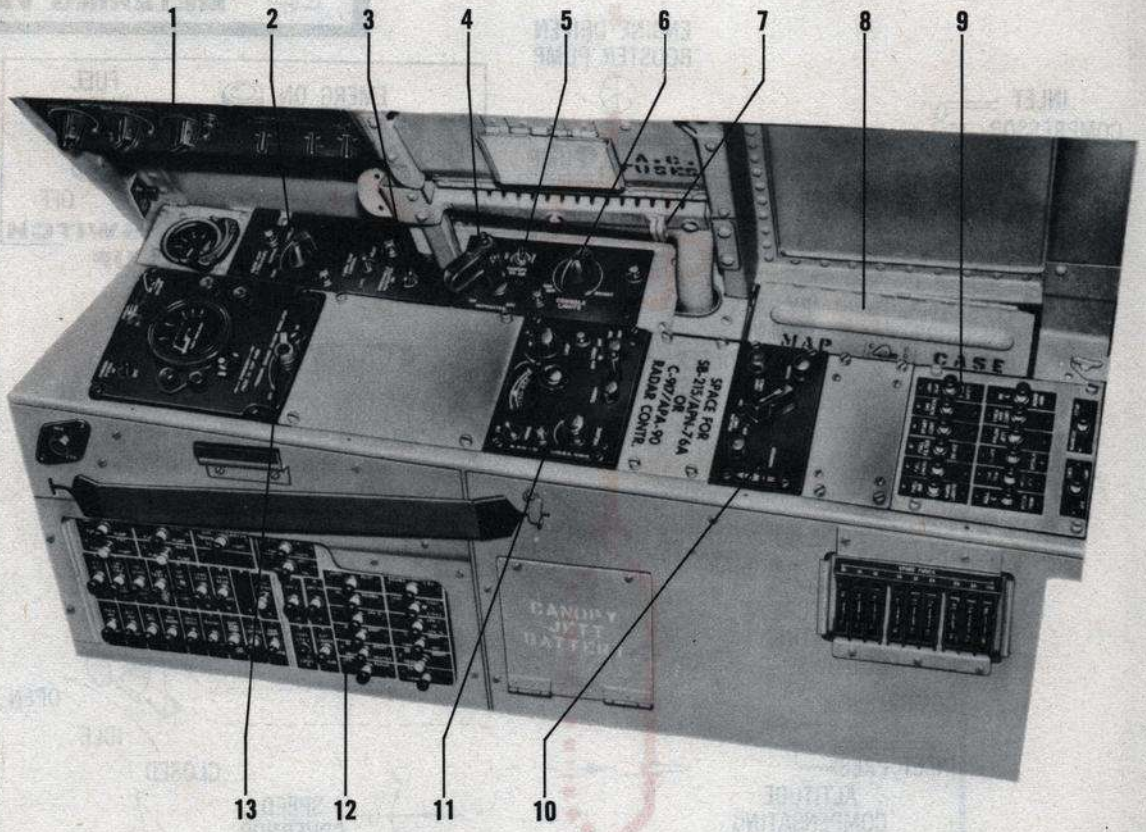


1 *Interior and Exterior Lights Control Panel (See figure 4-9)*
2 *Batori Computer*
3 *Cabin Temperature and Pressure Controls (See figure 4-3)*
4 *Defroster Control*
5 *Canopy Dry Air Switch*
6 *Side Air Outlet Shut-off*
7 *Cabin Light*
8 *Map Case*
9 *Radar Control Panel AN/APX-6 (See figure 4-7)*
10 *Command Radio Control Panel AN/ARC-33 (See figure 4-5)*
11 *Radio Compass Control Panel AN/ARN-6 (See figure 4-8)*
12 *Circuit Breaker Panel (See figure 1—25)*
13 *Oxygen Regulator (See figure 4-10)*

Figure 1—13

RIGHT HAND CONSOLE

F-84F-60 and up



1 *Interior and External Lights Control Panel (See figure 4–9)*
2 *Cabin Temperature and Pressure Controls (See figure 4–3)*
3 *Windshield Defroster Switch*
4 *Defroster Control*
5 *Canopy Dry Air Switch*
6 *Console Lights Rheostat*
7 *Side Air Outlet Shut-off*
8 *Map Case*
9 *Circuit Breaker Panel (See figure 1–25)*
10 *Radar Ground Support Control Panel AN/APW-11A*
11 *Radio Compass Control Panel – AN/ARN-6 (See figure 4–8)*
12 *Circuit Breaker Panel (See figure 1–25)*
13 *Oxygen Regulator (See figure 4–10)*

rpm, temperature and ambient pressure. In this instance, the main fuel pump by-pass valve is actuated by a differential pressure diaphragm, which senses fuel pump output pressure on one side of the diaphragm and metered fuel pressure on the other side of the diaphragm.

EMERGENCY FUEL CONTROL.

The emergency fuel control merely eliminates the normal fuel control compensating features. Thus during emergency operation fuel flow is a function of throttle control travel only, therefore the throttle must be moved with caution to prevent overspeeding, excessive exhaust temperatures, or flame-out, when operating on the emergency fuel system. The emergency fuel control is adjusted to provide 100 per cent engine rpm at sea level on a 100°F day; therefore, available full throttle rpm will vary with free air temperature and altitude.

WARNING

The emergency system is designed for in-flight failure of the normal system and provides a constant fuel flow for a given throttle setting. As altitude increases, fuel flow in excess of that required to maintain normal engine operation will produce engine overspeed conditions. Therefore, if the pilot should elect to go from the normal to the emergency system, he must throttle back before the transfer is made to avoid engine overspeeding or flame-out, caused by excessively rich mixtures.

EMERGENCY FUEL SWITCH.

The emergency fuel system is controlled by an emergency fuel switch (figure 1–16) which is powered from the primary bus. On aircraft prior to F-84F-55RE, the switch has three positions: ON (FLIGHT EMERG), OFF (NORM) and ALERT (TAKE-OFF ONLY). The ALERT (TAKE-OFF ONLY) position energizes the fuel pressure switch so that when the pressure across the fuel distributers falls to approximately 80 per cent of that required for full take-off thrust, the emergency fuel transfer valve will open automatically for emergency flow and the normal fuel system will be by-passed. The ON (FLIGHT EMERG) position opens the emergency fuel transfer valve thereby by-passing the fuel pressure switch to provide a direct switch over to the emergency fuel system. In the OFF (NORM) position the emergency fuel system is inoperative and will not cut-in when engine rpm is reduced during flight, or when landing. On F-84F-55RE



Figure 1–16

and later aircraft, the emergency fuel switch is a two-position switch, marked FUEL EMERG ON, and OFF and functions as in earlier aircraft in the ON or OFF position. However, the alert position, providing automatic cut-in of the emergency fuel system has been eliminated and the emergency fuel system must be manually selected.

Note

On aircraft prior to F-84F-55RE, the ALERT (TAKE-OFF ONLY) position will not be used during take-off. Under certain conditions the emergency system will unexpectedly cut-in at engine speeds as high as 95 per cent rpm if the emergency fuel switch is in the ALERT (TAKE-OFF ONLY) position. In order to preclude this occurrence take-off will be accomplished with the emergency fuel switch in the OFF (NORM) position.

EMERGENCY-ON INDICATOR LIGHT.

The red emergency-on indicator light (figure 1–22) is provided to show when the emergency fuel system

ENGINE FUEL
CONTROL SYSTEM SCHEMATIC

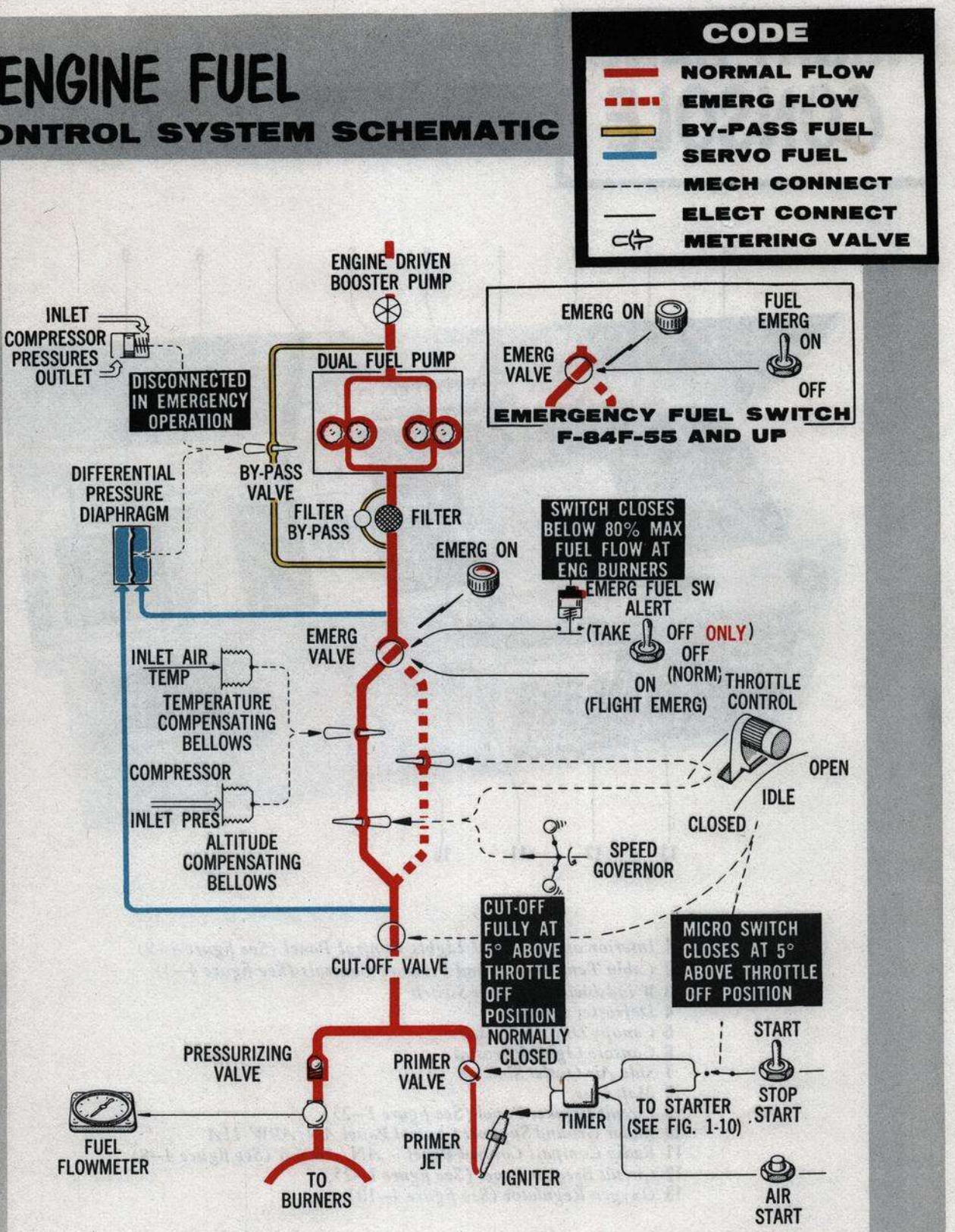




Figure 1—17

tained unit and is capable of turning the engine up to approximately 24 per cent rpm in 3 to 3½ seconds. Torque is developed by a high speed turbine, driven through reduction gears. Fuel for the turbine is supplied from the airplane's fuel system, while the air supply is stored in a high pressure storage bottle which is automatically refilled by the pneumatic compressor. The capacity of the storage bottle is sufficient for one start. The fuel and air mixture is automatically fed to the turbine and ignited when the starter switch is actuated and the throttle is 5 degrees or more forward of the CLOSED position. A centrifugally operated switch cuts off the fuel and air supply when the turbine reaches its maximum rpm, while a pressure switch cuts the starter out if maximum speed is not reached, or if the centrifugal switch is inoperative. Electrical power for operating the starter is supplied from the primary bus. The engine ignition and primer systems operate concurrently with the starter, and are designed to function for a period of 15 seconds if the throttle is 5 degrees or more forward of the CLOSED position, and will not operate when the throttle is closed. Controls are also provided for starting the engine during air starts. A switch is provided so that the engine can be turned over slowly and its rotation checked without the possibility of the engine starting.

STARTER SWITCH.

The starter switch (figures 1—7 and 1—8) is provided to actuate the engine starter and the automatic ignition and priming timer. It is a three position switch spring-loaded to the center position. The two extreme positions are START and STOP START with the center position unmarked. Held for a period of approximately one second in the START position ignites the combusion starter and energizes the engine ignition and priming timer unit, if the throttle is 5 degrees or more forward of the CLOSED position. The starter will operate until the engine rpm reaches approximately 24 per cent, or for approximately 4 seconds if maximum rpm is not reached. The engine ignition and priming timer will operate for 15 (±3) seconds only after the throttle is moved from CLOSED to 5 degrees or more forward of the CLOSED position. The START position is not recommended for use during an air start unless low engine rpm and low altitude make it necessary as damage to the starter will result. If the starter switch is momentarily held in the STOP START position, the combustion

is in operation. The indicator light is marked EMERG ON and will illuminate if the emergency fuel switch on aircraft prior to F-84F-55RE, is in the ALERT (TAKE-OFF ONLY) position and the fuel pressure switch actuates due to a drop in fuel pressure, caused by either a fuel system failure, a reduction in throttle setting, or at altitudes above 10,000 feet. When the emergency fuel switch is placed in the ON (FLIGHT EMERG) position on aircraft prior to F-84F-55RE, or FUEL EMERG ON in F-84F-55RE and later aircraft, the indicator light will illuminate immediately if the primary bus is energized as the circuit by-passes the fuel pressure switch.

THROTTLE CONTROL.

Engine power is selected by the throttle control (figure 1–17) whose extreme positions are marked CLOSED and OPEN. The throttle is designed so that neither engine ignition nor fuel will be supplied to the engine, nor will the starter be energized when the start switch is actuated, unless the throttle is 5 degrees or more forward of the CLOSED position. In the throttle CLOSED position, fuel is mechanically cut off, and the engine ignition and priming circuits, which are actuated by the start switch, are interrupted. Throttle position does not affect the starter circuit or the priming and ignition circuits, which are controlled by the air start switch, or operation of the engine crank switch. When the throttle is 5 degrees or more forward of the CLOSED position, the fuel cut-off is fully open, the engine priming and ignition circuits which are controlled by the start switch are closed, and the engine starter circuit is alerted. The throttle quadrant is supplied with an IDLE STOP position, which must be by-passed by thumb pressure in order to return the throttle to the CLOSED position. Clockwise rotation of the throttle grip provides manual ranging for the gun-bomb-rocket sight. The grip is spring-loaded to the counterclockwise (maximum range) position. The throttle control incorporates a microphone press-to-talk button (black button), and a red button which serves two purposes. During normal operation, the red button is an electrical caging button for the gun-bomb-rocket sight, but after the air refueling door has been opened, the red button then becomes an air refueling nozzle disconnect. This allows the pilot to effect a nozzle disconnect without removing his hand from the throttle control. On F-84F-40 and subsequent airplanes, the throttle control also incorporates the speed brake switch. The throttle is prevented from creeping by tightening the throttle control friction lock (figure 1–17).

PRIMING SYSTEM.

The engine fuel system prevents fuel from passing to the engine until a pressure of approximately 100 psi is built up by the main fuel pump, therefore the engine is started by a priming system which by-passes the engine main burners. Fuel pressure for the priming system, during a normal start on the airplane's battery, is provided by the engine driven booster pump and the main fuel pump, since the fuel tank booster pumps are energized from the secondary bus, and power to these pumps is not available from the airplane's battery. The rapid accelerating starter will turn up the engine to a high enough rpm for the engine driven booster pump and main fuel pump to deliver sufficient fuel pressure for engine starting. If a start is made using an external power source the secondary bus is energized and the fuel tank booster pumps will supply pressure to the engine driven booster pump and the main fuel pump. Fuel is supplied through a normally closed solenoid-operated primer valve to two primer jets around the engine, where it is ignited by igniters. The primer valve is energized to open from the primary bus through an automatic timing device. The timer opens the primer valve for a period of 15 ($\pm$3) seconds when the starter switch is actuated and the throttle is in the idle or above position. The timer is also energized to open the primer valve for 15 ($\pm$3) seconds if the air start switch is depressed, regardless of the throttle position; however, fuel will not flow to the engine unless the fuel cut-off is opened by having the throttle 5 degrees or more forward of the CLOSED position. In either case, the timer circuit can be interrupted so as to close the primer valve by actuating the starter switch to the STOP START position. Once the timer cycle has started, the 15 ($\pm$3) second limit must elapse before another 15 ($\pm$3) second cycle can be started, unless the timer circuit is interrupted by placing the starter switch in the STOP START position.

IGNITION.

The fuel-air mixture in the engine is ignited by an automatic ignition system which incorporates two igniters. Once the engine is started the ignition system is no longer used, as burning in the combustion chambers is continuous. Power for ignition is supplied by two high tension vibrators which derive their power from the primary bus. The system incorporates a timer device which supplies ignition continuously for 15 ($\pm$3) seconds; controls are also provided for interrupting the 15 ($\pm$3) second ignition cycle. The ignition system is operated by the start or air start switches which are discussed under starting system.

STARTING SYSTEM.

Engine starting torque is provided by a rapid accelerating combustion type starter (figure 1–24) mounted on the front of the engine. The starter is a self con-

starter will be turned off, and the automatic engine ignition and priming timer will be de-energized immediately. For starting, electrical power is supplied from the primary bus which is energized by the airplane's battery, if the battery switch is in the ON position. Fuel tank booster pumps will be inoperative but the rapid acceleration of the engine, when starting, will be sufficient for the engine driven booster pump and the main pump to supply fuel for starting. A start can also be accomplished with electrical power supplied from an external power source.

AIR START SWITCH.

The air start switch (figure 1–7 and 1–8) is provided to supply engine ignition and priming fuel during an air start, when the engine is windmilling and starting torque is not required. A ground check of the ignition system can also be made using the air start switch. In this case the throttle must be in the CLOSED position so that fuel will not flow to the engine primers. The switch is a push button type marked AIR START. When depressed momentarily, the automatic timing unit is energized from the primary bus to supply ignition to the engine and open the priming solenoid for a period of 15 (±3) seconds, regardless of the throttle position. However, priming fuel will not flow to the primers unless the throttle is 5 degrees or more forward of the CLOSED position. Ignition can be stopped, and the primer valve closed, if the timer circuit is interrupted by placing the starter switch in the STOP START position.

ENGINE CRANK SWITCH.

The engine crank switch (figures 1–7 and 1–8) bypasses the throttle control and is provided so that engine rotation and starter operation may be checked during ground inspection without starting the engine. The switch is a two position type with one position marked ENGINE CRANK and the other position unmarked. When held in the ENGINE CRANK position with the throttle CLOSED, power from the primary bus is supplied to start the combustion starter. Ignition or primer fuel will not be supplied to the engine in this instance. The combustion starter will stop when its maximum rpm is reached, or after 4 seconds of operation, or when the engine crank switch is released.

ENGINE ROTOR TEST SWITCH.

The engine rotor test switch (figures 1–7 and 1–8) is provided so that the engine rotor can be turned slowly to check its rotation. The switch is marked ENG ROTOR TEST and when depressed opens an electrically operated pneumatic valve which supplies compressed air to the combustion chamber of the starter. The compressed air operates the starter slowly. The engine will continue to rotate as long as the switch is depressed and the air supply is sufficient. The engine rotor test switch is powered from the primary bus.

ENGINE SCREEN.

The engine screens are provided to protect the engine compressor from foreign objects during ground operation. However, the screens are retractable during flight so as to prevent loss of thrust and minimize high exhaust gas temperatures caused by engine screen icing. Engine thrust is decreased by approximately 3 per cent with the screens extended. The screens are located in the air intake duct just forward of the engine and are operated with hydraulic pressure. The hydraulic pressure passes through a solenoid valve that is powered from the primary bus. A light indicates operation and position of the screens. On F-84F-61RE and later aircraft the engine screens have an automatic control feature, that may be selected by the pilot, to assure that the screens are extended when the landing gear is extended.

ENGINE SCREEN SWITCH. **A thru G**

The engine screen switch (figure 1–16) positions a solenoid valve in the hydraulic system to operate the engine screens. The two switch positions are EXTEND and RETRACT. When the switch is placed in the EXTEND or the RETRACT position the engine screen will move to the respective position and the solenoid valve will automatically return to neutral. The switch is left in the selected position after the screens have cycled.

ENGINE SCREEN SWITCH. **H and LATER**

The engine screen switch (figure 1–33) installed on F-84F-61RE and later aircraft is a three position switch marked RETR, EXT, and AUTO. The switch positions a solenoid valve in the hydraulic system to operate the screens. When the switch is placed in the RETR or EXT positions the engine screens will move to the respective positions and the solenoid valve will automatically return to neutral. The switch is left in the selected position after the screen has cycled. In the AUTO position, engine screen operation is automatic and the screens will automatically extend and remain extended as long as the main landing gear is in the extended position. The engine screens will also retract automatically after a time delay of 3½ (±1) minutes when the landing gear reaches the up and locked position. The time delay feature is provided so that enough altitude is gained before the screens retract after take-off so that emergency procedures can be initiated in the event of engine failure caused by debris entering the engine compressor section. If

manual selection is desired, the switch is placed in the desired position to retract or extend the screens.

ENGINE SCREEN WARNING LIGHT.

The engine screen warning light (figures 1–16 and 1–33) will illuminate whenever the engine screen switch is repositioned and will remain illuminated until both screens have completed their cycle to either the fully extended or retracted position if power is available from the primary bus.

ENGINE INSTRUMENTS.

The engine tachometer and the exhaust gas temperature indicator are self generated electrical instruments which do not require power from the airplane's electrical system. The fuel level indicator, the fuel flow indicator and the oil pressure indicator are operated from the a-c power circuit and will operate from either the main or alternate inverters.

ASSIST TAKE-OFF SYSTEM.

Provision is made for the installation of four solid fuel ato units on an expendable adapter which is suspended from retractable hooks on the underside of the fuselage (figure 1–18). The units are used to supply additional thrust for high gross weight or shorter run take-offs. Each unit is rated at 1000 pounds thrust and once ignited, burns continuously for 14 seconds. After ignition takes place the units cannot be turned off or the adapter cannot be jettisoned while the units are producing thrust. Power to ignite the units is supplied from the primary bus. The adapter is jettisoned and the hooks on the fuselage are retracted by means of hydraulic pressure which is controlled by an electrically operated shut-off valve powered from the primary bus.

ATO READY SWITCH.

The ato ready switch (22, figure 1–9; 22, figure 1–10) is provided as a safety switch to prevent accidental firing of the ato units. It is a switch type circuit breaker with two positions marked OFF and ATO READY. The ATO READY position arms the ato ignition system and iluminates the ato ready warning light (figures 1–7 and 1–8) which is marked ATO READY.

ATO IGNITION SWITCH.

The ato ignition switch (figures 1–7 and 1–8) is a push button type switch marked ATO IGNITION. When depressed to the ATO IGNITION position a circuit is completed to the ignition posts of the ato units if the ato ready switch is in the ATO READY position.

ATO JETTISON SWITCH.

The ato unit adapter, suspended from retractable hooks under the fuselage, is hydraulically jettisoned after the ato units have burned out. The jettisoning system is controlled by the ato jettison switch (figures 1–7 and 1–8). The switch is a push button type switch marked ATO JETTISON. Depressing the ato jettison switch energizes the ato jettison solenoid shut-off valve to allow hydraulic pressure to release the adapter and retract the hooks into the fuselage.

OIL SYSTEM.

The engine oil system is entirely automatic. Lubricating oil is contained in an oil tank which is mounted on the upper left side of the engine compressor housing. The oil tank capacities, in U.S. gallons, are as follows; total oil 5 gallons, usable oil 4.5 gallons and expansion space 0.8 gallons. Oil, under pressure, is delivered to the front bearings and accessory drives where it is scavenged and returned to the oil tank. Two metering pumps, in the oil pump, supply metered oil to the center and rear engine bearings where it is mixed with air and forms a mist. This oil is not scavenged but is vented overboard as a mist through a vent located on the underside of the fuselage. Air flow around the fuselage prevents the mist from collecting on the fuselage skin. Oil consumption is approximately 2.5 pounds (approximately 2 pints) per hour maximum. The oil tank is designed to supply sufficient oil to the engine during inverted flight for



Figure 1–18

a period of approximately one minute. Oil grade and specifications are noted in the servicing diagram figure 1–42.

AIRPLANE FUEL SYSTEM.

The airplane fuel system (figure 1–19), is designed to provide automatic fuel transfer during normal operation without attention from the pilot. The airplane is basically equipped with four internal, self-sealing fuel tanks; a main tank installed behind the pilot, a forward tank under the cockpit floor and interconnected tanks in both wings. In addition, a jettisonable external tank can be carried on each of four pylons. Fuel from the external tanks is transferred to the main tank before wing or forward tank fuel is used. Normally tanks empty in the following order; external tanks, wing tanks, forward tank and the main tank. A restrictor is incorporated in the forward tank outlet to adjust fuel flow so as to automatically maintain the required cg location; the wing tanks are emptied at the same time or before the forward tank. Transfer of fuel from the external to the main tank is accomplished by means of air pressure which is manually controlled. Each internal tank incorporates a float which controls a shut-off valve in the transfer line to the tank. Fuel will flow to the tank until it is full then the float will automatically close the shut-off valve in the transfer line to that tank. These shut-off valves may be closed at any time to prevent fuel flow to any of the internal tanks. Internal tank fuel is pumped into the main tank by booster pumps which operate automatically according to the position of the fuel tank selector. The main tank is kept full until all external and internal fuel is used. A booster pump in the main tank supplies the engine fuel system. The pilot may vary the normal selector to allow a direct flow of fuel to the engine from either the internal wing or forward tanks. If the wing or forward tank is selected and the main tank shut-off valve is open, fuel will flow to the main tank until it is full then all fuel will flow from the selected tank to the engine. The system is provided with a flowmeter which indicates the rate of fuel flow to the engine. Also a fuel quantity indicator which indicates the amount of fuel remaining in the airplane except for unmodified Type II external tanks. Provisions for ground refueling of the airplane, from a single point, are made through an adapter installed in the air refueling receptacle on airplanes up to F-84F-35. On later airplanes a ground refueling receptacle is installed on the underside of the right wing. The single point refueling equipment is designed to operate similar to the air refueling system. The refueling truck must be equipped with a single-point nozzle and must be capable of delivering fuel at 500 gpm at a pressure of 50 psi. The airplane is provided with an air refueling system and a fuel filter de-icing system which are covered in Section IV.

FUEL SPECIFICATION AND GRADE.

Recommended fuel specification and grade are noted on the servicing diagram, figure 1–42.

BOOSTER PUMPS.

An electric booster pump is provided in the main fuel tank to supply fuel to the engine fuel control system. Electric booster pumps in the wing and forward tanks normally transfer fuel from these tanks to the main tank but also may be used to supply the engine fuel control system directly by proper positioning of the fuel tank selector. All the booster pumps are electrically operated from the secondary bus and are controlled by a rotary switch mechanically connected to the fuel tank selector. At altitudes below 6,000 feet, full engine rpm may be maintained with a failed booster pump as the fuel can be recovered by direct suction of the engine driven booster pump. Satisfactory engine operation up to maximum range power settings will result up to 20,000 feet under the most severe conditions when using JP-4 fuel. However, if booster pump failure is experienced, above 20,000 feet with JP-4 fuel and engine operation is satisfactory (no rpm drop or excessive rpm fluctuation) flight may be continued without reducing altitude. It must be remembered that prolonged flight at high altitudes, without booster pump operation, will shorten the engine fuel pump life due to the low inlet pressures. Fuel from the wing or forward tanks cannot be transferred to the main fuel tank without the aid of the booster pumps in the respective tanks, however, fuel may be fed directly to the engine from the forward tank but at slightly lower altitudes than would be available when feeding from the main tank. It is possible to feed in this manner from the wing tanks but operation under these conditions is not recommended due to the lack of individual wing fuel tank level indicators. There are no direct indicators to show when a booster pump is not operating, however, booster pump failure may be suspected as noted under fuel system indicators.

FUEL SHUT-OFF VALVES.

Shut-off switches are provided to close the fuel shut-off valves in the internal tanks so that fuel will not be transferred from the external to the internal or from the wing and forward to the main. Refer to Section IV for detailed description.

FUEL TANK SELECTOR.

The fuel tank selector (figure 1–16) is a rotary control having four positions. The selector mechanically positions the fuel tank selector valve and indexes a

AIRPLANE FUEL SYSTEM SCHEMATIC

NOTES: OUTBOARD PYLONS CARRY CLASS II TANKS WHICH CANNOT BE REFUELED THRU THE AIR OR GROUND REFUELING RECEPTACLE

IN "ALL TANKS" OPERATION PYLON FUEL FLOWS ONLY TO MAIN TANK AND NOT TO THE FWD OR WING TANKS, PROVIDED THEY ARE FULL

IN "FWD AUX" OR "WING AUX" PYLON TANK FUEL FLOW WILL SUPPLY THE RESPECTIVE TANKS

CODE

- NORMAL FLOW
- WING AUX FLOW
- FWD AUX FLOW
- BOOSTER PUMP
- CHECK VALVE
- SHUT-OFF VALVE
- SHUT-OFF VALVE ACTING AS CHECK
- FUEL QUANTITY TRANSMITTER

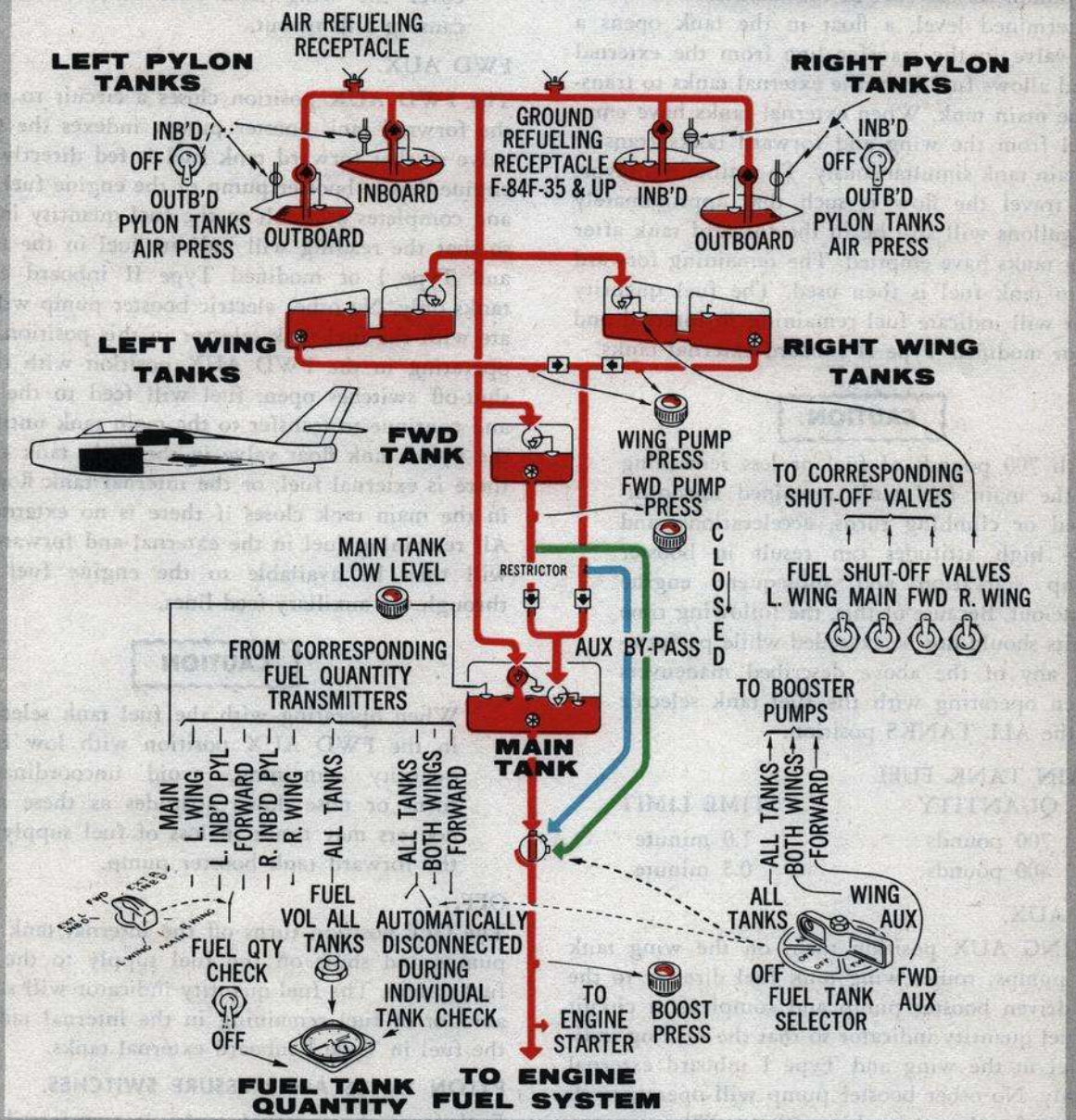


Figure 1-19

FUEL QUANTITY DATA		USABLE FUEL GALS.	USABLE FUEL POUNDS	FULLY SERVICED GALS.	FULLY SERVICED POUNDS	EXPANSION SPACE GALS.	EXPANSION SPACE POUNDS	TOTAL VOLUME GALS.	TOTAL VOLUME POUNDS
TANKS	Main	193.0	1254.5	193.4	1257.1	17.8	115.7	211.2	1372.8
	Fwd	171.0	1111.5	171.6	1115.4	1.7	11.0	173.3	1126.4
	L. Wing	97.0	630.5	99.0	643.5	7.5	48.7	106.5	692.2
	R. Wing	116.0	754.0	118.8	772.2	8.1	52.6	126.9	824.8
	L. Inboard Pylon—Type 1	222.0	1443.0	225.0	1462.5	8.5	55.2	233.5	1517.7
	R. Inboard Pylon—Type 1	222.0	1443.0	225.0	1462.5	8.5	55.2	233.5	1517.7
	R. Inboard Pylon—Type 1 Alt	450.0	2925.0	Will be supplied when available.					
	L. Inboard Pylon—Type 1 Alt	450.0	2925.0	Will be supplied when available.					
	L. Outboard Pylon—Type 1	222.0	1443.0	225.0	1462.5	8.5	55.2	233.5	1517.7
	R. Outboard Pylon—Type 1	222.0	1443.0	225.0	1462.5	8.5	55.2	233.5	1517.7

USABLE FUEL TOTALS	GALS.	POUNDS
Maximum Internal (Main, Forward, Wing)	577.0	3750.05
Internal plus Inboard Pylons	1021.0	6636.5
Inboard plus Inboard Pylons (Alt)	1477.0	9600.5
Inboard plus Inboard and Outboard Pylons	1465.0	9522.5

NOTE Weight based on fuel at 6.5 pounds per gallon

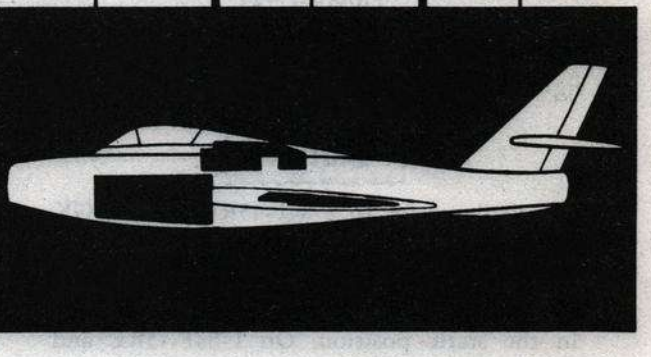


Figure 1—20

prior to F-84F-61RE there are two switches; one marked LEFT and the other RIGHT. Each switch has three positions; INB'D PYLON TANKS AIR PRESS., OUTB'D PYLON TANKS AIR PRESS., and OFF. On F-84F-61RE and later aircraft these two switches are marked L and R. Each switch has three positions; PYLON TANKS AIR PRESS. OUTBD, OFF and INBD. When in the INB'D or OUTB'D position on all aircraft, electrical power is directed to open the selected solenoid valve permitting air from the engine compressor to pressurize the respective tanks. In the OFF position the air pressure and vent ports are closed. The vent port is automatically opened during the air refueling cycle so as to permit fuel flow into the tanks. The air pressure port is spring-loaded to the closed position. Power from the primary bus keeps the port open, therefore, in the event of primary bus power failure the external fuel will not transfer.

PYLON TANK JETTISONING.

JETTISON EXTERNAL STORES SWITCH.

The jettison external stores switch (figures 1—7 and 1—8) is a push button type switch recessed in the panel to prevent accidental actuation. The switch is marked JETTISON EXTERNAL STORES, and when depressed will jettison the outboard and inboard pylon tanks together with the pylons on RE airplanes up to F-84F-45RE and all GK airplanes if the battery bus is energized. On F-84F-45RE and subsequent RE airplanes only the pylon tanks will be jettisoned and the pylons will be retained. Rockets will be jettisoned on all airplanes if the airplane is airborne and the primary bus is energized. In F-84F-71RE and later airplanes, an automatic delay circuit has been incorporated to prevent both inboard tanks from being released simultaneously thereby colliding and causing damage to the fuselage. The jettison external stores switch must be depressed for a minimum of 0.4 seconds to allow the automatic delay circuit to drop the

rotary switch which opens and closes circuits to the internal tank booster pumps and to the fuel quantity indicator so that readings on the indicator will reflect the tank(s) being used. The four positions are as follows:

ALL TANKS.

The ALL TANKS (normal) position turns on all booster pumps and channels all internal fuel into the main tank. The fuel quantity indicator will read fuel in all tanks except outboard external tanks and unmodified Type II inboard external tanks. The main tank booster pump supplies fuel to the engine driven booster pump. As the fuel in the main tank drops to a predetermined level, a float in the tank opens a shut-off valve in the transfer line from the external tanks and allows fuel from the external tanks to transfer to the main tank. When external tanks have emptied, fuel from the wing and forward tanks transfer to the main tank simultaneously. To maintain a favorable cg travel the flow is such that approximately 0 to 40 gallons will still be in the forward tank after the wing tanks have emptied. The remaining forward and main tank fuel is then used. The fuel quantity indicator will indicate fuel remaining in internal and Type I or modified Type II inboard external tanks.

CAUTION

With 700 pounds of fuel or less remaining in the main fuel tank, sustained uncoordinated or climbing turns, accelerations, and nose high attitudes can result in booster pump starvation and subsequent engine flame-out. Because of this, the following time limits should not be exceeded while performing any of the above described maneuvers when operating with the fuel tank selector in the ALL TANKS position.

MAIN TANK FUEL QUANTITY	TIME LIMIT
700 pounds	1.0 minute
400 pounds	0.5 minute

WING AUX.

The WING AUX position turns on the wing tank booster pumps; routes wing tank fuel directly to the engine driven booster pump and completes a circuit to the fuel quantity indicator so that the reading indicates fuel in the wing and Type I inboard external tanks only. No other booster pump will operate with the fuel tank selector in this position. When operating in WING AUX position with the fuel shut-off switches open fuel will feed to the engine and continue to transfer to the main tank until either the pylon tank float valve in the main tank closes if there is external fuel, or the internal tank float valve in the main tank closes if there is no external fuel. All remaining fuel in the external and wing tanks will then be available to the engine fuel system through the auxiliary feed lines.

CAUTION

When operating with the fuel tank selector in the WING AUX position, avoid uncoordinated maneuvers, steep descents or rapid maneuvers, since these maneuvers may uncover the wing tank fuel outlets thereby causing a flame-out.

FWD AUX.

The FWD AUX position closes a circuit to turn on the forward tank booster pump; indexes the selector valve so that forward tank fuel is fed directly to the engine driven booster pump of the engine fuel system and completes a circuit to the fuel quantity indicator so that the reading will indicate fuel in the forward and Type I or modified Type II inboard external tanks only. No other electric booster pump will operate with the fuel tank selector in this position. When operating in the FWD AUX position with the fuel shut-off switches open, fuel will feed to the engine and continue to transfer to the main tank until either the pylon tank float valve in the main tank closes if there is external fuel, or the internal tank float valve in the main tank closes if there is no external fuel. All remaining fuel in the external and forward tanks will then be available to the engine fuel system through the auxiliary feed lines.

CAUTION

When operating with the fuel tank selector in the FWD AUX position with low fuel quantity remaining, avoid uncoordinated turns or nose down attitudes as these maneuvers may result in loss of fuel supply to the forward tank booster pump.

OFF.

The OFF position turns off the internal tank booster pumps and shuts off the fuel supply to the engine fuel system. The fuel quantity indicator will show the amount of fuel remaining in the internal tanks plus the fuel in Type I inboard external tanks.

PYLON TANKS AIR PRESSURE SWITCHES.

Fuel from the external tanks is transferred to the main tank by means of air pressure. The pylon tank air pressure switches (figure 1–16) control the flow of air for pressurizing the external tanks. On aircraft

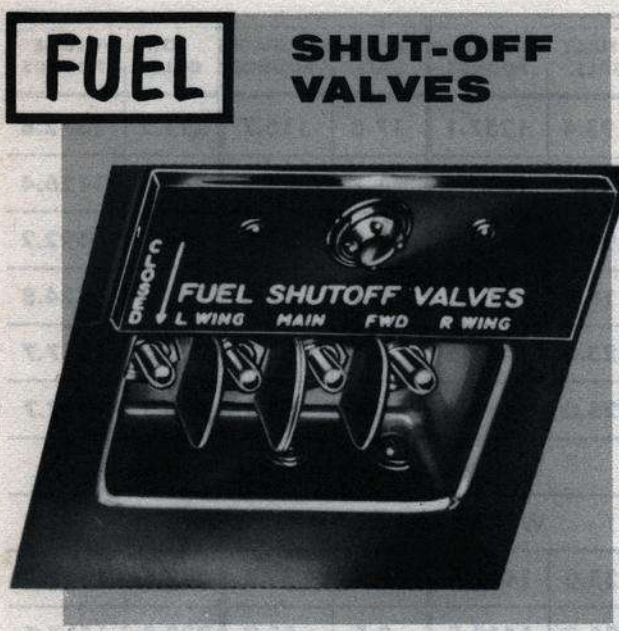


Figure 1—21

left inboard tank first and after a short delay to drop the right inboard tank.

CAUTION

On airplanes up to F-84F-45RE and all GK airplanes the pylons will jettison together with any stores installed if the external stores jettison switch is depressed with the airplane in the static position. On F-84F-45RE and later RE airplanes only the stores will jettison if the external stores jettison switch is depressed with the airplane in the static position.

JETTISON OUTB'D AND INB'D PYLON SWITCHES.

The inboard and outboard pylons can be jettisoned separately by actuating the respective pylon jettison switch (6, 7, figure 1—9; 18, 19, figure 1—10). Each of the two switches is guarded with a cover type guard. One guard is marked JETT INB'D PYLON and an arrow while the other is marked JETT OUTB'D PYLON with an arrow. When either switch is actuated in the direction of the arrow to the JETT position the respective pylons will be jettisoned simultaneously together with any stores carried on them if the battery bus is energized.

BOMB RELEASE SWITCH.

The outboard or inboard pylon tanks can be jettisoned in the same manner as normally releasing the bombs by use of the bomb release switch. This switch is described in detail in Section IV.

WING PUMP PRESSURE WARNING LIGHT.

Wing booster pump pressure is indicated by a red or an amber light (figure 1—22), marked WING PUMP PRESS. The light will illuminate if the pressure in the fuel line from either wing tank is below approximately 9 psi and the primary bus is energized. The light-on condition indicates that one or both wing tanks are empty or the booster pump in one or both wing tanks has failed. In the event of a failed booster pump in one wing, fuel from that wing will not transfer to the main tank. However, the fuel can be utilized in WING AUX operation.

CAUTION

In normal operation the flicker or light-on condition of the wing pump pressure warning light is disregarded since fuel is being fed to the engine from the main tank; however, in WING AUX operation, the engine is being fed directly from the wing tanks and at the first flicker or flash of the warning light the FWD AUX position on the fuel tank selector must be selected immediately (if fuel remains in the forward tank) to assure against a flame-out.

FORWARD PUMP PRESSURE WARNING LIGHT.

Forward tank booster pump pressure is indicated by a red or an amber light (figure 1—22) marked FWD PUMP PRESS. The light will illuminate if the pressure in the fuel line from the forward tank is below approximately 9 psi and the primary bus is energized. The light-on condition indicates that the forward tank is empty or the booster pump has failed. In the event of a booster pump failure the forward tank fuel cannot be transferred to the main tank by gravity since the main tank is higher than the forward. However, the fuel can be utilized in FWD AUX operation.

MAIN TANK LOW LEVEL WARNING LIGHT.

The main tank low level warning light (figure 1—22) is a red light marked MAIN TK LOW LEVEL and will illuminate when the main tank fuel level is between 830 and 1120 pounds and will remain on until the main tank is refueled or the primary bus is deenergized.

BOOSTER PRESSURE WARNING LIGHT.

The booster pressure warning light (figure 1—22) is a red light marked BOOST. PRESS. and will illuminate if the primary bus is energized and the fuel pressure between the fuel selector valve and the engine driven booster pump is below approximately 9 psi.

FUEL QUANTITY INDICATOR.

The fuel quantity indicator (15, figure 1–4; 16, figure 1–5; 16, figure 1–6) is an a-c powered electrical unit which operates from either the normal or alternate inverter. It reads the quantity of fuel remaining in any or all internal tanks in the airplane and Type I or modified Type II inboard external tanks in units of pounds. Fuel weight is calibrated by the combination of a float unit in each tank and a unit installed in the main tank which compensates for the density and temperature of fuel in the tanks. This combination assures a true indication of the weight of fuel in the airplane within a tolerance of approximately 4 per cent when operating with the fuel tank selector in the ALL TANKS positions; however, the indicator will read differently each time the airplane is serviced with fuel of a different density. A fuel volume switch is provided to change the electrical circuit so that full fuel volume is indicated on the same dial. The fuel volume reading is necessary in that it provides a means of indicating that the airplane is fully serviced regardless of fuel density. Three reference points are positioned on the dial to indicate full fuel for three different configurations.

WARNING

With 700 lbs of fuel or less remaining in the main tank, sustained uncoordinated or climbing turns, accelerations, and nose high attitudes can result in booster pump starvation and subsequent engine flame-out. A properly sealed main tank pump compartment will contain sufficient fuel to insure satisfactory engine operation, for the following periods, when performing any of the above maneuvers.

MAIN TANK FUEL QUANTITY	OPERATING TIME
700 lbs	1.0 minutes
400 lbs	0.5 minutes

NORMAL READING.

Normally the reading on the large scale multiplied by 1000 plus the reading on the small scale multiplied by 100 indicates the fuel remaining in the airplane in pounds. With the fuel tank selector in the ALL TANKS or OFF position and the fuel quantity check switch OFF the fuel quantity indicator will read the total weight of internal and Type I or modified Type II inboard external fuel remaining in the airplane. With the fuel tank selector in the WING AUX or FWD AUX position and the fuel quantity check switch OFF the quantity indicator will read the weight of fuel remaining in the respective tank plus the fuel remaining in the Class I inboard external tanks.

WARNING

Due to an inherent error in the system, on aircraft up to F-84F-45 having serial numbers below 52-7090 the fuel quantity indicator reads approximately 25 per cent low when operating with the fuel tank selector in the WING AUX or FWD AUX position.

FUEL VOLUME SWITCH.

The fuel volume switch (17, figure 1–4; 18, figure 1–5; 18, figure 1–6) marked FUEL VOL ALL TKS is provided to change the fuel quantity indicator a-c circuit so that fuel volume instead of fuel weight is read on the fuel quantity indicator. This information is valuable when refueling on the ground or in the air as the fuel capacity of the airplane, in gallons, remains constant. There are three dots on the indicator, one at 4195 lbs corresponds to full internal fuel only, the second dot at 7551 lbs corresponds to full internal fuel plus two 230 gal Type I inboard external tanks, the third dot at 10,761 lbs corresponds to full internal fuel plus two 450 gal Type I inboard external tanks. When the fuel volume switch is depressed with the fuel tank selector in the ALL TANKS position the pointer will stop at the dot corresponding to the airplane configuration if fully serviced. Validity of these readings would be affected if outboard ex-

FUEL SYSTEM WARNING LIGHTS



Figure 1—22

FUEL QUANTITY INDICATOR and SELECTOR SWITCH



Figure 1—23

ternal tanks or unmodified Type II inboard tanks are carried since these do not have fuel quantity transmitters.

FUEL TANK QUANTITY SELECTOR SWITCH.

The fuel tank quantity selector switch (17, figure 1—4; 18, figure 1—5; 18, figure 1—6) is provided so that the fuel quantity in individual tanks can be determined. It is a rotary switch with the following positions; MAIN, L WING, EXT L INB'D, FWD, EXT R INB'D and R WING. When positioned to any one of these positions, the quantity of fuel in the respective tank will register on the fuel quantity indicator when the fuel quantity check switch is placed in the FUEL QTY CHECK position regardless of the position of the fuel tank selector. Unmodified Type II inboard external tanks will not register fuel remaining as these tanks are not equipped with fuel quantity transmitters.

Note

On aircraft prior to F-84F-45, if the fuel quantity selector switch is positioned to the EXT R INB'D position without pylon tanks installed all internal fuel remaining will be indicated on the fuel quantity indicator when the fuel quantity check switch is positioned to the FUEL QTY CHECK position. If the quantity selector switch is positioned to EXT L INB'D position under the same conditions the quantity indicator will read zero.

CAUTION

On aircraft prior to F-84F-35RE the fuel quantity remaining readings for individual tanks, obtained by use of the fuel tank quantity selector switch, will not add up to the total fuel remaining reading obtained with the fuel tank selector in the ALL TANKS position due to the inherent tolerances in the calibrating system. However, the total fuel quantity remaining will be correct to within approximately 4 per cent.

FUEL QUANTITY CHECK SWITCH.

The fuel quantity check switch (17, figure 1—4; 18, figure 1—5; 18, figure 1—6) is used when it is desired to ascertain the quantity of fuel in the individual tanks. The switch has two positions FUEL QTY CHECK and OFF. When placed in the FUEL QTY CHECK position the quantity of fuel remaining in the tank, indicated by the position of the fuel tank quantity selector switch, will register on the fuel quantity indicator. The OFF position will register fuel remaining in tanks as indicated by the fuel tank selector.

FUEL FLOW INDICATOR.

The fuel flow indicator (18, figure 1—4; 19, figure 1—5; 19, figure 1—6) registers the flow of fuel to the engine in units of pounds per hour. The indicator is a-c powered from either the main or alternate inverter. It is operated by a fuel flow meter which is located in the fuel system between the pressurizing valve and the engine burners. All fuel flowing to the engine will be recorded whether from the normal or auxiliary systems.

ELECTRICAL POWER SUPPLY SYSTEM.

The aircraft is equipped with both a-c and d-c electrical power systems (figure 1—24). All circuits are protected with either a circuit breaker or a fuse both of which are accessible from the cockpit. A 4.5 volt dry cell battery is installed as an emergency source of power for canopy jettisoning if the main electrical system fails. On F-84F-61RE and later aircraft, a 26.25 volt, wet cell, silver zinc battery is provided for emergency operation of the AN/ARC-34 radio.

CIRCUIT BREAKER PANELS.

Circuit breaker panels (figure 1—25) are provided to protect the various electrical circuits in the airplane. The circuit breakers are of the push button type and are pushed in to reset.

ELECTRICAL

POWER SUPPLY SYSTEM SCHEMATIC

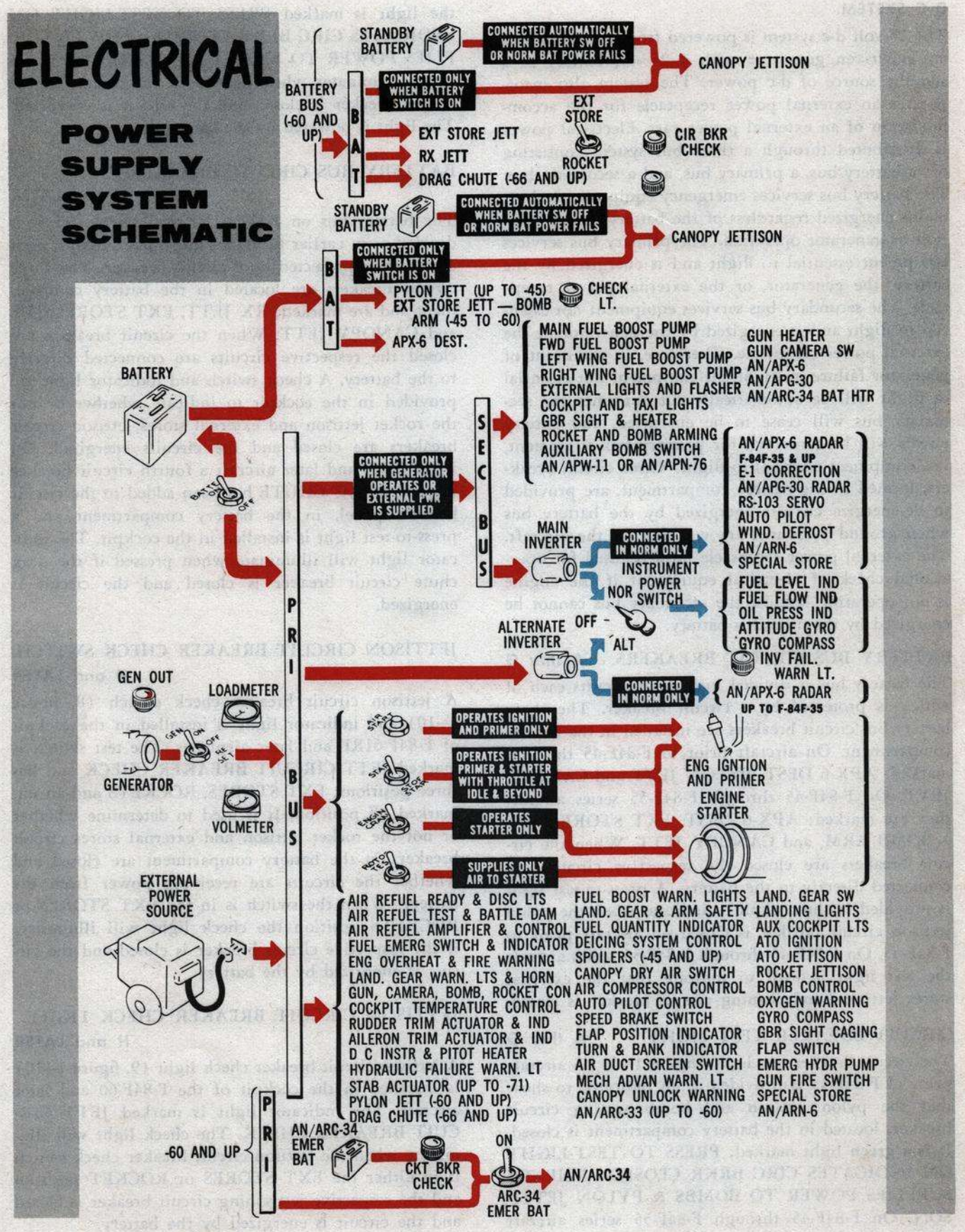


Figure 1—24

D-C SYSTEM.

The 28-volt d-c system is powered from a 400 ampere, engine-driven generator with a 24-volt battery as a standby source of d-c power. The system also incorporates an external power receptacle for the accommodation of an external power cart. Electrical power is distributed through a three bus system consisting of: a battery bus, a primary bus, and a secondary bus. The battery bus services emergency equipment and remains energized regardless of the battery switch position or generator operation. The primary bus services equipment essential to flight and is energized by the battery, the generator, or the external power receptacle. The secondary bus services equipment not essential to flight and is energized by the generator or the external power receptacle. Therefore, in the event of generator failure in flight, all equipment not essential to flight will be automatically cut out since the secondary bus will cease to be energized, and battery power will be conserved for primary bus equipment, i.e., equipment essential to flight. Three circuit breakers, located in the battery compartment, are provided to de-energize circuits energized by the battery bus when ground personnel are working on the aircraft. The external power receptacle must be used for operational check of electrical equipment if the engine is not operating because the secondary bus cannot be energized by the aircraft's battery.

BATTERY BUS CIRCUIT BREAKERS. **A thru G**

The battery bus is divided into three circuits each of which is protected by a circuit breaker. The three battery bus circuit breakers are installed in the battery compartment. On aircraft prior to F-84F-45 they are marked: APX-6 DEST, PYLON JETT and CANOPY JETT. On F-84F-45 through F-84F-55 series aircraft they are marked: APX-6 DEST, EXT STORE JETT – BOMB ARM, and CANOPY JETT. When the circuit breakers are closed the respective circuits are connected directly to the battery. A press-to-test light is provided in the cockpit to indicate when the pylon jettison circuit breaker is closed on aircraft prior to F-84F-45. On F-84F-45 through F-84F-55 series aircraft the test light is used to indicate that the external stores jettison-bomb arming circuit breaker is closed.

CIRCUIT BREAKER TEST LIGHT. **A thru G**

The circuit breaker test light (figure 1–6) on aircraft prior to F-84F-45 is provided as an indicator to show that the pylon jettison and bomb arming circuit breaker, located in the battery compartment is closed. It is a green light marked; PRESS TO TEST-LIGHT ON INDICATES CIRC BRKR CLOSED – THIS CB SUPPLIES POWER TO BOMBS & PYLON JETTISON. On F-84F-45 through F-84F-55 series aircraft the light is marked PRESS TO TEST-LIGHT ON INDICATES CIRC BRKR CLOSED – THIS CB SUPPLIES POWER TO EXT STORE JETTISON. If the light illuminates when pressed, it indicates that the circuit breaker is closed and the circuit is energized. The light is powered by the battery bus.

BATTERY BUS CIRCUIT BREAKERS. **H and LATER**

The battery bus on F-84F-61RE and later aircraft is divided as in earlier airplanes into three circuits, each of which is protected by a circuit breaker. The three circuit breakers are located in the battery compartment and are marked; RX JETT, EXT STORE JETT and CANOPY JETT. When the circuit breakers are closed the respective circuits are connected directly to the battery. A check switch and indicator light are provided in the cockpit to indicate whether or not the rocket jettison and external stores jettison circuit breakers are closed and the circuits energized. On F-84F-66RE and later aircraft a fourth circuit breaker marked DRAG CHUTE has been added to the circuit breaker panel, in the battery compartment and a press-to-test light is installed in the cockpit. The indicator light will illuminate when pressed if the drag chute circuit breaker is closed and the circuit is energized.

JETTISON CIRCUIT BREAKER CHECK SWITCH. **H and LATER**

A jettison circuit breaker check switch (8, figure 1–10) and indicator light is installed in the cockpit of F-84F-61RE and later airplanes. The test switch is marked JETT CIRCUIT BREAKER CHECK and has three positions; EXT STORES, ROCKETS and an unmarked off position. It is used to determine whether or not the rocket jettison and external stores circuit breakers in the battery compartment are closed and whether the circuits are receiving power from the battery. When the switch is in the EXT STORES or ROCKETS position the check light will illuminate if the respective circuit breaker is closed and the circuit is energized by the battery.

JETTISON CIRCUIT BREAKER CHECK LIGHT. **H and LATER**

A jettison circuit breaker check light (9, figure 1–10) is installed in the cockpit of the F-84F-60 and later aircraft. The indicator light is marked JETT CIRCUIT BREAKER CHECK. The check light will illuminate when the jettison circuit breaker check switch is in either the EXT STORES or ROCKET position and the respective jettisoning circuit breaker is closed and the circuit is energized by the battery.

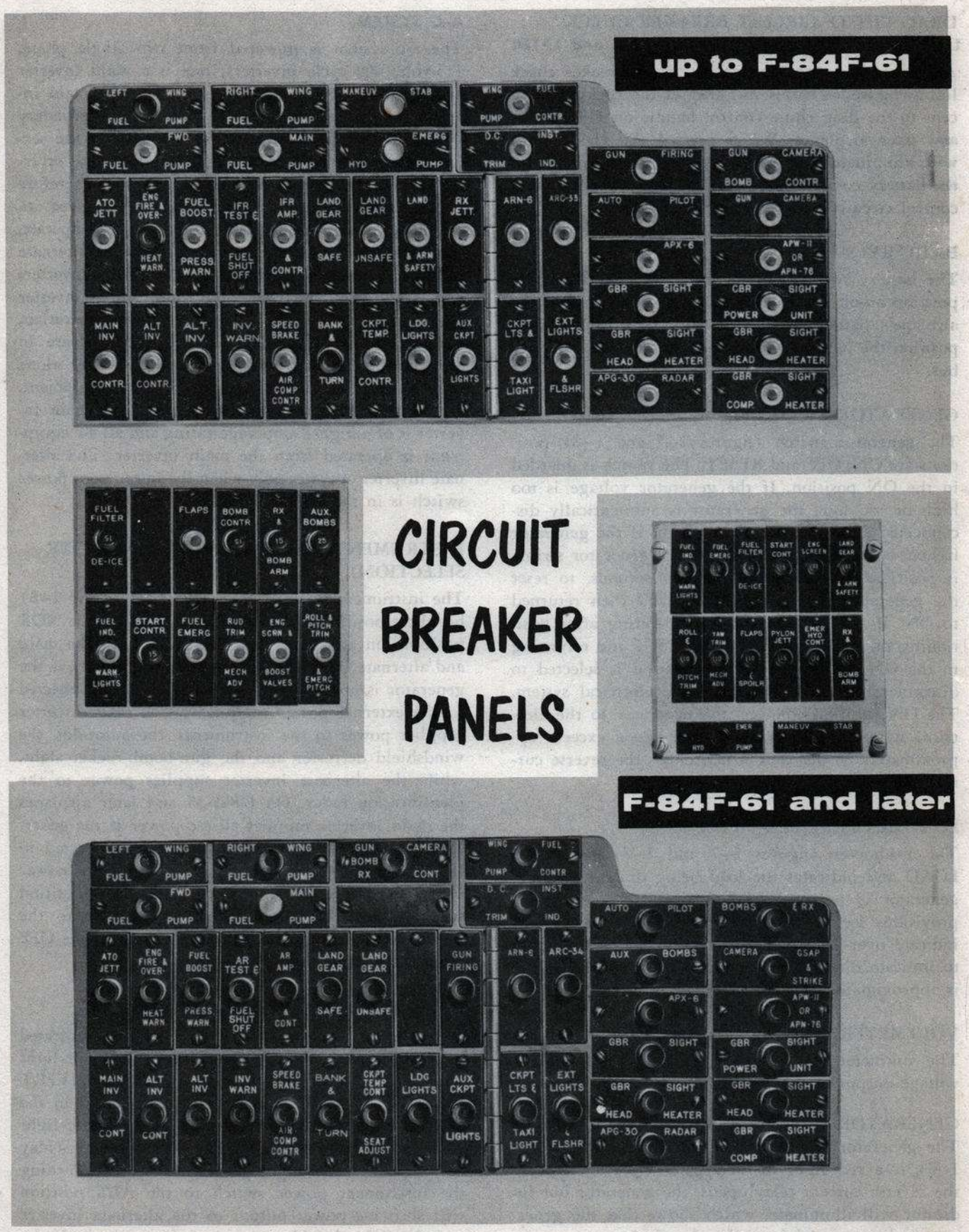


Figure 1—25

inverter failure indicator light goes on with the instrument power switch in the ALT position, it indicates that the alternate inverter is not operating. The light is energized by the primary bus.

HYDRAULIC POWER SUPPLY SYSTEM.

A thru J

The hydraulic power supply system (figure 1–26) is divided into three individual systems: a boost system which supplies pressure to the surface control actuators, a utility system which supplies all other hydraulic systems and an emergency system which supplies hydraulic pressure to the aileron and stabilator surface control actuators in the event of failure of the boost and utility systems. The boost and the utility systems are divided by check valves so that the boost system cannot supply pressure to the utility system. However, the utility system will supply hydraulic pressure not only to the utility system but also to the control system actuators if the demand arises. Hydraulic pressure in each of the boost and utility systems is provided by a variable delivery type engine driven pump. Each pump instantly and positively adjusts delivery to the demand of the respective hydraulic system. The pumps are designed so that pressure is supplied only when a system demands power. If pressure is not demanded the suction port of each piston is closed and pressure is not supplied. When power is required the suction port is open. A zero g type hydraulic reservoir has been installed in F-84F-30RE, -25GK and later aircraft to prevent damage to the hydraulic pump from cavitation when in flight under zero g conditions. The pressure in the emergency hydraulic system is provided by an electrically driven pump. This system automatically takes over and supplies hydraulic pressure to the aileron and stabilizer actuators if the boost and the utility systems pressure drops to approximately 600 to 800 psi. The airplane hydraulic system is fully automatic and it is only necessary to move the selected control or switch to the desired position to obtain control of the selected system. A hydraulic hand pump is provided for ground operation of the utility system. A compressed air system is provided for emergency operation of the landing gear. Hydraulically operated systems are; surface control actuators, landing gear, landing flaps, air refueling system, speed brakes, booster wheel brakes, ato release, engine screen system and pneumatic compressor. These systems are described under applicable headings.

WARNING

Do not fly in a zero g flight configuration for any extended period of time on F-84F-25RE airplanes as hydraulic pressure may be lost due to hydraulic pump cavitation. If loss of pressure occurs, considerable time may elapse before hydraulic pressure is regained.

HYDRAULIC HAND PUMP. A thru J

The hydraulic hand pump (17, figure 1–9; 14, figure 1–10) can be used to supply hydraulic pressure to the utility system for operating any hydraulic system except the flight control actuators. The hand pump has a telescoping handle that is pulled out, rotated 90 degrees and moved aft about one-quarter inch before using. This provides a longer handle and clearance between the handle and console for greater ease in operation. To operate a system, place the selected control in the desired position, then operate the hand pump.

Note

The hand pump is basically used during ground maintenance. However, in an emergency, hydraulic systems powered by the utility pump, may be actuated by the hand pump. Refer to figure 1–27 for the number of strokes of the hand pump required to operate each system.

HYDRAULIC PRESSURE GAGES. A thru J

Two hydraulic pressure gages (25, 28, figure 1–4; 25, 28, figure 1–5; 25, 28, figure 1–6) located on the instrument panel, are provided to indicate pressure in the utility and the boost systems. During normal operation both gages will read approximately 1500 psi. If the utility system pump fails the utility pressure gage will indicate the loss of pressure and the utility systems will be inoperative. However, the boost system gage will indicate pressure in the surface control actuators. If the boost system pump should fail, on airplanes up to F-84F-50, with the utility system operating normally, the utility pump will supply pressure to operate the surface control actuators and the boost system pressure gage will read zero. On F-84F-50 and later airplanes the boost system pressure gage will indicate pressure in the surface control actuator system from either the utility or boost system pumps. Emergency hydraulic pressure will not be indicated on either gage.

HYDRAULIC POWER SUPPLY SYSTEM.

K and LATER

The hydraulic power supply system (figure 1–28) installed in F-84F-71RE and later aircraft consists of three systems; the power, the utility and the emergency systems. Any one of the three systems may be used to power the surface control tandem actuators for the ailerons and stabilator in the event of failure of the other two hydraulic power sources. During

DRAG CHUTE CIRCUIT BREAKER CHECK LIGHT. J and LATER

A press-to-test type drag chute circuit breaker check light (figure 1–35) is installed in the cockpit, adjacent to the drag chute control handle on F-84F-66RE and later airplanes. When pressed the check light will illuminate if the drag chute circuit breaker in the battery compartment is closed and the drag chute control circuit is energized by the battery.

BATTERY SWITCH.

The battery switch (figures 1–7 and 1–8) is a two position on-off switch. The ON position connects the airplane's battery to the primary bus. In the OFF position the battery is disconnected from the primary bus.

GENERATOR SWITCH.

The generator switch (figures 1–7 and 1–8) positions are ON, OFF and RESET. The switch is guarded in the ON position. If the generator voltage is too high or too low, the generator is automatically disconnected from the electrical system. If the generator has cut-out due to over-voltages, the generator switch is positioned to RESET for a few seconds, to reset the generator field control relay, and then returned to ON. If the generator is not operating after positioning the generator switch to RESET and returning to the ON position, the OFF position is selected to disconnect the generator from the electrical system. The ON position connects the generator to the electrical system whenever the engine speed exceeds approximately 30 per cent which closes the reverse current relay.

LOADMETER.

The loadmeter (figures 1–7 and 1–8) is marked LOAD and indicates the load being drawn from the generator in per cent from 0 to 100 per cent, with provisions for an additional 25 per cent reading to indicate over-load, and a minus 10 per cent reading to indicate discharge. The normal loadmeter reading is approximately .5 (±.1).

VOLTMETER.

The voltmeter (figures 1–7 and 1–8) indicates the voltage output of the generator.

GENERATOR OUT INDICATOR LIGHT.

The generator out indicator light (figures 1–7 and 1–8) is a red light marked GEN OUT. Whenever the reverse current relay opens, the generator out indicator will illuminate, which shows that the generator is disconnected from the electrical system.

A-C SYSTEM.

The a-c system is powered from two single phase, 115-volt, 400 cycle inverters; one is a main inverter and the other is an alternate inverter. The main inverter requires power from the primary and secondary buses and will therefore not be available if the secondary bus (or generator) fails. The alternate inverter is powered from the primary bus, and therefore in event of generator failure, only a-c energized instruments which are necessary for flight will operate, provided the instrument power switch is in alternate position. A switch for the selection of the inverters and a light for indication of failure of either inverter are provided in the cabin. During normal operation, on airplanes up to F-84F-35, both inverters are in operation, as the output of the main inverter alone is not sufficient to accommodate all a-c equipment. On F-84F-35 and subsequent airplanes, the main inverter is of a higher amperage rating and all a-c equipment is operated from the main inverter. The alternate inverter operates only when the instrument power switch is in the ALT position.

INSTRUMENT POWER SWITCH (INVERTER SELECTION).

The instrument power switch (figures 1–7 and 1–8) has three positions; NOR, OFF and ALT. In the NOR position, on airplanes up to F-84F-35, both the main and alternate inverters are supplying a-c power if the generator is operating or external power is connected to the external power receptacle. The main inverter supplies power to the instruments, the autopilot, the windshield defroster and the gun-bomb-rocket sight, while the alternate inverter supplies power to the identification radar. On F-84F-35 and later airplanes the main inverter supplies all a-c power if the generator is operating or external power is connected to the external power receptacle if the instrument power switch is in the NOR position. The ALT position supplies power from the alternate inverter to the instruments if the primary bus is energized. The OFF position turns off both inverters.

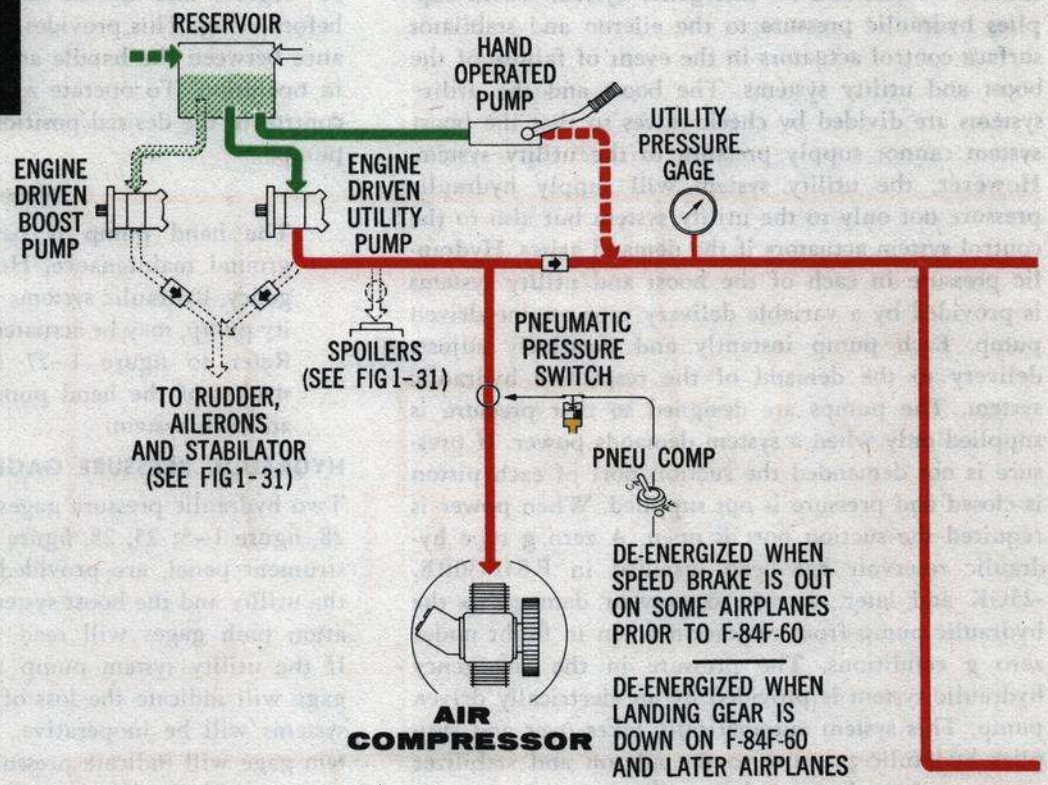
INVERTER FAILURE INDICATOR LIGHT.

Failure of the main or alternate inverter is indicated by illumination of the inverter failure indicator light (figures 1–7 and 1–8) which is marked INVERT FAILURE. If the instrument power switch is in the NOR position and the inverter failure indicator light illuminates, the main inverter is inoperative. (May be caused by inverter or generator failure.) Turning the instrument power switch to the ALT position will shift a-c power output to the alternate inverter and the light should go out in a few seconds. If the

HYDRAULIC

POWER SUPPLY SYSTEM SCHEMATIC

AIRCRAFT PRIOR TO F-84F-71



CODE

- HYDRAULIC PRESSURE (ACTIVE)
- HYDRAULIC PRESSURE (INACTIVE)
- EMERGENCY HYDRAULIC PRESSURE
- HYDRAULIC SUPPLY
- HYDRAULIC RETURN
- PNEUMATIC PRESSURE
- CHECK VALVE
- ELECTRICAL CONNECTION
- MECHANICAL CONNECTION

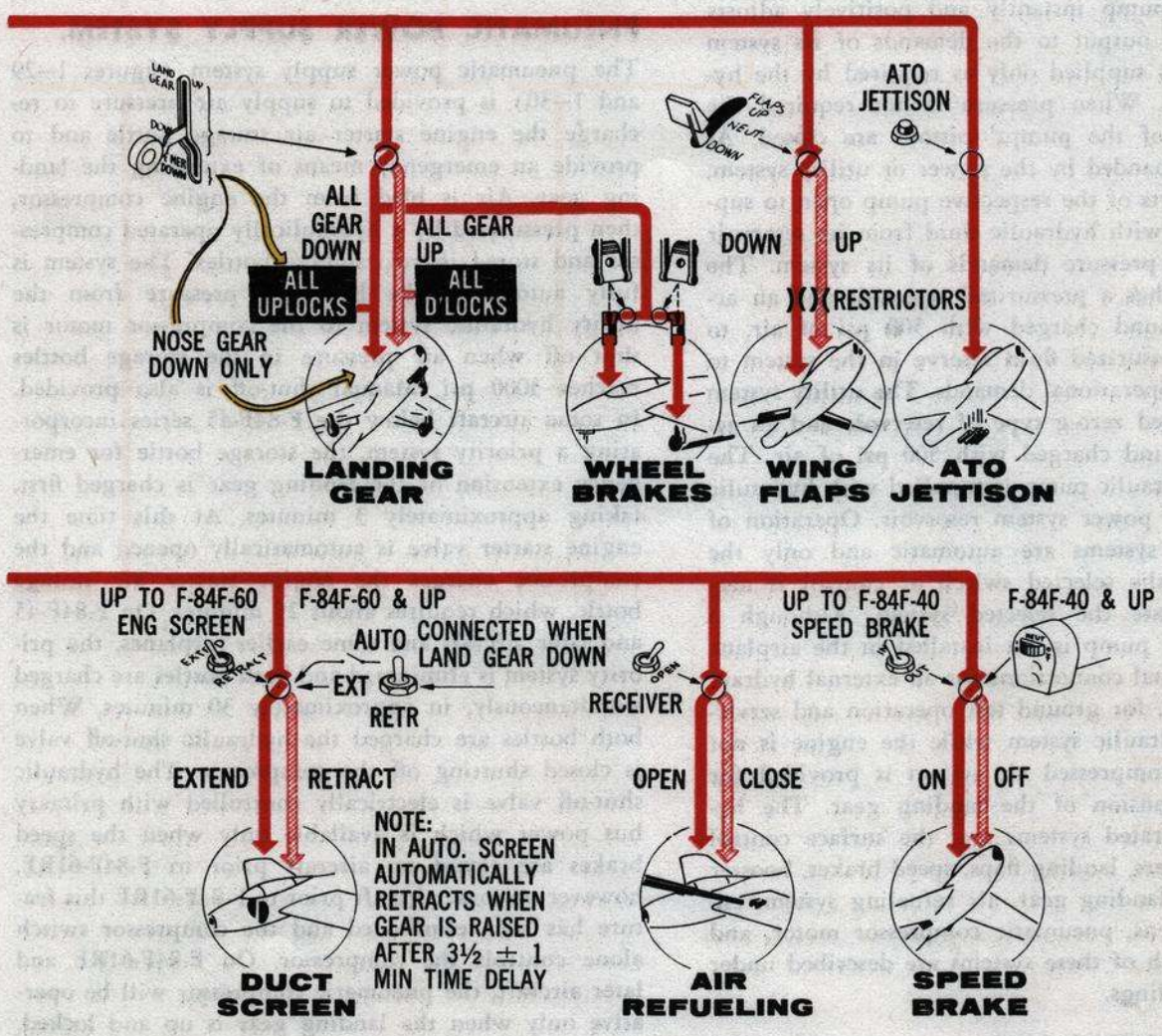


Figure 1–26 (Sheet 2 of 2)

actuated on the ground to permit compressor operation with the landing gear extended.

CAUTION

The compressor should not be operated for more than 30 minutes continuously to prevent overheating and possible compressor explosion. Therefore, if the storage bottles take an excessive amount of time to refill, the compressor should be shut-off.

Note

There is an automatic safety feature which will stop the storage bottle charging cycle in the event of compressor overheating. The compressor will automatically resume operation when the temperature reduces. Therefore, charging time may be more than the normal time required to charge the system. However, there is no indication by which the pilot can determine this condition.

PNEUMATIC COMPRESSOR SWITCH.

The pneumatic compressor switch (21, figure 1–9; 5, figure 1–10) is provided so that the compressor can be turned off during take-offs and landings or at any time when a demand is made for hydraulic pressure from the utility system. The switch has two positions and is marked PNEU COMP ON and OFF. The ON position, on aircraft prior to F-84F-61RE, opens the spring-loaded to closed hydraulic shut-off valve that controls the flow of hydraulic fluid to the pneumatic compressor drive motor, if the speed brake switch is in the IN position. However, on some aircraft prior to F-84F-61RE, the pneumatic compressor is not affected by speed brake operation and is controlled solely by the pneumatic compressor switch. The pneumatic compressor will be automatically turned off and remain inoperative in F-84F-61RE and later aircraft when the landing gear is extended. However, the automatic cut-off switch can be manually actuated on the ground to permit compressor operation with the landing gear extended.

FLIGHT CONTROL SYSTEMS. A thru J

NORMAL SYSTEM. A thru J

During normal operation all flight controls are hydraulically operated (figure 1–31). Movement of the control stick and rudder pedals mechanically position sliding hydraulic control valves which in turn regulate hydraulic pressure to the actuators at the control surfaces. Hydraulic pressure is supplied by an engine driven boost pump. An alternate source of power is supplied by the engine driven utility pump which automatically provides pressure if the boost pump pressure is insufficient. In addition to the hydraulic actuation, the rudder and ailerons retain the mechanical flight control linkage so that, if necessary, these controls can be actuated directly by movement of the control stick and rudder pedals. On airplanes prior to F-84F-50 no shut-off for hydraulic pressure to the rudder booster is provided and it will operate as long as adequate hydraulic pressure is available from the boost or utility systems. On these airplanes, the aileron booster will operate as long as adequate pressure is available from the boost, utility or emergency hydraulic systems. However, on F-84F-50 up to F-84F-71RE airplanes the boost and utility systems can be isolated from the rudder and aileron actuators. In this event, the rudder actuator will be inoperative and the aileron

HYDRAULIC HAND PUMP STROKES REQUIRED TO OPERATE INDIVIDUAL SYSTEMS

Cycles Required To Operate Individual Systems



		APPROX. STROKES
Speed Brake	Extend	102
Air Refueling Receptacle	Open	4
Air Refueling Receptacle	Close Latches	4
Air Refueling Receptacle	Open Latches	4
Air Refueling Receptacle	Close	2
Landing Flaps	Extend	46
Engine Screen	Extend	8
Engine Screen	Retract	8
Landing Gear	Extend	80

(Handle in down or emerg down — no pneumatic pressure)

Figure 1–27

normal operation both utility and power hydraulic pressures are supplied to the aileron, and stabilator tandem actuators through separate hydraulic lines so that if one hydraulic system fails, the actuators will still be powered by the engine driven pump of the other system. Should both the power and utility systems fail, the pilot must manually switch to the emergency hydraulic pump to supply pressure to the surface control tandem actuators through the power system hydraulic lines. If the utility system fails the rudder will be controlled through mechanical linkage and the power brakes, flaps, spoilers, speed brakes, engine duct screens, pneumatic compressor, air refueling equipment and ato release will be inoperative, even though the power or emergency hydraulic pressure is available. The power and utility systems are powered by individual, variable delivery, engine driven pumps. Each pump instantly and positively adjusts delivery of its output to the demands of its system and pressure is supplied only as required by the hydraulic system. When pressure is not required the suction ports of the pumps' pistons are closed. As pressure is demanded by the power or utility system, the suction ports of the respective pump open to supply the pump with hydraulic fluid from its reservoir and meet the pressure demands of its system. The power system has a pressurized reservoir and an accumulator, ground charged with 500 psi of air, to maintain a pressurized fluid reserve in the system to meet extreme operational demands. The utility system has a pressurized zero-g type of reservoir and an accumulator ground charged with 500 psi of air. The emergency hydraulic pump is supplied with hydraulic fluid from the power system reservoir. Operation of the hydraulic systems are automatic and only the movement of the selected switch or control is necessary to actuate the selected system. Although a hydraulic hand pump is not installed in the airplane there are external connections for an external hydraulic hand pump, for ground test operation and servicing of the hydraulic system while the engine is not operating. A compressed air system is provided for emergency extension of the landing gear. The hydraulically operated systems are; the surface control actuators, spoilers, landing flaps, speed brakes, booster wheel brakes, landing gear, air refueling system, engine duct screens, pneumatic compressor motor, and ato release. Each of these systems are described under applicable headings.

HYDRAULIC PRESSURE GAGE. **K and LATER**

A single hydraulic pressure gage (25, 28, figure 1–6) provided with two indicator needles, indicates hydraulic pressure for the power and utility systems. The face of the gage is divided into two vertical half sections, with one half marked UTILITY for utility system pressure and the other half marked POWER for the power system pressure. Each half section of the gage face is marked to show hydraulic pressure ranging from 0 to 2000 psi. Normal operating pressure, of the system, is approximately 1500 psi for both the utility and power system, depending on the amount of equipment operating. Emergency system pressure is indicated on the POWER half of the gage face. When the emergency pump is operating, the POWER indicator needle will show an emergency operating pressure of approximately 1500 psi in the power system. The hydraulic pressure gage is powered by the a-c electrical system and will operate only when the instrument power switch is in the NOR or ALT position and the main or alternate inverter is operating.

PNEUMATIC POWER SUPPLY SYSTEM.

The pneumatic power supply system (figures 1–29 and 1–30) is provided to supply air pressure to recharge the engine starter air storage bottle and to provide an emergency means of extending the landing gear. Air is bled from the engine compressor, then pressurized by a hydraulically operated compressor and stored in two storage bottles. The system is fully automatic; the hydraulic pressure from the utility hydraulic system to the compressor motor is shut off when air pressure in the storage bottles reaches 3000 psi. Manual shut-off is also provided. In some aircraft below the F-84F-45 series incorporating a priority system, the storage bottle for emergency extension of the landing gear is charged first, taking approximately 3 minutes. At this time the engine starter valve is automatically opened and the compressor charges the engine starter air storage bottle, which requires about 25 minutes. On F-84F-45 and later aircraft and some earlier airplanes, the priority system is eliminated and both bottles are charged simultaneously, in approximately 30 minutes. When both bottles are charged the hydraulic shut-off valve is closed shutting off the compressor. The hydraulic shut-off valve is electrically controlled with primary bus power which is available only when the speed brakes are closed on aircraft prior to F-84F-61RE, however on some aircraft prior to F-84F-61RE this feature has been eliminated and the compressor switch alone controls the compressor. On F-84F-61RE and later aircraft, the pneumatic compressor will be operative only when the landing gear is up and locked. This system is provided to cut out the hydraulic motor of the pneumatic compressor during periods when there is a greater than normal demand for pressure in the utility hydraulic system. The automatic cut-off switch in the left wheel well can be

HYDRAULIC

POWER SUPPLY SYSTEM SCHEMATIC

F-84F-71 AND LATER AIRCRAFT

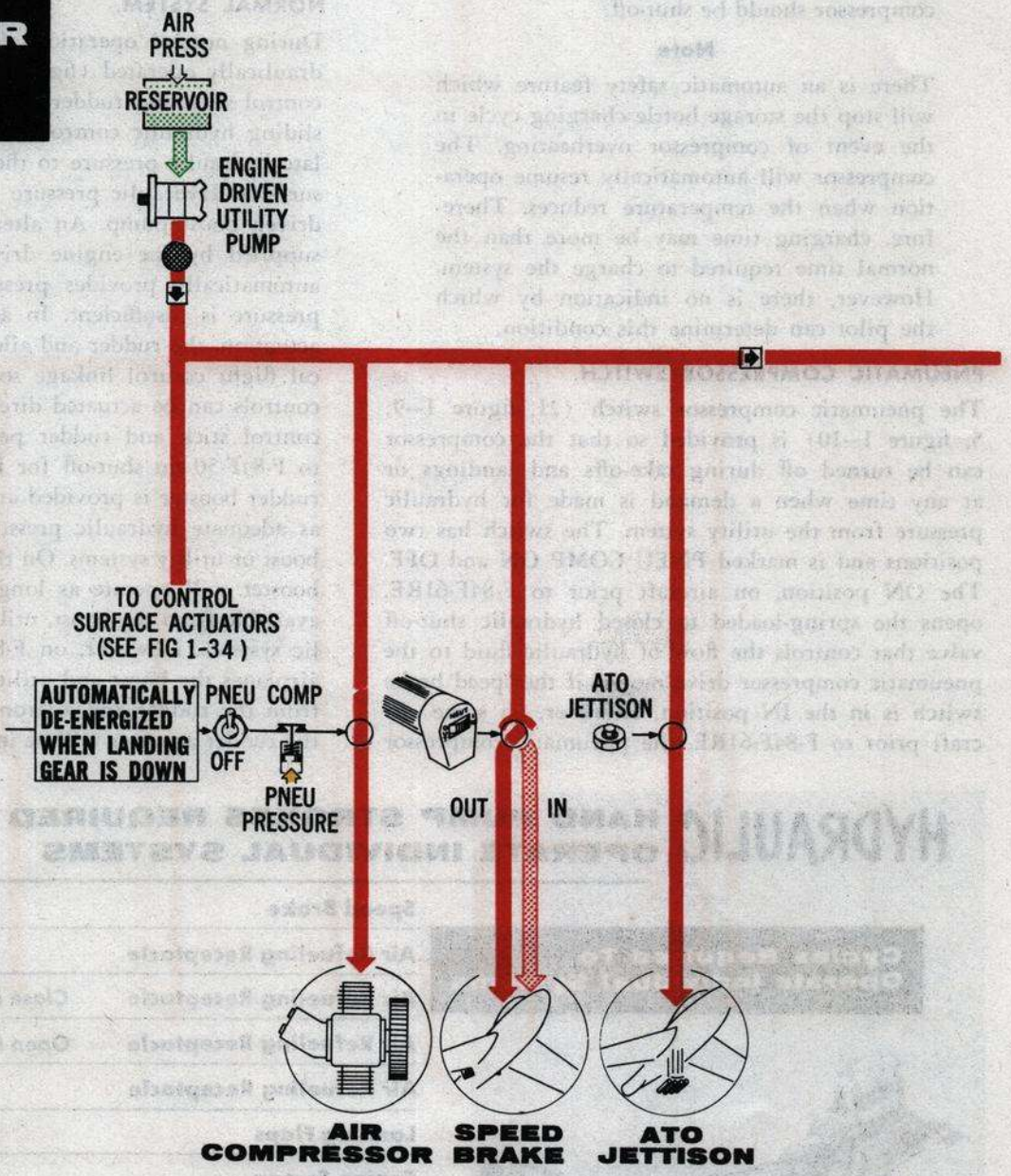


Figure 1-28 (Sheet 1 of 2)

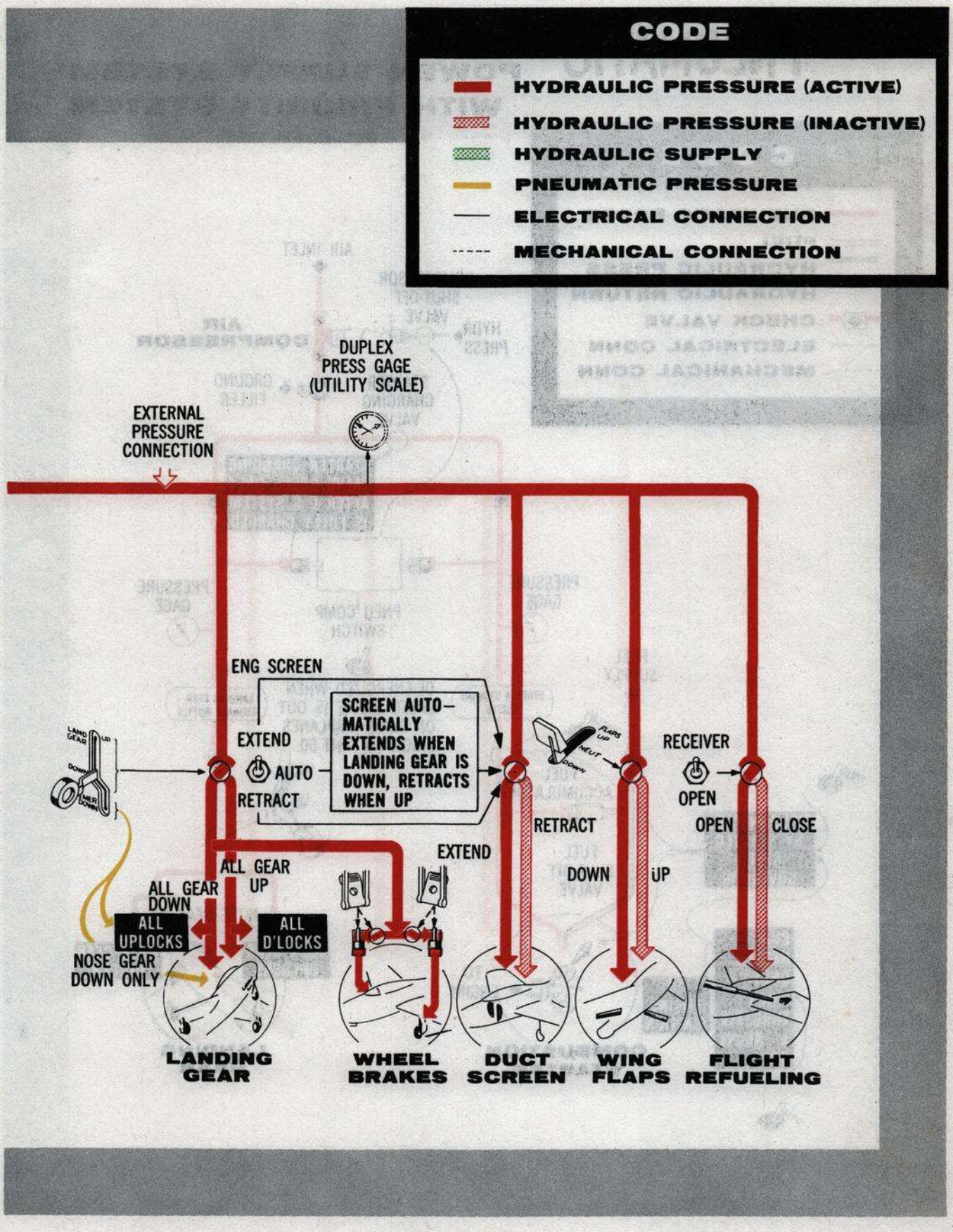


Figure 1-22 (Sheet 2 of 2)

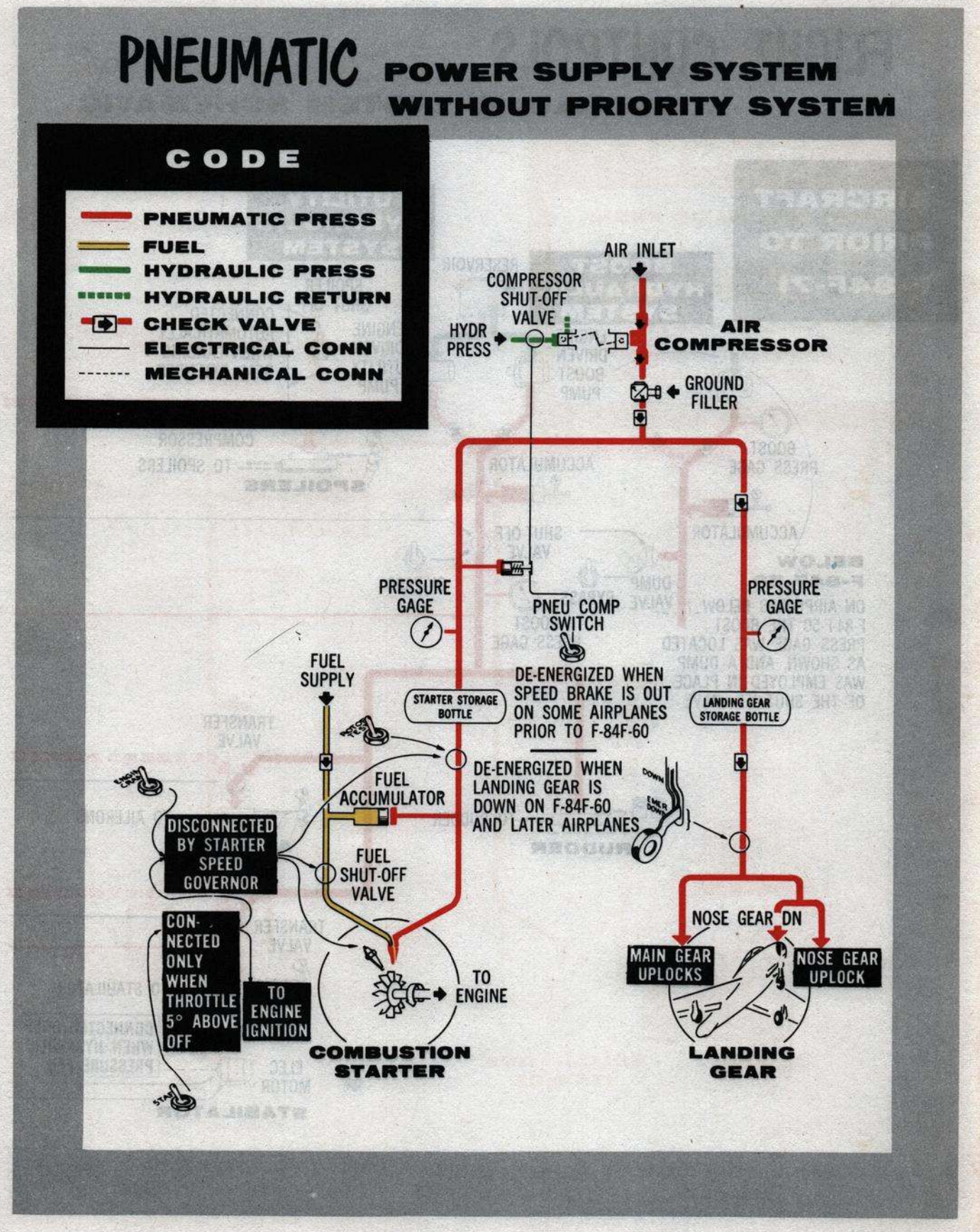
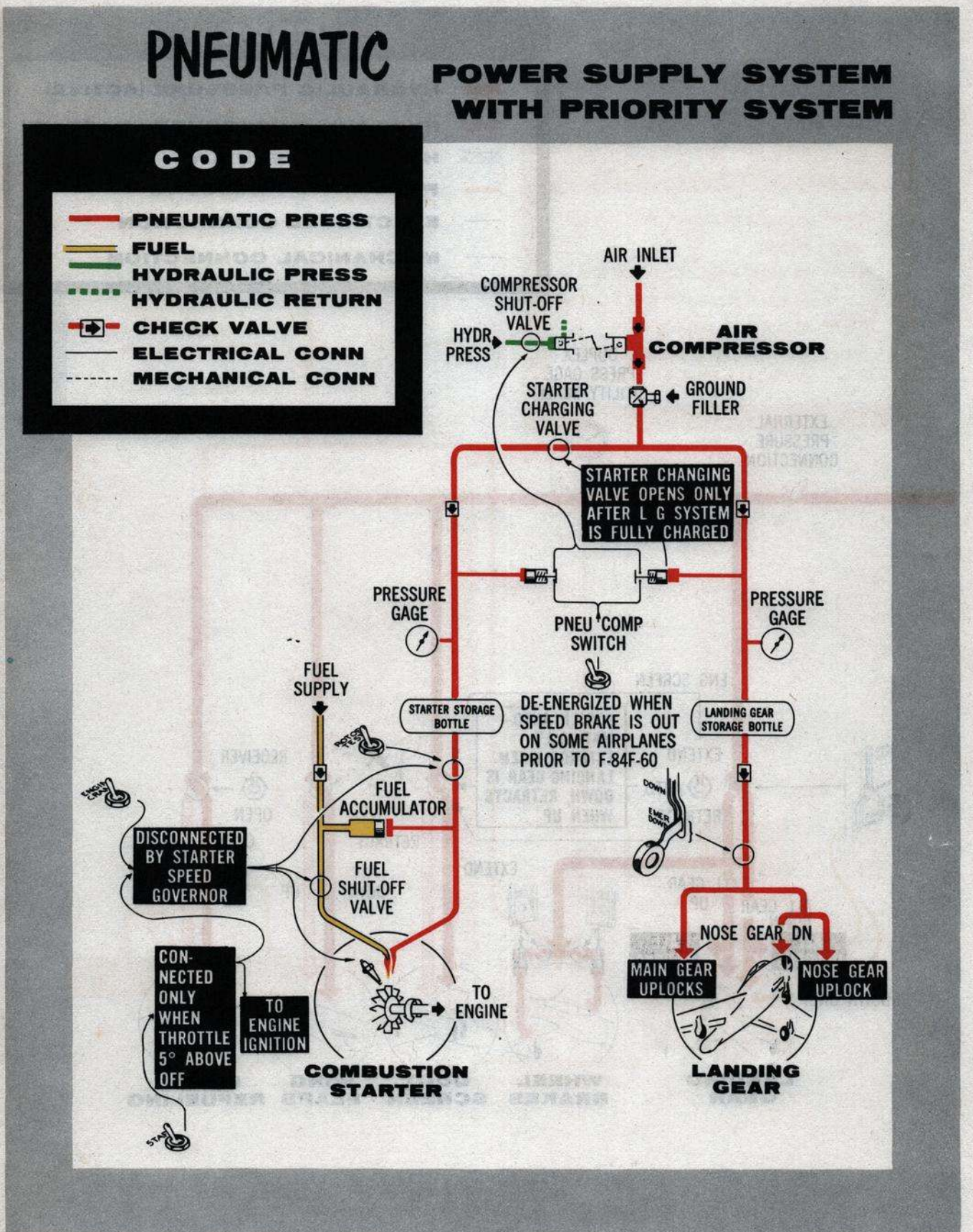

PNEUMATIC POWER SUPPLY SYSTEM WITHOUT PRIORITY SYSTEM
CODE
PNEUMATIC PRESS
FUEL
HYDRAULIC PRESS
HYDRAULIC RETURN
CHECK VALVE
ELECTRICAL CONN
MECHANICAL CONN
AIR INLET
COMPRESSOR SHUT-OFF VALVE
HYDR PRESS
AIR COMPRESSOR
GROUND FILLER
PRESSURE GAGE
PNEU COMP SWITCH
PRESSURE GAGE
FUEL SUPPLY
STARTER STORAGE BOTTLE
DE-ENERGIZED WHEN SPEED BRAKE IS OUT ON SOME AIRPLANES PRIOR TO F-84F-60
LANDING GEAR STORAGE BOTTLE
DE-ENERGIZED WHEN LANDING GEAR IS DOWN ON F-84F-60 AND LATER AIRPLANES
FUEL ACCUMULATOR
DISCONNECTED BY STARTER SPEED GOVERNOR
FUEL SHUT-OFF VALVE
CON-NECTED ONLY WHEN THROTTLE 5° ABOVE OFF
TO ENGINE IGNITION
TO ENGINE
COMBUSTION STARTER
NOSE GEAR DN
MAIN GEAR UPLOCKS
NOSE GEAR UPLOCK
LANDING GEAR

Figure 1—30


PNEUMATIC
POWER SUPPLY SYSTEM
WITH PRIORITY SYSTEM
CODE
PNEUMATIC PRESS
FUEL
HYDRAULIC PRESS
HYDRAULIC RETURN
CHECK VALVE
ELECTRICAL CONN
MECHANICAL CONN
AIR INLET
COMPRESSOR SHUT-OFF VALVE
HYDR PRESS
AIR COMPRESSOR
STARTER CHARGING VALVE
GROUND FILLER
STARTER CHANGING VALVE OPENS ONLY AFTER L G SYSTEM IS FULLY CHARGED
PRESSURE GAGE
PNEU COMP SWITCH
PRESSURE GAGE
FUEL SUPPLY
STARTER STORAGE BOTTLE
DE-ENERGIZED WHEN SPEED BRAKE IS OUT ON SOME AIRPLANES PRIOR TO F-84F-60
LANDING GEAR STORAGE BOTTLE
FUEL ACCUMULATOR
DISCONNECTED BY STARTER SPEED GOVERNOR
FUEL SHUT-OFF VALVE
CON-NECTED ONLY WHEN THROTTLE 5° ABOVE OFF
TO ENGINE IGNITION
TO ENGINE
COMBUSTION STARTER
NOSE GEAR DN
MAIN GEAR UPLOCKS
NOSE GEAR UPLOCK
LANDING GEAR

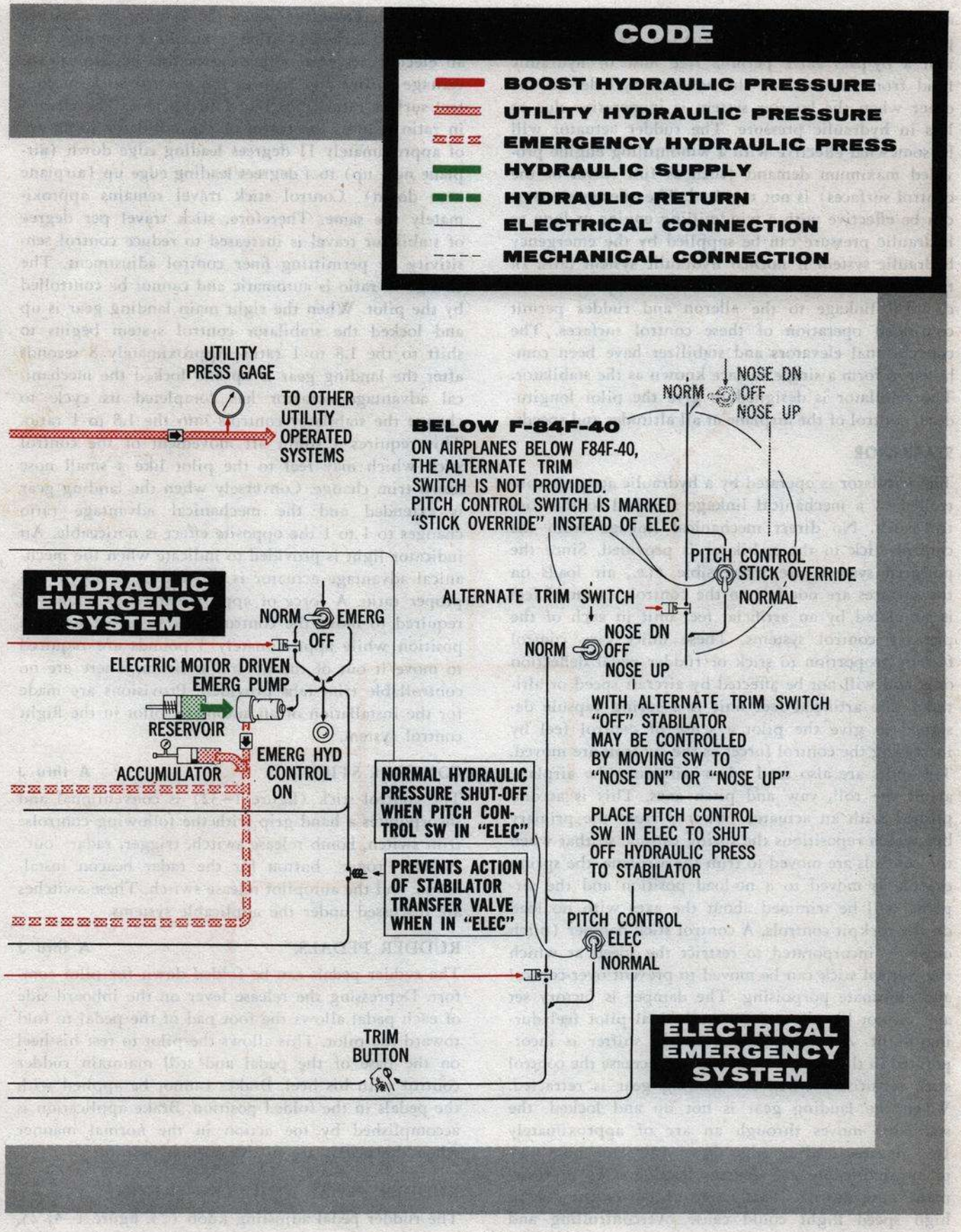


Figure 1-31 (Sheet 2 of 2)

FLIGHT CONTROLS

HYDRAULIC SYSTEM SCHEMATIC

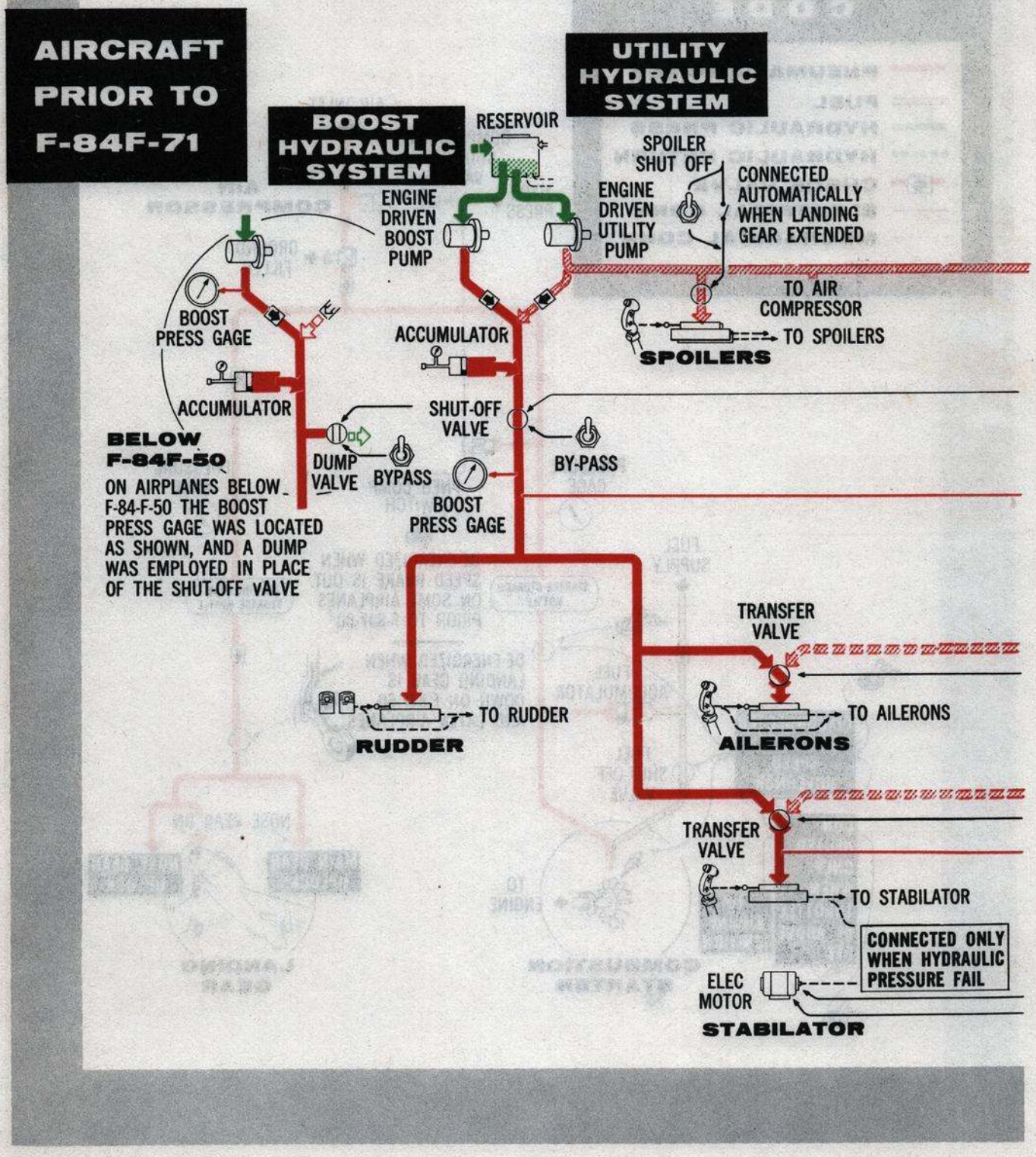


Figure 1–31 (Sheet 1 of 2)

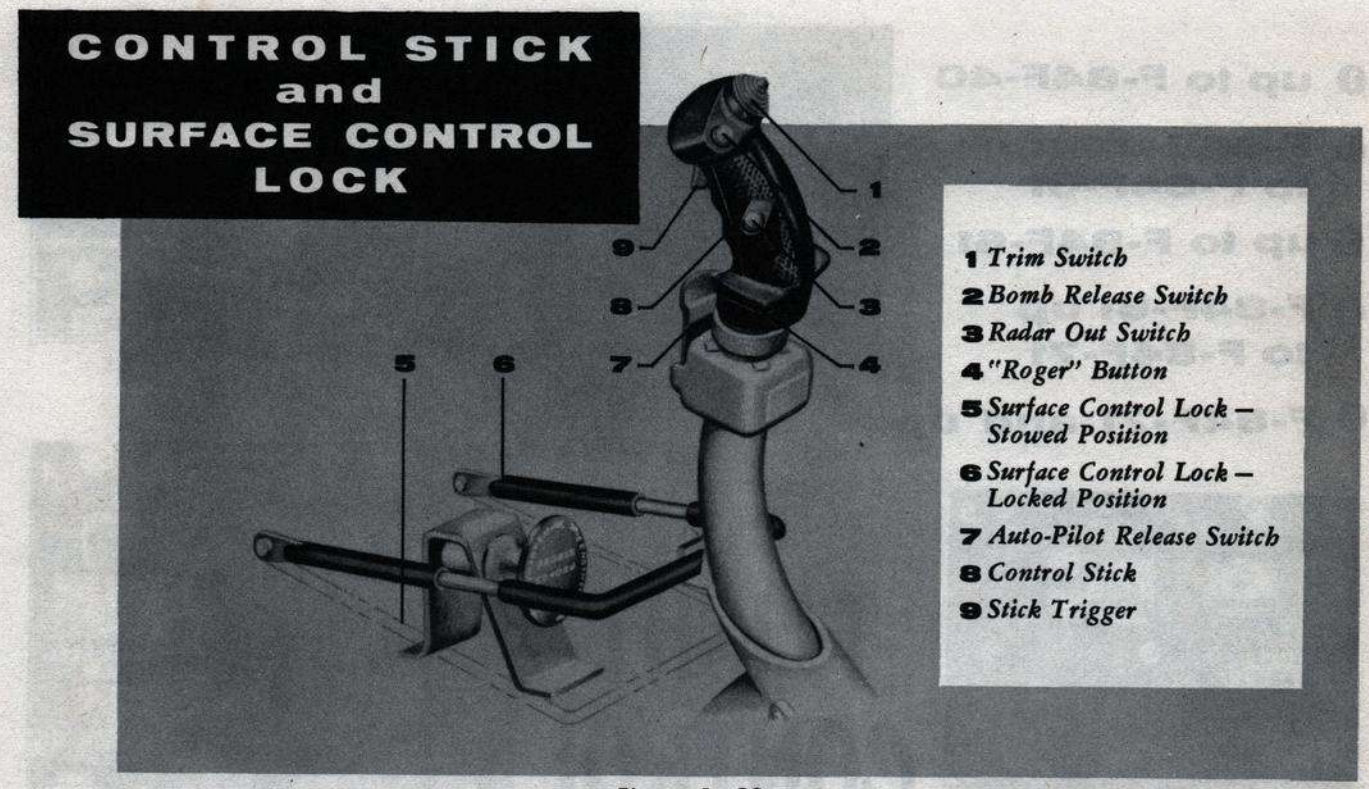


Figure 1—32

figure 1–5; 23, figure 1–6) adjust both rudder pedals simultaneously to the desired fore and aft position.

SURFACE CONTROL LOCK. **A thru J**

The surface controls are held in the neutral position when the airplane is parked by engaging the surface control lock (figure 1–32). The lock is engaged by positioning the rudder pedals to neutral then hooking the surface control lock over a fitting on the control stick. On earlier airplanes the surface control lock was a solid member. Later aircraft have been equipped with a control lock having telescoping side members incorporating shear rivets to preclude damage to control linkage in the event of inadvertent activation of the trim switch with the control surfaces locked.

CAUTION

Be sure surface controls are unlocked before turning battery switch ON. Do not operate trim switch with the controls locked. In either case the surface control lock may be damaged due to operation of the stabilator electrical actuator.

TRIM SWITCH. **A thru J**

Airplane trim about the roll and pitch axis is controlled by a five position trim switch (figure 1–32) which is spring-loaded to the center or off position. The lateral positions of the trim switch adjust the artificial feel unit in the aileron control system so as to change the neutral position of the spring capsule thereby trimming the airplane about the roll axis. The fore and aft positions of the switch adjust the artificial feel unit in the stabilator control to a no-load position. Both trim circuits are energized from the primary bus. The fore and aft positions of the trim switch also controls the stabilator electrical actuator if the emergency hydraulic system fails or if the pitch control switch is in the STICK OVERRIDE or ELEC position. On F-84F-40 and later airplanes the alternate trim switch must be in the NORM position in order for the trim switch to be operative.

RUDDER TRIM SWITCH. **A thru J**

Airplane trim about the vertical axis is accomplished by adjusting the neutral position of the spring capsule in the rudder control system. The neutral position is selected by a three position rudder trim switch (8, figure 1–9; 5, figure 1–10) which is energized from the primary bus and spring-loaded to the off position. The other switch positions are NOSE LEFT and NOSE RIGHT. The switch is held in the desired position until the airplane is trimmed about the vertical axis and then released.

ALTERNATE TRIM SWITCH (STICK SWITCH POWER AUXILIARY ELECTRICAL SWITCH). **D thru J**

On F-84F-40 up to F-84F-71RE airplanes the alternate trim switch (9, figure 1–9; 5, figure 1–10) is provided as an override for the trim switch on the con-

actuator will operate as long as emergency hydraulic pressure is available. The actuators are designed so that a by-pass valve permits free flow of hydraulic fluid from one end of the actuator cylinder to the other when the booster system is inoperative due to loss in hydraulic pressure. The rudder actuator will be somewhat effective with a windmilling engine provided maximum demand (such as full travel of the control surfaces) is not required. The aileron actuator can be effective with a windmilling engine as long as hydraulic pressure can be supplied by the emergency hydraulic system if normal hydraulic system fails. In the event of complete loss of hydraulic pressure mechanical linkage to the aileron and rudder permit continued operation of these control surfaces. The conventional elevators and stabilizer have been combined to form a single surface known as the stabilator. The stabilator is designed to give the pilot longitudinal control of the airplane at all altitudes and speeds.

STABILATOR.

The stabilator is operated by a hydraulic actuator controlled by a mechanical linkage attached to the control stick. No direct mechanical linkage from the control stick to the stabilator is provided. Since the powered systems are irreversible (i.e., air loads on the surfaces are not felt on the controls) control feel is simulated by an artificial feel unit in each of the primary control systems. These units vary control feel in proportion to stick or rudder pedal deflection only and will not be affected by aircraft speed or altitude. The artificial feel unit is a spring capsule designed to give the pilot a sense of control feel by increasing the control forces as the controls are moved. The units are also used when trimming the airplane about the roll, yaw and pitch axes. This is accomplished with an actuator powered from the primary bus which repositions the spring capsule so that when the controls are moved to trim the airplane, the spring capsule is moved to a no-load position and the airplane will be trimmed about the axes with no load on the cockpit controls. A control stick damper (pitch only) is incorporated to restrict the speed at which the control stick can be moved to prevent over-control and eliminate porpoising. The damper is factory set and cannot be adjusted for individual pilot feel during flight. A mechanical advantage shifter is incorporated in the stabilator linkage to decrease the control stick sensitivity when the landing gear is retracted. When the landing gear is not up and locked, the stabilator moves through an arc of approximately 16½ degrees leading edge down (airplane nose up) to approximately 4½ degrees leading edge up (airplane nose down). This range of movement during high speed flight could cause overcontrolling and porpoising. Therefore, when the landing gear reaches the up and locked position, a circuit is completed to an electric actuator which cycles the mechanical advantage shifter and reduces the control stick to control surface ratio from 1 to 1 to 1.8 to 1. The change in ratio reduces the travel of the stabilator to an arc of approximately 11 degrees leading edge down (airplane nose up) to 4 degrees leading edge up (airplane nose down). Control stick travel remains approximately the same. Therefore, stick travel per degree of stabilator travel is increased to reduce control sensitivity by permitting finer control adjustment. The change in ratio is automatic and cannot be controlled by the pilot. When the right main landing gear is up and locked the stabilator control system begins to shift to the 1.8 to 1 ratio. Approximately 8 seconds after the landing gear is up and locked the mechanical advantage actuator has completed its cycle to change the stabilator controls into the 1.8 to 1 ratio. This requires a slight aft movement of the control stick which may feel to the pilot like a small nose down trim change. Conversely when the landing gear is extended and the mechanical advantage ratio changes to 1 to 1 the opposite effect is noticeable. An indicator light is provided to indicate when the mechanical advantage actuator is shifting or is not in the proper ratio. A force of approximately 25 pounds is required to move the control stick to either extreme position while approximately 3 pounds are required to move it out of the neutral position. There are no controllable trim tabs provided. Provisions are made for the installation of an automatic pilot in the flight control system.

CONTROL STICK. **A thru J**

The control stick (figure 1–32) is conventional and incorporates a hand grip with the following controls: trim switch, bomb release switch, trigger, radar "out" switch; "roger" button for the radar beacon installation, and the autopilot release switch. These switches are discussed under the applicable systems.

RUDDER PEDALS. **A thru J**

The rudder pedals can be folded down for pilot comfort. Depressing the release lever on the inboard side of each pedal allows the foot pad of the pedal to fold toward the pilot. This allows the pilot to rest his heel on the base of the pedal and still maintain rudder control with his heel. Brakes cannot be applied with the pedals in the folded position. Brake application is accomplished by toe action in the normal manner when the pedals are in the normal position.

RUDDER PEDAL ADJUSTING KNOB.

The rudder pedal adjusting knob (23, figure 1–4; 23.



Figure 1—33

trol stick. The switch also provides a means of controlling the stabilator in the event of trim switch failure during electrical operation of the stabilator. The alternate trim switch is powered from the primary bus and has four positions. Two positions are marked STICK SW POWER: NORM and OFF. The other two positions are marked AUX ELEC: NOSE DN and NOSE UP. The NORM position supplies primary bus power to the control stick trim switch which controls the aileron and stabilator trim actuators if the pitch control switch is in the NORMAL position. The OFF position disconnects primary bus power from the trim switch on the control stick and is provided so that the trim switch can be isolated from the control system in the event of trim switch failure. In this position both aileron and stabilator trim circuits are inoperative. The NOSE DN and NOSE UP positions control the stabilator actuator directly and is used in event of failure of the trim switch when operating the stabilator electrically These positions do not actuate the stabilator trim actuator. When using the NOSE DN or NOSE UP positions, the pitch control switch must be in the ELEC position so that hydraulic pressure to the stabilator will in later airplanes, allowing free movement of the electrical actuator.

CAUTION

The alternate trim switch should be released from the NOSE UP or NOSE DN positions before reaching full up or full down stabilator travel to avoid the stabilator actuator from bottoming which may result in damage to the actuator or to the clutch. This circuit is not protected by limit switches.

AILERON AND RUDDER NEUTRAL TRIM INDICATORS. **A thru J**

The aileron and rudder neutral trim indicators (12, 13, figure 1–9; 10, 11, figure 1–10) are green lights that illuminate when the actuator in the respective artificial feel unit is in the neutral position. The light does not necessarily indicate the neutral position of the surface. It will so indicate only if there is no load on the cockpit controls. The lights are energized from

MECHANICAL ADVANTAGE INDICATOR LIGHT. A thru J

The mechanical advantage indicator light (14, figure 1–4; 15, figure 1–5; 15, figure 1–6) is an amber light marked STABILATOR M-A WARNING. The light will illuminate whenever the mechanical advantage actuator is cycling from either extreme position to the other position and the primary bus is energized. The light will also illuminate if the mechanical advantage linkage is out of cycle i.e., the landing gear down and mechanical advantage not in the 1 to 1 ratio or if the landing gear is up and locked and the mechanical advantage is not in the 1.8 to 1 ratio.

EMERGENCY HYDRAULIC SYSTEM. A thru J

In addition to the utility hydraulic system which will power the flight controls in the event of boost hydraulic failure, an emergency hydraulic system (figure 1–3) is provided to actuate the aileron and stabilator actuators. Emergency system pressure is supplied by an electrically driven pump and supplied with its own reservoir. If both boost and utility system pressures are low, the emergency hydraulic system will automatically supply pressure to the stabilator and aileron actuators during normal operation. In emergency operation rudder control is maintained through the direct mechanical linkage only. The emergency hydraulic pump is energized by the primary bus and controlled from the cockpit for either automatic operation or manual selection. An indicator light in the cockpit illuminates when the emergency system is operating.

EMERGENCY HYDRAULIC PUMP SWITCH. A thru J

The emergency hydraulic pump switch (24, figure 1–9; 5, figure 1–10) is provided so that the emergency hydraulic system can be cut-in directly in the event the automatic cut-in system is inoperative or to turn the emergency pump off; e.g. during ground maintenance when the engine is not running and normal hydraulic pressure is below 600 psi. The switch has three positions EMERG, OFF and NORMAL, guarded in the NORMAL position by a cover type guard, and energized by the primary bus. The OFF position disconnects the emergency hydraulic pump from the electrical circuit and must be used during ground maintenance when the normal hydraulic pressure is below 600 psi and the battery switch is ON, otherwise the emergency pump will operate continuously. The NORMAL position arms the hydraulic pressure switch so that when pressure in the boost and utility systems drops below 600 psi the emergency hydraulic pump is energized, the aileron and stabilator hydraulic pressure lines are transferred to the emergency hydraulic system and the emergency hydraulic controls on indicator light will illuminate. The EMERG position by-passes the hydraulic pressure switch and turns on the emergency hydraulic pump, transfers the aileron and stabilator hydraulic pressure lines to the emergency hydraulic system and illuminates the emergency hydraulic controls on indicator directly. The EMERG position is used if the automatic cut-in system is inoperative. When operating in the EMERG position and pressure in the boost or utility system is regained, the emergency system will continue to operate as the EMERG position by-passes the pressure switch. The battery life for emergency pump duration when operating from the airplane's battery with the generator inoperative is from approximately 15 minutes, provided no other equipment is operating, to approximately 3 minutes depending on the amount of equipment operating.

HYDRAULIC BY-PASS SWITCH. A thru J

The hydraulic by-pass switch (24, figure 1–9; 5, figure 1–10) is provided to relieve or shut-off hydraulic pressure in the boost and utility systems so that the emergency hydraulic system can be checked for operation prior to take-off. The switch has a momentary contact BY-PASS position, an off and a BY-PASS position. The momentary contact BY-PASS position can be used without moving the cover guard and is used when checking the emergency hydraulic system. This relieves the pilot of the possibility of leaving the switch in the BY-PASS position. If placed in either BY-PASS position, the by-pass valve is opened and boost and utility hydraulic pressure is dumped on the airplanes prior to F-84F-50 and shut-off from the rudder, aileron and stabilator actuators on later airplanes. In this case utility pressure will be maintained for utility systems operation. In the event the emergency hydraulic pump switch is in the NORMAL position and the pressure in the hydraulic line from the dump valve or shut-off valve to the actuators drops to approximately 600 psi, a hydraulic pressure switch closes which turns the emergency hydraulic pump on, transfers the aileron and stabilator hydraulic pressure lines to the emergency system, and illuminates the emergency hydraulic controls on indicator, if the primary bus is energized. Pressure in the hydraulic line downstream of the shut-off valve on F-84F-50 up to F-84F-71RE airplanes is vented to return. The emergency hydraulic system accumulator is also pressurized so that the emergency hydraulic system will be available if needed during take-off.

CAUTION

The by-pass switch should be used in flight only when it is desired to transfer from the normal hydraulic system to the emergency hydraulic system. The by-pass switch is not to be used in flight to transfer from the hydraulic to the electric actuator operation since hydraulic system operation is such that back pressures may develop and cause the actuator clutch to become disengaged from the electric motor.

EMERGENCY HYDRAULIC CONTROLS ON INDICATOR. **A thru J**

The emergency hydraulic controls on indicator (27, figure 1–4; 27, figure 1–5; 27, figure 1–6) is an amber light powered by the primary bus which will illuminate when the electrical circuit to the emergency hydraulic pump is energized. This condition occurs when the emergency hydraulic pump switch is in the NORMAL position and normal hydraulic pressure drops to approximately 600 psi thereby actuating the hydraulic pressure switch or when the emergency hydraulic pump switch is placed in the EMERG position. Illumination of the emergency hydraulic controls on indicator light does not indicate that the electric hydraulic pump is operating or pressurizing the emergency system but only indicates that the emergency pump circuit is energized.

EMERGENCY ELECTRIC SYSTEM. **A thru J**

In the event of failure of the emergency hydraulic system, an emergency electrical system is available for stabilator control. Rudder and aileron control will be maintained through the direct mechanical linkage. In electrical operation the stabilator movement is controlled by fore and aft movement of the trim switch on the control stick. With the pitch control switch in the NORMAL position and the primary bus energized when hydraulic pressure drops below 450 psi, the stabilator automatically changes over to electrical operation and control transfers to the trim switch. Provisions are also made for manual transfer to electrical operation. During electrical operation of the stabilator, the control stick should be moved in the direction of stabilator travel with sufficient force to position the hydraulic control valve on the actuator. While not assisting in stabilator movement this action assures smooth operation of the electrical actuator by releasing any hydraulic pressure built up in the actuator cylinder and, at the same time applying any residual pressure available in the direction of stabilator travel.

PITCH CONTROL SWITCH. **A thru J**

The pitch control switch (9, figure 1–9; 5, figure 1–10) is provided as an emergency switch to transfer stabilator control from the hydraulic system to the electrical system in the event of failure of the hydraulic pressure switch. On airplanes up to F-84F-40 the switch has two positions: STICK OVERRIDE and NORMAL. On F-84F-40 and later airplanes the two positions are ELEC and NORMAL. The switch is guarded in the NORMAL position and energized from the primary bus. The guard on the pitch control switch is of the slotted type and is capable of holding the switch in either position. The NORMAL position allows stabilator control with the fore and aft positions of the control stick when hydraulic pressure in the normal or emergency hydraulic systems is adequate. If hydraulic pressure in the emergency system drops below approximately 450 psi, actuation of a pressure switch changes the stabilator over to electrical operation and stabilator control transfers to the fore and aft positions of the trim button on the control stick. The STICK OVERRIDE or ELEC position bypasses the hydraulic pressure switch and electrically opens the by-pass valve which dumps hydraulic pressure in the normal system on airplanes prior to F-84F-50 and on later airplanes shuts off normal hydraulic system pressure to the rudder, aileron and stabilator actuators. Utility pressure is maintained for operation of the utility systems. The STICK OVERRIDE or ELEC position also shuts off emergency hydraulic pressure to the stabilator, disconnects the pitch trim feel device circuit and transfers stabilator control to the fore and aft positions of the trim button on the control stick. The aileron booster will be operated by the emergency hydraulic system if the emergency pump switch is in the NORMAL or EMERG positions and emergency hydraulic pressure is adequate.

WARNING

If the landing gear is up and locked the mechanical linkage from the control stick to the stabilator actuator or the actuator can be damaged if the trim switch is held in the fore and aft position until full travel of the stabilator is realized when operating the stabilator electrically. This occurs because the mechanical advantage linkage is in the 1.8 to 1 ratio and the limit of the stabilator electrical actuator travel is controlled by mechanical stops on the control stick which bottoms with the actuator at half travel. The actuator will con-

tinue to operate if the trim switch is held even after the control stick has reached its limit with resultant stretching of the control linkage. This condition is most prevalent in ground operation check out of the override system. In the event of runaway trim on F-84F-40 up to F-84F-71RE airplanes, the pitch control switch shall be in the ELEC position to insure proper control through the alternate trim switch.

WARNING

The STICK OVERRIDE or ELEC position must be used any time the electric actuator is used for stabilator operation except during electrical continuity ground check prior to take-off as outlined in Section II. The STICK OVERRIDE or ELEC position relieves hydraulic pressure in the system thereby preventing the actuator clutch from disengaging or the actuator from locking in one position.

FLIGHT CONTROL SYSTEMS. K and LATER

The flight controls on F-84F-71RE airplanes are identical to earlier models except for the actuating cylinders and the hydraulic pressure supply. The hydraulic system has been redesigned to make the power and utility systems two completely separate and functionally independent systems. The emergency hydraulic system is a simple secondary source of pressure for the power system only. The aileron and stabilator actuators are tandem cylinders which allow surface actuation by either the power, utility or emergency hydraulic pressure. The spoilers and rudder are actuated only from the utility system pressure.

NORMAL SYSTEM. K and LATER

During normal operation hydraulic pressure from the engine driven utility pump is directed to the utility side of the aileron and stabilator tandem actuators also to the spoiler and rudder actuators. An accumulator in the utility system stores a volume of pressurized hydraulic fluid to insure an adequate supply to the rudder and the utility side of the stabilator tandem actuator in the event of a greater-than-normal demand on the system is required. Hydraulic pressure from the engine driven power pump is directed to the power side of the aileron and stabilator tandem actuators and to an accumulator. The accumulator is provided for the same purpose as the accumulator in the utility system. If the utility system pressure should fail the ailerons and stabilator will actuate from the power system. The rudder will be controlled only through mechanical linkage and the spoilers will be inoperative as these surfaces are actuated by utility pressure only. If the power system pressure should fail all surfaces will operate with utility system pressure. In the event of failure of both the utility and power hydraulic systems the emergency hydraulic system must be manually selected for control operation. Pressure gages are provided to indicate pressure in each of the systems.

CONTROL STICK. K and LATER

The control stick (figure 1–32) is conventional and incorporates a hand grip with the following controls: trim switch, bomb release switch, trigger, radar "out" switch; "roger" button for the radar beacon installation, and the autopilot release switch. These switches are discussed under the applicable systems.

RUDDER PEDALS. K and LATER

The rudder pedals can be folded down for pilot comfort. Depressing the release lever on the inboard side of each pedal allows the foot pad of the pedal to fold toward the pilot. This allows the pilot to rest his heel on the base of the pedal and still maintain rudder control with his heel. Brakes cannot be applied with the pedals in the folded position. Brake application is accomplished by toe action in the normal manner when the pedals are in the normal position.

RUDDER PEDAL ADJUSTING KNOB.

The rudder pedal adjusting knob (23, figure 1–4; 23, figure 1–5; 23, figure 1–6) adjust both rudder pedals simultaneously to the desired fore and aft position.

SURFACE CONTROL LOCK. K and LATER

The surface controls are held in the neutral position when the airplane is parked by engaging the surface control lock (figure 1–32). The lock is engaged by positioning the rudder pedals to neutral then hooking the surface control lock over a fitting on the control stick. On earlier airplanes the surface control lock was a solid member. Later aircraft have been equipped with a control lock having telescoping side members incorporating shear rivets to preclude damage to control linkage in the event of inadvertent activation of the trim switch with the control surfaces locked.

CAUTION

Be sure surface controls are unlocked before turning battery switch ON. Do not operate trim switch with the controls locked. In either case the surface control lock may be damaged due to operation of the stabilator electrical actuator.

TRIM SWITCH. K and LATER

Airplane trim about the roll and pitch axis is controlled by a five position trim switch (figure 1–32)

which is spring-loaded to the center or off position. The lateral positions of the trim switch adjust the artificial feel unit in the aileron control system so as to change the neutral position of the spring capsule thereby trimming the airplane about the roll axis. The fore and aft positions of the switch adjust the artificial feel unit in the stabilator control to a no-load position. Both trim circuits are energized from the primary bus if the pitch trim switch is in the NORM position.

RUDDER TRIM SWITCH. **K and LATER**

Airplane trim about the vertical axis is accomplished by adjusting the neutral position of the spring capsule in the rudder control system. The neutral position is selected by a three position yaw trim switch (figure 1–11) which is energized from the primary bus and spring-loaded to the off position. The other switch positions are marked L and R. The switch is held in the desired position until the airplane is trimmed about the vertical axis and then released.

ALTERNATE PITCH TRIM SWITCH. **K and LATER**

The alternate pitch trim switch (figure 1–11) is provided as an override for the trim switch on the control stick. The switch is powered from the primary bus and has four positions. Two positions are marked STICK SW POWER: NORM and OFF. The other two positions are marked NOSE DN and NOSE UP. The NORM position supplies primary bus power to the control stick trim switch which controls the aileron and stabilator trim actuators. The OFF position disconnects primary bus power from the trim switch on the control stick so that the control stick trim switch can be isolated from the control system in the event of trim switch failure. In the OFF position both the aileron and stabilator trim actuator circuits are inoperative. The NOSE DN and NOSE UP positions actuate the stabilator trim actuator to trim the aircraft on its pitch axis in the event of failure of the control stick trim switch.

AILERON AND RUDDER NEUTRAL TRIM INDICATORS. **K and LATER**

The aileron and rudder neutral trim indicators (12, 13, figure 1–9; 10, 11, figure 1–10) are green lights that illuminate when the actuator in the respective artificial feel unit is in the neutral position. The light does not necessarily indicate the neutral position of the surface. It will so indicate only if there is no load on the cockpit controls. The lights are energized from the primary bus circuit.

MECHANICAL ADVANTAGE INDICATOR LIGHT. **K and LATER**

The mechanical advantage indicator light (14, figure 1–4; 15, figure 1–5; 15, figure 1–6) is an amber light marked STABILATOR M-A WARNING. The light will illuminate whenever the mechanical advantage actuator is cycling from either extreme position to the other position and the primary bus is energized. The light will also illuminate if the mechanical advantage linkage is out of cycle i.e., the landing gear down and mechanical advantage not in the 1 to 1 ratio or if the landing gear is up and locked and the mechanical advantage is not in the 1.8 to 1 ratio.

EMERGENCY SYSTEM. **K and LATER**

The emergency hydraulic system pressure is supplied by an electrically driven hydraulic pump which is directed to the power side of the aileron and stabilator tandem actuators. The emergency pump can be manually placed in operation through the emergency hydraulic pump switch and is used in the event of engine failure or similar malfunction which would render the utility and power hydraulic systems inoperative. The emergency pump receives its fluid supply from the power hydraulic system reservoir. The reservoir is mechanically pressurized by action of a spring and will supply fluid to the emergency pump as long as fluid remains in the reservoir. Emergency pressure cannot be utilized to operate any hydraulic system powered by the utility system except the ailerons and stabilator.

EMERGENCY HYDRAULIC PUMP SWITCH. **K and LATER**

The emergency hydraulic pump switch (5, figure 1–10) is provided so that the emergency hydraulic system can be turned on since the emergency hydraulic system does not include an automatic cut-in feature. The switch has two positions marked HYD EMER PUMP and OFF and is guarded in the OFF position by a cover type guard. The HYD EMER PUMP position connects primary bus power to energize the emergency hydraulic system directly and supplies hydraulic pressure to the power side of the aileron and stabilator tandem actuators. The OFF position disconnects the emergency hydraulic pump from the electrical system. Emergency hydraulic pressure will be indicated on the POWER half of the dual hydraulic pressure gage. The battery life for emergency pump operation with the generator inoperative, is from approximately 15 minutes, provided no other euipment is operating, to approximately 3 minutes, depending on the amount of equipment operating.

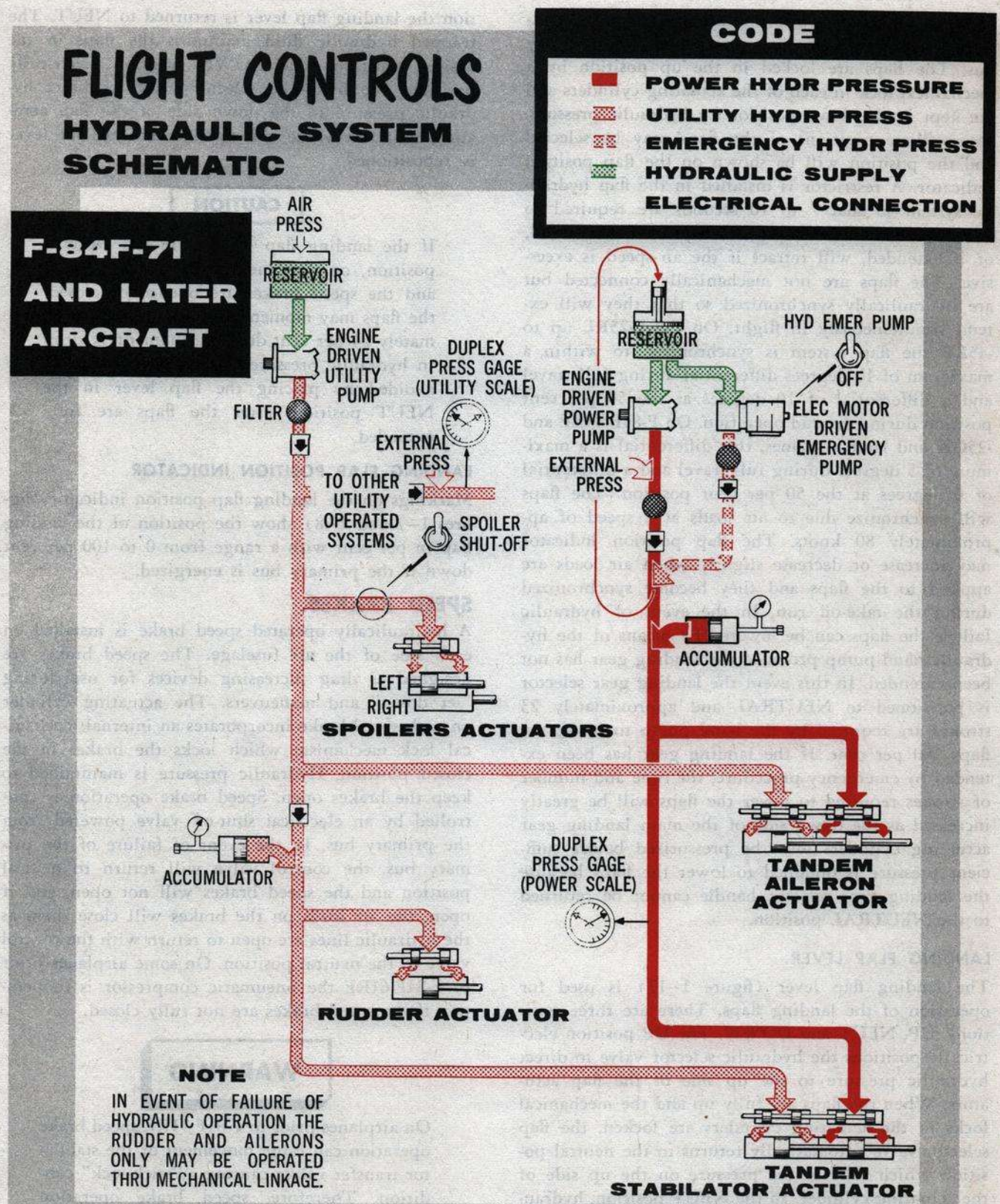
LANDING FLAPS.

The landing flaps are partial span, plain, trailing edge type and extend from the aileron to the fuselage on each wing. The flaps are extended and retracted with

FLIGHT CONTROLS

HYDRAULIC SYSTEM SCHEMATIC

F-84F-71 AND LATER AIRCRAFT



NOTE

IN EVENT OF FAILURE OF HYDRAULIC OPERATION THE RUDDER AND AILERONS ONLY MAY BE OPERATED THRU MECHANICAL LINKAGE.

Figure 1-34

SPEED BRAKE SWITCH.

The speed brake switch (figure 1–17), on airplanes up to F-84F-40, is an IN and OUT switch that obtains power from the primary bus and controls the position of the speed brake selector valve. On F-84F-40 airplanes the speed brake switch (figure 1–17) is a sliding switch located on the throttle control. The switch positions are the same, i.e. IN and OUT. The OUT position indexes the hydraulic selector valve to apply pressure to open and hold the speed brakes in the open position. The IN position indexes the selector valve to close the speed brakes and hold them in the closed position. The speed brakes cannot be positioned in any intermediate position on airplanes up to F-84F-45. However on F-84F-45 and later airplanes a third or NEUT position is provided on the speed brake switch. The NEUT position indexes the hydraulic selector valve to trap hydraulic fluid in the hydraulic lines so that the speed brakes will remain in any selected position. On these airplanes the speed brake switch should be left in the IN position during flight. If returned to the NEUTRAL position hydraulic pressure may bleed off sufficiently to open the brakes slightly in which case the pneumatic compressor will become inoperative on some airplanes prior to F-84F-61RE.

AILERON SPOILERS. E and LATER

Spoilers are incorporated in F-84F-45 and subsequent airplanes. The spoilers are located on the upper surface of both wings, immediately forward of the flaps and are automatically actuated through the control stick lateral deflection for UP aileron only. The spoilers increase the roll performance (rate of roll) of the airplane during high speed, low altitude flight. At the intermediate speeds the spoilers are less effective, but together with aileron displacement, rate of roll is more than adequate. At low speeds the spoilers are not effective, however, aileron effect is adequate for low speed flight. As the aileron moves up from 0 to 10 degrees the corresponding spoiler moves from 0 to approximately 45 degrees. Spoiler extension of approximately 45 degrees remains constant for the remainder of aileron travel. The spoilers are hydraulic actuated and controlled by a normally open shut-off valve powered from the primary bus. The spoilers will only operate after the right main landing gear is up and locked. A switch is also provided in the cockpit so that the spoilers can be turned off during flight. In the event of primary bus power failure, the spoilers cannot be turned off either by the switch in the cockpit or by extension of the landing gear. The spoilers will be inoperative when the autopilot is turned on.

SPOILER SHUT-OFF SWITCH. E and LATER

The spoiler shut-off switch, (19, figure 1–9; 4, figure 1–10) is an on-off switch powered from the primary bus. The switch is marked SPOILER SHUT-OFF and is guarded in the on position. When in the on position, the spoilers will operate when the right main landing gear is up and locked. In this configuration the spoilers can be made inoperative by placing the spoiler shut-off switch in the off position.

LANDING GEAR SYSTEM.

The retractable tricycle landing gear is hydraulically operated and electrically actuated from the primary bus. Each strut is enclosed by fairing doors that are flush with the contour of the wing and fuselage when the gear is retracted and remain open when the landing gear is extended. The nose wheel shock strut is mechanically shrunk as it is being retracted and automatically returns to its fully extended position when the gear is let down. Mechanical locks secure the three struts in the retracted or extended positions. Inadvertent retraction of the gear when the airplane is on the ground is prevented by a solenoid lock which automatically prevents moving the landing gear selector handle. A switch is provided to override this safety system in emergencies. The main landing gear downlocks are spring-loaded to the locked position and are unlocked by hydraulic pressure when the struts are retracted. In an emergency the main gear uplocks are released by pneumatic pressure and the gears drop to the locked down position by gravity. During normal operation the nose gear is retracted and extended with hydraulic pressure. In an emergency the nose gear is unlocked and extended with pneumatic pressure. Ground safety locks are provided for maintenance purposes only. Landing gear position indicators and a warning horn are provided to inform the pilot of the position of the landing gear struts. On aircraft prior to F-84F-61RE an armament safety switch, incorporated on the main landing gear struts, prevents the guns from being fired as long as the weight of the aircraft keeps the shock struts compressed. On F-84F-61RE and later aircraft the armament safety switch is incorporated in the landing gear selector handle. Also on the later aircraft a pneumatic compressor shut-off switch is actuated by the main landing gear uplock so as to cut the pneumatic compressor off when the landing gear is released from the up and locked position.

LANDING GEAR SELECTOR HANDLE.

The landing gear selector handle (figures 1–7 and 1–8) controls the extension and retraction of the landing gear struts for both the normal and emergency systems. The normal system control valves and

hydraulic pressure and are controlled by an electrically operated shut-off valve powered from the primary bus. The flaps are locked in the up position by a mechanical lock in each of the actuating cylinders and are kept in the down position by hydraulic pressure. Intermediate positions of the flaps may be selected and the position will be shown on the flap position indicator. A restrictor is installed in the flap hydraulic system so that 7 to 10 seconds are required to retract or extend the flaps. The flaps will not extend, or if extended, will retract if the air-speed is excessive. The flaps are not mechanically connected but are hydraulically synchronized so that they will extend simultaneously in flight. On F-84F-25RE up to -45RE the flap system is synchronized to within a maximum of 10 degrees differential during full travel and a differential of 10 degrees at the 50 per cent position during ground operation. On F-84F-45RE and -25GK and later airplanes, this differential is a maximum of 5 degrees during full travel and a differential of 6 degrees at the 50 per cent position. The flaps will synchronize due to air loads at a speed of approximately 80 knots. The flap position indicator may increase or decrease slightly when air loads are applied to the flaps and they become synchronized during the take-off run. In the event of hydraulic failure the flaps can be lowered by means of the hydraulic hand pump provided the landing gear has not been extended. In this event the landing gear selector is positioned to NEUTRAL and approximately 23 strokes are required by the hand pump to lower the flaps 100 per cent. If the landing gear has been extended by emergency procedure, the time and number of strokes required to lower the flaps will be greatly increased as the down side of the main landing gear actuating cylinders must be pressurized before sufficient pressure is obtained to lower the flaps because the landing gear selector handle cannot be returned to the NEUTRAL position.

LANDING FLAP LEVER.

The landing flap lever (figure 1–17) is used for operation of the landing flaps. There are three positions, UP, NEUT and DOWN. The UP position electrically positions the hydraulic selector valve to direct hydraulic pressure to the up side of the flap actuators. When the flaps are fully up and the mechanical locks in the actuating cylinders are locked, the flap selector valve automatically returns to the neutral position which relieves the pressure on the up side of the actuating cylinder. In the NEUT position, hydraulic pressure in the down side of the flap actuating cylinder is trapped while pressure in the up side is relieved. This position is used for partial flap extension. When the flaps are lowered to the desired position the landing flap lever is returned to NEUT. The trapped hydraulic fluid maintains the flaps in the desired position. The DOWN position electrically positions the hydraulic selector valve to direct hydraulic pressure to the down side of the flap actuating cylinders where it is maintained until the lever is repositioned.

CAUTION

If the landing flap lever is in the DOWN position, on airplanes prior to F-84F-45RE, and the speed brakes are opened or closed, the flaps may momentarily blow up approximately 24 per cent due to a momentary drop in hydraulic pressure. This condition can be avoided by placing the flap lever in the NEUT position, after the flaps are fully extended.

LANDING FLAP POSITION INDICATOR.

Markings on the landing flap position indicator (figures 1–7 and 1–8) show the position of the landing flap in per cent with a range from 0 to 100 per cent down if the primary bus is energized.

SPEED BRAKES.

A hydraulically operated speed brake is installed on each side of the aft fuselage. The speed brakes are designed as drag increasing devices for use during "let down" and maneuvers. The actuating cylinder on each speed brake incorporates an internal mechanical lock mechanism which locks the brakes in the closed position. Hydraulic pressure is maintained to keep the brakes open. Speed brake operation is controlled by an electrical shut-off valve powered from the primary bus. In the event of failure of the primary bus, the control valve will return to neutral position and the speed brakes will not open, and if open, the air loads on the brakes will close them as the hydraulic lines are open to return with the control valve in the neutral position. On some airplanes prior to F-84F-61RE the pneumatic compressor is inoperative if the speed brakes are not fully closed.

WARNING

On airplanes prior to F-84F-71RE speed brake operation can cause movement of the stabilator transfer valves causing a "stick-lock" condition. Therefore, speed brake operation should be avoided whenever a stick-lock condition could become critical; for example, in very close formations or in maneuvers close to the ground.

LANDING GEAR SELECTOR HANDLE LIGHT.

A red light, located in the plastic knob of the landing gear selector handle illuminates when the landing gear is in an unsafe condition.

The light indications are as follows:

RED LIGHT	a. With throttle below minimum cruise rpm. (65% rpm at low altitude).	a. Indicates landing gear not locked down.
	b. With throttle above minimum cruise rpm. (65% rpm at low altitude).	b. Indicates landing gear in any unlocked position.

LANDING GEAR WARNING HORN.

The landing gear warning horn, located in the aft wall of the cockpit, will sound if the throttle is retarded below minimum cruise setting and the landing gear is not down and locked.

LANDING GEAR WARNING HORN SILENCE SWITCH.

The landing gear warning horn silence switch (figure 1–17) is a push button type switch marked L G WARN HORN SILENCE. The warning horn can be silenced by depressing the landing gear warning horn silence switch momentarily. If the horn has been silenced and the throttle is opened above minimum cruise then closed again, the horn will start to sound again.

LANDING GEAR WARNING LIGHT AND HORN TEST SWITCH.

The landing gear warning light and horn test switch (figures 1–7 and 1–8) is a push button type switch marked TEST L G HANDLE LT AND HORN. If the test switch is pushed and held, the red light in the landing gear selector handle will illuminate regardless of the position of the landing gear. This tests the electrical circuit and the lamp in the selector handle. The landing gear warning horn will also sound if the throttle is positioned below the minimum cruise rpm position.

BRAKE SYSTEMS.

BRAKES – WHEEL.

Fluid for the brake control is provided by the utility hydraulic system. The system is designed so that foot pressure on the master cylinder, attached to each rudder pedal, is added to the hydraulic pressure of the brake system. System hydraulic pressure is available to the brakes only when the landing gear selector handle is in the DOWN or EMERG DOWN position and the primary bus is energized. The brakes will be effective with a minimum hydraulic pressure of approximately 55 psi. If pressure is not available from the utility hydraulic system, the brakes will function through conventional action of the master brake cylinder when toe pressure is applied to the pedal. However, in this event approximately twice the toe pressure will be required for the brakes to be as effective as when hydraulic pressure is available. Parking brakes are not provided.

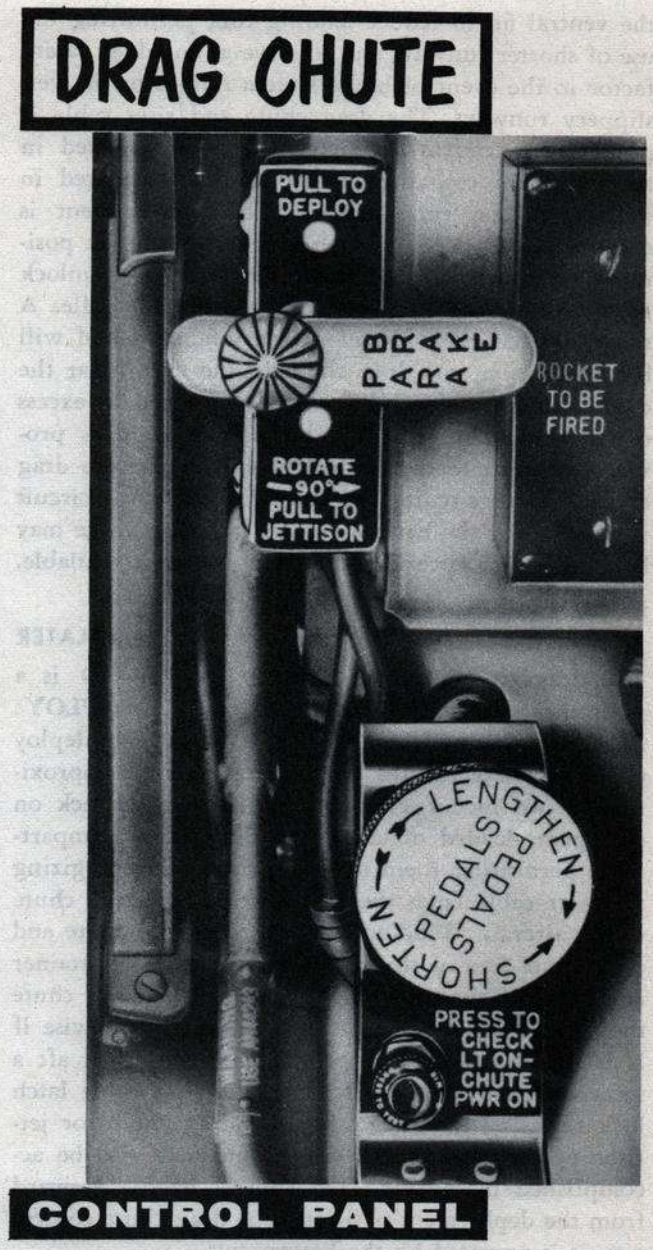


Figure 1–35

DRAG CHUTE. **J and LATER**

A 16 foot drag chute is installed in a compartment in

indicators are energized from the primary bus. The selector has a plastic wheel shaped knob which incorporates a red warning light. There are four selector handle positions on aircraft prior to F-84F-61RE; UP, NEUTRAL, DOWN and EMERG DOWN. On F-84F-61RE and later aircraft the selector handle has three positions; UP, DOWN and EMERG DOWN. The DOWN position electrically positions the hydraulic control valve to apply pressure to extend the landing gear and to energize the brake boosters. Hydraulic power is supplied to the brakes only when the landing gear selector handle is in the DOWN or EMERG DOWN position and primary bus power is available. An electrical solenoid prevents the landing gear selector from being moved from the DOWN position, with the shock struts compressed. This safety can be overriden if it is desirable to retract the gear before the weight is off the landing gear struts. The UP position electrically positions the hydraulic control valve so that hydraulic pressure releases the downlocks, retracts the landing gear and closes the fairing doors. Hydraulic pressure is maintained in the system as long as the selector handle is in the UP position. The NEUTRAL position which has been deleted on F-84F-61RE and later aircraft, shuts off hydraulic pressure and relieves the hydraulic pressure in the landing gear system, so that in the event of leakage downstream of the selector valve, hydraulic fluid will not be lost. However, use of the NEUTRAL position is not recommended. The EMERG DOWN position is used whenever the normal system fails to lower the gear. This position mechanicaly opens the pneumatic valve and compressed air unlocks all three gears and extends the nose gear. The main gears drop and lock by gravity. To position the landing gear selector handle from one position to another position, the handle must be pulled out toward the pilot first, then moved to the new position. When going from the DOWN to the EMERG DOWN position the handle must be pulled out toward the pilot first, then pushed inboard and down to the EMERG DOWN position. Once the EMERG DOWN position has been selected the handle cannot be returned to the DOWN position until the handle lock has been released by the ground crew and the system has been bled completely. An armament safety switch has been incorporated in the landing gear selector handle on F-84F-61RE and later aircraft so that the armament system cannot be energized when the landing gear selector handle is in the DOWN or EMERG DOWN position.

CAUTION

Once the landing gear is extended by the emergency procedure, the emergency landing gear release switch will not retract the gear. In the event that only the main gear can be locked down with the main system, the possibility exists of back pressure in the return hydraulic lines unlocking the main landing gear whenever the nose gear is lowered by means of the pneumatic system. However, within a short time, the pneumatic system should reactuate the downlock cylinder, relocking the main gears in the down position. Therefore, the landing gear position indicators must be rechecked to ascertain whether all gears are down and locked after the pneumatic system has been used to lower any gears.

Note

The landing gear selector handle should be left in the UP position during flight as the landing gear may unlock during high g maneuvers if the handle is not in the UP position.

EMERGENCY LANDING GEAR RELEASE SWITCH.

The emergency landing gear release switch (figures 1–7 and 1–8) is provided as an override switch for the landing gear selector handle solenoid lock. The switch is marked EMERGENCY RELEASE OF L G HANDLE and is protected by a cover type guard. When it is necessary to retract the landing gear, while the airplane is on the ground, the cover guard is lifted and the emergency landing gear release switch is actuated. This energizes the landing gear selector handle solenoid lock which allows the selector handle to be moved to the UP position.

CAUTION

If the landing gear shock struts are overinflated, so as to be fully extended, it will be possible to move the landing gear selector to the UP position with the airplane on the ground.

LANDING GEAR POSITION INDICATORS.

On aircraft prior to F-84F-61RE the three landing gear position indicators (figures 1–7 and 1–8) are marked LEFT, NOSE and RIGHT. When the respective gear is locked down the outline of the wheel appears on the indicator. If the gear is in any position between locked down or up, alternate red and white stripes appear and when the gear is retracted the word UP appears on the indicator. Green indicator lights, marked LEFT, NOSE and RIGHT, illuminate on F-84F-60 and later aircraft, when the respective landing gear is extended and in a safe, locked condition for landing.

the ventral fin to reduce landing roll, permitting the use of shorter runways and to serve as an added safety factor in the event of brake system failure or on wet, slippery runways. The drag chute and riser cable is packed in a canvas deployment bag and stowed in an aluminum container which in turn is placed in the ventral fin compartment. The compartment is equipped with doors, spring-loaded to the open position and an electrically actuated latch lock and unlock mechanism controlled by a pull-type tee handle. A shear pin has been provided as a safeguard and will break releasing the drag chute in the event that the drag chute is accidentally released at speed in excess of 220 knots. A press-to-test indicator light is provided adjacent to the control handle to test the drag chute control circuit. The drag chute control circuit is powered by the battery bus and the drag chute may be deployed or jettisoned if battery power is available.

DRAG CHUTE CONTROL HANDLE.

J and LATER

The drag chute control handle (figure 1–35) is a pull-type tee handle marked PULL TO DEPLOY: ROTATE 90°, PULL TO JETTISON. To deploy the drag chute the tee handle is pulled aft approximately two inches, electrically releasing the lock on the spring-loaded doors of the drag chute compartment permitting them to swing open and energizing the riser cable latch thereby securing the drag chute to the aircraft. Wind action pulls the pilot chute and drag chute free of the deployment bag and container and clear of the aircraft. To jettison the drag chute the control handle is rotated 90° counter-clockwise if it is in the deployment position and is pulled aft a second time to electrically open the riser cable latch lock releasing the riser cable and drag chute for jettisoning. Jettison of the drag chute may also be accomplished by pushing the control handle forward from the deployment position. The drag chute control circuit is powered by the battery bus.

DRAG CHUTE POWER TEST INDICATOR LIGHT. **K and LATER**

A press-to-test indicator light (figure 1–35) marked PRESS TO CHECK LT ON – CHUTE PWR ON, is located adjacent to the drag chute control handle. The indicator light is pressed in to determine if the drag chute control circuit is energized. If the light illuminates it indicates that the drag chute control circuit is energized.

INSTRUMENTS — FLIGHT.

The turn and bank indicator, the radio compass indicator, the flap position indicator, the voltmeter, the loadmeter, and the pitot heater are operated from the d-c power supply. The slaved gyro compass indicator, attitude gyro indicator, the fuel level indicator, the fuel flow indicator and the oil pressure indicator are powered from the a-c power circuit, and will operate from either the main or alternate inverters. The accelerometer and the mach meter, both installed in the instrument panel, do not require any electrical power. The static vent is located on the lower section of the forward fuselage, while the pitot pressure head is located on the tunnel division of the nose section. The pitot heater is described in Section IV.

ATTITUDE INDICATOR.

The attitude indicator, Type J-8 (9, figure 1–4; 9, figure 1–5; 11, figure 1–6) shows the attitude of the aircraft in relation to the earth's horizontal plane during any aircraft maneuver, throughout 360 degrees. It is an electrically driven instrument receiving power from the a-c bus and will operate from either the main or alternate inverter. The position of the sphere, which is visible to the pilot during level flight and in dives or climbs up to 27 degrees, is unmarked. Relative motion of the aircraft is indicated on the face of the instrument by movement of the horizontal bar with respect to the miniature airplane in the center of the dial. Angular displacement of the horizontal bar, with respect to the miniature airplane, indicates the degree of roll. The actual amount of roll is indicated by the position of the bank index relative to the 10, 20, 30, 60 and 90 degree roll markings on the face of the instrument. When the aircraft exceeds 27 degrees of dive, the horizontal bar is held in its extreme (27 degree) position. At this point, the word DIVE, on the upper portion of the sphere, becomes visible. As the angle of dive increases graduations become visible on the sphere. These graduations are placed at the 70, 75 and 80 degree intervals; the 85 degree dive indication is reached when the trim indicator coincides with the edge of the bulls eye. When the aircraft exceeds 27 degrees of climb, the horizontal bar is held in its extreme (27 degrees) downward position and any increase in climb is indicated on the sphere. The lower portion of the sphere is marked similarly to the upper with the word CLIMB substituted for DIVE. The horizontal bar may indicate a pitch and/or a bank error in excess of 5 degrees after a loop or during a turn. The J-8 indicator will immediately begin to correct these errors once true gravitational forces are sensed. This characteristic error is commonly called "sluggishness" or "lag" by pilots. In successive loops, the above described error may become increasingly greater and may cause the horizon bar to reach the limit of its movement. This is normal in successive loops and is not indicative of a defective instrument. The J-8 attitude indicator may be caged manually by means of a gyro centering device oper-

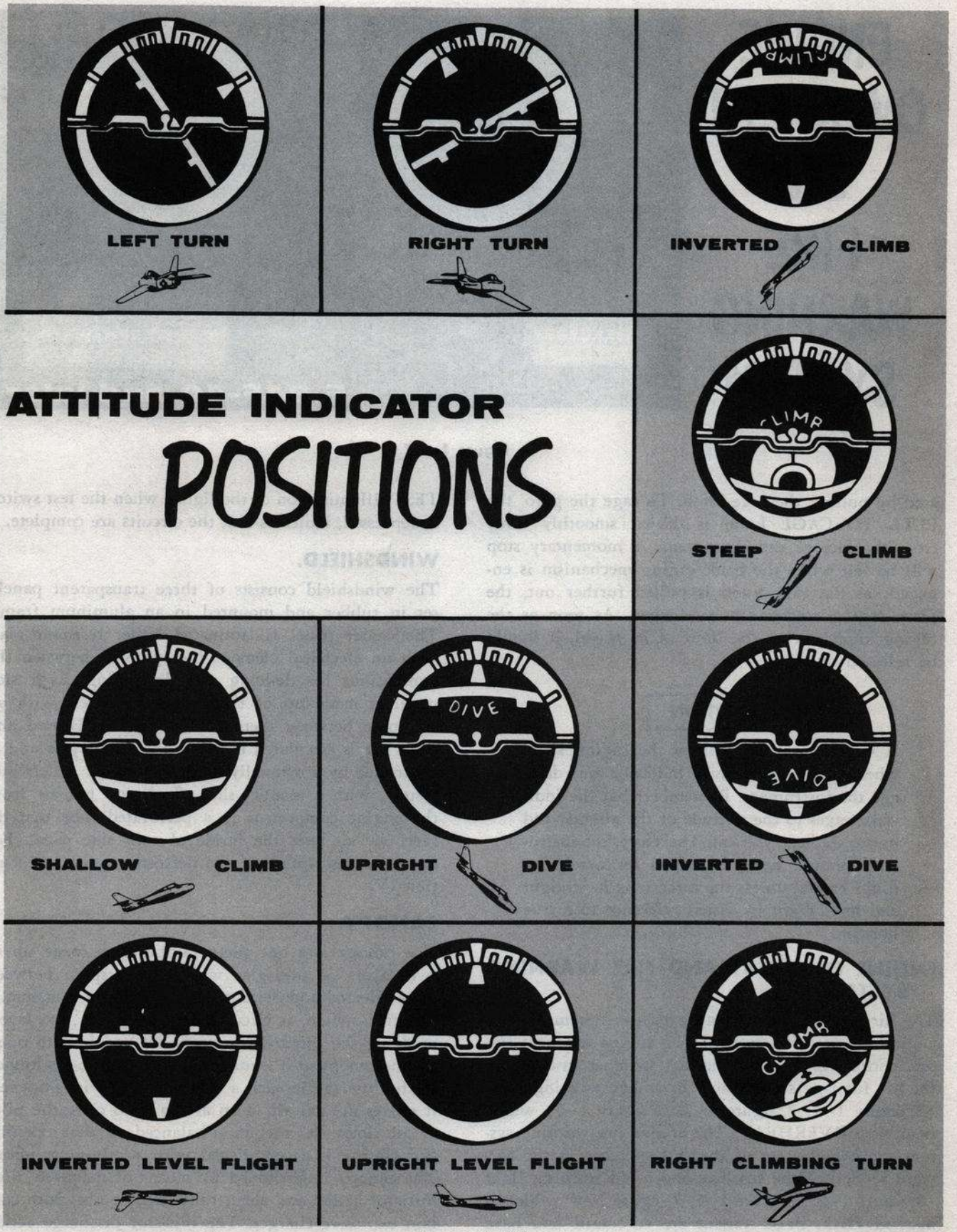

LEFT TURN
RIGHT TURN
INVERTED CLIMB
ATTITUDE INDICATOR
POSITIONS
STEEP CLIMB
SHALLOW CLIMB
UPRIGHT DIVE
INVERTED DIVE
INVERTED LEVEL FLIGHT
UPRIGHT LEVEL FLIGHT
RIGHT CLIMBING TURN

Figure 1–36

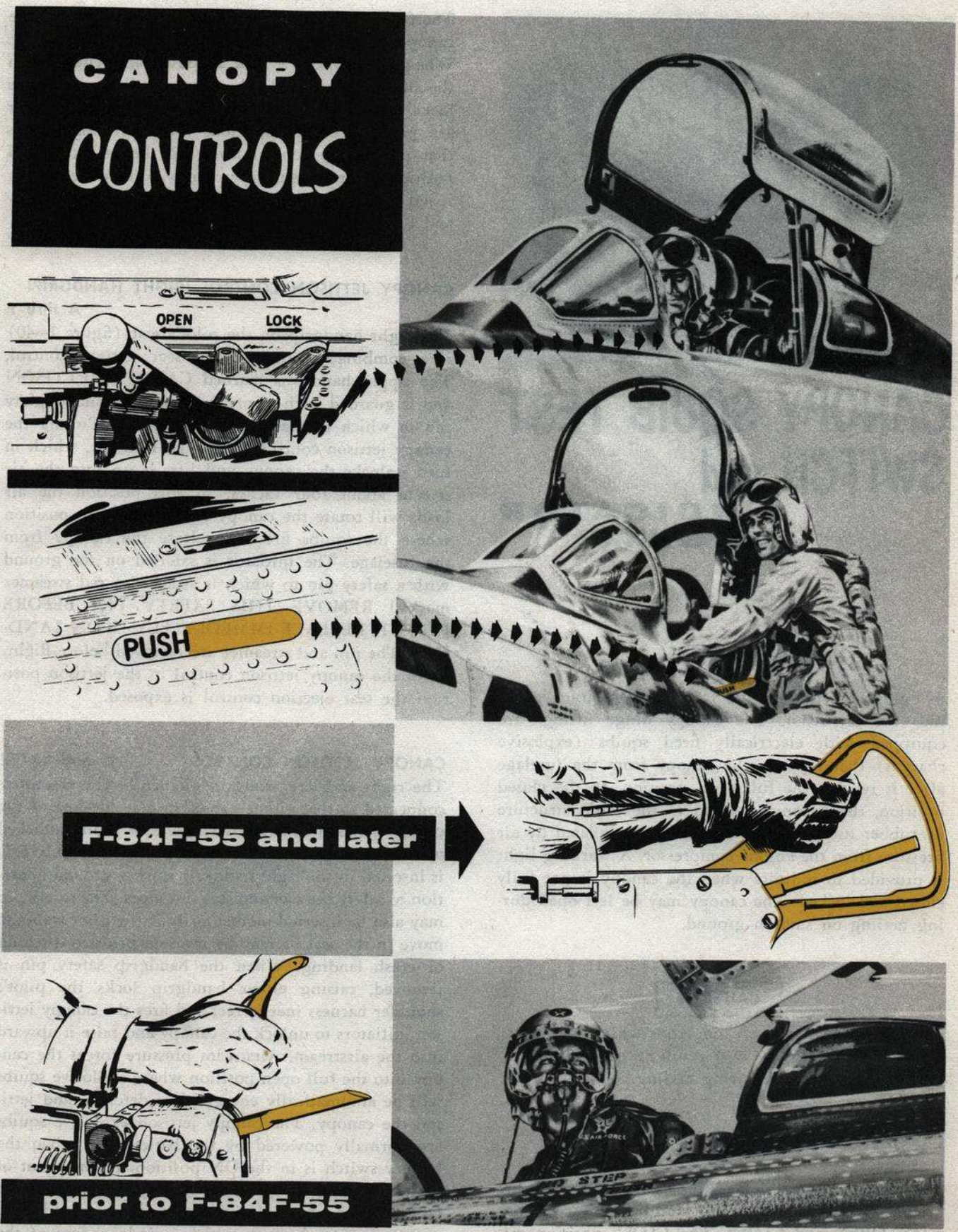

CANOPY
CONTROLS
OPEN
LOCK
PUSH
F-84F-55 and later
prior to F-84F-55
STEP

Figure 1—38

ENGINE OVERHEAT and FIRE WARNING SYSTEM



Figure 1—37

ated by pulling the cage knob. To cage the gyro, the PULL TO CAGE knob is drawn smoothly away from the face of the instrument. A momentary stop will be felt when the bank caging mechanism is engaged; as the cage knob is pulled further out, the pitch caging mechanism is engaged. As soon as the caging knob reaches the limit of its travel, it should be released quickly.

CAUTION

A violent or hard pull on the caging knob when caging the attitude indicator may damage the instrument. Remember that the indicator cages to the attitude of the aircraft and not to the true vertical. Therefore, the instrument should never be caged to correct in-flight errors, unless the aircraft is in straight and level flight by visual reference to a true horizon.

ENGINE OVERHEAT AND FIRE WARNING SYSTEM.

The airplane has an engine overheat system and an engine fire warning system. The engine overheat system consists of a set of thermal switches installed in the aft fuselage section and an amber warning light (8, figure 1–4; 7, figure 1–5; 7, figure 1–6) which is marked OVERHEAT. The engine fire warning system consists of a set of thermal switches in the forward section of the fuselage and a red warning light (8, figure 1–4; 7, figure 1–5; 7, figure 1–6) which is marked FIRE. Both systems are automatic and have a test switch adjacent to the lights marked CIRCUIT TEST. Illumination of the lights, when the test switch is depressed, indicates that the circuits are complete.

WINDSHIELD.

The windshield consists of three transparent panels, set in rubber and mounted in an aluminum frame. The center panel is laminated bullet resistant glass with an electrical element incorporated between the laminations for de-icing and de-fogging. Each side panel is made up of two plexiglas panels with an air space between them for de-fogging. Heated and dried air is circulated between the two layers and is controlled by a manually operated switch. A defroster system, with a manual shut-off, directs hot air from the engine compressor to a perforated tube that directs the air over the inside of each side panel. For complete description of the defroster system, see Section IV.

CANOPY.

The canopy is a one piece bubble type made up of two layers of plexiglas with an air space between them. Heated and dried air, controlled by a manually operated switch, is circulated between the two layers to defog the canopy. Power is not required to operate the canopy as it is manually operated and is hinged to the fuselage in such a way that when it is opened, it moves up and aft in an arc so as to clear the pilot at all times. It is counter-balanced so that opening and closing is accomplished with a minimum effort. The canopy is jettisoned by means of manually fired initiator action and electrically fired squibs, both contain explosive charges. The initiator discharge action builds up high pneumatic pressure which is directed

EXTERNAL CANOPY CONTROL.

The external canopy control (figure 1–38) located on the left side of the fuselage below the canopy is used to open or close the canopy from outside the airplane. The forward end is marked PUSH and if pushed in, the control rotates from its flush position so that a handle is available and at the same time unlocks the canopy from the fuselage. The canopy is then lifted to the open position. The external canopy control will remain exposed until the canopy is closed and locked.

CANOPY SQUIB TEST SWITCH AND INDICATOR LIGHTS.

The canopy is hinged to the fuselage by a hinge on each side and one in the aft center. Two independent squib circuits for jettisoning the canopy, are provided in the fittings attaching the side hinges to the canopy, and in the fittings on each side of the aft hinge. If one circuit is inoperative the other circuit will be sufficient to jettison the canopy. A test circuit is incorporated in the squib firing circuit, therefore, it is possible to check the firing circuit on the ground. The canopy squib test switch (figure 1–39) has three positions: A CIRCUIT, off and B CIRCUIT. If the switch is held in the A CIRCUIT position, a circuit is completed through one set of squibs in each fitting and the indicator lights (figure 1–39), marked L, FWD and R; and L, AFT and R, will illuminate if all squibs circuits are closed. If any one of the four lights remains out, it indicates an open circuit in that squib circuit. When held in the B CIRCUIT position, the four indicator lights will illuminate, if circuit in the second set of squibs in each fitting is closed. Any light not illuminating will indicate which squib circuit is open.

Note

The primary bus must be energized and the canopy must be fully open when making this test, as the circuits are completed through the fully open limit switch.

CANOPY OPEN INDICATOR LIGHT.

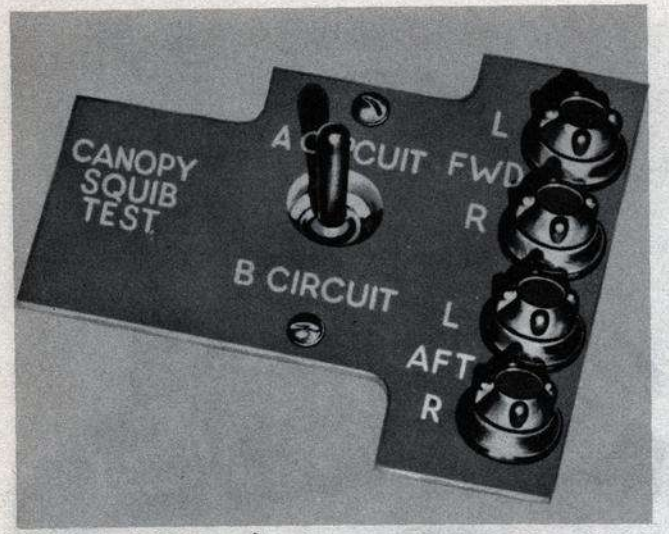
The canopy open indicator light (3, figure 1–4; 6, figure 1–5; 6, figure 1–6) is a red light marked CANOPY OPEN. The light will illuminate if the canopy is not fully closed and locked, if the primary bus is energized.

PILOT'S SEAT.

The pilot's seat (figures 1–40 and 1–41) is an upward ejection catapult type, designed to eject the pilot clear of the aircraft in an emergency. On aircraft prior to F-84F-55, the seat height is manually adjusted. The seat includes; a headrest, adjustable armrests, a shoulder harness attached to a locking inertia reel in the seat by a harness cable, a lap-type safety belt, and a right and left handgrip control. The left handgrip locks the shoulder harness inertia reel and the right handgrip is used for canopy and seat ejection. Provisions have been made in the seat to accommodate a life raft attached to the pilot's parachute. The pilot's seat on F-84F-55 and later aircraft incorporates; a switch controlled, motor-driven mechanism for seat height adjustment, adjustable armrests that can be pivoted down out of the pilot's way, a shoulder harness attached to a locking inertia reel in the seat by means of a shoulder harness cable, and an automatic safety belt. The shoulder harness inertia reel will lock automatically when either handgrip is raised for canopy jettisoning, or may be manually locked by a control handle on the left side of the seat. Right and left hand, loop-type handgrips are provided for canopy jettison and are interconnected so that both handgrips are raised when either is pulled upward to release the canopy. Both the handgrips contain a seat ejection trigger lever which is exposed for seat ejection when the handgrips are raised to the up and locked position. Either trigger lever may be used for seat ejection. On all aircraft, the seat catapult is fired by initiator action which develops high pneumatic pressure that is directed to fire the catapult mechanism for seat ejection. Initiator action is prevented by a safety pin inserted in the right handgrip to secure both handgrips during ground operation. The safety pin has a long red streamer attached which is marked REMOVE BEFORE FLIGHT.

AUTOMATIC SAFETY BELT. B and LATER

A type MA-1 lap type safety belt is installed in F-84F-30 and later airplanes, which is released automatically after seat ejection by an initiator which is located on the back of the seat. In aircraft prior to F-84F-55, a ground safety pin is inserted in the initiator to prevent inadvertent action. This pin must be removed prior to flight and re-inserted after each flight. On F-84F-55 and later aircraft, the safety provisions for the belt initiator are provided through the installation of the single ground safety pin in the seat right armrest and additional pins are unnecessary. In operation, the initiator fires when the seat is ejected, supplying gas pressure to a special belt disconnect, thus releasing the belt and shoulder harness. A time delay feature in the initiator insures that the belt will not release until the pilot is entirely clear of the airplane. A key is inserted in the seat belt buckle automatic release mechanism when locking the buckle. This key is retained in the buckle when the



CANOPY SQUIB TEST SWITCH and INDICATOR LIGHTS

Figure 1—39

to unlock the canopy and raise it about four inches into the airstream. The canopy hinge fittings are equipped with electrically fired squibs (explosive charges) that separate the canopy from the fuselage after it reaches the full open position. In the closed position, the canopy is sealed to the cabin structure by rubber tubes that are automatically inflated by air pressure from the engine compressor. A warning light is provided to indicate when the canopy is not fully closed and locked. The canopy may be left open during taxiing on smooth ground.

CAUTION

Do not rest arms on longerons while canopy is open as injury will result if canopy unexpectedly closes during taxiing.

CANOPY CONTROL LEVER.

The canopy control lever (10, figure 1—9; 7, figure 1—10) operates a manual lock and has only two positions: OPEN and CLOSE. The CLOSE position mechanically locks the canopy to the fuselage structure. The OPEN position releases the canopy locks and the canopy can then be lifted to the full open position. When fully open, a lock automatically engages on the side hinges to hold the canopy fully open. These locks are released by pulling the canopy control lever aft, past the OPEN position. This operation assures that the canopy control lever will be in the OPEN position before closing the canopy. When the canopy is jettisoned, the mechanical locks between the canopy and fuselage are automaticaly opened.

CANOPY JETTISON CONTROL (RIGHT HANDGRIP) **A thru F**

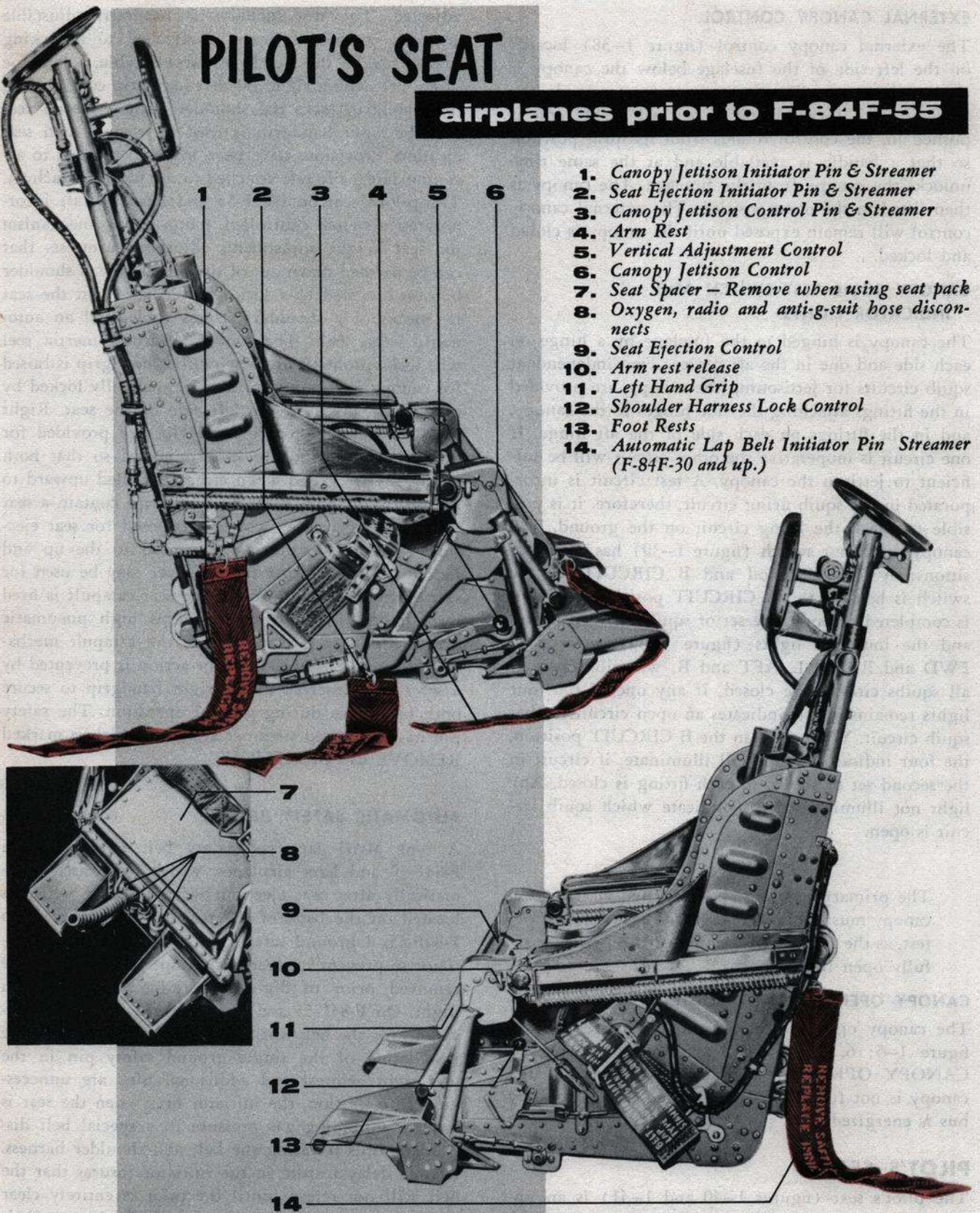
The right handgrip on the pilot's seat (figure 1—40) is a combination canopy and seat jettison control. The upper handle is marked CANOPY JETTISON and is guarded with a spring-loaded clip and a safety pin to which is attached a red streamer. Pulling the canopy jettison control up fires an initiator, which in turn unlocks the canopy and lifts it up into the air stream about four inches. In this position the air loads will rotate the canopy to the full open position where the squibs fire and release the canopy from the fuselage. The initiator is safetied on the ground with a safety pin to which is attached a red streamer marked REMOVE THIS SAFETY PIN BEFORE FLIGHT, REPLACE IMMEDIATELY UPON LANDING. The pin and streamer are removed before flight. With the canopy jettison control in the jettison position the seat ejection control is exposed.

CANOPY JETTISON CONTROL. **G and LATER**

The right and left handgrip (figure 1—41) are interconnected so that either handgrip may be used as the canopy jettison control. A single safety pin, attached to a red streamer marked REMOVE BEFORE FLIGHT, is inserted in the right handgrip during ground operation to safety the ejection seat initiators. The safety pin may also be inserted momentarily if the pilot wants to move in the seat or may be inserted prior to ditching or crash landing. When the handgrip safety pin is removed, raising either handgrip locks the pilot's shoulder harness inertia reel and fires the canopy jettison initiators to unlock the canopy and raise it upward into the airstream. Airstream pressure forces the canopy into the full open position where explosive squibs will be automatically energized to detonate and jettison the canopy. The canopy jettison explosive squibs are normally powered by the battery bus when the battery switch is in the ON position. In the event of battery failure, or when the battery switch is in the OFF position, the explosive squibs are powered by the canopy jettison battery, which is independent of the

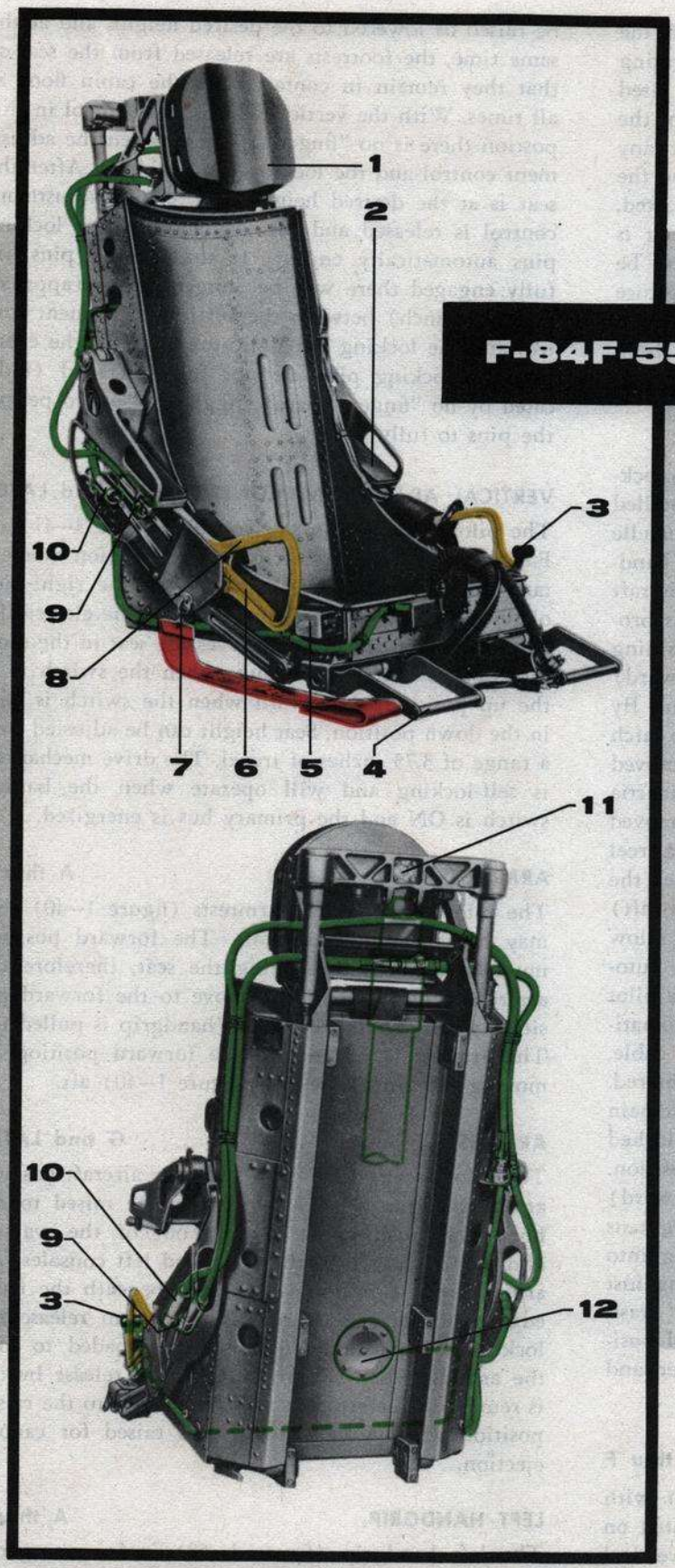
PILOT'S SEAT

airplanes prior to F-84F-55



1. *Canopy Jettison Initiator Pin & Streamer*
2. *Seat Ejection Initiator Pin & Streamer*
3. *Canopy Jettison Control Pin & Streamer*
4. *Arm Rest*
5. *Vertical Adjustment Control*
6. *Canopy Jettison Control*
7. *Seat Spacer – Remove when using seat pack*
8. *Oxygen, radio and anti-g-suit hose disconnects*
9. *Seat Ejection Control*
10. *Arm rest release*
11. *Left Hand Grip*
12. *Shoulder Harness Lock Control*
13. *Foot Rests*
14. *Automatic Lap Belt Initiator Pin Streamer (F-84F-30 and up.)*

Figure 1—40



F-84F-55 and later aircraft

PILOT'S SEAT

1. Headrest
2. Arm rest
3. Shoulder harness lock control
4. Foot rest
5. Vertical adjustment control
6. Seat trigger
7. Safety pin
8. Right handgrip
9. Canopy jettison initiator
10. Seat ejection initiator
11. Vertical adjustment actuator
12. Shoulder harness inertia reel

Figure 1–41

automatic features operate, and pops out when the belt is opened manually. Parachutes incorporating automatic rip cord release mechanisms may be used with the automatic seat belts. Manual operation of the system can override the automatic features at any time. For example, it is possible to manually open the lap belt even though the initiator action has started. However, it must be remembered that if the belt is opened manually, the parachute rip cord must be pulled manually. The parachute automatic feature may likewise be overriden by manual operation, even though the automatic parachute rip cord has been actuated.

SHOULDER HARNESS LOCK CONTROL.

A two-position (lock-unlocked) shoulder harness locking control lever (figures 1—40 and 1—41) is installed on the left side of the pilot's seat. The control handle may be actuated manually or automatically by handgrip action when jettisoning the canopy. On aircraft prior to F-84F-55 the reel lock control handle is provided with a latch mechanism for positively retaining the control handle in either the locked (full forward) or unlocked position (full aft) on the quadrant. By pressing down on top of the control handle, the latch is released and the control handle may be moved freely from one position to the other. The inertia reel lock on F-84F-55 and later aircraft may be moved manually or automatically to lock the inertia reel when jettisoning the canopy. On all aircraft, when the control handle is in the unlocked position (full aft) the shoulder harness reel cable will extend to allow the pilot to lean forward in the cockpit and automatically retract as tension is released when the pilot moves back. However, the inertia reel will automatically lock, preventing further extension of the cable, when an impact force of 2 to 3 g's is encountered. When the reel is locked in this manner, it will remain locked until the control handle is moved to the locked position and then returned to the unlocked position. If the control is in the locked position (full forward) while the pilot is leaning forward, as he straightens up, the harness will retract with him, moving into successive locked positions as he moves back against the seat. The locked position is used when a crash landing or ditching is anticipated. This control position provides an added safety precaution over and above that of the automatic safety lock.

VERTICAL ADJUSTMENT CONTROL. A thru F

The vertical adjustment control (figure 1—40) with an attached locking pin indicator lever is located on the right side of the pilot's seat. Moving the vertical adjustment control up releases the seat so that it may be raised or lowered to the desired height, and at the same time, the footrests are released from the seat so that they remain in contact with the cabin floor at all times. With the vertical adjustment control in this postion there is no "finger" space between the adjustment control and the locking pin indicator. After the seat is at the desired height, the vertical adjustment control is released and the seat and footrest locking pins automatically engage. If the locking pins are fully engaged there will be "finger" space (approximately 5/8 inch) between the vertical adjustment control and the locking pin indicator lever. In the event that the locking pins are not fully engaged (indicated by no "finger" space), jiggle the seat to permit the pins to fully seat.

VERTICAL ADJUSTMENT CONTROL. G and LATER

The pilot's seat adjustment control (figure 1—41) on F-84F-55 and later aircraft is a three position momentary contact toggle switch located on the right side of the pilot's seat. The switch actuates the electrically driven seat adjustment and moves the seat in the same direction as switch travel, up, when the switch is in the up position; downward when the switch is held in the down position. Seat height can be adjusted over a range of 3.75 inches of travel. The drive mechanism is self-locking and will operate when the battery switch is ON and the primary bus is energized.

ARMRESTS. A thru F

The pilot's seat has two armrests (figure 1—40) that may be moved fore and aft. The forward position must be used when ejecting the seat, therefore the armrests will automatically move to the forward position when the respective seat handgrip is pulled up. The armrest is released to the forward position by moving the armrest release (figure 1—40) aft.

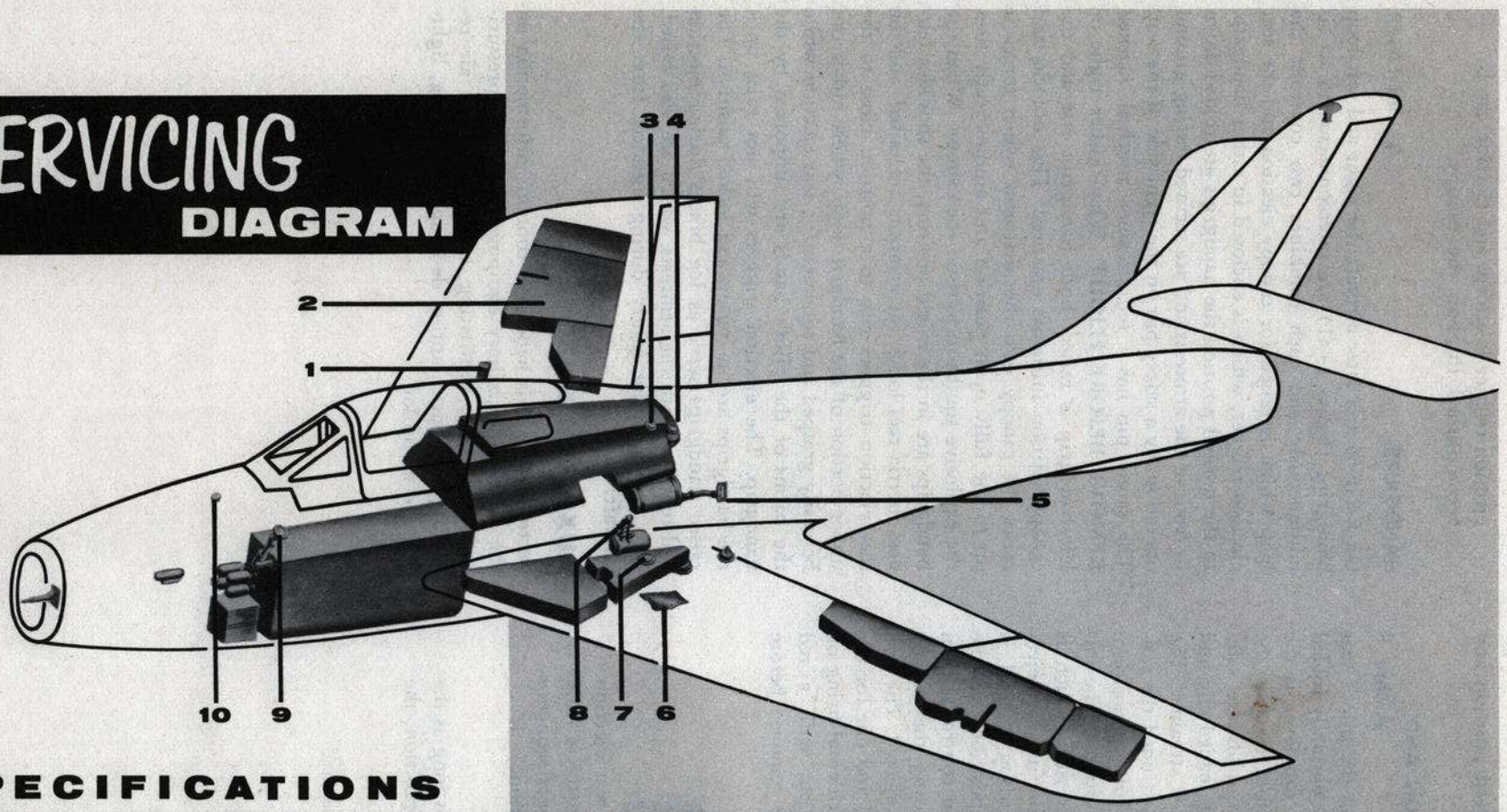
ARMRESTS. G and LATER

The pilot's seat on F-84F-55 and later aircraft has two armrests (figure 1—41) which may be raised to the horizontal position or lowered out of the way to afford better access to the right and left consoles. An armrest release button is provided beneath the front edge of either armrest and is pressed to release the locking mechanism, which is spring-loaded to lock the armrest when the pressure on the release button is removed. The armrests will both move to the raised position when either handgrip is raised for canopy ejection.

LEFT HANDGRIP. A thru F

The left handgrip (figure 1—40) is for emergency use. When the handgrip is pulled up it automatically

SERVICING DIAGRAM



SPECIFICATIONS

Fuel Recommended		MIL-F-5624 GRADE JP-4
Oil		MIL-L-7808
Hydraulic Fluid		MIL-O-5606
Alcohol		MIL-A-6091
Oxygen	*High Pressure*	MIL-O-8069 GRADE A TYPE I
	Liquid	MIL-O-8069 GRADE B TYPE II

1. *External Power Receptacle*
2. *Wing Tank*
3. *Main Tank*
4. *Alcohol Tank*
5. *Oil Tank*
6. *Refueling Receptacle*
7. *Wing Tank*
8. *Hydraulic Reservoir*
9. *Forward Tank*
10. *Oxygen Filler Valve*

Figure 1—42

releases the left armrest to the forward position and locks the shoulder harness.

RIGHT HANDGRIP (CANOPY JETTISON AND SEAT EJECTION) A thru F

The right handgrip (figure 1–40) on the pilot's seat is made up of two controls which are normally folded down in front of the armrests. The top lever is the canopy jettison control and the bottom lever is the pilot's seat ejection control. Both controls are safe-tied in the folded position by a spring-loaded clip and a safety pin to which is attached a red streamer. The seat ejection control cannot be actuated until the canopy jettison control has reached its full up position. Each lever controls the firing of an initiator. The initiators develop a high pneumatic pressure which is directed to actuate the canopy jettison and seat ejection systems. When the canopy jettison control is pulled all the way up, it locks in position and the canopy is jettisoned. The seat ejection control is then exposed and when it is squeezed, using the canopy jettison control as a brace, the seat is ejected. The two initiators, one for the canopy jettison and one for the seat ejection, are protected against accidental firing on the ground by inserting a safety pin with a red streamer attached. The pins must be removed before flight.

WARNING

Do not attempt to squeeze the seat ejection control until canopy jettison control is fully up and locked so as to assure proper sequence of canopy jettison and seat ejection.

Note

If the canopy does not jettison, as long as the right armrest is in the full up position, the ejection trigger is armed, and ejection can be accomplished through the canopy.

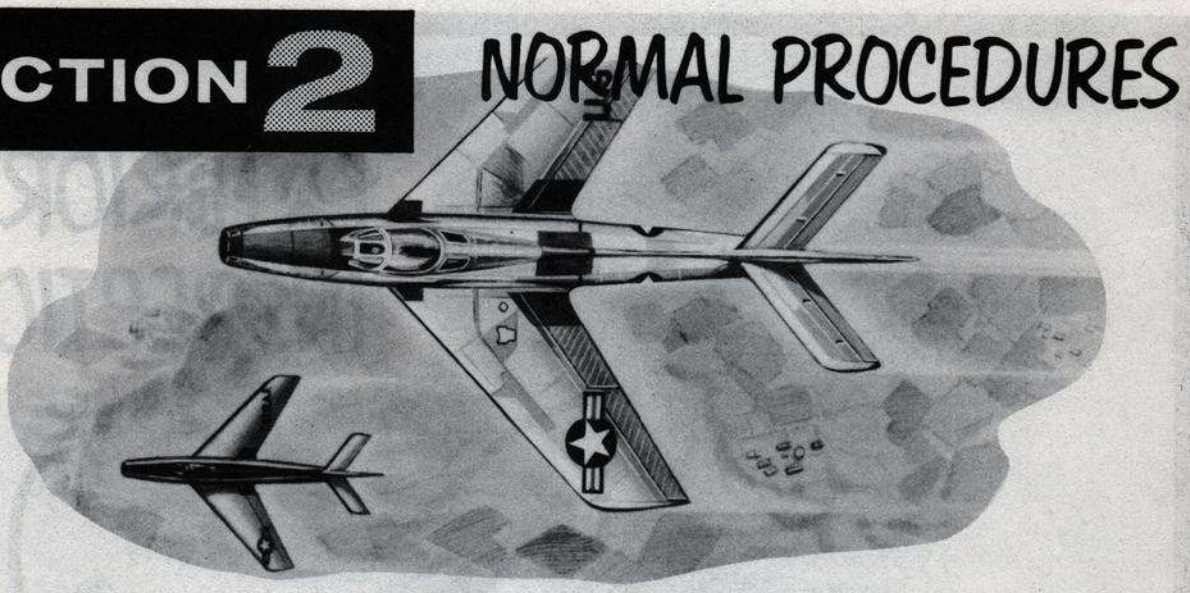
HANDGRIPS. G and LATER

On F-84F-55 and later aircraft the right and left loop handgrips (figure 1–41) are interconnected to act simultaneously and each combines two controls; the loop which is raised for canopy ejection and the seat ejection trigger, which is enclosed in either handgrip. In the normal position the handgrips are folded down in front of the armrests and are secured during ground operation, by a safety pin on the right side of the seat. The safety pin has a red streamer attached, marked REMOVE BEFORE FLIGHT. When either right or left handgrip is raised, both handgrips rise and the canopy jettison initiators are fired. This unlocks and raises the canopy into the airstream which forces it up to the fully open position and automatically fires the explosive squibs to jettison the canopy. When the handgrips are in the raised position, the shoulder harness inertia reel locks, the armrests are raised, and the seat ejection triggers rise to a position close to the upper portion of the handgrip loop, where either can be easily grasped and squeezed for seat ejection while the palms of the pilot's hands are supported by the handgrip. The ejection triggers will not raise until the handgrips are in the up and locked position. The raised handgrips serve as leg braces during ejection and together with the armrests, which are also raised, help prevent pilot injury during ejection from the aircraft.

AUXILIARY EQUIPMENT.

Section IV of this handbook contains information on the following auxiliary equipment: oxygen, pressurization, heating, ventilating, communications, air refueling, armament, anti-g, de-icing, de-fogging, lighting and autopilot.

SECTION 2 NORMAL PROCEDURES



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2 FORWARD FUSELAGE AND RIGHT WING.

a. Check air pressure in starter air storage bottle – 2300 to 3200 psi.
b. Static ports – Clear.
c. All access doors and gun deck cover – Installed.
d. Check battery lift – Retracted and secured.
e. Sucker doors – Check links.
f. Oxygen filler – Secured. (Build-up arm in horizontal position).
g. Pylon tank or bomb – Proper installation on inboard pylon and pylon tank filler cover secured.
h. Armament safety override switch – Check.
i. Single point ground refueling receptacle – Cap installed and door secured (F-84F-35 and later).
j. External power receptacle door – Closed.
k. Landing gear strut – Visible damage and proper inflation. Strut extension approximately 5 3/8 inches.
l. Landing gear tire – Blisters, grease or oil, proper inflation and evidence of slippage.
m. Wheel chock – In place.
n. Landing gear safety clip – Removed and stowed.
o. Air pressure in inboard pylon jettison system – 1600 psi.
p. Air pressure in inboard pylon tank jettison system – 2000 psi.

3 RIGHT WING TIP

a. Front rocket posts – Properly retracted (prior to F-84F-55RE).
b. Front rocket posts – Removed and plastic plugs inserted (F-84F-55RE and later aircraft).
c. Rear rocket doors – Flush fit with under side of wing skin and security of latches. (Prior to F-84F-55RE).
d. Rear rocket posts – Removed and plastic plugs installed (F-84F-55RE and later aircraft).
e. Pylon tank or bomb – Proper installation on outboard pylon and pylon tank filler cover secured.
f. Air pressure in outboard pylon jettison system – 1600 psi.
g. Air pressure in outboard pylon tanks jettison system – 2500 psi.
h. Position lights – Condition.
i. Landing light retracted.

4 RIGHT WING TRAILING EDGE AND AFT FUSELAGE

a. Wing fuel filler cap – Installed.
b. Ato units if installed – Nozzles clear.
c. Engine access doors – Closed and secured.
d. Speed brake – Condition.
e. Check emergency hydraulic system accumulator air pressure – 500 to 600 psi without emergency hydraulic pressure. Check reservoir rod for quantity. (Prior to F-84F-71RE).
f. Check utility hydraulic system accumulator air pressure 500-600 psi, without hydraulic pressure. (F-84F-71RE and later).
g. Check power hydraulic system accumulator air pressure 500-600 psi, without hydraulic pressure (F84F-71RE and later).
h. Check fuselage splice cover band – Proper installation.

5 EMPENNAGE

a. Tailpipe dust plug – Removed.
b. Tailpipe for accumulation of fuel or oil and warpage.
c. Empennage for general condition and evidence of hydraulic leaks.
d. Tail position lights – Condition.
e. Fuel tank vent – Condition.
f. Check drag chute compartment doors – Closed and secured (F-84F-66RE and later).

6 AFT FUSELAGE AND LEFT WING TRAILING EDGE

a. Make same inspections as in step 4 in reverse order.

7 LEFT WING TIP

a. Make same inspections as in step 3 in reverse order.

8 LEFT WING AND FORWARD FUSELAGE

a. Make applicable inspections as in step 2.
b. Air refueling door (if installed) – Evidence of damage and door closed flush with wing skin.
c. Forward fuel tank filler cap – Installed (prior to F-84F-55RE).
d. External tanks ground refuel switch pushed in and panel cover installed (F-84F-35 and later).
e. Check air refueling valves test switch cover closed (F-84F-35 and later).

9 AFT CANOPY

a. Check oil supply and tank filler cap installed.
b. Check hydraulic oil supply, reservoir filler cap installed and access door in a flush position.
c. Check the index mark on the main tank filler cap (if installed) to determine that it is closed and that the access door is in a flush position.

WARNING

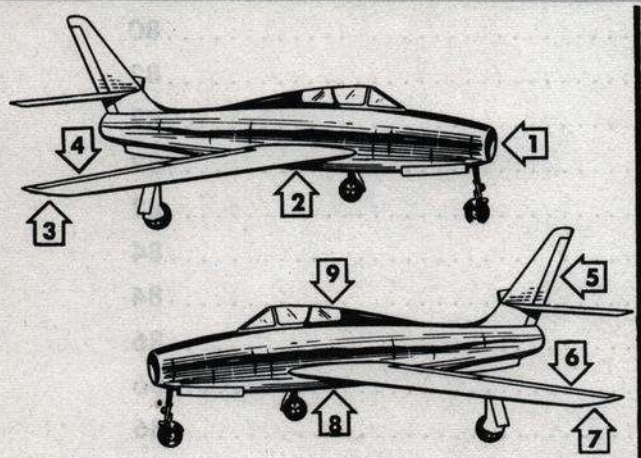
Be cautious when removing cap when aircraft has been serviced thru single point refueling. Fuel under pressure will be released in force.

d. Check alcohol supply, tank filler cap installed and access door in a flush position.
e. Canopy and canopy frame – Cleanliness and security.
f. Canopy for cracks, nicks, crazing and security.
g. Check canopy jettison initiator quick disconnect for security.

Figure 2—1 (Sheet 2 of 2).

EXTERIOR INSPECTION





1 NOSE SECTION

a. Intake duct plug and pitot cover – Removed.
b. Air intake ducts for foreign objects.
c. Check pneumatic pressure for emergency nose gear extension (2500-3000 psi).
d. Nose wheel shock strut – Visible damage and proper inflation. Strut extension 2 to 4 inches depending on weight of airplane.
e. Nose gear safety pin – Removed and stowed.
f. Nose wheel tie – Proper inflation and evidence of slippage.
g. Nose gun blast tubes – Plugs installed.
h. Nose wheel static ground wire – Ground contact.
i. Check shell casing doors – Secured.

Figure 2—1 (Sheet 1 of 2).

FLIGHT RESTRICTIONS.

Refer to Section V of this handbook for flight restrictions on the aircraft.

FLIGHT PLANNING.

Determine cruise control data such as power settings, airpseeds, etc., from data in the Appendix of this handbook.

WEIGHT AND BALANCE.

Check take-off and anticipated landing gross weight and balance. Consult Handbook of Weight and Balance Data, T.O. 1-1B-40 for loading procedure. Make sure weight and balance clearance (Form F) is satisfactory. Check that total weight of fuel, oil, armament, oxygen, and special equipment carried is suitable to the mission to be performed. Refer to Section V for weight limitations for various configurations.

ENTRANCE TO AIRPLANE.

1. Place a ladder against the left side of the aircraft at the cockpit. No external grips or steps are provided.
2. Open canopy using the external canopy control.

CAUTION

Do not use the gun sight as a hand hold. Be careful not to kick or drop anything on the control stick grip.

BEFORE EXTERIOR INSPECTION.

1. Check Forms 1 or 781 for status of the airplane.
2. Test canopy squib A and B circuits (canopy must be open).

WARNING

If the squib test circuits are not functioning properly and the squibs in the rear hinge bolts fire in F-84F-25GK to -35GK airplanes, the bolts will take a horizontal path. Therefore, be sure that no personnel are in line with these bolts when testing the canopy squib circuits.

3. Battery switch OFF.
4. Check that emergency escape system safety pin is installed in pilot's seat in right handgrip.
5. Check that canopy jettison initiator and seat ejection initiator safety pins are removed. (Prior to F-84F-55RE.)
6. Check that all circuit breakers are in and seated.
7. Auxiliary bomb selector switch OFF (prior to F-84F-61RE).
8. Armament selector switch OFF (F-84F-61RE and later).
9. Rocket selector switch OFF (prior to F-84F-61RE).
10. Rocket arming switch OFF or FUSE DELAY.
11. Rocket jettison ready switch—NORMAL (cover guard down) (prior to F-84F-61RE).
12. Ato ready switch OFF.
13. Bomb switches OFF or SAFE.

WARNING

Since take-off requires a large amount of rearward stick travel, there is a good possibility of the bomb release button being inadvertently energized by contacting the pilot's clothing or the parachute harness. In order to preclude this possibility, the bomb and rocket selector switches must be placed in the OFF position, and the bomb and rocket arming switches must be in the OFF or SAFE position prior to take-off.

14. Gun arming switch OFF.
15. Fuel tank selector OFF.
16. Outboard and inboard pylon jettison switches, cover guard down.
17. Landing gear selector handle DOWN.
18. Emergency landing gear release switch, cover guard down.

EXTERIOR INSPECTION.

1. Make a complete pre-flight inspection of the airplane (See figure 2–1).

ON ENTERING THE PILOT'S COMPARTMENT.

INTERIOR CHECK — ALL FLIGHTS.

1. Release control lock and adjust rudder pedals to proper position.
2. Examine safety belt and shoulder harness for security of adjustment and proper operation of lock movement and leave unlocked.

CAUTION

When adjusting and securing the safety belt on airplanes prior to F-84F-55RE make certain belt does not interfere with the canopy jettison linkage.

3. Adjust armrests to desired position and seat for proper height. Check ejection seat cannon plug for security.

WARNING

A type A-5 seat cushion is provided for use in the seat when a life raft is not utilized. Recent investigations have indicated that some pilots are leaving the standard A-5 cushion in the ejection seat when carrying the C-2A life raft. Sitting on both of these items does not provide any added comfort but actually creates a definite injury hazard as well as possibly positioning the pilot where it may be difficult to reach all the controls. Chance of vertebrae injury is increased considerably by the pilot sitting on a thick, compressible mass, such as a combination of the life raft and A-5 seat cushion, because when utilizing the ejection seat in this circumstance, it will not exert a direct force on its occupant until the seat has moved 2 or 3 inches upward. After this amount of travel, the seat has gathered such momentum that excessive impact is produced when the seat initially lifts the pilot. The chance of injury is also increased considerably under these circumstances if a crash landing cannot be avoided. If a crash landing is made, the combined compressiveness of the two items will permit the pilot to sink down far enough to loosen the shoulder straps thus allowing the pilot to slump forward. In this position, the impact may severely injure his back. Therefore, because of the above, the A-5 seat cushion should not be left in the seat if the C-2A life raft is being carried. However, if additional height in the seat is needed, a solid filler block may be used in conjunction with the C-2A pack, provided the combined thickness does not exceed 5 inches.

4. Circuit breaker test light, test (prior to F-84F-61RE).

5. Check rocket and external stores jettison circuits (F-84F-61RE and later).

6. Check drag chute circuit breaker test light (F-84F-66RE and later).

7. Check the trim switch for security of mounting on the control stick. Operate the trim switch in all four ON positions and note that it automatically returns to the OFF position when released. If the switch sticks in any of the ON positions, enter this fact with a red cross in the Form I and 781 and do not fly the airplane.

CAUTION

Do not twist the grip as such action may cause the grip to become less secure.

8. Check all circuit breakers on left console IN. (Prior to F-84F-61RE.)

9. Emergency hydraulic pump switch OFF.

10. Hydraulic by-pass switch, off. (Prior to F-84F-71RE).

11. Pneumatic compressor switch OFF.

12. Pitot heat switch OFF.

13. Spoiler shut-off switch cover guard down (F-84F-45 and later).

14. AN/ARC-34 emergency battery switch – safety wire unbroken (F-84F-61RE and later).

15. Check AN/ARC-34 circuit breaker test light.

16. Emergency fuel switch OFF (NORM).

17. Engine screen switch EXTEND (Prior to F-84F-61RE).

18. Engine screen switch AUTO (F-84F-61RE and later).

19. Fuel filter de-icing switch OFF.

20. Pylon tanks air pressure switches OFF.

21. Gun heater switch OFF.

22. Pitch control switch NORMAL (Prior to F-84F-71RE).

23. Alternate trim switch NORM (F-84F-40 up to F-84F-71RE).

24. Pitch trim switch NORM (F-84F-71RE and later).

25. Inboard bomb selector switch OFF (Prior to F-84F-61RE).

26. Outboard bomb selector switch OFF (Prior to F-84F-61RE).

27. Test operate hydraulic hand pump to insure presure, indicated on utility pressure gage (Prior to F-84F-71RE).

28. Landing flap lever NEUT.

29. Speed brake switch, to position of speed brakes.

30. Throttle control CLOSED.

31. Air refueling receiver switch, closed.

32. Fuel shut-off valve, up position.

33. Landing lights switch OFF.

34. Gyro compass switch NORMAL.

35. Set altimeter, accelerometer and clock to correct setting.

36. Gun-bomb-rocket sight mechanical caging lever CAGE.

37. Drag chute control handle – Full forward position (F-84F-66RE and later).

38. Instrument power switch NOR.

39. Generator switch ON.

40. Check oxygen pressure – Low 300 psi min, High 1800 psi (prior to F-84F-35).


DANGER
AREAS
BLAST FENCE
USAF
6'
25'

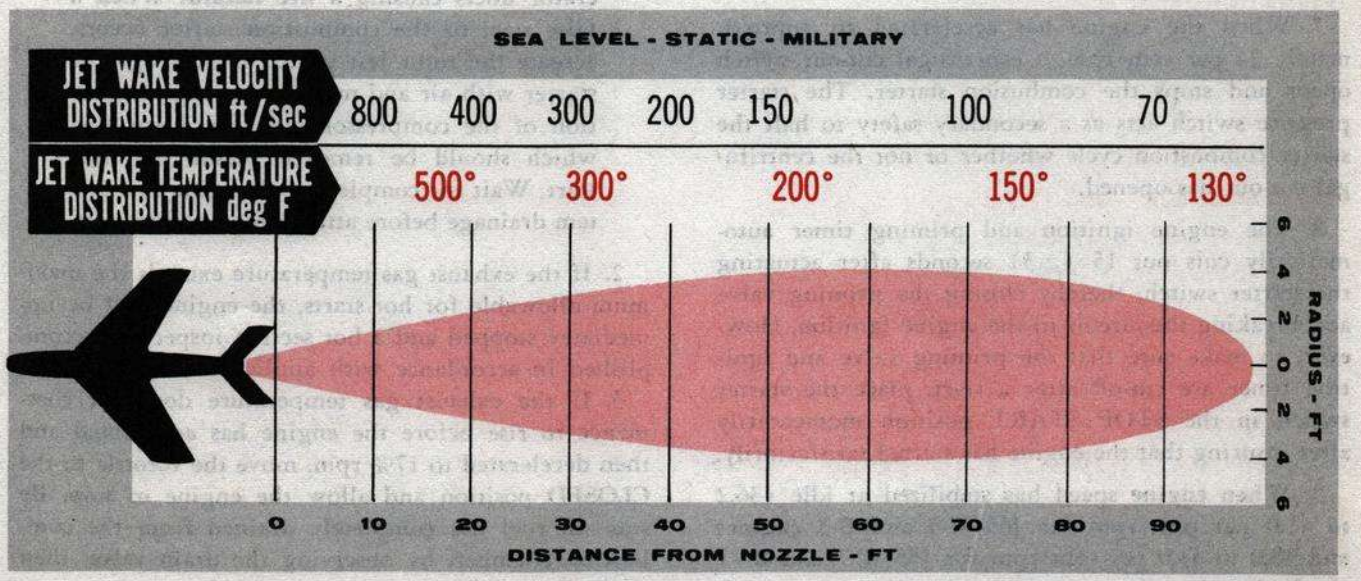

SEA LEVEL - STATIC - MILITARY
JET WAKE VELOCITY DISTRIBUTION ft/sec
800 400 300 200 150 100 70
JET WAKE TEMPERATURE DISTRIBUTION deg F
500° 300° 200° 150° 130°
RADIUS - FT
6 4 2 0 2 4 6
0 10 20 30 40 50 60 70 80 90
DISTANCE FROM NOZZLE - FT

Figure 2–2

41. Check liquid oxygen quantity — FULL (F-84F-35 and later).

Note

The liquid oxygen gage should read between 4 and 4½ liters when the system is fully charged. Do not be alarmed that the gage does not read 5 liters, since it is impossible to charge the liquid oxygen converter to 5 liters. Use the oxygen duration chart to determine your oxygen duration for the indicated supply.

42. Autopilot engaging switch OFF (if installed).

43. Check all circuit breakers on right console IN.

44. Cabin vent selector PRESSURE (prior to F-84F-35RE and F-84F-51GK).

45. Cabin vent selector NORMAL (F-84F-35RE and later and F-84F-51GK and later).

46. Defroster control OFF.

47. Canopy dry air switch OFF (F-84F-61RE and later).

48. Check all radio controls — OFF.

49. Battery switch ON.

Note

Use external power source whenever practicable to conserve the airplane's battery.

50. Check and test all warning lights.

51. Check fuel quantity.

52. Internal and external lights OFF.

53. Remove emergency escape system safety pin in pilot's seat right handgrip.

54. Remove safety pin from automatic lap belt initiator (if installed) (F-84F-30 and later).

55. Connect pilot's oxygen, G-suit and radio connections.

56. Head the aircraft into the wind if practicable.

57. Make certain that all personnel are clear of the jet exhaust and intake areas.

INTERIOR CHECK — NIGHT FLIGHTS.

1. Console lights CHECK.
2. Instrument panel lights CHECK.
3. Position lights CHECK with crew chief.
4. Landing lights CHECK.
5. Taxi light CHECK.
6. Air refueling receptacle light CHECK.
7. Flashlight CHECK.

ENGINE OPERATION.

BEFORE STARTING THE ENGINE.

If the aircraft is to be operated under possible conditions of carbon monoxide contamination, such as during "runup" or taxiing directly behind another operating jet aircraft or during "runup" with the tail into the wind the following procedure will be used:

1. Before starting engine, don oxygen mask, connect hose to oxygen regulator, and place diluter lever at the 100% OXYGEN position.

2. Whenever contamination is suspected, 100 per cent oxygen will be used during ground operation and take-off.

3. After contamination is no longer suspected, place the diluter lever of the oxygen regulator at the NORMAL OXYGEN position.

WARNING

The oxygen diluter lever must be returned to the NORMAL OXYGEN position as soon as possible, because the use of 100 per cent oxygen throughout a long mission will so deplete the oxygen supply as to be hazardous to the pilot.

EMERGENCY HYDRAULIC SYSTEM CHECK.

K and LATER

1. External power connect or battery switch ON and instrument power switch ALT.

2. Check utility and power hydraulic pressure gages for zero reading. If gages do not read zero cycle controls to dissipate pressure.

3. Place emergency hydraulic pump switch in the HYD EMER PUMP position. The power hydraulic pressure gage should indicate 1500 ±100 psi.

Note

During control checks, rates of motion of the control stick fore and aft and from side to side must be equal.

4. Move control stick to full forward position.

5. With emergency hydraulic pressure at 1500 (±100 psi control stick should operate smoothly and steadily from full forward to full aft then to full forward. Stick travel may then become restricted during the next aft travel due to the emergency pump limitation.

6. Return control stick to neutral. Check aileron operation through complete range at normal rates. Operation should be smooth and steady with NO indication of system starvation or reduction in rate.

7. Return emergency hydraulic pump switch to OFF position after power hydraulic pressure gage reads 1500 (±100) psi.

STARTING THE ENGINE.

1. Throttle control CLOSED.
2. Emergency hydraulic pump switch OFF.
3. Battery switch OFF and check external power connected.

Note

If external power is not available turn battery switch ON and instrument power switch to ALT. After engine has started return instrument power switch to NOR.

4. Fuel tank selector ALL TANKS.

Note

If the fuel selector should bind, due to pressure build up in the fuel lines, the simplest way to free up the fuel tank selector is to motor the engine over slowly by actuating the engine crank switch to the ENGINE CRANK position for one or two seconds while holding the fuel tank selector toward the ALL ON position. An alternate method, is to hold pressure against the fuel tank selector toward any on position while making a normal start. As the engine picks up speed the selector will free up and if positioned to a tank containing fuel, a normal start will follow.

5. Move throttle control to IDLE which opens the fuel shut-off valve.

6. Immediately actuate the starting switch to START and hold in this position for about 1 second. This energizes the engine primer and ignition timer and the combusion starter.

7. When the engine has accelerated to approximately 24 per cent rpm, a centrifugal cut-out switch opens and stops the combusion starter. The starter pressure switch acts as a secondary safety to halt the starter combustion cycle whether or not the centrifugal cut-out has opened.

8. The engine ignition and priming timer automatically cuts out 15 (± 3) seconds after actuating the starter switch, thereby closing the priming valve and breaking the circuit to the engine ignition. However, to make sure that the priming valve and ignition timer are cut-off after a start, place the starter switch in the STOP START position momentarily after insuring that the engine has started satisfactorily.

9. When engine speed has stabilized at idle (36.2 to 41.0 per cent rpm for J65-W-3 and B-3 engines and 38.0 to 43.0 per cent rpm for J65-W-7 and B-7) check that the oil pressure is within limits.

10. Check that all engine instruments are within range and indicate normal operation. Advance throttle as desired.

11. Disconnect external power.

PROCEDURE IN THE EVENT OF FALSE ENGINE START.

1. If the exhaust gas temperature reaches maximum allowable for starts during an attempted start, position the throttle to the CLOSED position and allow the engine to stop. Be sure all fuel has completely drained from the combusion chamber by observing the drain valve then attempt another start. Re-start only if "hot start" conditions have not been exceeded. Refer to Section V for hot start conditions.

CAUTION

If the engine fails to start after one starting attempt, the starter compressed air storage bottle must be recharged. If the engine fails to start after two starting attempts, a 45 minute cooling period is required before making a third attempt. Unlimited single starts at 45 minute intervals may be made thereafter. A re-start should be made only if "hot start" conditions have not been exceeded.

WARNING

If a start is attempted and combustion does not occur in the starter, fuel can drain into the pants duct area and possibly into the generator ducts causing a fire hazard. When a false start of the combustion starter occurs, actuate the rotor test switch to scavenge the starter with air and make a thorough inspection of the compressor inlet for latent fuel which should be removed before the next start. Wait for completion of engine fuel system drainage before attempting another start.

2. If the exhaust gas temperature exceeds the maximum allowable for hot starts, the engine will be immediatey stopped and a hot section inspection accomplished in accordance with applicable engine T.O.

3. If the exhaust gas temperature does not commence to rise before the engine has accelerated and then decelerated to 17% rpm, move the throttle to the CLOSED position and allow the engine to stop. Be sure all fuel has completely drained from the combustion chamber, by observing the drain valve, then attempt another start.

ENGINE GROUND OPERATION.

WARM-UP.

1. No warm-up period is required. Take-off may be made immediately if the engine instruments show normal readings.

Note

In the event condensation in the form of mist or snow is blown into the cabin from the air conditioning-outlets and is found to be objectionable to the pilot, the cabin vent switch can be positioned to RAM, or a higher temperature selected on the cabin temperature selector.

ENGINE STALL CHECK.

The following procedure will be used to check engine ground acceleration in lieu of the Bode stall check.

1. Advance the throttle from a stabilized position of 47 per cent rpm to maximum rpm position in 1 second or less. The engine airframe combination is considered acceptable if the exhaust gas temperature remains in limits and the acceleration time limit is not exceeded. Refer to Section V for exhaust gas temperature limits and acceleration time limits.

Note

Any rapid advance of the engine throttle in flight while the engine is still decelerating may induce compressor surge or compressor stall. If the engine "chugs" and continues to accelerate without a sudden and excessive EGT rise, the pilot need not take any corrective action. If the "chugging" is accompanied by an rpm hang-up and/or a sudden and excessive rise in EGT, the throttle should be moved to the IDLE position immediately and left there until the stall condition has dissipated as evidence by EGT stabilizing at the idle reading. After stall dissipation, the throttle may be advanced at the normal rate to obtain desired rpm setting.

ACCELERATION.

If maximum exhaust gas temperature is exceeded during acceleration of the engine, retard the throttle slightly until the temperature has dropped below the steady state limit. The engine may then be accelerated by advancing the throttle gradually so that the acceleration temperature limit is not exceeded.

Note

An immediate investigation should be conducted to determine the cause of exceeding the limiting temperature during the first acceleration and the cause should be eliminated before any more fast accelerations are made.

It will take slightly longer to accelerate to 100 per cent with a cold engine than it does with a warm engine.

WARNING

If the engine rpm exceeds the acceleration limitations, as noted in Section V, the engine will be immediately stopped and the necessary corrective action taken in accordance with the applicable engine T.O.

GROUND TEST — BEFORE TAXIING.

A thru J

1. Emergency hydraulic pump switch — NORMAL.
2. Check hydraulic pressure in boost and utility systems.
3. Check for firm and positive brake action.
4. Test operate speed brakes through complete range.

Note

While actuating speed brakes, check for loss of pressure in hydraulic boost system indicated by temporary drop on boost gage. This indicates a failure of the boost pump.

5. Lower landing flaps full down (100 per cent) then return to take-off position (50 per cent).
6. Test operate ailerons and rudder through complete range and check for free and correct movement.
7. Test operate stabilator through complete range and check for free and correct movement.
8. Actuate trim switch and check trim operation of the stabilator and the aileron. Aileron trim indicator light should illuminate at neutral trim. Position the alternate trim switch in the OFF position while holding the trim switch (F-84F-40 and up). Trim actuators should become inoperative. Return switch to NORM position.
9. Actuate rudder trim switch and check rudder trim. Rudder trim indicator should illuminate at neutral trim.
10. At engine IDLE rpm and with the emergency hydraulic pump switch in the NORMAL position, actuate the hydraulic by-pass switch to the BY-PASS position. On airplanes prior to F-84F-50, both hydraulic pressure gages should show pressure has been dumped while on later airplanes only the boost hydraulic pressure gage will drop. The emergency hydraulic system should function and the EMERG HYD CONTROLS ON indicator should illuminate. Check the ailerons and stabilator for proper movement. Operation should be smooth and steady.

Note

This operation is a simulated emergency condition and operation is limited by the capacity of the electric-hydraulic pump.

11. ELECTRICAL CONTINUITY CHECK—GROUND OPERATION ONLY. (For emergency flight operation see Section III.)
With stabilator and aileron trim in neutral position and engine at IDLE: check pitch control switch in NORMAL, place the emergency hydraulic pump switch in the OFF position, by-pass switch in BY-PASS. Cycle stick to dissipate the emergency hydraulic pressure. While applying 15 to 50 pound load on the control stick in the aft direction, actuate the trim switch to move the control stick aft approximately *ONE* inch. This check is a continuity check assuring that the electrical system will take over during the normal sequence of failures; i.e., normal hydraulic system, then emergency hydraulic system.

CAUTION

Do not repeat unnecessarily as the actuator may be subjected to jamming loads due to these artificially induced conditions.

12. Position the emergency hydraulic pump switch to EMERG and the hydraulic by-pass switch to off. Emergency ON indicator light should illuminate and the hydraulic pressure gages should not fluctuate when the control stick is moved.

13. Emergency hydraulic pump switch NORMAL, alternate trim switch NORM (F-84F-40 and up), then position the pitch control switch to STICK OVERRIDE or ELEC position with the engine at 100 per cent rpm. On airplanes prior to F-84F-50, both hydraulic pressure gages should show pressure has been dumped while on later airplanes only the boost hydraulic pressure gage will drop. The EMERG HYD CONTROLS ON indicator should illuminate. The stabilator should not move unless the trim switch is actuated. Otherwise, the aircraft should not be flown. However, the control stick can be flexed fore and aft approximately ½ inch which is equivalent to the movement of the linkage to the actuator. Actuate the trim switch to move the stick forward and aft and simultaneously apply sufficient load on the stick to position the actuator control valve in the direction of the stabilator motion. Check the ailerons for emergency hydraulic control.

Note

On all F-84F-25RE and GK airplanes Serial Nos 51-9357, 9360, 9361, 9363, 9364 and 9367, without spoilers installed, accomplish the above check at 85 per cent instead of 100 per cent engine rpm. The location of the dump valve does not allow the system to dump completely at 100 per cent rpm. However, when spoilers are installed on these airplanes, the dump valve will be relocated and the system will dump satisfactorily at 100 per cent engine rpm.

14. On F-84F-40 and subsequent airplanes: Pitch control switch ELEC, emergency hydraulic pump switch NORMAL, alternate trim switch OFF. Actuate the alternate trim switch momentarily to NOSE UP and NOSE DN and simultaneously apply sufficient load on the control stick to position the actuator control valve in the direction of stabilator motion.

CAUTION

Release the alternate trim switch from the NOSE UP or NOSE DN position before reaching full up or full down stabilator travel to avoid the stabilator actuator from bottoming which may result in damage to the actuator or to the clutch. This circuit is not protected with limit switches.

15. Place control stick in neutral and check that the alternate trim switch is in NORM, emergency hydraulic pump switch NORMAL, hydraulic by-pass switch off and pitch control switch in NORMAL. Check flight controls for free and correct movement to assure that they have returned to operation on the normal hydraulic system.

16. Check fuel tank selector ALL TANKS.

17. Check charge on loadmeter at IDLE rpm and above.

18. Check voltage on voltmeter at IDLE rpm and above.

19. Check communication equipment.

20. Check that no fuel is overflowing from main tank vent lines (observed by crew chief).

21. Turn compressor switch ON and check pneumatic pressure gage (checked by crew chief).

22. Depress canopy dry air switch to CANOPY DRY AIR for maximum of 15 seconds (canopy closed).

23. Oxygen mask adjusted properly and oxygen system operating. Arrange oxygen hose so as not to interfere with full stick travel.

24. Oxygen warming system switch OFF.

25. Check autopilot operation. Refer to Section IV.

GROUND TEST — BEFORE TAXIING.

K and LATER

1. Emergency hydraulic pump switch OFF.

STABILIZED Exhaust Gas Temperature at 100% RPM After 15 Minutes Operation

AIR SCREENS RETRACTED

J-65-W-3 or B-3 ENGINES

AMBIENT TEMP °F	MAX EGT °C	MIN EGT °C
100	620	600
90	618	598
80	616	596
70	614	594
60	612	592
50	611	591
40	609	589
30	607	587
20	605	585
10	603	583
0	601	581
–10	599	579
–20	597	577
–30	595	575
–40	593	573
–50	592	572
–60	590	570
–65	589	569

J-65-W-7 or B-7 ENGINES

AMBIENT TEMP °F	MAX EGT °C	MIN EGT °C
100	650	630
90	647	627
80	645	625
70	642	622
60	640	620
50	637	617
40	635	615
30	632	612
20	630	610
10	627	607
0	625	605
–10	622	602
–20	620	600
–30	617	597
–40	615	595
–50	612	592
–60	610	590
–65	609	589

Figure 2-3

STABILIZED Exhaust Gas Temperature at 100% RPM After 3 Minutes Operation

AIR SCREENS RETRACTED

J-65-W-3 or B-3 ENGINES

AMBIENT TEMP °F	MAX EGT °C	MIN EGT °C
100	635	615
90	633	613
80	631	611
70	629	609
60	627	607
50	626	606
40	624	604
30	622	602
20	620	600
10	618	598
0	616	596
–10	614	594
–20	612	592
–30	610	590
–40	608	588
–50	607	587
–60	605	585
–65	604	584

J-65-W-7 or B-7 ENGINES

AMBIENT TEMP °F	MAX EGT °C	MIN EGT °C
100	665	645
90	662	642
80	660	640
70	657	637
60	655	635
50	652	632
40	650	630
30	647	627
20	645	625
10	642	622
0	640	620
–10	637	617
–20	635	615
–30	632	612
–40	630	610
–50	627	607
–60	625	605
–70	624	604

Figure 2–4

2. Check hydraulic pressure in power and utility systems.

3. Check for firm and positive braking action.

4. Test operate speed brakes through complete range.

5. Lower landing flaps full down (100 per cent) then return to take-off position (50 per cent).

6. With engine at IDLE rpm check utility and power hydraulic pressures with hydraulic systems in static state. Gages should read 1500 (±100) psi.

7. With spoilers OFF, position control stick full forward. With 1500 (±100) psi indicated on both pressure gages cycle stick to full limits of aileron and stabilator deflection (rate of 1 cycle is approximately in 4 to 6 seconds). Power and utility hydraulic pressure should not drop below 400 psi. Return control stick to neutral.

8. Check rudder for free and correct movement.

9. Actuate the trim switch and check trim operation of the stabilator and ailerons. The aileron trim indicator should illuminate at neutral trim. Position the pitch trim switch in the OFF position while holding the trim switch. Trim actuators should become inoperative. Check NOSE UP or DN position. Return switch to NORM.

10. Actuate yaw trim switch and check rudder trim. Rudder trim indicator should illuminate at neutral trim.

11. Check full tank selector ALL TANKS.

12. Check external tanks air pressure switches OFF.

13. Check charge on loadmeter at IDLE rpm and above.

14. Check voltage on voltmeter at IDLE rpm and above.

15. Check communication equipment.

16. Check that no fuel is overflowing from main tank vent lines (observe by crew chief).

17. Turn compressor switch ON and check pneumatic pressure gage (checked by crew chief).

18. Actuate canopy dry air switch to CANOPY DRY AIR for maximum of 15 seconds (canopy closed).

19. Oxygen mask adjusted properly and oxygen system operating. Arrange oxygen hose so as not to interfere with full stick travel.

20. Oxygen warning system switch OFF.

21. Check autopilot operation refer to Section IV.

TAXIING INSTRUCTIONS.

Remove chocks, close and lock canopy, release brakes and increase power until airplane starts to move. Once the airplane is moving, taxi at the lowest practicable rpm to conserve fuel and avoid damage from tailpipe blast. Brakes are required for steering as the rudder is ineffective at low speeds and nose wheel steering is not provided. Slightly higher than normal force is required on the brakes for turning, however, the airplane is easy to taxi. When the airplane is fully loaded with external items, a much higher rpm is necessary to get the airplane rolling. When heavily loaded, the turning radius must be slightly increased to prevent excessive side loads on the struts and tires. Limit taxiing to a minimum as the airplane range is decreased by the high rate of fuel consumption during taxiing. Fuel consumed during taxiing is approximately 15 to 25 pounds per minute. The canopy may be left open at all speeds during taxiing on smooth ground.

CAUTION

Do not rest arms on canopy rail while canopy is open as injury will result if the canopy unexpectedly closes during taxiing.

BEFORE TAKE-OFF.

CAUTION

On airplanes with fuel booster pumps modified in acordance with T.O. 6J10-3-10-502 dated 15 June 1954, the center of gravity will move approximately one per cent forward of the maximum allowable forward cg position when special stores are carried on the inboard pylons. Furthermore, when operating under this condition, a larger unsticking force will be required to raise the nose wheel during take-off.

After taxiing into take-off position, complete the following checks:

PREFLIGHT ENGINE CHECK.

1. With engine idling, check instrument readings to make sure engine is functioning properly.

2. Engine screens extended.

3. Advance throttle to 100 per cent rpm and check exhaust gas temperature in accordance with figure 2–3 or 2–4.

4. Retard throttle to 90 per cent rpm.

5. Position emergency fuel switch to the ON (FLIGHT EMERG) position. Emergency-on indicator light should illuminate.

Note

The engine rpm will increase or decrease immediately depending on how much the ambient conditions vary from a standard day.

Maximum RPM EMERGENCY FUEL SYSTEM
at Standard Barometric Pressure

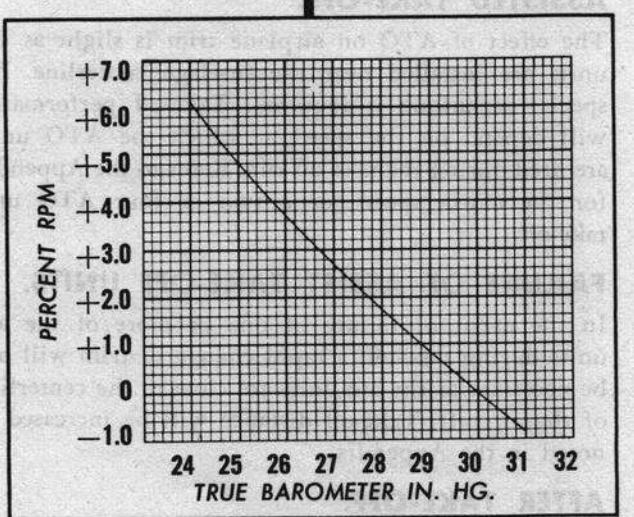
J65-W-3 or B-3 ENGINES

Ambient Temp °F	Percent RPM	Ambient Temp °F	Percent RPM
100	102.1	10	95.7
90	101.4	0	94.9
80	100.8	−10	94.1
70	100.1	−20	93.3
60	99.4	−30	92.5
50	98.7	−40	91.7
40	97.9	−50	91.0
30	97.1	−60	90.2
20	96.4	−65	89.9

J65-W-7 or B-7 ENGINES

Ambient Temp °F	Percent RPM	Ambient Temp °F	Percent RPM
100	101.6	10	95.6
90	101.1	0	94.8
80	100.6	−10	94.0
70	100.0	−20	93.1
60	99.3	−30	92.3
50	98.6	−40	91.5
40	97.9	−50	90.7
30	97.1	−60	89.9
20	96.4	−65	89.5

Correction Curves for Barometric Pressure



EXAMPLE

GIVEN

TEMP = 40°F

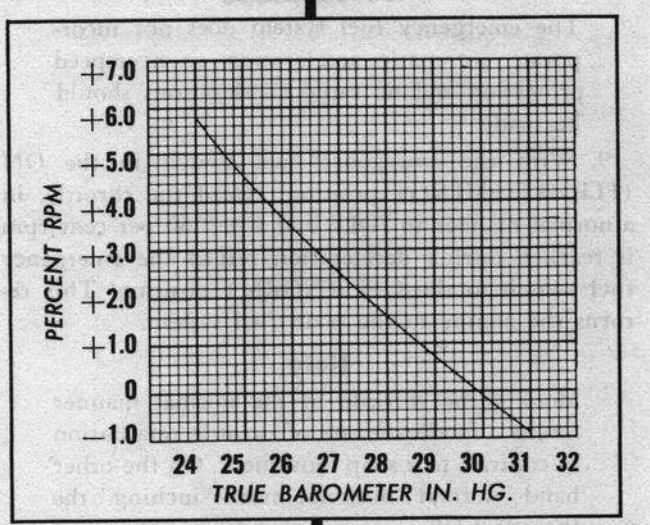
BAROMETER = 28.5 IN. HG.

SOLUTION

40°F = 97.9% RPM

CORRECTION +1.3% RPM

ANS. 99.2% RPM



EXAMPLE

GIVEN

TEMP = 40°F

BAROMETER = 28.5 IN. HG.

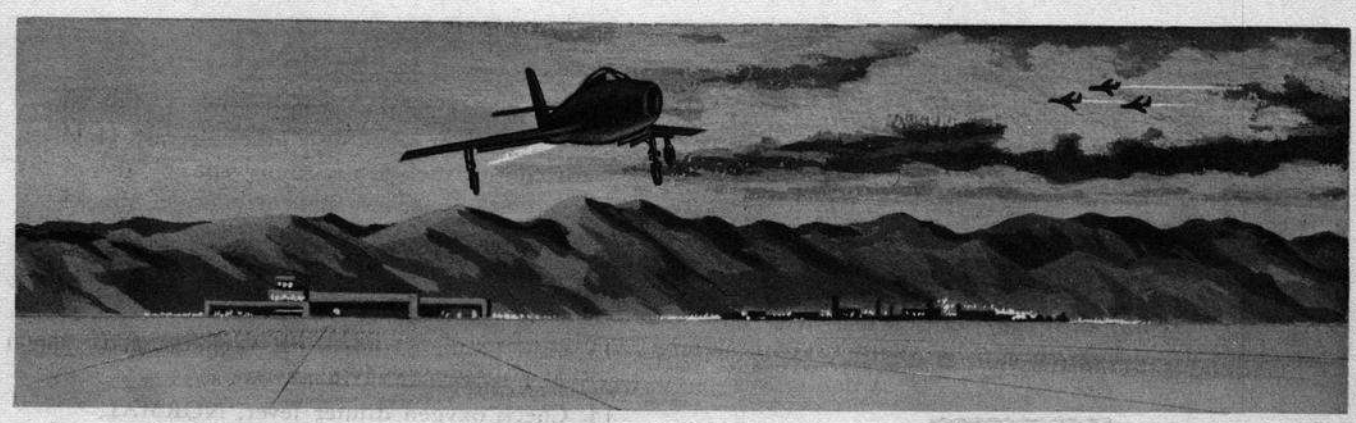
SOLUTION

40°F = 97.9% RPM

CORRECTION +1.2% RPM

ANS. 99.1% RPM

Figure 2–5



TAKE-OFF

The following technique must be used to obtain performance illustrated in the appendix.

1. Refer to Appendix for minimum take-off distances and speeds required by various combinations of gross weight, pressure altitude and air temperature, also for best climbing speed, rate of and time to climb, and fuel consumption.

2. Advance the throttle control to take-off rpm. Check emergency fuel switch in OFF (NORM) position. Check instruments, release brakes and begin take-off run.

Note

If the main fuel system fails during take-off place the emergency fuel switch in the ON (FLIGHT EMERG) position. This transfers the engine to the emergency fuel system. When this transfer occurs at take-off rpm, a sudden change in fuel flow and rpm will occur. The pilot should recognize what has occurred and advance or retard the throttle smoothly but slowly to regain take-off rpm.

3. Maintain directional control by minimum use of brakes until rudder becomes effective at approximately 60 knots (IAS).

4. If using ato, push ato ignition switch as air-speed approaches the desired values as noted in the Appendix.

5. Check air speed at predetermined points on take-off run to check aircraft acceleration. (Refer to figure A-10.)

6. Leave control stick in neutral until take-off speed is reached. This reduces drag to minimum.

Caution

Control stick is left in neutral until take-off speed is reached to prevent raising the nose too early and getting on the back side of the power curve.

7. Lift airplane off ground using necessary control stick travel at take-off speed.

If the ambient conditions are near standard, no apparent change in rpm will occur.

6. Slowly acelerate engine to full throttle and check maximum rpm with figure 2–5. Immediately retard the throttle to a point below the maximum steady state speed as noted in figure 5–1.

WARNING

Engine must not be operated in steady state above limits shown in figure 5–1. However, it will be noted in figure 2–5 that emergency top rpms at ambient temperatures of 80°F, and above are over the ground running limits. Engine rpms for checking the emergency fuel system can exceed ground operating limits long enough to compare tachometer readings with figure 2–5. Immediately after checking, the engine should be switched to the normal fuel system or throttle retarded so that steady state limits are not exceeded.

7. Retard throttle to IDLE and check rpm: 36.2 to 41.0 per cent rpm for J65-W-3 and B-3 engines and 38.0 to 43.0 per cent for J65-W-7 and B-7 engines.

8. Slowly accelerate the engine to 90 per cent rpm.

CAUTION

The emergency fuel system does not incorporate automatic acceleration or overspeed protection and no rapid accelerations should be made.

9. With the emergency fuel switch in the ON (FLIGHT EMERG) position, retard the throttle, in a normal manner to IDLE and when 60 per cent rpm is reached during deceleration return the emergency fuel switch to the OFF (NORM) position. This returns the engine to the main fuel system.

Note

Moving the throttle in the normal manner means a moderate rate of throttle retardation in contrast to a snap movement. On the other hand "normal" does not mean "inching" the throttle back.

10. Position engine screens as required.

WARNING

Under certain conditions engine screens may have to be retracted prior to take-off. For further information see Section IX.

PREFLIGHT AIRCRAFT CHECK.

1. Emergency hydraulic pump switch NORMAL (Prior to F-84F-71RE).
2. Emergency hydraulic pump switch OFF (F-84F-71RE and later).
3. Hydraulic by-pass switch off (Prior to F-84F-71RE).
4. Pitch control switch NORMAL (Prior to F-84F-71RE).
5. Alternate trim switch NORM (F-84F-40 up to F-84F-71RE).
6. Pitch trim switch NORM (F-84F-71RE and later).
7. Landing flaps, check in take-off position.
8. Speed brake switch IN (all airplanes).
9. Trim indicator lights, illuminated.
10. Fuel tank selector ALL TANKS.
11. Pylon tank air pressure switches OFF.
12. Safety belt and shoulder harness tightened and check inertia reel unlocked.
13. Prior to ato take-off, place ato ready switch in ATO READY. Ato ready warning light should go on.
14. Autopilot engaging switch OFF if installed.
15. Check flight controls for free and correct movement and to assure that they have returned to operation on the normal hydraulic system.

TAKE-OFF.

See figure 2–6.

ASSISTED TAKE-OFF.

The effect of ATO on airplane trim is slight as the units are installed near the fuselage centerline. No special technique is required. Take-off performance will depend on the speed at which the ATO units are fired during the take-off run. Refer to the Appendix for the cut-in speed for a two or four ATO unit take-off.

FAILURE OF ASSIST TAKE-OFF UNITS.

In the event of failure of one or more of the ato units during take-off, a rapid change of trim will not be necessary as the ato units are close to the centerline of the aircraft. Take-off distance will be increased as noted in the Appendix.

AFTER TAKE-OFF.

1. Landing gear selector handle: UP when definitely airborne. Leave handle in the UP position after gear is retracted. Check landing gear position indicators.

Note

Do not exceed 190 knots until landing gear is up and locked. The landing gear will retract in approximately 10 seconds at normal temperatures.

2. Landing flap lever: UP after landing gear has fully retracted and all obstacles are cleared.

3. After flaps are retracted, return landing flap lever to NEUT.

4. Pylon tank air pressure switches OUTB'D PYLON TANK AIR PRESS or INB'D PYLON TANKS AIR PRESS (Prior to F-84F-61RE). PYLON TANKS AIR PRESS OUTB'D or INB'D L or R (F-84F-61RE and later).

5. After take-off, drop ato units when at a safe altitude, by depressing ato jettison switch.

CAUTION

To prevent damage to the fuselage drop ato units between 200 and 250 knots IAAS.

6. Ato ready switch: OFF.

7. Climb to a safe altitude and adjust speed for best climb.

CAUTION

The engine rpm and exhaust gas temperature MUST be monitored during a locked throttle climb to altitude. The throttle may have to be retarded to keep both the rpm and/or the EGT within specified limits.

8. Cabin vent selector to PRESSURE if take-off was made in RAM (prior to F-84F-35RE and F-84F-51GK).

9. Cabin vent selector NORMAL if take-off was made in RAM (F-84F-35RE and F-84F-51GK and later).

10. Engine screen switch: as desired.

Note

Leave engine screens extended, during gunnery mission or when foreign objects present a hazard to flight.

11. Pneumatic compressor switch ON.

CAUTION

The compressor should not be operated for more than 30 minutes continuously to prevent overheating and possible compressor explosion. Therefore, if the storage bottles take an excessive amount of time to refill, the compressor should be shut-off.

12. Trim airplane for wing-level flight, desired pitch trim and directional heading then engage autopilot, if installed, by turning engaging switch ON.

CAUTION

Do not engage the autopilot when close to the ground or when near other aircraft. Hold the control stick firmly to prevent any abrupt resultant maneuver that may occur should automatic pilot not function properly. Do not engage at speeds in excess of 425 knots IAS below 20000 feet altitude.

13. Gun heater switch on if flight is above 15000 feet.

14. Check oxygen diluter lever, NORMAL.

CLIMB.

The climb characteristics of the airplane permit a high initial rate of climb and sustained climbing speed to the service ceiling. See Appendix for recommended climb speeds, rate of climb, engine rpm and fuel consumption during climb.

CAUTION

The engine rpm and exhaust gas temperature MUST be monitored during a locked throttle climb to altitude. The throttle may have to be retarded to keep both the rpm and/or the exhaust gas temperature within specified limits.

FLIGHT CHARACTERISTICS.

Refer to Section VI for detailed information on the aircraft flight characteristics.

SYSTEMS OPERATION.

Refer to Section VII for detailed information regarding operation of the various aircraft systems.

PRE-TRAFFIC PATTERN CHECK LIST.

1. Auxiliary bomb selector switch, OFF (Prior to F-84F-61RE).

2. Rocket selector switch, OFF (Prior to F-84F-61RE).

3. Rocket arming switch OFF or FUSE DELAY.

4. Outboard and inboard bomb selector switches, OFF (Prior to F-84F-61RE).

5. Armament selector switch, OFF (F-84F-61RE and later).

6. Bomb arming switch, SAFE.

7. Gun heater switch OFF.

8. Engine screen switch EXTEND (Prior to F-84F-61RE) or AUTO (F-84F-61RE and later). Check engine screen warning light ON the OFF.

9. Fuel tank selector ALL TANKS unless operation has been necessary in AUX.

LANDING APPROACH



1. Enter initial approach pattern at 300 knots IAS at minimum distance of 3 miles from end of active runway, 1500 feet above field elevation.
2. Break point will be one third of the way down the landing runway. Speed brake switch OUT.
3. Retard throttle to 60 percent rpm to assure operation of the landing gear warning horn and light.
4. Reduce speed to 220 knots IAS and lower gear when opposite end of runway.
5. Check gear down and locked by retarding throttle to 60 percent rpm.
6. Maintain break altitude until on base leg. Air speed 180 knots minimum (add 5 knots for each 1000 lbs. of fuel above 1000 lbs).
7. Call tower on base leg.
8. Full flaps during turn to final. Return flap lever to NEUT. Airspeed 175 knots minimum (add 5 knots for each 1000 lbs. of fuel above 1000 lbs).
9. Check utility hydraulic pressure to insure brake condition.
10. Final turn completed at minimum of 500 feet above field elevation and 2000 feet from end of runway.
11. Come in over the fence at no less than 160 knots with full flaps and touch down at speeds recommended in Appendix 1.

NOTE

The term "fence" is that point where monitoring the airspeed ceases and full attention is directed to flare-out and landing.

Figure 2–7

10. Gun arming switch, OFF.

11. Gun-bomb-rocket sight mechanical caging lever, CAGE.

CAUTION

If the mechanical caging lever is left in the UNCAGE position during landing or taxiing, the sight mirror or mirror suspension may become damaged due to vibration.

12. Emergency fuel switch OFF (NORM).

Note

On aircraft prior to F-84F-55, the engine will switch to the emergency fuel system when the throttle is retarded during landing if the emergency fuel switch is in the ALERT (TAKE-OFF ONLY) position.

13. Pneumatic compressor switch, OFF.

14. Autopilot engaging switch OFF or depress autopilot release switch if autopilot is installed.

CAUTION

Do not disengage autopilot close to the ground or when near other aircraft. Hold the control stick firmly while disengaging autopilot as the aircraft may assume a wing down attitude if it is out of trim manually.

15. Oxygen; 100% OXYGEN if desired.

16. Check safety belt and shoulder harness. Leave shoulder harness unlocked.

LANDING APPROACH.

See figure 2–7.

LANDING.

NORMAL LANDING.

Refer to Appendix for landing data. A ten minute interval between landings is necessary to permit the brakes to cool.

1. Landing is made with the tail low, touching down on the main gear then letting the nose wheel contact. It is not necessary to hold the nose wheel off as long as possible as the increased drag is negligible.

Note

The tail can be dragged by touching down at too low an airspeed. Directional control is good throughout the entire landing roll.

2. After touchdown, apply brakes constantly and evenly as required until aircraft has slowed to taxiing speed. To obtain landing data as shown in the Appendix, brakes must be applied and held after touchdown.

CAUTION

Do not apply brakes until nose wheel has contacted the ground so as to minimize landing load on nose wheel strut.

3. Landing flaps lever UP and speed brake switch IN before taxiing.

MINIMUM DISTANCE LANDING ROLL.

The following landing technique will give a higher runway friction so that more braking can be used without sliding the wheels.

1. After minimum speed touch down, allow nose wheel to settle and lightly apply brakes.

2. Ease stick aft, and as nose wheel tries to rise, apply enough brakes to hold the nose wheel in contact with runway.

3. Apply more aft stick followed by more brakes to keep the nose wheel on the ground. Keep applying more aft stick and brakes to keep the nose wheel down until full aft stick is reached.

4. Once full aft stick is reached, brakes can be applied up to the wheel sliding point.

5. Directional control should be maintained with rudder than releasing brakes as this would increase landing roll.

6. Stabilator and brake technique should be held until airplane is down to taxi speed.

LANDING WITH EXTERNAL LOAD.

Landing with external loads such as bombs, fuel in the pylon tanks and rockets should be avoided because the loads applied to the wing structure during such landings may cause wrinkles in the wing unless very smooth landings are made. Landing is made in the normal manner except that the speed will be higher because of the higher stalling speed due to the increased weight.

CROSS WIND LANDING.

The procedure for cross wind landing is the same as for normal landing. However, if the drift appears excessive, the upwind wing may be lowered just before contact. During landing roll the airplane can be held in a straight path with the rudder until speed reduces to approximately 70 knots. At the lower speeds, direction is controlled by the use of the brakes.

HEAVY WEIGHT LANDINGS ON WET AND DRY RUNWAYS.

Flight tests have revealed that the subject aircraft can be landed on a wet, hard surface runway (concrete



Figure 2—8

or asphalt) with a length of 7000 feet, provided the gross weight does not exceed 21,600 pounds and the touchdown speed is not above 160 knots IAS. In addition approximately 2000 more feet of wet runway distance is required than for a dry runway at the same gross weight. The subject aircraft may also be landed at the maximum gross weight on a dry, hard surface runway with a length of 7000 feet, provided the approaches are unobstructed.

PROCEDURE

A rectangular traffic pattern is recommended when a heavyweight or wet runway landing is to be made. Prior to landing:

1. The pilot must assure himself sufficient landing pattern spacing so that jet wash from preceding aircraft is at a minimum.

2. The approach speeds for each landing must be computed before attempting a maximum gross weight or a wet surface runway landing. The final approach speed should be the minimum "over the fence" speed (flare speed) for the corresponding gross weight as shown in figure A—61. Establish the base leg 1500 feet above the runway altitude, IAS 225 knots, wheels down, flaps up, dive brakes in. Make the turn to final at 800-1000 feet above 5 miles out, maintain power as required to hold 190 knots IAS, and complete the landing check, full flaps and dive brakes out. When about 2 miles from touchdown, reduce the airpseed to the pre-determined final approach speed and adjust the power so that a 200- to 300-foot rate of descent can be held to the flare-out point. Immediately prior to touchdown, the power should be reduced to idle and the nose pulled to the optimum up position. The touchdown speed should be the minimum touchdown speed for corresponding gross weight as shown in figure A—61. The flaps should be retracted immediately upon touchdown. Even though the nose falls through, it should again be pulled off so that maximum aerodynamic braking can be employed.

Note

If traffic conditions permit, the engine should be shut down when the ability to stop on the runway is in doubt.

3. When landing on a wet surface runway, the first 2000 feet of roll is the most critical in that the aircraft has a "skimming" tendency until the lift of the wing has dissipated. If brakes are used during this period. they will tend to aggravate this condition, resulting in a severe yaw. It is virtually impossible to determine when one wheel has stopped rotating on a wet runway; therefore, the best assurance against blowing a

CONDENSED CHECK LIST

Before Exterior Inspection

1. Forms 1 or 781 CHECK
2. Battery squib A and B circuits TEST
3. Battery switch OFF
4. Emergency escape system safety pin CHECK
5. Canopy jettison initiator and seat ejection initiator safety pins CHECK (Prior to F-84F-55RE)
6. Circuit breakers CHECK
7. Auxiliary bomb selector switch OFF (Prior to F-84F-61RE)
8. Armament selector switch OFF (F-84F-61RE and later)
9. Rocket selector switch OFF (Prior to F-84F-61RE)
10. Rocket arming switch OFF or FUSE DELAY
11. Rocket jettison ready switch CHECK (Prior to F-84F-61RE)
12. Ato ready switch OFF
13. Bomb switches OFF or SAFE
14. Gun arming switch OFF
15. Fuel tank selector OFF
16. Outboard and inboard pylon jettison switches CHECK
17. Landing gear selector handle DOWN
18. Emergency landing gear release switch CHECK

Exterior Inspection

1. NOSE SECTION

a. Intake duct plug and pitot cover REMOVED
b. Air intake ducts CHECK
c. Pneumatic pressure CHECK
d. Nose wheel shock strut CHECK
e. Nose gear safety pin REMOVED and STOWED
f. Nose wheel tire CHECK
g. Nose gun blast tubes CHECK
h. Nose wheel static ground wire CHECK
j. Shell casing doors CHECK

2. FORWARD FUSELAGE AND RIGHT WING

a. Air pressure in starter air storage bottle CHECK
b. Static ports CLEAR
c. All access doors and gun deck cover CHECK
d. Battery lift CHECK
e. Sucker doors CHECK
f. Oxygen filler CHECK
g. Pylon tank or bomb CHECK
h. Armament safety override switch CHECK
i. Single point ground refueling receptacle CHECK
j. External power receptacle door CLOSED
k. Landing gear strut — CHECK
l. Landing gear tire CHECK
m. Wheel chocks IN PLACE
n. Landing gear safety clip — REMOVED and STOWED
o. Air pressure in inboard pylon jettison system CHECK
p. Air pressure in inboard pylon tank jettison system CHECK

3. RIGHT WING TIP

a. Front rocket posts CHECK (Prior to F-84F-55RE)
b. Front rocket posts CHECK (F-84F-55RE and later)
c. Rear rocket doors CHECK (Prior to F-84F-55RE)
d. Rear rocket posts CHECK (F-84F-55 and later)
e. Pylon tank or bomb CHECK
f. Air pressure in outboard pylon jettison system CHECK
g. Air pressure in outboard pylon tank jettison system CHECK
h. Position lights CHECK
i. Landing light CHECK

4. RIGHT WING TRAILING EDGE AND AFT FUSELAGE

a. Wing fuel filler cap CHECK
b. Ato units if installed CHECK
c. Engine access doors CHECK
d. Speed brake CHECK
e. Emergency hydraulic system accumulator air pressure CHECK (Prior to F-84F-71RE)
f. Utility hydraulic system accumulator air pressure CHECK (F-84F-71RE and later)

Figure 2–9 (Sheet 1 of 5)

tire is intermittent braking action, with equal pressure being applied to the brakes. If the aircraft starts to yaw, the pilot must not try to "catch" it by use of asymmetric braking; rather, he should release both brakes, and *after* the aircraft stabilizes *use the rudder* and *only* a light application of brakes.

EMERGENCY LANDING.

Refer to Section III for procedure in event of an emergency landing.

GO-AROUND.

See figure 2–8.

STOPPING THE ENGINE.

1. Emergency hydraulic pump switch OFF.
2. Move throttle to IDLE STOP.
3. Throtle CLOSED.

Note

If engine is being shut down from 95 per cent rpm or above, pause for at least one minute at the IDLE STOP to allow the temperature conditions within the engine to stabilize, then move the throttle from idle to CLOSED. If the engine is being shut down from below normal thrust, the throttle may be moved to the CLOSED position immediately.

4. Install landing gear ground safety clips, after engine stops rotating.
5. Turn fuel tank selector to OFF.

Note

If the fuel tank selector is turned to the OFF position, immediately after closing the throttle, the fuel tank selector becomes tightly bound on some airplanes and cannot be moved to any other position without extreme difficulty. Therefore, when stopping the engine, wait until the engine stops rotating before turning the fuel tank selector to the OFF position to avoid fuel pressure build up between the selector valve and the engine driven pump. This will also prevent damage to the engine fuel pump due to the possibility of the pump running dry while the engine coasts to a stop.

6. All switches OFF except the generator switch.

BEFORE LEAVING AIRPLANE.

1. Chocks in place.
2. Install safety pin in canopy jettison control (Right handgrip) (Prior to F-84F-55).
3. Install safety pin in right handgrip to safety canopy jettison and seat ejection control (F-84F-55 and later).
4. Install safety pins in seat ejection and canopy jettison initiators (Prior to F-84F-55).
5. Check that drag chute control handle is in the full forward position (F-84F-66RE and later).
6. Fill out Form 1 or 781.
7. Close canopy.

CONDENSED CHECK LIST continued

g. Power hydraulic system accumulator air pressure CHECK (F-84F-71RE and later)
h. Fuselage splice cover band CHECK

5. EMPENNAGE

a. Tail pipe dust plug REMOVED
b. Tail pipe CHECK
c. Empennage for general condition CHECK
d. Tail position lights CHECK
e. Fuel tank vent CHECK
f. Drag chute compartment doors CHECK (F-84F-66RE and later)

6. AFT FUSELAGE AND LEFT WING TRAILING EDGE

a. Make same inspections as in step 4 in reverse order

7. LEFT WING TIP

a. Make same inspections as in step 3 in reverse order

8. LEFT WING AND FORWARD FUSELAGE

a. Make applicable inspections as in step 2
b. Air refueling door CHECK
c. Forward fuel tank filler cap CHECK (Prior to F-84F-55RE)
d. External tanks ground refuel switch CHECK
e. Air refueling valves test switch CHECK (F-84F-35 and later)

9. AFT CANOPY

a. Oil supply and filler cap CHECK
b. Hydraulic oil supply and filler cap CHECK
c. Main tank fuel filler cap CHECK
d. Alcohol supply and filler cap CHECK
e. Canopy and canopy frame CHECK
f. Canopy glass CHECK
g. Canopy jettison initiator quick disconnect CHECK

Interior Check — All Flights

1. Control lock and rudder pedals CHECK
2. Safety belt and shoulder harness CHECK
3. Arm rests and seat height CHECK
4. Circuit breaker test light TEST (Prior to F-84F-61RE)
5. Rocket and external stores jettison circuits TEST (F-84F-61RE and later)
6. Drag chute circuit breaker test light TEST (F-84F-66RE and later)
7. Trim switch CHECK
8. Circuit breakers on left console CHECK
9. Emergency hydraulic pump switch OFF
10. Hydraulic by pass switch OFF (Prior to F-84F-71RE)
11. Pneumatic compressor switch OFF
12. Pitot heat switch OFF
13. Spoiler shut-off switch CHECK (F-84F-45RE and later)
14. AN/ARC-34 emergency battery switch CHECK
15. AN/ARC-34 circuit breaker test light TEST
16. Emergency fuel switch OFF (NORM)
17. Engine screen switch EXTEND (Prior to F-84F-61RE)
18. Engine screen switch AUTO (F-84F-61RE and later)
19. Fuel filter de-icing switch OFF
20. Pylon tanks air pressure switches OFF
21. Gun heater switch OFF
22. Pitch control switch NORMAL (Prior to F-84F-71RE)
23. Alternate trim switch NORM (F-84F-40 up to F-84F-71RE)
24. Pitch trim switch NORM (F-84F-71RE and later)
25. Inboard bomb selector switch OFF (Prior to F-84F-61RE)
26. Outboard bomb selector switch OFF (Prior to F-84F-61RE)
27. Hydraulic hand pump operation CHECK (Prior to F-84F-71RE)
28. Landing flap lever NEUT
29. Speed brake switch CHECK
30. Throttle control CLOSED
31. Air refueling receiver switch CHECK
32. Fuel shut-off valves CHECK
33. Landing lights switch OFF
34. Gyro compass switch NORMAL
35. Altimeter, accelerometer and clock SET
36. Gun-bomb-rocket sight mechanical caging lever CHECK
37. Drag chute control handle CHECK (F-84F-66RE and later)
38. Instrument power switch NOR
39. Generator switch ON
40. Oxygen pressure CHECK (Prior to F-84F-35)
41. Oxygen quantity CHECK (F-84F-35 and later)
42. Autopilot engaging switch OFF
43. Circuit breakers on right console CHECK
44. Cabin vent selector PRESSURE (Prior to F-84F-35RE and F-84F-51GK)

Figure 2–9. (Sheet 2 of 5)

CONDENSED CHECK LIST continued

45. Cabin vent selector NORMAL (F-84F-35RE and F-84F-51GK and later)
46. Defroster control OFF
47. Canopy dry air switch OFF (F-84F-61RE and later)
48. All radio controls CHECK
49. Battery switch ON
50. All warning lights CHECK
51. Fuel quantity CHECK
52. Internal and external lights OFF
53. Emergency escape system safety pin REMOVE
54. Safety pin in automatic lap belt initiator REMOVE (F-84F-30 and later)
55. Oxygen, G-suit and radio connections CHECK
56. Head aircraft into the wind if practicable
57. All personnel clear of jet exhaust and intake areas CHECK

Interior Check — Night Flights

1. Console lights CHECK
2. Instrument panel lights CHECK
3. Position lights CHECK
4. Landing lights CHECK
5. Taxi light CHECK
6. Air refueling receptacle light CHECK
7. Flashlight CHECK

Before Starting the Engine

1. Don oxygen mask, oxygen hose CONNECT
2. Oxygen diluter lever 100% OXYGEN
3. Oxygen diluter lever NORMAL OXYGEN

Emergency Hydraulic System Check (F-84F-71RE and Later)

1. External power, battery switch and instrument power switch CHECK
2. Utility and power hydraulic pressure gages CHECK
3. Emergency hydraulic pump switch and power hydraulic pressure gage CHECK
4. Control stick FULL FORWARD
5. Control stick operation CHECK
6. Control stick and aileron operation CHECK
7. Emergency hydraulic pump switch OFF

Starting Engine

1. Throttle control CLOSED
2. Emergency hydraulic pump switch OFF
3. Battery switch OFF external power connected
4. Fuel tank selector ALL TANKS
5. Throttle control to IDLE
6. Starting switch to START and hold for 1 second
7. At 24 percent rpm combustion stops in starter
8. Starter switch STOP START
9. Oil pressure at IDLE rpm CHECK
10. Engine instruments CHECK
11. External power disconnected and battery switch ON

Engine Stall Check

1. Engine acceleration from 47 to maximum rpm CHECK

Ground Test Before Taxiing (Prior to F-84F-71RE)

1. Emergency hydraulic pump switch NORMAL
2. Hydraulic pressure in boost and utility systems CHECK
3. Positive brake action CHECK
4. Speed brake operation CHECK
5. Landing flaps 50 percent down
6. Aileron and rudder operation CHECK
7. Stabilator operation CHECK
8. Operation of aileron and stabilator trim CHECK
9. Operation of rudder trim CHECK
10. Engine at IDLE rpm, emergency hydraulic pump switch NORMAL and hydraulic by-pass switch BY-PASS hydraulic pressure gages, aileron and stabilator operation CHECK
11. Electrical continuity check ground operation CHECK
12. Emergency hydraulic pump switch EMERG and hydraulic by-pass switch off. Hydraulic pressure and emergency on indicator light CHECK
13. Stabilator electric operation with trim switch CHECK
14. Stabilator electric operation with pitch control switch CHECK
15. Controls for free and correct movement on normal hydraulic system CHECK
16. Fuel tank selector ALL TANKS

Figure 2–9. (Sheet 3 of 5)

CONDENSED CHECK LIST continued

After Take-Off

1. Landing gear selector handle UP when airborne
2. Landing flap lever UP after gear is retracted
3. Landing flap lever NEUT after flaps are retracted
4. Pylon tank air pressure switches CHECK
5. Drop ato units at a safe altitude
6. Ato ready switch OFF
7. Adjust speed for best climb
8. Cabin vent selector PRESSURE (Prior to F-84F-35RE and F-84F-51GK)
9. Cabin vent selector NORMAL (F-84F-35RE and F-84F-51GK and later)
10. Engine screen switch, as desired
11. Pneumatic compressor switch ON
12. Trim airplane and engage autopilot if installed
13. Gun heater switch, as required
14. Oxygen CHECK

Pre-Traffic Pattern Check List

1. Auxiliary bomb selector switch OFF (Prior to F-84F-61RE)
2. Rocket selector switch OFF (Prior to F-84F-61RE)
3. Rocket arming switch OFF or FUSE DELAY
4. Outboard and inboard bomb selector switches OFF (Prior to F-84F-61RE)
5. Armament selector switch OFF (F-84F-61RE and later)
6. Bomb arming switch SAFE
7. Gun heater switch OFF
8. Engine screen switch EXTEND (Prior to F-84F-61RE) AUTO (F-84F-61RE and later)
9. Fuel tank selector ALL TANKS unless operation has been necessary in AUX.
10. Gun arming switch OFF
11. Gun-bomb-rocket sight mechanical caging lever CAGE
12. Emergency fuel switch OFF (NORM)
13. Pneumatic compressor switch OFF
14. Autopilot engaging switch OFF
15. Oxygen 100% OXYGEN if desired
16. Safety belt and shoulder harness CHECK

Landing Approach

1. Enter initial approach at approximately 300 knots IAS 3 miles from end of active runway 1500 ft altitude
2. Break point approximately 1/3 of the way down runway. Speed brake switch OUT
3. Landing gear warning horn and light CHECK
4. Reduce speed and lower gear
5. Gear down and locked CHECK
6. Maintain break altitude until on base leg
7. Call tower on base leg
8. Full flaps during turn to final
9. Utility hydraulic pressure CHECK
10. Final turn completed
11. Come in over the fence at no less than 160 knots. Check Appendix 1 for touchdown speeds

Landing

1. Land with tail low
2. After touchdown apply brakes constantly and evenly as required
3. Landing flaps lever UP and speed brake switch IN before taxiing

Go-Around

1. Throttle 100 percent rpm
2. Speed brake switch IN
3. Landing gear RETRACT
4. Landing flaps RETRACT
5. Refer to Section VI for sink rates

Stopping the Engine

1. Emergency hydraulic pump switch OFF
2. Throttle IDLE STOP
3. Throttle CLOSED
4. Landing gear safety clips INSTALL
5. Fuel tank selector OFF
6. All switches OFF except generator switch

Before Leaving Airplane

1. Chocks in place
2. Safety pin in canopy jettison control INSTALL (Prior to F-84F-55)
3. Safety pin in canopy jettison and seat ejection control INSTALL (F-84F-55 and later)
4. Safety pins in seat ejection and canopy jettison initiators INSTALL (Prior to F-84F-55)
5. Drag chute control in full forward position (F-84F-66RE and later)
6. Fill out Form 1 or 781
7. Canopy CLOSED

Figure 2–9. (Sheet 5 of 5)

CONDENSED CHECK LIST continued

17. Loadmeter reading at IDLE rpm and above, CHECK
18. Voltmeter reading at IDLE rpm and above CHECK
19. Communication equipment CHECK
20. Overflow from main fuel tank vent lines CHECK
21. Pneumatic pressure CHECK
22. Canopy dry air switch ACTUATE
23. Oxygen system CHECK
24. Oxygen warning system switch OFF
25. Autopilot operation CHECK

Ground Test Before Taxiing (F-84F-71RE and Later)

1. Emergency hydraulic pump switch OFF
2. Hydraulic pressure in power and utility systems CHECK
3. Positive brake action CHECK
4. Speed brake operation CHECK
5. Landing flaps 50 percent down
6. Utility and power hydraulic pressure at engine IDLE rpm CHECK
7. Control stick full forward, spoilers OFF. Power and utility hydraulic pressure while cycling control stick CHECK
8. Rudder for free and correct movement CHECK
9. Trim operation of ailerons and stabilator CHECK
10. Rudder trim CHECK
11. Fuel tank selector ALL TANKS
12. External tanks air pressure switches OFF
13. Loadmeter reading at IDLE rpm and above CHECK
14. Voltmeter reading at IDLE rpm and above CHECK
15. Communication equipment CHECK
16. Overflow from main fuel tank vent lines CHECK
17. Pneumatic pressure CHECK
18. Canopy dry air switch ACTUATE
19. Oxygen system CHECK
20. Oxygen warning system switch OFF
21. Autopilot operation CHECK

Before Take-Off

PREFLIGHT ENGINE CHECK

1. Engine instruments CHECK
2. Engine screens RETRACTED
3. Advance throttle to 100 percent rpm. Exhaust gas temperature CHECK
4. Retard throttle to 90 percent rpm
5. Emergency fuel switch ON
6. Advance throttle to full rpm. Check rpm
7. Retard throttle to IDLE and check rpm
8. Accelerate engine to 90 percent rpm
9. Emergency fuel switch OFF
10. Engine screens AS REQUIRED

PREFLIGHT AIRCRAFT CHECK

1. Emergency hydraulic pump switch NORMAL (prior to F-84F-71RE)
2. Emergency hydraulic pump switch OFF (F-84F-71RE and later)
3. Hydraulic by-pass switch, off (prior to F-84F-71RE)
4. Pitch control switch NORMAL (Prior to F-84F-71RE)
5. Alternate trim switch NORM (F-84F-40 up to F-84F-71RE)
6. Pitch trim switch NORM (F-84F-71RE and later)
7. Landing flaps CHECK
8. Speed brake switch IN
9. Trim indicator lights CHECK
10. Fuel tank selector ALL TANKS
11. Pylon tank air pressure switches OFF
12. Safety belt and shoulder harness CHECK
13. Ato ready switch ATO READY
14. Autopilot engaging switch OFF
15. Flight controls for free and correct movement CHECK

Take-Off

1. Minimum take-off distances and speeds CHECK
2. Advance throttle to take-off rpm. Check instruments
3. Maintain directional control by use of brakes until rudder becomes effective
4. On ato take-off, push ato ignition switch as airspeed approaches the cut-in speed noted in the Appendix
5. Aircraft acceleration CHECK
6. Control stick neutral until take-off speed is reached
7. Lift airplane off ground using necessary control stick travel

Figure 2–9. (Sheet 4 of 5)



SECTION 3 EMERGENCY PROCEDURES



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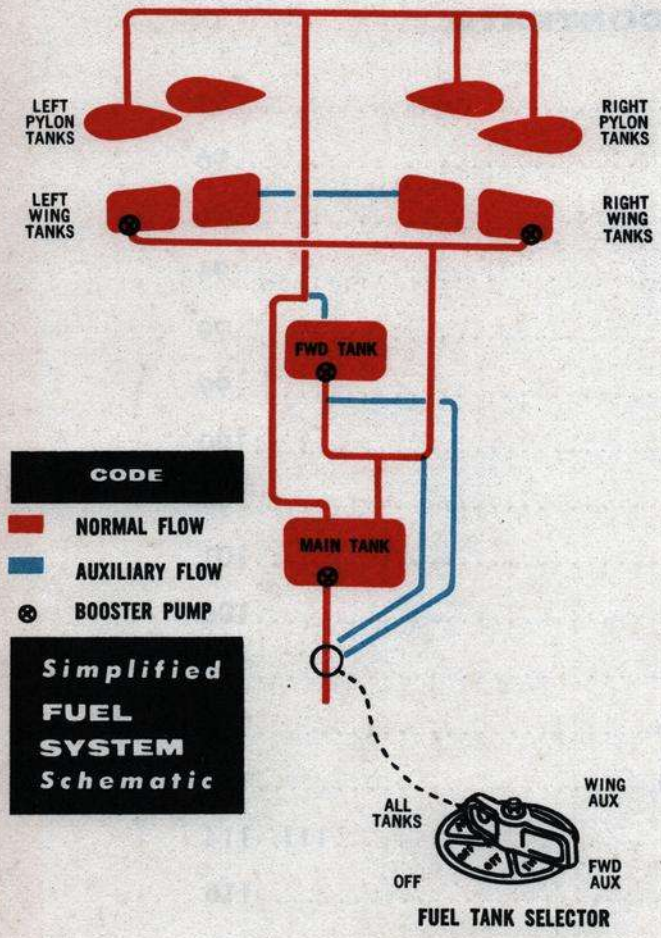
PROCEDURE

ON ENCOUNTERING ENGINE FLAME-OUT

Complete engine failure, due to damage within the engine rarely occurs. In these cases air starts should not be attempted as fire may result. However, engine flame-outs can occur due to various causes and successful air starts can be made.

The fuel system is designed so that the main tank is kept full until all other fuel is used, provided both wing and forward tank booster pumps are operating. Therefore if a loss of thrust occurs, due to an acceleration or deceleration flame-out, an air start can be successfully made without changing the fuel flow.



However, if it is suspected that the main tank is empty, an auxiliary fuel flow should be selected before attempting an air start.

If the flame-out is caused by an engine fuel control failure, the emergency fuel flow is selected prior to air starting.

If the engine rpm is below generator cut-in speed the fuel booster pressure warning light will not isolate the fuel system failure, as the fuel tank booster pumps are powered by the secondary bus and the light will remain illuminated as long as the secondary bus is not energized, even though the booster pumps are not defective.

If a flame-out occurs due to rapid engine acceleration or deceleration, sustained inverted flight, or similar reason,

Attempt an air start as follows:

Note

Flight characteristics of the aircraft with a dead engine are normal and rapid trim changes are not necessary.

1. Close throttle to prevent flooding the engine.

2. Fuel tank selector ALL TANKS.

Note

If time permits, the quantity of fuel remaining in the main tank can be determined by placing the instrument power switch in the ALT position, positioning the fuel quantity selector switch to the MAIN position, and the fuel quantity check switch to the FUEL QTY CHECK position.

3. If start is unsuccessful, place the fuel tank selector in the WING AUX position and attempt another air start.

4. If start is unsuccessful on WING AUX place the fuel tank selector in the FWD AUX position and attempt another air start.

5. If it is suspected that the flame-out occurred due to failure of the engine fuel control, place the emergency fuel switch in the ON position before attempting an air start.

Figure 3—1.

ENGINE FAILURE.

PROCEDURE ON ENCOUNTERING ENGINE FLAME-OUT.

See figure 3–1.

ENGINE AIR STARTING.

1. Throttle CLOSED.

CAUTION

Do not turn the fuel tank selector to the OFF position as pressure built up in the fuel lines may make it difficult to place the selector in any other position.

2. Establish a glide speed at 225 knots. This should produce an indicated engine speed between 17 per cent and 21 per cent rpm.

3. Turn off all unnecessary electrical equipment to conserve battery for air starting.

4. Select fuel tank as required.

CAUTION

Attempt an air start only if it is suspected that power failure was caused by a fuel system failure or a flameout. If power failure was accompanied by an explosion or similar noise that would indicate damage to the engine, an attempted air start may only result in a fire.

5. Descend to an altitude below 30000 feet. Air starts at altitudes below 20000 feet are more positive than attempted starts at higher altitudes.

6. Momentarily depress the AIR START switch. This opens the primer valve and energizes the engine ignition timer for a period of 15 (±3) seconds.

CAUTION

It is not recommended that the starter switch be used during air starts to increase engine rpm as damage to the starter may result.

7. Immediately move the throttle to a position at IDLE or above, but not exceeding ⅓ open position, and maintain until ignition takes place. This opens the fuel shut-off valve. A delay in accomplishing this action will waste part of the 15 (±3) second ignition cycle. After ignition takes place monitor the exhaust gas temperature by movement of the throttle.

Note

The ignition timer will not recycle, even though the AIR START switch is pushed again, until its 15 (±3) second period has run out unless the circuit to the timer is first interrupted. The starter switch must be momentarily tripped to its STOP START position to interrupt this circuit if a second air start attempt is required during the 15 (±3) second period.

8. When engine rpm and exhaust gas temperature have stabilized at idle speed, the throttle may be advanced as desired.

CAUTION

If air start is made on the emergency fuel system the throttle must not be advanced beyond the IDLE position previous to light-off and must be monitored at all times to avoid excessive speeds and exhaust gas temperatures.

Note

After the engine has started, momentarily position the starter switch to the STOP START position to assure the primer valve is closed and the ignition timer is de-energized.

COMPLETE ENGINE FAILURE DURING TAKE-OFF.

BEFORE FLYING SPEED IS REACHED.

1. Throttle CLOSED.
2. Fuel tank selector OFF.
3. Brake to a stop on the runway if possible.
4. Depress external stores jettison switch if necessary.
5. If impossible to stop on runway: Jettison canopy, operate landing gear ground retract switch, landing gear selector UP then turn battery switch OFF after gear is retracted.

CAUTION

To assure sufficient hydraulic pressure to retract the gear, refrain from using other hydraulic units while trying to retract the gear.

Note

If battery switch is turned OFF before gear is retracted the landing gear downlocks may re-engage thereby preventing the landing gear from retracting.

AFTER LEAVING THE GROUND.

1. Landing gear UP.
2. Jettison external stores if necessary.
3. Throttle CLOSED.
4. Fuel tank selector OFF.
5. Jettison canopy.
6. Shoulder harness LOCKED.
7. Land straight ahead, changing course only enough to miss obstacles.

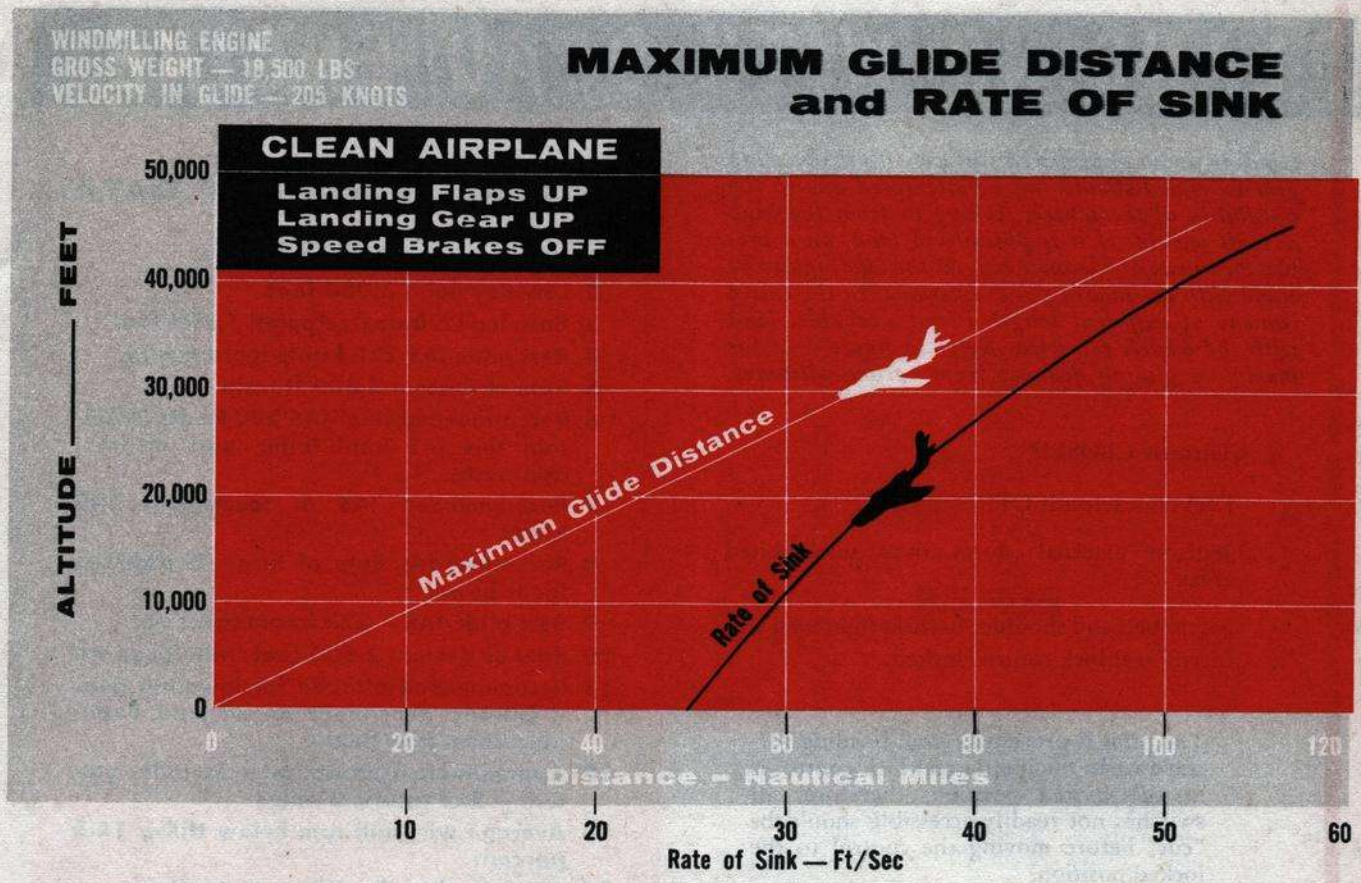


Figure 3—2.

as far as possible, but still maintain sufficient power to sustain flight. If no evidence of fire exists, proceed cautiously and land as soon as possible. If evidence of fire exists, close throttle, turn fuel tank selector OFF and make decision to either bail-out or make an emergency landing.

DURING FLIGHT.

IF ALTITUDE AND TERRAIN PERMIT. Close throttle immediately, turn fuel tank selector to OFF, and turn off all unnecessary electrical equipment. Check for any evidence of fire such as presence of smoke in cockpit, engine noise, abnormal tailpipe temperature or verification from another aircraft. Do not attempt a restart if indication of fire is present. If a fire persists or even if it goes out, prepare to either abandon the airplane or make an emergency landing. If it is definitely determined that no fire exists, a restart may be accomplished.

IF ALTITUDE OR TERRAIN PRECLUDE SHUTTING DOWN THE ENGINE COMPLETELY. Reduce power as much as possible in order to maintain flight. Check for evidence of fire. If no evidence of fire exists, proceed cautiously and land as soon as possible. If evidence of fire exists, close throttle, turn fuel tank selector to OFF and make decision to either bail-out or make an emergency landing.

FIRE WHILE STARTING THE ENGINE.

1. Throttle CLOSED.
2. Fuel tank selector OFF.
3. Battery switch OFF or disconnect external power supply.
4. Leave cabin immediately.

ENGINE FIRE DURING TAKE-OFF — IF NOT AIRBORNE.

1. Throttle CLOSED.
2. Fuel tank selector OFF.
3. Brake to a stop on runway if possible.
4. Depress external stores jettison switch as necessary.
5. If impossible to stop on runway: Jettison canopy, operate landing gear ground retract switch, landing gear selector UP then turn battery switch OFF.
6. Leave cabin as soon as possible.

ENGINE FIRE DURING TAKE-OFF — IF AIRBORNE.

1. If practicable, after passing point of safe abort, climb to a minimum safe ejection altitude.

8. On ground contact, battery and generator switches OFF.

WARNING

Battery switch should be left in the ON position until ground contact is made to insure operation of stabilator controls.

9. If sufficient altitude has been obtained before engine failure, follow emergency bail-out procedure.

PARTIAL ENGINE FAILURE DURING TAKE-OFF.

1. If not airborne, abort take-off.
2. If airborne, jettison external stores.
3. If airborne and fuel system booster pressure warning light is ON, indicating a restricted fuel supply from the main tank, turn fuel tank selector to WING AUX or FWD AUX. Go around and land.
4. If airborne and fuel system booster pressure warning light is OFF, indicating a failed engine fuel control, place the emergency fuel switch in the ON (FLIGHT EMERG) position. The emergency-on indicator light should illuminate. Go around and land.

CAUTION

When the emergency fuel system is selected, a sudden change in fuel flow and rpm will occur. The pilot should recognize what has occurred and advance or retard the throttle smoothly, but slowly, to regain take-off rpm.

ENGINE FAILURE DURING FLIGHT.

If engine failure occurs during flight the following procedure is recommended:

1. Throttle CLOSED.
2. Landing flaps UP and speed brake IN for maximum glide.
3. Trim airplane for 205 knots IAS.
4. Attempt an air start.
5. If an air start is impossible, make a forced landing or abandon the airplane as conditions dictate.

IF ENGINE FAILS TO STOP WHEN THROTTLE IS CLOSED.

If the engine throttle or fuel control malfunction so that the engine cannot be stopped the fuel tank selector should be placed in the OFF position. This cuts off the fuel flow to the engine and the engine will stop without danger of fire.

CAUTION

After using the above procedure for shutting the engine down the fuel tank selector may become tightly bound due to a fuel pressure build up between the selector valve and the engine driven pump. This condition should be alleviated and the engine fuel pump checked for damage before attempting to restart the engine.

MAXIMUM GLIDE WITH DEAD ENGINE.

For maximum glide distance, trim airplane to maintain recommended glide speed with gear and flaps UP, speed brakes IN (see figure 3–2).

LANDING WITH DEAD ENGINE.

See figure 3–3.

FIRE.

ENGINE FIRE DURING FLIGHT.

ENGINE OVERHEAT LIGHT ON.

Illumination of the overheat warning light indicates an overheat condition, or possible fire in the aft section, necessitating action as follows:

1. Reduce power immediately.
   a. If light goes out, continue flight at reduced power and land as soon as possible.
   b. If light does not go out, indicating possible fire rather than overheat, check for indications of fire such as smoke in cockpit, engine noise, abnormal tailpipe temperature, or verification from another airplane.
      (1) If no fire is apparent, continue flight at minimum power and land as soon as possible.
      (2) If positive indications of fire exist, close throttle, turn fuel tank selector OFF and make decision to land or bail-out.

ENGINE FIRE WARNING LIGHT ON.

Illumination of the fire warning light indicates a fire in the forward engine section. However, some false warnings have occurred, therefore it is preferable under unfavorable flight conditions to take precautionary measures before completely shutting down the engine whenever a fire warning light appears.

ON TAKE-OFF RUN.

If there is enough runway left, close throttle, turn fuel tank selector to OFF and stop as soon as possible.

IMMEDIATELY AFTER BECOMING AIRBORNE.

Maintain maximum power and climb immediately to a safe ejection altitude. Level off, then throttle back

2. Throttle back enough to maintain altitude.
3. Check for evidence of fire, smoke, noises, verification from another aircraft.
4. If no evidence of fire exists, land as soon as possible.
5. If evidence of fire exists, prepare to bail-out or make an emergency landing.

SMOKE ELIMINATION.

If smoke or fumes enter the cabin, the cause may be a fire, a fuel leak in the engine compartment, or a failed refrigeration turbine.

1. Connect oxygen mask.
2. Set oxygen regulator diluter lever to 100% OXYGEN.
3. Position cabin temperature control to highest point. If smoke is eliminated the cause is in the refrigeration turbine.
4. If smoke is not eliminated, position cabin vent selector to RAM and defroster control to OFF.

Note

The intake distribution valve will close and the ram air and dump valves will open. The intake of air through the ram air valve will scavenge the air in the cockpit through the open dump valve, and rapidly dissipate the fumes and smoke.

LANDING EMERGENCIES.

LANDING WITH WHEELS RETRACTED.

1. Jettison external stores over uninhabited area. Retain empty inboard external tanks on smooth terrain.

WARNING

Be sure that the bomb arming switch is SAFE and the rocket arming switch is OFF or DELAY.

2. Jettison canopy.
3. Safety belt and shoulder harness tightened and inertia reel lock control locked.

CAUTION

The pilot is prevented from bending forward when the reel lock control is in the locked position; therefore, all switches not readily accessible should be "cut" before moving the control to the locked position.

4. Extend landing flaps as desired.
5. Make normal approach.
6. On contact with the ground, close throttle, turn fuel tank selector OFF and turn battery switch OFF.
7. Leave cabin as soon as possible.

WARNING

Leave airplane on the left side to prevent possible actuation of the seat ejection control.

LANDING WITH MAIN GEAR DOWN — NOSE GEAR UP OR UNLOCKED.

If the nose gear will not extend or lock down as indicated by the landing gear position indicators, proceed as follows:

1. Jettison external stores over uninhabited areas.
2. Jettison canopy.
3. Landing gear DOWN.
4. Plan approach to touch down as near the end of runway as possible.
5. Make normal approach, landing flaps DOWN, and speed brakes OUT.
6. Safety belt and shoulder harness tightened and inertia reel lock control locked.

CAUTION

The pilot is prevented from bending forward when the reel lock control is in the locked position; therefore, all switches not readily accessible should be "cut" before moving the control to the locked position.

7. On contact with the ground, close throttle, turn fuel tank selector OFF and turn battery switch OFF.
8. Hold the nose wheel off the ground as long as possible.
9. Do not use brakes unless it becomes absolutely necessary as this will tend to slam the nose to the ground.
10. Leave cabin as soon as possible.

WARNING

Leave airplane on the left side to prevent possible actuation of the seat ejection control.

LANDING WITH UNBALANCED EXTERNAL LOAD.

Landing with an unbalanced inboard pylon configuration can be accomplished without any special technique, provided hydraulic power is available for aileron control. However, landing with an unbalanced outboard pylon configuration should only be accom-

LANDING WITH DEAD ENGINE

Landing on an unprepared surface with the landing gear extended should not be attempted due to the possibility of the wheels sinking in from the high aircraft weight. If it is possible to land, on a prepared runway of adequate length, the landing can be made with the landing gear extended. In the case a runway of sufficient length is not available, land with the wheels retracted. Refer to figure 3–2 for maximum gliding distance from various altitudes.

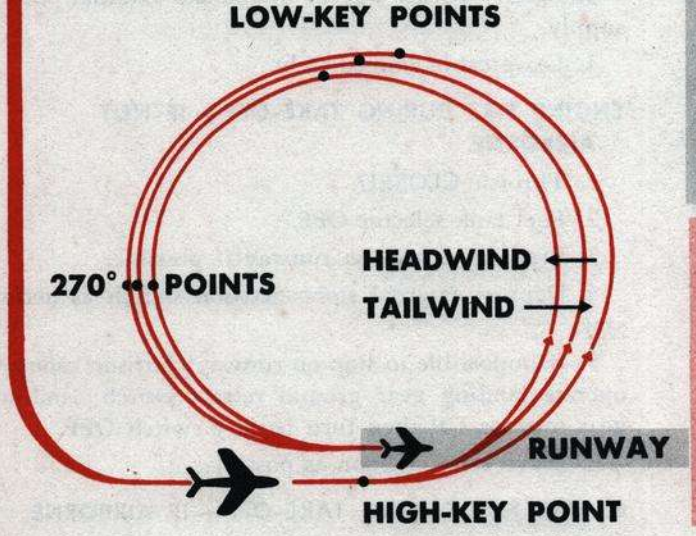
1. Throttle CLOSED
2. Fuel tank selector OFF
3. Jettison external stores over uninhabited areas.

CAUTION

4. Safety belt and shoulder harness tightened and inertia reel lock control locked.

   The pilot is prevented from bending forward when the inertia reel lock control is in the locked position, therefore, all switches not readily accessible should be "cut" before moving the control to the locked position.

5. Speed brake OFF, landing gear UP and landing flaps UP to increase glide distance.
6. Pneumatic compressor switch OFF
7. Emergency hydraulic pump switch EMERG position.



ACTUAL FLAME-OUT DATA

1. Hi-Key point 6,000 feet
2. Low Key point 3,000 feet
3. Base leg (270 degree point) 1,500 feet
4. Best glide IAS 220 knots (gear down)
5. Rate of descent 4,000 ft/min
6. Recommended final IAS 200 knots (maintain this IAS until latter part of final approach).
7. Recommended IAS at touchdown 140 knots
8. Recommended Rate of turn – 3 deg/sec (gear down)
9. Best glide IAS – 225 knots (gear up)
10. Rate of descent 2,500 feet/min (gear up)
11. Recommended altitude for lowering gear – Entirely dependent on altitude available when over field.
12. Approximate distance for rectangular pattern – 2x3 nautical miles
13. Average windmill rpm below HiKey 14.5 percent
14. Average time for HiKey to touchdown – 2 min 10 seconds.
15. Average time for gear to lock down – 7 to 8 seconds.
16. Average time for full extension of landing flaps – 14 seconds.

PATTERN ALTITUDE VARIATIONS

1. HiKey point 5,000 to 9,000 feet
2. Low Key Point 2,500 to 4,500 feet
3. 270 Degree point 1,000 to 2,000 feet

FLAME-OUT SIMULATION DATA

Flame-out patterns can be successfully simulated by using idle power with speed brakes extended.

Figure 3–3

EMERGENCY ENTRANCE



Emergency entrance to the cockpit is made by depressing the forward end of the external canopy control. This action rotates the control so that it can be grasped and pulled forward to unlock the canopy. The canopy is then lifted up with the handgrip on either side of the canopy skirt. If the external canopy control, or the canopy becomes jammed, the pilot should actuate the canopy jettison control to release the canopy from the airplane.

WARNING

If the canopy is released by the pilot, the ground crew should avoid standing in the turtle deck area as the canopy will be lifted high enough for the jettison squibs to release the canopy from the airplane. Extreme caution must be observed, while getting out of the airplane, in order to avoid moving the seat ejection lever, which will be exposed.

Figure 3—4

CAUTION

The pilot is prevented from bending forward when the inertia reel lock control is in the locked position; therefore, all switches not readily accessible should be "cut" before moving the control to the locked position.

c. Check landing gear and speed brake UP and IN respectively.

7. Touchdown in a nose high attitude.

8. If a regular wave or swell pattern exists, aim the touchdown parallel to the waves and attempt to land on the crest or on the falling side of the wave.

9. More often, the sea surface will be irregular with two or more wave or swell patterns intermingled. In this case, the best compromise is to head into whatever wind may be blowing. Examine sea to find areas where the intermingling waves cancel out. Aim touchdown for one of these calmer areas.

10. Make actual touchdown in the same attitude as for normal landing. Make the "softest" possible landing. Do not stall the airplane at the time of contact.

11. After the airplane has slowed down in the water, leave the cabin at once, since fighter aircraft sink very rapidly.

BAIL-OUT PROCEDURE.

In all cases of emergency exit in flight, it is recommended that escape be accomplished by means of seat ejection. This is the safest method of escape in either high speed or low speed flight since it precludes the possibility of pilot injury through collision with the tail surfaces. Because of the increasing incidents of vertebrae injuries occurring to pilots during forced landings of high performance aircraft, more consideration should be given to more frequent use of the ejection seats in preference to forced landings. Ejection should be made whenever possible above 1500 feet (although with the use of the automatic belt and parachute, successful ejections may be accomplished at altitudes as low as 300 feet). Whenever the terrain is unknown or unsuited for forced landings, the ejection seat should be utilized. Figures 3—5 and 3—6

plished if the pilot is sufficiently familiar with the airplane and all other landing factors are normal. With hydraulic pressure available, there is sufficient lateral control to maintain level flight for the critical asymmetric outboard configuration of one full 230 gal tank if the landing is made at a minimum speed of 180 knots. If the pilot has any doubt about making the landing it is recommended that the outboard stores be jettisoned.

LANDING WITH ONE GEAR UNLOCKED.

Studies of landing gear configurations whenever all gear will not extend reveals that less damage to the aircraft and less personal injury will result if the following procedure is observed.

1. If a prepared, hard surface runway is not available, retract landing gear and make a wheels up landing.

2. If landing is to be made on a prepared, hard surface runway leave any two landing gears down and locked and proceed as follows:

   a. Jettison external stores, except empty pylon tanks since they minimize damage to the wing. External tanks which contain fuel should be jettisoned.

   b. Use same procedure as for landing with nose gear up or unlocked.

OVER-RUN BARRIER ENGAGEMENT.

The following technique should be employed to successfully engage a runway overrun barrier if an engagement becomes necessary.

1. Jettison external stores over an open area in those cases of a known emergency prior to landing. Jettisoning the pylon tanks in the case of an emergency on take-off is hazardous and since successful barrier engagement can be accomplished with the tanks still installed, no attempt should be made to jettison them while on the ground.

2. Excessive use of the brakes which might result in tire blow-out should be avoided because a blow-out could result in a loss of directional control and failure to stay on the runway for barrier engagement.

3. Off center engagements are successful and may be safely accomplished.

4. Barrier engagements can successfully be accomplished at any ground speeds from a minimum of approximately 35 knots up to a maximum of 130 knots, but more positive engagement can be assured if the barrier is contacted at a speed as close to minimum as possible.

BRAKE FAILURE.

1. Use up fuel until minimum fuel remains (1000 lbs).

2. Close throttle on touchdown.

3. If left brake is out, make landing on left side of runway.

4. If right brake is out, make landing on right side of runway.

5. If both brakes are out, land as short as possible at lowest safe speed. Landing flaps DOWN, and speed brakes OUT.

6. Dragging the tail during landing will shorten the roll.

LANDING WITH FLAT TIRE.

1. If nose wheel tire is flat; make normal landing holding nose wheel off as long as possible.

2. If one main wheel tire is flat; make normal landing on side of runway nearest inflated tire.

3. If both main wheel tires are flat; make normal landing in center of runway and use brakes sparingly and with caution.

EMERGENCY ENTRANCE.

See figure 3–4.

DITCHING.

Bail-out is preferred to ditching. High speed aircraft tend to skip on contact, therefore, pilot must continue to fly the aircraft after touchdown until aircraft settles. In the event of low altitude or any other reason where bail-out is impracticable ditch the airplane as follows:

1. Turn IFF to emergency.

Note

The instrument power switch must be in the NOR position to assure operation of the IFF equipment.

2. Oxygen; 100% OXYGEN.

3. Jettison all external stores.

4. Set landing flaps 50 to 75 per cent DOWN.

5. Jettison canopy by pulling the CANPOY-JETTISON control all the way up to the locked position.

WARNING

Be careful not to squeeze the seat ejection control accidentally.

6. If time permits complete the following:

   a. Throttle CLOSED.

   b. Shoulder harness and safety belt secured and inertia reel lock control locked. Unbuckle parachute and disconnect oxygen, anti-g and electrical connections.

MINIMUM SAFE EJECTION Altitudes

1. Manual safety belt and any type parachute **2000 ft**
2. Automatic safety belt (or manual belt opened prior to ejection) and manually actuated parachute **1000 ft**
3. Automatic safety belt and automatic parachute if parachute-attached lanyard key is inserted into safety belt buckle **500 ft**

BAIL-OUT

1 Jettison canopy by pulling canopy jettison lever all the way up until it locks. Pull up left handgrip (this locks shoulder harness and releases left arm rest).



2 Place feet firmly on foot rests and brace arms on arm rests. Sit erect with head hard against head rest and chin tucked in.



WARNING

Do not accidentally squeeze the seat ejection lever until ready to jettison the seat.

If time and conditions permit, observe the following precautions:

1. Unclamp the oxygen hose from the shoulder harness and clip to parachute harness prior to ejection to avoid being strapped in the seat with the oxygen hose.
2. Before ejection, stow all loose equipment.
3. At altitude, pull ball handle on bail-out bottle.
4. Before low altitude ejections, without automatic safety belt, unfasten the safety belt prior to ejection to aid in separating from the seat.
5. If the canopy does not jettison, an attempt should be made to release the canopy by placing the canopy control lever in the OPEN position and raising the canopy into the air stream. As a last resort, the seat may be ejected without jettisoning the canopy. This procedure should be used only after all attempts to release the canopy have been made. When using the last resort procedure, it is recommended that the seat be adjusted to the bottom position to allow the greatest possible clearance between the top of the head and the top of the headrest.

PROCEDURE

Prior to F-84F-55

3 **Squeeze the seat ejection control to eject seat.**



AFTER THE SEAT EJECTS

Aircraft without automatic opening safety belts:

1. Unfasten safety belt and kick free of seat.
2. If wearing a conventional manually operated parachute pull the "D" ring when altitude is reached where normal breathing is possible. If ejection takes place at safe breathing altitude pull "D" ring 2 seconds after separating from the seat.
3. If wearing an automatic parachute, pull the arming lanyard manually when kicking free of seat. Parachute will open at a preset altitude. If below the preset altitude the parachute will open 2 seconds after pulling the arming lanyard.

Aircraft with automatic opening safety belts:

1. In normal operation the safety belt will separate 2 seconds after ejection allowing separation from the seat. With the arming lanyard key inserted in the belt the parachute will open automatically at a preset altitude or if below the altitude the parachute will open 2 seconds after separation from the seat.
2. If the safety belt fails to open automatically after 2 seconds, manually unfasten the safety belt and kick free of the seat. Then pull the parachute arming lanyard.
3. Kick free of the seat and pull the parachute arming lanyard if wearing an automatic opening parachute WITHOUT arming lanyard key inserted into the safety belt buckle

If wearing a manually operated parachute, pull the "D" ring when altitude is reached where normal breathing is possible.

PROCEDURE

F-84F-55 and later

2 **Place feet firmly on footrests and brace arms on armrests. Sit erect with head hard against headrest and chin tucked in.**



3 **Squeeze either seat jettison trigger to eject seat.**



AFTER EJECTION

Aircraft without automatic opening safety belts:

1. Unfasten safety belt and kick free of seat.
2. If wearing a conventional manually operated parachute, pull the "D" ring when altitude is reached where normal breathing is possible. If ejection takes place at safe breathing altitude pull "D" ring 2 seconds after separating from the seat.
3. If wearing an automatic parachute, pull the arming lanyard manually when kicking free of seat. Parachute will open at a preset altitude. If below the preset altitude the parachute will open 2 seconds after pulling the arming lanyard.

Aircraft with automatic opening safety belts:

1. In normal operation the safety belt will separate 2 seconds after ejection allowing separation from the seat. With the arming lanyard key inserted in the belt the parachute will open automatically at a preset altitude or if below the altitude the parachute will open 2 seconds after separation from the seat.
2. If the safety belt fails to open automatically after 2 seconds, manually unfasten the safety belt and kick free of the seat. Then pull the parachute arming lanyard.
3. Kick free of the seat and pull the parachute arming lanyard if wearing an automatic opening parachute WITHOUT arming lanyard key inserted into the safety belt buckle.
   a. If wearing a manually operated parachute, pull the "D" ring when altitude is reached where normal breathing is possible.

MINIMUM SAFE EJECTION ALTITUDES

1. Manual safety belt and any type parachute **2000 ft**
2. Automatic safety belt (or manual belt opened prior to ejection) and manually actuated parachute **1000 ft**
3. Automatic safety belt and automatic parachute if parachute-attached lanyard key is inserted into safety belt buckle **500 ft**

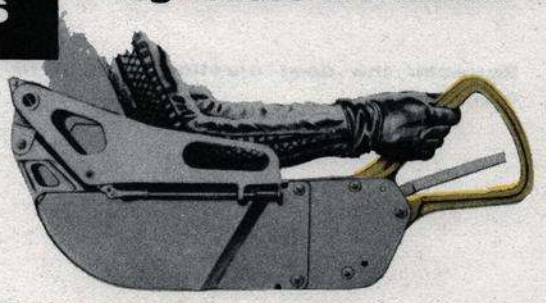
EJECTION PROCEDURES

If time and conditions permit, observe the following precautions:

1. Unclamp the oxygen hose from the shoulder harness and clip to parachute harness prior to ejection to avoid being strapped in the seat with the oxygen hose.
2. Before ejection, stow all loose equipment.
3. At altitude, pull ball handle on bail-out battle.
4. Before low altitude ejections, without automatic safety belt, unfasten the safety belt prior to ejection to aid in separating from the seat.

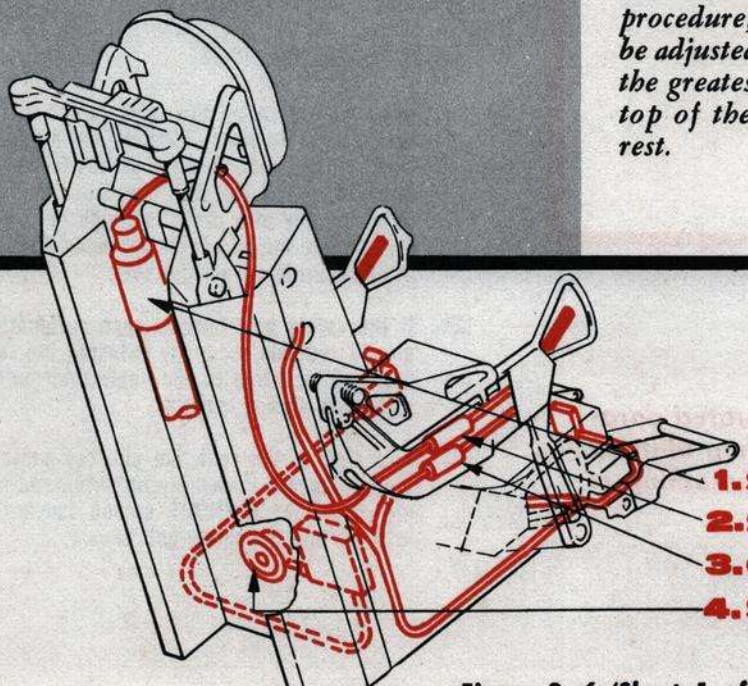
BAIL-OUT

1 **Jettison canopy by pulling either leg brace all the way up until it locks. Shoulder harness locks automatically when leg braces are raised.**



If Canopy Fails to Jettison

If the canopy does not jettison, an attempt should be made to release the canopy by placing the canopy control lever in the OPEN position and raising the canopy into the airstream. As a last resort, the seat may be ejected without jettisoning the canopy. This procedure should be used only after all attempts to release the canopy have been made. When using the last resort procedure, it is recommended that the seat be adjusted to the bottom position to allow the greatest possible clearance between the top of the head and the top of the headrest.



Note

To prevent external fuel from transferring to the wing tanks actuate the L WING and R WING fuel shut-off valves to the CLOSED position.

2. Plan remainder of flight so as to land as soon as possible.

3. Continue to operate with fuel tank selector in the ALL TANKS position at optimum altitude until the main tank low level warning light illuminates, or if range is critical, until the fuel quantity indicator shows the main tank to be almost empty.

4. Descend to an altitude below 20000 feet with JP-4 fuel and turn fuel tank selector to WING AUX.

CAUTION

When operating with the fuel tank selector in the WING AUX position, avoid uncoordinated maneuvers, steep descents or rapid maneuvers since these maneuvers may uncover the wing tank fuel outlets thereby causing a flame-out.

FORWARD TANK BOOSTER PUMP FAILURE.

Forward tank booster pump failure is indicated by a premature light-on condition of the forward pump pressure warning light. Fuel in the forward tank can be recovered up to an altitude of approximately 20000 feet with JP-4 fuel by operating with the fuel tank selector in the FWD AUX position. In event of a forward tank booster pump failure, proceed as follows to recover all fuel.

1. Continue to operate with fuel tank selector in ALL TANKS at optimum altitude until the main tank low level warning light illuminates, or if range is critical, until the fuel quantity indicator shows the main tank to be almost empty.

Note

To prevent external fuel from transferring to the forward tank, actuate the FWD fuel shut-off valve to the CLOSED position.

2. Plan remainder of flight so as to land as soon as possible.

3. Descend to an altitude below 20000 feet with JP-4 fuel and turn fuel tank selector to FWD AUX.

CAUTION

When turning fuel tank selector from ALL TANKS to FWD AUX do not hesitate when in the WING AUX position as the wing tanks will be empty and a flame-out will result. When operating with the fuel tank selector in the FWD AUX position with low fuel quantity remaining, avoid uncoordinated turns or nose down attitudes as these maneuvers may result in loss of fuel supply to the forward tank booster pump.

ENGINE FUEL CONTROL SYSTEM FAILURE.

Failure of the engine fuel control system will be indicated by a loss of thrust with the fuel system booster pressure warning light OFF. Operate as folows:

1. Retard throttle control to IDLE.

2. Position emergency fuel switch to ON (FLIGHT EMERG).

3. Move throttle control slowly up to the desired engine rpm.

CAUTION

There is no acceleration or overspeed control in the emergency fuel system and no rapid accelerations should be made.

ELECTRICAL FAILURE.

COMPLETE FAILURE.

If the electrical failure is complete, the booster pumps and fuel system indicators will be inoperative. At altitudes below 20000 feet with JP-4 fuel satisfactory engine operation up to maximum range power settings can be maintained with fuel temperatures up to 80°F. Operate fuel system as follows.

1. Turn fuel tank selector to FWD AUX. Continue to operate in FWD AUX until forward tank fuel is used.

2. Operate with fuel tank selector on WING AUX until wing tank fuel is used.

3. Turn fuel tank selector to ALL TANKS for remainder of fuel in main tank.

CAUTION

With complete electrical failure, fuel warning lights are inoperative and fuel consumption from the fuel tanks will have to be estimated. Fuel in the pylon tanks cannot be recovered because the solenoid operated air shut-off valves will be closed. Land as soon as possible. It will be impossible to select the emergency fuel system with complete electrical failure.

GENERATOR FAILURE.

In the event of generator failure only, the fuel warning lights will illuminate as they are powered from the primary bus. The fuel tank booster pumps will be

show the basic seat ejection procedure recommended for bail-outs where time does not permit full preparation. Also shown in the figures 3–5 and 3–6 are precautions to be observed before ejection if time and conditions permit.

FUEL SYSTEM FAILURE.

Airplane fuel system failure is indicated by premature illumination of the wing or forward pump pressure warning lights or the fuel system booster pressure warning light. The only indication of an engine fuel system component failure will be a loss of rpm or flame-out. (See figure 3–7.)

MAIN TANK BOOSTER PUMP FAILURE.

Main tank booster pump failure is indicated by illumination of the fuel system booster pressure warning light (generator out indicator light not illuminated) when operating with the fuel tank selector in the ALL TANKS position. If a main tank booster pump failure is accompanied by power loss (rpm drop or excessive rpm fluctuation), proceed as follows to recover all fuel.

Note

In order to prevent fuel transfer from the remaining tanks to the main tank, place the fuel shut-off valve marked MAIN in the CLOSED position.

1. Turn fuel tank selector to FWD AUX until forward tank fuel is almost depleted, then turn to WING AUX immediately.

CAUTION

When operating with the fuel tank selector in the FWD AUX position with low fuel quantity remaining, avoid uncoordinated turns or nose down attitudes as these maneuvers may result in loss of fuel supply to the forward tank booster pump.

Note

Main tank booster pump failure will not cause an rpm drop under ordinary conditions below 6000 feet altitude, as the fuel in the main tank can be recovered by direct suction of the engine driven booster pump. Engine operation up to maximum range power setting, with an inoperative main booster pump and a maximum fuel temperature of 80°F, will be satisfactory up to 20000 feet when operating on JP-4 fuel under the most severe conditions. However, satisfactory engine operation may be maintained above these altitudes depending on the fuel type and fuel temperature.

2. Continue to operate at optimum altitude with the fuel tank selector in WING AUX and descend to an altitude below 20000 feet with JP-4 fuel before the wing pump pressure warning light illuminates.

CAUTION

When operating with the fuel tank selector in WING AUX position, avoid uncoordinated maneuvers, steep descents or rapid maneuvers since these maneuvers may uncover the wing tank fuel outlets thereby causing a flame-out.

3. When wing fuel pump pressure warning light illuminates turn fuel tank selector counter-clockwise to the ALL TANKS position for remainder of fuel.

CAUTION

With 700 lbs of fuel or less remaining in the main tank, sustained uncoordinated or climbing turns, accelerations, and nose high attitudes can result in booster pump starvation and subsequent flame-out. A properly sealed main tank pump compartment will contain sufficient fuel to insure satisfactory engine operation, for the following periods, when performing any of the above maneuvers.

MAIN TANK FUEL QUANTITY	OPERATING TIME
700 pounds	1.0 minute
400 pounds	0.5 minute

WING TANK BOOSTER PUMP FAILURE.

Wing tank booster pump failure in one or both tanks is indicated by a premature light-on condition of the wing pump pressure warning light. Fuel in the wing tank with an inoperative booster pump will not be transferred to the main tank. The engine can be operated at the maximum range power setting with the fuel tank selector in WING AUX and without wing tank booster pump pressure up to an altitude of approximately 20000 feet with JP-4 fuel. Fuel remaining in one wing tank cannot be recovered if the other wing tank is empty, as the engine driven booster pump will suck air from the empty tank. If a wing booster pump failure is suspected, proceed as follows to recover the most fuel.

1. Pull circuit breaker marked WING FUEL PUMP CONTR as soon as the wing pump pressure warning light illuminates. This will stop both pumps and prevent the wing tank, with the operating pump, from emptying.

FUEL SYSTEM FAILURE

NOTE

IN THE EVENT A MAIN BOOSTER PUMP FAILURE IS ACCOMPANIED BY POWER LOSS PROCEED AS FOLLOWS:

MAIN BOOSTER FAILURE

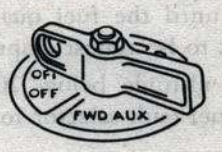
1 HALT FUEL FLOW TO MAIN TANK BY MEANS OF APPROPRIATE SHUT-OFF VALVE

CLOSED ↓ L. WING MAIN FWD R. WING

2 SWITCH TO FWD AUX FUEL FLOW

3 AT WARNING LT INDICATION SWITCH TO WING AUX FUEL FLOW

4 AT WARNING LT INDICATION SWITCH TO ALL TANKS TO RECOVER REMAINING FUEL UNDER LIMITED OPERATION



FWD BOOSTER FAILURE

1 HALT FUEL FLOW TO FWD TANK BY MEANS OF APPROPRIATE SHUT-OFF VALVES

CLOSED ↓ L. WING MAIN FWD R. WING

2 REMAIN IN ALL TANKS POSITION

3 WHEN ALMOST EXHAUSTED SWITCH TO FWD AUX TO RECOVER REMAINING FUEL UNDER LIMITED OPERATION

WING BOOSTER FAILURE

1 HALT FUEL FLOW TO WING TANKS BY MEANS OF APPROPRIATE SHUT-OFF VALVES

CLOSED ↓ L. WING MAIN FWD R. WING

NOTE:—PULL WING BOOSTER PUMP CIRCUIT BREAKERS!

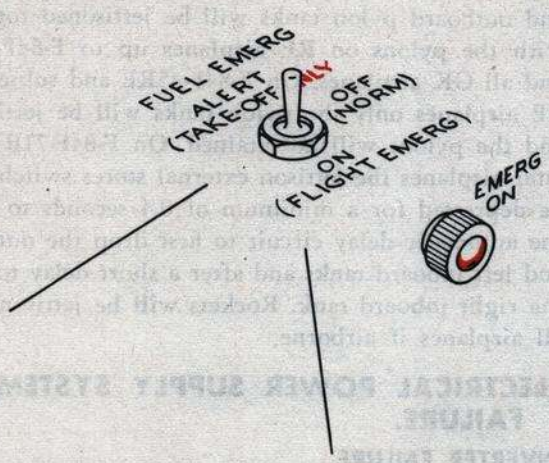
2 REMAIN IN ALL TANKS POSITION

3 WHEN ALMOST EXHAUSTED SWITCH TO WING AUX TO RECOVER REMAINING FUEL

Figure 3–7 (Sheet 1 of 2).

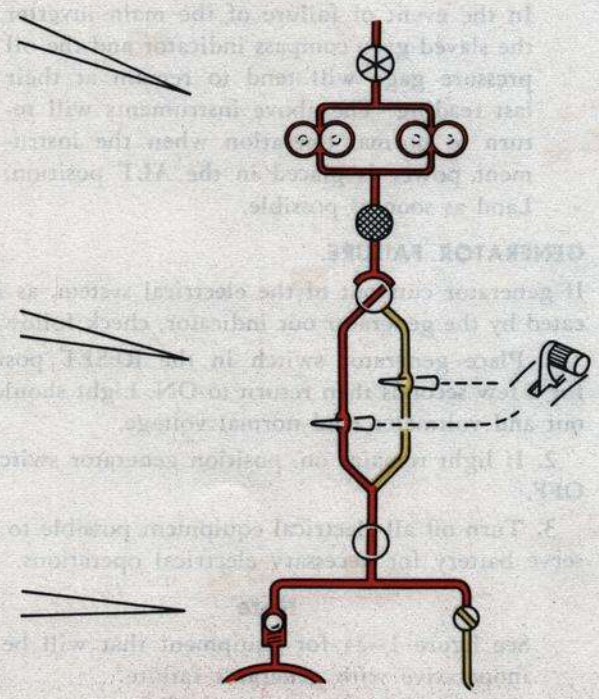
CODE

- FUEL FLOW
- STATIC FUEL
- EMPTY



NORMAL ENGINE CONTROL

NORMAL ENGINE FUEL FLOW IS MAINTAINED REGARDLESS OF ANY OF THE AIRPLANE SYSTEM FAILURES SHOWN AT LEFT-EMERGENCY SWITCH REMAINS "OFF"



ENGINE CONTROL FAILURE

SHOULD FAILURE OCCUR IN ENGINE CONTROL, PLACE EMERGENCY SWITCH AT ON (FLIGHT EMERG)

THIS FLOW MAY BE EMPLOYED WITH EITHER A NORMAL AIRPLANE FLOW OR ANY OF THE FAILURE CONDITIONS SHOWN AT LEFT

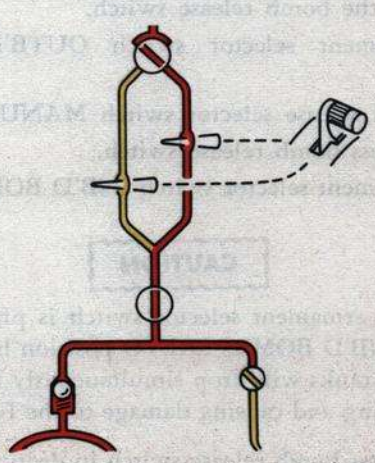


Figure 3—7 (Sheet 2 of 2).

inoperative as they are powered from the secondary bus. Operate the fuel system in the same manner as for complete electrical failure except for external tanks which will be used if the respective air pressure switches are in the INB'D PYLON TANKS AIR PRESS or OUTB'D PYLON TANKS AIR PRESS position.

Note

Fuel in the pylon tanks can be recovered as the air pressure solenoid shut-off valves are energized by the primary bus.

PYLON TANK JETTISON.

Refer to Section V for recommended speeds for jettisoning external tanks.

NORMAL JETTISON. **A thru G**

The pylon tanks are released in the following manner by use of the bomb release switch.

1. Inboard bomb selector switch SINGLE.

CAUTION

If the inboard bomb selector switch is placed in the ALL position both inboard tanks will drop simultaneously thereby colliding and causing damage to the fuselage.

2. Outboard bomb selector swich ALL.
3. Bomb release selector switch MANUAL RELEASE.
4. Depress bomb release switch to drop outboard and left inboard tanks. Depress bomb release switch again to drop right inboard tank.

NORMAL JETTISON. **H and LATER**

The pylon tanks are released in the following manner by use of the bomb release switch.

1. Armament selector switch OUTB'D BOMBS SALVO.
2. Bomb release selector switch MANUAL.
3. Depress bomb release switch.
4. Armament selector switch INB'D BOMBS SING.

CAUTION

If the armament selector switch is placed in the INB'D BOMBS SALVO position both inboard tanks will drop simultaneously thereby colliding and causing damage to the fuselage.

5. Depress bomb release switch to drop left inboard tank. Depress bomb release switch again to drop right inboard tank.

EMERGENCY JETTISON.

The inboard or outboard pylon tanks can be jettisoned individually or simultaneously as conditions dictate. To jettison individually, actuate the inboard pylon jettison or the outboard pylon jettison switch to the JETT position. This also jettisons the respective pylons. To jettison the pylon tanks simultaneously, depress the external stores jettison switch. The inboard and outboard pylon tanks will be jettisoned together with the pylons on RE airplanes up to F-84F-45RE and all GK airplanes. On F-84F-45RE and subsequent RE airplanes only the pylon tanks will be jettisoned and the pylons will be retained. On F-84F-71RE and later airplanes the jettison external stores switch must be depressed for a minimum of 0.4 seconds to allow the automatic delay circuit to first drop the outboard and left inboard tanks and after a short delay to drop the right inboard tank. Rockets will be jettisoned on all airplanes if airborne.

ELECTRICAL POWER SUPPLY SYSTEM FAILURE.

INVERTER FAILURE.

Inverter failure is noted if the inverter failure indicator light illuminates. Turn the instrument power switch to ALT position. If the light does not go out in a few seconds, both inverters have failed.

CAUTION

In the event of failure of the main inverter the slaved gyro compass indicator and the oil pressure gage will tend to remain at their last reading. The above instruments will return to normal operation when the instrument power is placed in the ALT position. Land as soon as possible.

GENERATOR FAILURE.

If generator cuts out of the electrical system, as indicated by the generator out indicator, check following:

1. Place generator switch in the RESET position for a few seconds then return to ON. Light should go out and voltmeter read normal voltage.
2. If light remains on, position generator switch to OFF.
3. Turn off all electrical equipment possible to conserve battery for necessary electrical operations.

Note

See figure 1–24 for equipment that will be inoperative with generator failure.

4. Turn instrument power switch to ALT.
5. Land as soon as possible.

HYDRAULIC POWER SUPPLY SYSTEM FAILURE. A thru J

In the event of failure of the boost system hydraulic pump, the utility pump will automatically supply pressure to the control surface actuators. In the event of failure of both the boost and utility hydraulic system pumps, the emergency hydraulic pump will automatically supply hydraulic pressure to the aileron and the stabilator actuators, if the emergency hydraulic pump switch is in the NORMAL position. If the emergency hydraulic system fails, stabilator control is automatically transferred to electrical actuation and is controlled by the control stick trim button, if the pitch control switch is in the NORMAL position, and on F-84F-40 and subsequent airplanes when the alternate trim switch is in the NORM position. The stabilator can also be controlled with alternate trim switch NOSE UP and NOSE DN positions on F-84F-40 and subsequent airplanes.

Note

The hand pump is basically used during ground maintenance. However, in an emergency, hydraulic systems powered by the utility pump may be actuated by the hand pump. Refer to figure 1–27 for the number of strokes of the hand pump required to operate each system.

NORMAL HYDRAULIC SUPPLY SYSTEM FAILURE. K and LATER

In the event of utility system pressure failure, all hydraulic systems except the aileron and stabilator will be inoperative. These two control systems will continue to be actuated by the engine driven power system pump. The rudder will be actuated through the mechanical linkage from the rudder pedals to the rudder. The landing gear can be extended by means of pneumatic pressure. In the event of power hydraulic system failure all hydraulic systems will be inoperative. If both utility and power systems are inoperative due to hydraulic pressure failures, the emergency hydraulic system can be selected for aileron and stabilator system operation. A failure in the power hydraulic tubing or reservoir, however, will not be corrected by emergency hydraulic system operation.

FLIGHT CONTROL SYSTEM FAILURE. A thru J

STICK LOCK. A thru J

There is a possibility of the internal bearings binding in the stabilator actuator causing a momentary hesitation experienced in the control stick. In addition, speed brake operation can cause movement of the transfer valves causing a "stick-lock" condition. In the event of a "stick-lock", reverse the movement of the stick momentarily. If this does not clear the condition, immediately revert to the electrical operation of the stabilator by placing the pitch control switch in the STICK OVERRIDE or ELEC position.

CAUTION

Until such time as the affected transfer valves are replaced by an improved valve, speed brake operation should be avoided whenever a stick-lock condition could become critical; for example, in very close formations or in maneuvers close to the ground.

STABILATOR SYSTEM FAILURE. A thru J

BOOST PRESSURE FAILURE. A thru J

If the boost hydraulic pressure gage drops rapidly while the utility gage retains pressure, it is probable that the boost pump drive shaft has sheared or a leak has developed between the pump and the common line. If the cause is a leak, the utility gage will drop in a short period of time as the boost pump will pump hydraulic fluid overboard and uncover the utility pump standpipe. However, if the failure is a sheared pump shaft, the utility system will automatically supply pressure to the stabilator, aileron and rudder actuators. When operating all systems from the utility pumps, the pressure required for operation of the landing gear, flaps and speed brakes is diverted from the control system and may cause a momentary control stiffness. If the boost gage drops slowly or fluctuates, indicating a leak in the boost system, the utility gage will drop shortly afterwards, with the time element depending on the extent of the leak. In any event, when the boost gage fluctuates or drops off, follow the procedure outlined in paragraph under Utility and Boost Pressure Failure.

UTILITY PRESSURE FAILURE. A thru J

In the event that the utility system pressure gage drops or fluctuates the probability is that the utility pump drive shaft has sheared or a leak has developed in the utility system. In the event of a leak, hydraulic fluid will be pumped overboard until the level of the utility standpipe is reached. If the leak is in the common system the boost gage will fluctuate or drop shortly thereafter. If the cause is a sheared pumpshaft, the boost system will continue to supply pressure to the control actuators while the utility systems will be inoperative. The landing gear will have to be extended by emergency procedure and the landing flaps can be lowered by means of the hydraulic hand pump. In any event, when the utility system gage fluctuates or drops off, follow the procedure outlined in paragraph under Utility and Boost Pressure Failure.

UTILITY AND BOOST PRESSURE FAILURE.

A thru J

In the event both boost and utility pressures fail, the emergency hydraulic system will automatically take over and power the stabilator and ailerons if the emergency hydraulic pump switch is in the NORMAL position. However, if the pressure switch does not function with failure of the normal hydraulic system, the emergency hydraulic system will not take-over automatically but it can be actuated by positioning the emergency hydraulic pump switch in the EMERG position. The transition from boost or utility system pressure to emergency hydraulic system will be smooth and automatic due to the emergency accumulator providing a ready source of pressure and pressure switches providing circuity for transfer to emergency hydraulic system. If a landing is not contemplated immediately, electrical operation can be selected to conserve the emergency hydraulic system for landing. However, in order to assure satisfactory emergency pump operation, place a load on the emergency hydraulic system by executing a turn and a change in pitch attitude.

WARNING

Do not attempt electrical operation on airplanes prior to F-84F-40 with a trim switch failure. In this event, emergency hydraulic operation is possible, however, airplane trim must be overcome manually. If the emergency hydraulic system should fail, while making a landing on these airplanes and the trim switch has also failed, the airplane pitch can *not* be controlled. On F-84F-40 and later airplanes electrical operation is possible with trim switch failure provided the stick switch power auxiliary electric switch is positioned to OFF before placing the pitch control switch in the ELEC position. On these airplanes an emergency hydraulic system landing is recommended with a trim switch failure provided that the alternate trim switch is left in the OFF position. However, in this configuration aileron and stabilator trim must be manually overcome.

The landing pattern should be set up so that a safe landing can be accomplished with a minimum movement of the stabilator. Trimming and flying the airplane in this manner minimizes the danger when making a landing by electric control, should the pilot elect to do so, if failure of the emergency hydraulic system is experienced either in the approach or before. If an electric landing is to be made consideration should be given to the following:

1. Experience of pilot in aircraft.
2. Weather – Visibility and wind conditions. Due to poor lateral control, an electric landing is not recommended in strong cross winds or gusty winds.
3. Runway length and condition.
4. Approach to runway.
5. Fuel available.
6. Availability of runway barrier.

WARNING

In event it is determined that an electric-electric landing should not be attempted, a more positive check of the hydraulic system should be made by using the electric emergency hydraulic system for several minutes after utility and boost system failure to assure that no major leaks exist in this system. The electric-electric operation may then be selected: however, the emergency hydraulic system should be turned on at a minimum altitude of 500 feet prior to landing. In event failure of the emergency hydraulic system ocurs prior to touchdown, a go-around and a climb should be initiated and a bail-out effected.

If electric operation of the stabilator is desired during flight prior to landing proceed as follows:

1. Place the stabilator in electrical operation with manual aileron control as follows:

a. Pitch control switch in STICK OVERRIDE or ELEC.

WARNING

The STICK OVERRIDE or ELEC position must be selected to preclude a "stick-lock" condition.

b. Emergency hydraulic pump switch to OFF.

CAUTION

Actuate the trim switch to move the stick forward and aft and simultaneously apply sufficient load on the stick to position the actuator control valve in the direction of stabilator motion.

2. Continue to fly the aircraft in this manner and accomplish a landing as follows:

a. Jettison asymmetrical loads, outboard tanks or any tanks with fuel. Retain empty inboard pylon tanks.

b. Landing flaps DOWN if desired. Use hydraulic hand pump while still in level flight.

c. Leanding gear DOWN. Use emergency procedure while still in level flight.

d. Set up a long flat final approach at approximately 500 to 800 fpm descent, approximately 180 to 200 knots IAS with or without flaps respectively, power on.

e. After approach is set up return stabilator to hydraulic control by positioning the emergency hydraulic pump switch to NORMAL and then position the pitch control switch to NORMAL. Retrim the airplane in this attitude to prevent any necessary retrim when closer to the ground. Return stabilator to electrical operation.

f. Control rate of descent with the stabilator and throttle. Make small changes in stabilator and wait for response. When changing power settings make changes smoothly.

g. Do not let airspeed get below 180 until just before touchdown.

h. During the final approach, shortly before "over the fence point" is reached, first position the emergency hydraulic pump switch to NORMAL and then position the pitch control switch to NORMAL. (This switch operational sequence *must* be followed otherwise a momentary stick-lock may be experienced.) After this has been accomplished flight should be controlled by combining stick movement with trim button operation to permit immediate transition to electric operation if the emergency hydraulic system fails. Keep stick motion to a minimum.

Note

The control stick will remain locked until the stabilator is positioned with the trim switch if emergency hydraulic system failure has caused the electrical system to take over.

i. Make a normal landing using the emergency hydraulic system or, if failure of this system has occurred, either make an electric landing using the trim switch (if conditions are favorable), or apply power, climb, and prepare to abandon airplane.

CAUTION

Actuate the trim switch to move the stick forward and aft and simultaneously apply sufficient load on the stick to position the actuator control valve in the direction of stabilator motion.

j. If an electric landing is to be made, and in order to preclude a "stick-lock," immediately position the pitch control switch to STICK OVERRIDE or ELEC. In addition do not attempt to round out but gradually reduce power and let airplane settle to contact ground.

CAUTION

Stabilator response in electrical operation is too slow to round out.

k. On ground contact, reduce throttle to IDLE and stop cock throttle if deemed necessary.

l. Apply steady hard pressure on brakes until speed is reduced to taxi speed.

STABILATOR OPERATION WITH ENGINE FAILURE. **A thru J**

In the event of an engine failure the following procedure is recommended:

1. Emergency hydraulic pump switch OFF.

2. Operate the ailerons and stabilator utilizing pressure from the normal system produced by the windmilling engine. Keep stick movements to a minimum.

3. When preparing to land, place the emergency hydraulic pump switch in the NORMAL position.

EMERGENCY HYDRAULIC PUMP FAILURE. **A thru J**

In the event of emergency hydraulic pump failure, or emergency hydraulic operation is not possible and normal hydraulic pressure is not available; the following procedure is recommended:

1. Position the pitch control switch in STICK OVERRIDE or ELEC.

WARNING

The STICK OVERRIDE or ELEC position must be selected to preclude a "stick-lock" condition.

2. Fly the airplane with manual aileron control and electrical stabilator control and prepare to abandon the airplane.

CAUTION

Actuate the trim switch to move the stick forward and aft and simultaneously apply sufficient load on the stick to position the actuator control valve in the direction of the stabilator motion.

TRIM SWITCH FAILURE. **D thru J**

WITH HYDRAULIC PRESSURE AVAILABLE. **D thru J**

In the event of trim switch failure, which may cause a "runaway" trim or no trim, electrical actuation of the stabilator is recommended until preparing to land. This procedure relieves the pilot of maintaining constant stabilator trim loads on the control stick.

1. Alternate trim switch off.
2. Emergency hydraulic pump switch OFF.
3. Pitch control switch ELEC.

WARNING

It is mandatory that the STICK OVERRIDE or ELEC position be used whenever the stabilator is operated electrically during flight. Failure to do so will result in a locked stabilator actuator.

4. Select the NOSE UP or NOSE DN position of the alternate trim switch to fly the airplane until preparing to land.

CAUTION

When operating in this manner, aileron trim is inoperative.

5. When preparing to land, position the emergency hydraulic pump switch to NORMAL and the pitch control switch to NORMAL.

CAUTION

The ailerons and stabilator will operate from the normal or emergency hydraulic system. However, aileron and stabilator trim will have to be overcome manually during the landing approach. Be prepared for a trim change when the hydraulic system takes over.

WITHOUT HYDRAULIC PRESSURE. **D thru J**

1. Alternate trim OFF.
2. Select the NOSE UP or NOSE DN position of the alternate trim switch to fly the airplane.
3. Fly the airplane with manual aileron control and electrical stabilator control and prepare to abandon airplane.

FLIGHT CONTROLS SYSTEM FAILURE. K and LATER

UTILITY HYDRAULIC SYSTEM FAILURE. K and LATER

The power hydraulic system will provide adequate pressure for continued flight. The rudder will be controlled by mechanical linkage and the spoilers will be inoperative. The rudder will buffet slightly at high speed with this type of failure as the rudder system is not irreversible without hydraulic pressure. A landing should be made as soon as possible. When preparing to land it is recommended as an added safety precaution that the emergency hydraulic system be turned ON.

POWER HYDRAULIC SYSTEM FAILURE. K and LATER

In the event of a line failure in the power system, the emergency hydraulic system will in all likelihood also be inoperative as these two systems use common lines. If a line failure is suspected in the power hydraulic system this condition can further be checked by turning the emergency pump on and noting the pressure on the power hydraulic system gage. If pressure is regained the failure is probably due to the power hydraulic pump or downstream to the check valve. If pressure is not regained a line failure can be suspected. Turn emergency pump off after ascertaining where failure has occurred. The utility hydraulic system will provide adequate pressure for continued flight. However, a landing should be made as soon as possible. When preparing to land it is recommended that the emergency hydraulic system be turned ON if the failure was caused by the power pump. If the failure is such that the emergency system is inoperative, the pneumatic compressor and spoilers should be turned off.

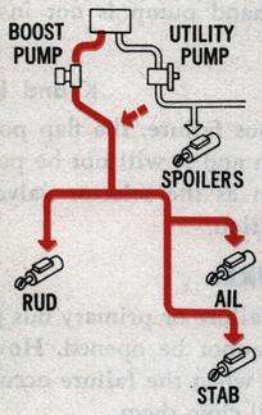
UTILITY AND POWER HYDRAULIC SYSTEM FAILURE. **K and LATER**

An engine flame-out will cause both the utility and power hydraulic system pressure to drop considerably. However, the airplane can adequately be controlled with hydraulic pressure and flow developed by a windmilling engine. Duration of the emergency hydraulic pump when operating on the airplane's battery will be from 3 to 15 minutes depending on condition of battery and equipment operating. The emergency hydraulic system should be turned on prior to landing to supplement the windmilling engine driven pumps.

FLIGHT CONTROLS

Prior to F-84F-71

SYSTEMS OPERATION SCHEMATIC



NORMAL OPERATION

BOOST PUMP SUPPLIES PRESSURE FOR HYDRAULIC OPERATION OF RUDDER, AILERONS AND STABILATOR

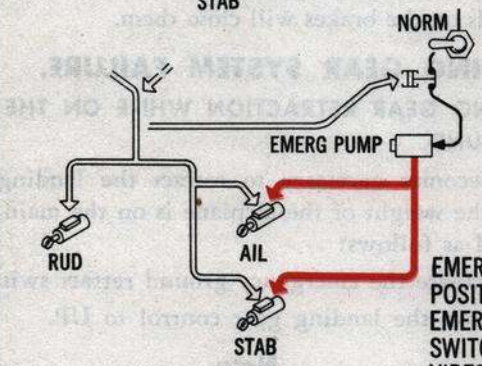
UTILITY PUMP SUPPLIES UTILITY SYSTEM ONLY

BOOST PUMP FAILURE

IN THE EVENT OF BOOST PUMP FAILURE PRESSURE IS SUPPLIED BY THE UTILITY PUMP FOR HYDRAULIC OPERATION OF THE RUDDER, AILERON AND STABILATOR AS WELL AS THE UTILITY SYSTEM

✱NOTE

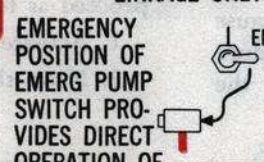
NOTE: ON AIRPLANES WHERE THE "STICK SW PWR" SWITCH IS NOT PROVIDED (BELOW F-84F-40) POWER IS SUPPLIED DIRECTLY TO THE TRIM SWITCH SO THAT METHODS OF OPERATION A & B REMAIN AS DESCRIBED. METHOD C, IN THE ABSENCE OF THE SWITCH IS, OF COURSE, NOT AVAILABLE.



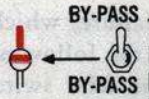
EMERGENCY OPERATION

WITH THE EMERGENCY PUMP SWITCH IN NORMAL POSITION EMERGENCY PRESSURE WILL BE SUPPLIED AUTOMATICALLY TO OPERATE AILERONS AND STABILATOR ON FAILURE OF UTILITY AND BOOST SYSTEMS

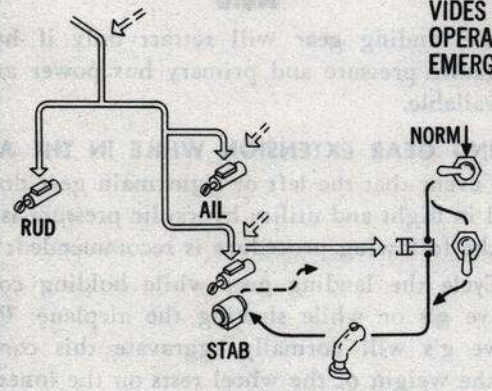
RUDDER OPERATION IS THRU MECHANICAL LINKAGE ONLY



EMERGENCY POSITION OF EMERG PUMP SWITCH PROVIDES DIRECT OPERATION OF EMERG SYS



THE BY-PASS SWITCH DUMPS NORMAL PRESSURE TO CHECK EMERG HYD SYSTEM



B THE PITCH CONTROL SWITCH PERMITS DIRECT SELECTION OF ELECTRICAL OPERATION

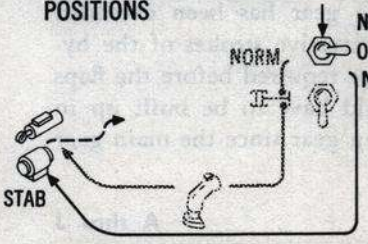
IF EMERG PRESS IS STILL AVAILABLE HYD OPERATION OF AILERONS WILL CONTINUE

ELECTRICAL OPERATION

A WITH "STICK SW PWR" SWITCH IN "NORM" POSITION FAILURE OF ALL HYDRAULIC SYSTEMS AUTOMATICALLY ENERGIZES THE ELECTRICAL STABILATOR CONTROL SYSTEM WITH CONTROL THROUGH THE TRIM SWITCH

AILERONS AND RUDDER OPERATION IS THROUGH MECHANICAL LINKAGE ONLY.

C IN THE "OFF" POSITION THE "STICK SW PWR" SWITCH MAY BE EMPLOYED TO CONTROL THE STABILATOR BY MOVING IT TOWARD THE "NOSE D'N" OR "NOSE UP" POSITIONS



SEE NOTE✱

Figure 3-8

ered by means of the pneumatic system. However, within a short time, the pneumatic system should reactuate the downlock cylinder relocking the main gears in the down position. Therefore, the landing gear position indicators must be checked to ascertain whether all gears are down and locked after the pneumatic system has been used to lower any gears.

2. If the landing gear will not extend by normal procedures, indicated by the landing gear position indicators, warning horn or low hydraulic pressure, proceed as follows:

CAUTION

If brakes are not available land with the gear retracted.

a. Reduce speed to 220 knots IAS or below.
b. Move landing gear control to EMERG DOWN.

Note

Once the landing gear is extended by positioning the landing gear selector the EMERG DOWN position you are committed to a wheels down landing since the selector handle can only be released from the EMERG DOWN position by use of a screwdriver. The possibility of blowing up the hydraulic reservoir due to back pressures when retracting the landing gear also exists.

c. If necessary, yaw the airplane to lock the main gear.
d. Check landing gear position indicators to ascertain that all gears are locked down.

Note

Observe the landing gear position indicators when yawing the airplane to determine when the spring-loaded downlocks on the main gear are engaged. The nose gear is extended by air pressure and the spring-loaded nose gear downlock is locked when the strut is fully extended as indicated by the nose gear position indicator.

WARNING

If both utility and power hydraulic pressure gages read zero and engine is operating normally the flight controls must not be moved until the emergency system is turned ON and hydraulic pressure is regained on the power hydraulic pressure gage. If hydraulic pressure is not regained the surfaces will tend to creep in the direction of applied air loads. If hydraulic pressure is not regained abandon airplane after ascertaining that gage pressure indications are realistic and that hydraulic failure has occurred. This can be accomplished by slightly operating the ailerons to determine if hydraulic pressure is available.

Note

Both utility and power hydraulic pressure gages are powered from the a-c bus. In the event of an a-c power failure both gages will be inoperative and remain at the last pressure reading.

TRIM SWITCH FAILURE. **K and LATER**

In the event of trim switch failure, which may cause a "runaway" trim or no trim the following procedure is recommended to isolate the trim switch from the circuit:

1. Alternate trim switch (PITCH TRIM) OFF.
2. Select the NOSE UP or NOSE DN position of the alternate trim switch to trim airplane about pitch axis. Trim about the roll axis cannot be controlled.

LANDING FLAPS SYSTEM FAILURE.

A thru J

HYDRAULIC FAILURE. **A thru J**

In the event of hydraulic pressure failure and before emergency extension of the landing gear the landing flaps can be extended by placing the landing flap lever in the DOWN position and by actuating the hydraulic hand pump. If the landing gear has been extended by the emergency system, excessive strokes of the hydraulic hand pump would be required before the flaps will move as pressure would have to be built up in the down side of the landing gear since the main gear extends by gravity.

ELECTRICAL FAILURE. **A thru J**

In the event of primary bus failure, the flap position indicator will be inoperative and it will not be possible to operate the flap system as the selector valve will be in the neutral position.

LANDING FLAPS SYSTEM FAILURE.

K and LATER

HYDRAULIC FAILURE. **K and LATER**

In the event of utility system failure it will not be possible to lower the landing flaps, since the utility system cannot be operated by the power or emergency hydraulic systems and a hand pump is not installed in the aircraft.

ELECTRICAL FAILURE. **K and LATER**

In the event of primary bus failure, the flap position indicator will not function and it will not be possible to operate the flap system as the selector valve will remain in the neutral position.

SPEED BRAKE FAILURE.

In the event of hydraulic failure or primary bus power failure the speed brake cannot be opened. However, if the speed brake is open when the failure occurs the air loads on the brakes will close them.

LANDING GEAR SYSTEM FAILURE.

LANDING GEAR RETRACTION WHILE ON THE GROUND.

If it becomes necessary to retract the landing gear while the weight of the airplane is on the main struts proceed as follows:

1. Actuate the emergency ground retract switch.
2. Move the landing gear control to UP.

Note

The landing gear will retract only if hydraulic pressure and primary bus power are available.

LANDING GEAR EXTENSION WHILE IN THE AIR.

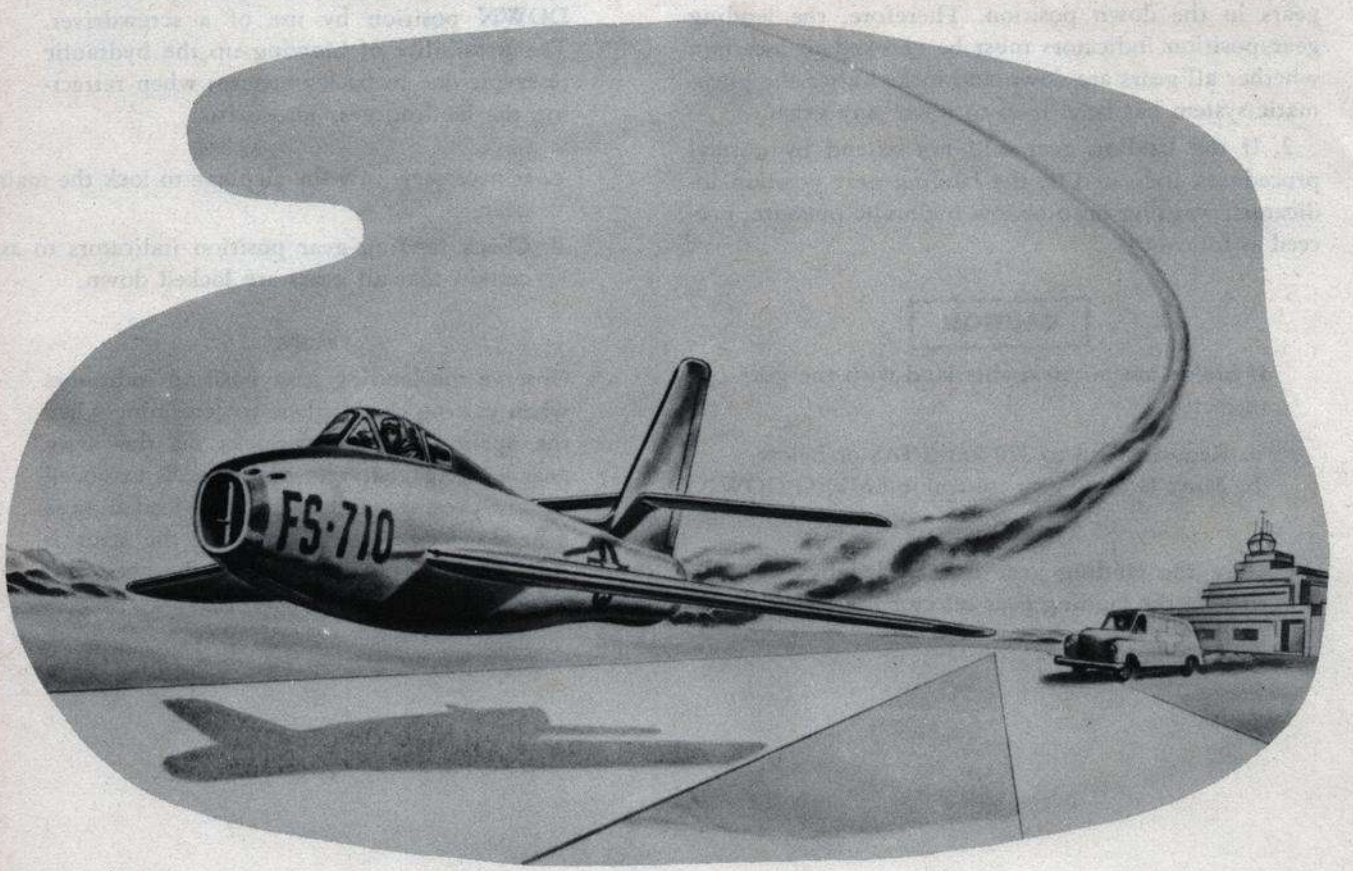
In the event that the left or right main gear does not extend in flight and utility hydraulic pressure is available, the following procedure is recommended:

1. Cycle the landing gear while holding constant negative g's or while shaking the airplane. Pulling positive g's will normally aggravate this condition since the weight of the wheel rests on the inner landing gear door.

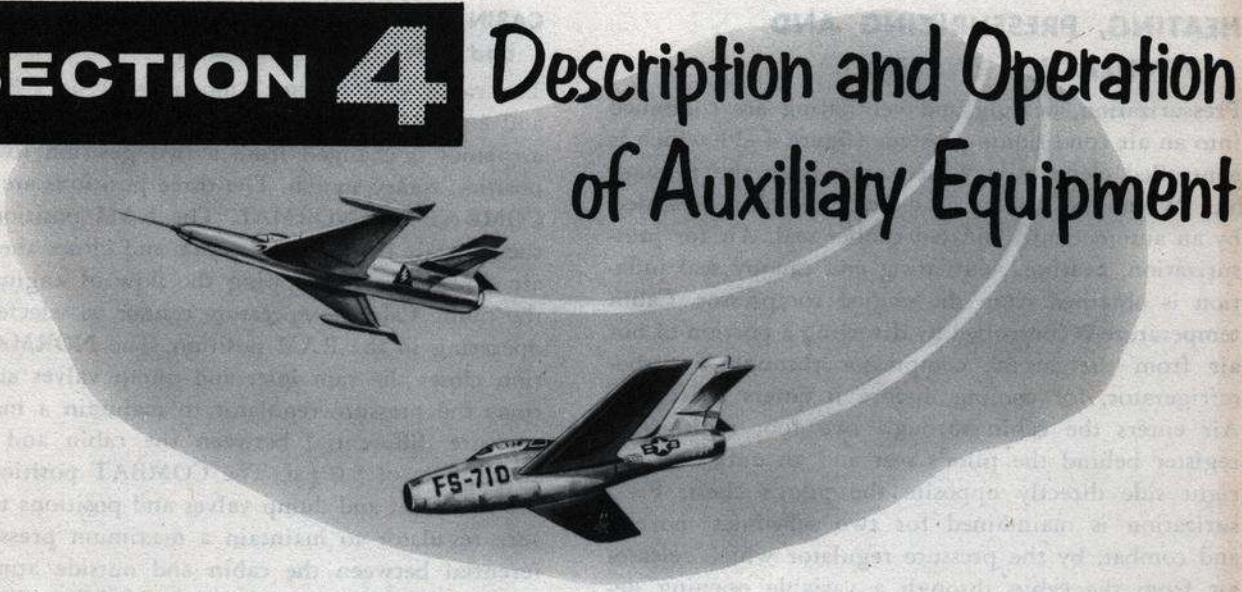
Note

Use of the emergency system when utility hydraulic pressure is still available is not recommended since the gear cannot be retracted, if desired, once the EMERG DOWN position is selected.

In the event that only the main gear can be locked down with the main system, the possibility exists of back pressure in the return hydraulic lines unlocking the main landing gear whenever the nose gear is low-


FS-710

SECTION 4 Description and Operation of Auxiliary Equipment



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HEATING, PRESSURIZING AND VENTILATING SYSTEM.

Pressurization, heating and ventilating are combined into an air conditioning system (figure 4–1) which is controlled electrically with power from the primary bus. When the canopy is closed the cabin is sealed by an automatically inflated rubber seal. Air for pressurization, heating, ventilating and canopy seal inflation is obtained from the engine compressor. Cabin temperature is controlled by diverting a portion of hot air from the engine compressor through a turbo-refrigerator, for cooling, before it enters the cabin. Air enters the cabin through two foot registers, a register behind the pilot's seat and an outlet on the right side directly opposite the pilot's chest. Pressurization is maintained for two schedules, normal and combat, by the pressure regulator which releases air from the cabin through a variable opening designed to maintain the proper pressure differential and rate of change of cabin air for the normal schedule. (See figure 4–2.) From sea level to 12500 feet altitude the cabin is unpressurized; from 12500 to 31000 feet altitude normal pressure remains equivalent to atmospheric pressure at 12500 feet; above 31000 feet a constant normal pressure differential of 5.0 psi is maintained between cabin and outside atmosphere. For the combat schedule; the cabin is unpressurized from sea level to 12500 feet: from 12500 to 21200 feet altitude cabin pressure remains equivalent to atmospheric pressure at 12500 feet; above 21200 feet a constant pressure differential of 2.75 psi is maintained between cabin and outside atmosphere. The cabin altimeter (figures 1–7 and 1–8) indicates the equivalent cabin altitude. The dump valve operates automatically to relieve excessive cabin pressure and can also be opened to dump cabin pressure if necessary. Outside ventilating air is available to the cabin only if pressurization is shut off.

CABIN VENT SELECTOR — UP TO F-84F-35RE AND F-84F-51GK.

Cabin pressurization is selected by the cabin vent switch (figure 4–3) which is a two position electrical switch marked PRESSURE and RAM. The RAM position opens the ram air valve and dump valves allowing a flow of ram air through the cabin and closes the engine air shut-off valve stopping the flow of engine air to the cabin. Cabin temperature cannot be selected when operating in the RAM position. The PRESSURE position closes the ram inlet and dump valves and the air flow by-pass valve modulates to maintain the temperature called for by the cabin temperature control. The cabin vent switch is powered from the primary bus and is normally left in the PRESSURE position.

CABIN VENT SELECTOR — F-84F-35RE and later and F-84F-51GK and later.

The cabin vent selector (figure 4–3) on F-84F-35RE and later RE airplanes and F-84F-51GK and later GK airplanes is changed from a two position to a three position rotary switch. The three positions are: RAM, COMBAT and NORMAL. The RAM position opens the ram air through the cabin and closes the engine air shut-off valve stopping the flow of engine air to the cabin. Cabin temperature cannot be selected when operating in the RAM position. The NORMAL position closes the ram inlet and dump valves and positions the pressure regulator to maintain a maximum pressure differential between the cabin and outside atmosphere of 5.0 psi. The COMBAT position closes the ram inlet and dump valves and positions the pressure regulator to maintain a maximum pressure differential between the cabin and outside atmosphere of 2.75 psi. This position is provided for pilot safety to minimize danger resulting from sudden decompression during combat. The cabin vent pressure switch is powered from the primary bus and is normally left in the NORMAL position.

CABIN TEMPERATURE CONTROL.

Cabin temperature is adjusted for pilot comfort by using the cabin temperature control (figure 4–3) which is a three position switch marked COOL, OFF and HEAT, spring-loaded to the OFF position. By holding the cabin temperature control in the COOL or HEAT position, the cabin temperature can be adjusted to the individual needs, if primary bus power is available.

SIDE AIR OUTLET SHUT-OFF.

The side air outlet shut-off (6, figure 1–12; 6, figure 1–13; 7, figure 1–14) is located on the right side of the cabin. The quantity of hot or cold air going into the cabin through this outlet may be varied by manually sliding the shut-off over the air outlets.

ANTI-ICING AND DE-ICING SYSTEMS.

DEFROSTING SYSTEM.

The center windshield panel is designed and built so that an electrical current, passing through an electrical conductive coating between laminations, keeps the windshield panel at a temperature of 100°F and therefore ice free. Both a-c and d-c power are required for operation; the a-c being supplied only by the main inverter, and the d-c by the primary bus. On airplanes up to F-84F-35RE and up to F-84F-40GK, the system automatically energizes when the primary and secondary busses are energized, as there is no manual control provided. On F-84F-35RE and later and F-84F-40GK and later airplanes, a switch is provided for

AIR-CONDITIONING SYSTEM SCHEMATIC

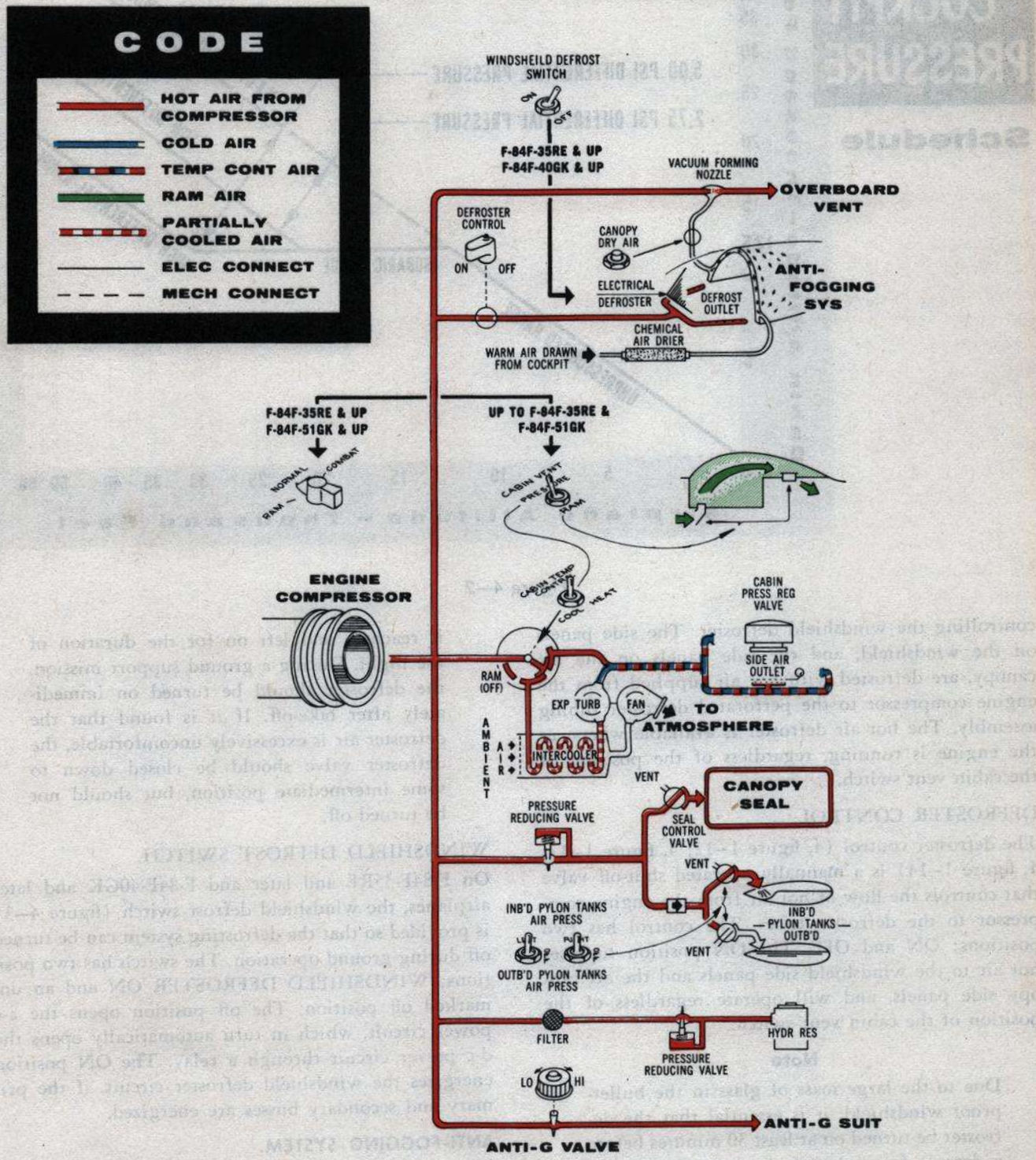


Figure 4—1.

COCKPIT PRESSURE

Schedule

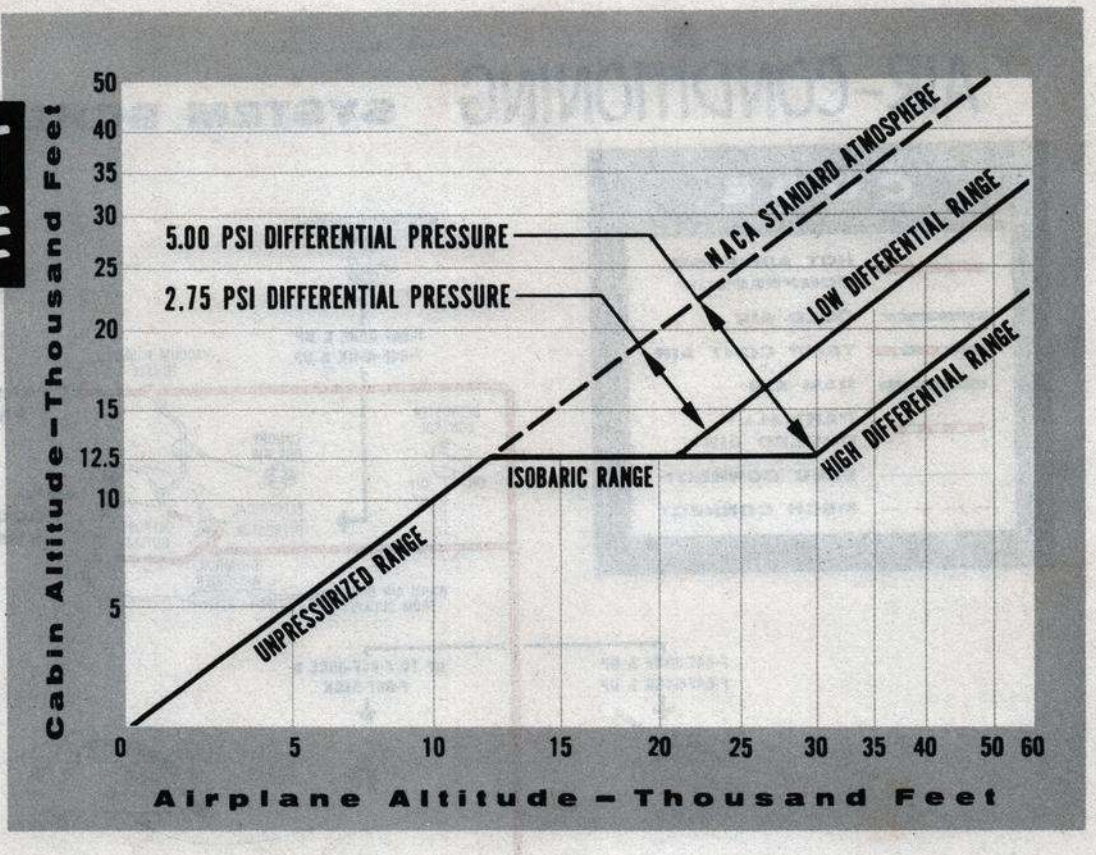


Figure 4—2

controlling the windshield defroster. The side panels on the windshield, and the side panels on the aft canopy, are defrosted with hot air supplied from the engine compressor to the perforated defroster tubing assembly. The hot air defroster is available whenever the engine is running, regardless of the position of the cabin vent switch.

DEFROSTER CONTROL.

The defroster control (4, figure 1—12; 4, figure 1—13; 4, figure 1—14) is a manually operated shut-off valve that controls the flow of hot air from the engine compressor to the defroster tubes. The control has two positions: ON and OFF. The ON position supplies hot air to the windshield side panels and the aft canopy side panels, and will operate regardless of the position of the cabin vent switch.

Note

Due to the large mass of glass in the bullet-proof windshield, it is essential that the defroster be turned on at least 30 minutes before a descent from altitude is undertaken. Since a descent often cannot be anticipated 30 minutes in advance, the defroster should be turned on whenever an altitude of 20000 ft is reached, and left on for the duration of the flight. During a ground support mission, the defroster should be turned on immediately after take-off. If it is found that the defroster air is excessively uncomfortable, the defroster valve should be closed down to some intermediate position, but should not be turned off.

WINDSHIELD DEFROST SWITCH.

On F-84F-35RE and later and F-84F-40GK and later airplanes, the windshield defrost switch (figure 4—3) is provided so that the defrosting system can be turned off during ground operation. The switch has two positions; WINDSHIELD DEFROSTER ON and an unmarked off position. The off position opens the a-c power circuit, which in turn automatically opens the d-c power circuit through a relay. The ON position energizes the windshield defroster circuit, if the primary and secondary busses are energized.

ANTI-FOGGING SYSTEM.

The canopy and the windshield side panels are defogged by air, taken from the cabin, passed through a chemical drier, and circulated through the space between the inner and outer surfaces of the panels.

CABIN TEMPERATURE & PRESSURE CONTROLS

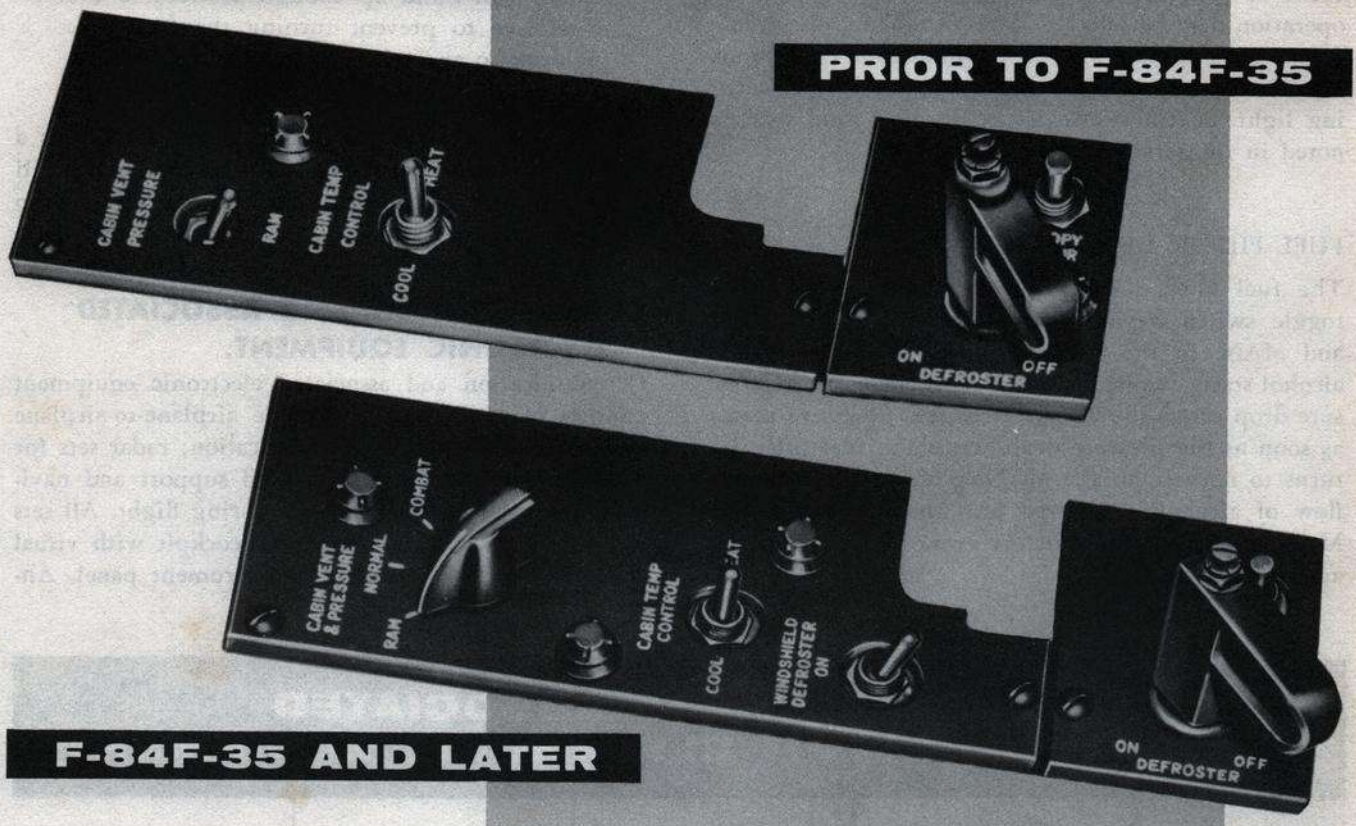


Figure 4—3

The drier must be checked periodically to make sure that the chemical is still active. Circulation is controlled electrically through a normally closed shut-off valve.

CANOPY DRY AIR SWITCH (ANTI-FOGGING). The canopy dry air switch (5, figure 1—12; 5, figure 1—13; 5, figure 1—14) controls the flow of dry air in the anti-fogging system. On aircraft prior to F-84F-61RE, it is a momentary push button switch marked CANOPY DRY AIR, and on F-84F-61RE and later aircraft it is at two-position toggle switch marked CANOPY DRY AIR, ON, OFF; actuating the switch for approximately 10 to 15 seconds prior to take-off, opens the normally closed solenoid shut-off valve, which allows dry air to pass through the space between the inner and outer surfaces of the canopy and windshield side panels. Actuating the switch for longer periods is unnecessary, as the space will be filled with dry air and continued use will only replace the dry air with more dry air. When the switch is released the solenoid valve closes and shuts off the flow of dry air to the anti-fogging system. The valve also closes when energy from the primary bus is not available.

PITOT HEATER.

The pitot tube, installed in the duct divider in the nose of the airplane, is electrically heated from the primary bus to keep it ice free.

PITOT HEAT SWITCH.

The pitot heat switch (20, figure 1—9; 16, figure 1—10) has two positions OFF and PITOT HEAT. The PITOT HEAT position turns on the heater element which heats the pitot tube and keeps it free of ice.

CAUTION

The pitot heater should not be used on the ground as serious overheating will occur without sufficient air flow.

FUEL FILTER DE-ICING SYSTEM.

A fuel filter de-icing system is installed to remove

ice that may collect in the low pressure fuel filter. Alcohol is injected into the fuel line upstream of the fuel filter by means of an electric pump which is inoperative if the alcohol tank is empty or in the event of primary bus failure. Automatic or manual operation may be selected. The alcohol supply is sufficient for approximately two minutes of continuous injection. An icing condition is indicated by a warning light. Specifications of the de-icing fluid used is noted in the servicing diagram.

FUEL FILTER DE-ICING SWITCH.

The fuel filter de-icing switch (figure 1–16) is a toggle switch having three positions; AUTO, OFF and MAN. In the AUTO position the injection of alcohol starts automatically at the predetermined pressure drop across the low pressure fuel filter and ceases as soon as the pressure drop across the fuel filter returns to normal. In the MAN. position a continuous flow of alcohol is injected into the fuel filter. The MAN. position is used in the event of failure of the automatic system.

Note

If the fuel filter de-icing switch is positioned to MAN. with the throttle closed and the fuel tank selector in the OFF position, the alcohol will build up enough pressure in the fuel line to prevent turning the fuel tank selector to any other position.

FUEL FILTER ICE WARNING LIGHT.

The fuel filter ice warning light (figure 1–22) is a red light marked FILTER ICING. The light will illuminate automatically when the fuel pressure drop across the low pressure fuel filter is indicative of icing and go out when the pressure returns to normal.

COMMUNICATION AND ASSOCIATED ELECTRONIC EQUIPMENT.

Communication and associated electronic equipment consists of radio sets to provide airplane-to-airplane and airplane-to-ground communication; radar sets for aircraft identification and ground support and navigation equipment for guidance during flight. All sets are remotely controlled from the cockpit with visual indicators on the console and instrument panel. An-

COMMUNICATION and ASSOCIATED ELECTRONIC EQUIPMENT

Type	COMMAND SET	IFF SET	RADIO COMPASS	RADAR SET
Designation	AN/ARC-33 or AN/ARC-34	AN/APX-6 or AN/APX-6A	AN/ARN-6	AN/APW-11 or AN/APW-11A
Function	Two-way voice communication	Automatic Identification	Radio Navigation	Ground Support
Range	30 miles at 1000 feet altitude to 135 miles at 10,000 feet altitude	100 miles up to 50,000 feet altitude	250 miles	—
Location of Controls	R. H. Console (figure 1–12)	R. H. Console (figure 1–12)	R. H. Console (figure 1–12)	R. H. Console (figure 1–12)

Figure 4–4



Figure 4—5

tennas are concealed within the airplane and therefore are protected from air loads during high speed flight and are kept free of ice and dirt.

OPERATION OF COMMUNICATION EQUIPMENT.

Insert microphone plug and headset plug into two extensions on the front of the pilot's seat. The primary bus must be energized for radio operation. Each set is described individually in the following paragraphs:

Note

The Command Radio Set and the Radio Compass will operate from the airplane's batteries as power is supplied to these sets from the primary bus. When the instrument power switch is in the NOR position, the IFF Radio Set is energized by the alternate inverter on aircraft prior to F-84F-35 or by the main inverter on later aircraft. On all aircraft the IFF Radio Set is inoperative when the instrument power switch is in the ALT position.

COMMAND SET — AN/ARC-33. **A thru G**

Radio set AN/ARC-33 is a remotely controlled receiver-transmitter designed to operate, in the 225.0 to 399.9 mc band. A total of 1750 crystal controlled receive and transmit channels are provided within tuning range of the set. Any 20 of these channels may be preset at the radio set control unit so as to be quickly available when desired. Because of the nature of the operating frequencies employed, communication is essentially over line-of-sight distances with a practical maximum of approximately 75 miles. The radio set is designed to operate at altitudes as high as 50000 feet. A guard receiver, constantly tuned to the guard frequency, is incorporated and may be placed in operation along with the main channel receiver, thus making it possible to continually monitor an emergency or command channel while still carrying on communication on another channel. All operating controls are located on the right console (figure 4—5) with the exception of the microphone press-to-talk button which is located on the throttle. A side tone circuit is provided which feeds a side tone signal into the headset, so that the pilot can monitor his own transmitted signals. The radio will operate if the battery switch is in the ON position and the primary bus is energized.

RADIO ON-OFF SWITCH.

A two position toggle switch (figure 4—5) marked ON-OFF located on the radio control panel supplies primary power to operate the radio set when placed in the ON position. A warm up period of approximately 75 seconds is necessary before radio operation becomes satisfactory for reception or transmission.

PRESET CHANNEL SELECTOR SWITCH.

The preset channel selector switch (figure 4—5) is used to select any one of the 20 preset channel frequencies desired for radio transmit-receive operation. The indicator windows above the knob will show the channel number selected by the selector knob, however, the channel number will be covered when the function switch is in the G position. A tone will be heard in the headset when changing channels for approximately six seconds until the newly selected channel is ready for operation. Do not attempt transmission until the tone is no longer heard in the headset.

PRESET CHANNEL INDICATOR.

The preset channel indicator (figure 4—5) mechanically indicates in the window immediately above the preset channel selector knob, the number of the preset channel selected. When the function switch is placed in the G position the preset channel number shown in the indicator window above the preset channel selector switch will be automatically blanked out.

FUNCTION SWITCH.

The function switch (figure 4—5) a four position rotary selector switch marked MAIN, BOTH, G, with a guarded fourth position marked by a white dot, is used to select the type of transmit-receive operation desired. In the MAIN position the main receiver is used and transmission is on the preset channel. In the BOTH position, the radio receives on the main receiver on the preset channel and the guard receiver is tuned to the guard frequency simultaneously while transmission is carried on the preset channel. The G position switches the main receiver and the trans-



Figure 4—6

ing cycle of six seconds must be completed before radio transmission can be resumed.

COMMAND SET AN/ARC-34. **H and LATER** Radio set AN/ARC-34, a remotely controlled receiver-transmitter operating in the 225.0 to 399.9 mc band. A total of 1750 crystal controlled receive-transmit channels, in increments of one-tenth of a megacycle, are within tuning range of the radio set and may be manually selected by the pilot. Any 20 channels within the radio's total frequency range may be preset in any order for quick selection by the rotary type preset channel selector switch on the radio control panel. Four knobs are provided for manual selection of an operating frequency, so that manual operation does not disturb the preset channel arrangement. Receiver and transmitter tuning is automatically completed after a channel change. Two receivers, a main, and a guard receiver which is constantly tuned to the guard frequency are provided. The guard receiver may be operated along with the main receiver, thus making it possible to monitor the guard channel for command or emergency communication, while still carrying on communication on another channel. Receiver operation is manually selected by a rotary type function switch. Continuous tone transmission is also provided through a tone button which may be used for voice transmission, or as a key for code signals. All radio operating controls are located on the left console (figure 4—6) with the exception of the microphone press-to-talk button, which is located on the throttle control. The pilot can monitor his own transmitted signals through a side-tone circuit which feeds from the transmitter into his headset. The transmitter and the main receiver are tuned to the same frequency. The radio will operate if the battery switch is ON and the primary bus is energized.

FUNCTION SWITCH.

The function switch (figure 4—6) a rotary, four position selector switch marked OFF-MAIN-BOTH-ADF is used to turn the AN/ARC-34 radio on or off, or select the type of receiver operation desired. The OFF position shuts off power to the transmitter, main and guard receivers. In the MAIN position the radio receives on the main receiver and both the main receiver and transmitter are tuned to the preset or manually set up channel selected while the guard receiver remains inoperative. When the function switch is in the BOTH position the radio will receive signals simultaneously from the guard receiver which is constantly tuned to the guard channel, and from the main receiver, which with the transmitter will operate on either a preset or manually selected frequency depending upon the type of channel selection used. The ADF position is for an automatic direction finder which is not installed in F-84F aircraft.

MANUAL-PRESET-GUARD SELECTOR SWITCH.

The lever type, three position selector switch (figure 4—6) marked MANUAL-PRESET-GUARD is used to select the method of channel selection or to switch both the main receiver and the transmitter to the guard channel frenquency. A MANUAL-PRESET-GUARD switch indicator window is provided and the type of selection as set up by the switch is indicated, while the other positions are visible, but covered by a green shutter. In the MANUAL position, the four tuning knobs at the top of the control panel are used permitting manual selection of any one of the 1750 frequencies in the radio's tuning range for transmit-receive operation. The PRESET and GUARD positions on the MANUAL-PRESET-GUARD switch indicator window will be covered, as will the preset channel indicator window. The indicator windows above each of the four manual tuning knobs are open and provide a direct reading in megacycles and tenths of a megacycle of each frequency manually selected by the knobs. In the PRESET position, the preset channel selector switch is used and transmit-receive operation may be carried on any one of the 20 preset channels as selected by the preset channel selector switch and indicated in the preset channel indicator. The

mitter over to operate on the guard frequency and cuts off power to the guard receiver, regardless of the position of the preset channel selector switch. The word GUARD will appear in the guard channel indicator window and the channel number in the preset channel indicator window will automatically be blanked out. The guarded white dot position is used to release and extract the preset channel memory cylinder, the preset channel selector switch and the control panel section securing this assembly, from the radio control panel for changing the selection of preset channels, as set up on the preset channel memory cylinder. The release button marked with a white dot must be depressed and held to move the function switch to the guarded white dot position. When the release button is in the depressed position or the function switch is in the white dot position the main receiver and the transmitter will operate on the guard frequency.

CAUTION

Do not move the function switch to the white dot position as it is not feasible for the pilot to attempt to preset the channels in flight.

GUARD CHANNEL INDICATOR.

The guard channel indicator window (figure 4–5), located above the preset channel indicator window indicates when the main receiver and transmitter are operating in the guard channel. The word GUARD appears in the indicator window automatically when the function switch is in the G position.

TONE PUSH BUTTON.

The spring-loaded push button marked TONE (figure 4–5) on the radio control panel, switches the radio from receive to tone transmission operation the preset channel shown in the channel indicator window, when held in the depressed position regardless of whether or not the microphone press-to-talk button is depressed. The 1020 cycle tone is continuous during voice transmission while the button is held in the depressed position for transmit operation. The radio automatically switches over to receive operation when the button is released.

Note

Tone transmission is usually perceptible over a slightly greater distance and through greater interference than voice transmission. Therefore it is especially adaptable in emergency use for code key operation when interference or jamming makes voice transmission impractical, or as a radio marker signal for radio direction finding.

VOLUME CONTROL.

The volume control (figure 4–5), a rotary switch marked VOLUME, regulates the volume for the main and guard receivers and the headset volume, however it cannot increase the volume beyond a pre-determined level.

MICROPHONE PRESS-TO-TALK BUTTON.

The microphone press-to-talk button, (figure 1–17) located on the engine throttle control, switches the radio set over to transmission operation for voice modulation when held in the depressed position. When the button is released the radio returns to receive operation.

STARTING.

1. Place the ON-OFF switch in the control panel panel in the ON position. Allow approximately 75 seconds for radio warm up.

2. Rotate the preset channel selector control knob until the respective number for the desired channel appears in the indicator window above the knob.

Note

When changing channels there will be approximately six seconds delay for channel set up time during which a tone signal will be heard in the headset until the radio is ready for operation on that channel. Do not attempt transmit operation until the tone ceases. The tuning drive motor is protected by a thermal time delay cut-out which opens the motor circuit after approximately one minute of continuous tuning. Therefore, if the tuning motor is unable to come to rest because of some fault in the equipment, or because of constant rotation of the preset channel selector control, the tuning motor circuit is automatically broken after approximately 30 seconds. The motor circuit may be reset by selecting a new channel, then returning to the original channel.

3. Listen for the tone in the headset. Make no attempt to receive or transmit while the tone is heard.

4. Place the function switch in the MAIN, BOTH or G position depending on the operation desired.

5. Adjust the volume control for comfortable level in the headset.

STOPPING.

1. Place the ON-OFF switch in the conrol panel in the OFF position.

Note

Once the radio has been turned off, the 75 second warm-up period and the channel tun-

manual tuning knob windows and the MANUAL and GUARD positions on the MANUAL-PRESET-GUARD switch indicator windows will be blanked out. In the GUARD position, the main receiver and transmitter are switched to the guard channel frequency and the guard receiver is inoperative even if the function switch is in the BOTH position. The manual tuning indicator window, the preset channel indicator window and the PRESET and MANUAL positions in the MANUAL-PRESET-GUARD indicator window will be covered.

TONE PUSH BUTTON.

The spring-loaded push button marked TONE (figure 4–6) switches the radio over from receive to tone transmission on the manually selected or preset frequency that the radio is operating on as long as the depressed position is held. A 1020 cycle tone is continuous during voice transmission as long as the tone button is depressed. The tone button may also be used as a key for code transmission. The microphone press-to-talk button, regardless of its position has no effect on the operation or function of the tone button.

Note

Tone transmission is usually perceptible over a slightly greater distance and through greater interference than voice transmission. Therefore it is especially adaptable in an emergency for code key operation, when interference or jamming conditions make voice transmission impractical, or to serve as a radio marker signal for direction finding.

VOLUME CONTROL.

The volume control (figure 4–6) marked VOLUME regulates the headset volume for signals received on both the main and guard receivers. Volume control range is predetermined so that the signal volume may not be reduced below a preset level.

MICROPHONE PRESS-TO-TALK BUTTON.

The microphone press-to-talk button (figure 1–17) located on the engine throttle control, switches the radio set from receive to transmit operation for voice modulation when held in the depressed position. When the button is released the radio returns to receive operation. The microphone press-to-talk button, regardless of its position, has no effect on the function or operation of the tone push button.

STARTING.

1. Place the function switch in the BOTH position.

2. Turn MANUAL-PRESET-GUARD selector switch to PRESET position.

3. Rotate preset channel selector knob until desired channel number appears in preset channel indicator window. Allow approximately one minute for equipment warm-up and automatic channel tuning adjustment cycle. At the end of the warm-up period the equipment will be in the standby condition ready to receive signals on the preset command and fixed guard frequencies simultaneously. During transmission periods the pilot should receive his own signals on a side tone received by his headset. A little receiver noise may or may not be heard during non-transmission periods.

Note

When selecting a new preset channel there will be a delay of four seconds before the automatic tuning cycle adjusts the set for operation on the newly selected frequency.

4. Adjust the volume control for a comfortable signal level in the headset.

5. Before transmission, check that equipment is functioning and tune-up is complete by listening for voice side-tone, or tone signal when tone button is depressed.

STOPPING.

1. Place the function switch in the OFF position.

Note

Once the radio set has been turned off the one minute warm-up period must be completed before radio transmission can be resumed.

OPERATING PRECAUTIONS.

1. Transmit only when the channel is clear to prevent confusion and loss of messages. The guard frequency should not be used for transmission unless the message is urgent.

2. Use both receivers for general reception unless signals from one make the desired signals from the other unusable.

3. It is possible to set the preset channel buttons or manual frequency selector knobs for frequencies below 225.0 megacycles. Since this is below the operating frequency range, the automatic tuning mechanism cannot accomplish tune-up. It will operate for approximately 120 seconds and will then be turned off automatically by a protective relay. Under these conditions there will be no side-tone if transmission is attempted and operation of the frequency selection knobs will have no effect. To restore operation, select a channel within the 225.0 to 399.9 megacycle range. Turn the function switch to the OFF position and then to BOTH. After approximately one minute the radio equipment will operate in a normal manner.



Figure 4—7

IFF SET — AN/APX-6.

The purpose of the IFF Set (figure 4—7) is to enable the aircraft in which it is installed to automatically identify itself as friendly whenever it is properly challenged by suitably equipped friendly surface and airborne radar equipment. A type AN/APX-6 IFF Set is installed on aircraft prior to F-84F-61RE and incorporates three destructors which are inserted in the face of the IFF transponder. On F-84F-61RE and later aircraft, an AN/APX-6A type IFF Set is installed which is similar to the earlier type but does not incorporate destructor features.

CAUTION

Before take-off make sure that the IFF frequency counters have been set to the proper frequency channels. If the use of destructors is required on AN/APX-6 installations in aircraft prior to F-84F-61RE, check that all three destructors have been inserted in the face of the IFF transponder.

STARTING.

1. Rotate the master control to NORM position unless instructed otherwise.

Note

The IFF Set is inoperative with the instrument power switch in the ALT position.

2. Set mode 2 and mode 3 control as instructed.

STOPPING.

1. Rotate the master control to the OFF position.

Note

On aircraft prior to F-84F-61RE, if the destructor control was operated during the flight, report this fact immediately upon landing so that a new receiver-transmitter may be installed.

RADIO COMPASS — AN/ARN-6.

The radio compass AN/ARN-6 (figure 4—8) is an airborne navigational instrument. There are four bands covering a frequency range of 100 to 1750. The radio compass is capable of providing the following:

1. Automatic visual bearing indication of the direction of arrival of radio signals and simultaneous aural reception of corresponding sound.

2. Aural reception of radio signals, using a non-directional antenna.

3. Aural-null directional indicators of the arrival of radio signals using a loop antenna.

STARTING.

1. Turn the function switch to COMP, ANT or LOOP position.

Note

The function switch position marked CONT on the control panel is not used on this installation.

STOPPING.

1. Rotate function switch to OFF.

RADAR SET — AN/APW-11.

In aircraft prior to F-84F-61RE an AN/APW-11 type radar set is installed. An AN/APW-11A type is in-

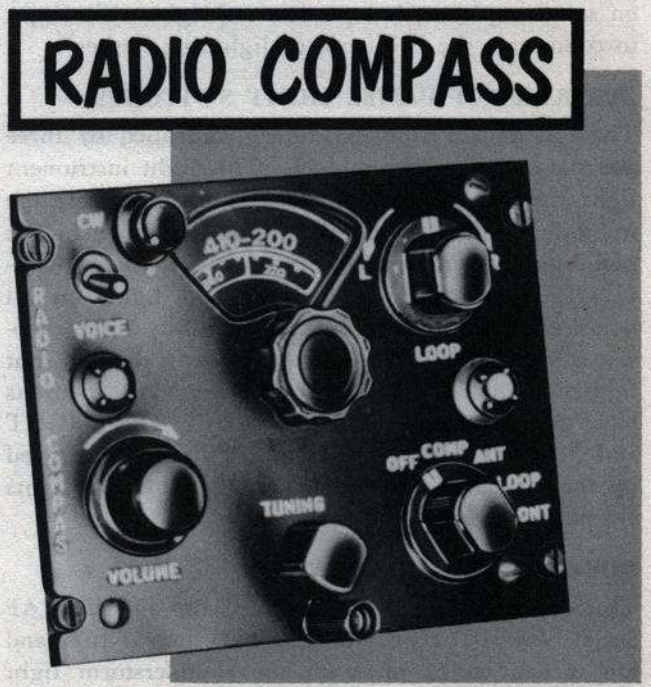


Figure 4—8

TAXI LIGHTS.

The taxi light is mounted on the nose wheel strut and is powered by the secondary bus and controlled by an ON-OFF switch (figure 4–9) located above the right console. A switch in the nose wheel well will automatically put the light out when the nose wheel is retracted.

Note

The taxi light will illuminate only when the nose gear is down and locked. Therefore, when viewed from the ground, it may be used as an indication of a safe nose gear condition.

POSITION LIGHTS.

Position lights consist of a red light on the left wing tip, a green light on the right wing tip, a yellow and a white light on the tail, and a white light on the top and the bottom of the fuselage. All lights are powered from the secondary bus and controlled by a position light switch (figure 4–9), having three positions, STEADY, OFF and FLASH. In the STEADY position the wing, tail, and fuselage lights will provide continuous illumination. In the FLASH position the wing and white tail lights will flash alternately with the yellow tail light, and the fuselage lights will be steady. The intensity of the position lights is controlled by a DIM-BRIGHT switch (figure 4–9) adjacent to the position light switch.

OXYGEN SYSTEM.

HIGH PRESSURE SYSTEM. **A and B**

The oxygen system is a high pressure system with pressure being supplied from four high pressure oxygen cylinders, installed in the forward fuselage above the battery well. The cylinders are properly check valved for combat safety, and are refilled through a single filler valve, located on the right side of the forward fuselage. The oxygen supply passes through a reducing valve which reduces pressure to approximately 400 psi, then flows to the oxygen regulator panel on the right console. Oxygen supply from the regulator to the pilot's pressure breathing demand oxygen mask passes through a quick disconnect on the front of the pilot's seat. A warning light is incorporated in the oxygen system as a visual indication of the proper functioning of the system.

Note

As an airplane ascends to high altitudes, where the temperature is normally quite low, the oxygen cylinders become chilled. As the cylinders grow colder, the oxygen gage pressure is reduced, sometimes rather rapidly. With a 100°F decrease in temperature in the cylinders the gage pressure can be expected to drop 20 per cent. This rapid fall in pressure is occasionally a cause for unnecessary alarm. All the oxygen is still there, and as the airplane descends to warmer altitude, the pressure will tend to rise again, so that the rate of oxygen usage may appear to be slower than normal. A rapid fall in oxygen pressure while the airplane is in level flight, or while it is descending, is not ordinarily due to falling temperature, of course. When this happens, leakage or loss of oxygen must be suspected.

LIQUID OXYGEN SYSTEM. **C and LATER**

A liquid oxygen system is installed in F-84F-35 and later airplanes. This system consists of five liter capacity vacuum insulated container, build-up coils, check valves, relief valves and quantity gage. Liquid oxygen is stored in the vacuum container and passes into the build-up coils. Here it evaporates into gaseous oxygen and passes into the oxygen regulator at approximately 70 psi. The oxygen system from the regulator to the pilot's oxygen mask is identical with previous airplanes. Excessive pressures in the system between the vacuum container and the regulator are relieved through the relief valves and vented overboard.

Note

The liquid oxygen quantity gage should read between 4 and 4½ liters when the system is fully charged. Do not be alarmed that the gage does not read 5 liters, since it is impossible to charge the liquid oxygen converter to 5 liters. Use the oxygen duration chart to determine your oxygen duration for the indicated supply.

REGULATOR.

An automatic pressure breathing diluter-demand oxygen regulator (figure 4–10) is installed on the right console and includes a low pressure gage and a flow indicator. The regulator automatically supplies the proper mixture of oxygen and air at all altitudes with provisions for positive pressure breathing at high altitudes and also indicates the proper functioning of the oxygen system by means of a warning light. Either Type D-1 or Type D-2 automatic pressure demand regulators may be installed. The Type D-2 regulator differs from the late Type D-1 regulator in that the slight positive pressure from 8000 to 28000 feet has been removed and a better panel and instrument lighting system has been included. The slight positive pressure has been removed to conserve oxygen. It will

INTERNAL & EXTERNAL LIGHTS



Figure 4—9

stalled in F-84F-61RE and later aircraft. These radar sets, have a higher classification than this handbook. Refer to applicable T.O.'s for detailed information.

LIGHTING EQUIPMENT.

INSTRUMENT LIGHTS.

Individual instrument ring lights are installed on each instrument and illuminate the instruments with a red light. Red instrument flood lighting is provided by a spot light mounted on each side of the canopy frame to illuminate placards and can also be used as auxiliary illumination. Thunderstorm lights are provided on some airplanes that produce a bright white light to counteract the brilliance of lightning flashes.

INSTRUMENT PANEL LIGHT SWITCHES.

The instrument panel lights are controlled by three rheostat switches (figure 4–9). The flight instrument light rheostat is marked FLIGHT and controls the individual lights on all the flight instruments. The non-flight instrument light rheostat is marked NON-FLIGHT and controls the individual lights on all non-flight instruments. The red auxiliary light rheostat is marked AUXILIARY and controls the two spot lights mounted on the canopy frame. All rheostats have two positions OFF and BRIGHT. The FLIGHT and NON-FLIGHT instrument lights are energized by the secondary bus while the AUXILIARY lights are powered from the primary bus.

THUNDERSTORM LIGHT SWITCH.

Thunderstorm lights are installed on airplanes AF Serial Nos 51-1621, 51-1622, 51-1623 and 51-1624 and are turned on or off with the thunderstorm light switch located above the right console. The switch is a two position switch marked STORM LTS ON and an unmarked off position. The thunderstorm lights are powered from the primary bus.

CONSOLE AND INSTRUMENT PANEL LIGHTS.

The left console is lighted by three incandescent lights covered with red filters and mounted above the console. The placards on the instrument panel and on the right console are lighted with incandescent lights used in conjunction with plastic panels. These lights are energized by the secondary bus and are controlled by a rheostat switch (14, figure 1–9; 6, figure 1–14) marked CONSOLE LIGHTS with three positions, OFF, DIM and BRIGHT.

CABIN LIGHT.

A type C4A cabin light (7, figure 1–12; 7, figure 1–13) is mounted on the right side of the cabin. The light is provided with an extension cord and it may be removed from its mounting bracket to be used as a portable light. The light is powered by the primary bus and controlled by a rheostat switch located on the light. The rheostat switch controls the intensity of the light for continuous illumination. A push button type switch on the light may be used for intermittent light use. The light is equipped with a red filter which may be removed and the light used as a white spot light.

LANDING LIGHTS.

A landing light, mounted on an electrically retracted door is installed on each wing tip. The door and light are both actuated with power from the primary bus and controlled by a landing light switch.

LANDING LIGHTS SWITCH.

The landing light switch (33, figure 1–4; 33, figure 1–5; 33, figure 1–6) has three positions EXTEND & ON, OFF and RETRACT. The EXTEND & ON position opens the doors and turns the landing lights on. The OFF position will turn the lights off if the doors are open but the doors will not retract. The RETRACT position retracts the landing lights to the fully closed position.

CREW MEMBER OXYGEN DURATION — HOURS

CABIN ALTITUDE FEET	GAGE PRESSURE — P.S.I. 1800	1600	1400	1200	1000	800	600	400	BELOW 400
40,000	15.2	13.3	11.4	9.5	7.6	5.7	3.8	1.9	EMERGENCY Descend to Altitude Not Requiring Oxygen
	15.2	13.3	11.4	9.5	7.6	5.7	3.8	1.9	
35,000	11.2	10.1	8.6	7.2	5.7	4.3	2.8	1.4	
	11.2	10.1	8.6	7.2	5.7	4.3	2.8	1.4	
30,000	8.3	7.3	6.2	5.2	4.1	3.1	2.0	1.0	
	8.1	7.1	6.1	5.1	4.1	3.0	2.0	1.0	
25,000	7.8	6.8	5.8	4.8	3.9	2.9	1.9	0.9	
	6.3	5.5	4.7	3.9	3.1	2.4	1.6	0.8	
20,000	8.9	7.8	6.7	5.6	4.5	3.3	2.2	1.1	
	4.7	4.1	3.5	2.9	2.3	1.7	1.1	0.6	
15,000	10.8	9.5	8.1	6.8	5.4	4.0	2.7	1.4	
	3.8	3.3	2.8	2.3	1.9	1.4	0.9	0.4	
10,000	14.3	12.5	10.7	8.9	7.2	5.4	3.6	1.8	
	3.0	2.6	2.3	1.9	1.5	1.1	0.7	0.3	

High Pressure Oxygen Duration Chart

UP TO F-84F-35

BLACK FIGURES Indicate Diluter Lever Normal

RED FIGURES Indicate Diluter Lever "100%"

1 Crew Member
4 Type AN6025-AX205 Cylinders

Liquid Oxygen Duration Chart

F-84F-35 AND LATER AIRCRAFT

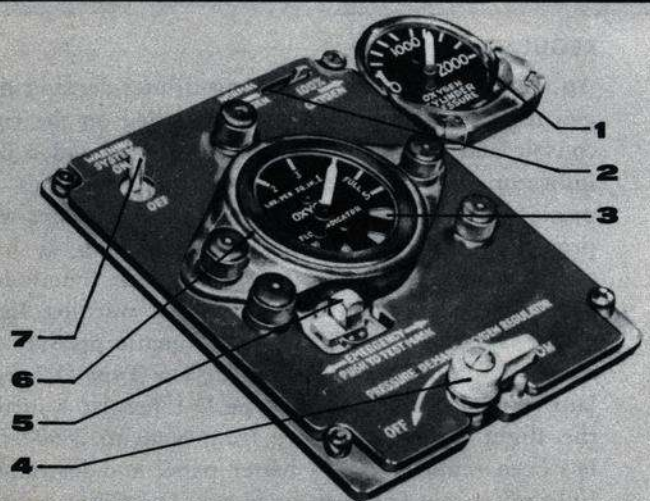
BLACK FIGURES Indicate Diluter Lever Normal

RED FIGURES Indicate Diluter Lever "100%"

1 Crew Member
1 Type A-3 Converter

CREW MEMBER OXYGEN DURATION — HOURS

CABIN ALTITUDE FEET	GAGE QUANTITY — LITERS 5	4	3	2	1	BELOW 1
40,000	24.0	19.2	14.4	9.6	4.8	EMERGENCY Descend to Altitude Not Requiring Oxygen
	24.0	19.2	14.4	9.6	4.8	
35,000	24.0	19.2	14.4	9.6	4.8	
	24.0	19.2	14.4	9.6	4.8	
30,000	17.3	13.8	10.4	6.9	3.5	
	17.8	14.2	10.6	7.1	3.5	
25,000	13.3	10.6	8.0	5.3	2.7	
	16.8	13.4	10.0	6.7	3.4	
20,000	10.1	8.1	6.1	4.0	2.0	
	19.0	15.2	11.4	7.6	3.8	
15,000	7.8	6.2	4.6	3.1	1.5	
	23.0	18.4	13.8	9.2	4.6	
10,000	6.6	5.3	4.0	2.6	1.3	
	23.0	18.4	13.8	9.2	4.6	



Oxygen Regulator

1 *High Pressure Oxygen Gage (up to F-84F-35)*
Liquid Oxygen Quantity Gage (F-84F-35 and later)
2 *Regulator Diluter Level*
3 *Oxygen Flow Indicator*
4 *Oxygen Supply Shut-off Lever*
5 *Oxygen Emergency Toggle Lever*
6 *Low Pressure Gage*
7 *Oxygen Waring System Switch*

Figure 4—10.

be noted in the oxygen duration chart that an increasing number of manhours of oxygen is available above 25000 feet altitude when operating with the diluter lever in the NORMAL OXYGEN position. This is caused because with increasing altitude, the volume of an equivalent mass of air at sea level increases, the regulator attempts to maintain a constant mass of flow of oxygen to the lungs by increasing the oxygen flow from the oxygen system and decreasing accordingly the amount of air mixed with the oxygen. Beyond the altitude at which 100 per cent oxygen is being used, further expansion of the gas will occur and, unless a pressurized system is used, the lungs cannot expand sufficiently to absorb the normal oxygen consumption. Therefore, even with a pressurized system though not as soon, an altitude will be reached beyond which less and less mass will be absorbed because of the continually expanding gas.

REGULATOR DILUTER LEVER.

The regulator diluter lever (figure 4–10) has two positions, NORMAL OXYGEN and 100% OXYGEN. When the lever is in the NORMAL OXYGEN position, the regulator unit will function to provide automatic mixing of air and oxygen in sea level concentration at all altitudes. In the event that the regulator malfunctions, a pressure relief valve in the regulator unit will protect the pilot from excessive pressure. When the lever is in the 100% OXYGEN position, the automatic air-oxygen mixing feature is by-passed and 100 per cent oxygen is supplied regardless of altitude.

OXYGEN SUPPLY SHUT-OFF LEVER.

An ON-OFF oxygen supply shut-off lever (figure 4–10) is located on the aft end of the regulator. When the lever is in the ON position, system oxygen is supplied to the regulator unit. When the lever is in the OFF position the oxygen supply to the regulator is shut-off to prevent any flow of oxygen from that unit when not in use.

OXYGEN EMERGENCY TOGGLE LEVER.

The oxygen emergency toggle lever (figure 4–10) is provided for emergency operation or to supply maximum pressure for leakage test of the oxygen mask. When the lever is in the EMERGENCY position (either to the right or left from the normal off position), oxygen is supplied to the mask at a fixed pressure increase over that being supplied automatically. This will provide an increased flow of oxygen in any emergency. When the lever is pushed straight into the test mask position, maximum pressure is delivered at the outlet regardless of altitude, for leakage test of the oxygen mask. The lever will return to the off position when released. In the off position, oxygen flow is controlled automatically by the regulator unit.

OXYGEN WARNING SYSTEM SWITCH.

An ON-OFF switch (figure 4–10) is provided on the regulator to control the oxygen warning system. When the switch is in the ON position, power is supplied from the primary bus to the warning light circuit. In the OFF position the warning light circuit is de-energized.

HIGH PRESSURE GAGE. **A and B**

The high pressure gage (figure 4–10) indicates the pressure in the oxygen system before it is reduced. Maximum operation pressure of high pressure system is 1800 psi and the gage scale indicates pressures from 0 to 2000 psi.

LOW PRESSURE GAGE.

The low pressure gage (figure 4–10) incorporated in the oxygen regulator unit records the oxygen pressure being supplied to the regulator. The gage scale reads from 0 to 500 psi. The maximum operating pressure is 450 psi for the high pressure system and approximately 70 psi for the liquid oxygen system. Tolerance and operating conditions can cause this pressure to vary between 65 and 115 psi in the liquid oxygen system.

OXYGEN QUANTITY GAGE. **C and LATER**

An oxygen quantity gage (figure 4–10) is installed on the right console of F-84F-35 and later airplanes to record the amount of liquid oxygen remaining in the vacuum container. The gage is calibrated to read from 0 to 5 liters. The quantity gage may fluctuate approximately 1 liter while taking deep breaths. Fluctuation and erratic indications may be expected during maneuvers and while flying in rough air. Excessive engine vibration, etc. may also cause fluctuation. The gage will register 5 liters during and immediately after servicing. After the vent and build up valve is positioned in the BUILD-UP position, the gage will register erratic, false indications for approximately 30 minutes. A full converter will then indicate only approximately 4½ liters due to the vapor loss resulting from heat generated during servicing. Use the oxygen duration chart to determine your oxygen duration for the indicated supply.

OXYGEN FLOW INDICATOR.

A blinker type oxygen flow indicator (figure 4–10) is incorporated in the pressure demand regulator unit. Black and luminescent segments alternately appear through four slots in the indicator face with each breath taken through the oxygen mask.

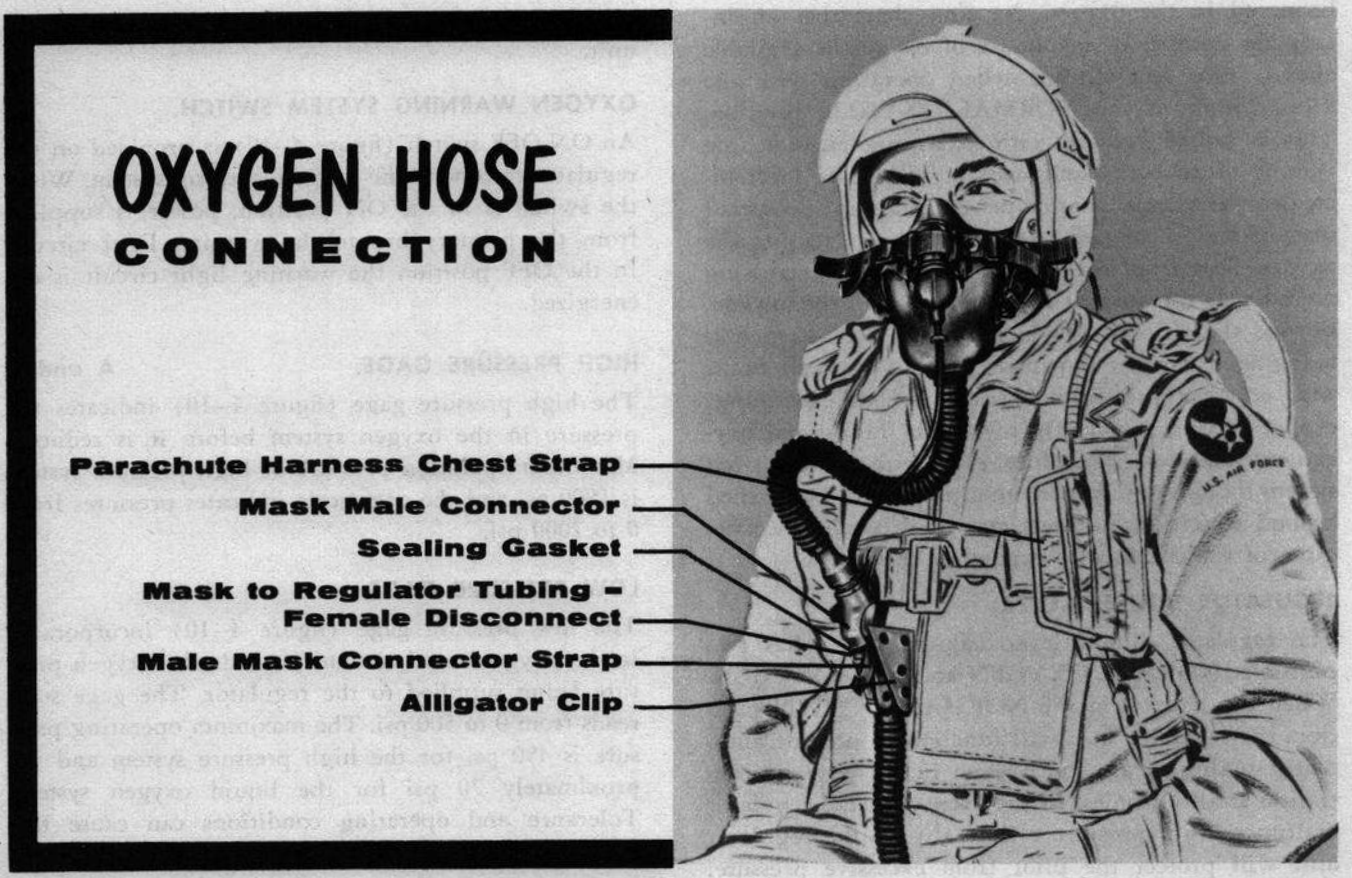


Figure 4—11

OXYGEN SYSTEM WARNING LIGHT.

An oxygen system warning light (figures 4—22, 4—23 and 4—24) labeled OXYGEN WARNING is provided to indicate the functioning of the oxygen system. A dim continuous glow from the light indicates the pilot is breathing normally through the mask. A bright continuous illumination of the light indicates either a zero flow, or a continuous flow of oxygen through the regulator. This would result when the oxygen supply lever is in the ON position and the regulator is unused at high altitude, or when the regulator emergency toggle is pushed to EMERGENCY position, or the regulator diluter lever is at 100% OXYGEN and the regulator unused at any altitude. Breaking of the disconnect between the mask to regulator tubing, or any large leak between the regulator and the pilot will cause the light to come on brightly.

Note

At altitudes below 10000 feet with the oxygen regulator operating and the mask being used, the light may blink brightly or glow continuously dim. Since this condition may occure only at low altitudes, it should not cause undue concern, as either condition indicates satisfactory operation at low altitudes.

PRESSURE DEMAND OXYGEN MASKS.

Only the type A-13, A-13A or MS22001 pressure demand oxygen mask will be used with the automatic pressure demand oxygen regulator. These masks can be identified by the presence of a gray anodized aluminum exhalation valve (pressure-compensating), which is located in the mask directly below the chin position. Pressure demand masks, when used at altitude, will occasionally produce a distinct vibration in the mask that can be identified by a "wheezing" sound. This condition may be overlooked, in that operational qualities are not disturbed in any manner. If a blocking condition (cannot exhale) occurs during flight, a "sharp" exhalation will usually correct the difficulty. In the event a "sharp" exhalation does not relieve the blocking condition, the mask may be lifted off the face momentarily at the chin section. Extreme caution must be exercised in using this procedure, since the danger of hypoxia increases rapidly above 30000 feet cabin altitude. Oxygen masks other than those specified above will not be used with automatic pressure demand oxygen regulators. Use of unauthorized oxygen masks results in rapid depletion of the aircraft oxygen supply, and pressure breathing required at altitude will be lost.

USE OF AUTOMATIC PRESSURE DEMAND REGULATOR.

1. The diluter lever will always be set at the NORMAL OXYGEN position, except in cases where noxious gases are suspected, or pre-breathing of oxygen is deemed necessary. These exceptions are rare, and if the diluter lever is placed in the 100% OXYGEN position, extreme care must be exercised in monitoring the oxygen supply.

2. Turn oxygen supply shut-off lever to the ON position.

3. Place the oxygen warning system switch in the ON position.

4. Press oxygen emergency toggle lever straight in to test mask for leakage at any altitude. Place lever to right or left of the normal off position to provide an increased flow of oxygen only in case of emergency. If emergency use is necessary, however, extreme caution must be used to prevent rapid loss of system pressure through the emergency valve.

5. As breathing through the mask is started, the warning light should blink brightly a few seconds and then change to a dim continuous glow, and the oxygen flow indicator should start functioning. The proper flow of oxygen will be automatically maintained by the regulator unit.

OXYGEN SYSTEM CHECK.

ALL FLIGHTS.

The pilot will check the cabin oxygen system pressure gage before take-off, and there will not be less than 1800 psi pressure in the system. If there is less than 1800 psi pressure, the oxygen system will be charged to capacity prior to flight.

OXYGEN REGULATOR CHECK.

Check the oxygen regulator prior to take-off with the diluter valve first at the NORMAL OXYGEN position and then at the 100% OXYGEN position as follows:

1. Remove mask and blow gently into the end of the oxygen regulator hose as during normal exhalation. If there is a resistance to blowing, the system is satisfactory. Little or no resistance to blowing indicates a faulty demand diaphragm or diluter air valve, a leaking mask-to-regulator tubing, or a faulty ejection seat quick disconnect.

2. Place oxygen warning system switch in the ON position. Warning light should emit a bright (steady or blinking) light. Move emergency toggle lever from center to left or right position. The warning light should change from a bright light, to a filament glow, and back to a bright light. Return emergency toggle-lever to center (off) position.

3. With oxygen supply shut-off lever in the ON position, oxygen mask connected to regulator, diluter lever in 100% OXYGEN position, and normal breathing, conduct the following check:

   a. Observe warning light for proper operation. Warning light should change from bright to a dim filament glow.

   b. Deflect emergency toggle lever to right or left. A positive pressure should be supplied to mask. Return emergency toggle lever to center position.

   c. Depress emergency toggle lever straight in. A positive pressure should be applied to the mask. Hold breath to determine if there is leakage around mask. Release emergency toggle lever, positive pressure should cease.

4. Return diluter lever to NORMAL OXYGEN.

EMERGENCY OPERATION.

1. With symptoms of anoxia, or if smoke or fumes should enter the cabin, immediately place the regulator diluter lever in the 100% OXYGEN position and place the emergency lever in the EMERGENCY position.

2. In the event of accidental loss of cabin pressure, no action is required if oxygen is being used, as the regulator unit will automatically compensate for the increased cabin altitude.

3. If the oxygen regulator should become inoperative, pull the cord of the H-2 emergency oxygen cylinder, and descend to a cabin altitude not requiring oxygen.

AIR REFUELING SYSTEM.

The airplane is equipped with an air refueling system (figure 4–12) which enables the airplane to be refueled in the air from a tanker using a flying boom. The receiver is located on the left wing upper surface and is concealed by a flush type door, which is hydraulically operated. During the refueling operation, the engine is operated with the fuel tank selector in the ALL TANKS position, so that the engine is fed from the main tank. The forward, wing, main and pylon tanks are filled during the refueling cycle. Once the receiver door in the wing is open and the tanker's boom is inserted in the nozzle, refueling sequence is accomplished electrically through an amplifier, which is powered from the primary bus. When the tanks are full, the fuel flow in the refueling lines is reduced to an amount equal to the engine consumption and the fuel pressure in the lines increases. These changes are noted in the tanker airplane and a disconnect is effected. An automatic disconnect will be accomplished if the fuel pressure is excessive in the refueling lines.

AIR-REFUELING SYSTEM

SCHEMATIC

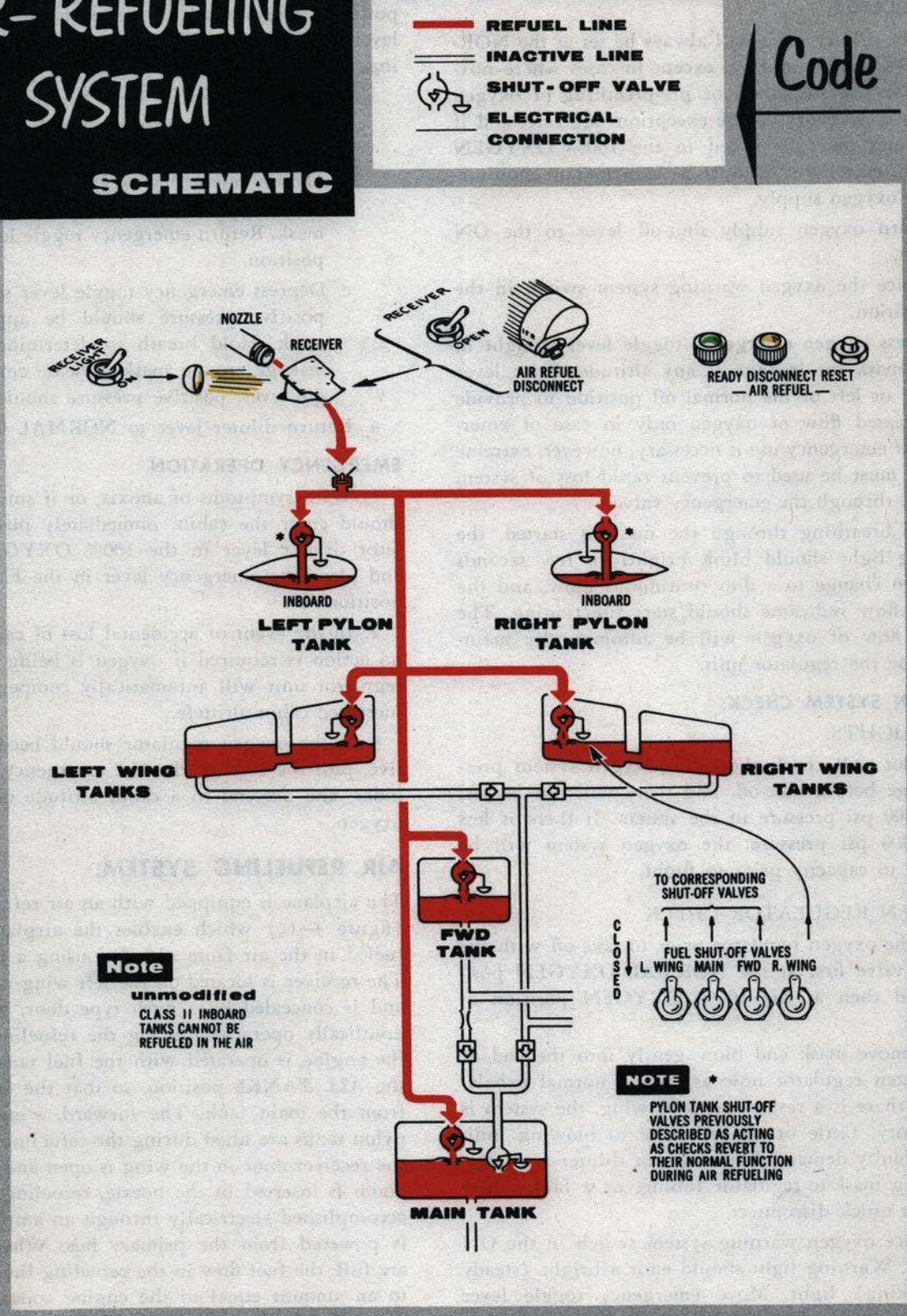


Figure 4-12



Figure 4—13

if rough air causes excessive tension on the nozzle, or by any uncontrolled or intentional change in flight attitude of the receiver airplane wherein a conical ange of 15° from the normal is exceeded. Provision is made so that the forward, main or wing tanks can be isolated, if damaged, from the refueling system. In the event the main tank is damaged and is shut-off during refueling, operation can be accomplished with the fuel tank selector in the WING AUX or FWD AUX position. On F-84F-55RE and later aircraft an air refueling amplifier override switch provides an alternate method of shutting off hydraulic power to the air refueling receptacle nozzle latches, thereby releasing the tanker's nozzle and effecting a disconnect in the event of amplifier failure or malfunction.

RECEIVER SWITCH.

The air refueling receiver switch (30, figure 1—16) is a two-position toggle switch marked OPEN and an unmarked position. The OPEN position unlocks and opens the receiver door and retracts the nozzle latches hydraulically, opens the pylon tank vent valves and cuts off power to the tank-pressurization circuit, and also supplies d-c power from the primary bus to the refueling amplifier, an electronic device that automatically controls the air refueling cycle by control signals from the tanker aircraft received through the signal coil in the nozzle. The ready indicator light will illuminate when the receiver door is opened. The unmarked position closes and locks the receiver door hydraulically, closes the pylon tank vent valves, restores power to the tank pressurization circuit and disconnects the power supply to the refueling amplifier.

NOZZLE DISCONNECT SWITCH.

The gun-bomb-rocket sight caging switch (figure 1—17) on the throttle control, is used as the nozzle disconnect switch when refueling in the air. The caging switch is in the air refueling circuit only when the receiver switch is in the OPEN position. The switch is depressed to IFR DISCONN if it is desired to end the refueling cycle before the fuel tanks are full. Depressing the nozzle disconnect switch illuminates the disconnect indicator light, causes the tanker pumps to shut down, closes the fuel valves, signals the tanker operator that a disconnect has been made and releases the refueling boom from the receiver nozzle.

AMPLIFIER OVERRIDE SWITCH. **G and LATER**

An air refueling amplifier override switch (figure 4—13) is installed on F-84F-55 and later aircraft. The switch is used in conjunction with the nozzle disconnect switch to effect a disconnect in the event of amplifier malfunction. The amplifier override switch is a two-position switch marked NORMAL and AMPLIFIER OVERRIDE. During the normal refueling cycle the switch is left in the NORMAL position and the air refueling system power and actuating signals function automatically through the amplifier and the entire air refueling sequence is an automatic operation after contact is made. When the amplifier override switch is placed in the AMPLIFIER OVERRIDE position, and the nozzle disconnect switch is depressed, the amplifier is disconnected from the electrical circuit and electrical power to the hydraulic power control solenoid is disconnected. This unlocks the nozzle latches and effects a disconnect. Electrical signals cannot be exchanged through the receiver and tanker nozzle induction coils to automatically signal the tanker for disconnect and pump shut down with the amplifier override switch in the AMPLIFIER OVERRIDE position.

RESET SWITCH.

The air refueling reset switch (figure 4—13) is a push button switch spring-loaded to the off position. If at any time during a refueling cycle the airplane becomes disconnected and the disconnect indicator light illuminates the airplane is made ready for refueling again by depressing the reset switch to the RESET position. The refueling system can also be made ready for refueling by closing then reopening the receiver door.

Note

Holding the reset button in the depressed position during nozzle contact in a refueling operation will cut off power to the refueling amplifier and cause a disconnect.

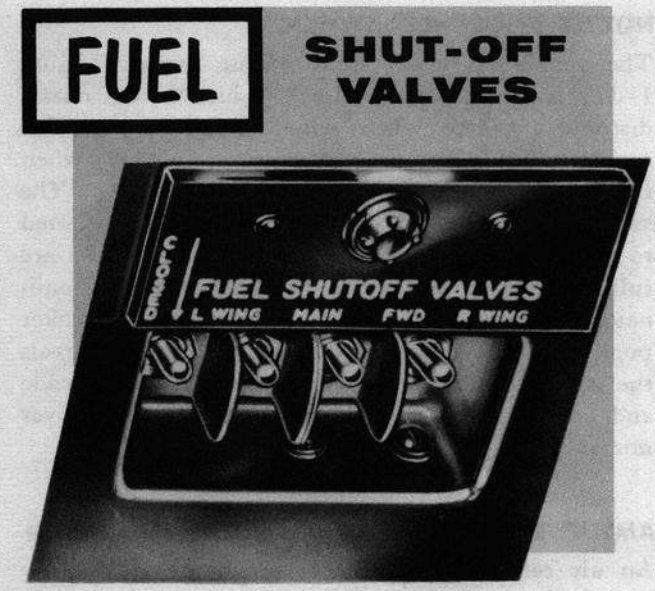


Figure 4—14

RECEIVER LIGHT SWITCH.

The air refueling receiver light switch (figure 4—13) is a toggle switch with an ON and an unmarked position. The ON position supplies power from the primary bus to illuminate a flood light on the side of the aircraft which lights up the receiver nozzle to aid the boom operator in the tanker during night refueling operations. The light can also be used as a formation light at night.

FUEL SHUT-OFF VALVES.

The same fuel lines are used for transfer of fuel from the external to the internal tanks as is used to supply all tanks during air refueling. The fuel shut-off valves (figure 4—14) provide a means of controlling fuel flow to the individual internal tanks by closing a valve at the fuel line entrance to the tank. Each of the four fuel shut-off valves is controlled by a two-position toggle switch. The switches are marked L WING, MAIN, FWD and R WING with an arrow indicating the CLOSED position. During normal operation the switches are left in the up position, which allows fuel to transfer from the external to the internal tanks and also allows all tanks to be refueled from the refueling receptacle. By placing the fuel shut-off valve in the CLOSED position the respective fuel tank will not receive fuel by transfer or air refueling. When the main fuel shut-off switch is in the CLOSED position both valves in the main tank are closed and fuel from neither internal nor external tanks can be transferred. This system is provided to isolate each of the internal tanks, in the event of battle damage to the tank, or failure of the booster pump in the tank. The fuel shut-off valves are actuated by the primary bus.

READY INDICATOR LIGHT.

The ready indicator light (figure 4—13) powered by the primary bus is a green light marked READY and when illuminated indicates that the receiver nozzle is open, power is supplied to the refueling amplifier and the amplifier is ready for the refueling cycle. The ready indicator light will go out when contact is made.

DISCONNECT INDICATOR LIGHT.

The air refueling disconnect indicator (figure 4—13) powered by the primary bus is an amber light marked DISCONNECT. Illumination indicates the tanker's fuel pumps are shut down, the tanker's fuel valves are closed and that the boom nozzle has been disconnected from the receiver. If the disconnect indicator is illuminated the reset switch must be depressed or the receiver door closed and reopened before the refueling system will be ready to make another refueling cycle.

AIR REFUELING SYSTEM OPERATION.

NORMAL OPERATION.

(See figure 4—15.)

OPERATION WITHOUT HYDRAULIC PRESSURE. **A thru J**

In the event of hydraulic system failure, continuous hand pumping is required during air refueling if automatic refueling is desired. Hand pump actuation at the rate of approximately nine cycles per minute should be adequate for maintaining sufficient pressure in the system to keep the refueling boom latches engaged. In the event hand pumping during the re-fueling operation is not desired or is impractical, refueling may be accomplished by the following procedure:

1. Open the refueling receptacle by means of hand pump actuation.

2. Make contact with the refueling boom. Hand pump actuation is not required during this operation if the refueling receptacle maintains an open position.

3. Advise tanker by radio communication to begin manual refueling.

4. Maintain contact with the refueling boom by power control manipulation. Since the hydraulically operated refueling boom locking latches are ineffective without hydraulic pressure, boom contact must be maintained by constant thrust of the receiver aircraft.

5. Breakaway when advised by boom operator that refueling is complete.

6. Close refueling receptacle by means of hand pump actuation.

BATTLE DAMAGE.

If the main, forward or wing tanks have been dam-

aged and it is desired to refuel, these tanks may be isolated from the refueling system by placing the desired fuel shut-off valve in the CLOSED position. Refuel as in normal operation.

AUTOMATIC PILOT.

An MB-2 automatic pilot is installed in some airplanes. The autopilot will automatically hold the airplane on any predetermined course and altitude, change course at will with an exact coordinated turn, maintain the airplane at a selected altitude and pitch trim in laterally straight level flight or at a desired angle of climb or dive up to 45 degrees, and hold a fixed radius in climbing turns and dives. Changes in airspeed are automatically compensated for and control surface displacement is regulated in relation to airspeed and altitude. Automatic control originates in an a-c powered gyroscopic unit which includes a vertical and a directional gyro as references. The vertical gyro establishes a flight reference about the lateral and longitudinal axis of the airplane while the directional gyro establishes a reference for the airplane's directional course in relation to the earth's magnetic field. Error signals are transmitted from both the vertical and directional gyros to the autopilot system for any deviation of the aircraft in flight. The autopilot

AIR REFUELING SYSTEM

OPERATION

1. Approach tanker at selected altitude and speed.

2. Fuel tank selector ALL TANKS unless operation is necessary in auxiliary.

3. Pneumatic compressor switch OFF.

4. Receiver switch OPEN. Ready indicator light on.

5. Receiver light switch ON if refueling operation is at night.

6. Ready indicator light will go out after contact is made.

7. After refueling check disconnect indicator light on.

8. If the disconnect indicator light illuminates before refueling is completed, depress the reset switch.

Note

A disconnect may be accomplished at any time by depressing the disconnect switch.

9. Receiver switch, up position after refueling is completed.

Note

Fuel system operation is normal after the receiver door is closed.

10. Pneumatic compressor switch ON.

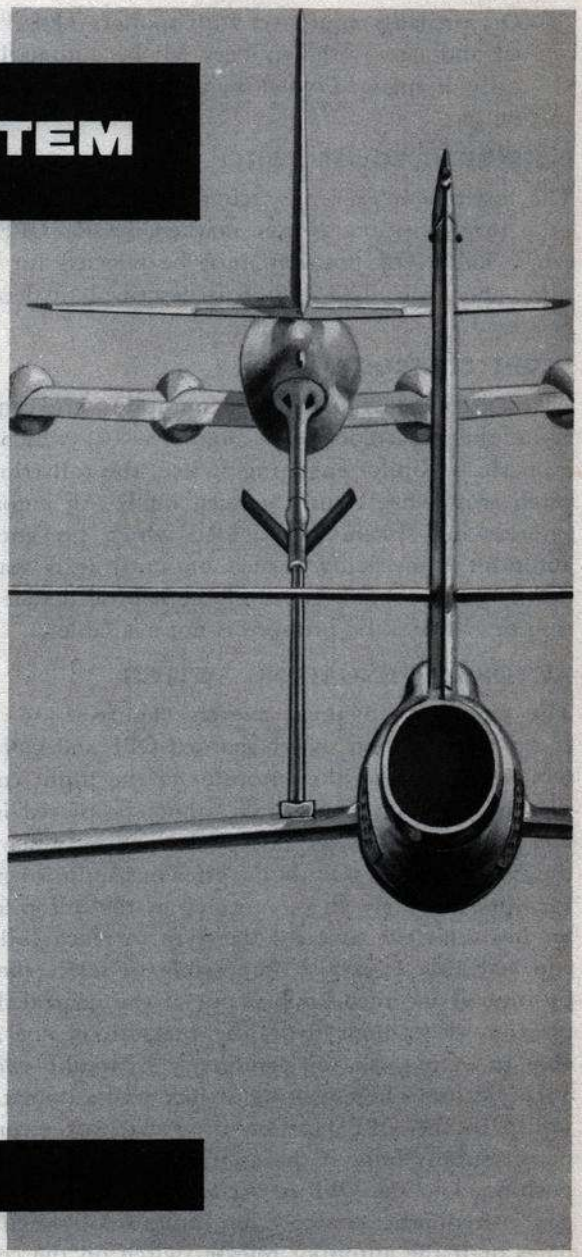


Figure 4—15

compensates and corrects for these errors through the flight controls. An automatic altitude control senses changes in pressure and when engaged will maintain the airplane at a constant altitude. The automatic pilot can be easily overpowered manually at any time by the human pilot or it can be immediately disconnected by means of the autopilot release switch. If the autopilot is engaged with the aircraft in a wing-level climb or dive, the aircraft will continue on course in the climb or dive. However, if the aircraft is in a turn when the autopilot is engaged, a rapid roll to level attitude will take place as there is no roll synchronization.

Note

On airplanes equipped with spoilers (F-84F-45 and later), the spoilers wil be automatically disengaged when the autopilot is turned on.

INSTRUMENT POWER SWITCH.

The instrument power switch (figures 1–7 and 1–8) is a three-position switch marked NOR, OFF and ALT. The NOR position must be selected for autopilot operation. This switch is described in detail in Section I.

FLIGHT CONTROLLER.

All control functions of the autopilot are centered about the flight controller (figure 4–16) which contains the autopilot engaging switch, the roll trim and pitch trim wheels and the turn knob. An automatic interlocking system is provided which prevents the autopilot from being turned on until it is warmed up, if the turn knob is out of the neutral detent position or if hydraulic pressure is not available.

AUTOPILOT ENGAGING SWITCH.

The autopilot engaging switch (figure 4–16) is a rotary two-position switch marked OFF and ON. The ON position locks the autopilot to the flight control system. The engaging switch cannot be placed in the ON position unless the instrument power switch is in the NOR position and the inverter bus supplied power for approximately three minutes to the autopilot allowing sufficient time for the gyro to reach full rpm and stabilize. It is also impossible to select the ON position if the turn knob is out of the neutral detent position or enough hydraulic pressure is not available to extinguish the emergency hydraulic controls on indicator. The engaging switch will automatically return to the OFF position if primary or secondary power supply fails, if the instrument power switch is positioned to the OFF or ALT position, if the emergency hydraulic controls on indicator light illuminates or if the autopilot release switch on the control stick is depressed.

PITCH TRIM WHEEL.

The pitch trim wheel, (figure 4–16) located on the left and right side of the flight controller and marked DN and UP, controls the pitch attitude of the airplane. If either pitch trim wheel is rotated aft for nose up and forward for nose down trim, the airplane will maintain the selected attitude. The pitch trim is limited to a climb or dive angle of approximately 45 ±5 degrees from the horizontal plane. The wheels may be rotated as rapidly as required, consistent with structural limitations and pilot comfort.

ROLL TRIM WHEEL.

The roll trim wheel (figure 4–16) marked ROLL TRIM, controls the lateral trim of the airplane. If the roll trim wheel is rotated clockwise for right wing down or counter-clockwise for left wing down the airplane will maintain a selected trim. The roll trim is limited to approximately ±5 degrees from level flight.

TURN KNOB.

The turn knob is a rotary switch marked LIFT TO TURN and has two extreme positions to the left and right of neutral marked L and R. If the turn knob is in the neutral detent position, it must be lifted before it can be turned to the L or R positions. When rotated to the L or R position the airplane will make a coordinated turn to the left or right. The airplane will lock onto the directional heading it is taking at the time the turn knob is returned to the detent position. The bank angle is governed by the degree of right or left rotation of the turn knob from the neutral position. The bank angle is held to a maximum of 45 ±5 degrees from wing level flight position. The autopilot cannot be engaged if the turn knob is out of the neutral detent position.

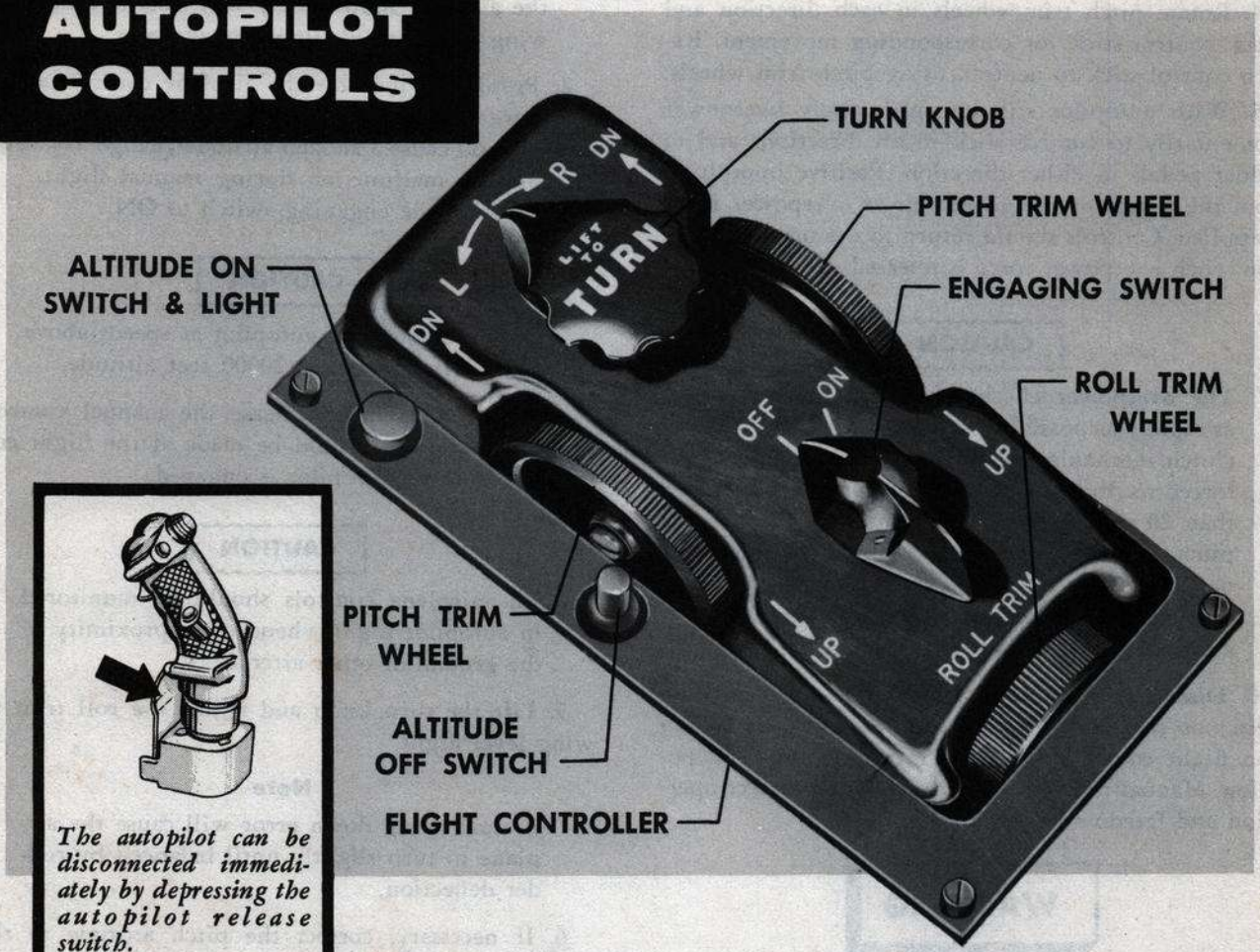
AUTOPILOT RELEASE SWITCH.

An autopilot release switch (figure 4–16) is installed on the forward side of the control stick. This is a spring-loaded switch and when depressed, automatically disengages the autopilot from the control system. The autopilot engaging switch, on the flight control, will automatically return to the OFF position when the release switch is depressed.

ALTITUDE CONTROL SWITCHES.

The automatic altitude control consists of two momentary push button switches (figure 4–16), one marked ALTITUDE ON and the other ALTITUDE OFF. When the ALTITUDE ON switch is depressed, the automatic altitude control will hold the airplane to within ±30 feet or ±.1 per cent of indicated altitude or ±10 per cent of indicated airspeed in feet, whichever is greater in level flight. During climbs,

AUTOPILOT CONTROLS



The autopilot can be disconnected immediately by depressing the autopilot release switch.

Figure 4—16

dives or turns the altitude should be held to within ±100 feet. The automatic altitude control can be switched off by depressing the ALTITUDE OFF switch or by disconnecting the autopilot from the control system.

ALTITUDE CONTROL INDICATOR LIGHT.

The altitude control indicator light (figure 4—16) is incorporated with the altitude on switch. The light will illuminate when the altitude on switch is depressed and remains on as long as the automatic altitude control is in operation. Rotating the knurled rim of the light increases or decreases the intensity of the light for pilot comfort.

GROUND TEST.

Check autopilot operation as follows:

1. With flight controls in neutral and turn knob in detent, turn engaging switch to ON. When the autopilot is engaged on the ground, a slight oscillation of the control may be expected. This is normal and should not be encountered with air loads on the control surfaces when in flight. There should be no appreciable movement of the control stick or rudder pedals. A very slight momentary "kick" is permissible but there should be no movement to a new position.

Note

The engaging switch cannot be moved to the ON position unless the instrument power switch is in the NOR position, the primary and secondary busses are energized for approximately 3 minutes, and hydraulic pressure is sufficient to extinguish the emergency hydraulic controls on indicator light.

2. Rotate roll trim wheel in each direction and check control stick for corresponding movement. Spoilers shoud not operate. Return ailerons to neutral by rotating roll trim wheel as required.

3. Lift turn knob out of neutral detent. There should be no appreciable movement of the control stick or rudder pedals. Rotate turn knob in each direction and check control stick for corresponding movement. There should be no perceptible rudder movement.

4. Rotate pitch trim wheels in each direction and check control stick for corresponding movement. Return control stick to neutral, using pitch trim wheels.

5. With autopilot still engaged, apply overpower momentarily to control stick in all directions and to rudder pedals in either direction. Positive opposition from the autopilot should be felt as overpower force is applied. Controls should return to the original position when overpower force is released.

CAUTION

The overpower check should be performed as rapidly as possible to avoid overheating the clutch mechanism. The clutch should not be forced to slip continuously for periods longer than 20 seconds out of every minute. In the pitch axis the overpower should be held only for a few seconds as the automatic trim will cause the trim to oppose the overpower, and if sustained will give full opposing trim.

6. Disengage the autopilot by depressing the release switch on the control stick. Autopilot engaging switch (on flight controller) should return to the OFF position. Manually check flight controls for correct operation and freedom of movement.

WARNING

During preflight check out operations automatic trim is in operation. At the conclusion of the preflight check out, the controls will be at an undetermined position that may include either extreme. Trim must be checked and reset before take-off. Aileron and rudder neutral position can be determined by the aileron and rudder neutral trim indicator lights. The control stick should be centered for stabilator neutral.

INFLIGHT OPERATION.

NORMAL ENGAGEMENT.

1. Trim the airplane for wing level flight, desired pitch trim and directional heading. Maintain stabilized flight for a few seconds.

Note

Automatic synchronization in pitch and in yaw permits the autopilot to be engaged on any heading and in any pitch attitude up to 45 degrees from level flight, without airplane attitude change. If engagement is made when the airplane is not in a wing level attitude, the airplane immediately will assume a near wing level attitude upon engagement.

2. Prepare to monitor the airplane controls and to overpower the autopilot, if necessary, in case engagement should cause a sudden attitude change as a result of autopilot malfunction during manual flight.

3. Position the engaging switch to ON.

CAUTION

Do not engage the autopilot at speeds above 425 knots IAS below 20000 feet altitude.

4. After engagement, release the manual controls. Control operations should be made at the flight controller while the autopilot is engaged.

CAUTION

The airplane controls should be monitored in autopilot flight whenever in proximity to the ground or other aircraft.

5. Lift the turn knob and adjust the roll trim for wing level flight.

Note

A small wing down error will cause the airplane to turn slightly until balanced by rudder deflection.

6. If necessary, correct the pitch attitude to that desired by means of the pitch trim wheels.

7. For heading correction, fly a coordinated turn to the desired new heading by means of the autopilot controls.

ENGAGEMENT OF AUTOMATIC ALTITUDE CONTROL.

Automatic altitude control is engaged by depressing the altitude on switch. The indicator light illuminates and stays on while the control is in the autopilot circuit.

Note

Automatic altitude control can be engaged in dive or climb. The airplane will return to and hold the altitude at which the switch is operated. Smoothest "lock-on" of altitude control is made with the airplane in level flight at the desired altitude.

CAUTION

If the altitude control is engaged in a steep dive or climb, the clutch in the altitude unit may slip and the aircraft will level at an



Figure 4—17

altitude below or above the desired altitude at some discomfort to the pilot.

DISENGAGEMENT OF AUTOPILOT.

1. Allow the autopilot to fly the airplane on a straight course for a short time following any autopilot controlled maneuvers. This will insure that the autopilot circuits have stabilized on the present altitude and heading.
2. Monitor the airplane controls, prepare to take immediate corrective action if necessary.
3. Place the engaging switch in the OFF position.

Note

The autopilot can be disengaged by depressing the release switch on the control stick. The engaging switch will automatically return to the OFF position.

NAVIGATION EQUIPMENT.

SLAVED GYRO MAGNETIC COMPASS.

A type J-2 slaved gyro magnetic compass is installed in the airplane which provides visual indication of the magnetic heading of the airplane. The indication is read on an indicator (6, figure 1—4; 5, figure 1—5; 5, figure 1—6) hose operation is governed by a gyro whose spin axis is stabilized in a horizontal plane by means of a leveling device and whose orientation in azimuth is slaved to the earth's magnetic meridian by a direction-sensing component, located in the left stabilizer. The compass requires both a-c and d-c power. The a-c power is supplied from the main or alternate inverter. The gyro is free to operate within 85 degrees from level flight in dive and climb, and in right and left bank. At the limits, it strikes mechanical stops, which render the indications on the directional gyro control and the settable dial indicator inaccurate. After return to level flight, errors up to 5 degrees in heading may be introduced; but the gyro will recover its erect and slaved positions automatically, in a period of 5 minutes or less, and thereafter will again resume correct indications until the limits are again exceeded. The flux valve unit of the remote compass transmitter remains pendulous through 30 degrees on both sides of the vertical, in pitch and roll. When these limits are exceeded, or a coordinated turn is being executed, the vertical components of the earth's field are picked up which results in flash signals. Restoration of the airplane to an attitude within these limits renders the flux valve unit pendulous again, and it automatically resumes correct sensing. A thermal switch in the amplifier provides fast slaving and leveling of the directional gyro, during the initial operation of the compass.

GYRO COMPASS SLAVING SWITCH.

The gyro compass slaving switch (figure 4—17) has two positions: NORMAL and CUTOUT. The NORMAL position supplies power to the heating, leveling and slaving systems. The CUTOUT position cuts off the power supply to the control field of the slaving torque motor, and is used when the horizontal lines of magnetic force dip at 84 degrees or more.

GYRO COMPASS FAST SLAVING SWITCH.

The gyro compass fast slaving switch (figure 4—17) marked PUSH FOR FAST SLAVE, is pushed in momentarily to shorten the time required to restore the gyro to its erect and slaved position, after level flight is resumed, following maneuvers in which the gyro has hit the mechanical stops. Approximately three minutes of fast slaving is obtained by depressing the fast slaving switch. The fast slaving switch is also used during initial starting of the compass to assure both a-c and d-c power are supplied to the system simultaneously.

Note

After the fast slaving switch is pressed, a time delay circuit maintains the fast slave action for approximately three minutes. During this three minute interval, any maneuvering of the airplane can induce errors into the equipment. At the completion of the three minutes, the system normally reverts to slow slave and the large errors which have been introduced will remain for a considerable time. Therefore, the fast slaving switch

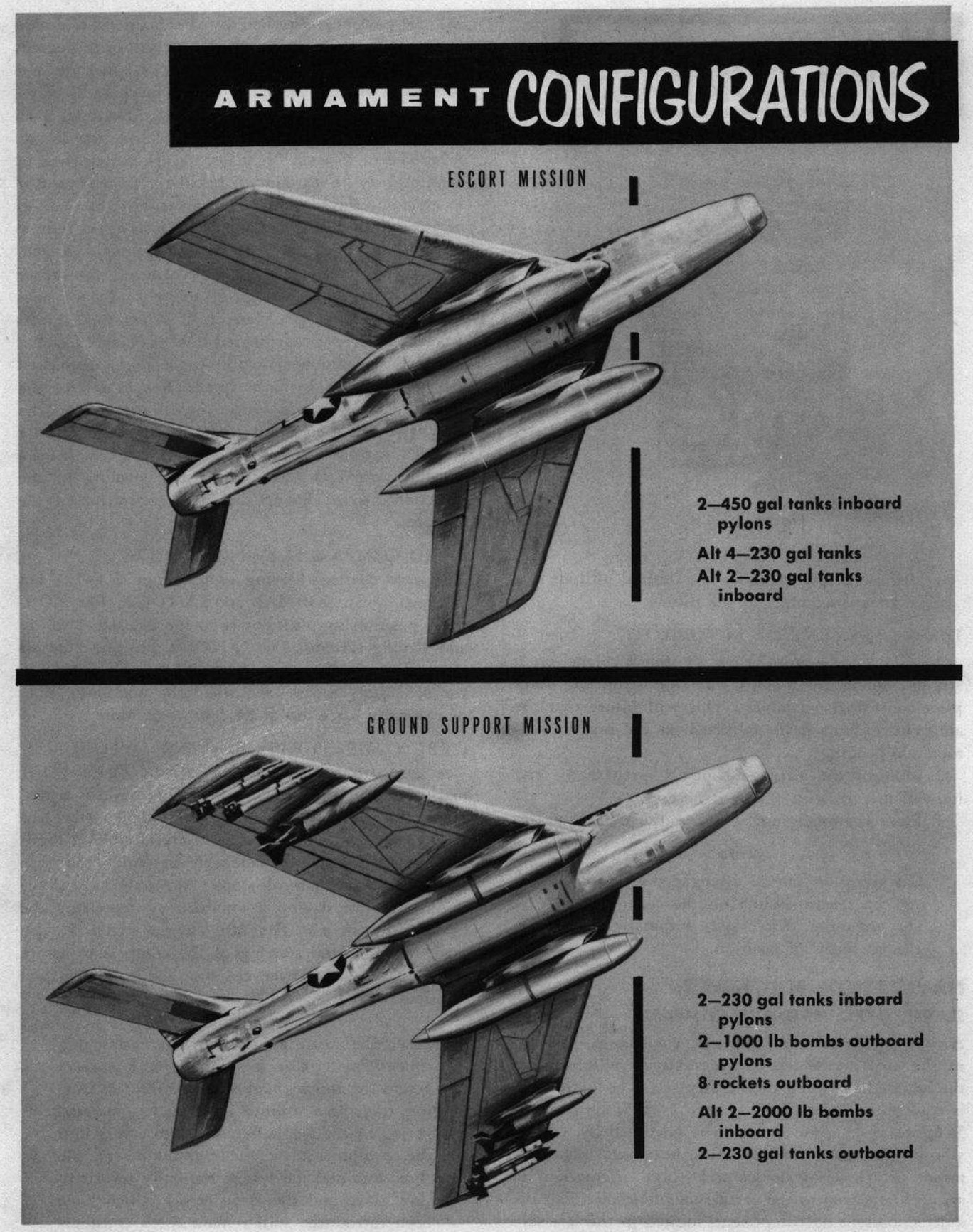
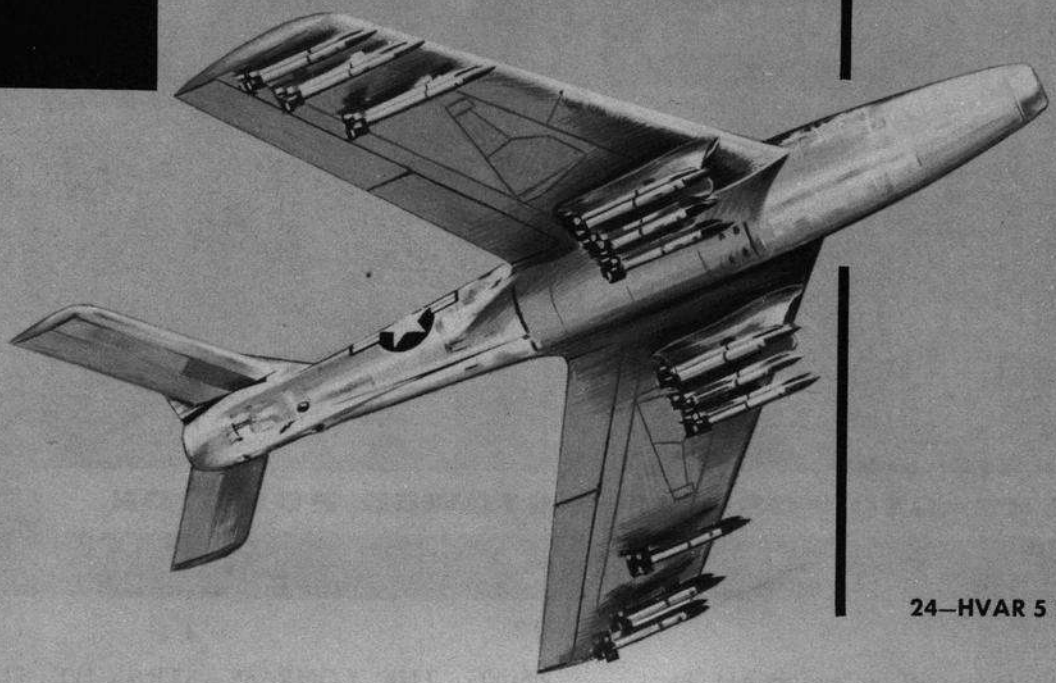


Figure 4-18 (Sheet 1 of 2).

ROCKET CONFIGURATION



24—HVAR 5 inch rockets

ROCKET FIRING SEQUENCE

VIEW LOOKING FORWARD

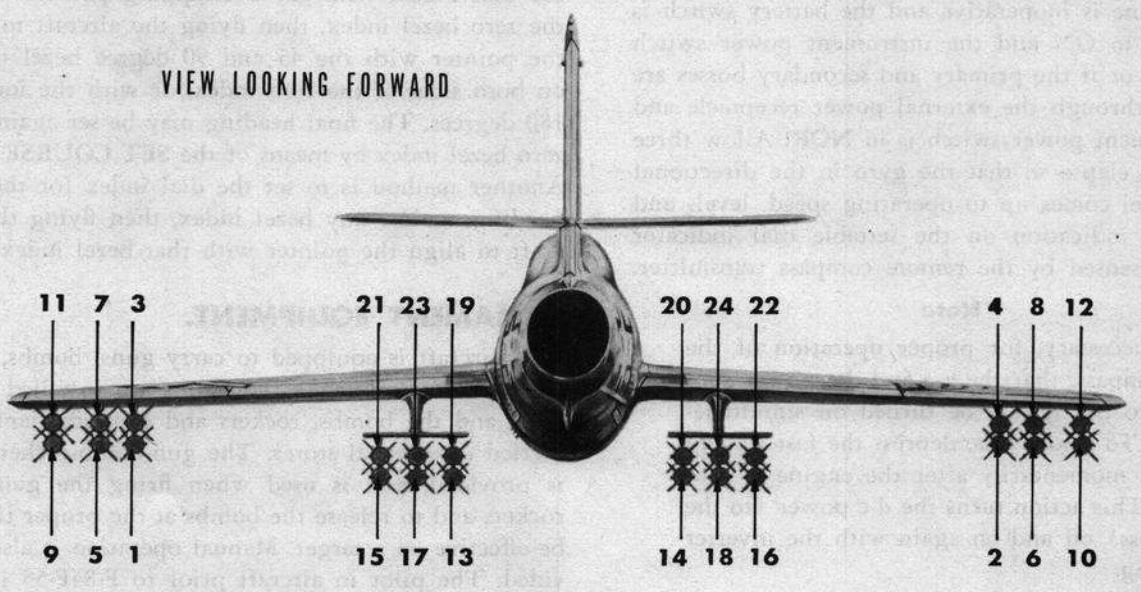


Figure 4–18(Sheet 2 of 2).

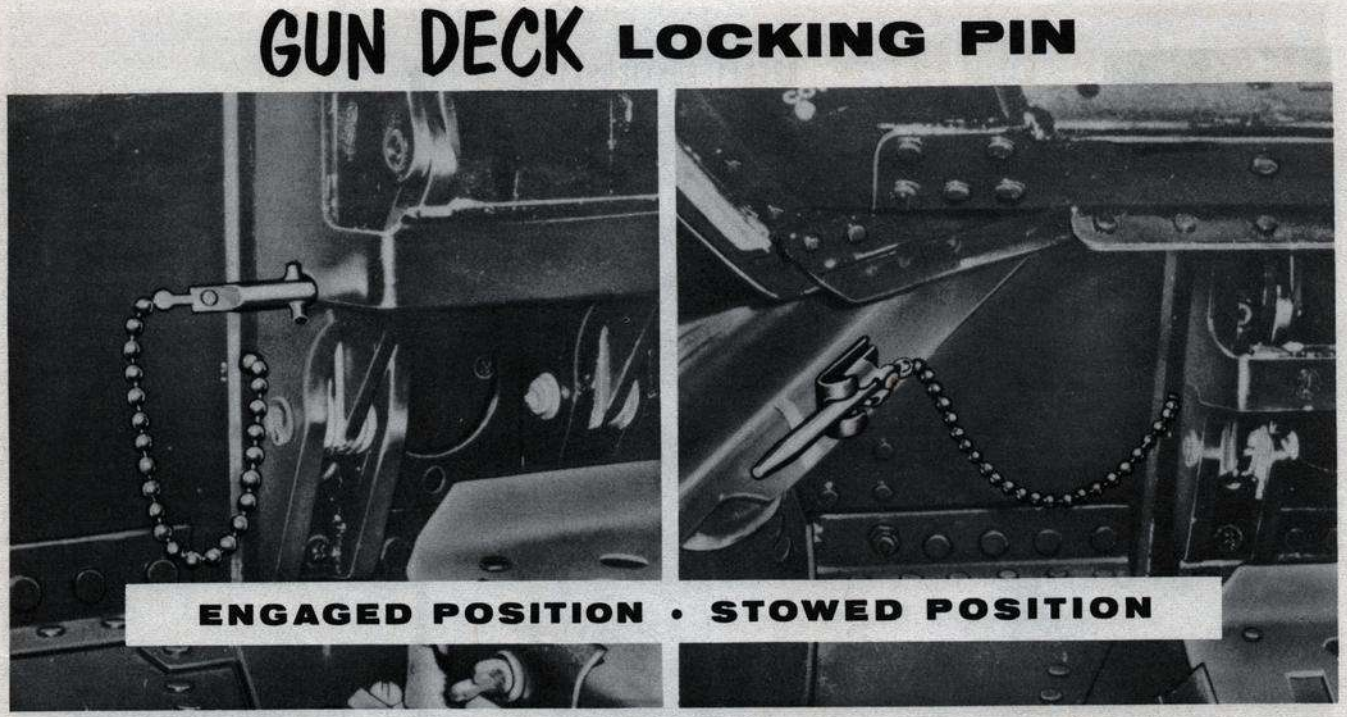


Figure 4—19

when the airplane can be maintained in straight flight for at least three minutes after the fast slaving switch is depressed.

STARTING.

The compass will operate if the engine is operating and the instrument power switch is in NOR or ALT, if the engine is inoperative and the battery switch is positioned to ON and the instrument power switch is in ALT, or if the primary and secondary busses are energized through the external power receptacle and the instrument power switch is in NOR. Allow three minutes to elapse so that the gyro in the directional gyro control comes up to operating speed, levels and aligns the indication on the settable dial indicator with that sensed by the remote compass transmitter.

Note

It is necessary, for proper operation of the J-2 compass, that the a-c and d-c power supplies to the system be turned on simultaneously. To assure this, depress the fast slaving switch momentarily after the engine is running. This action turns the d-c power (to the compass) off and on again with the inverter running.

OPERATION.

SETTING INDICATOR. By means of the SET COURSE knob on the indicator, set the dial index for the heading it is desired to fly. It is preferable to set the dial index against the zero bezel index of the indicator, although any index may be chosen.

USING THE COMPASS – STRAIGHT FLIGHT. After the airplane becomes airborne, the indicator is referred to in the same manner as a magnetic compass.

USING THE COMPASS – IN TURNS. Perfect 45, 90 and 180 degree turns can be executed by setting the dial index, with the overlapping pointer against the zero bezel index, then flying the aircraft to align the pointer with the 45 and 90 degree bezel indices on both sides of the zero index, or with the index at 180 degrees. The final heading may be set against the zero bezel index by means of the SET COURSE knob. Another method is to set the dial index for the new heading against any bezel index, then flying the aircraft to align the pointer with that bezel index.

ARMAMENT EQUIPMENT.

This aircraft is equipped to carry guns, bombs, rockets and chemical tanks. The guns are installed internally and the bombs, rockets and chemical tanks are carried as external stores. The gun-bomb-rocket sight is provided, and is used when firing the guns and rockets and to release the bombs at the proper time to be effective on a target. Manual operation is also provided. The pilot in aircraft prior to F-84F-55 is protected from enemy fire by two pieces of armor plate installed behind the seat. On F-84F-55 and later aircraft an armored headrest and plastic shoulder armor is incorporated in the seat, to protect the pilot. A gun camera mounted above the instrument panel records results of fixed gun and rocket firing.

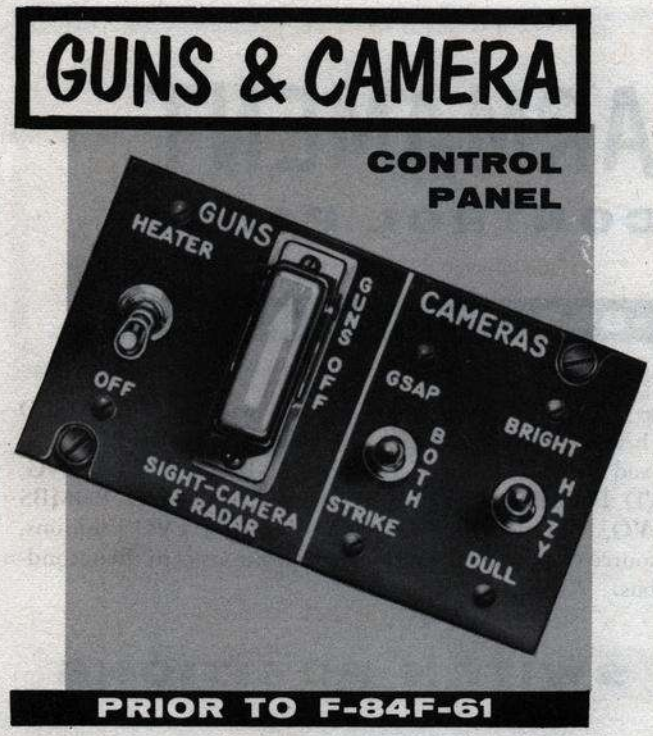


Figure 4—20

GUN ARMING SWITCH.

The gun arming switch (5, figure 1—9; 20, figure 1—10) has three positions: GUNS, OFF and SIGHT-CAMERA & RADAR. A-C power is supplied to the sight gyros and heaters as soon as the secondary bus is energized if the instrument power switch is in the NOR position. The SIGHT-CAMERA & RADAR or GUNS position supplies d-c power to the sight tube heaters, relays and control units in addition to the gyros and heaters, and also energizes the gun camera circuit. In addition the GUNS position energizes a relay so that the guns will fire when the stick trigger is actuated and the weight is off the landing gear on aircraft prior to F-84F-61RE or the landing gear handle is moved upward to retract the landing gear on F-84F-61RE and later aircraft. The sight is ready for use with the gun arming switch in either the SIGHT-CAMERA & RADAR or GUNS position.

ARMAMENT SELECTOR SWITCH. H and LATER

The armament selector switch (figure 4—21), installed in F-84F-61RE and later aircraft is a twelve-position rotary selector switch used to select bombs or rockets to be released and the sequence in which they will be released when the bomb release switch on the control stick is depressed. The armament selector switch may also be used to jettison either bombs or rockets, or all external stores. In its various positions, the switch will function as follows on manual or automatic release when the bomb release switch is depressed.

GUN-BOMB-ROCKET SIGHT.

The A-4 gun-bomb-rocket sight (figure 4—22, 4—23, 4—24) automatically computes the fire control problems for gun fire from fixed guns, for bombing and for rocket fire. The computed range takes into account the speed of the target. The sight reticle image, consisting of a circle and a central dot, is reflected on an inclined transparent window. The automatic features of the sight enables the pilot to direct his full attention to the selected target, provided he flies the aircraft so that the reticle circle is continuously superimposed on the target. Range data is supplied to the sight, for gunnery operations, by a manual range control, or automatically by an AN/APG-30 radar range unit. The radar system also provides automatic search within its range. It automatically locks onto and tracks a target in range and indicates to the pilot when the equipment is tracking a target. On overland targets below 6000 feet, radar range distance may be reduced by use of the radar range sweep control, to prevent the radar from locking on the ground when target is at low altitudes. Bombs can be released automatically at the proper release point by a mechanism within the sight. Electrical power (28 volt d-c) is supplied to the sight and sight heaters from the secondary bus. A-C electrical power is supplied from the main inverter and a sight inverter, which are both powered from the secondary bus. Manual sight ranging may be used if the a-c power supply fails, or when the radar system is inoperative. The sight can be operated as a fixed reticle sight as long as d-c power is available.

SIGHT DIMMER CONTROL.

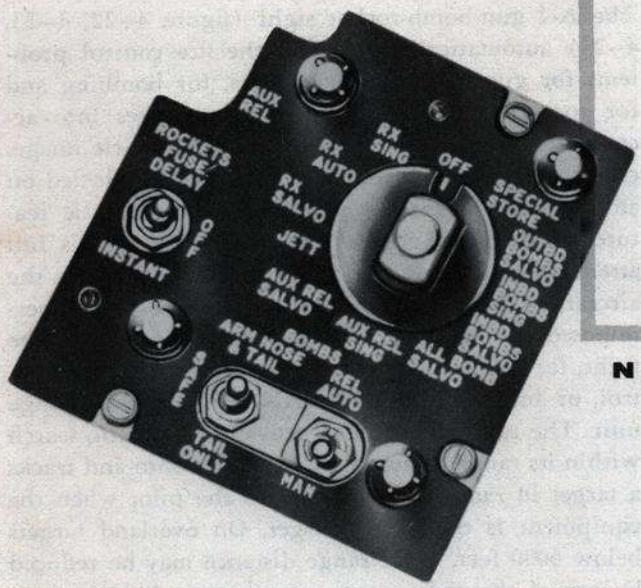
The sight dimmer control (figures 4—22, 4—23, 4—24) controls the illumination intensity of the reticle image from DIM to BRIGHT.

SIGHT FILAMENT SWITCH.

The sight filament switch (figures 4—22, 4—23, 4—24) has two positions PRIM and SEC and is used to select one of the dual filaments of the lamp for the sight reticle circle and dot. If either filament goes out, the spare filament may be cut-in by changing the switch to the other position.

ELECTRIC CAGING BUTTON.

The push-button type caging switch, on the throttle control (figure 1—17) is used to stabilize the reticle image on the target. Depressing the switch, electrically cages the gyros in the computer and brings the sight line to the "no deflection" position, which gives the pilot a fixed sight for placing the reticle image on the target initially. The caging button is also used as the nozzle disconnect switch when refueling in the



ARMAMENT
CONTROL PANEL

F-84F-61RE and later

Note When the bomb release selector switch is in the AUTO RELEASE position and the bomb-rocket selector switch is indexed to the OUTB'D BOMBS, INB'D BOMBS SING, INB'D BOMBS SALVO, INB'D AND OUTB'D BOMBS SALVO, AUX REL SING, AUX BOMB SALVO positions, the source of power for these switch positions is in the secondary bus.

ARMAMENT SELECTOR SWITCH POSITIONS

Position	Power Source	Function
SPECIAL STORE	Primary & Secondary Bus	Equipment has a higher classification than covered by this Handbook.
OUTB'D BOMBS	Primary & Secondary Bus	Releases right and left outboard bombs simultaneously when bomb release switch is depressed.
INB'D BOMBS SING	Primary & Secondary Bus	Releases left inboard bomb when bomb release switch is depressed. Circuit transfers to right pylon and right bomb will release when bomb release switch is depressed again.
INB'D BOMBS SALVO	Primary & Secondary Bus	Releases right and left inboard bombs simultaneously when bomb release switch is depressed.
INB'D & OUTB'D BOMBS SALVO	Primary & Secondary Bus	Releases all inboard and outboard bombs simultaneously when bomb release switch is depressed.
AUX REL SING	Primary & Secondary Bus	Releases bombs on left auxiliary rack when bomb release switch is depressed then releases bombs on right auxiliary rack when bomb release switch is depressed again. Auxiliary bomb release indicator light will go out after all auxiliary bombs are released.
AUX BOMB SALVO	Primary & Secondary Bus	Releases auxiliary bombs or fires chemical tanks on both wings simultaneously when bomb release switch is depressed. Auxiliary bomb release indicator will go out when stores are dropped.
JETTISON	Primary & Battery Bus	Will jettison all external stores when bomb release switch is depressed. Jettison indicator light will light. Rockets will not jettison if aircraft is not airborne.
Rx SALVO	Primary & Secondary & Battery Bus	Jettisons all rockets when bomb release switch is depressed.
Rx AUTO	Primary & Secondary Bus	Fires rockets in automatic sequence through intervalometer when bomb release switch is depressed and held.
OFF	No Power	Bomb and rocket circuits not energized, jettison may be accomplished, through external stores jettison switch.

Figure 4—21

air. The receiver door must be open for the caging switch to operate in this manner.

MECHANICAL CAGING LEVER.

The mechanical caging lever (8, figure 1–6) is used to cage or uncage the sight mirror and has two positions marked CAGED and UNCAGED. For firing at ground targets, or in the event of sight failure, the caging lever may be placed at CAGED and the reticle used as a fixed sight. The mechanical caging lever should always be positioned to CAGED during landing, take-off, and any ground operation, violent air maneuvers or at any time turbulence is encountered to protect the sight mirror suspension.

SPAN ADJUSTMENT LEVER.

The span adjustment lever (figures 4–22, 4–23, 4–24) is set to the wingspan of the target, in feet, when the gun-bomb-rocket sight is operated with manual range.

MANUAL RANGE CONTROL.

The manual range control, incorporated in the throttle control (figures 4–22, 4–23, 4–24) provides for manual ranging during gunnery operation when radar ranging is impossible (below 6000 feet on overland target). The range control covers a span of 1500 feet, from approximately 1200 feet to approximately 2700 feet. Clockwise rotation of the twist grip reduces the range (increases the reticle size). The manual ranging control is spring-loaded to the full counterclockwise (detent) position which is used for operation of the radar ranging system.

RADAR "OUT" SWITCH.

When the radar detects a target, it locks on it and measures its range. The radar may be shifted to another target by means of the radar "out" switch (figure 1–32) located on the left side of the control stick grip. Depressing the "out" switch for several seconds causes the radar to reject the target and drift in or out in range.

RADAR RANGE SWEEP CONTROL.

The radar range sweep control (figures 4–22, 4–23, 4–24) in a rheostat marked INCREASE with an arrow showing the direction. Turning the control, in the MIN direction lowers the radar ranging distance to prevent radar from locking on the earth when the aircraft is at low altitudes. Turning the control toward MAX increases the range. During normal operations control should be at MAX.

BOMB-TARGET-WIND CONTROL.

The bomb-target-wind control (figures 4–22, 4–23, 4–24) has a ROCKET GUN position and a BOMB scale indicating downwind and upwind adjustment. Setting the B-T-W control adjusts the sight to compensate for the components of wind velocity and target motion parallel to the direction of the attacking airplane. The ROCKET GUN position is selected when using the sight for gun or rocket firing.

ROCKET DIVE ANGLE CONTROL.

The rocket dive angle control (figures 4–22, 4–23, 4–24) is three separate controls on one dial. One pointer has three positions on the top of the dial; BOMB, GUN and ROCKET. The appropriate position is selected for bombing, gunery or rocket firing. If the pointer is in either the BOMB or ROCKET position and the radar "out" switch on the control stick is depressed the pointer will automatically return to the GUN position. The second pointer is the rocket setting pointer and has three positions; 5" HVAR, 2.25" SCAR and 2.75" FFAR. Each position has an N and S position. When firing rockets the rocket dive angle control is turned to N for dives up to 40 degrees or to S for dives greater than 40 degrees under the type of rocket being fired. The third pointer has three positions; TR, HI and LO and is used for gunnery only. The TR position is used in a low speed attacking airplane for the purpose of controlling gun fire or rocket fire against a low speed target. The HI position is used when the sight is in a high speed attacking airplane flying against a high speed target. The LO position is used when the sight is in a high speed attacking airplane directing fire against a low speed target.

TARGET INDICATOR LIGHT.

The target indicator light (figures 4–22, 4–23, 4–24) is located on the left side of the gun sight. Illumination of the light indicates that the radar set is "locked-on" a target.

OPERATION.

STARTING THE SIGHT. The sight gyros and heaters start to operate as soon as the secondary bus is energized.

1. Position the gun arming switch to either the GUNS or SIGHT CAMERA & RADAR position which supplies power to the amplifier. Allow approximately five minutes for the amplifier tubes to warm up, and the sight to reach its maximum operating efficiency.

2. Check to see that the reticle image appears on the reflector glass.

3. Check the reticle image for moving the mechanical caging lever from one position to the other. The dot should flicker as the lever is moved, and the circle should change to four circular arcs in the CAGED position.

STOPPING. Position the gun arming switch to the



Figure 4—22



Figure 4—23



Figure 4—24

OFF position. This turns off the tube heaters, relays and controls, but leaves the sight operating and ready for use within one minute after repositioning the gun selector switch. The gyros and heaters will operate as long as the secondary bus is energized. Position the mechanical caging lever to CAGED.

GUNNERY EQUIPMENT.

Four .50 caliber machine guns are installed in the gun bay of the fuselage, and one .50 caliber machine gun is installed in the leading edge of each wing. Electric heaters are provided for the guns. The normal load of ammunition for each gun is 300 rounds. All guns are charged manually prior to take-off. A gun camera, installed above the instrument panel operates automatically when the guns are fired, and it may be operated separately. An armament safety switch prevents the guns from being fired or rocket jettisoning while the aircraft is in the static position. On aircraft prior to F-84F-61RE, the armament safety switch de-energizes the gun and rocket circuit when the landing gear shock struts are compressed by the weight of the aircraft. On F-84F-61RE and later aircraft the safety switch disarms the gun and rocket circuits when the landing gear selector is in the DOWN or EMERG DOWN positions. If for any reason the guns must be fired or the rockets jettisoned while the airplane is on the ground, the safety circuit can be by-passed by removing the cover of the armament safety override switch located in the right wheel well. The primary bus must be energized in order to fire the guns.

STICK TRIGGER.

The gun camera and gun firing circuits are energized by depressing the stick trigger (figure 1—32) located on the control stick grip. There are two definite switch positions. The first position starts the gun camera operating if the gun arming switch is in the SIGHT-CAMERA & RADAR or the GUNS position, and the secondary bus is energized. The second, or fully depressed position fires the guns if the gun arming switch is in the GUNS position; the secondary bus is energized and, on aircraft prior to F-84F-61RE, the weight is off the wheels; or on F-84F-61RE and later aircraft, the landing gear selector handle is up and out of the DOWN position. If the rocket dive angle control is in either BOMB or ROCKET position in preparation for a bomb or rocket run, and gun firing is required, the rocket dive angle control will automatically return to the GUNS position when the radar "out" switch is depressed.

CAUTION

On aircraft prior to F-84F-61RE, if the landing gear shock struts are overinflated so as to be fully extended, it will be possible to fire guns on the ground by depressing the stick trigger, if the gun arming switch is in the GUNS position and the primary bus is energized.

GUN HEATER SWITCH.

The gun heater switch (5, figure 1–9; 21, figure 1–10), located on the left console, is a circuit breaker type switch having two positions: OFF and HEATER. The HEATER position supplies power to the gun heaters from the secondary bus. Gun heat should be used when gunnery is anticipated during cold weather operation and at altitudes above 15000 feet.

CAMERA APERTURE SWITCH.

The camera aperture switch (5, figure 1–9; 20, figure 1–10) is provided to adjust the camera aperture for existing light conditions so as to improve pictures taken during gunnery. The switch operates from the secondary bus and has three positions: BRIGHT, HAZY and DULL, which refer to light conditions and adjust the camera aperture accordingly.

GUNFIRE OPERATION.

WITH RADAR RANGE.

1. Gun heater switch HEATER.
2. Gun arming switch GUNS. Allow five minutes for amplifier to warm up and stabilize.
3. Set rocket dive angle control to GUN.
4. Set the TR, HI, LO pointer on the rocket dive angle control to suit gunnery target speed.
5. Set B-T-W control to ROCKET-GUN.
6. Check instrument power switch – NOR.
7. Manual range control on throttle in detent.
8. Set mechanical caging lever on sight heat to UNCAGED.
9. Set reticle dimmer control for desired brilliance.
10. When searching for targets, press caging button on throttle control to stabilize the reticle image.
11. When target is located and tracking is started, release caging button. Fly the airplane so that the reticle image is continuously and accurately centered on the target. After the target has been tracked smoothly without slipping or skidding for approximately one second, fire the guns.

WITH MANUAL RANGE.

1. Gun heater switch HEATER.
2. Gun arming switch GUNS. Allow five minutes for amplifier to warm up and stabilize.
3. Set rocket dive angle control to GUN.
4. Set B-T-W control to ROCKET GUN.
5. Check instrument power switch NOR.
6. Set mechanical caging lever on sight head to UNCAGED.
7. Set reticle dimmer control for desired brilliance.
8. Identify target, and set wing span with span adjustment lever corresponding to the target wing span.
9. When searching for targets, press caging button on throttle control to stabilize the reticle image.
10. After the target is close enough for a sphere containing the wing tips to coincide with the framing circle at minimum diameter, release the caging button.
11. Track smoothly, turning manual range control on throttle so that the circle continuously and accurately frames or encloses the target. After the target has been framed and tracked smoothly for approximately one second, without slipping or skidding, fire the guns.

BOMBING EQUIPMENT.

Two jettisonable bomb pylons can be installed under each wing. The pylons are jettisoned by explosive charges in the attaching bolts and are blown away from the airplane by compressed air cylinders. These cylinders must be charged manually. Each inboard pylon will carry all bombs up to, and including 1000 pounds, or an external fuel tank. The gun-bomb-rocket sight is used for bomb sighting and automatic bomb release. Controls are provided for normal or emergency release of any external stores carried on the pylons. Normal release may be accomplished automatically or manually, with bombs released singly or simultaneously. The arming condition of the bomb nose and tail fuses is manually selected.

BOMB ARMING SWITCH.

The bomb arming switch (figures 4–21 and 4–25) has three positions; ARM NOSE & TAIL, SAFE, and TAIL ONLY and is energized by the secondary bus. When the switch is placed in the ARM NOSE & TAIL position the electric circuit is indexed to arm the bombs for time explosion. When the switch is placed in the TAIL ONLY position, the electric circuit is indexed to arm the bombs for impact explosion. In the SAFE position the bombs are unarmed when dropped.

BOMB RELEASE SWITCH.

The bomb release switch (figure 1–32) is a spring-loaded, button type switch installed on the top of the control stick and energized by the primary bus. When the switch is depressed the bomb rack electric circuit is energized to release the bombs or pylon tanks in accordance with the setting of the bomb release selector switch. The bomb release switch will also fire the rockets, salvo the rockets, or release bombs, depending on the position of the rocket selector switch, or the inboard or outboard bomb selector switch respectively, on aircraft prior to F-84F-61RE or the position of the armament selector on F-84F-61RE and later aircraft.



Figure 4—25

BOMB RELEASE SELECTOR SWITCH.

The bomb release selector switch (figures 4—21 and 4—25) is energized from the primary bus and has two positions, which are AUTO RELEASE and MANUAL RELEASE. In the AUTO RELEASE position the bombs will be released automatically by the gun-bomb-rocket sight. In the MANUAL RELEASE position, the bombs are released manually by depressing the bomb release switch on the control stick, regardless of whether or not the sight is utilized or in operation.

INBOARD BOMB SELECTOR SWITCH. **A thru G**

Release of the bombs installed on the inboard pylons on aircraft prior to F-84F-61RE, is controlled by the inboard bomb selector switch (figure 4—25) which is energized from the primary bus. The switch has three positions INBD ALL, OFF and SINGLE. When the switch is in the SINGLE position the left bomb will release when the bomb release switch is depressed. The right bomb will release when the release switch is depressed again. With the switch placed in the INBD ALL position, both bombs will release simultaneously, when the bomb release switch is depressed. When in the OFF position the bombs on the inboard pylons will not release, when the bomb release switch is depressed.

OUTBOARD BOMB SELECTOR SWITCH.

A thru G

Release of the bombs installed on the outboard pylons on aircraft prior to F-84F-61RE, is controlled by the outboard bomb selector switch (figure 4—25), which is energized from the primary bus. The bomb release switch

and remains on until the fragmentation bombs are dropped. The ALL position is used when firing chemical tanks. The OFF position must be used when bombs are installed on the pylons.

JETTISON EXTERNAL STORES SWITCH.

The jettison external stores switch (figures 1–7 and 1–8) is a push button type switch recessed in the panel to prevent accidental actuation. The switch is marked JETTISON EXTERNAL STORES, and when depressed will jettison the outboard and inboard pylon tanks together with the pylons on RE airplanes up to F-84F-45RE and all GK airplanes if the battery bus is energized. On F-84F-45RE and subsequent RE airplanes only the pylon stores will be jettisoned and the pylons will be retained. On F-84F-71RE and later aircraft the jettison external stores switch must be depressed for a minimum of 0.4 seconds. This allows an automatic delay to release the left inboard store and after a short delay to release the right inboard store. If both stores are dropped simultaneously they may collide causing damage to the fuselage. Rockets will be jettisoned on all airplanes if the airplane is airborne and the primary bus is energized.

CAUTION

On airplanes prior to F-84F-45RE and all GK airplanes the pylons will jettison together with any stores installed if the external stores jettison switch is depressed with the airplane in the static position. On F-84F-45RE and later RE airplanes, only the stores will jettison if the external stores jettison switch is depressed with the airplane in the static position.

INBOARD PYLON JETTISON SWITCH.

The inboard pylon jettison switch (6, figure 1–9; 18, figure 1–10) is guarded with a cover type guard which is marked JETT INBD PYLON and an arrow. When actuated in the direction of the arrow the inboard pylons are jettisoned simultaneously together with any stores carried on them if the battery bus is energized.

OUTBOARD PYLON JETTISON SWITCH.

The outboard pylon jettison switch (7, figure 1–9; 19, figure 1–10) is guarded with a cover type guard which is marked JETT OUTBD PYLON and an arrow. When actuated in the direction of the arrow the outboard pylons are jettisoned simultaneously together with any stores carried on them if the battery bus is energized.

BOMBING OPERATION – MANUAL.

1. Set bomb selector switch as desired.
2. Set bomb arming switch as desired.
3. Set bomb release selector in MANUAL RELEASE.
4. Press bomb release switch on control stick.

CAUTION

Before depressing the bomb release switch, check to determine that all selector switches are in proper position. This is necessary to determine that only the desired circuits will be energized. It is possible, for example, if both the rocket jettison ready switch and the rocket selector switch are both on in aircraft prior to F-84F-61RE, to fire some rockets and drop the others when the bomb release switch is depressed.

BOMBING OPERATION USING GUN-BOMB-ROCKET SIGHT.

1. Set rocket dive angle control to BOMB position.

Note

If the radar "out" switch is depressed with the dive angle control in the BOMB position, the control wil automatically return to the GUN position.

2. Set B-T-W control to the known or estimated up or downwind velocity plus or minus the estimated target velocity. The reticle will immediately move down to a position just over the nose.
3. Set the mechanical caging lever on the sight head to UNCAGED.
4. Set reticle dimmer control for desired brilliance.
5. Set the bomb release selector switch in the AUTO RELEASE position.
6. Position inboard or outboard bomb selector switch as desired.
7. Fly an approach which will give the desired dive angle during the bombing run. The electrical caging button must be depressed during this maneuver.
8. After a smooth dive has been established with the reticle on the target, release the electrical caging button.
9. Depress the bomb release switch at approximately the bomb drop point.
10. Track very smoothly until the reticle image becomes extinguished. This indicates an automatic bomb release.
11. If manual release is desired, place the bomb release selector switch in the MANUAL RELEASE

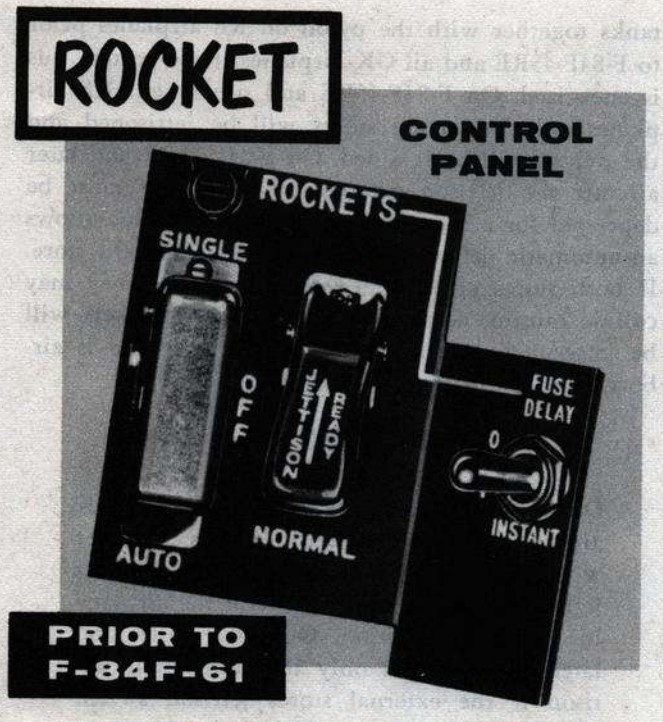


Figure 4—27

position, get on the target and track as above. After the reticle image circle becomes extinguished, press the bomb release button. The manual release is not as accurate as the automatic release because of the time lag due to the pilot's reaction time.

12. Computation accomplished during the above prescribed procedure will be good for only one release, i.e., a single bomb, bombs in train with interval control not exceeding ½ second from the first to the last bomb, a pair of bombs released simultaneously or a salvo.

EMERGENCY OPERATION.

The bombs can be dropped simultaneously unarmed by depressing the jettison external stores switch.

CAUTION

On airplanes prior to F-84F-45RE and all GK airplanes the pylons will jettison together with any stores installed if the external stores jettison switch is depressed with the airplane in the static position.

ROCKET EQUIPMENT.

Rocket firing equipment is provided for launching twenty-four 5" HVAR type rockets. Six rockets are carried on three forward and six aft support posts under each wing and six rockets are carried on an adapter on each inboard pylon. Arming solenoids, mounted in the leading edge of each wing and on each pylon, retain the rocket nose fuse arming wires when the rockets are fired in the armed condition. Rocket firing sequence is controlled by a rocket release control. Each forward post is equipped with a jettison mechanism for jettisoning the rockets in an emergency. The fore and aft rocket supports on aircraft prior to F-84F-55 retract automatically after the rockets have been fired or jettisoned. However, on F-84F-55 and later aircraft the rocket support posts are installed only when rockets are to be carried and are not retractable. The forward posts are jettisoned by explosive squib action, while the aft posts remain projecting from the wing after rocket firing or jettison and are later removed on the ground, where flush plugs are installed in place of the posts if rockets are not to be carried on the wing. The rockets may be fired singly or in train. The gun-bomb-rocket sight is used for aiming rockets and the rockets are fired by depressing the bomb release switch. Refer to figure 4—18 for rocket firing sequence.

ROCKET ARMING SWITCH.

The rocket arming switch (figures 4—21 and 4—27) is energized by the secondary bus and has three positions: FUSE DELAY, OFF and INSTANT. When the switch is in the INSTANT position the arming wire is retained by the arming solenoid when the rocket is fired. This will arm the rocket for contact detonation by releasing the contact fuse pin. When the switch is placed in the FUSE DELAY or the OFF position, the arming solenoids are de-energized and release the arming wires which remain attached to the rockets. The nose contact fuses will therefore remain in the safe or unarmed position and the rockets will be detonated by the base fuse.

ROCKET RELEASE CONTROL.

The rocket release control (figure 4—28) is an electrically operated timing device incorporating an intervalometer, a reset knob and an indicator. The intervalometer automatically selects the next rocket firing circuit in sequence whether firing the rockets singly or in train. The indicator, marked RX TO BE FIRED, informs the pilot by rocket number, the position and location of the next rocket to be fired and enables him to keep check of the number of rockets fired and those remaining on the launchers. The reset knob, turned counter-clockwise, permits the intervalometer to be re-indexed so that any rocket number can be selected for firing depending on the airplane configuration.

ROCKET SELECTOR SWITCH. **A thru G**

The rocket selector switch (figure 4—27) is energized by the primary bus and has three positions: OFF, SINGLE and AUTO. When the switch is placed in the SINGLE position, the electrical circuit to the

still attached thereto, and provided the fins are secured per instruction, only slight damage will occur to the aircraft consisting of two superficial scratches on the under surface of the wing and scorched paint. The trajectory of the rocket under double release is immediate nose-over.)

ROCKET FIRE OPERATION.

1. Set B-T-W control to ROCKET-GUN.

2. Set rocket dive angle control to type rocket being fired and the expected dive condition; set pointer to S for steep dives of more than 40° or N for dives less than 40°.

Note

If the stick trigger is depressed with the dive angle control in the ROCKET position the sight will automatically return to the GUN position.

3. Set mechanical cage lever on sight head to UNCAGED.

4. Set reticle dimmer control for desired brilliance.

5. Depress the electrical caging button.

6. Fly on the desired approach to the target, until the reticle image lies on the target, then track smoothly.

MISCELLANEOUS EQUIPMENT.

ANTI-G SUIT PROVISIONS.

An air pressure outlet connection on the front of the pilot's seat (figures 1—40 and 1—41) provides for the attachment of the air pressure intake tube of the pilot's anti-g suit. Air pressure for inflation of the anti-g suit bladder is conducted from the engine compressor through a pressure regulating valve (25, figure 1—9; 23, figure 1—10) located on the left console which starts functioning when a force of 1.75 g's is applied to the aircraft. A control marked HI and LO allows for adjustment of the rate of inflation of the anti-g suit. In the LO range the valve opens at 1.75 g and then allows 1 psi of air pressure to pass to the suit for every increase of 1 g force thereafter. In the HI range the valve still opens at 1.75 g but delivers 1.5 psi per g force thereafter. The suit will inflate in 0.2 to 2.0 seconds depending on the input pressure.



Figure 4—28

energized when the bomb release switch is pressed. When the switch is placed in the AUTO position, the firing circuits to each of the rockets is completed in automatic sequence by the intervalometer when the bomb release switch is pressed and held.

ROCKET JETTISON READY SWITCH. **A thru G**

The rocket jettison ready switch (figure 4—27) is energized by the primary bus and has two positions: NORMAL and JETTISON READY. The NORMAL position is guarded with a red cover guard and is in the rocket firing circuit. The JETTISON READY position indexes the rocket jettison circuit so that the pylon adapter and the rockets on the rocket ports will be jettisoned simultaneously when the bomb release switch on the control stick is pressed. However, if bombs or tanks are installed on the pylons they will not jettison with the rockets on the wings.

Note

Rockets can be jettisoned only if the airplane is airborne or the struts are overinflated so as to be fully extended.

ARMAMENT SELECTOR SWITCH. **H and LATER**

For complete description of this switch refer to BOMBING EQUIPMENT.

JETTISON EXTERNAL STORES SWITCH.

The jettison external stores switch (figures 1—7 and 1—8) is a push button type switch recessed in the panel to prevent accidental actuation. The switch is marked JETTISON EXTERNAL STORES, and when depressed will jettison the outboard and inboard pylon tanks together with the pylon on RE airplanes prior to F-84F-45RE and all GK airplanes if the battery bus is energized. On F-84F-45RE and subsequent RE airplanes only the pylon stores will be jettisoned and the pylons will be retained. On F-84F-71RE and later aircraft the jettison external stores switch must be depressed for a minimum of 0.4 seconds. This allows an automatic delay to release the right inboard store. If both stores are dropped simultaneously they may collide causing damage to the fuselage. Rockets will be jettisoned on all airplanes if the airplane is airborne and the primary bus is energized.

CAUTION

On airplanes up to F-84F-45RE and all GK airplanes the pylons will jettison together with any stores installed if the external stores jettison switch is depressed with the airplane in the static position. On F-84F-45RE and later RE airplanes only the stores will jettison if the external stores jettison switch is depressed with the airplane in the static position.

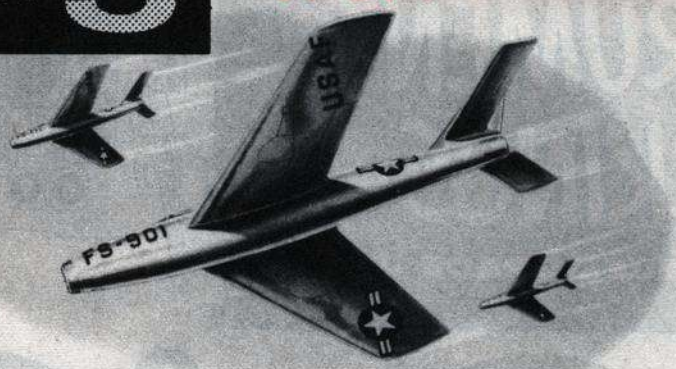
ROCKET FIRING (MANUAL).

1. Set selector switch as desired.
2. Set rocket arming switch as desired.
3. Set rocket indicator as desired.
4. Press bomb release switch on control stick.

CAUTION

The lower rocket must always be fired first. When a misfire occurs in the air during "single" round firing the pilot shall check his intervalometer to ascertain which round has misfired, remembering that the number shown on the intervalometer is the rocket number to be fired. Reference to rocket firing sequence will identify the rocket as an upper or lower rocket. If the rocket is a lower rocket, the rocket firing sequence will reveal from which rocket it is suspended. The upper rocket should not be fired. The intervalometer should be positioned upon the next position when the number of the upper rocket of the misfired pair appears on the intervalometer thereby by-passing a double rocket release. (During automatic firing, the pilot has little control over the rockets as they fire at 0.1 second intervals while firing button is held down. If a misfire should occur during automatic firing, experience indicates that if the upper rocket is fired with the lower rocket

SECTION 5 OPERATING LIMITATIONS



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Weight Limitations 166
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INTRODUCTION.

This section includes the engine and aircraft limitations that must be observed for safe and efficient operation. Instrument markings form a part of these limitations; however, these limitations are not repeated in the text and must be referred to on the instrument marking page. For complete restrictions carefully read the instrument marking page and the explanatory text.

ENGINE LIMITATIONS.

OVER TEMPERATURE LIMITS.

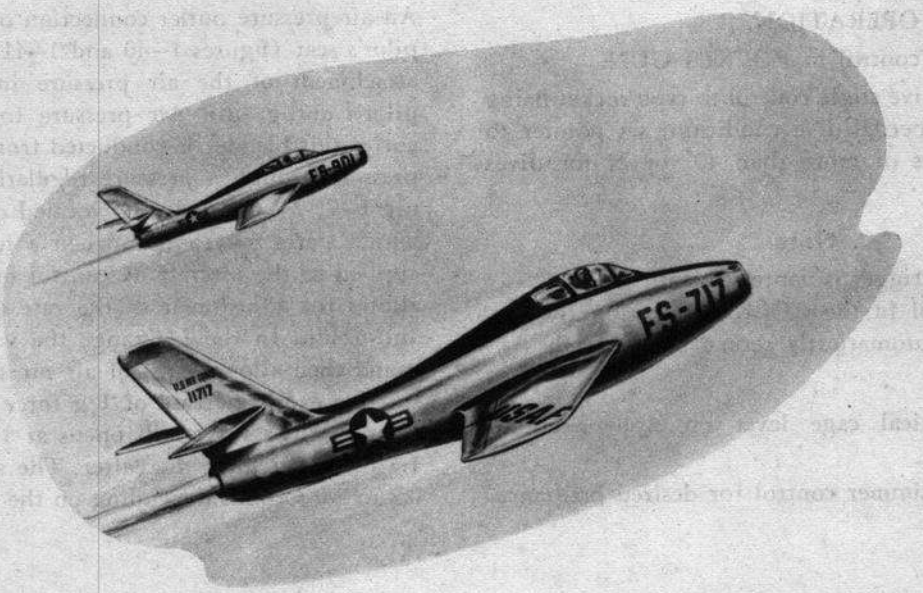
A hot section inspection in accordance with applicable T.O. shall be performed after five starts during which the exhaust gas temperature is between 800° and 900°C or after one start during which the exhaust gas temperature is 900°C or higher. Each hot start will be recorded in the Form 1. Maximum exhaust gas temperature during engine idling, 36.2 to 41.0 per cent rpm for J65-W-3 and B-3 engines and 38.0 to 43.0 per cent rpm for J65-W-7 and B-7 engines, is 660°C.

OVERSPEED LIMITS.

A hot section inspection in accordance with applicable T.O. must be performed if overspeeding of 106 to 108 per cent rpm is encountered during flight or ground operation. The engine must be removed from service if overspeeding in excess of 108 per cent rpm is encountered and inspected in accordance with applicable T.O.

ENGINE ACCELERATION.

Engine acceleration time from 47 to 100 per cent rpm should be 14 seconds or less.


FS-717

5



OIL PRESSURE INDICATOR

- 20 to 40 psi *Continuous operation*
- 15 psi *Minimum during flight*
- 60 psi *Maximum during start and initial run*

7

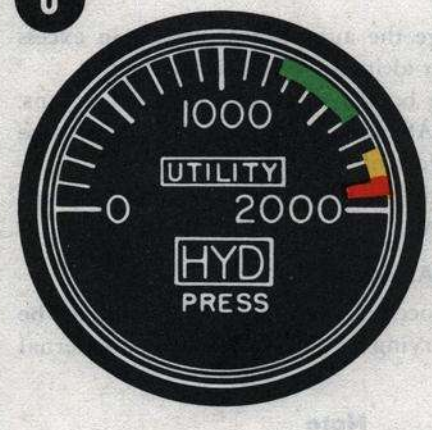


TACHOMETER

- 83 to 96.5% rpm *Best cruise rpm*
- 100.7% rpm *Maximum (Ground or flight 30 minutes)*



6



HYDRAULIC PRESSURE UTILITY SYSTEM PRIOR TO F-84F-71RE

- 1250 to 1600 psi *Normal*
- 1750 to 1900 psi *Permissible pressure 5 sec. maximum*
- 1925 psi *Maximum*

HYDRAULIC PRESSURE BOOST SYSTEM F-84F-71RE AND LATER

- 1250 to 1650 psi *Normal*
- 1750 to 1900 psi *Permissible pressure 5 sec maximum*
- 1925 psi *Maximum*

9



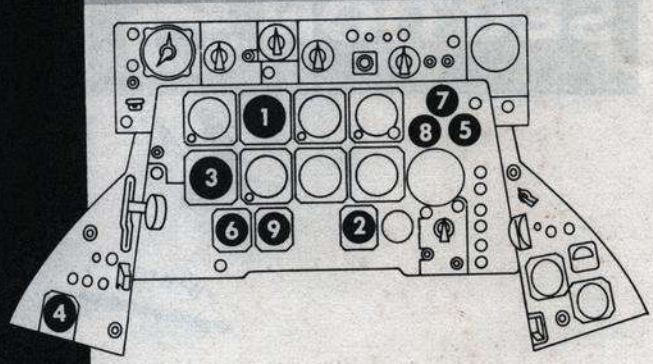
HYDRAULIC PRESSURE BOOST SYSTEM PRIOR TO F-84F-71RE

- 1250 to 1600 psi *Normal*
- 1750 psi *Maximum*

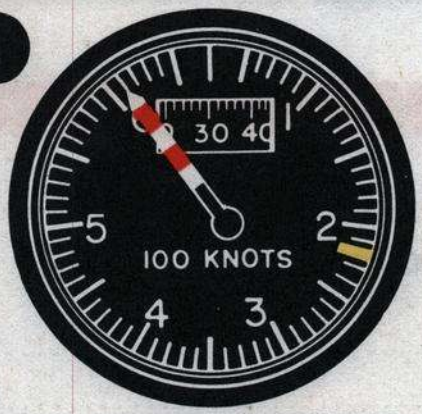
Figure 5–1 (Sheet 2 of 3)

INSTRUMENT MARKINGS

FUEL-GRADE JP4



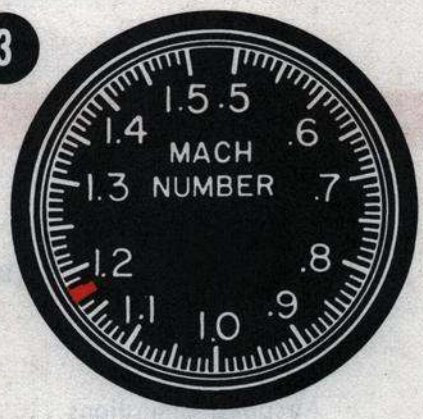
1



AIR SPEED INDICATOR

- 220 knots *Landing gear down (225 Flaps down)*
- 610 knots *Maximum airspeed*

3



MACHMETER

- 1.175 *Design Dive Speed*

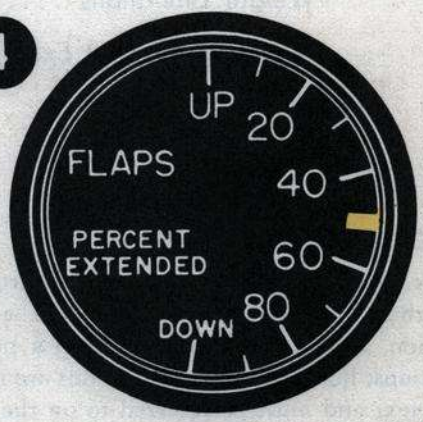
2



ACCELEROMETER

- +5.9g *Maximum, clean airplane over Mach No. .90 or airplane with combat external stores at any Mach. No.*
- +7.5g *Maximum, clean airplane under Mach No. .90*
- −2.0g *Maximum*

4



LANDING FLAP POSITION INDICATOR

- 50% *Take-off*

Figure 5—1 (Sheet 1 of 3)

INSTRUMENT MARKINGS

EXHAUST TEMPERATURE INDICATORS 8



J65-W-3 or B-3 ENGINE

- 200 to 585°C *Continuous operation*
- 200°C *Minimum for flight*
- 620°C *Maximum for flight (30 min)*
- 800°C *Maximum during starting and acceleration*



J65-W-7 or B-7 ENGINE

- 200 to 595°C *Continuous operation*
- 200°C *Minimum for flight*
- 650°C *Maximum for flight (30 min)*
- 800°C *Maximum during starting and acceleration*

Figure 5—1 (sheet 3 of 3)

TRANSIENT TEMPERATURE LIMITS.
J65-W-3 or B-3 ENGINES.

Acceleration	Max Exhaust Gas Temp
after 10 seconds	800°C
after 30 seconds	660°C
after 15 minutes (See Section VII)	620°C

TRANSIENT TEMPERATURE LIMITS.
J65-W-7 or B-7 ENGINES.

Acceleration	Max Exhaust Gas Temp
after 10 seconds	800°C
after 30 seconds	690°C
after 15 minutes (See Section VII)	650°C

AIRSPEED LIMITATIONS.

1. Do not lower the landing gear above 220 knots IAS.
2. Do not lower landing flaps above 225 knots IAS.
3. Do not extend landing lights above 225 knots IAS.
4. Jettison ato units between 200 and 250 knots IAS to prevent damage to the rear hooks and fuselage.
5. Do not engage the autopilot at speeds in excess of 425 knots IAS at altitudes below 20000 feet.
6. Dropping fire bombs from the outboard pylons, above 400 knots IAS, will cause the airplane to lose approximately 60 feet of altitude.
7. Do not open the air refueling receptacle at speeds above 350 knots IAS.

JETTISON EXTERNAL STORES.

The following procedures and restrictions shall be observed while carrying any of the described external stores.

Note

All types of tanks can be released when full or nearly full to lighten aircraft in case of an emergency.

1. 230-gallon Type II Sutton tanks carried on inboard pylons – jettisoning speed from 200 to 310 knots IAS, pneumatic gun forward and charged to 2000 psi, drop with any quantity of fuel while in a steady climb.
2. 230-gallon Type II Sutton tanks carried on outboard pylons – jettisoning speed from 220 to 310 knots

IAS, pneumatic guns charged to 2500 psi, drop only when tanks are empty and while in a steady climb.

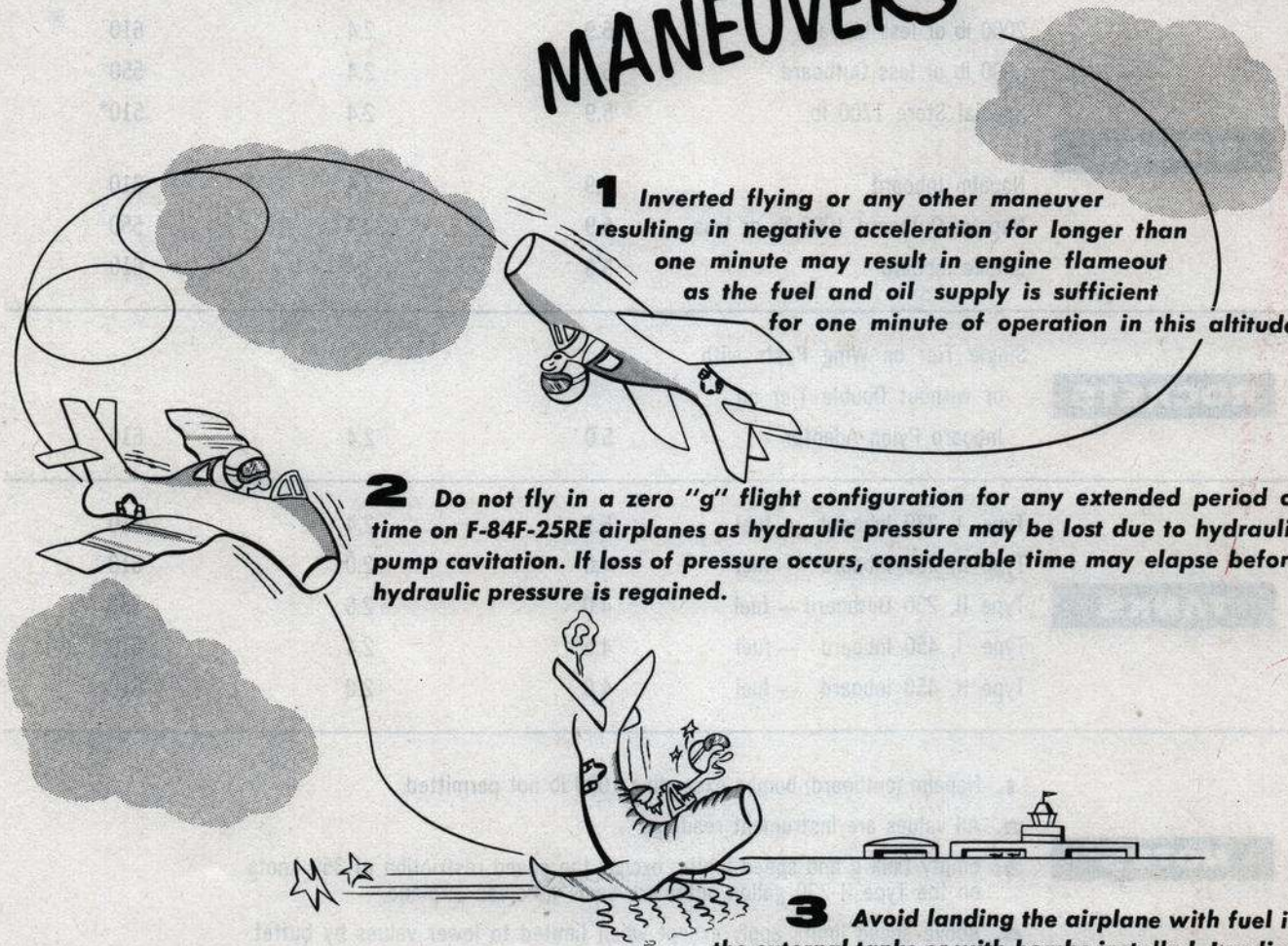
3. 450-gallon Type II Royal Heater tanks carried on inboard pylons – jettisoning speed from 200 to 275 knots IAS, pneumatic guns charged to 2000 psi, drop with any quantity of fuel while in a steady climb. While carrying tanks – maximum acceleration of 4G, safe rate of descent 5000 feet per minute, maximum rate of descent 10000 feet per minute.

4. 230-gallon Type I Republic 00500 tanks carried on inboard pylons – jettisoning speed from 200 to 500 knots IAS, pneumatic gun aft and charged to 2000 psi, release singly with any quantity of fuel while level, diving, or pulling up but with no negative G force.

5. 230-gallon Type IV Royal Jet tanks carried on inboard pylons–jettisoning speed from 220 to 275 knots IAS, pneumatic gun forward and charged to 2000 psi, release with any quantity of fuel while in a steady climb.

6. 230-gallon Type IV Royal Jet tanks carried on outboard pylons–jettisoning speed 230 to 270 knots IAS, pneumatic gun charged to 2500 psi, release with any quantity of fuel while in steady climb.

PROHIBITED MANEUVERS

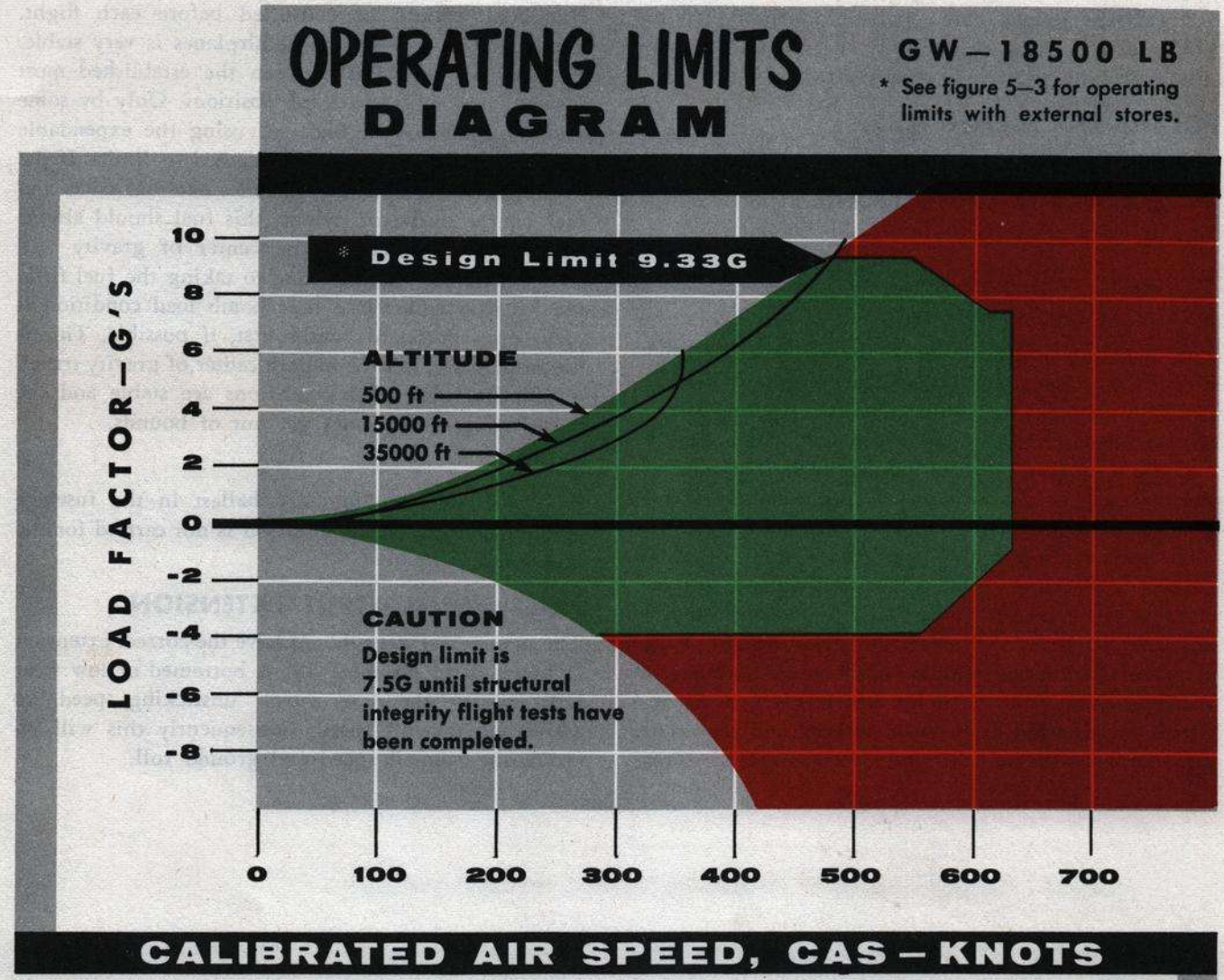


1 ***Inverted flying or any other maneuver resulting in negative acceleration for longer than one minute may result in engine flameout as the fuel and oil supply is sufficient for one minute of operation in this altitude.***

2 ***Do not fly in a zero "g" flight configuration for any extended period of time on F-84F-25RE airplanes as hydraulic pressure may be lost due to hydraulic pump cavitation. If loss of pressure occurs, considerable time may elapse before hydraulic pressure is regained.***

3 ***Avoid landing the airplane with fuel in the external tanks or with bombs installed. Landing with fuel in the external tanks or with bombs installed requires that a good landing technique be employed to prevent wrinkling or buckling the wings during such landings. Land with a minimum of internal fuel if practicable.***

Figure 5—2.



This is an operating limits diagram for the F-84F airplane. It shows what speeds and g's are possible and allowable for the airplane. The upper and lower curved lines represent the maximum load that the airplane can sustain before the wing stalls. At 135 knots CAS the upper curved line shows that the load can be 1g or 5000 feet. This corresponds to the stalling speed of the airplane with flaps and gear up. At this speed the load cannot be greater than 1g because the wing cannot lift any more than the weight of the airplane at this airspeed. At 300 knots CAS it is possible for the airplane to develop a load of 4.3g at 5000 feet. When the load on the airplane at 300 knots has been increased to 4.3g the airplane has reached the point where the wings cannot lift any more, and the airplane will stall if the pilot tries to increase the load. Further study of this diagram will show that the pilot cannot exceed the load of 9.33g unless the airplane is indicating speed which is greater than 485 knots CAS at 5000 feet. Above this indicated airspeed of 485 knots CAS, it is up to the pilot to be careful to make sure that a load greater than 9.33g is not obtained up to speeds of 500 knots CAS or 7.33g above 610 knots CAS. It is the high indicated airspeeds which pack the terrific wallop and the high indicated airspeeds are only possible at low altitudes. The green area represents the area of g loads and airspeeds, which may be used by the pilot without damage to the airplane. It should be possible for the airplane to perform all the maneuvers and tactics which are required within the green area.

Figure 5—4

ACCELERATION LIMITATIONS

F-84F SYMMETRIC FLIGHT LIMIT LOAD FACTOR AND SPEED RESTRICTIONS

The following limit load factors include the factor of .80 which is required until completion of static and structural integrity flight tests. If a combination of stores is used, the lowest limiting load factor and velocity is to be used.

		Plus G All Altitudes	Neg. G	Speed Knots IAS
CLEAN	Below .94M	7.5	3.0	610
	Above .94M	5.9	3.0	
BOMBS	2000 lb or less Inboard	5.9	2.4	610
	1000 lb or less Outboard	5.9	2.4	550
	Special Store 1700 lb	5.9	2.4	510*
	Napalm Inboard	5.9	2.4	610
	Napalm Outboard 1000 lb or less	5.9	2.4	550
	Smoke Inboard	5.9	2.4	610
ROCKETS	Single Tier on Wing Posts with or without Double Tier on Inboard Pylon Adapter	5.0	2.4	610
TANKS	Type I, 230 Inboard — fuel	5.9	2.4	610
	Type II, 230 Inboard — fuel	4.0	2.0	610
	Type II, 230 Outboard — fuel	4.0	2.0	350
	Type I, 450 Inboard — fuel	4.5**	2.4	610
	Type II, 450 Inboard — fuel	4.0	2.0	610

NOTES

1. Napalm (outboard) bombs exceeding 1000 lb not permitted.
2. All values are instrument readings.
3. Empty tank g and speed limits, except the speed restriction of 350 knots on the Type II 230 gallon outboard, same as clean airplane.
4. Above speed limits apply except when limited to lower values by buffet.

* Maximum Mach limit .95
** USAF Shackle limitations

Figure 5—3.

7. Inboard pylons bare – jettisoning speed 200 to 525 knots IAS, forward gun only charged to 1800 psi, release with no negative G on aircraft.

PROHIBITED MANEUVERS.

(See figure 5–2.)

ACCELERATION LIMITATIONS.

(See figure 5–3.)

WEIGHT LIMITATIONS.

MAXIMUM GROSS WEIGHT.

The maximum gross weight of the airplane has been limited to 27000 pounds, plus the weight of the expendable assist take-off units. The load limiting factor is determined by the main wheel tires which have a maximum loading of 13500 pounds each. The normal gross weight of the airplane is approximately 18600 pounds. This includes pilot, all internal fuel, oil, all guns and ammunition. Therefore, a total of 8400 pounds of external stores of any description, not including assist take-off units, may be loaded on the airplane to obtain the maximum gross weight. Each airplane is equipped with a Handbook of Weight & Balance, Data, T.O. 1-1B-40, which gives more accurate information as to basic weight and center of gravity positions of the individual airplane. This Handbook should be consulted before each flight. The center of gravity of the airplanes is very stable. All loadings will fall between the established most forward and most rearward positions. Only by some unusual condition in flight of using the expendable load can the center of gravity exceed its limits. If the loading of external stores includes external tanks and fuel on the outboard pylons, this fuel should always be used first, otherwise the center of gravity will exceed its most aft limit, due to taking the fuel from the internal tanks. If a four bomb load condition is used, drop outboard bombs first, if possible. This is not imperative, but for smooth center of gravity travel, is practical. All other conditions are stable and the center of gravity cannot get out of bounds.

BALLAST.

It is not necessary to carry ballast in the fuselage ammunition cans if ammunition is not carried for the nose guns.

NOSE WHEEL STRUT EXTENSION.

The nose wheel strut should have the correct extension as noted in (1, figure 2–1). A bottomed or low strut will increase the nose wheel "unsticking speed" to above the take-off speed. Consequently this will increase the take-off speed and ground roll.

SECTION 6 FLIGHT CHARACTERISTICS



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Flight Characteristics with External Stores 177

GENERAL FLIGHT CHARACTERISTICS.

The airplane is designed for high speed at all altitudes. The swept wing and tail surfaces reduce the effects of compressibility, therefore the high speed is limited only by the available thrust and the total drag of the airplane. All flight controls are hydraulically operated to provide comfortable control forces and ease of maneuvering. Minor longitudinal trim changes occurring in level flight at high Mach Numbers are easily trimmed out. This, in combination with trimming of the aileron and rudder artificial "feel" systems permits complete trim throughout the speed range.

FLIGHT CONTROLS.

The stabilator, ailerons and rudder are equipped with irreversible hydraulic actuators. In the event of failure of the normal and emergency hydraulic systems, the rudder and aileron forces will be heavy due to friction forces in addition to the airloads. In this case, the stabilator is controlled by an electrical actuator on airplanes prior to F-84F-71RE. At moderate speeds, the airplane is controllable with hydraulic power off, but it is not recommended that landings be made when operating the stabilizer electrically as the rate of stabilator movement is too slow. The rudder is a useful control for picking up a wing if the hydraulic power off aileron forces are excessive. In the event of engine failure, the emergency hydraulic system automatically takes-over and powers the stabilizer and aileron actuators. Rudder control will be adequate through the mechanical linkage.

A mechanical advantage shifter is incorporated in the stabilator control system to allow for more control surface deflection in take-off and landing than at high speeds. The shifting is done automatically as the land-

MINIMUM FLYING SPEEDS

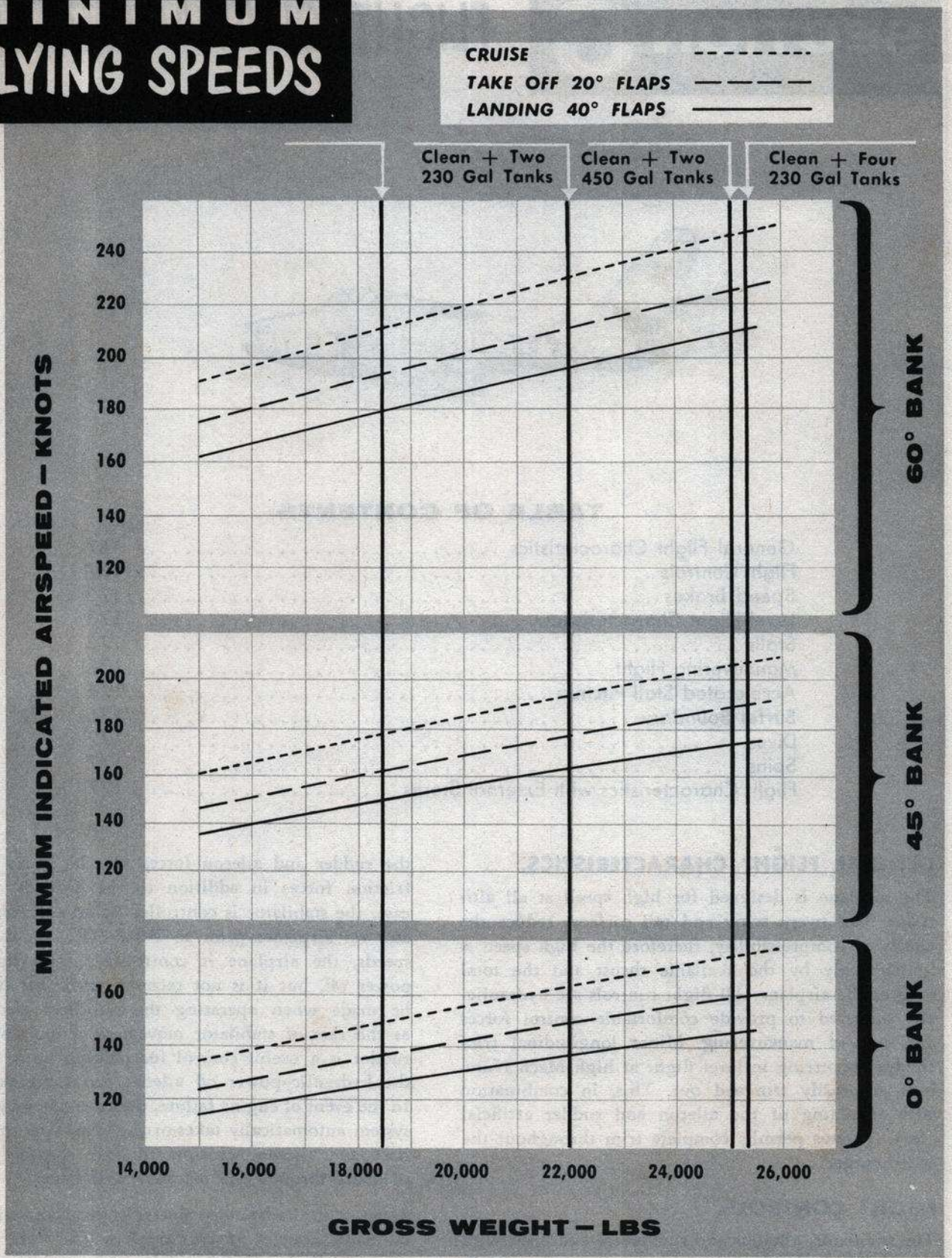


Figure 6–1

RATE OF DESCENT for SEVERAL POWER SETTINGS

FLAPS	40 DEGREES
SPEED BRAKE	OUT
LANDING GEAR	DOWN
GROSS WEIGHT	16280 LBS
FUEL REMAINING	207 GALS
EXTERNAL STORES	NONE

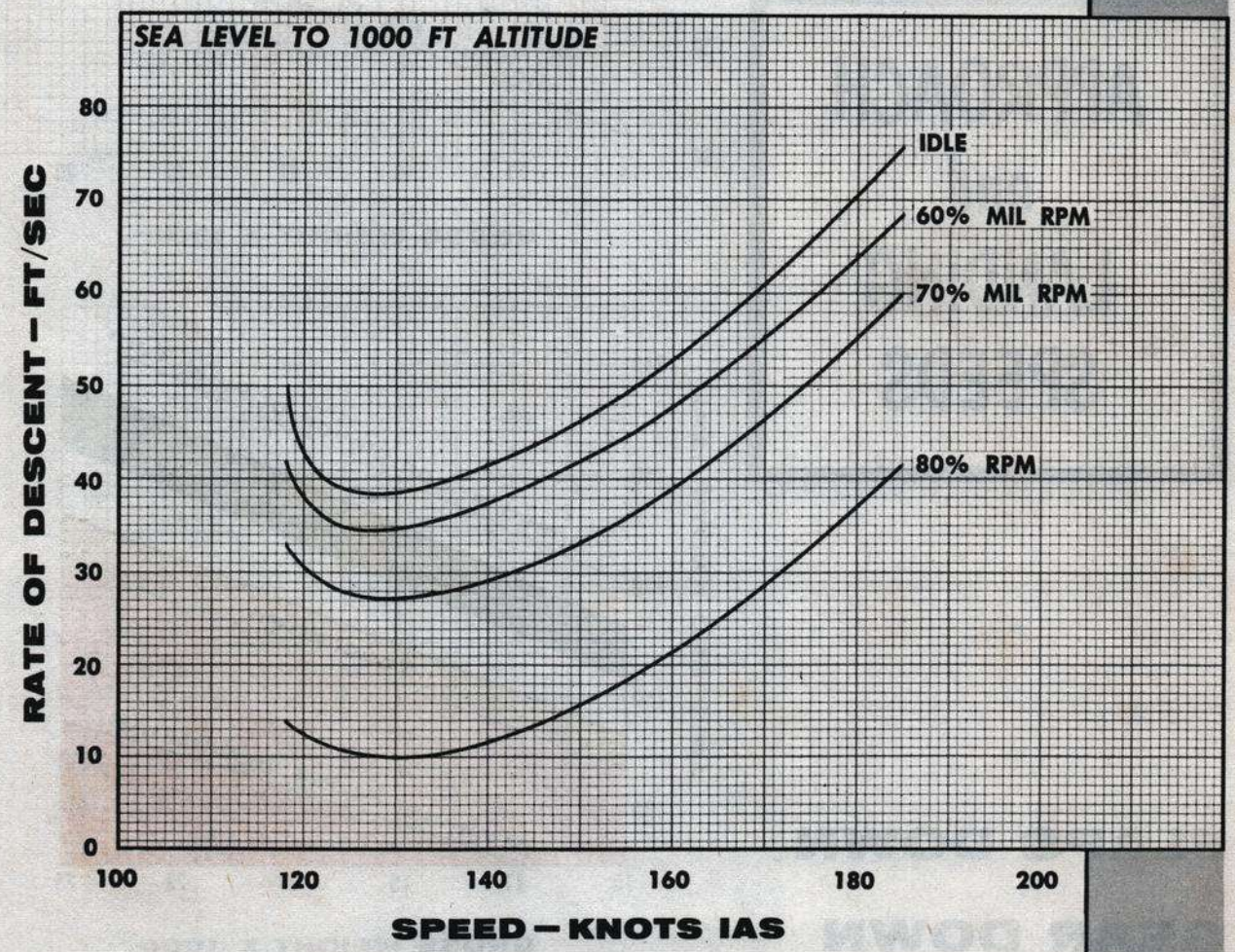
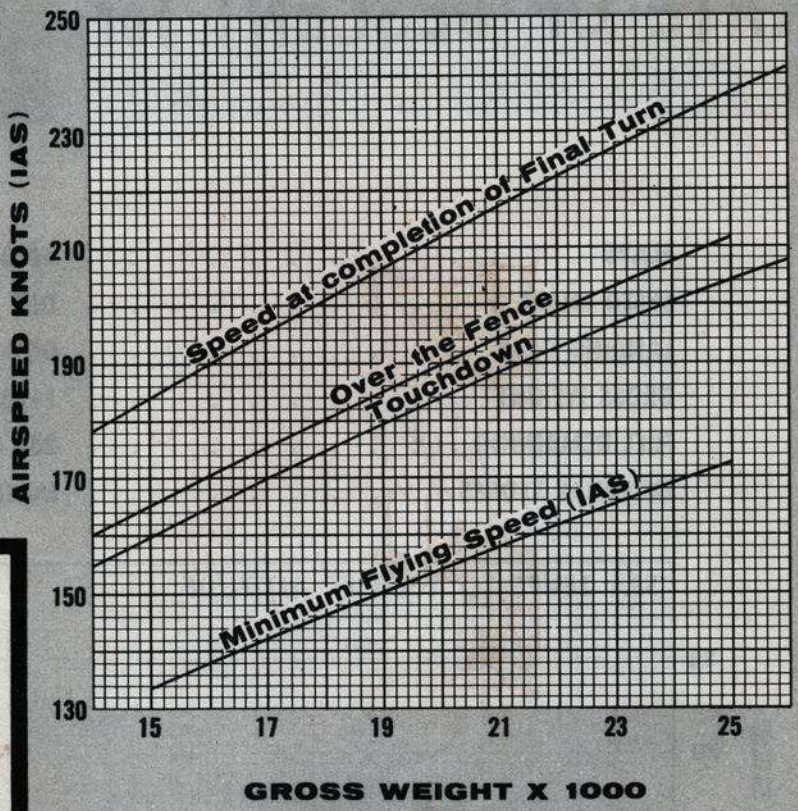


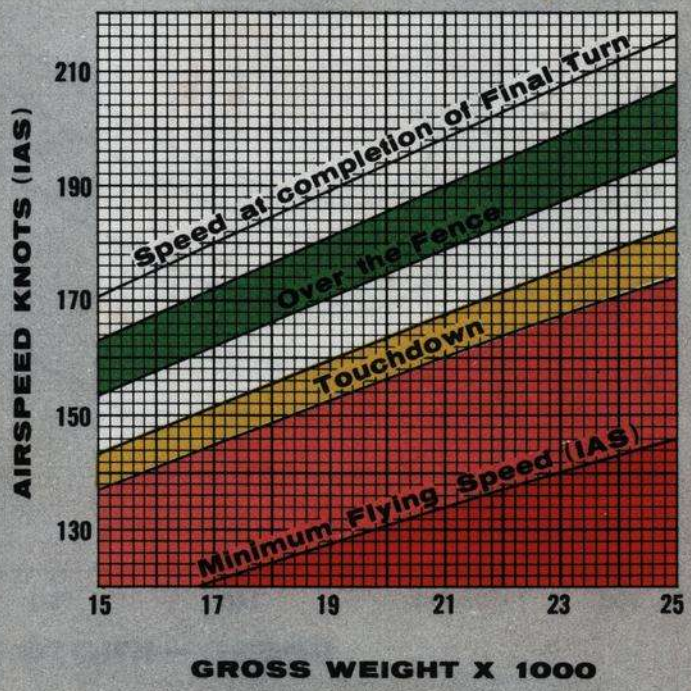
Figure 6–2

APPROACH and LANDING SPEEDS

FLAPS UP
GEAR DOWN



FLAPS DOWN
GEAR DOWN



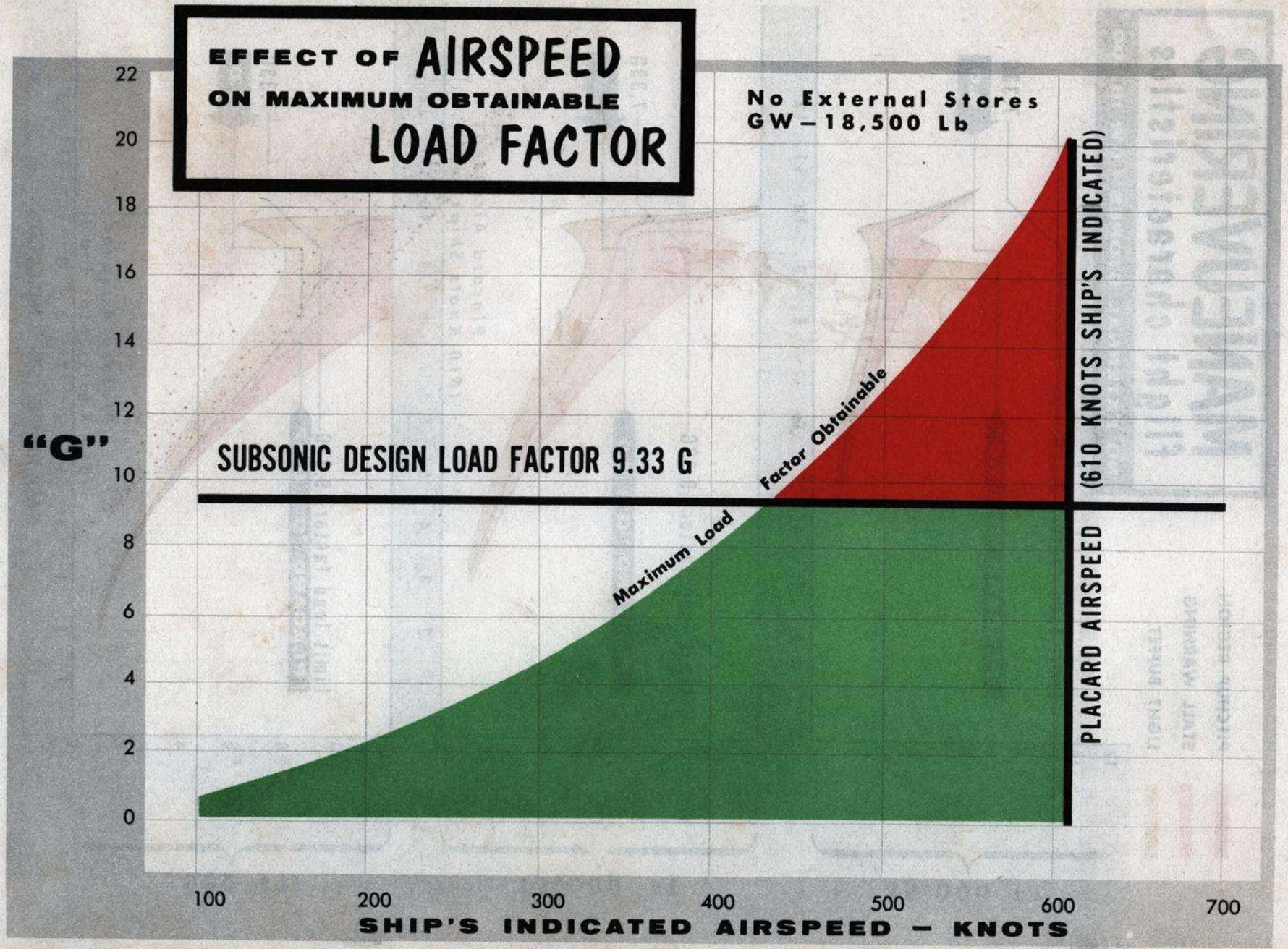

EFFECT OF AIRSPEED
ON MAXIMUM OBTAINABLE
LOAD FACTOR
No External Stores
GW—18,500 Lb
"G"
22
20
18
16
14
12
10
8
6
4
2
0
SUBSONIC DESIGN LOAD FACTOR 9.33 G
Factor Obtainable
Maximum Load
(610 KNOTS SHIP'S INDICATED)
PLACARD AIRSPEED
100
200
300
400
500
600
700
SHIP'S INDICATED AIRSPEED — KNOTS

Figure 6—4

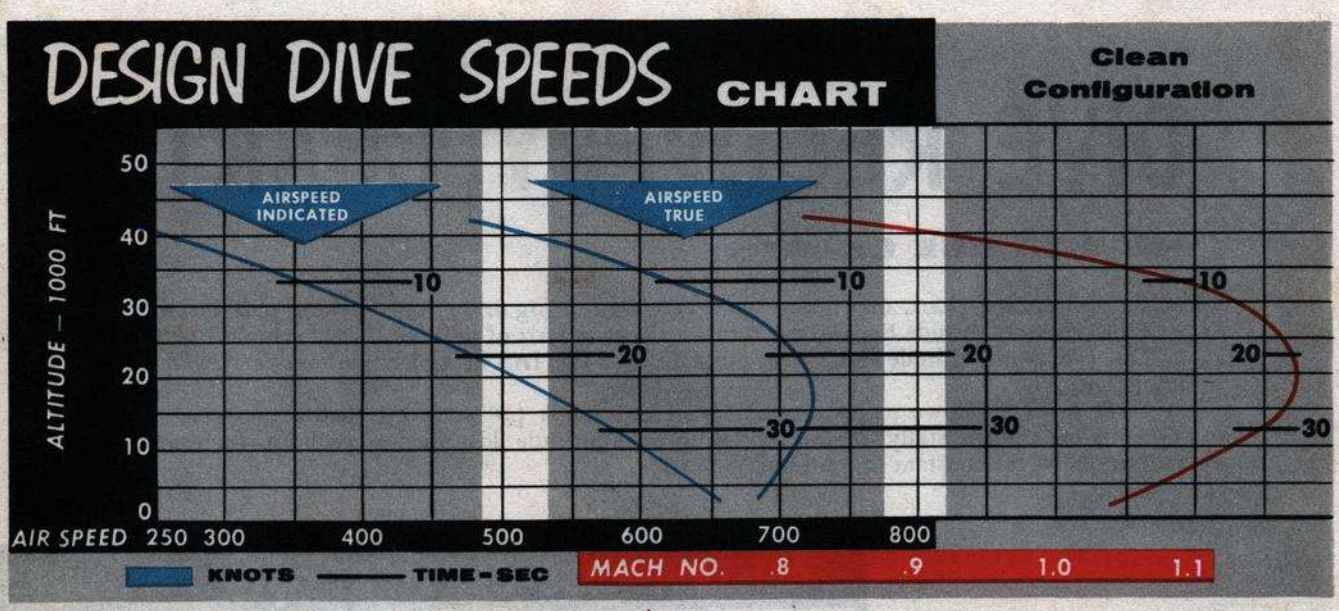


Figure 6—6

ing gear is retracted or extended. After take-off, when the gear retracts, the stabilator leading edge will move up (airplane nose down trim change) while the shifter is operating at any fixed aft stick position. Since this movement is relatively slow and the normal airplane nose up trim requirement is decreasing as the airplane accelerates, only small corrections need be made by the pilot to compensate for the change in stabilator position. When the gear is extended for landing the procedure outlined in the preceding sentence will be reversed and a slight nose up trim change will be noticed.

WARNING

Lateral control is inadequate under "Boost Off" high speed, low altitude conditions, and under turbulent landing conditions.

SPEED BRAKES.

Retractable speed brakes are provided on each side of the aft fuselage. They are effective and provide good deceleration from any speed with only minor trim changes. Buffeting due to the extension of these brakes is slight and not limiting to the utility of the airplane.

LEVEL FLIGHT CHARACTERISTICS.

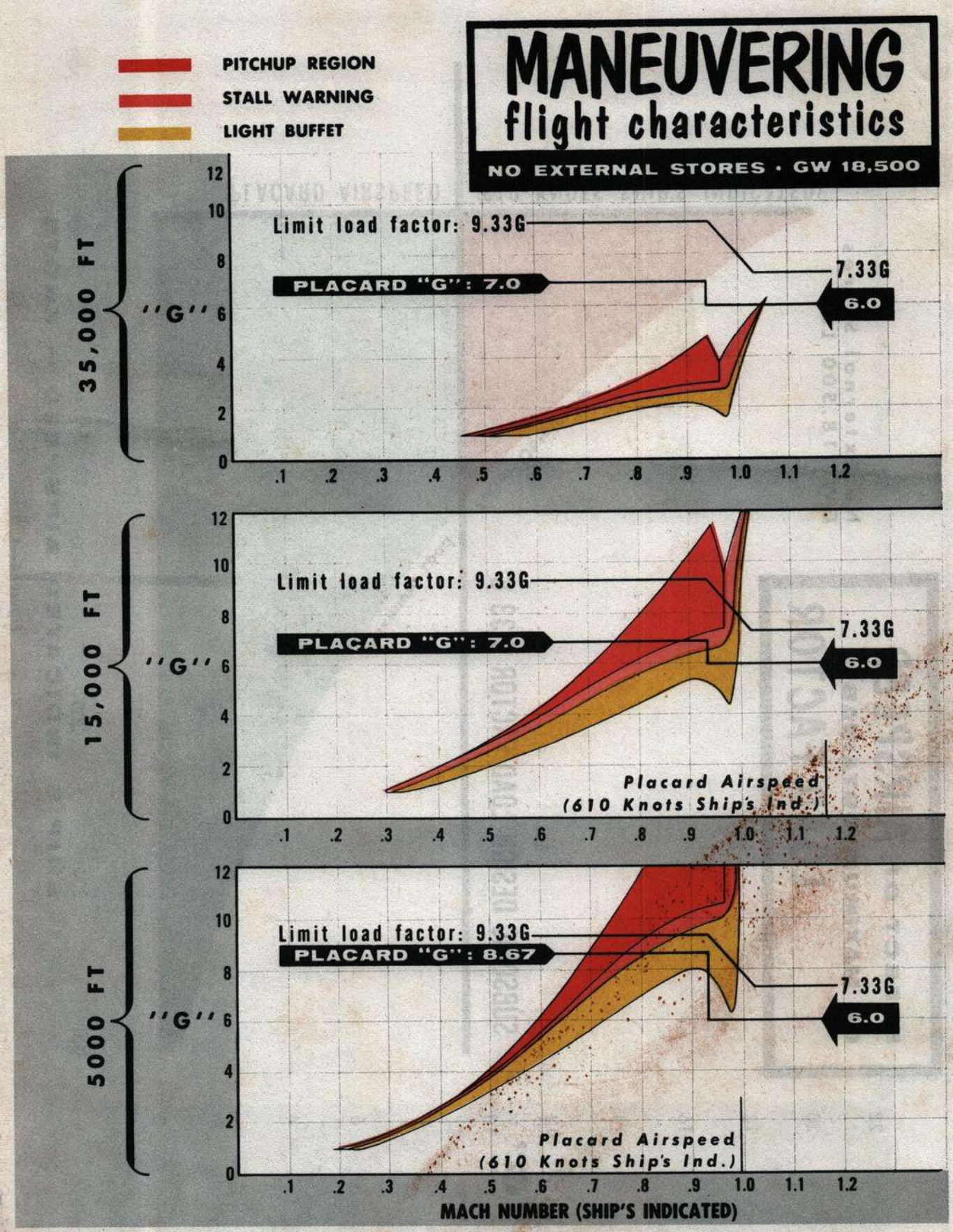
LOW SPEED.

The low speed characteristics and handling qualities are good. Angles of attack at minimum flying speeds are somewhat higher than with a straight wing.

The stabilizing tendency for the leading wing to rise, when the airplane is yawed with the rudder, is more noticeable with swept wings than with a straight wing. This is known as "dihedral effect". This dihedral effect produces considerable rolling tendency when the airplane is yawed, particularly at low speeds, and can be used very effectively to assist lateral control. Good control effectiveness about all control axes is provided down through the stall. The glide path becomes increasingly difficult to adjust at low speeds and therefore approach speeds must be governed accordingly. Extension or retraction of the landing flaps and gear causes only a slight trim change.

CRUISE AND HIGH SPEED.

The airplane trims well throughout the entire speed range. Stability is good about all axes. At Mach Numbers between approximately .85 and 0.95 a slight nose down tendency is present. This trim change is scarcely noticeable. In unaccelerated flight the airplane does not encounter any buffet throughout the speed range.


MANEUVERING
flight characteristics
NO EXTERNAL STORES · GW 18,500
PITCHUP REGION
STALL WARNING
LIGHT BUFFET
35,000 FT
15,000 FT
5000 FT
"G"
Limit load factor: 9.33G
PLACARD "G": 7.0
PLACARD "G": 8.67
7.33G
6.0
Placard Airspeed
(610 Knots Ship's Ind.)
0 2 4 6 8 10 12
.1 .2 .3 .4 .5 .6 .7 .8 .9 1.0 1.1 1.2
MACH NUMBER (SHIP'S INDICATED)

DIVE RECOVERY CHARTS

HOW TO USE CHARTS

Select appropriate chart, depending upon acceleration (4g or 6g) to be held in pull out; then –
1. Enter chart at altitude line nearest actual altitude at start of pull-out. (For example 20,000 ft.)
2. On scale along altitude line, select point nearest the IAS at which pull-out is started (350 knots IAS.)
3. Sight vertically down to point on curve of dive angle (70°) directly below airspeed.
4. Sight back horizontally to scale at left to read altitude lost during pull-out (constant 4g pull-out 5700 ft.; constant 6g pull-out 3800 ft.).

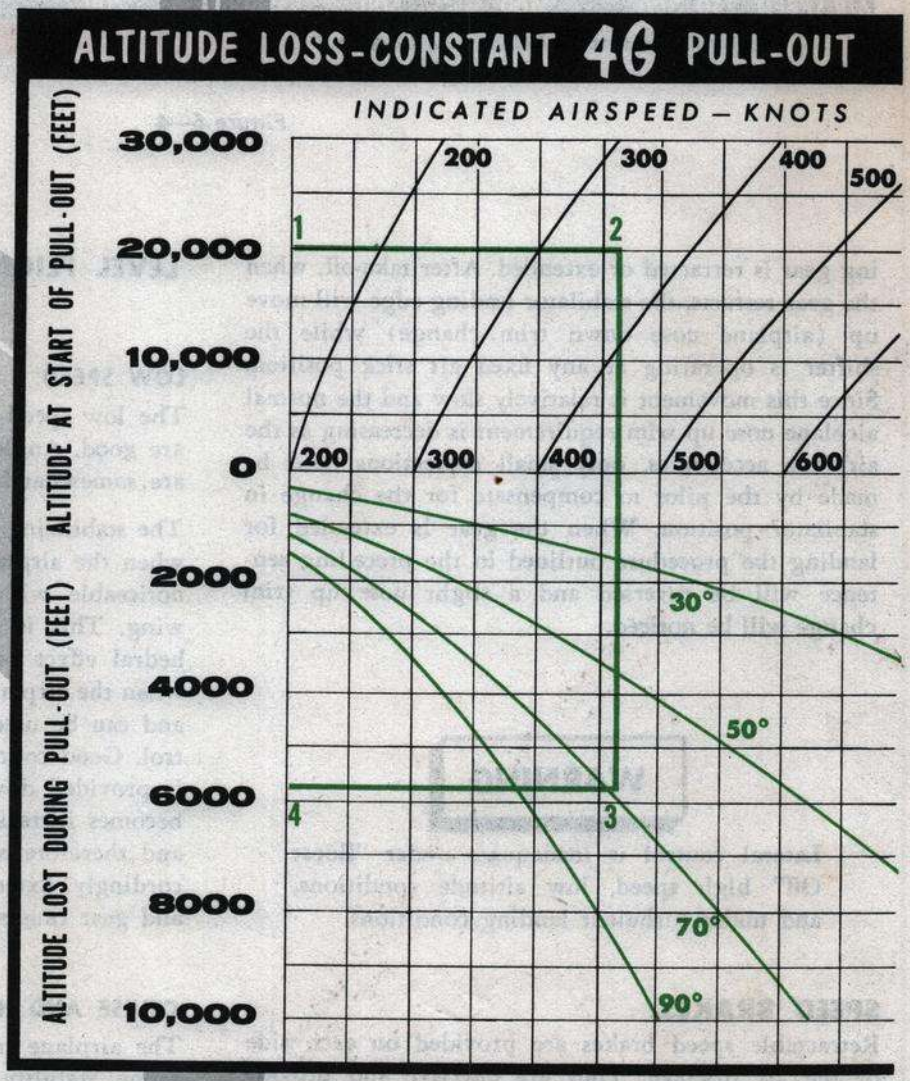
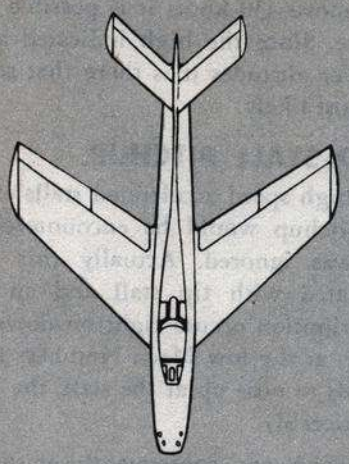


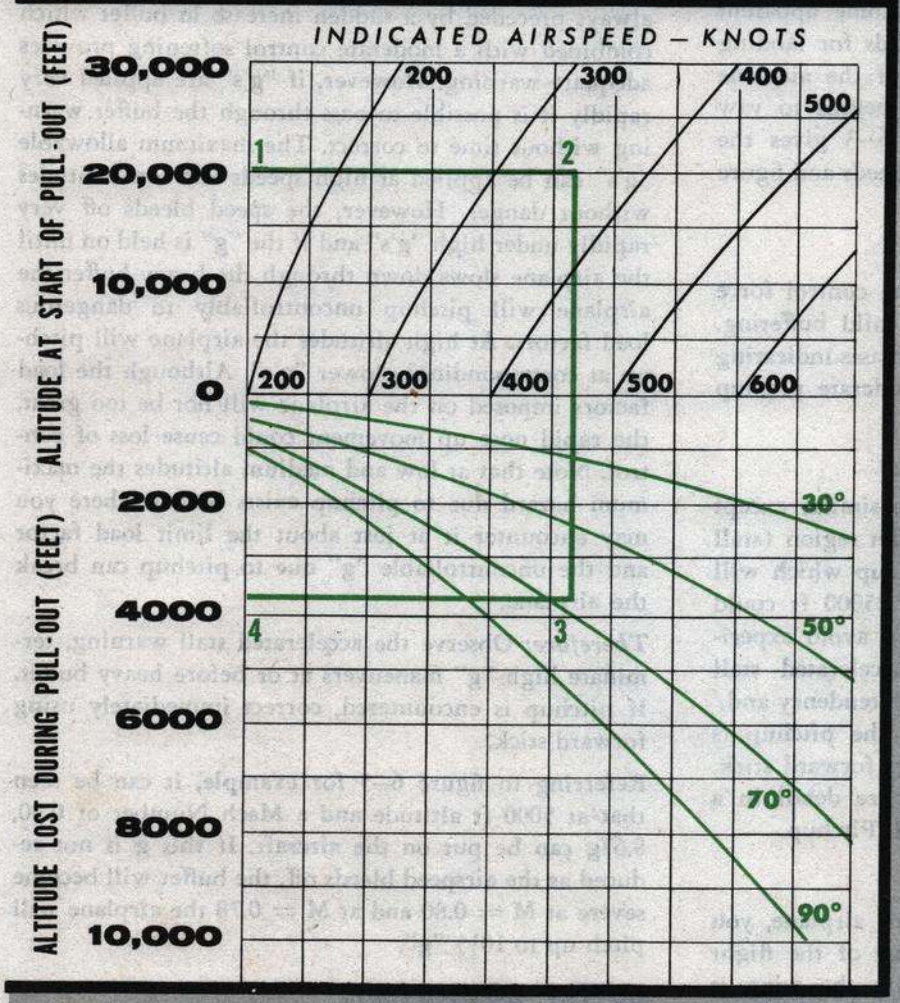
Figure 6–7 (sheet 1 of 2)



WARNING

Boundaries of load factors attainable with maximum elevator deflection are shown to indicate the maximum speeds at which 4g & 6g pull up can be executed. Pull-outs at speeds beyond the boundary lines result in altitude losses greater than shown for a given condition of speed, angle of dive and load factor. Caution should be exercised to make sure sufficient altitude is available to clear local terrain for any maneuver.

ALTITUDE LOSS-CONSTANT 6G PULL-OUT



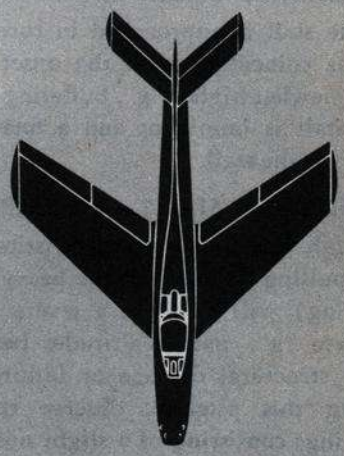


Figure 6—7 (sheet 2 of 2)

STALLS.

STALLS UNACCELERATED.

A slight yawing tendency followed by light buffeting occurs in advance of the stall. A control softening or slight nosing up tendency occurs coincident with heavier buffet. This is easily controlled with stabilator. Lateral control is adequate during the stall and recovery and any roll off tendency is easily controllable. Rudder is very effective in bringing a wing up particularly if the aileron boost is inoperative with resultant high stick forces. Since the airplane does not "fall through" until after the stall, but maintains a nose high attitude, practice stalls will be misleading. The airplane appears to be flying at speeds well below those which are usable for landing but under these conditions the sinking speeds are excessively high. It is rather difficult to establish a clear cut stall speed. With increased experience it will become apparent to the pilot that the practical air speeds for landing are governed by the sinking speeds of the airplane and those speeds at which the ship begins to yaw slightly prior to the buffet. Figure 6–3 gives the recommended approach, and landing speeds and figure 6–1 presents the actual stall speeds.

ACCELERATED STALLS — LOW SPEED.

As the stall is approached in turns the control force softens coincident with the onset of mild buffeting. At somewhat higher "g", buffeting increases indicating that stall is imminent and a final moderate pitchup occurs at the stall.

ACCELERATED STALLS — HIGH SPEED.

At high speeds the characteristics are similar except that pulling up through the heavy buffet region (stall warning) will result in a severe pitchup which will increase "g", and at altitudes below 25000 ft could cause structural damage or failure. To avoid experiencing this pitchup, observe the accelerated stall warnings consisting of a slight nose up tendency and/or an increase in buffet severity. If the pitchup is experienced, correct immediately using forward stick. This phenomenon, is described in more detail in a separate section on Accelerated Stall Pitchup.

MANEUVERING FLIGHT.

With the high speed capability of this airplane, you will be operating during a major part of the flight time in the high speed region where the wing is capable of developing load factors which can destroy the airplane.

The "g's" which the wing is capable of developing at various airspeeds are shown in figure 6–4. Note that the obtainable "g" increases with indicated airspeed and that above 430 knots it is possible to overload the airplane. Since the high indicated airspeeds occur at the lower altitudes it is there that structural overloading is most likely.

ACCELERATED STALL PITCHUP.

The section on high speed accelerated stalls explained that a severe pitchup would be encountered if the stall warning was ignored. Actually this pitchup, which is associated with tip stall and an inboard shift of lift distribution occurs right on down to low speeds. However, at the low Mach Numbers although the airplane tends to nose up at the stall, the "g" does not increase noticeably.

At the higher speeds and consequently at the higher "g's" an uncontrollable pitchup will be encountered if the buffet warning is ignored. This pitchup may be severe enough to break the wing. The pitchup is always preceded by a sudden increase in buffet which combined with a moderate control softening provides adequate warning. However, if "g's" are applied very rapidly it is possible to pass through the buffet warning without time to correct. The maximum allowable "g's" can be applied at high speeds and low altitudes without danger. However, the speed bleeds off very rapidly under high "g's" and if the "g" is held on until the airplane slows down through the heavy buffet the airplane will pitchup uncontrollably to dangerous load factors. At high altitudes the airplane will pitchup at correspondingly lower "g's". Although the load factors imposed on the airplane will not be too great, the rapid nose up movement could cause loss of control. Note that at low and medium altitudes the maximum hazard due to pitchup exists because there you may encounter it at just about the limit load factor and the uncontrollable "g" due to pitchup can break the airplane.

Therefore: Observe the accelerated stall warning, terminate high "g" maneuvers at or before heavy buffet. If pitchup is encountered, correct immediately using forward stick.

Referring to figure 6–5 for example, it can be seen that at 5000 ft altitude and a Mach Number of 0.90, 8.67g can be put on the aircraft. If this g is not reduced as the airspeed bleeds off, the buffet will become severe at M = 0.80 and at M = 0.78 the airplane will pitch up to 10½ "g".

BUFFET BOUNDARY.

The buffet boundary occurs at relatively high "g's" particularly at the higher indicated speeds as shown in figure 6–4. A very mild buffet is experienced when the "g" is increased to the initial onset of buffet and this remains mild with further increase in "g" until an

increase in the buffet intensity occurs at a higher "g". It is the latter increase in intensity which constitutes the accelerated stall warning. This should normally be considered a stopping point to prevent the high Mach Number stall pitchup previously described. The mild buffeting at somewhat lower "g's" does not limit maneuvers.

DIVES.

The acceleration in a dive is very rapid, and high dive speeds can be obtained. The speeds reached in a 60 deg dive from 40000 ft are shown in figure 6–6. Dives at high Mach Numbers close to the ground, are prohibited because of the large altitude loss during recovery as shown in figure 6–7. The high Mach Number dive characteristics are excellent. No buffet is experienced as the airplane picks up speed. The transition from subsonic to supersonic velocity is sometimes accompanied by a very slight, wing dropping, and/or yawing. Both are easily controlled by the pilot. Supersonic characteristics are excellent but reduced control effectiveness should be anticipated.

CAUTION

If the angle of dive is not steep enough to accelerate to supersonic speed and the aircraft stays at approximately Mach 1.0 some aircraft will tend to roll at this transition speed. Recovery is easily accomplished by either increasing speed or slowing down by reducing power and extending speed brakes.

SPINS.

The F-84F airplane has demonstrated consistently good spinning characteristics with no tendency toward flat or unrecoverable spins. When the airplane is held in a spin the 1st 3 or 4 turns are oscillatory. These oscillations decrease in amplitude as the spin progresses until after approximately 4 turns the airplanes' longitudinal axis is at an angle of approximately 60° relative to the ground. The airplane loses altitude at the rate of 1000 to 1200 ft turn taking approximately 2 seconds to complete one turn. Demonstration spins indicate that the best recoveries are effected when the corrective action is initiated during that part of the oscillation where the airplane nose is descending and with speed brakes retracted.

SPIN RECOVERY.

To recover from a spin the following procedure is recommended:

1. Apply full back stick and approximately ⅓ ailerons with the spin, then abruptly apply full opposite rudder.

WARNING

Ailerons held against the spin will prevent recovery. It is imperative that the ailerons be held neutral or slightly with the spin and the stick full back during recovery.

2. When the spin rotation stops neutralize rudder and ailerons and when the pullout is well underway ease the stick forward slowly. Premature forward movement of the stick during recovery attempt will cause the nose to go under excessively which may result in an inverted spin.

3. If the spin is entered when carrying external stores, use the recommended spin recovery procedure. If the spin does not stop in three turns, jettison external stores, and repeat recommended recovery procedure.

INVERTED SPINS.

As mentioned above improper recovery procedure from a normal erect spin may cause the spin to become inverted. This is recognized by the negative g's and the tendency for the pilot's hands and feet to pull away from the controls. The airplane is easily recoverable from an inverted spin using the following recovery procedure.

1. Neutralize controls.

2. Apply full rudder opposite to the direction of rotation.

WARNING

The direction of rotation in an inverted spin is easily confused. Therefore, in the inverted spin if the recovery is not accomplished in two turns, the pilot has interpreted the spin direction improperly and the rudder should be reversed.

FLIGHT CHARACTERISTICS WITH EXTERNAL STORES.

Various combinations of external tanks, bombs, rockets and special stores can be flown to very high Mach

Numbers with good flight characteristics. The aircraft with external stores is limited from higher speeds only by a slight directional and lateral instability which is easily recognized by the pilot as a "snaking" and roll wobbling effect. External stores tend to increase the severity of buffet during accelerated G maneuvers so that there is ample warning prior to any stall or pitchup.

WARNING

Abrupt, large displacements of the rudder should be avoided with external tanks installed. In this configuration excessive sideslip angles can lead to dangerous snap maneuvers. Extended speed brakes tend to further aggravate this condition.

WARNING

With unsymmetrical loadings, such as the special store installed, the ship will tend to roll off at high speeds. If severe roll off is encountered, slow down by reducing power. Applying G to the aircraft will increase the roll off tendency.

SECTION 7 SYSTEMS OPERATION



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ENGINE.

FUEL CONTROL.

The essential purpose of the fuel control is to regulate thrust as a function of throttle control position. Each position of the throttle always corresponds to the same percentage of maximum available thrust. The control also provides protection against overspeed, overtemperature, compressor surge and combustion flame-out. The top speed is established as high as possible without exceeding the maximum allowable turbine stresses, in order to obtain the maximum possible thrust. A small increase in speed above maximum greatly increases the turbine stresses. Furthermore, increasing the speed increases the turbine inlet temperature, and this temperature rise reduces the maximum allowable stresses of the turbine materials. Consequently, any speed increase above maximum will drastically shorten the life of the engine, if not cause immediate failure. In addition to providing steady state speed regulation, the control provides the proper fuel flow during acceleration and deceleration. During an acceleration, the control increases the fuel flow sufficiently to produce the most rapid acceleration of

which the engine is capable, without encountering compressor surge or exceeding the maximum temperature limits of the engine. During a deceleration, the control decreases the fuel flow sufficiently to produce a rapid deceleration, yet prevent loss of combustion, or flame-out. A compressor discharge pressure limiter is incorporated in the fuel control which automatically reduces the fuel flow to the engine, whenever the compressor discharge pressure exceeds its limit. This fuel flow reduction will cause a gradual reduction in rpm until the compressor discharge pressure returns to its limit. Reduction in fuel flow will occur at high airspeed, low altitude conditions and should be recognized by the pilot, to avoid unnecessary concern on his part regarding proper functioning of the fuel control. In order to maintain short acceleration times with increasing altitude, and to prevent loss of combustion during deceleration at altitude, it is necessary that the engine idle at progressively higher speeds as the altitude increases. In the event of failure of the main fuel control, the emergency control is provided which will permit safe operation of the engine. The essential requirement of the emergency system is that it be completely reliable. It must be as simple and as uncomplicated as possible. Therefore, the emergency control consists of a simple throttle valve, and during emergency operation fuel flow is a function of throttle control travel only. The compensating features for overspeed, overtemperature, compressor surge, and combustion flame-out have been eliminated to simplify the emergency system as much as possible.

EXHAUST GAS TEMPERATURE STABILIZATION.

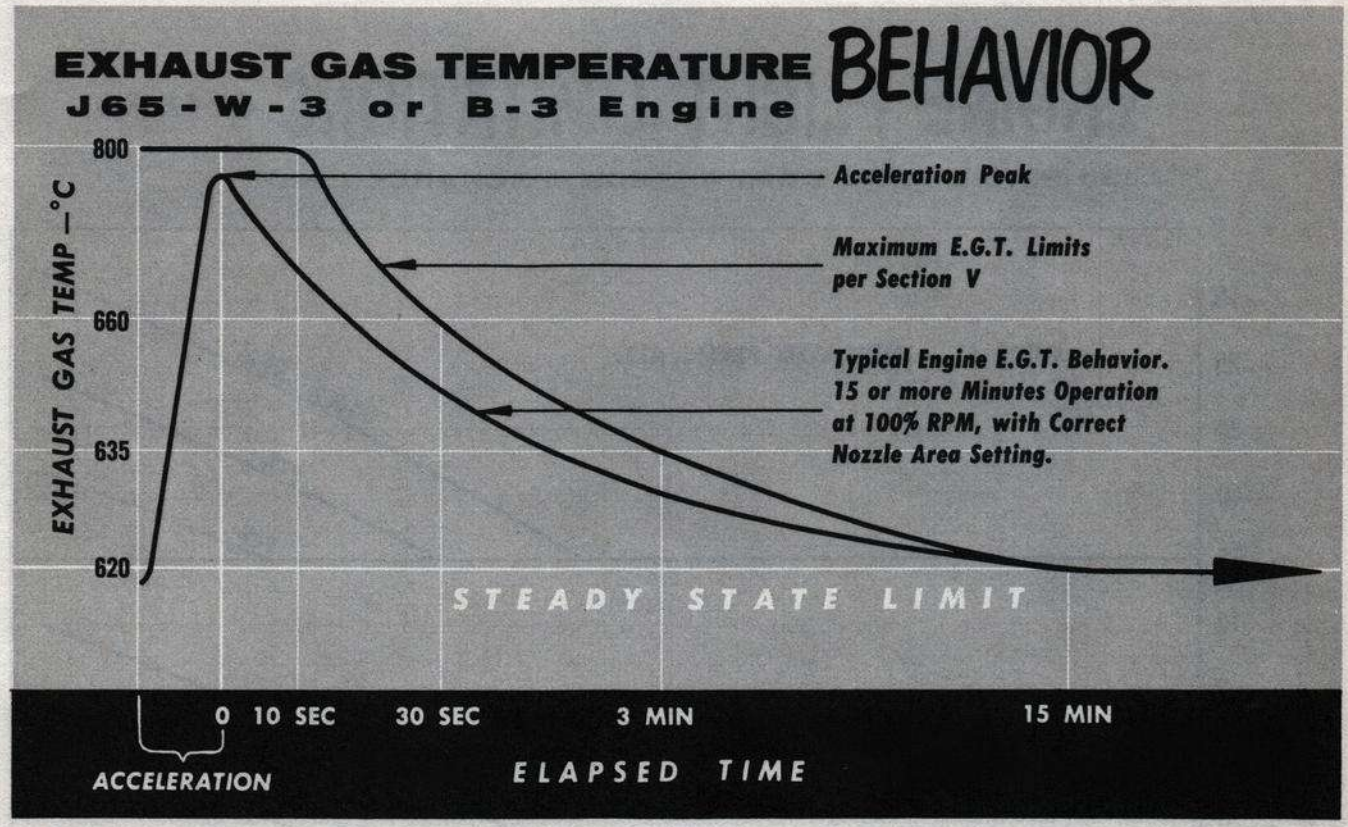
Approximately 15 minutes of steady running time at 100 per cent rpm is necessary after starting a cold engine, in order to obtain stabilized exhaust gas temperature readings. Assume that a start is made with a cold engine, and the throttle is advanced to obtain 100 per cent rpm. As the engine heats up, the turbine casing expands more rapidly than the turbine wheel. The net effect is a temporary increase in the clearance between the unshrouded turbine blades and the case. When this clearance is at maximum, the turbine efficiency is poorest and the exhaust gas temperature is highest. As the engine is run at full rpm the turbine wheel heats up and expands, the blade tip clearance diminishes, the turbine efficiency improves, and the exhaust gas temperature falls until stabilization is achieved. When a pilot starts the engine just prior to take-off, the temporary over-temperature operation should be recognized and understood as such. Figure 7–1 graphically illustrates the exhaust gas temperature behavior of a typical J65-W-3 or B-3 engine as compared to a curve of maximum exhaust gas temperature limits versus time. It will be noted that as the engine is accelerated from idle to full rpm, the exhaust gas temperature will peak somewhere below the short time maximum allowable and then settle to the gradual slope of the range between 635° and 620°C. At the end of 15 minutes, the exhaust gas temperature is reduced to the 620°C maximum or the stabilized valve according to figure 2–4. It is recognized that a start, take-off and climb operation will sometimes be accomplished before 15 minutes have elapsed. When this occurs the general characteristics as shown in figure 7–1 will occur in flight particularly in steady state conditions; but they might be modified somewhat by the flight operations selected by the pilot. Also to be considered are other factors which influence exhaust gas temperature characteristics over and above throttle setting and temperature soaking effects. Lower ambient temperatures encountered as the airplane increases in altitude and characteristics of fuel flow schedule will account for part of the exhaust gas temperature sag at the medium altitudes. However, at altitudes of 35000 feet and up, the exhaust gas temperature tends to rise due to the characteristics of the engine and control combination. Both of these latter manifestations will occur regardless of how long the engine has been running and should therefore not be confused with exhaust gas temperature stabilization behavior.

ENGINE COMPRESSOR DISCHARGE LIMITS.

The engine must not be operated with the compressor discharge pressure above 130 psi. However, a compressor discharge pressure indicator is not provided for the pilot so that he must rely on a combination of Mach No. and temperature at low altitudes to prevent exceeding the compressor discharge limits. This limit will occur at low altitude, high airspeed on cold days. The fuel control does not incorporate an automatic cut-off to reduce the fuel flow under these conditions, therefore, the throttle must be retarded by the pilot to reduce fuel flow. Figure 7–1 depicts the permissible Mach No. for various ambient temperatures and altitudes. It will be noted that a high Mach No. is permissible with a lower engine rpm for a given temperature. If the higher rpm is maintained, the maximum compressor discharge pressure will be exceeded and engine damage may result.

ENGINE OIL PRESSURE.

Loss of engine oil pressure occurs when the airplane is flown in a zero g attitude and does not return to normal for considerable time, even though the airplane is returned to the normal flight attitude. The engine oil pressure will recover to normal in one minute or


EXHAUST GAS TEMPERATURE BEHAVIOR
J65-W-3 or B-3 Engine
EXHAUST GAS TEMP — °C
800
660
635
620
Acceleration Peak
Maximum E.G.T. Limits per Section V
Typical Engine E.G.T. Behavior. 15 or more Minutes Operation at 100% RPM, with Correct Nozzle Area Setting.
STEADY STATE LIMIT
0 10 SEC 30 SEC 3 MIN 15 MIN
ACCELERATION
ELAPSED TIME

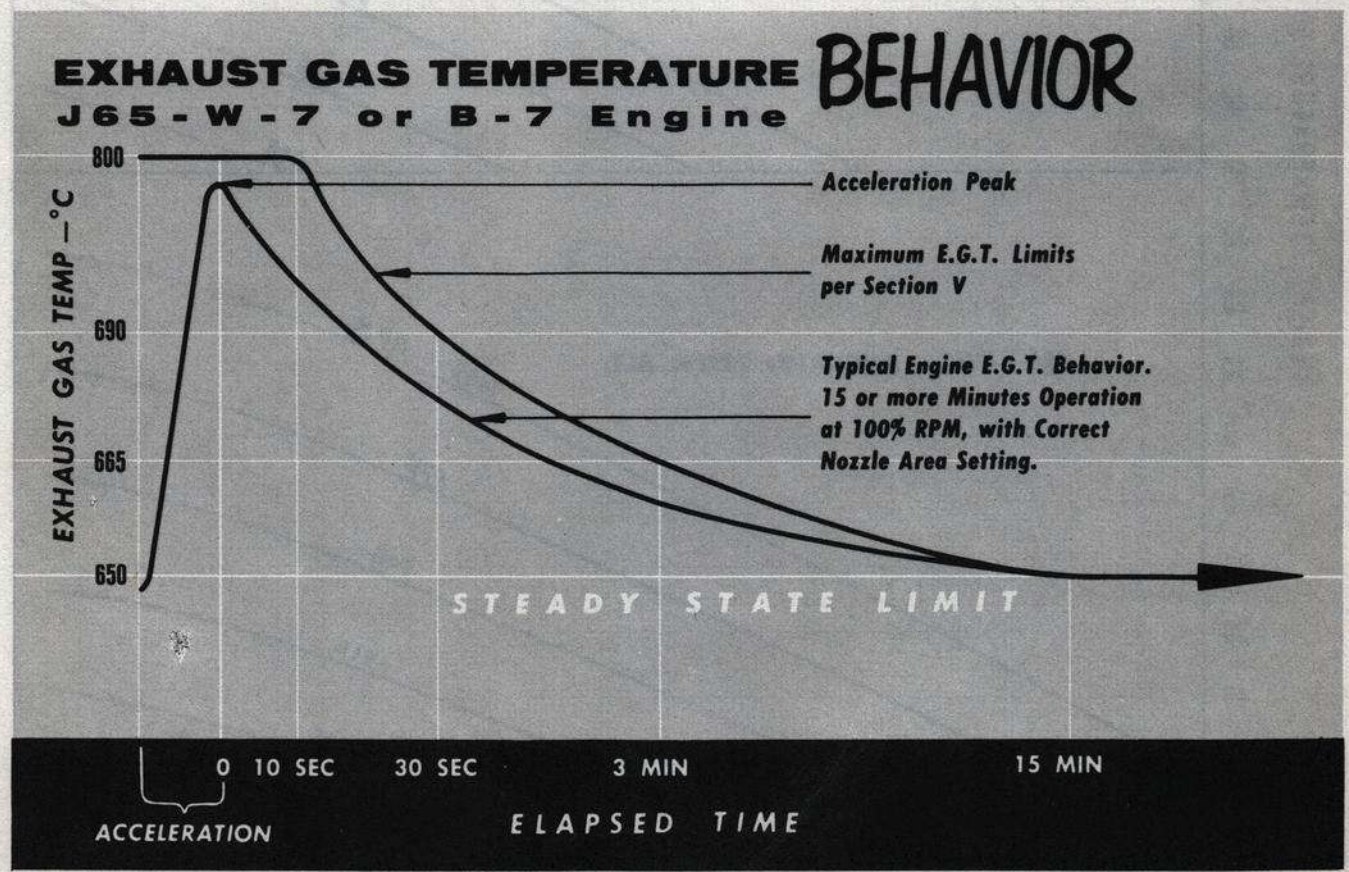
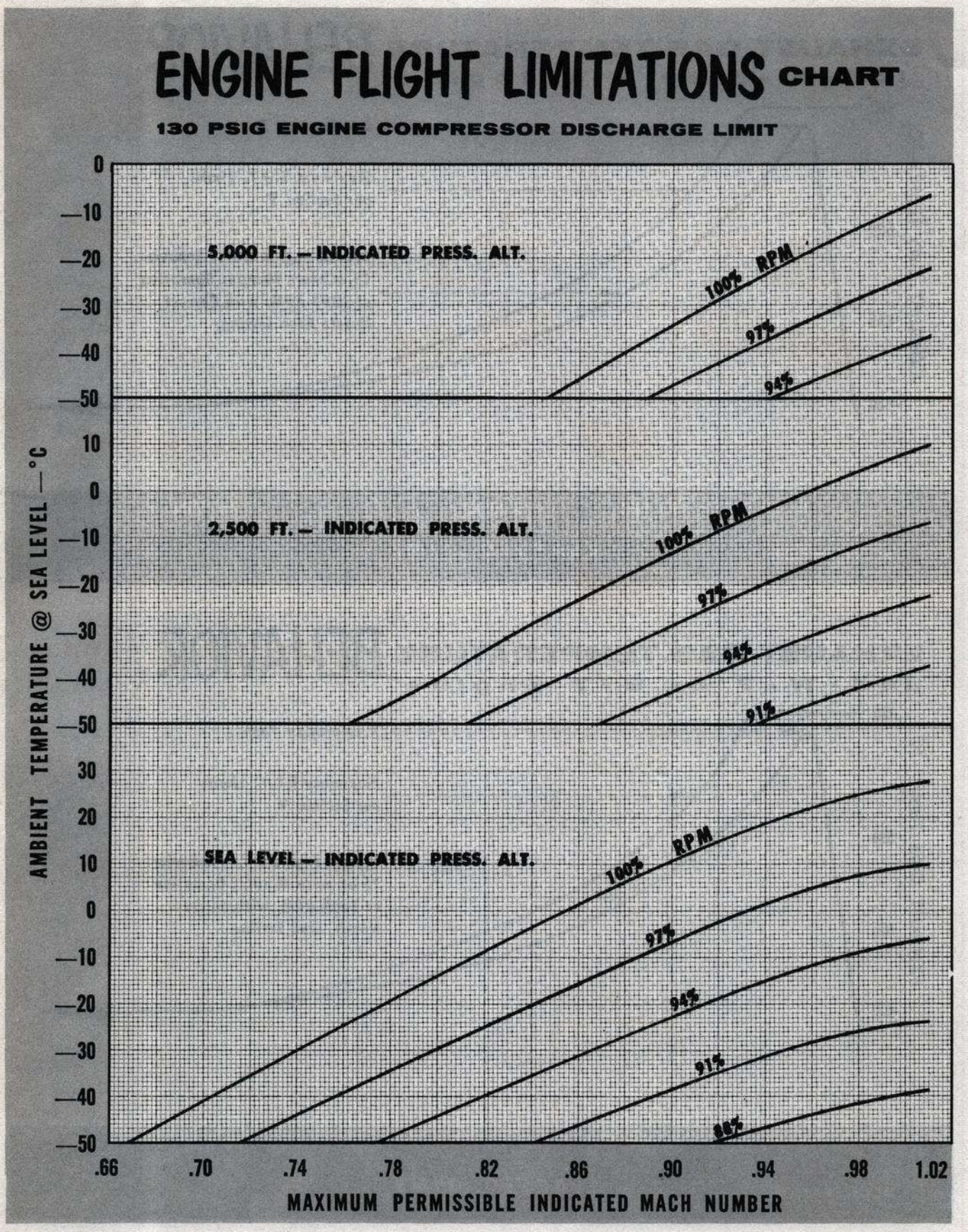
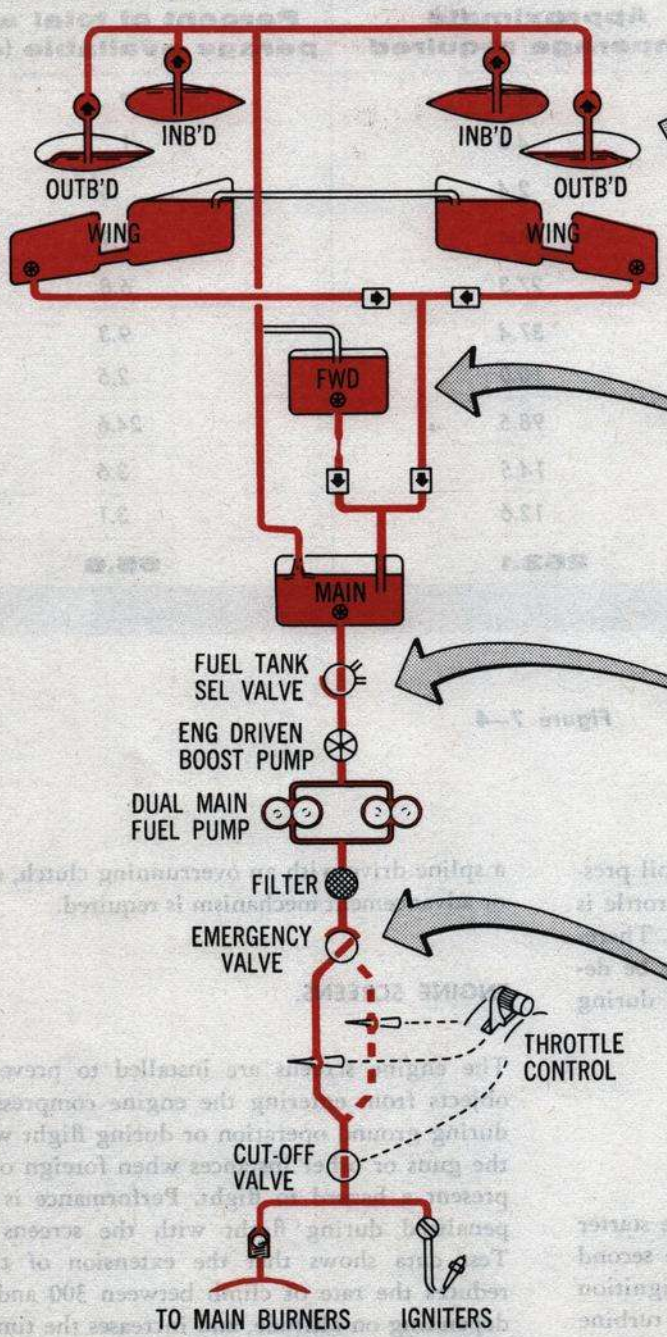

EXHAUST GAS TEMPERATURE BEHAVIOR
J65-W-7 or B-7 Engine
EXHAUST GAS TEMP — °C
800
690
665
650
Acceleration Peak
Maximum E.G.T. Limits per Section V
Typical Engine E.G.T. Behavior. 15 or more Minutes Operation at 100% RPM, with Correct Nozzle Area Setting.
STEADY STATE LIMIT
0 10 SEC 30 SEC 3 MIN 15 MIN
ACCELERATION
ELAPSED TIME

Figure 7—1

ENGINE FLIGHT LIMITATIONS CHART



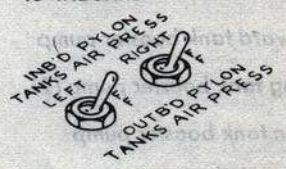
FUEL SYSTEM MANAGEMENT
SCHEMATIC



NOTE: — PYLON TANKS "OFF" FOR TAKE-OFF

PYLON TANKS

USE OUTBOARD FIRST WHEN EMPTY SWITCH IS INBOARD



WING & FWD TANKS

TRANSFER OF FUEL TO MAIN TANK BEGINS AUTOMATICALLY WHEN PYLON TANKS ARE EMPTY

NOTE: — 0-40 GALS REMAIN IN FWD TANK WHEN WING TANKS ARE EMPTY

FUEL TANK SELECTOR

"ALL TANKS" POSITION FOR NORMAL OPERATION



EMERGENCY SWITCH

"OFF" — CRUISE & LAND (FLOW AS AT LEFT)

PRIOR TO F-84F-55 "ALERT" — TAKE-OFF (FLOW UNCHANGED AS LONG AS NORMAL PRESS IS MAINTAINED)



Figure 7-3

fuel used in the check climb and the acceleration of the airplane and engine. Tests have also shown that the screens have excellent debris retention characteristics. However, there is a remote possibility that some forms of debris caught by the screens can peel off the screen edge and be sucked into the compressor during the retraction of the screen. Therefore, where possible, screens should not be retracted until flight conditions make it possible for the pilot to use the established emergency procedures in the event of extreme foreign object damage to the engine.

FUEL SYSTEM MANAGEMENT.

During normal operation fuel is transferred first from the outboard pylons, then the inboard pylons to the main tank so that the pylons can be dropped to reduce drag. Fuel is then transferred simultaneously from the wing and forward tanks to the main tank at varying flows so that the wing tanks will empty while there still remains 0 to approximately 40 gals in the forward tank. The fuel in the main tank is then consumed. Inasmuch as the normal fuel system is fully automatic, with the tank selector in the ALL TANKS position, the pilot does not have to select the various fuel flow patterns, except for manual selections of the external tanks air pressure. If it is necessary to operate on either the wing or forward auxiliary fuel flow patterns, the fuel tank selector should not be turned through the OFF position, as a flame-out may occur due to a lack of fuel supply. The emergency fuel switch must be in the OFF (NORM) position for all normal operations. If the switch is left in the ALERT (TAKE-OFF ONLY) position on aircraft prior to F-84F-55RE, during take-off, the emergency system will automatically take over at an altitude of 6000 feet due to the reduction of fuel flow with increased altitude. The emergency system will also take over, if armed, under 6000 feet, if the rpm is decreased, due to the reduced fuel flow.

FUEL TANK SELECTOR.

If the fuel tank selector is turned to the OFF position, immediately after closing the throttle, the fuel tank selector becomes tightly bound on some airplanes and cannot be moved to any other position without extreme difficulty. This is caused by a fuel pressure build-up between the fuel tank selector valve and the engine driven pump as the engine coasts to a stop. If this condition exists, the simplest way to free up the fuel tank selector is to motor the engine over slowly by actuating the engine crank switch to the ENGINE CRANK position for one or two seconds while holding the fuel tank selector toward the ALL ON position. An alternate method, is to hold pressure against the fuel tank selector toward any on position, while making a normal start. As the engine picks up speed, the selector will free up and if positioned to a tank containing fuel, a normal start will follow.

OPERATION WITH VARIOUS FUELS.

At the present time fuel in accordance with Spec MIL-F-5624A (grade JP-4) is the only recommended fuel for use in the engine. If it becomes necessary to use gasoline (MIL-F-5572) as an alternate fuel this is considered an emergency procedure and a hot section inspection of the engine must be performed after each time MIL-F-5572 is used.

PYLON TANK FEEDING.

When a pylon tank stops feeding, there may be a slight rumble accompanied by vibration from below the pilot's seat area. This condition is of short duration and is caused by air surges into the main tank or as the pressure reducing valve, which controls both the cockpit seal and pylon tank air pressure, fluctuates on stabilizing for the new required air flow. If the pylon tanks stop feeding prematurely, attempt to obtain fuel transfer again as follows:

1. Actuate the pylon tank air pressure switches.
2. Cycle the air refueling receptacle door.
3. Execute a series of zooms and dives.
4. Descend to a lower altitude.
5. Cycle the fuel shut-off valves.

PYLON TANK PRESSURIZATION.

Suction relief valves are not incorporated in Type II external tanks, therefore, the air pressure must be maintained to prevent the tanks from collapsing during high rates of descent. If inboard pylon tanks are retained, the pylon tanks air pressure switches should be left in the INB'D PYLON TANKS AIR PRESS position after the tanks are empty. However, if inboard and outboard tanks are both retained, descents must be made at a slow rate and the pylon tanks air pressure switch alternately placed in the INB'D PYLON TANKS AIR PRESS and OUTB'D PYLON TANKS AIR PRESS position at approximately every 1000 feet of descent in order to equalize the pressure differential and prevent the tanks from collapsing.

PYLON TANK AIR PRESSURE SWITCHES.

When the airplane is serviced on the ground, the feed lines from the wing tanks to the main tank may be

ELECTRICAL LOAD CHART

Major components which require comparatively high amperage while in operation. Components requiring very little amperage are not listed.

Component	Approximate amperage required	Percent of total amperage available (400)
Gun-bomb-rocket Sight heaters	28.0	7
Pitot heater	4.0	1
Flight Instruments	2.4	.6
Forward tank booster pump	28.4	7.1
Wing tank booster pump (2)	27.3	6.8
Main tank booster pump	37.4	9.3
Alternate Inverter	10.0	2.5
Main Inverter	98.5	24.6
Communication Equipment	14.5	3.6
Misc.	12.6	3.1
Total load	**263.1**	**65.6**

Figure 7—4

less, if the engine rpm is not decreased. The oil pressure will not recover in one minute, if the throttle is retarded when zero oil pressure is experienced. Therefore, it is recommended that engine rpm not be decreased when the oil pressure drops to zero during zero "g" maneuvers.

STARTING SYSTEM.

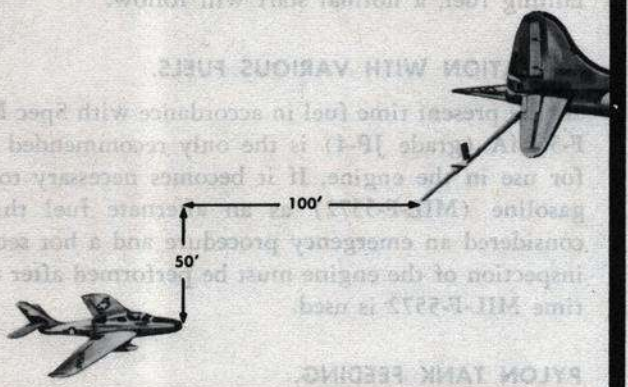
The starting system is automatic, however, the starter switch should be held for a minimum of one second to assure energizing the starter and engine ignition systems and the primer timer units. The starter turbine reaches a speed of 44000 rpm in 3 to 3.5 seconds to turn the engine up to a self sustaining speed of 2000 rpm through a two stage planetary gear reduction with a ratio of 22:1. The starter is engaged to the engine with a spline drive with an overrunning clutch, and no jaw or advancement mechanism is required.

ENGINE SCREENS.

The engine screens are installed to prevent foreign objects from entering the engine compressor section during ground operation or during flight when firing the guns or other instances when foreign objects may present a hazard to flight. Performance is somewhat penalized during flight with the screens extended. Test data shows that the extension of the screens reduces the rate of climb between 300 and 475 fpm, depending on altitude, and increases the time to climb to 40000 feet by 1.5 minutes. Maximum sea level static thrust is reduced by approximately 4.4 per cent. Extension of the screens produced a negligible effect on level flight maximum speed, exhaust gas temperature,

AIR REFUELING

1.



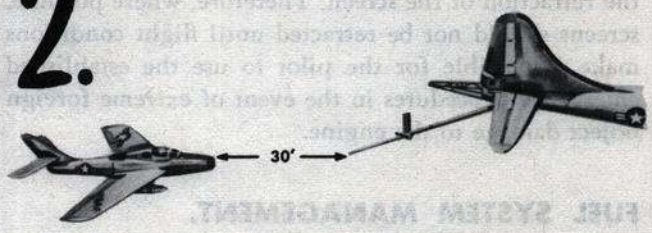
OBSERVATION POSITION

Take a position 100 feet directly behind and 50 feet below the tanker, out of the tanker downwash field, which is known as the observation position. Upon reaching this position the receiver pilot should trim the airplane, stabilize the power setting to maintain position, check the throttle friction lock and open the refueling slipway door. The speed brakes and flaps should be in the retracted position.

Note

Do not open the refueling receptacle at speeds above 350 Knots IAS.

2.

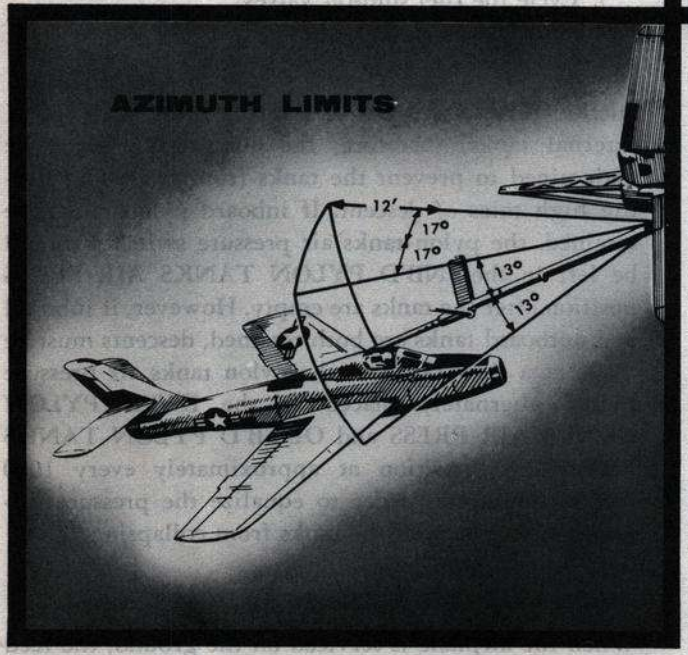


FORMATED POSITION

When going from the observation position to the formated position move forward and upward simultaneously to a position at the proper elevation but approximately 30 feet aft of the end of the boom. Then move forward slowly to contact the boom. It is also possible, though somewhat more difficult, to move from the observation position directly to the contact position. Since the receiver is now in the tanker's downwash, more power and a slightly different pitch trim may be required.

Note

The flaps may be extended 20 percent to aid in contacting the tanker.



EMERGENCY OPERATION

Figure 7—5 (Sheet 1 of 2)

SYSTEM 3. PILOT TECHNIQUE



CONTACT POSITION

When making contact with the boom the receiver pilot will rely primarily upon his visual observations and verbal instructions from the boom operator. The pilot director lights, located on the bottom of the tanker, are actuated by movements of the boom and therefore provide assistance only when in contact. When the receiver is properly positioned the boom is inserted by the boom operator and contact is made. If contact is broken, the pilot should recycle the amplifier before making another contact.

EMERGENCY OPERATION

The word BREAKAWAY is an emergency term and is to be used only as such. When BREAKAWAY is heard over the radio during air refueling operations the following will be accomplished by the indicated crew members:

Tanker pilot: Increase power and climb on course.

Receiver pilot: Actuate the air refueling emergency disconnect switch on the throttle control. Decrease power (chop throttle). Drop aft of tanker. Do not dive under tanker or attempt to turn until well clear of the tanker and boom.

Note

If electrical disconnect fails, mechanical disconnect without damage can be made by the abrupt reduction of power allowing the receiver to slow down and effect a "Brute Force" disconnect.

REFUELING

As soon as contact is made, indicated by the nozzle contact indicator light, refueling begins. The receiver pilot should advance the throttle as smoothly as possible to maintain position as the fuel is transferred. The increased power is required to overcome the rate of change of receiver weight, boom effects and the momentum of the fuel being transferred. Prompt throttle action is necessary to avoid dropping backward and downward because of the dynamic effects during transfer. The pilot has to anticipate this power change because it is very difficult to overcome any appreciable aft motion after it becomes established.

Note

After refueling, leave pylon tank air pressure switches in the OFF position until wing tank fuel level drops. The switches are then positioned to the ON posiion. This procedure will purge the fuel transfer lines of air.

NORMAL DISCONNECTS

When all the tanks are full the nozzle will automatically disconnect and the boom retract. As soon as contact is broken the receiver pilot should leave the contact position by dropping straight down and aft until out of the tanker's downwash. The refueling door is then closed before increasing speed.

Note

The receiver pilot or the boom operator can effect a disconnect before the tanks are full by depressing the nozzle disconnect switch. Also an automatic disconnect will result if the flight envelope is exceeded in any direction. The limits of this envelope are defined by the boom position relative to the tanker. Disconnect occurs at:

1. *Boom extension beyond 45 feet and closer than 33 ft to the tanker.*
2. *Boom elevation above 25 degrees and below 49 degrees relative to tanker horizontal center line.*
3. *Boom azimuth of 17 degrees left or right of tanker centerline.*

Figure 7-5 (Sheet 2 of 2)

filled with air. The trapped air is not bled out until the main tank level drops and allows the main tank shut-off valve, from the wings and forward tanks, to open. If the fuel tank selector is positioned to WING AUX before the wing transfer lines are filled with fuel, the engine will be momentarily starved and a flame-out will result. With the pylon tank air pressure switches OFF enough fuel will be consumed from the main tank during ground operation through take-off to start transfer of fuel from the forward and wing tanks to the main tank. This should bleed the wing and forward transfer lines sufficiently.

ELECTRICAL POWER SUPPLY SYSTEM.

The electrical load chart (figure 7–4) lists the major components which require comparatively high amperage while in operation so that a pilot can ascertain that the loadmeter reading is normal prior to take-off. Components requiring very little amperage are not listed.

SPEED BRAKE OPERATION.

If the landing flap lever is in the DOWN position on airplanes prior to F-84F-45, and the speed brakes are extended or retracted, the flaps may momentarily blow up approximately 10 degrees (25 per cent) due to a momentary drop in hydraulic pressure. This condition can be avoided by placing the flap lever in the NEUT position after the flaps are fully extended.

HYDRAULIC POWER SUPPLY SYSTEM.

EMERGENCY HYDRAULIC SYSTEM. A thru J

Depressing the hydraulic by-pass switch during ground test opens a dump valve in the normal hydraulic system so that hydraulic pressure is relieved on aircraft prior to F-84F-50 and on later aircraft shuts off normal hydraulic pressure to the aileron, rudder and stabilator so the emergency system can be checked for operation. The emergency hydraulic system accumulator consists of a floating piston within a closed cylinder. The compartment on one side of the piston is filled with compressed air while the other side contains hydraulic fluid. When the airplane remains idle for a period of time the hydraulic fluid will lose its pressure and the piston will move to the extreme end of the cylinder. Hydraulic pressure will be regained in the accumulator in approximately 10 minutes during engine operation through a bleed from the normal hydraulic system. However, if the pressure in the boost and utility systems is dumped and the emergency hydraulic system cuts-in, the accumulator will pressurize itself immediately. Therefore, the emergency system is operated prior to take-off so that in the event of failure of the boost and utility systems, a fully pressurized emergency accumulator will be available, if needed, during take-off.

LANDING GEAR SYSTEM.

A vibration, felt after take-off when the landing gear is retracted may be mistaken for engine roughness but could be caused by an unbalanced nose wheel. This vibration would be more noticeable after take-off in the heavier configurations as the take-off speed is higher. Vibration, caused by the nose wheel, will diminish as the wheel coasts to a stop.

OXYGEN SYSTEM.

Numerous instances of the presence of carbon monoxide in the flight compartment of jet aircraft have been suspected. Some of these instances have been brought to light through accident investigations. There are various possibilities by which carbon monoxide may enter the compartment during ground operation; however, as yet, neither the exact concentration nor the exact sources have been determined, except as indicated below. Consequently, the following instructions should be complied with. If the subject aircraft is to be operated under possible conditions of carbon monoxide contamination, such as during "runup" or taxiing directly behind another operating jet aircraft or during "runup" with its tail into the wind the following procedure shall be used:

1. Before starting engine, don oxygen mask, connect hose to oxygen regulator, and place dilute lever at the 100% OXYGEN position.

2. Whenever contamination is suspected, 100 per cent oxygen will be used during ground operation and take-off.

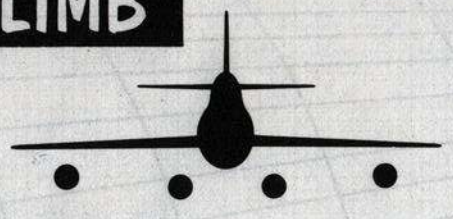
3. After contamination is no longer suspected, place the diluter lever of the oxygen regulator at the NORMAL OXYGEN position.

WARNING

The oxygen diluter lever must be returned to the NORMAL OXYGEN position as soon as possible because the use of 100 per cent oxygen throughout a long mission will so deplete the oxygen supply as to be hazardous to the pilot.

F-84F-25 AND LATER • J65-W-3 OR B-3 ENGINES • STANDARD DAY •

NORMAL POWER (8000 RPM) CLIMB



ALT-FT	CAS-KNOTS	MACH NO.
45,000	185	.70
40,000	210	.70
35,000	235	.70
30,000	245	.66
20,000	260	.57
10,000	275	.50
SEA LEVEL	285	.43

CONFIGURATION: CLEAN + 2(230) GAL
CLASS I TANKS + 2(230) GAL CLASS II TANKS

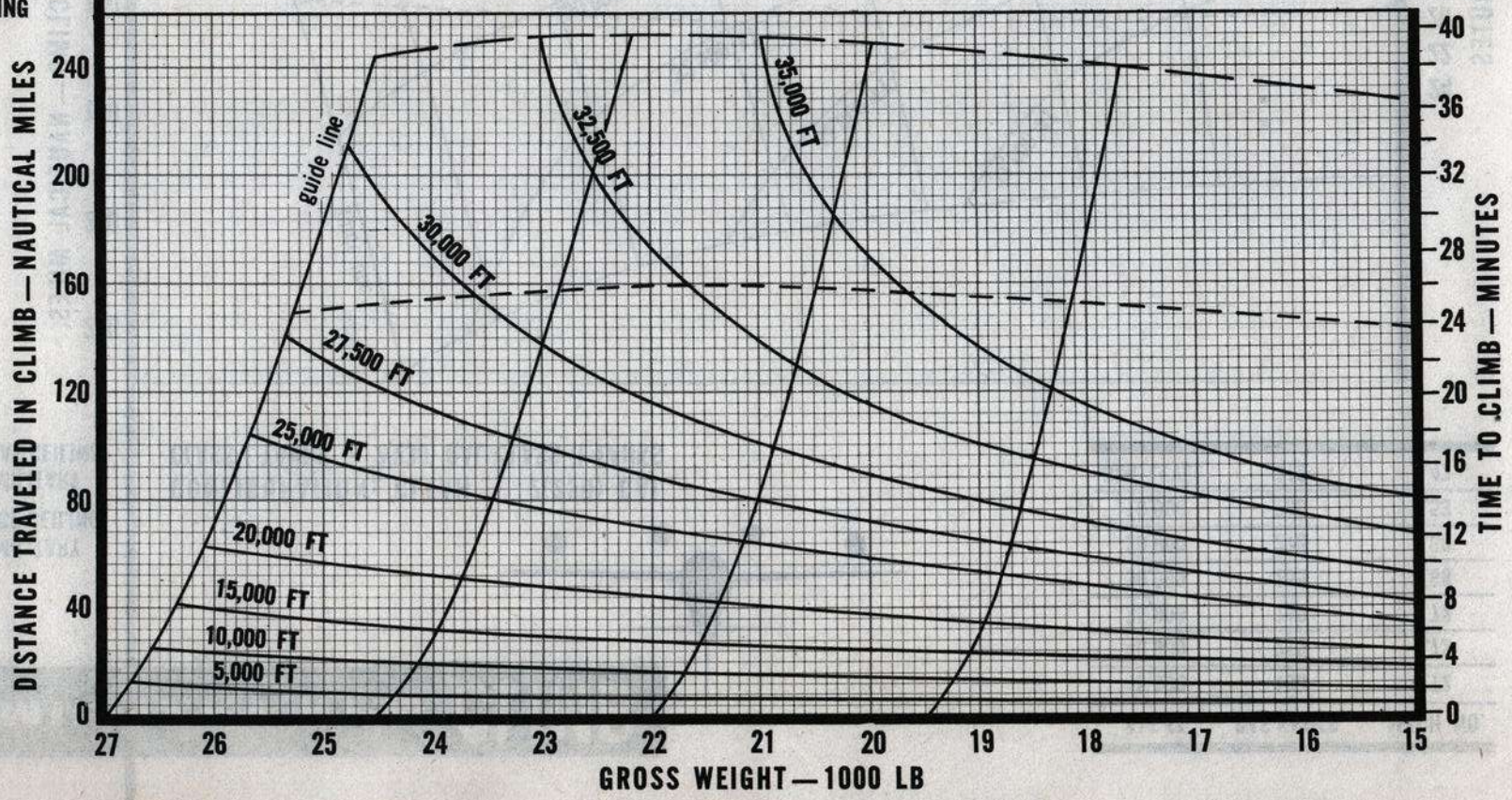
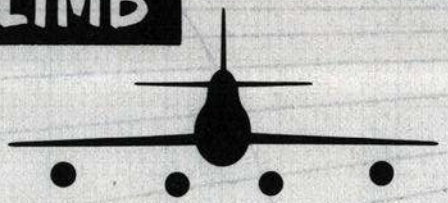


Figure A–35

98% MILITARY RPM CLIMB



ALT-FT	CAS-KNOTS	MACH NO.
45,000	190	.72
40,000	215	.72
35,000	240	.72
30,000	255	.68
20,000	275	.60
10,000	295	.53
SEA LEVEL	310	.47

— — — 98% MILITARY SERVICE CEILING

- - - - - - 98% MILITARY COMBAT CEILING

CONFIGURATION: CLEAN + 2(230) GAL CLASS I TANKS + 2(230) GAL CLASS II TANKS

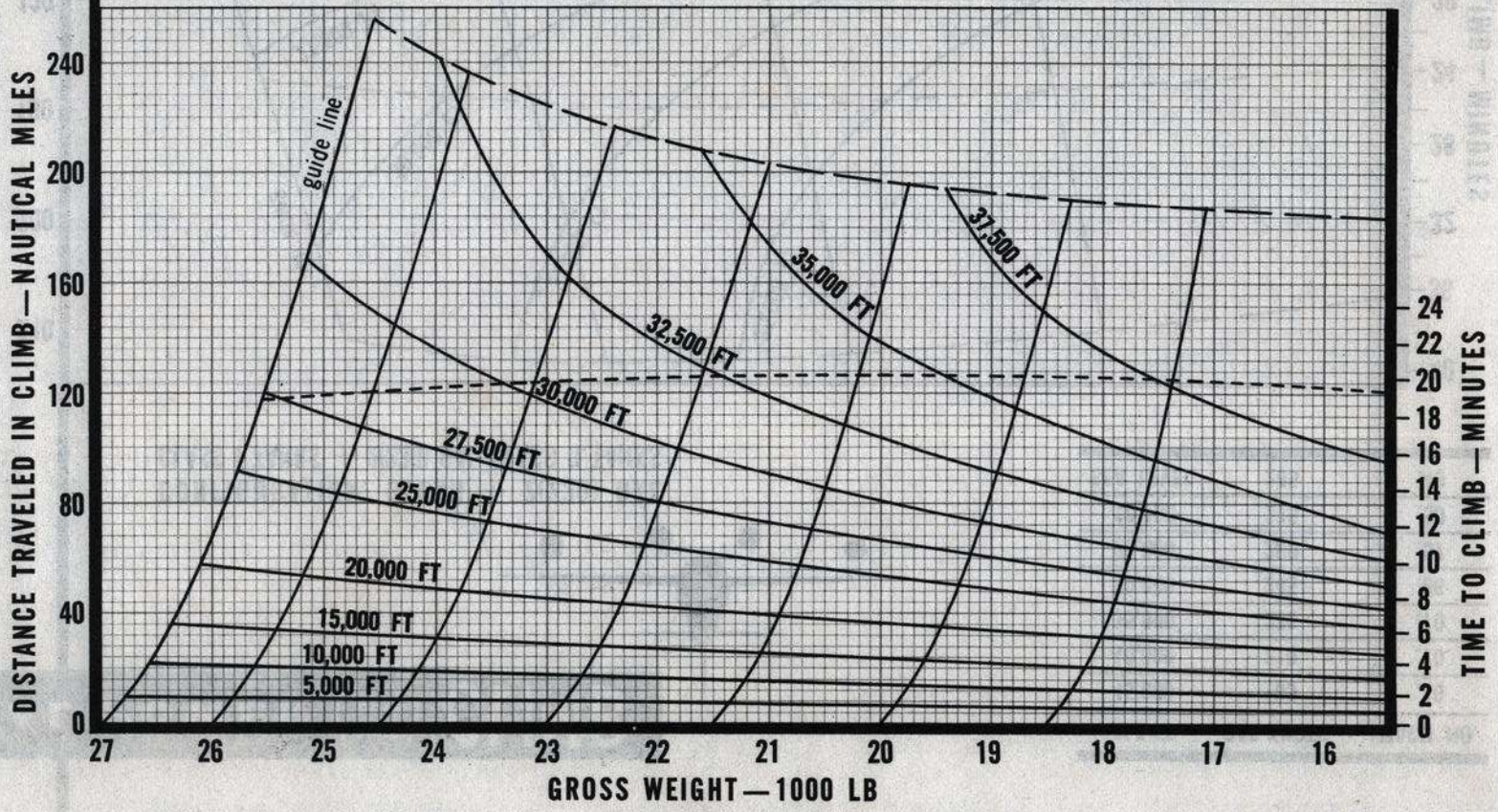


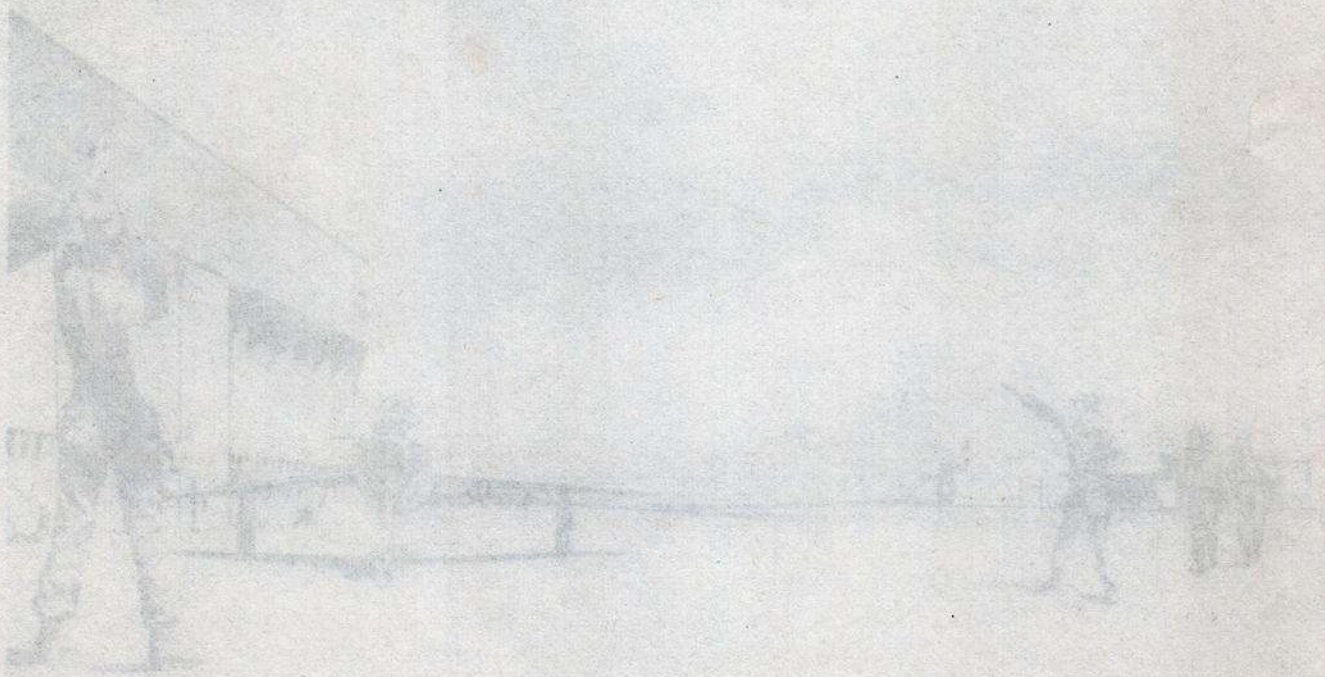
Figure A–36

AIR REFUELING SYSTEM.

The word "BREAKAWAY" is restricted to use as a code word to denote emergency separation. At any time when in contact made position, any crew member of the tanker or receiver can call the radio signal "BREAKAWAY" when he feels the circumstances are either hazardous to the safety of the aircraft or malfunction of the equipment warrants disconnect. On hearing the word "BREAKAWAY" the receiver pilot will actuate his disconnect switch immediately. The tanker pilot will pull up abruptly 50 or 100 feet and apply power. The receiver pilot will not dive out of the refueling envelope until separation has been made.

PILOT TECHNIQUE.

(See figure 7–5.)



SECTION 9 ALL-WEATHER OPERATION



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INTRODUCTION.

This section contains information on the proper procedure and technique for operating under conditions requiring instrument flight and approach. Only data and procedures that differ from, or are in addition to normal operating instructions covered in Section II are included. Repetition of some material from Section II has been necessary for emphasis, clarity and continuity of thought. Abnormal operational conditions covered in this section include thunderstorms, turbulence, rain, icing, cold weather, hot weather, desert conditions and night flying.

OPERATION UNDER INSTRUMENT FLIGHT CONDITIONS.

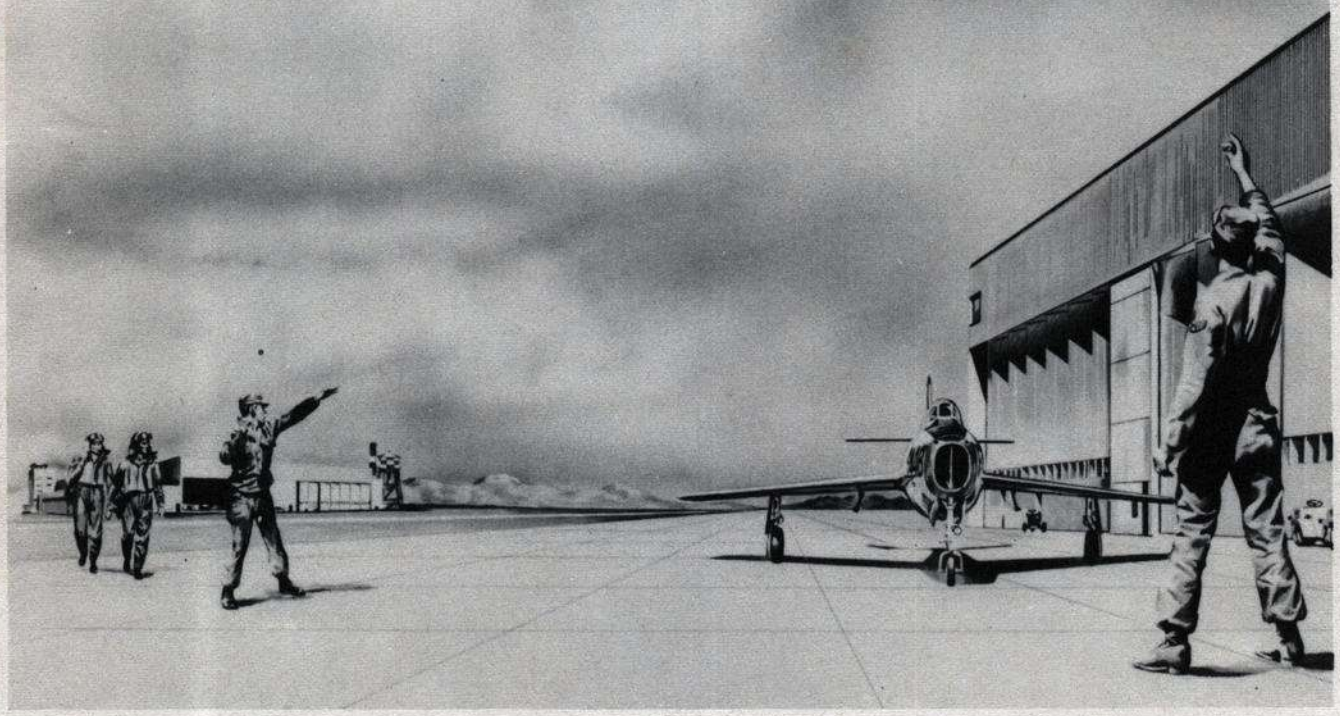
WARNING

Investigations of recent accidents have revealed the possibility of engine failure while or after flying through thunderstorms, hailstorms, icing conditions or severe turbulence or even through thick clouds. Engines are in process of being modified to increase shroud clearances in the 8, 9 and 10 stages to a minimum of .070 inch and to .060 inch on the 11 and 12 stages. Aircraft having modified engines installed will *not* be restricted in accordance with the following instructions. Aircraft with unmodified engines installed are placarded to restricting weather flights. Until such time as modified engines are installed the aircraft shall not be flown through any clouds, thunderstorms, hailstorms, icing

SECTION 8

CREW DUTIES

SECTION 8 -
"Crew Duties"
is not applicable
to this airplane



conditions or severe turbulence (acceleration in excess of 7½g) unless demanded by operational necessity. In the event the aircraft is inadvertently subjected to any of the above conditions an entry should be made in the aircraft DD Form 781. If it becomes absolutely necessary to enter a thunderstorm area or if one is inadvertently entered, follow thunderstorm penetration information. If only icing conditions or precipitation is encountered it is advisable to reduce power as much as possible and still maintain safe flight.

Flying the F-84F aircraft under abnormal operational conditions requiring instrument flight, demands proficiency in instrument procedures and technique. Instrument flight should not be attempted unless you are a qualified instrument pilot and a holder of an AF Form 8A (green) or AF Form 8 (white) instrument certificate. You should have a complete knowledge of existing Air Force regulations, Technical Orders, and other publications pertaining to all-weather operation. Careful attention should be given to the fuel planning phase of the preflight planning of IFR flights.

Allowances must be made for uncertain factors such as; delayed departures, heavy traffic, limited approach and control facilities at field, slow rate of descent, locating range stations, wave-off and go-around. These additional fuel requirements must be added to that normally required for VFR flights and the endurance and/or range factors reduced accordingly. Because of the critical time element, landing should always be made on the first approach, if possible.

Instrumentation of the F-84F aircraft is adequate for blind flying and instrument approach. Radio navigation equipment provides for low frequency range, automatic direction finding (ADF), manual direction finding (MDF), and ground controlled approach (GCA) system instrument approach.

For ease of handling, bank angles should be limited to approximately 30 degrees, unless conditions dictate otherwise. This bank angle gives very nearly the optimum bank angle for all speeds and altitudes, 1½ degrees per second at high speeds and altitude and approximately 3 degrees per second at low speeds and altitude, such as during GCA's. At altitudes above 37000 feet with an external load, it becomes necessary to limit the bank angle to 20 degrees to prevent loss of altitude during turns.

When turbulent air is encountered, the aircraft has "snaking" and "dutch roll" characteristics. Without pylon tanks installed, the nose will oscillate from side-to-side several degrees, depending on the degree of turbulence. This condition is accompanied by small bank oscillations. With pylon tanks installed, the same condition exists with a greater amplitude of bank oscillations. The pilot cannot apply sufficient control pressures to stop the condition. For this reason, the attitude indicator should be used for turns instead of the needle and ball. To make a turn, establish the desired bank angle and hold this angle until the desired heading is obtained. On GCA's, hold an average heading on the glide path when the condition is encountered.

All recommended airspeeds in this section should be adhered to during the final stages of any instrument procedure or approach in minimum weather conditions. During some stages of landing approaches, the aircraft is being operated on the flat portion of the power curve, that is, small changes in power give fairly large changes in airspeed. If airspeed is excessive, especially on the glide path in conditions of low ceiling and visibility, with a wet or icy runway, the distance required to stop will be increased.

INSTRUMENT TAKE-OFF AND INITIAL CLIMB.

1. Visually line-up aircraft on runway.
2. Set slaved gyro magnetic compass pointer to the indices at the top of the dial regardless of the indicated heading.
3. Set attitude gyro and adjust reference plane for level flight.
4. Pitot heater and defroster ON if precipitation or icing conditions are anticipated.
5. Horizontal stabilizer in 2 degrees nose-up trim.
6. Hold brakes and advance throttle to take-off rpm.
7. Check engine instruments, then release brakes.
8. Use brakes for directional control until rudder becomes effective. Use slaved gyro as the primary instrument for heading until the airplane is airborne.

Note

If miniature airplane was lined up with horizon bar on attitude indicator at start of take-off, placing miniature airplane about two horizon bar widths above horizon bar gives a good take-off and initial climb attitude.

9. Take-off at normal speeds (Refer to Appendix).
10. Maintain a constant nose-high, wing-level attitude, after leaving the ground.
11. Landing gear selector UP when definitely airborne and the rate of climb and altimeter show definite ascent.
12. Landing flap control up at approximately 190 knots IAS.

TYPICAL RADAR RECOVERY PENETRATIONS

DESCENT

Speed Brakes –	OUT
IAS –	250 knots
RPM –	IDLE

APPROACH ALTITUDE

Landing Gear & Flaps –	UP
Speed Brakes –	IN
IAS –	200-220 knots
RPM	– 80 ± 2% (with two 230 gal pylon tanks)
	– 75 ± 2% (no external load)

"GATE" OR TURN-ON & FINAL APPROACH

Landing Gear –	DOWN
Flaps –	20°
Speed Brakes –	IN
IAS –	175 knots
RPM	– 83 ± 2% (with two 230 gal pylon tanks)
	– 82 ± 2% (no external load)

GLIDE PATH

Speed Brakes –	OUT
Flaps –	FULL DOWN
IAS –	160-165 knots
RPM	– 86 ± 2% (with two 230 gal pylon tanks)
	– 83 ± 2% (no external load)

Minimum Weather Conditions

Time and fuel required to descend from altitude to 2500 feet

ALTITUDE (feet)	TIME (min.)	FUEL (lbs.)	DISTANCE (nautical miles)
40,000	8	97.5	43
30,000	6	78.0	32
20,000	4	59.5	20

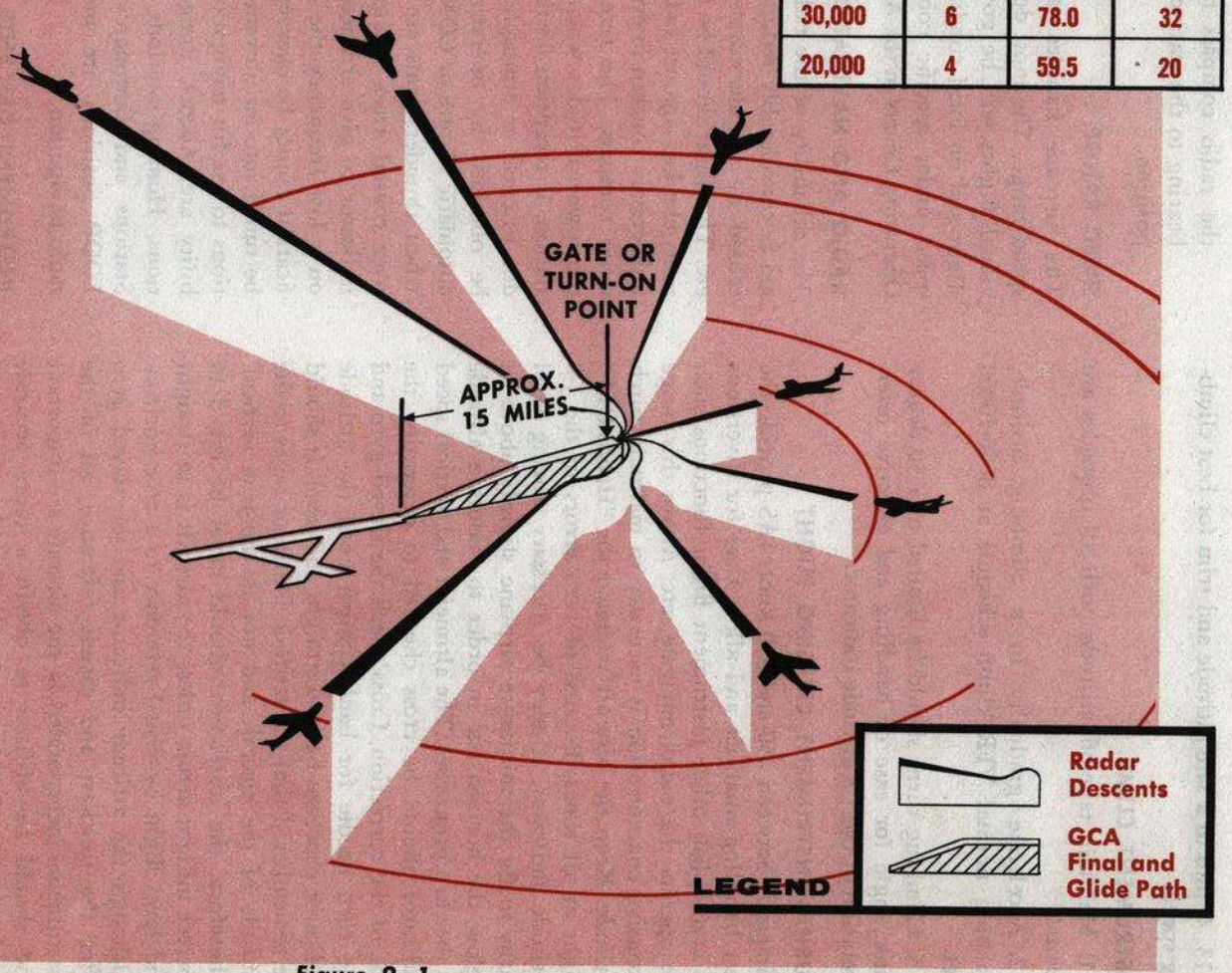


Figure 9–1

13. Climb to a safe altitude and trim for best climbing speed.

INSTRUMENT CLIMB.

1. Maintain take-off attitude until all obstacles are cleared.

2. Accelerate gradually in a climbing attitude, reaching normal VFR climb schedule at 8000-10000 feet.

3. Climbing turns should be limited to a 30 degree bank angle for ease of handling and effective interpretation of the J-8 attitude indicator.

DURING INSTRUMENT CRUISING FLIGHT.

Airspeeds between 250 and 350 knots IAS provide the best handling qualities and allow time for diversions to accomplish other instrument flight functions such as; operate the radio, navigate, etc. Above this range excessive concentration is necessary to maintain pitch attitude. Keep the aircraft trimmed for "Hands-OFF" flight at all times. Because of turn errors in the J-8 attitude indicator, it may be necessary during level turns to fly the miniature airplane slightly above or below the horizon bar in order to maintain altitude as the turn progresses. The altimeter and vertical speed indicator should be cross checked to determine the size of the correction. Cross check the slaved gyro and the turn needle for bank control until the attitude indicator processes back to straight and level. It should be remembered that the attitude indicator cages to the attitude of the aircraft and not to the true vertical. Therefore, the instrument should never be caged to correct inflight errors unless the aircraft is in straight and level flight by visual reference to a true horizon. Although the attitude indicator and the slaved gyro offer the quickest and easiest reference, all of the instruments incorporated in the aircraft are important and should be utilized to obtain a more accurate interpretation of what is going on. Bank angles should be limited to 30 degrees for ease of handling and better pitch control. It becomes exceedingly difficult to maintain pitch attitude at bank angles in excess of 30 degrees, because of the J-8 errors and the elevator breakout forces. This is especially so at high airspeeds, where small changes in pitch give significant changes in vertical speed.

Note

The ARN-6 radio compass is susceptible to precipitation static. By switching to the "LOOP" position and rotating the needle 90° to the station and/or reducing indicated airspeed and/or changing altitude, the reception can often be improved. When precipitation static completely muffles audio reception, the radio compass needle may still give a bearing to the station, if left in the "COMP" position.

SPEED RANGE.

The airplane handles satisfactorily throughout the speed range. The most desirable speed range for individual flights will be governed by the nature of the flight and on local conditions. For the most desirable speed under specific conditions refer to the Flight Operating Charts in the Appendix.

RADIO AND NAVIGATION EQUIPMENT.

The reliability of the radio compass as a navigational aid is considerably reduced at high altitudes by static caused by thunderstorms, thin overcasts, haze, dust, etc. The flight should be thoroughly planned and positions checked against radio range signals to eliminate unnecessary concern in event of faulty operation of the radio compass. The reception normally improves at the lower altitudes when the airplane is nearing the station. If reception on the ANT position is too noisy due to crash or atmospheric static, better results may be obtained by operating in LOOP position. The automatic feature or COMP position is very unreliable when thunderstorms are in the area or when flying over coastal areas where shore line effect cause the indicator to give erroneous readings. When receiving on a low frequency the importance of station identification cannot be overemphasized as it is very easy to be tuned into an unwanted station. The desirable stations to use for navigation in the order of their reliability are, Adcock Range Stations, Loop Range Stations, Homing Stations, Clear Channel Commercial Stations and Commercial Stations. The ANT and LOOP positions are more accurate in performing radio navigation.

INSTRUMENT DESCENTS.

The optimum power for conservation of fuel during descents is IDLE. However, if descents are made in formation, the lead ship must maintain adequate power to afford wing ships flexibility of position. Descending turns become progressively more difficult as the bank angle exceeds 30 degrees and/or the airspeed exceeds 250 knots IAS. Two hundred and fifty knots IAS, with idle power and speed brakes extended, gives a rate of descent of 5000 feet per minute at high altitudes, and approximately 4000 feet per minute at the lower altitudes.

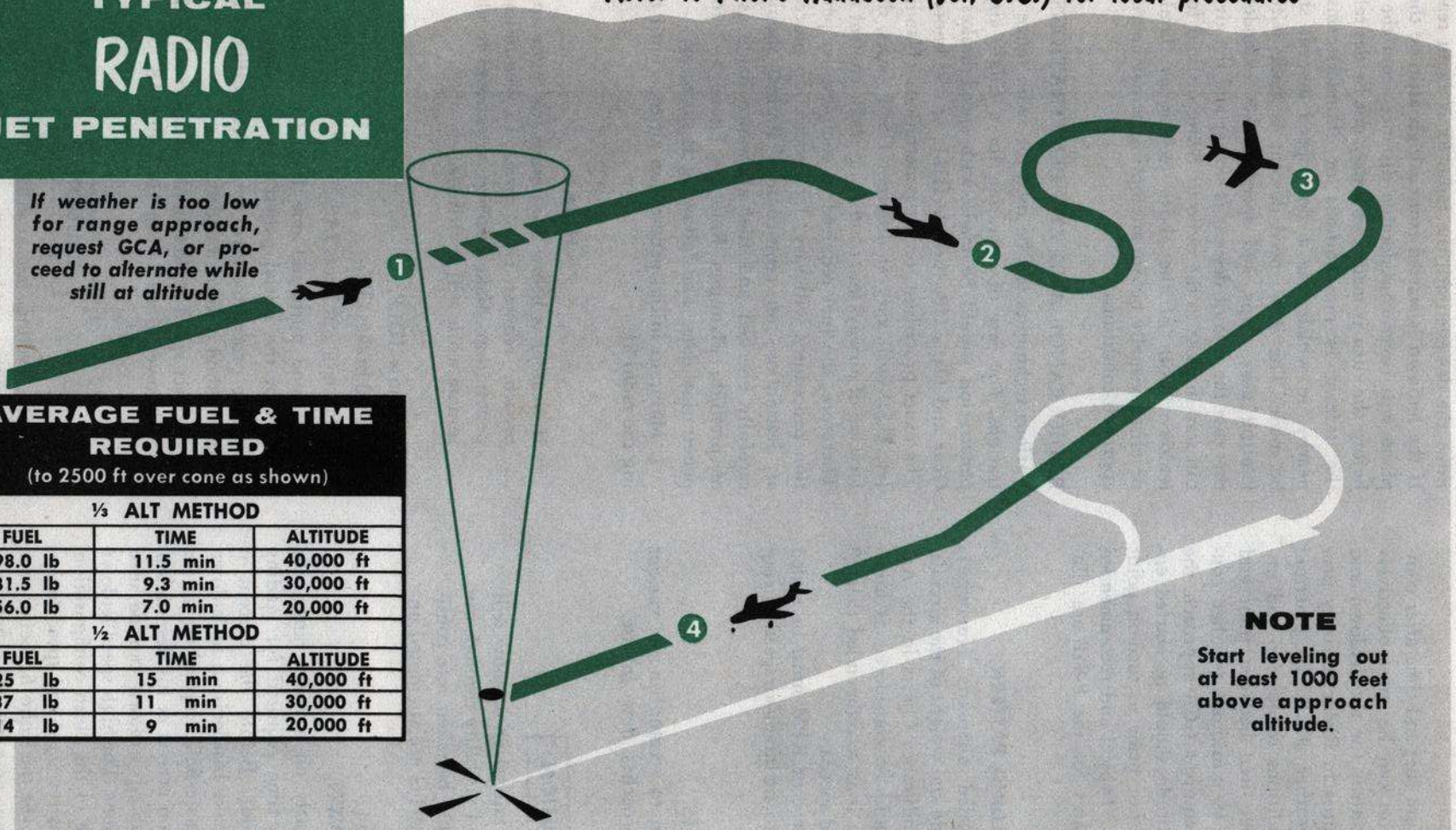
CAUTION

Closely monitor the altimeter during descents to prevent misreading.

TYPICAL RADIO JET PENETRATION

Refer to Pilot's Handbook (Jet, U.S.) for local procedures

If weather is too low for range approach, request GCA, or proceed to alternate while still at altitude



AVERAGE FUEL & TIME REQUIRED

(to 2500 ft over cone as shown)

⅓ ALT METHOD		
FUEL	TIME	ALTITUDE
198.0 lb	11.5 min	40,000 ft
181.5 lb	9.3 min	30,000 ft
156.0 lb	7.0 min	20,000 ft
½ ALT METHOD		
FUEL	TIME	ALTITUDE
325 lb	15 min	40,000 ft
237 lb	11 min	30,000 ft
214 lb	9 min	20,000 ft

NOTE

Start leveling out at least 1000 feet above approach altitude.

① APPROACH

Approach station at prescribed initial penetration altitude.

② OUTBOUND

Speed brakes — OUT
IAS — 250 knots
RPM — "IDLE" (or as req.)

③ PENETRATION TURN

(90° method)

④ *COCKPIT CHECK

Speed Brakes — IN
IAS — 220 knots
RPM — 80±2%
*If making low approach lower gear before reaching low cone.

Figure 9–2

RADAR RECOVERY.

Letdowns utilizing minimum fuel and time after completion of weather mission can be most effectively accomplished by radar control for the letdown and turn-on to GCA final approach. Radar recovery procedure to be used in weather should be practiced under VFR and IFR conditions to develop and improve the coordination required between pilot and ground radar controller. If minimum weather conditions exist which will require a GCA approach, the descent from cruising altitude should be started enroute, so as to terminate just prior to turn-on point to final approach of GCA. Typical and recommended radar penetration procedures for the F-84F are illustrated in figure 9–1.

IFR LOITERING AND HOLDING PATTERN.

For best loitering indicated airspeeds (fuelwise), which depend upon altitude and weight of the aircraft, refer to the Maximum Endurance Charts in the Appendix. These speeds should be considered as minimum; for better handling it is recommended that 10 knots be added to the listed speeds.

Approximately 2 to 4 per cent RPM must be added to the level flight RPM to maintain airspeed during holding pattern turns.

INSTRUMENT APPROACHES.

The aircraft can be flown to accomplish the various types of instrument approaches now in use.

CAUTION

Precipitation such as rain, sleet, or snow will greatly reduce forward visibility through the windshield. This should be taken into consideration before approaches are attempted under these conditions.

RADIO RANGE LETDOWN.

In all letdowns, particularly on a radio range, the outstanding factor is the time required for landing after reaching low altitude. Before the descent is started the pilot should make his decision to letdown or to proceed to his alternate field, depending on the latest weather and traffic on arrival at his destination. Either a high or slow speed letdown can be used depending on local conditions. The high speed letdown is made with the airplane in the clean configuration, i.e.; landing gear and flaps retracted and speed brakes closed. Start the descent over the radio fix being used for the letdown and continue on a straight course until one half the altitude is lost; turn 180 degrees and continue the descent until the radio fix is again reached. If the letdown is started from a high altitude the airplane will cover considerable distance from the field before the turn is made. This may not be desirable if the terrain is mountainous or thunderstorms are nearby, in which case a slow speed descent should be made. The slow speed descent is made with the landing gear, flaps, and speed brakes extended. In this case the rate of descent is slower and the airplane can stay in close to the radio fix being utilized for the letdown. Both of the above techniques should be practised visually before attempting actual instrument approach conditions.

RADIO RANGE AND ADF PENETRATIONS.

Various techniques can be used for radio range penetrations. For ease of operation for a single aircraft, penetration should be made with speed brakes ON, Gear and Flaps UP, throttle IDLE, at 250 knots IAS. The exact procedure for Jet penetrations (Handbook, Jet, U.S.) will vary at different USAF bases, due to location of airways and conflicting traffic control zones. Therefore, the fuel required to complete jet penetration procedures will vary. Jet penetration procedures at destination, on cross-country flights, should be carefully checked and fuel allowance made as part of preflight planning. Refer to figure 9–2 for jet penetration data. The following is suggested:

1. Maintain initial penetration altitude until reaching the radio fix.

Note

If weather is below minimums for range approach, request GCA prior to beginning penetration. Make decision to proceed to alternate while still at altitude.

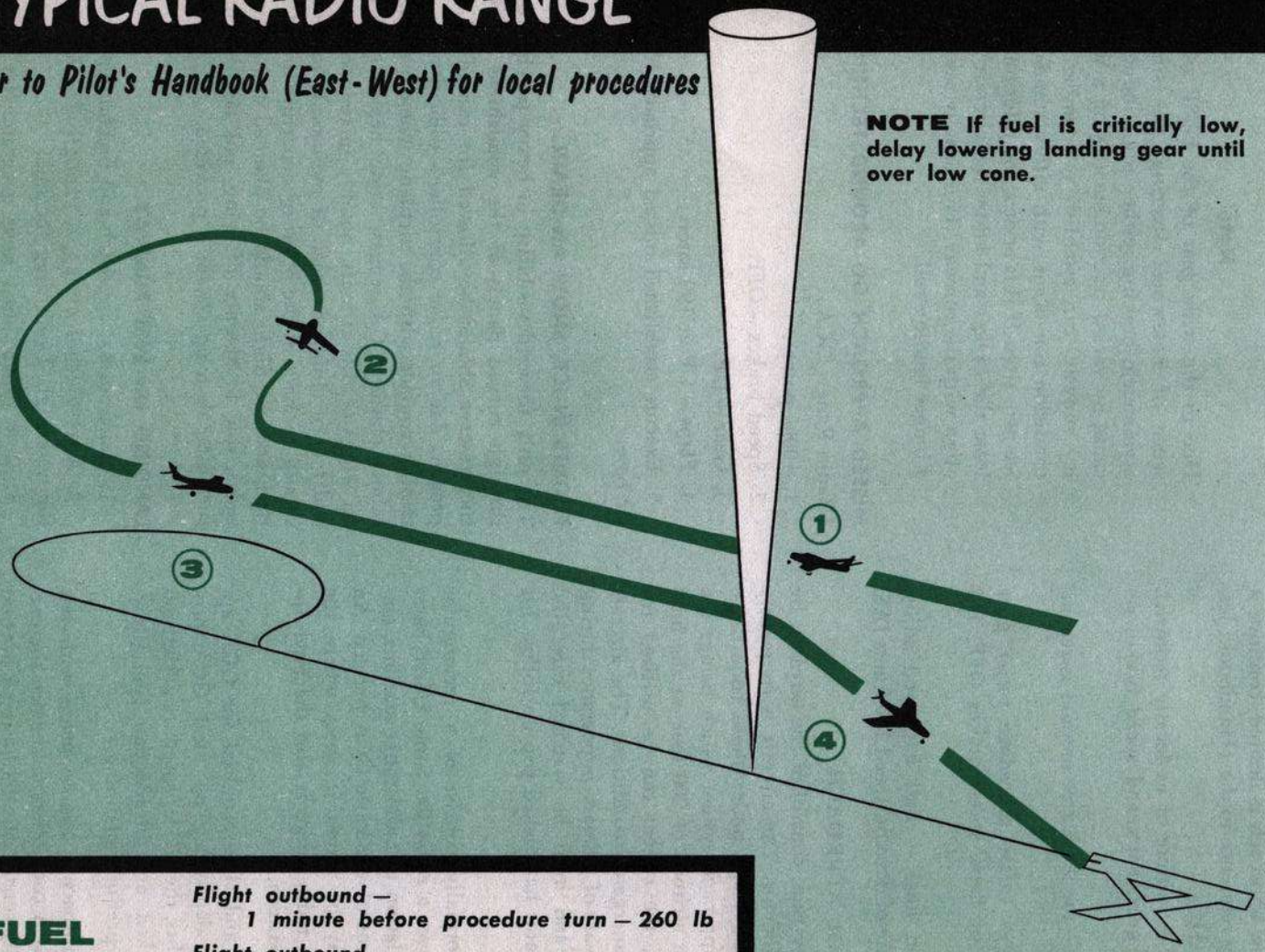
2. Throttle IDLE.
3. Speed brakes ON.
4. Maintain 250 knots IAS.
5. Descend outbound one-third (or as locally required) of the initial penetration altitude.
6. Make procedure turn while descending. The 90 degree method is recommended.
7. Retract speed brakes at initial approach altitude, and add power to maintaing 220 knots IAS.

CAUTION

Start leveling out at least 1000 feet above minimum penetration (initial approach) altitude.

TYPICAL RADIO RANGE LOW APPROACH

Refer to Pilot's Handbook (East-West) for local procedures



NOTE If fuel is critically low, delay lowering landing gear until over low cone.

1 OUTBOUND
Configuration — CLEAN
IAS — 220 knots
RPM — 80 ± 2%
Time — 1 minute (or as locally required)

2 PROCEDURE TURN
(90° method)

3 COCKPIT CHECK
Landing Gear — DOWN
Flaps — 20°
IAS — 175 knots
RPM 83 ± 2%

4 LOW APPROACH
Flaps — DOWN
Speed Brakes — OUT
IAS — 165 knots
RPM — (as required)

FUEL REQUIRED

Flight outbound — 1 minute before procedure turn — 260 lb

Flight outbound — 2 minutes before procedure turn — 361 lb

(No conservatism fuel factors included)

Figure 9—3

Note

If the penetration is made on the final approach leg of a radio fix, after reaching final approach altitude inbound, lower gear, 20 degrees of flaps, add power and continue to the station at 175-180 knots IAS.

RADIO RANGE APPROACHES.

1. If not VFR over the station at completion of the penetration and a low approach is desired, continue a standard approach by reference to the (Handbook, Jet, U.S.). (See figure 9–3).

2. Outbound – One minute or as locally required. Use 220 knots IAS, gear, flaps, and speed brakes retracted.

3. Procedure turn – the 90 degree method is recommended.

4. Cockpit check – (after procedure turn) gear DOWN, 20 degree of flaps, speed brakes OFF, 175 knots IAS.

5. Over station on final – Full flaps and adjust power to establish rate of descent, speed 165 knots IAS.

GROUND CONTROL APPROACH.

In moderate to heavy rain, control of the airplane by GCA is extremely difficult. The aircraft is frequently lost on the operator's scope under these conditions. GCA is a landing approach system which brings the airplane down to an altitude of 200 feet on the final approach. However, the system can be utilized for touch down under emergency conditions. The aircraft heading and altitude are of primary importance during the final approach and must be watched carefully. Once the GCA operator has picked you up follow his instructions.

GCA approaches normally consist of a rectangular pattern beginning over a radio fix. Some USAF bases ideally located in relation to radio range stations, employ modified versions of the basic GCA pattern. An example of this may be found in cases where the approach leg of the radio range is also the final approach of the GCA pattern.

Therefore, the fuel and time required for GCA approaches will vary, depending on local GCA procedures. On IFR flights, the GCA procedure at destination should be checked, and an adequate fuel allowance made as part of preflight planning.

Emergency GCA approaches can be made with less fuel by requesting GCA controllers to shorten the pattern. This will usually consist of eliminating a portion of the downwind leg, and making the base leg closer in. There is no advantage in turning on to final approach closer than 5-7 miles, because the chance of over-shooting the turn, and less time for GCA final controller to direct the aircraft, increase the probability of a missed approach and/or not being lined up with the runway for landing. Fuel is best conserved by shortening the downwind leg and/or delaying the cockpit check until on base leg or final approach, prior to intercepting the glide path. For the recommended GCA procedure, see figure 9–4.

Note

Due to the wide gear of the F-48F and absence of nosewheel steering, the slightest asymmetric braking, either pilot induced or cause by varied traction such as on a wet or icy runway, can establish yaw angles. This condition can occur with either standard or ice grip tires. If this occurs, the pilot must release the brakes and allow the aircraft to realign with the runway. This usually results in a longer landing roll.

MISSED APPROACH GO-AROUND TECHNIQUES.

(Radio Range, GCA).

1. 100% power.
2. Speed brakes – OFF.
3. Gear – UP.
4. Flaps – UP at 190 knots.
5. Execute established missed approach for particular base.

FLIGHTS IN ICE, SNOW AN DRAIN.

The only forward visibility in heavy precipitation is through curved panels of the windshield. Adequate fuel reserve should be allowed for missed GCA approach, due to radar controller's difficulty in maintaining contact with the airplane when precipitation echoes clutter GCA scopes. Icing has marked effect on wings of this aircraft, notably in reduced airspeed and rate of climb. A check of radiosonde information should be made at the point of departure and destination, and the flight should be planned at ice-free altitudes, due to absence of wing and tail de-icing. A fuel filter de-icing system is provided.

LANDING ON WET RUNWAY.

1. Make normal approach and touchdown.
2. After touchdown, apply enough aft stick to hold the nose high. Don't drag the tail.
3. Slow down until nose gear touches (approximately 90 knots).
4. Hold full aft stick and apply brakes as required.

TYPICAL GCA APPROACHES

1 DOWNWIND

Landing Gear	UP
Flaps	UP
Speed Brakes	IN
IAS —	220 knots
RPM —	80 ± 2%

2 BASE

Landing Gear	DOWN
Flaps	20°
Speed Brakes	IN
IAS	175 knots
RPM	83 ± 2%

3 FINAL

Landing Gear	DOWN
Flaps	20°
Speed Brakes	IN
IAS	175 knots
RPM	83 ± 2%

4 GLIDE PATH

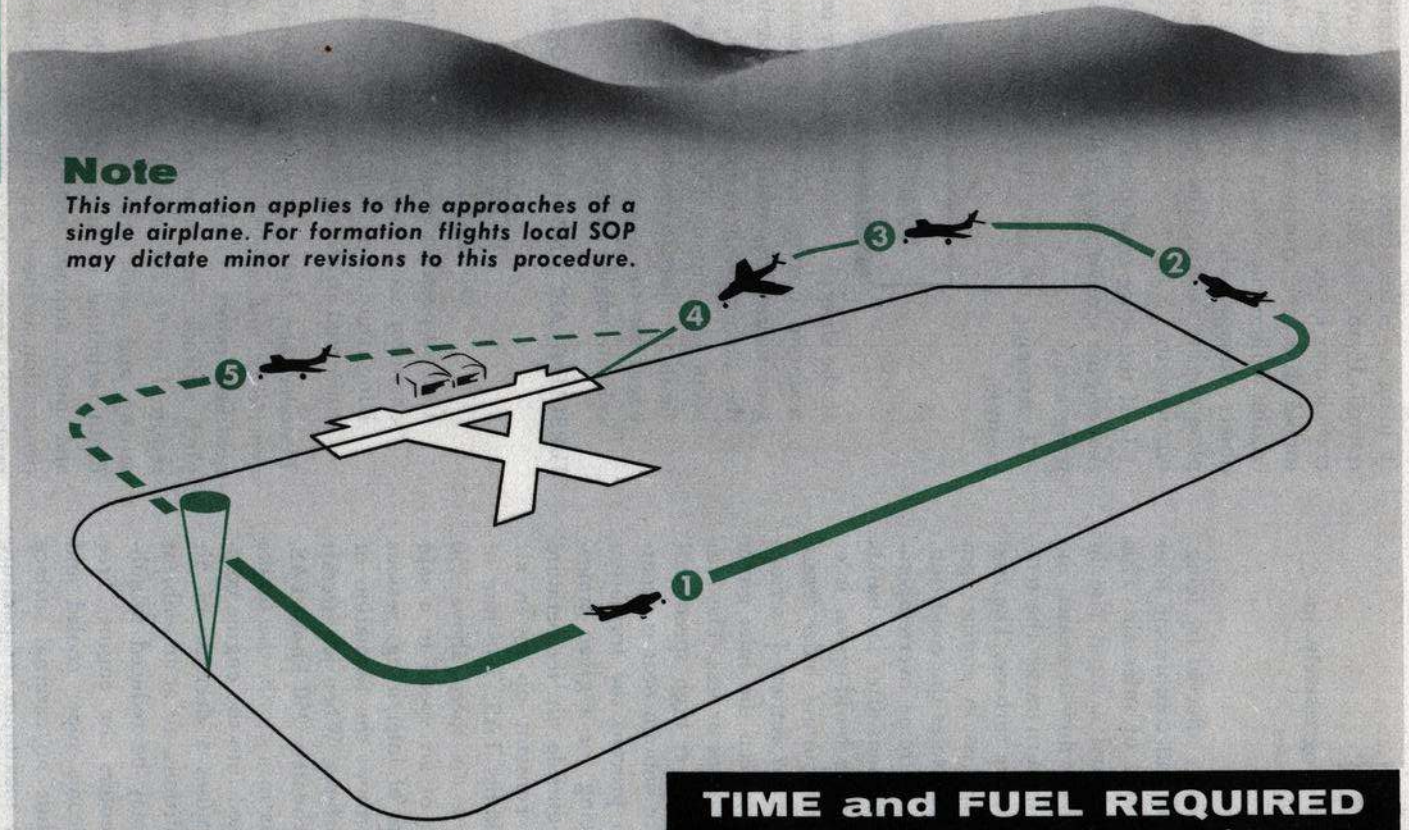
Landing Gear	DOWN
Flaps	FULL DOWN
Speed Brakes	OUT
IAS	160-165 knots
RPM	86 ± 2%

5 GO AROUND

Landing Gear	UP
Flaps	UP (at 190 knots)
Speed Brakes	IN
RPM	100%

Note

This information applies to the approaches of a single airplane. For formation flights local SOP may dictate minor revisions to this procedure.



Note

These figures are for an aircraft with two 230 gal class II pylon tanks installed. Without pylon tanks installed, power setting will be approximately 3% lower.

TIME and FUEL REQUIRED

(30 Nautical Miles from fix to touchdown)

Typical Rectangular GCA	374 lbs
Time	9 min
Missed Approach and Go-Around	480 lbs

(No conservation fuel factors included)

Figure 9–4

CAUTION

Apply brakes gently then progressively increase pressure as speed decreases.

ENGINE ICING.

Axial flow jet engines are seriously affected by icing. Ice forms on fixed inlet screens and compressor inlet guide vanes and restricts the flow of inlet air. This is indicated by a loss of thrust and a rapid rise in exhaust gas temperature. As the air flow decreases, the fuel-air ratio increases, which in turn raises the temperature of the gases going into the turbine. The fuel control attempts to correct any loss in engine rpm by adding more fuel, which aggravates the condition. Complete turbine failure from extreme overtemperature may occur in a matter of seconds after ice builds up in the engine inlet. Critical ice build-up on inlet screens can occur in less than one minute under severe conditions. With the inlet screens retracted, serious blocking of the air passages between the inlet guide vanes can still occur in four minutes or less. The idea that heating due to ram pressure at high speed will prevent icing is dangerous. Not enough heat is generated at subsonic velocities to prevent the formation of ice. The rate of engine icing for a given atmospheric icing intensity, with outside air temperature below freezing, is relatively constant up to an air speed of approximately 250 knots TAS. The rate of icing increases with increasing air speed above 250 knots. Therefore, a reduction of air speed to a safe minimum will reduce the rate of inlet icing. Serious inlet duct icing can occur without the formation of ice on the external aircraft surfaces. When jet aircraft fly at velocities below approximately 250 knots TAS, and at high power settings, as in a climb, the intake air is sucked, instead of rammed into the engine compressor inlet. This suction causes a decrease of air temperature. Under these conditions, air at an ambient temperature above freezing may be reduced to subfreezing temperature as it enters the engine. Free moisture in the air may become super cooled and could cause engine icing, while no external surface icing would be evident. The maximum temperature drop which can occur is approximately 5°C (9°F). The greatest temperature drop occurs at high rpm on the ground and decreases with decreasing engine rpm and increasing air speed. If possible, avoid take-off when the temperature is between −10°C (14°F) and 5°C (41°F) if fog is present or the dew point is within 4°C (7°F) of the ambient temperature. These are the conditions under which jet engine icing can occur without wing icing. If take-off is necessary when the above conditions exist, the engine screens should be retracted prior to take-off. A different hazard occurs if icing is encountered with the engine screens retracted. If any ice builds up on the nose of the aircraft it may erode or melt off, and blow back into the intake duct and compressor section, damage to the engine will occur which will be similar to foreign object damage. This may or may not result in complete engine failure. The following procedure is recommended:

1. If the icing conditions cannot be avoided, check that engine screens are retracted prior to entering the icing area.

2. Attempt to leave the icing area as soon as possible.

WARNING

If the throttle is not immediately retarded to maintain normal tailpipe temperatures, engine failure may result due to overheating of the turbine and exhaust system. This may occur very rapidly. Do not advance the throttle in an effort to maintain thrust, as this will aggravate the overheating condition and accelerate engine failure.

TURBULENT AIR AND THUNDERSTORM FLYING.

CAUTION

If at all possible, avoid flight through a thunderstorm to prevent damage from hail or icing conditions which are commonly encountered in thunderstorms.

Thunderstorm flying demands considerable instrument experience and should be attempted only by well-qualified pilots. Constant throttle setting, constant pitch attitude, and light to moderate stick forces are required to fly the aircraft in turbulent air. Power setting and pitch attitude are the keys to proper flight technique in turbulent air. This power setting and pitch attitude required for the recommended penetration airspeed should be established before entering the storm. Don't chase the airspeed indicator because the readings may be inaccurate. Fly by pitch attitude reference, and airspeed will average out regardless of momentary readings. Mental preparation is the largest factor in a thunderstorm penetration. Prepare yourself mentally for the worst, ride the storm, and let your good judgment and instrument proficiency get you through.

BEFORE TAKE-OFF.

Perform the following before take-off, when flight through a thunderstorm is anticipated:

GCA LANDING ROLLS

Runway distance required after GCA approaches

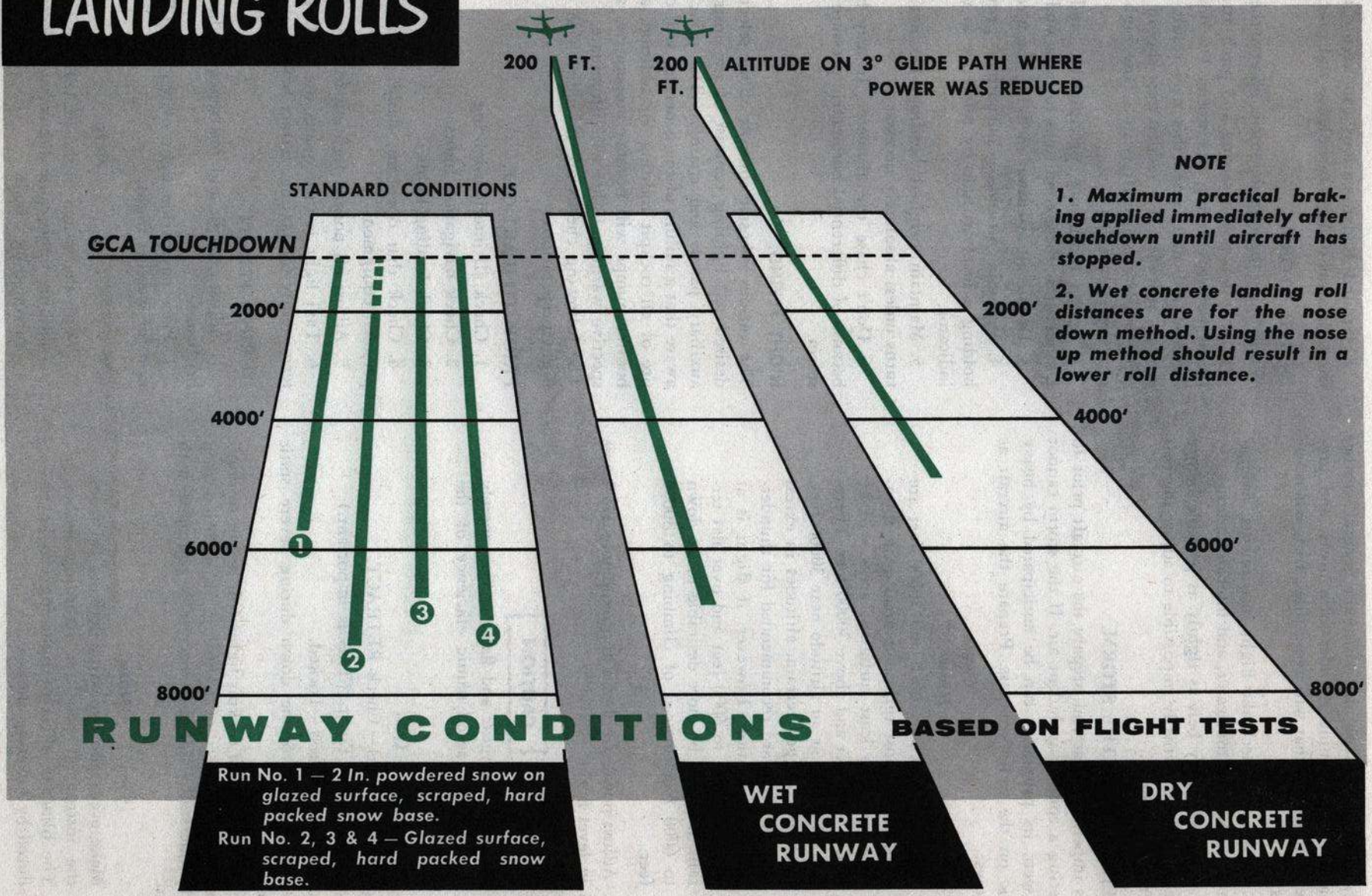


Figure 9—5

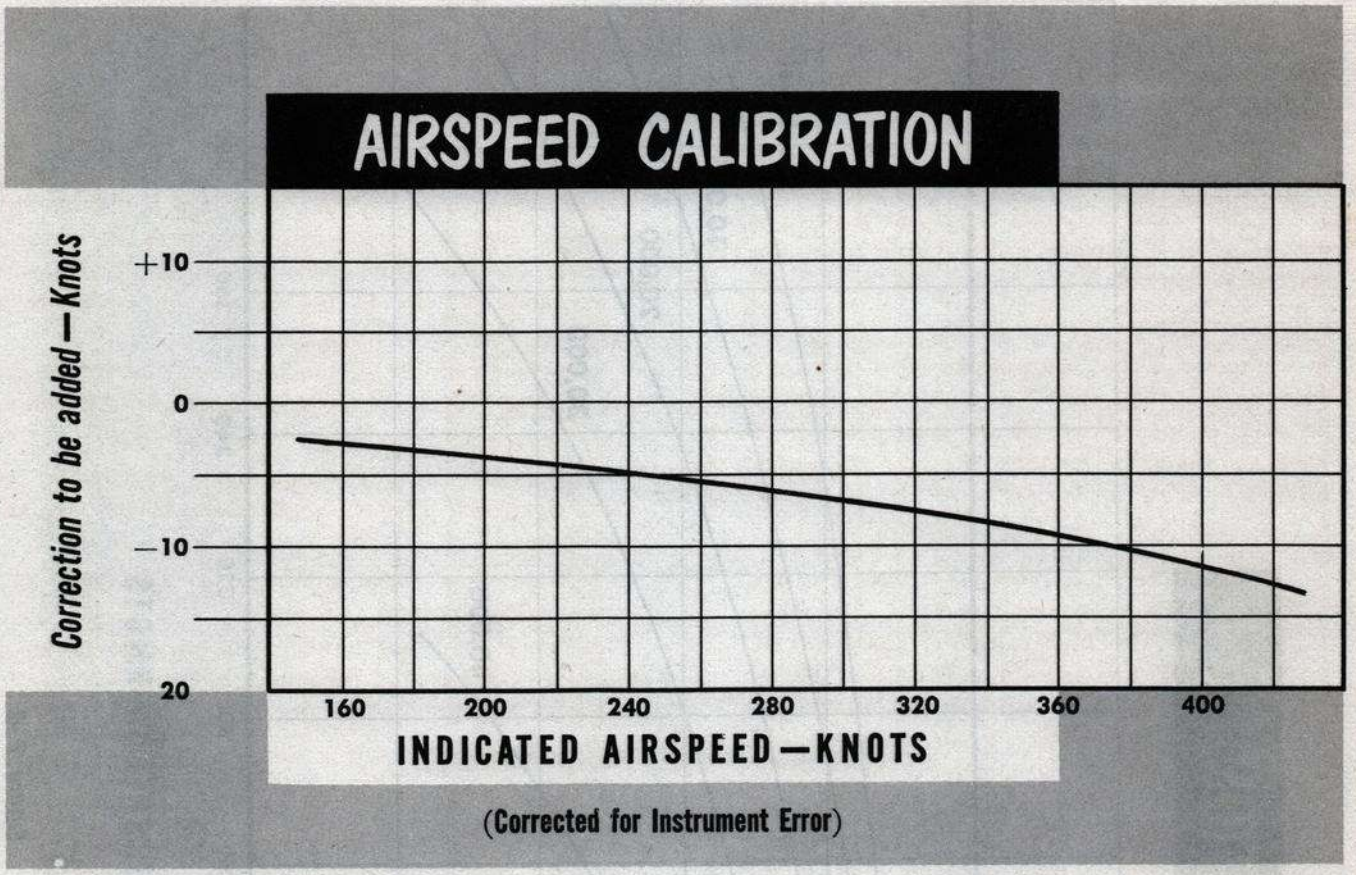


Figure 9—6

3. If flight through thunderstorm is anticipated, adjust cockpit lights to highest intensity to prevent momentary blindness from lightning flashes. In addition turn on thunderstorm lights, if aircraft is equipped with them.

COLD WEATHER PROCEDURES.

PREFLIGHT.

1. When the ambient temperature is 0°C (32°F) or lower, use a portable heater to blow hot air into the airplane air inlet duct for a period of 10-15 minutes. This procedure is necessary to prevent the starter-generator unit from being damaged due to ice seizure of the compressor rotor.

Note

To heat the cockpit, loosen the canopy cover and open the canopy enough so that the heater hose can be inserted into the cockpit.

2. Inspect fuel tank vents, pitot tubes, fuselage and wing drainage and ventilation holes, and remove ice if present.

3. Clean dirt and ice from shock struts and all exposed actuating cylinder pistons. Check shock struts and tires for proper inflation. Wipe exposed parts of shock struts and pistons with a rag soaked in the same type hydraulic fluid as used in the system.

4. Use external power for operating and ground

5. Remove wing, empennage and canopy covers, and the duct plugs in the air intake ducts and tailpipe.

6. Remove snow and ice from surfaces, control hinges, fuel tank caps and vents, and inside and outside of wings and fuselage.

7. Check surface controls.

PRESTARTING.

1. Start engine in normal manner.

Note

If the ambient temperature is below freezing the engine rotor may be locked due to ice formation. Depress the engine rotor test switch for approximately one half second. This opens the starter air storage bottle valve and turns the starter turbine sufficiently to give an indication on the tachometer or an audible sound of rotor freedom. If it is determined that the rotor is frozen, blow hot air through the engine for 10 or 15 minutes

1. Make a thorough analysis of the general weather situation to determine thunderstorm areas, and prepare a flight plan that will avoid these areas whenever possible.

2. Be sure to check the flight instruments, navigation equipment, pitot heater, and interior lighting.

3. Tighten safety belt as tightly as possible before take-off, as it is virtually impossible to adjust the belt after it is fastened.

APPROACHING THE STORM.

It is imperative that you prepare the aircraft prior to entering a zone of turbulent air. If the storm cannot be seen, its proximity can be anticipated by heavy static on the radio compass. Prepare the aircraft as follows:

Note

Altitudes between 10000 and 20000 feet are usually the most turbulent areas in a thunderstorm. The least turbulent areas will be below 6000 feet and above 30000 feet. Therefore, if flying at an altitude near 30000 feet, or if over rugged terrain, altitudes in excess of 30000 feet are recommended for thunderstorm penetration. However, if flight is at altitudes close to 6000 feet and over flat terrain, it would be more desirable to let down to 6000 feet, instead of climbing to 30000 feet.

1. Adjust power to obtain approximately 275 knots IAS in level flight.

CAUTION

Do not lower gear and flaps, as they merely decrease the aerodynamic efficiency of the airplane.

2. Pitot heater – ON.

3. Engine screens – Check RETRACT.

4. Safety belt – Tight. (This is important.)

5. Shoulder harness – Locked.

6. Turn radio volume down during severe static conditions.

7. At night, turn cockpit lights full bright to minimize blinding effect of lightning. In addition turn on thunderstorm lights if aircraft is equipped with them.

Note

Make every effort to avoid looking up from the instrument panel at lightning flashes. The blinding effect of lightning can be reduced by lowering the seat.

8. Ground Radar stations can vector the aircraft through areas of least turbulence and precipitation.

IN THE STORM.

While flying through the storm, observe the following:

1. Maintain power setting and pitch attitude established before entering the storm. Do not chase the airspeed indicator, since this may result in extreme aircraft attitudes. If a sudden gust should be encountered while the aircraft is in a nose high attitude, a stall may result.

2. Expect turbulence, precipitation, and lightning. Do not allow these conditions to cause undue concern.

3. Devote all attention to flying the aircraft.

4. Maintain attitude. Concentrate principally on holding a level attitude by reference to the attitude indicator.

5. Maintain original heading. Do not make any turns unless absolutely necessary.

6. Don't chase the altimeter. It may be in error because of differential barometric pressure within the storm.

NIGHT FLYING.

The various rheostat controls afford selection of any desired red lighting contrast of the instrument and auxiliary panels and consoles. The pilot should be aware that a failure of the generator will cause a failure of all cockpit lighting, in addition, all the fuel booster pumps will become inoperative, and the respective warning lights will illuminate.

The following checks are in addition to the normal flight preparations.

PRIOR TO TAKE-OFF.

1. Check all interior lighting.

2. Check navigation lights.

3. Check landing lights.

4. Check that operating flashlight is included in personal equipment.

5. Adjust all normal lighting to desired brilliance.

6. Taxi light is inadequate, use landing lights intermittently for taxiing, retract before take-off.

DURING FLIGHT.

1. Adjust cockpit and instrument lights to desired brilliance.

2. Place navigation light switch in STEADY position for weather flight.

Note

With the switch in the FLASH position, the flashing lights cause distracting reflections on surrounding clouds.

2. If there is no oil pressure after 30 seconds running, or if pressure drops after a few minutes ground operation, shut down and check for blown lines or for congealed oil.

3. Care should be exercised when using full, or near full engine power when airplane is being run-up on chocks as slippage of chocks occurs frequently.

4. Inspect all instruments for proper operation.

5. Operate wing flaps through several cycles.

TAKE-OFF.

1. Do not taxi through loose snow as it may get into brakes and freeze. Pack or remove loose snow from runway prior to take-off.

2. Never turn on electrical equipment except that absolutely needed, until generator shows CHARGE.

3. Pitot heater ON if icing conditions are anticipated.

4. Heating (pressurizing system), and defroster system ON.

5. Full power check will probably be impossible until airplane is in position for take-off due to slippage on ice or hard packed snow, therefore, it will be necessary to make full power check in conjunction with take-off. Power should be applied as rapidly as possible in order to enable use of maximum amount of runway if take-off is discontinued due to engine malfunctioning or failure.

WARNING

Never take-off with snow, ice or frost on wings. (Even loose snow may not blow off.) Loss of lift and treacherous stalling characteristics will ensue.

AFTER TAKE-OFF.

1. Turn gun heat switch ON immediately after take-off.

2. After take-off from a snow or slush covered field, operate landing gear and flaps through several complete cycles to preclude their freezing in the UP position.

Note

Landing gear retracting time is from 9 seconds at −20°F to 12 seconds at −65°F.

LANDING.

1. Pump brake pedals several times during the approach.

2. Disconnect electrical units not absolutely needed.

WARNING

Landing gear extension time is from 8 seconds at −20°F to 8.5 seconds at −65°F.

3. Use brakes sparingly and not until absolutely necessary after setting the airplane down.

4. Taxi with sufficient rpm to cut-in generator if conditions permit because low temperature decreases battery output.

POST FLIGHT.

1. Clean dirt and ice from shock struts and all exposed actuating cylinder pistons and wipe with a rag soaked in hydraulic fluid of the same type as used in the system.

2. Leave brakes in OFF position.

3. Leave canopy slightly open to prevent cracking of transparent areas due to differential contraction. Also air circulation retards frost formation in cockpit.

4. Install wing, empennage and canopy covers and install dust plugs in air intake duct and tailpipe.

5. Check specific gravity of battery at least weekly. If less than 1.250 remove battery and service.

6. Moor airplane firmly.

7. If lay-over of several days is expected, remove the battery. Further, at temperatures below −29°C (−20°F) remove the battery if lay-over exceeds four hours.

SUMP DRAINAGE.

Drain fuel tank sump of condensate, frequently. Under prolonged freezing conditions a small amount of ice or snow gets into the fuel tanks each time the airplane is serviced. When there is sufficient rise in temperature due to placing the airplane in a hangar or to warmer weather, these crystals melt, resulting in water in the system. Regular and frequent drainage especially under thawing conditions, is the best method of preventing ice in the fuel lines when the airplane is again subjected to freezing weather. Keeping the tanks as full as possible when the airplane is parked will also help to reduce moisture condensation.

ALTIMETER CALIBRATION

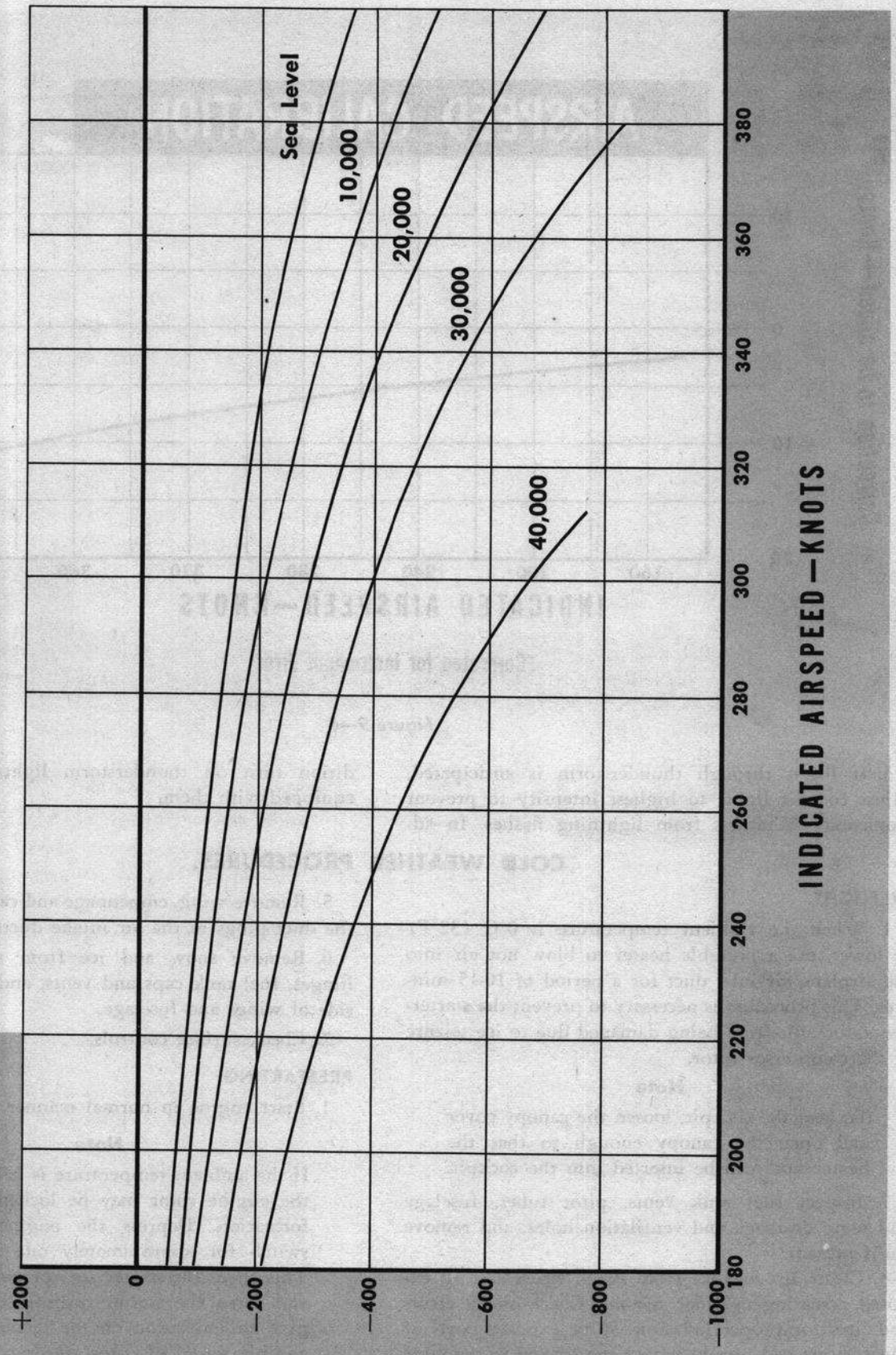


Figure 9-7

APPENDIX 1



PERFORMANCE DATA

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HOT WEATHER AND DESERT PROCEDURES.

BEFORE ENTERING THE AIRPLANE.

1. All metal surfaces exposed to the sun are burning hot to touch. Wear gloves to prevent burns.

2. Make all possible ground checks before starting the engine.

3. If operating in sandy country, ascertain that air filters, instrument filters, and oil filters have been cleaned for each flight.

4. Check seals and tires to ascertain that they are not blistered or show other evidence of deterioration.

5. Run the engine on the ground only as long as is necessary. Don't run-up engines to windward of other planes, personnel or ground installation.

TAKE-OFF.

1. If ground is sandy or dusty, avoid taking off in the wake of another airplane.

2. Cabin vent switch; PRESSURE position unless high humidity causes cockpit to fill up with fog. If so take-off with cabin vent switch in RAM.

Note

Take-off distances will be longer because the air is less dense during warm weather.

AFTER TAKE-OFF.

Do not climb the airplane at less than flying speed specified in the climb chart.

LANDING.

Because hot air is less dense than cold air, true stalling speed will be greater and additional distance will be required for landing.

PARKING.

1. If in sandy country, close and cover all openings to keep sand out. Cover windshield and canopy to prevent sand scratches.

2. Keep canvas covers on the windshield and canopy whenever the airplane is parked in the sun. If this is not done, the sun's heat will soften and distort the transparent plastic. Malfunctioning of instruments and communications equipment will also result.

3. If blowing sand is not a hazard, keep canopy and selected access doors open to permit air circulation.

EXAMPLE: NO ASSIST.

Determine take-off speed, ground roll and distance to clear 50 ft obstacle for the following configuration:

Airplane gross weight	22,300 lbs
Pressure altitude	2,000 feet
Air temperature	35°C
Headwind	0 and 30 knots
Ato Units	0

Procedure:

Enter figure A–7 at air temperature (A) and move up to pressure altitude curve (B). Continue horizontally across to airplane gross weight (C) and vertically to ground roll distance (E). Drop to 0 wind curve (F) and horizontal to distance to clear 50 ft obstacle (G). For a 30 knot headwind, drop from airplane gross weight (C) to (D) then follow curve to headwind (H) then drop to ground roll distance (J). Continue from (J) vertically to 30 knot headwind curve (K) and horizontal to distance to clear 50 ft obstacle (L).

Conclusion:

Take-off speed (C) 154 knots CAS (154 knots IAS)

Ground roll distance (E) 7250 feet (zero wind)

Distance to clear 50 ft obstacle (G) 9650 ft (zero wind)

Ground roll distance (J) 4700 feet (30 knot headwind)

Distance to clear 50 ft obstacle (L) 70000 ft (30 knot headwind)

EXAMPLE 2 ATO UNIT ASSIST.

Determine take-off speed, ground roll, distance to clear 50 ft obstacle and ato cut-in speed for the following configuration:

Airplane gross weight	22,430 lbs
Pressure altitude	2,000 feet
Air temperature	20°C
Headwind	0 and 30 knots
Ato Units	2

Procedure:

Enter figure A–8 at air temperature (A) and move up to pressure altitude curve (B). Continue horizontally across to airplane gross weight (C) and vertically to ground roll distance (E). Drop to 0 wind curve (F) and horizontally to distance to clear 50 ft obstacle (G). For a 30 knot headwind, drop from airplane gross weight (C) to (D) then follow curve to headwind (H) then drop to ground roll distance (J). Continue from (J) vertically to 30 knot headwind curve (K) and horizontally to distance to clear 50 ft obstacle (L). To determine ato cut-in speed enter figure at airplane gross weight (A) and move horizontal to pressure altitude (B). Drop to temperature curve (C) and horizontally to cut-in speed (D).

Conclusion:

Take-off speed (C) 156 knots CAS (156 knots IAS)

Ground roll distance (E) 5200 feet (zero wind)

Distance to clear 50 ft obstacle (G) 6500 ft (zero wind)

Ground roll distance (J) 3500 ft (30 knot headwind)

Distance to clear 50 ft obstacle (L) 4500 ft (30 knot headwind)

Ato cut-in speed (D) 109 knots CAS.

TAKE-OFF ACCELERATION CHECK DATA.

F-84F take-off ground roll distance curves, figures A–7, A–8 and A–9, and speed vs distance curves, figure 10, are presented to allow the pilot to determine speed at any distance down the runway (line speed) during the take-off ground roll. Stopping distance curves are presented in figure A–11 to determine the minimum distance required to stop from any speed. Using this information, the runway marker (painted stripes, signs, etc.) at which acceleration is checked can be chosen so that the aircraft may be stopped on the remaining runway from normal predicted speed at that point should the take-off be aborted. Figure A–12 presents a graph of airspeed position error correction to be applied in determining cockpit indicated airspeed from any calibrated airspeed presented in figures A–10 and A–11.

The purpose of line speed is to provide a means of checking take-off acceleration. A check on the speed at some point reasonably early in the take-off run will allow the pilot to properly monitor his take-off run. It is possible to predict two line speeds for a given line or check point on the runway, (a) normal line speed which assumes normal take-off ground roll distance and (b) minimum line speed which assumes that the entire runway length will be used for the take-off ground roll due to low acceleration. To minimize the number of aborts and assure full utilization of available runway length, the minimum line speed should be used for the acceleration check. If the observed speed at the check point is equal to or more than the minimum line speed, take-off acceleration is acceptable and the take-off should be continued. If it is less than the minimum line speed the take-off should be aborted. Since the check point is chosen so that the airplane can be stopped on the remaining runway from the normal line speed, it will be less difficult to stop from a speed less than minimum line speed.

INTRODUCTION.

To facilitate preflight and in-flight mission planning, two standard types of operating data are presented in this Section. The first type provides altimeter and airspeed position error corrections. The second type provides performance during normal operation, with various weight configurations and the instructions necessary to obtain this performance. All data pertain to NACA standard ambient temperatures unless otherwise indicated. Most of the charts are applicable to non-standard atmosphere if the recommended calibrated airspeed (CAS) valves are maintained unless a deviation in calibrated airspeed is necessary to avoid violating engine limits. This rule is necessary because performance is greatly dependent on Mach number which, at each pressure altitude, is dependent on CAS alone. Fuel quantities are given in pounds so that the charts can be used when the engine is operated on either the recommended or emergency alternate fuel.

ALTIMETER CORRECTION CHART.

Static pressure, which affects the altimeter readings, is not always accurately measured due to the location of the static vent. Additional factors which effect the degree of error in the altimeter are the attitude of the airplane, the airspeed and the installation of external tanks on the inboard pylons. The error in the altimeter reading is greatest at low altitudes and high speeds making it more critical during ground support missions. The altimeter position error correction chart (figure A–1) is provided so that for a given altitude, airplane loading configuration and airspeed the altimeter error can be determined. The error is added algebraically to the altimeter reading to obtain the true pressure altitude.

AIRSPEED INSTALLATION CORRECTION CHARTS.

In order to obtain true airplane speeds several corrections must be applied to the airspeed indicator reading. The first correction is made for the error in the individual instrument. This value is noted on the instrument calibration card and when applied to the instrument reading provides indicated airspeed (IAS). The second correction is for airspeed installation error. This correction is taken from figure A–2, and when applied to the indicated airspeed (IAS) provides calibrated airspeed (CAS). The third correction is taken from figure A–3 and when applied to calibrated airspeed provides equivalent airspeed (EAS). Dividing the equivalent airspeed by the square root of relative density (ratio of ambient to standard sea level density) provides true airspeed (TAS). Vectorially adding wind velocity to true airspeed provides ground speed (GS).

SAMPLE PROBLEM.

For purposes of explaining the use of the airspeed Position Error Correction Chart and the Compressibility Correction Table, consider a clean airplane flying at 25,000 feet at an airspeed indicator reading of 350 knots. Since the airplane is not equipped with an outside air temperature indicator, determine the ambient temperature at 25,000 feet from the Standard Altitude Table (figure A–6) which will be –35°C.

Airspeed Indicator reading	350 knots
Correction for Instrument error (from instrument calibration card)	–2
Indicated Airspeed (IAS)	348 knots
Correction for Installation Error (from airspeed position error correction chart figure A–2)	–8
Calibrated Airspeed (CAS)	340 knots
Correction for Compressibility Error (from compressibility correction table figure A–3)	–16
Equivalent Airspeed (EAS)	324 knots
Correction for Air Density (from standard altitude table figure A–6)	x 1.49
True Airspeed (TAS)	483 knots

MACH NUMBER POSITION ERROR CORRECTION CHART.

Due to the inaccuracies of the static pressure position errors will be carried into the Machmeter. The Mach number position error correction chart (figure A–4) indicates the amount of error for various speeds in terms of Mach No.

SPEED CONVERSION CHART.

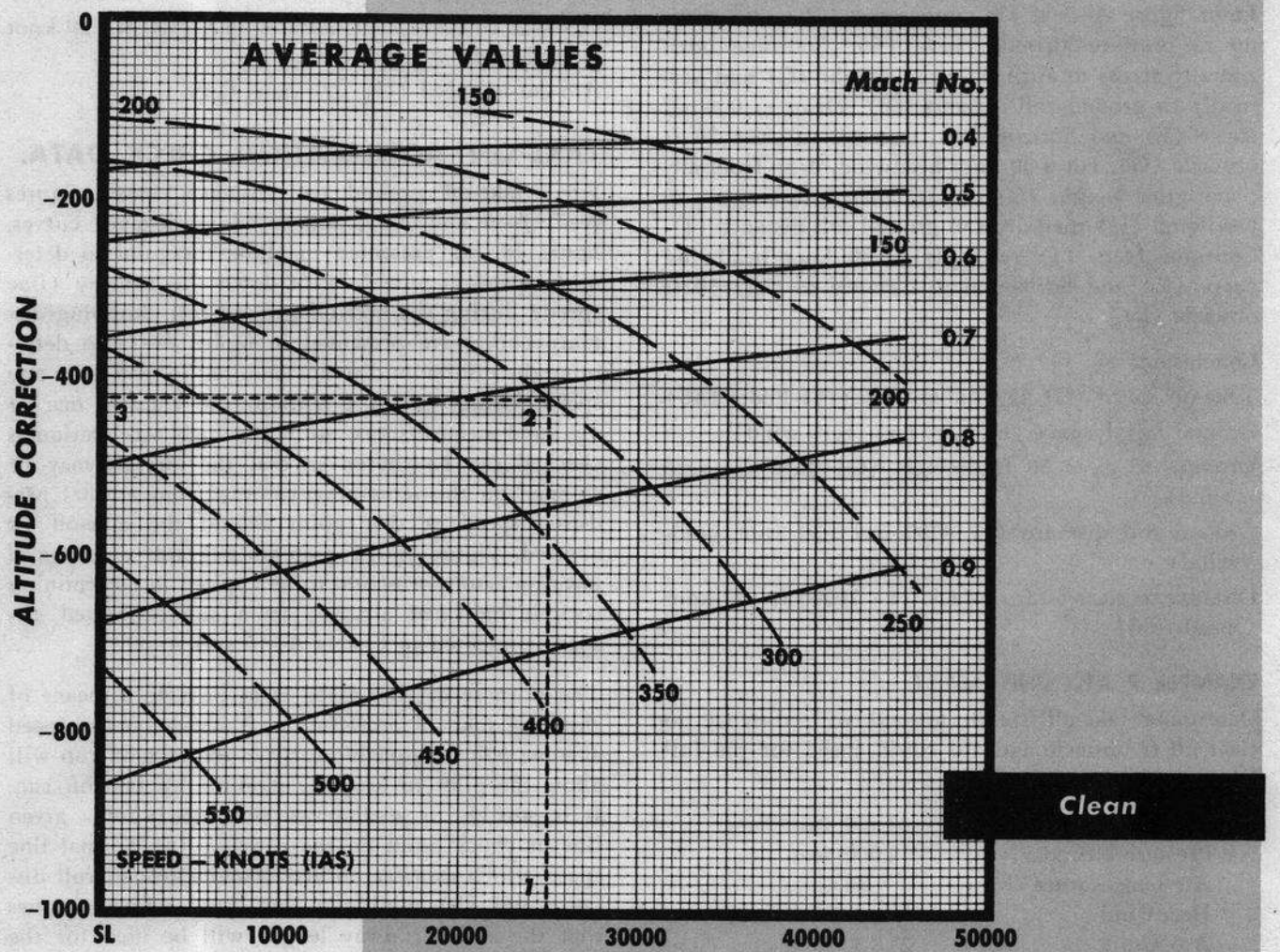
The speed conversion chart (figure A–5) reflects the Mach No. and the true airspeed at any altitude for a given calibrated airspeed.

TAKE-OFF CHARTS.

Take-off charts (figures A–7, A–8 and A–9) are provided for no assist, two ato and four ato assist configurations. The charts take into account ambient temperature, pressure altitude and gross weight. Take-off speed, ground roll and distance to clear a 50 ft obstacle with or without a headwind are obtained from the charts. Ato cut-in speeds are plotted on separate charts which are to be used in conjunction with the corresponding take-off chart.

ALTIMETER POSITION ERROR CORRECTION CHART

FLUSH STATIC SYSTEM

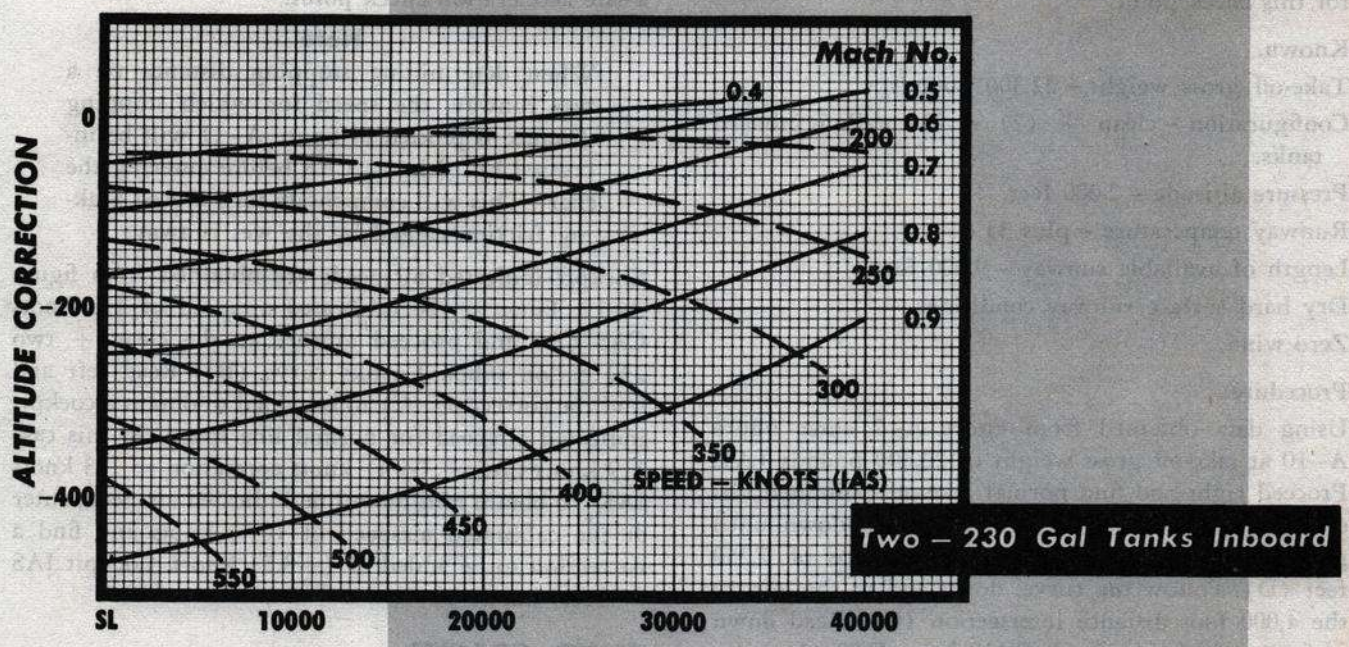


EXAMPLE

ALTIMETER READS 25,000 ft at 300 knots (IAS) clean airplane.

Enter bottom of chart at 25,000 foot mark (1) and move up to the 300 knot curve (2). Move across and read altimeter correction of —422 feet. Pressure altitude equals 25,000 — 422 or 24,578 feet.

Figure A—1 (sheet 1 of 2)



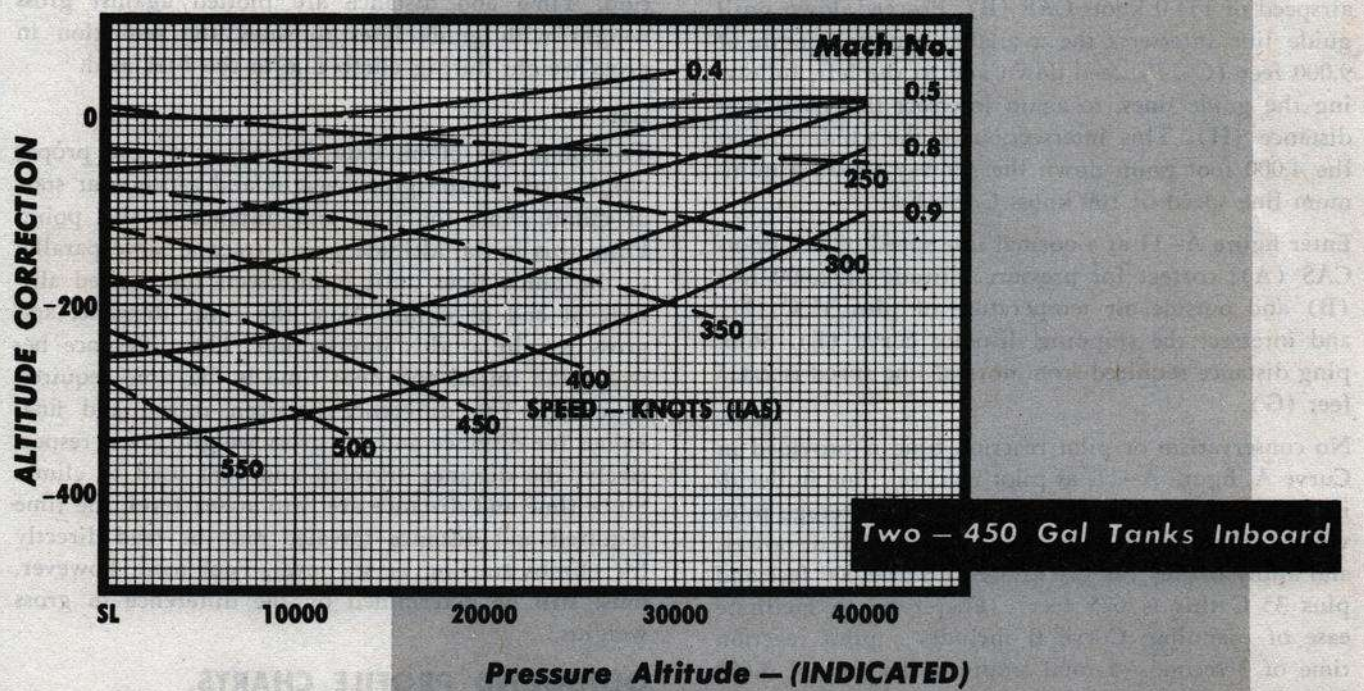


Figure A–1 (sheet 2 of 2)

EXAMPLE:

Determine if a point 4,000 feet down a 9,000 foot runway can be used as a safe acceleration check point. Determine also the normal and minimum line speeds for this check point.

Known.

Take-off gross weight – 22,300 pounds.

Configuration – clean + (2) – 230 gallon inboard tanks.

Pressure altitude – 2,000 feet.

Runway temperature – plus 35°C.

Length of available runway – 9,000 feet.

Dry hard surface runway conditions.

Zero wind.

Procedure:

Using data obtained from figure A–7 enter figure A–10 at take-off gross weight of 22,300 pounds (A). Proceed right and find normal take-off calibrated airspeed of 154.0 knots CAS (B). Proceed down until guide line intersects ground roll distance of 7,250 feet (D). Follow the curve, down and to the left, to the 4,000 foot distance intersection (G). Read down to find normal line speed of 119 knots CAS (J).

To determine minimum line speed, again enter figure A–10 at the take-off gross weight of 22,300 pounds (A). Proceed right and find normal take-off airspeed of 154.0 knots CAS (B). Proceed down until guide line intersects the available runway length of 9,000 feet (C). Proceed down and to the left, following the guide lines, to again intersect the 4,000 foot distance (H). This intersection of the guide line at the 4,000 foot point down the runway shows a minimum line speed of 109 knots CAS (K).

Enter figure A–11 at a normal line speed of 119 knots CAS (A), correct for pressure altitude of 2,000 feet (B) and outside air temperature of plus 35°C (D) and intersect the stopping distance curve (E). Stopping distance required from normal line speed is 2,825 feet (G).

No conservatism or pilot reaction time is provided in Curve A, figure A–11, as pilot reaction time in deciding to abort the take-off is variable. The average pilot will use about 3 seconds to make a decision, cut power, and apply brakes (at 119 knots CAS at 2,000 feet and plus 35°C this is 625 feet). Therefore, to facilitate ease of planning, Curve B includes a pilot reaction time of 3 seconds–a total stopping distance of 3,450 feet (H).

Conclusion:

By adding the check distance of 4,000 feet plus the predicted stopping distance with normal pilot reaction time of 3,450 feet, the total distance required to accelerate to the 4,000 foot point down the runway and stop is 7,450 feet. Since this is well within the 9,000 foot runway, the 4,000 foot point can be used as a safe acceleration check point.

Note

When determining stopping distance on a wet runway, the speed for which stopping distance is plotted in figure A–11 will be increased by 10 knots CAS before entering the chart. This will compensate for reduced braking friction caused by the wet runway.

Cockpit indicated airspeeds are obtained from figure A–12. Enter at the calibrated airspeed of 119 knots CAS (A) and proceed upward to the clean + two 230 gallon inboard tanks curve (B). Read left and find the correction (C) to be added to obtain a cockpit indicated airspeed for normal line speed. In this case 119 knots CAS + (+4) knots correction = 123 knots IAS. To obtain minimum line indicated airspeed, enter at the calibrated airspeed of 109.0 knots and find a correction to be added of (+3.5) knots. Cockpit IAS = 112.5 knots.

CLIMB GRAPHS.

Climb charts for military power, normal power, and 98 per cent military power, based on a recommended climb speed schedule are shown for each configuration. Time and distance are plotted against gross weight with guide lines to show the reduction in gross weight during climb due to the fuel used.

USE.

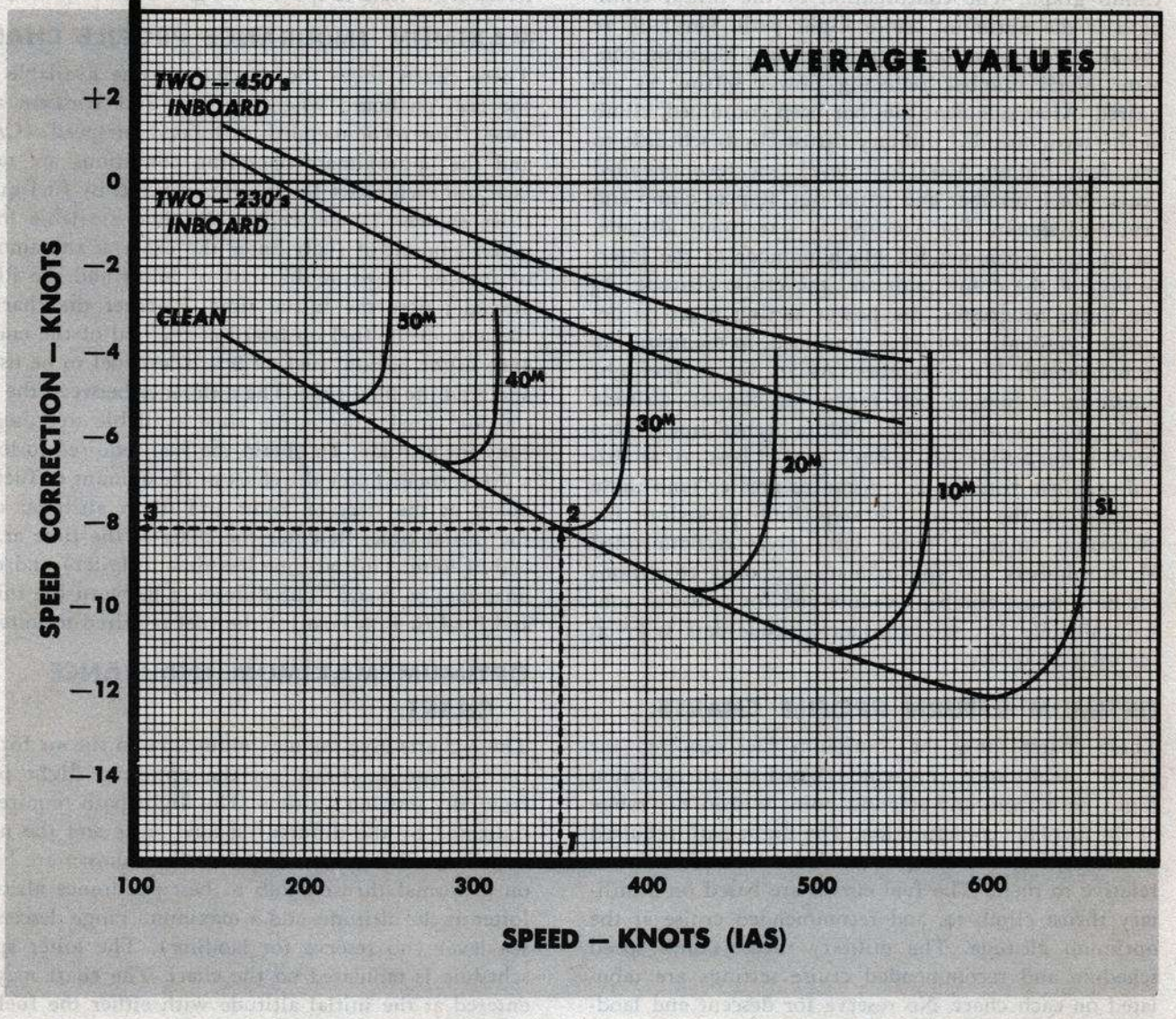
To obtain the climb data desired, enter the proper climb chart at the gross weight and altitude at start of climb. Note the time and distance at this point. From this initial altitude point, trace a curve parallel to the guide lines until it intersects the desired altitude at end of climb. Note the time, distance, and gross weight at this intersection. The difference between the initial and final time is the time required to climb. The difference between initial and final values for distance and for gross weight gives, respectively, the distance traveled and fuel used to climb. Since time and distance are zero at sea level, the time required and distance traveled may be read directly for climbs starting at sea level. Fuel used, however, must still be determined by the difference in gross weights.

OUTBOUND PROFILE CHARTS.

These charts give the relationship of time, fuel, distance, and altitude to maximum range for no-wind conditions. This relationship is based on a mission sequence of take-off, military thrust climb, and maxi-

AIRSPEED POSITION ERROR CORRECTION CHART

FLUSH STATIC SYSTEM



EXAMPLE

Find CAS of clean airplane at 25,000 feet flying at 350 knots IAS.

Enter chart at 350 knots IAS (1) and move up to intersect altitude curve (2). Move across and read correction of –8.2 knots (3). CAS = 350 – 8.2 or 341.8 knots.

Figure A–2

mum range cruise. The fuel curves include an allowance for start, taxi and take-off, and the fuel used in climb to each altitude, as well as the fuel required for maximum range cruise. The time lines include the time required to climb to cruise altitude but do not include the time to start, taxi, or take-off. The initial climb path shows the distance traveled during the military thrust climb from sea level to cruising altitude, using the climb speed schedule shown on the Military Thrust Climb graph. The continuation of the initial climb path is the optimum cruise flight path. Level off at the altitude shown for maximum range. Maintain constant Mach number reducing power setting as required. After sufficient fuel has been consumed, climb at the recommended military thrust climb schedule to the next higher 5000 foot level, set recommended cruise Mach number and cruise out. Repeat climb and cruise as shown. For a cruise at a constant altitude, set up the recommended Mach number at the intersection of the climb path and the cruise altitude. As the flight progresses, the power setting must be decreased gradually as fuel is consumed, to maintain the recommended Mach number. As an aid to preflight planning, a line of best range for constant-altitude flight appears on the chart (white dashed line). This curve is not a flight path, but a plot of best cruise altitude against distance. For distances greater than those covered by the curve, use step-climb procedure for maximum range. A cruise table gives recommended Mach numbers and approximate operating conditions for both cruise-climb procedure and for cruise at constant altitude. Cruise-at-constant-altitude data is given for each 5000 feet.

OPTIMUM RETURN PROFILE CHARTS.

These charts show the minimum fuel required for maximum distance (no wind) based on an optimum flight path from any starting point within the range of the airplane configuration. The flight path required is indicated by the different shaded areas and the notes relative to them. The fuel curves are based on a military thrust climb to, and recommended cruise at the optimum altitude. The military thrust climb speed schedule and recommended cruise settings are tabulated on each chart. No reserve for descent and landing has been included. The time shown at the optimum altitude is cruise time only; it does not include the time required for the climb to optimum altitude or any allowance for descent, loiter and landing. The chart may be entered at the initial altitude with either the fuel on board (to determine the distance available) or with the distance to be flown (to determine the fuel required). The shaded area in which the initial point falls, establishes the cruising procedure to be used, as stated in the note relative to the area. The time required to fly the distance is the time at cruise altitude (obtain from profile), plus the time required to climb (obtained from either profile or graphical military thrust climb chart). The effect of wind must be applied to obtain the actual fuel and time to fly the distance. A close approximation can be obtained by considering the head or tail wind for the time it requires to complete the flight (neglecting the difference in wind at the lower altitudes since comparatively little time is spent during the climb phase).

MAXIMUM ENDURANCE PROFILE CHART.

These charts show the maximum time available for the fuel on board when loitering at a constant altitude. The recommended calibrated airspeed (CAS) and the approximate operating conditions are tabulated on each chart for weights covered by fuel quantities shown. To determine the time available for a given amount of fuel: Enter the chart at the amount of fuel on board at the start of loiter and the flight altitude; note the initial time. Re-enter the chart at the amount of fuel on board at the end of the endurance flight (initial fuel on board less fuel to be used) and read the final time. The difference between the initial and final time is the time available to loiter at constant altitude. To obtain the fuel required to loiter a given time: Enter the chart at the amount of fuel on board at the start of loiter and flight altitude; note the initial time. Re-enter the chart at the time at the end of loiter (initial time less time to loiter) and read final fuel on board. The difference between the initial and final fuel on board is the fuel required to loiter.

OPTIMUM MAXIMUM ENDURANCE CHART.

These charts give the maximum time in the air for the fuel remaining, based on the optimum flight path, from any starting altitude. The flight path required is indicated by the different shaded areas and the notes relative to them. Time and fuel lines shown are based on a normal thrust climb to best endurance altitude, loiter at the altitude, and a maximum range descent to sea level (no reserve for landing). The loiter speed schedule is tabulated on the chart. The chart may be entered at the initial altitude with either the fuel remaining (to determine the time available) or the time desired (to determine the fuel requirement). The shaded area in which the initial point falls establishes the flight path to be used, as stated in the note relative to the area.

DESCENTS.

Two types of descents are shown for six configurations of the airplane; the recommended descent (with idle power), the maximum range descent (with idle

COMPRESSIBILITY CORRECTION TABLE

Pressure Altitude	CALIBRATED AIRSPEED—KNOTS									
	150	200	250	300	350	400	450	500	550	600
5,000	0	0	1	2	2	3	5	6	8	10
10,000	0	1	2	3	5	7	10	13	17	21
15,000	1	2	3	6	8	12	16	21	27	
20,000	1	3	5	8	12	17	23	31		
25,000	2	4	7	11	17	24	32			
30,000	2	5	9	15	23	32				
35,000	3	7	12	20	29					
40,000	4	9	16	25						

Remarks: SUBTRACT CORRECTION FROM CALIBRATED AIRSPEED TO OBTAIN TRUE INDICATED AIRSPEED.

Figure A—3

power). Distance, time, fuel consumed and rate of descent are shown on the graphs.

LANDING DISTANCES.

Distances, ground and total to clear a 50 foot obstacle. with or without the drag chute inflated are shown in the landing distance graphs. In both graphs, the distances are computed for the speed brake closed.

COMBAT ALLOWANCE CHART.

The Combat Allowance Chart shows the relationship between time and fuel with changes in altitude at military power and normal power. Combat time or fuel may be determined from this chart for a given thrust setting. The time limitations for military thrust operation are shown. Normal thrust does not have a time limitation.

NAUTICAL MILES PER POUND OF FUEL GRAPHS.

Cruise data (zero wind) throughout the speed range from maximum endurance to military thrust are shown on the Nautical Miles per pound of Fuel Graphs. Several weights for each configuration are given at altitudes of sea level, 15000, 25000, 35000, 40000 and 45000 feet. Each graph includes specific range (nautical miles per pound) fuel flow, and power settings. Also included are curves of recommended cruise true Mach number, maximum endurance, and normal and military thrust. Specific range is plotted against true Mach number. Cruising range is the product of specific range multiplied by fuel amount. Large fuel amounts should be divided into several smaller amounts. The smaller the amount of fuel used in the calculation, the greater the accuracy of the range. To obtain the cruising range for a given amount of fuel, use the following steps. (If several fuel amounts are being used, repeat the steps for each. The sum of the individual ranges is the total cruising range.)

a. Select the proper graph for the airplane configuration and altitude.

b. Determine the average weight of the airplane for the amount of fuel being considered.

c. Enter the graph at this average weight and the desired true Mach number, or desired power setting, to obtain specific range (nautical miles per pound of fuel).

d. The specific range multiplied by the amount of fuel (pounds) equals the cruising range.

e. Interpolate the approximate fuel flow and power setting at the true Mach number and average weight.

When there is a wind to be considered, multiply the specific range found in step c by the range factor (ground speed divided by true airspeed) to obtain the specific range for wind. Proceed with steps d and e to complete the problem.

MACH NUMBER POSITION ERROR CORRECTION CHART

EXAMPLE

Correct Mach Number for clean airplane flying at an indicated Mach No. of .7.

Enter curve at Mach No. .7 (1) and move up to curve for clean configuration (2). Move across and read correction of —.0225 (3). Corrected Mach No. = .7 — .0225 or .677.

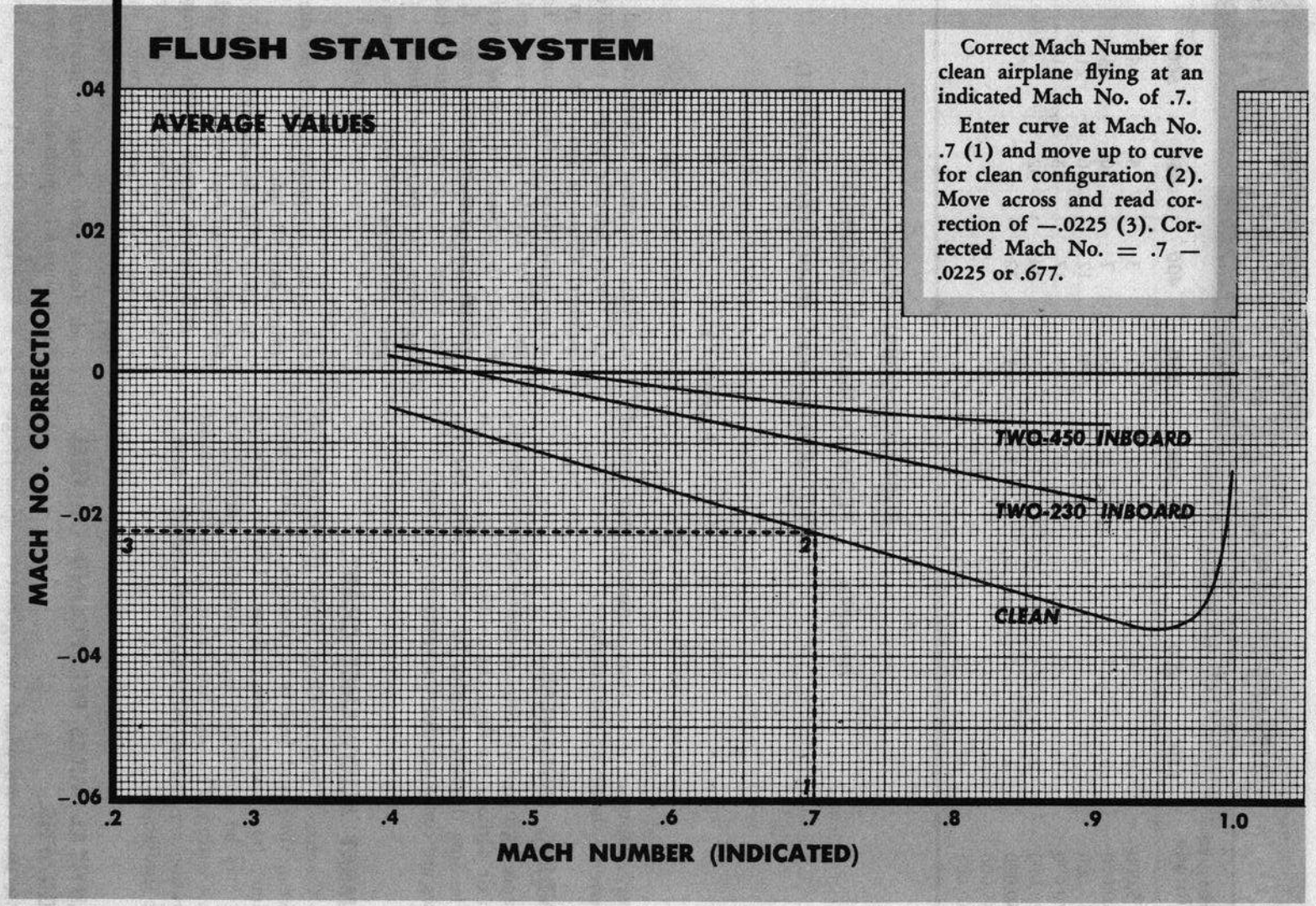


Figure A—4

SPEED CONVERSION CHART

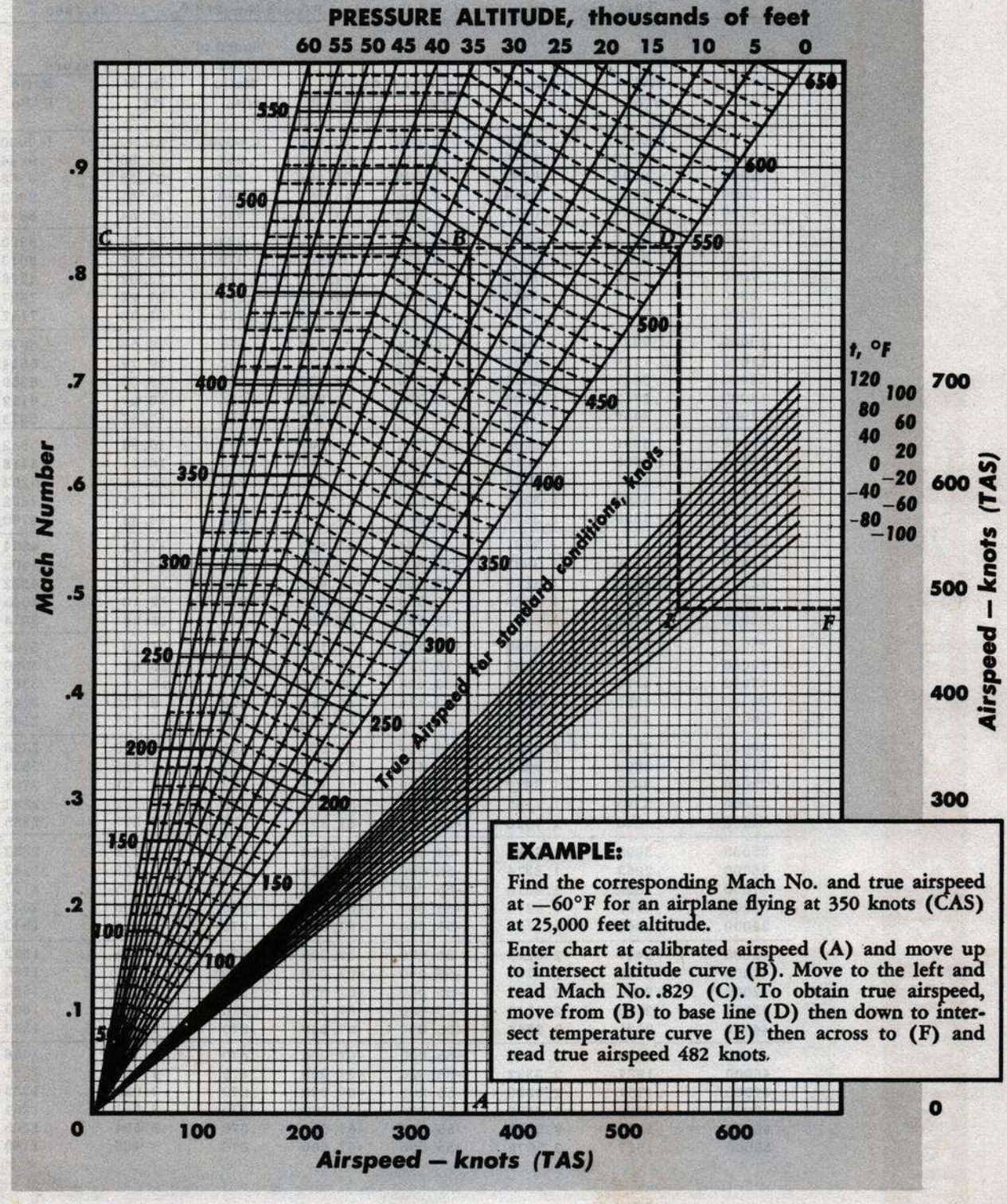
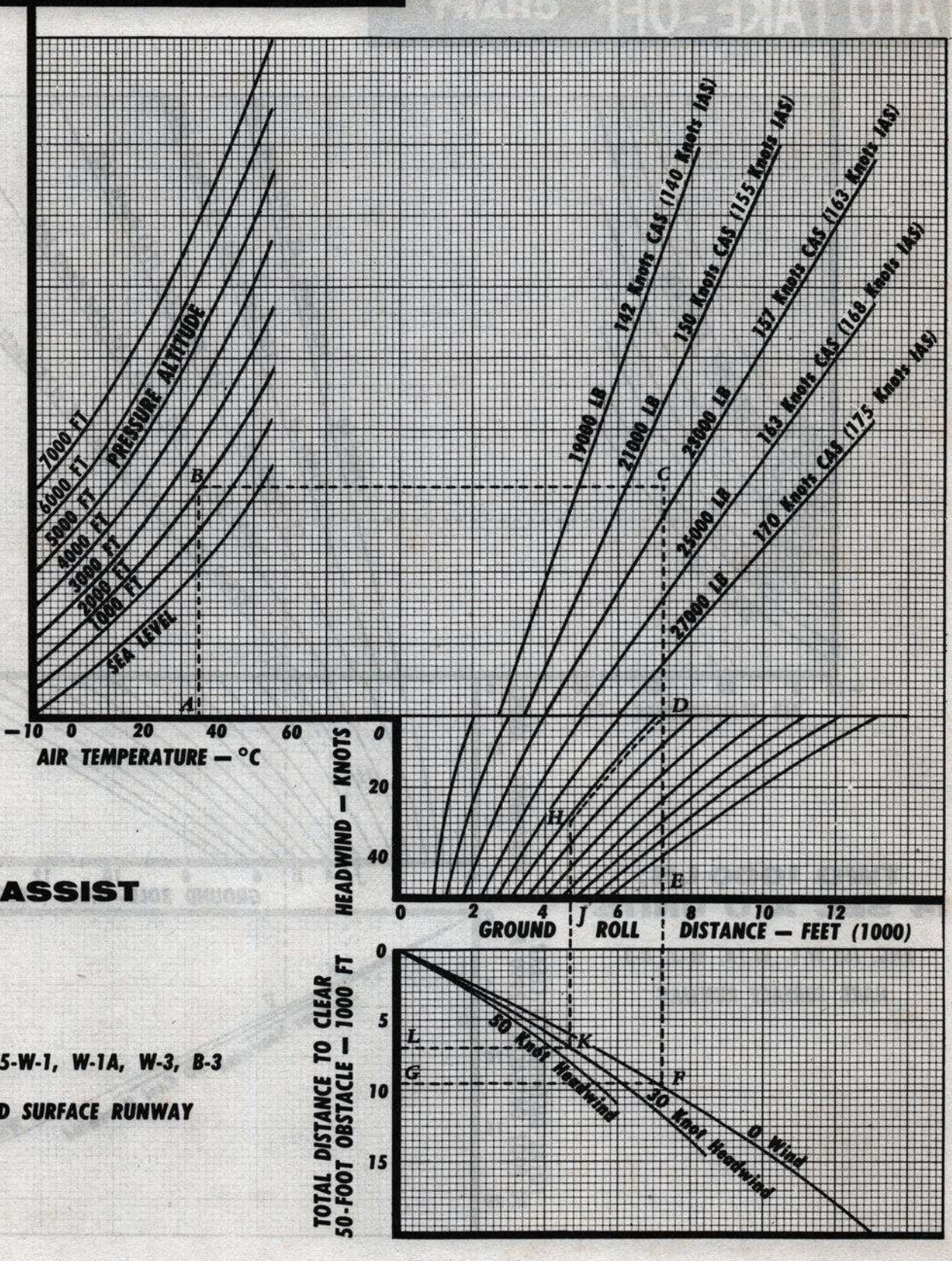


Figure A—5

TAKE-OFF CHART



NO ASSIST

ENG: J65-W-1, W-1A, W-3, B-3

HARD SURFACE RUNWAY

STANDARD ALTITUDE TABLE

Standard Sea Level Air:
T = 15° C. W = .07651 lb/cu. ft. ρ_o = .002378 slugs/cu. ft.
P = 29.921 in. of Hg. 1" of Hg. = 70.732 lb/sq. ft. = 0.4912 lb/sq. in.
This table is based on NACA Technical Report No. 218 a_o - 1116 ft./sec.

Altitude feet	Density Ratio ρ/ρ_o	$\frac{1}{\sqrt{\sigma}}$	Temperature Deg. C	Temperature Deg. F	Speed of Sound Ratio a/a_o	Pressure In. of Hg.	Pressure Ratio P/Po
0	1.0000	1.0000	15.000	59.000	1.0000	29.92	1.0000
1000	.9710	1.0148	13.019	55.434	.997	28.86	.9644
2000	.9428	1.0299	11.038	51.868	.993	27.82	.9298
3000	.9151	1.0454	9.056	48.301	.990	26.81	.8962
4000	.8881	1.0611	7.075	44.735	.986	25.84	.8636
5000	.8616	1.0773	5.094	41.169	.983	24.89	.8320
6000	.8358	1.0938	3.113	37.603	.979	23.98	.8013
7000	.8106	1.1107	1.132	34.037	.976	23.09	.7716
8000	.7859	1.1280	-0.850	30.471	.972	22.22	.7427
9000	.7619	1.1456	-2.831	26.904	.968	21.38	.7147
10000	.7384	1.1637	-4.812	23.338	.965	20.58	.6876
11000	.7154	1.1822	-6.793	19.772	.962	19.79	.6614
12000	.6931	1.2012	-8.774	16.206	.958	19.03	.6359
13000	.6712	1.2206	-10.756	12.640	.954	18.29	.6112
14000	.6499	1.2404	-12.737	9.074	.950	17.57	.5873
15000	.6291	1.2608	-14.718	5.507	.947	16.88	.5642
16000	.6088	1.2816	-16.699	1.941	.943	16.21	.5418
17000	.5891	1.3029	-18.680	-1.625	.940	15.56	.5202
18000	.5698	1.3247	-20.662	-5.191	.936	14.94	.4992
19000	.5509	1.3473	-22.643	-8.757	.932	14.33	.4790
20000	.5327	1.3701	-24.624	-12.323	.929	13.75	.4594
21000	.5148	1.3937	-26.605	-15.890	.925	13.18	.4405
22000	.4974	1.4179	-28.586	-19.456	.922	12.63	.4222
23000	.4805	1.4426	-30.568	-23.022	.917	12.10	.4045
24000	.4640	1.4681	-32.549	-26.588	.914	11.59	.3874
25000	.4480	1.4940	-34.530	-30.154	.910	11.10	.3709
26000	.4323	1.5209	-36.511	-33.720	.906	10.62	.3550
27000	.4171	1.5484	-38.493	-37.287	.903	10.16	.3397
28000	.4023	1.5768	-40.474	-40.853	.899	9.720	.3248
29000	.3879	1.6056	-42.455	-44.419	.895	9.293	.3106
30000	.3740	1.6352	-44.436	-47.985	.891	8.880	.2968
31000	.3603	1.6659	-46.417	-51.551	.887	8.483	.2834
32000	.3472	1.6971	-48.399	-55.117	.883	8.101	.2707
33000	.3343	1.7295	-50.379	-58.684	.879	7.732	.2583
34000	.3218	1.7628	-52.361	-62.250	.875	7.377	.2465
35000	.3098	1.7966	-54.342	-65.816	.871	7.036	.2352
36000	.2962	1.8374	-55.000	-67.000	.870	6.708	.2242
37000	.2824	1.8818	-55.000	-67.000	.870	6.395	.2137
38000	.2692	1.9273	-55.000	-67.000	.870	6.096	.2037
39000	.2566	1.9738	-55.000	-67.000	.870	5.812	.1943
40000	.2447	2.0215	-55.000	-67.000	.870	5.541	.1852
41000	.2332	2.0707	-55.000	-67.000	.870	5.283	.1765
42000	.2224	2.1207	-55.000	-67.000	.870	5.036	.1683
43000	.2120	2.1719	-55.000	-67.000	.870	4.802	.1605
44000	.2021	2.2244	-55.000	-67.000	.870	4.578	.1530
45000	.1926	2.2785	-55.000	-67.000	.870	4.364	.1458
46000	.1837	2.3332	-55.000	-67.000	.870	4.160	.1391
47000	.1751	2.3893	-55.000	-67.000	.870	3.966	.1325
48000	.1669	2.4478	-55.000	-67.000	.870	3.781	.1264
49000	.1591	2.5071	-55.000	-67.000	.870	3.604	.1205
50000	.1517	2.5675	-55.000	-67.000	.870	3.436	.1149

ATO TAKE-OFF CHART

ENG: J65-W-1, W-1A, W-3, B-3
HARD SURFACE RUNWAY

TWO 1000 LB, 14 SEC ATO UNITS

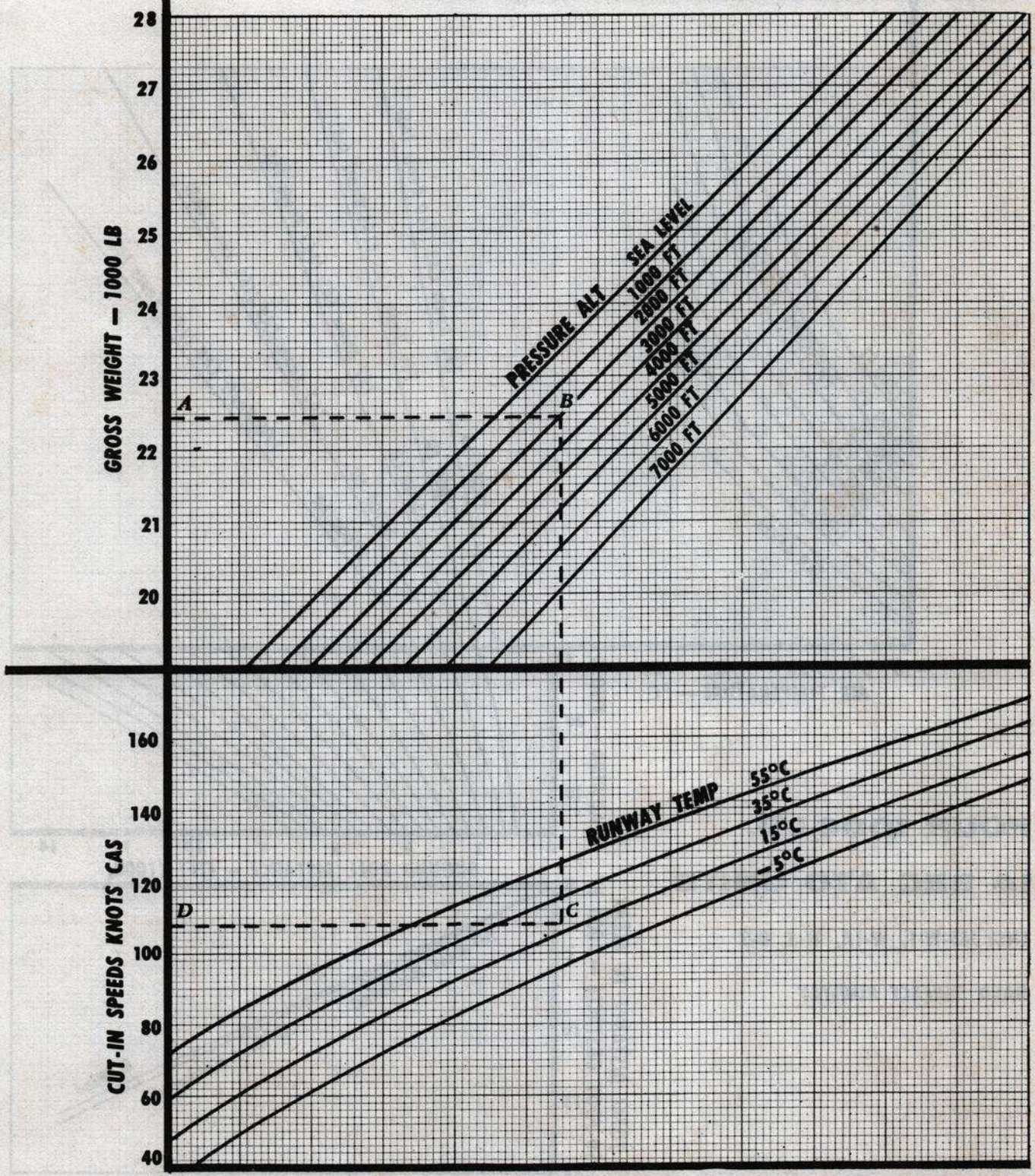
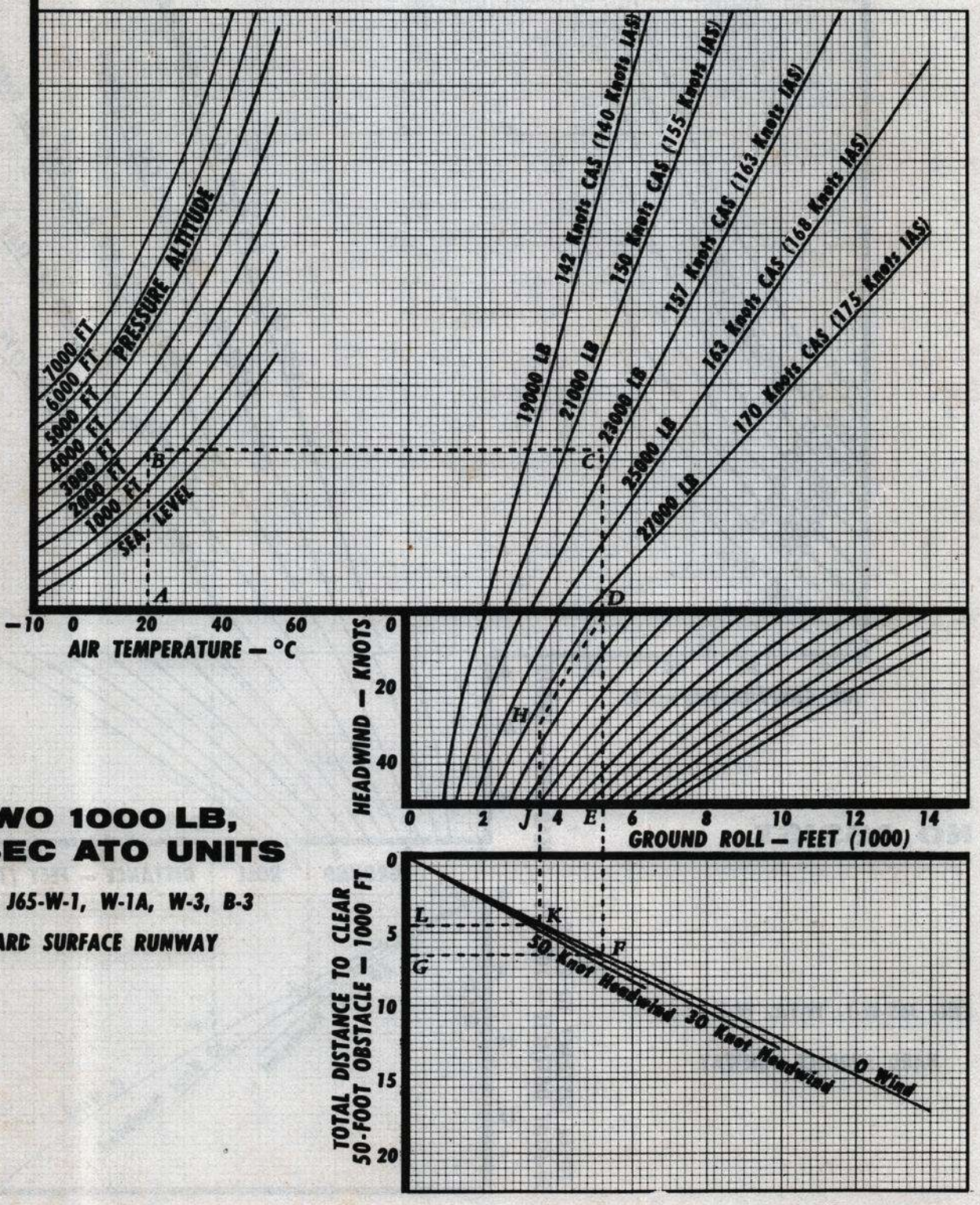


Figure A-8 (Sheet 2 of 2)

ATO TAKE-OFF CHART

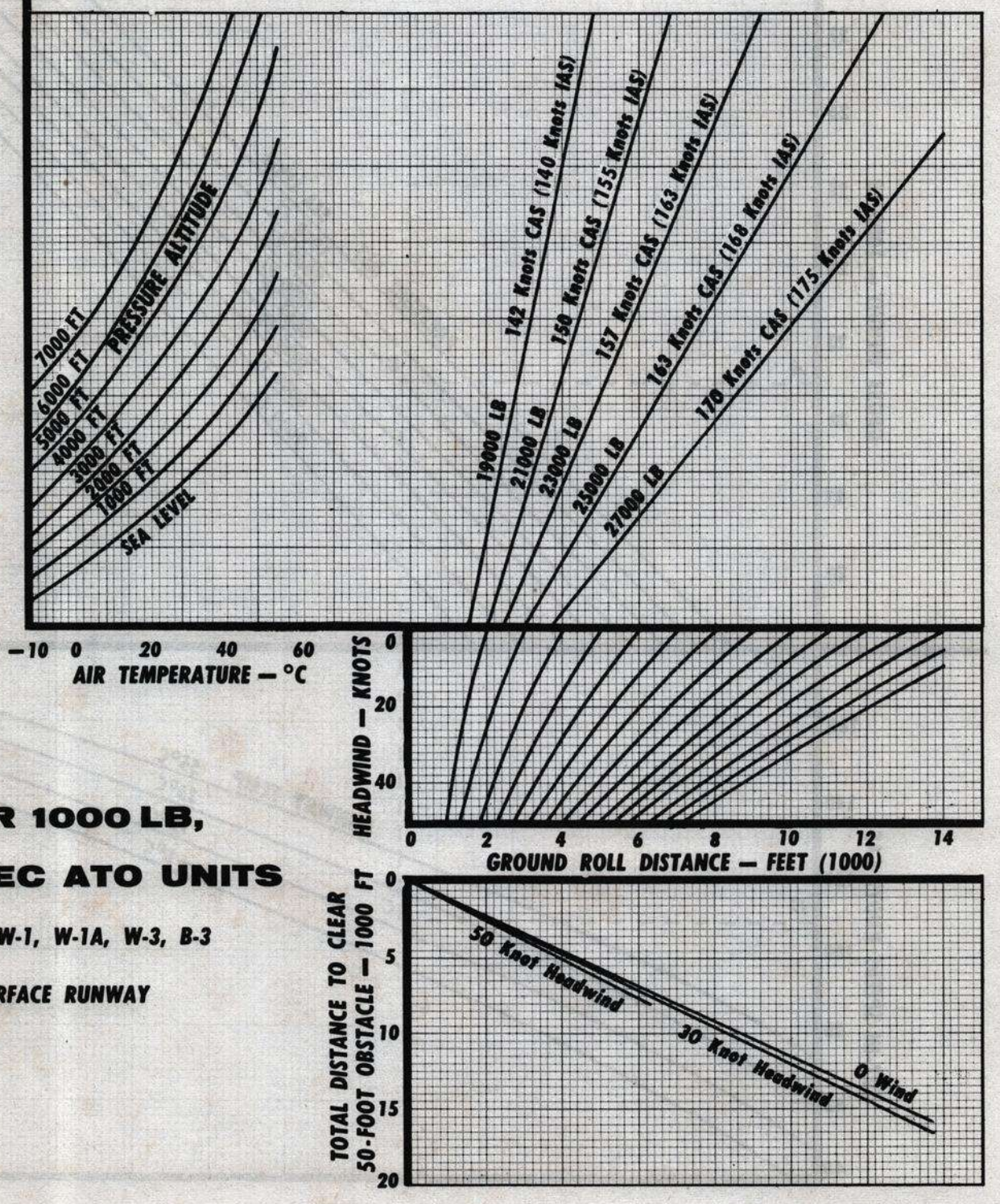


TWO 1000 LB, 14 SEC ATO UNITS

ENG: J65-W-1, W-1A, W-3, B-3

HARD SURFACE RUNWAY

ATO TAKE-OFF CHART



FOUR 1000 LB, 14 SEC ATO UNITS

ENG: J65-W-1, W-1A, W-3, B-3

HARD SURFACE RUNWAY

ATO TAKE-OFF CHART

ENG: J65-W-1, W-1A, W-3, B-3
HARD SURFACE RUNWAY

FOUR 1000 LB, 14 SEC ATO UNITS

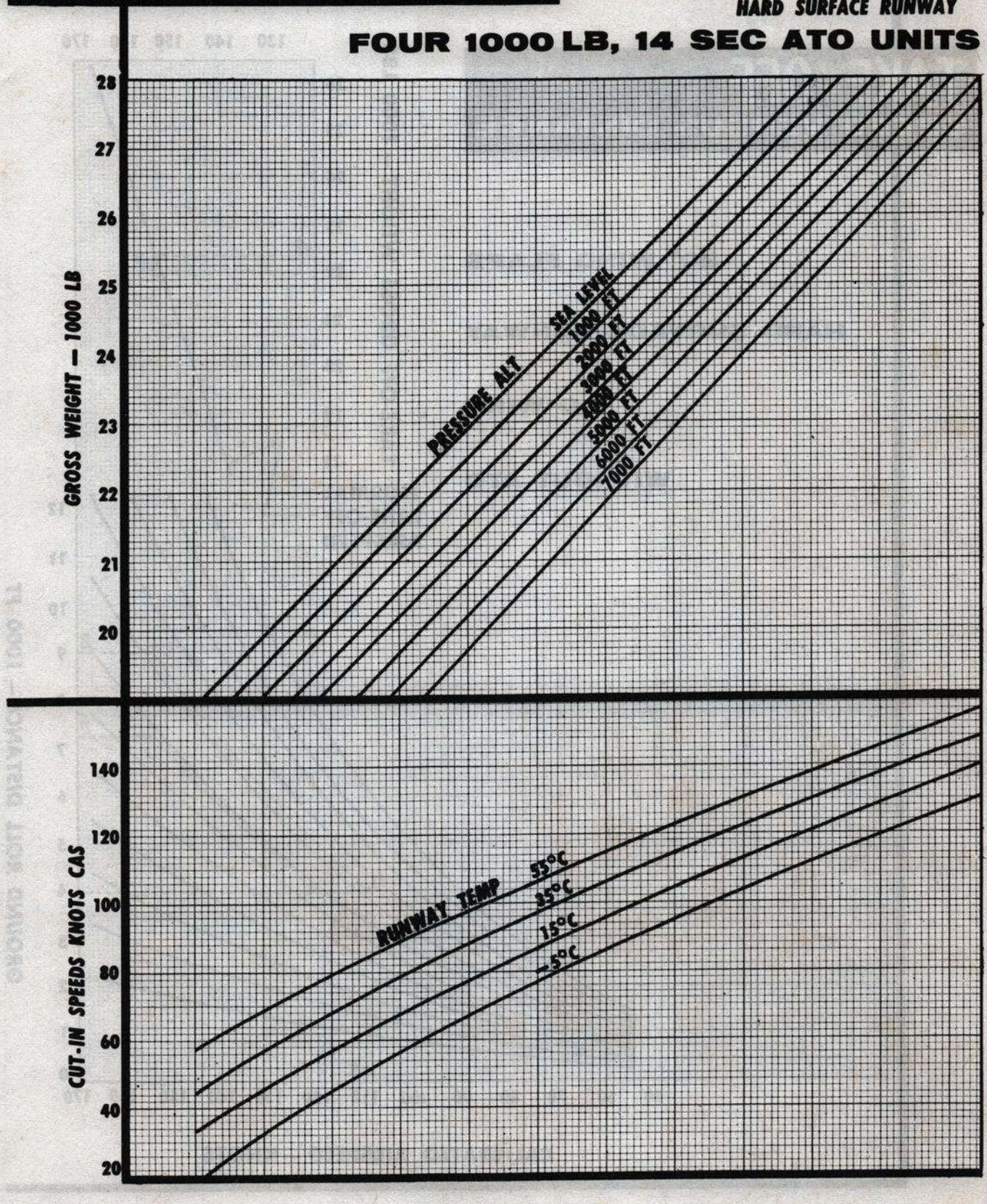


Figure A-9 (Sheet 2 of 2)

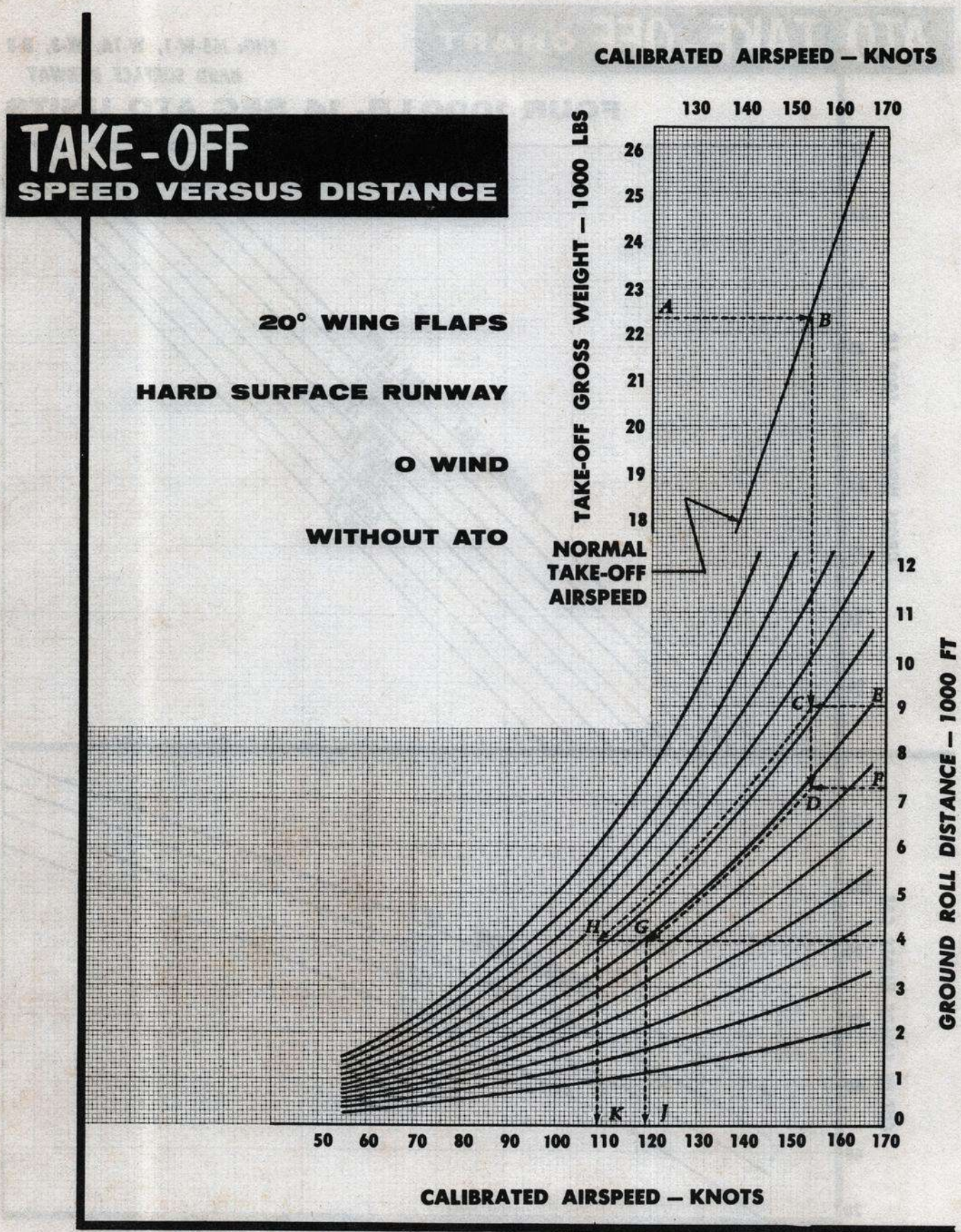

TAKE-OFF
SPEED VERSUS DISTANCE
20° WING FLAPS
HARD SURFACE RUNWAY
0 WIND
WITHOUT ATO
CALIBRATED AIRSPEED — KNOTS
130 140 150 160 170
TAKE-OFF GROSS WEIGHT — 1000 LBS
26 25 24 23 22 21 20 19 18
A
B
NORMAL TAKE-OFF AIRSPEED
C
E
F
D
H
G
K
J
12 11 10 9 8 7 6 5 4 3 2 1 0
GROUND ROLL DISTANCE — 1000 FT
50 60 70 80 90 100 110 120 130 140 150 160 170
CALIBRATED AIRSPEED — KNOTS

Figure A—10

ABORTED TAKE-OFF
STOPPING DISTANCE

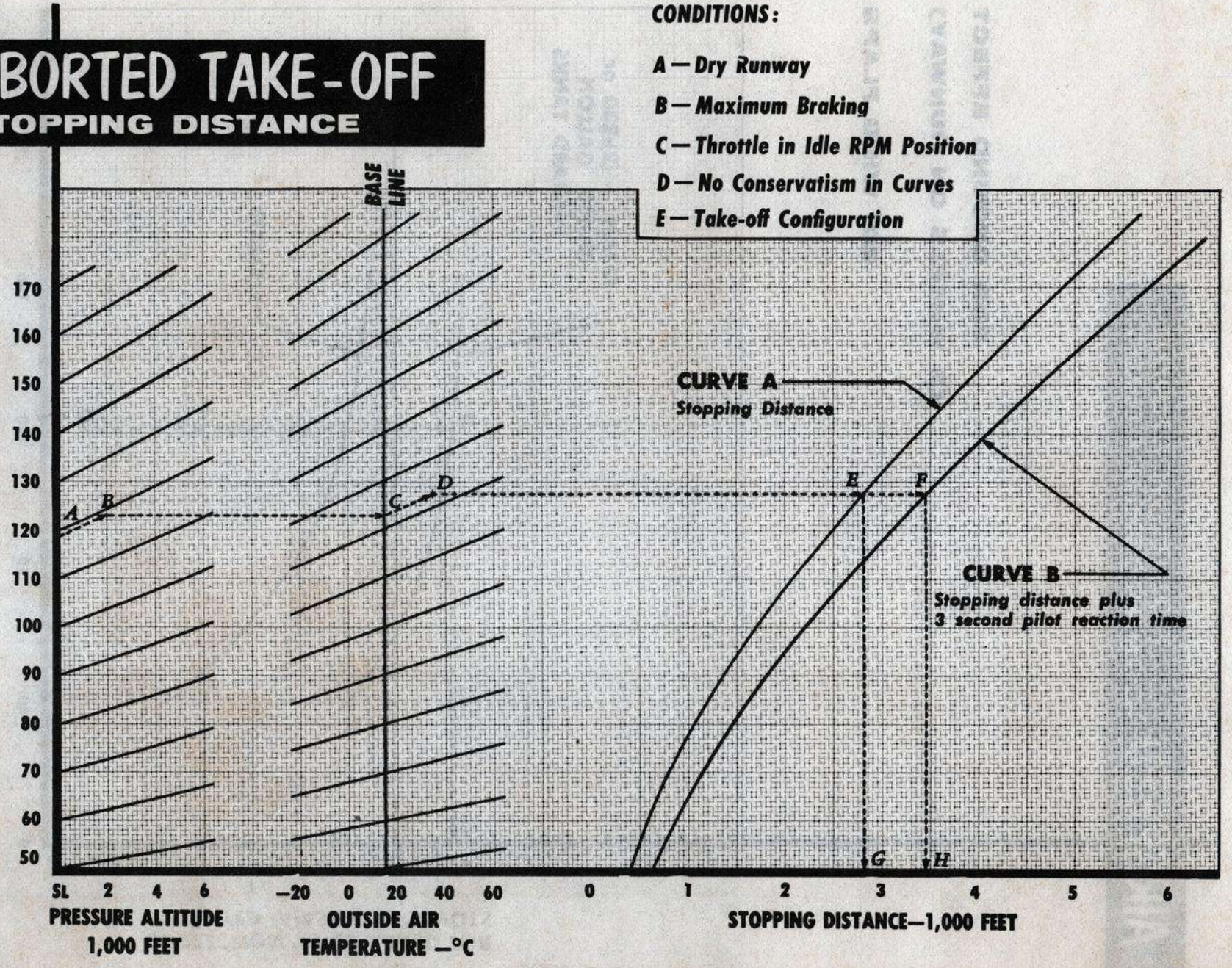


Figure A—11

AIRSPEED POSITION ERROR CORRECTION CHART

FOR GROUND EFFECT

(3 WHEELS ON RUNWAY)

20° WING FLAPS

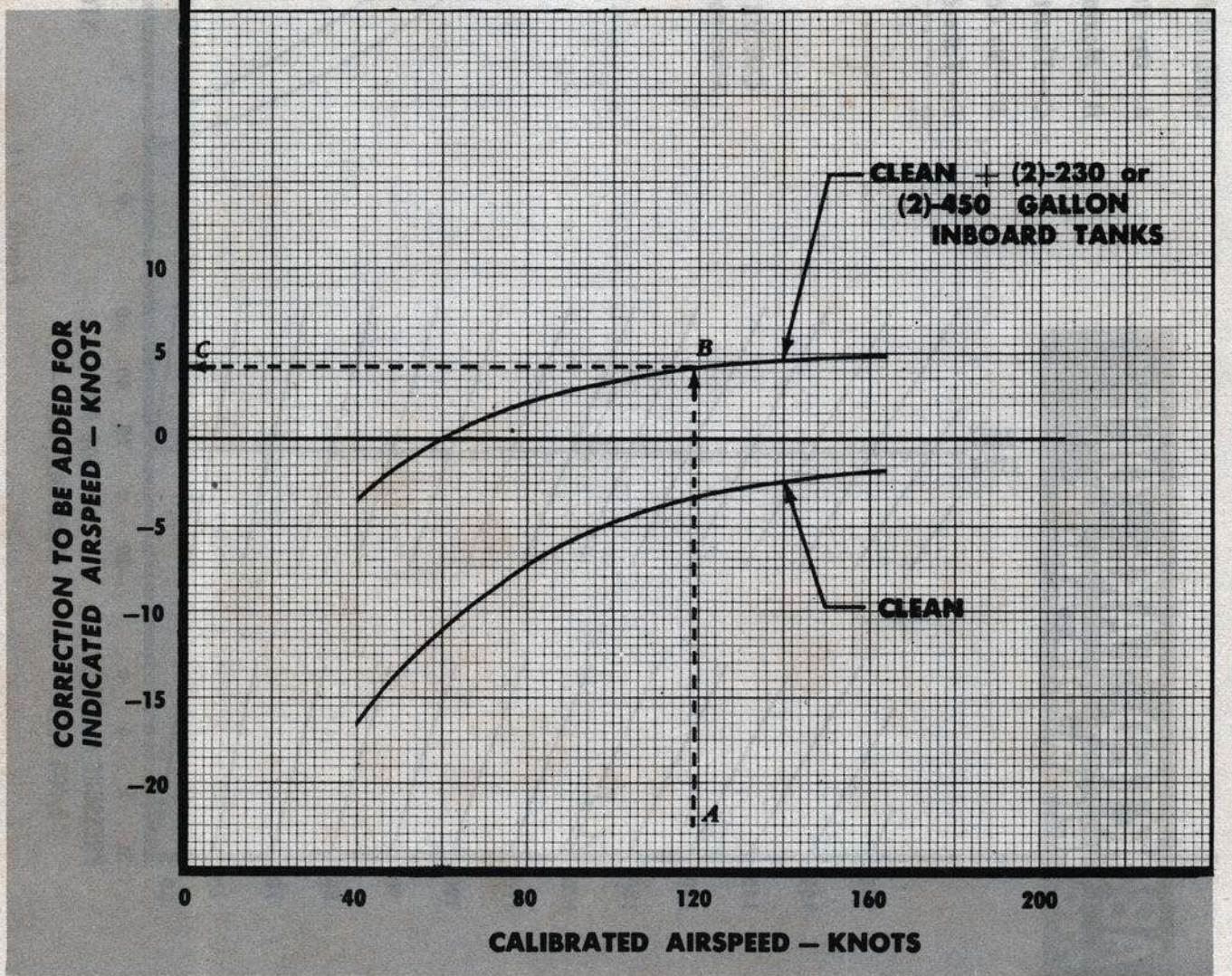


Figure A—12

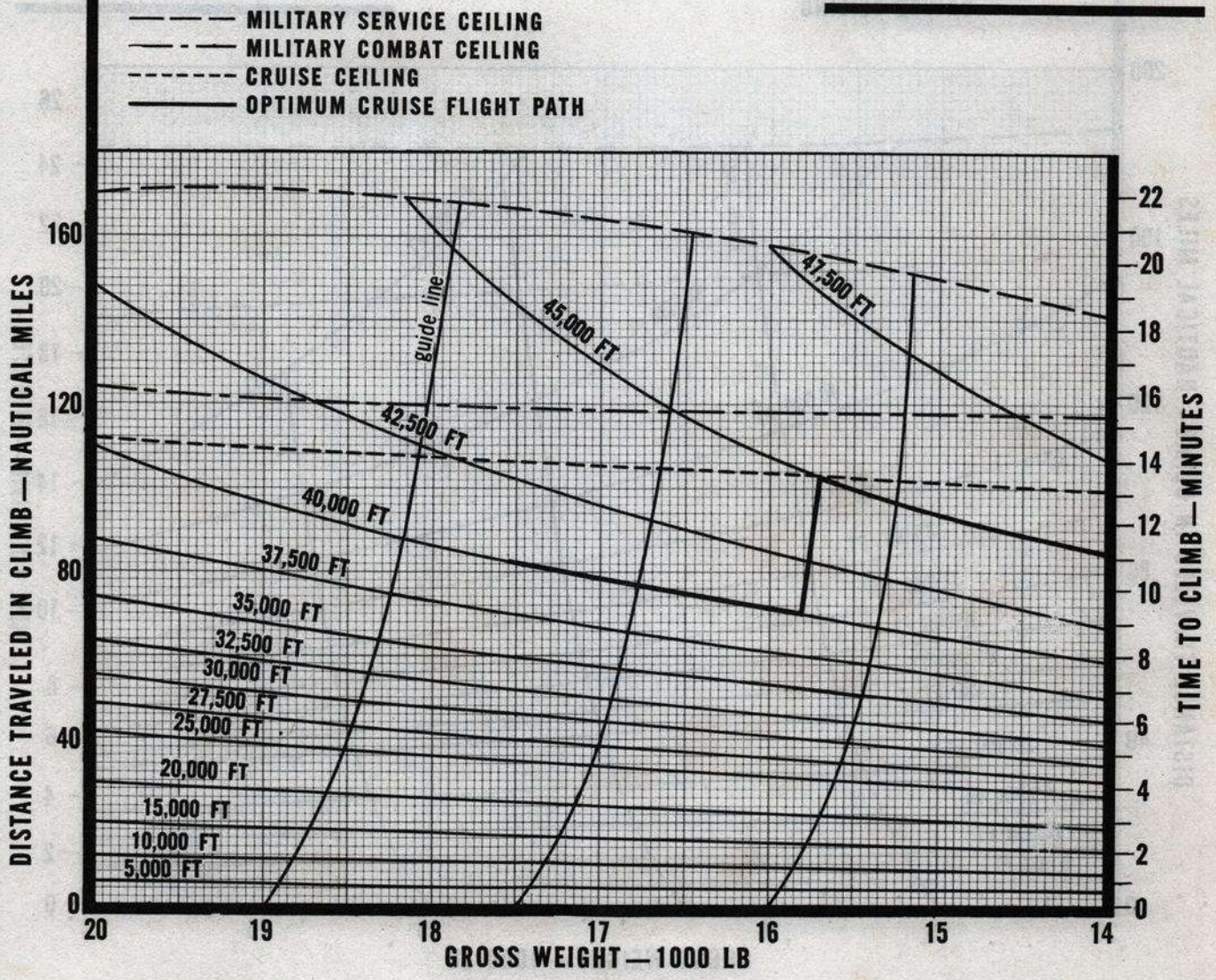
F-84F-25 AND LATER • J65-W-3 OR B-3 ENGINES • STANDARD DAY •

MILITARY POWER (8300 RPM) CLIMB



CONFIGURATION: CLEAN

ALT-FT	CAS-KNOTS	MACH NO.
45,000	220	.81
40,000	245	.81
35,000	275	.81
30,000	300	.79
20,000	340	.74
10,000	380	.68
SEA LEVEL	395	.60



F-84F-25 AND LATER • J65-W-3 OR B-3 ENGINES • STANDARD DAY •

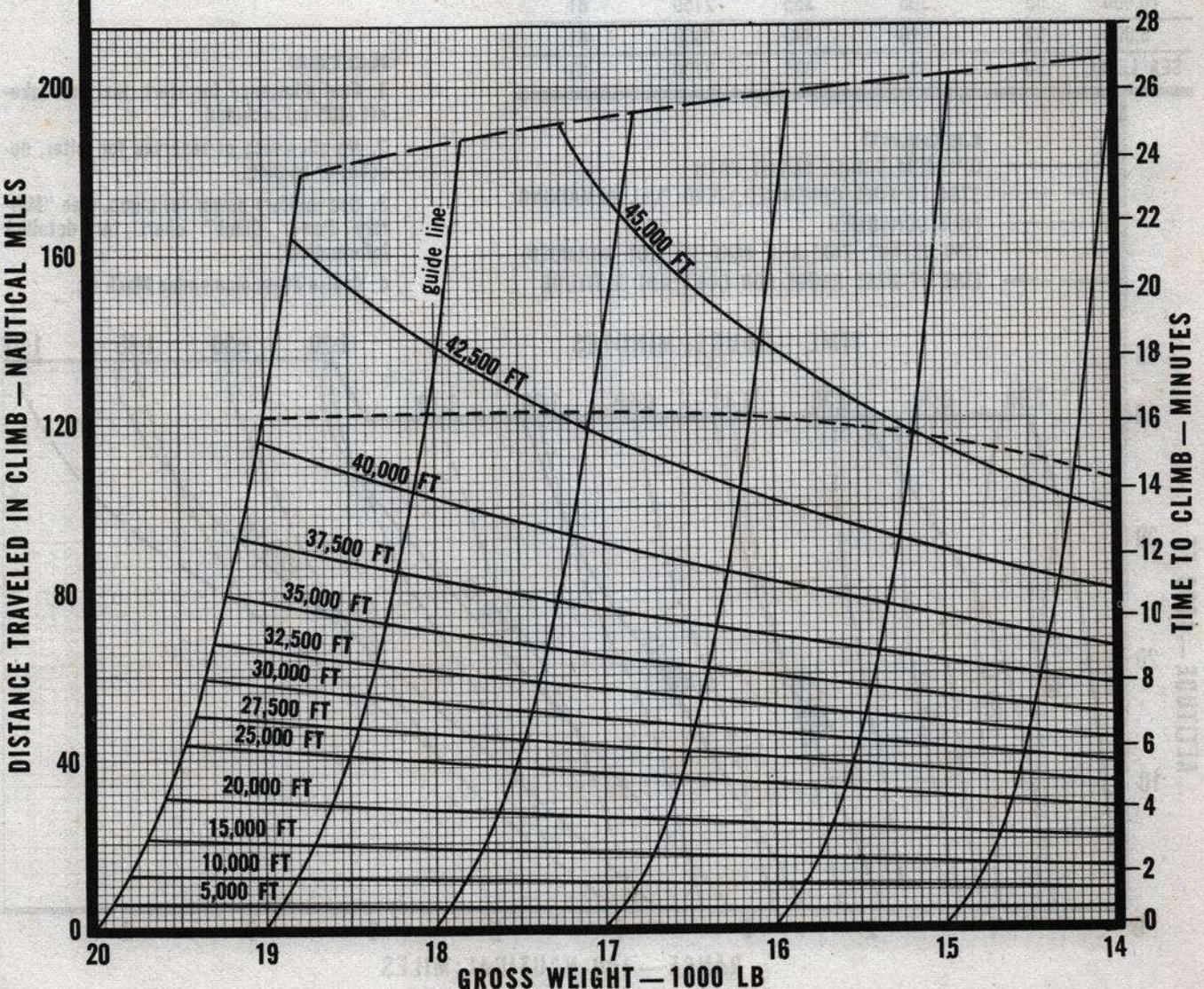
98% MILITARY RPM CLIMB



CONFIGURATION: CLEAN

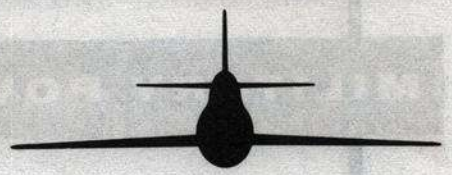
ALT-FT	CAS-KNOTS	MACH NO.
45,000	220	.81
40,000	250	.81
35,000	275	.81
30,000	300	.79
20,000	335	.73
10,000	360	.64
SEA LEVEL	380	.57

— — — 98% MILITARY SERVICE CEILING
– – – – – 98% MILITARY COMBAT CEILING



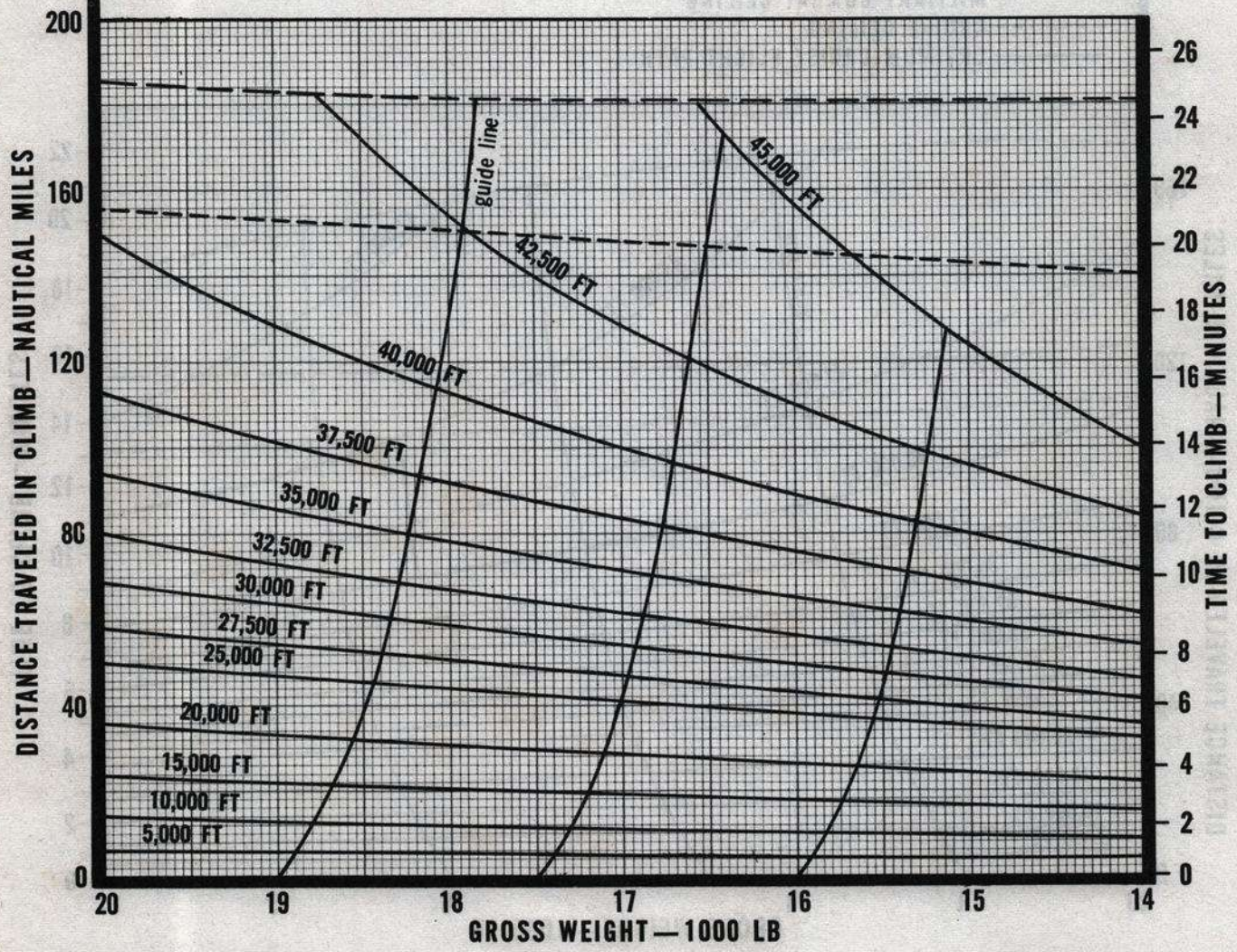
F-84F-25 AND LATER • J65-W-3 OR B-3 ENGINES • STANDARD DAY •

NORMAL POWER (8000 RPM) CLIMB



CONFIGURATION: CLEAN

ALT-FT	CAS-KNOTS	MACH NO.
45,000	215	.80
40,000	240	.80
35,000	270	.80
30,000	295	.78
20,000	325	.70
10,000	340	.61
10,000	345	.52



OPTIMUM RETURN PROFILE

NOTES

1. Fuel required at any point below the line of best range for constant altitude flight, or below the optimum range flight profile, includes military power climb to flight altitude.
2. No allowance made for loiter, descent or landing.
3. Best cruise condition determined by intersection of climb path guide lines and lines of best range.
4. Cruise at recommended Mach No.



CONFIGURATION: CLEAN
GROSS WEIGHT: 14,936 — 18,700 LB

ALT-FT	MACH NO.	APPROXIMATE			
		CAS-KNOTS	TAS-KNOTS	LB/HR	% MIL RPM
45,000	.85	230	490	1650	96
40,000	.83	255	480	1550	90
35,000	.80	275	460	1600	86
30,000	.76	285	445	1700	84
25,000	.71	295	430	1800	84
20,000	.65	295	395	1900	83
15,000	.60	300	375	2000	82
10,000	.55	305	355	2150	81
5,000	.52	320	340	2350	81
SEA LEVEL	.50	335	335	2700	81

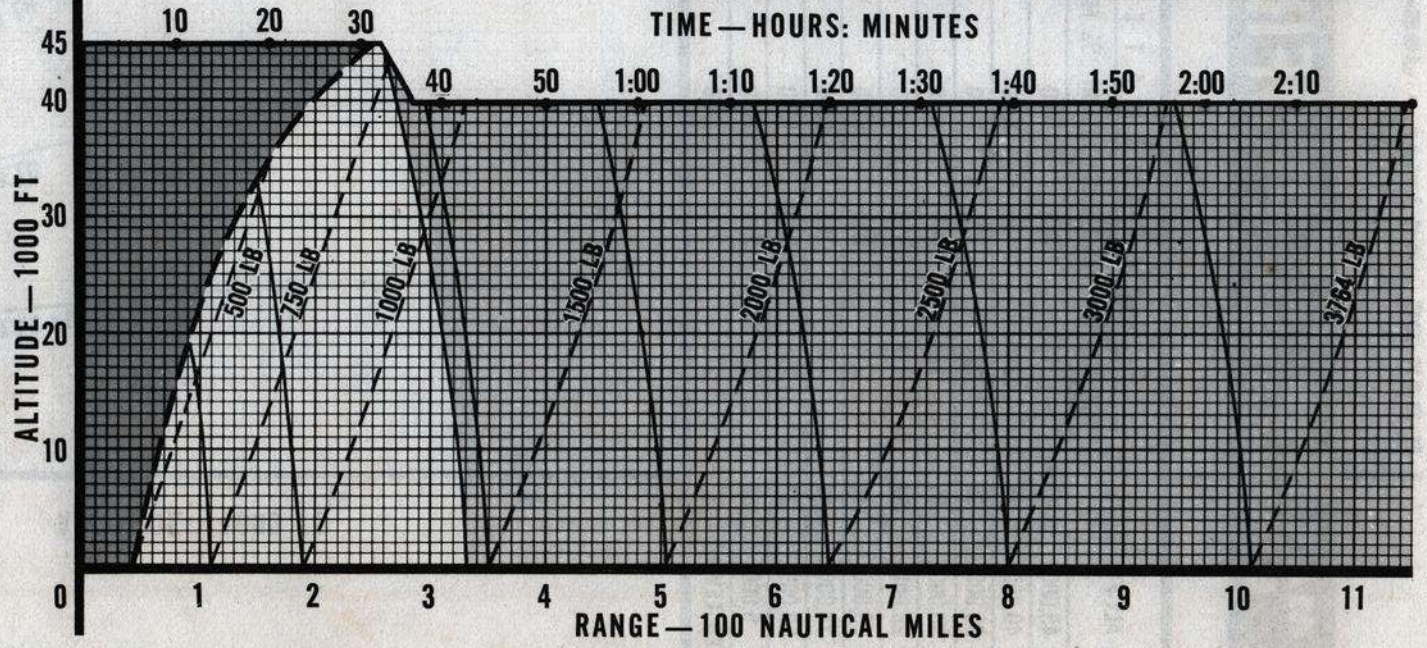
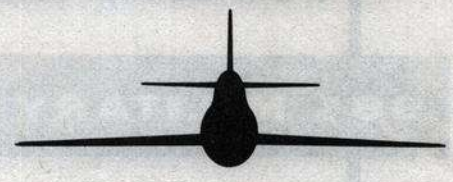


Figure A—17

F-84F-25 AND LATER • J65-W-3 OR B-3 ENGINES • STANDARD DAY •

OUTBOUND PROFILE



CONFIGURATION: CLEAN
TAKE-OFF GROSS WEIGHT: 18,700 LB

ALT-FT	MACH NO.	APPROXIMATE			
		CAS-KNOTS	TAS-KNOTS	LB/HR	% MIL RPM
45,000	.85	230	490	1650	96
40,000	.83	255	480	1550	90
35,000	.80	275	460	1600	86
30,000	.76	285	445	1700	84
25,000	.71	295	430	1800	84
20,000	.65	295	395	1900	83
15,000	.60	300	375	2000	82
10,000	.55	305	355	2150	81
5,000	.52	320	340	2350	81
SEA LEVEL	.50	335	335	2700	81

NOTES

1. Fuel allowance for start, taxi and take-off (465 lb) included.
2. No allowance or reserves for loiter, descent or landing.
3. Use military power for climb. (see "Military Power Climb" chart for detailed information.)
4. Cruise at recommended Mach No.

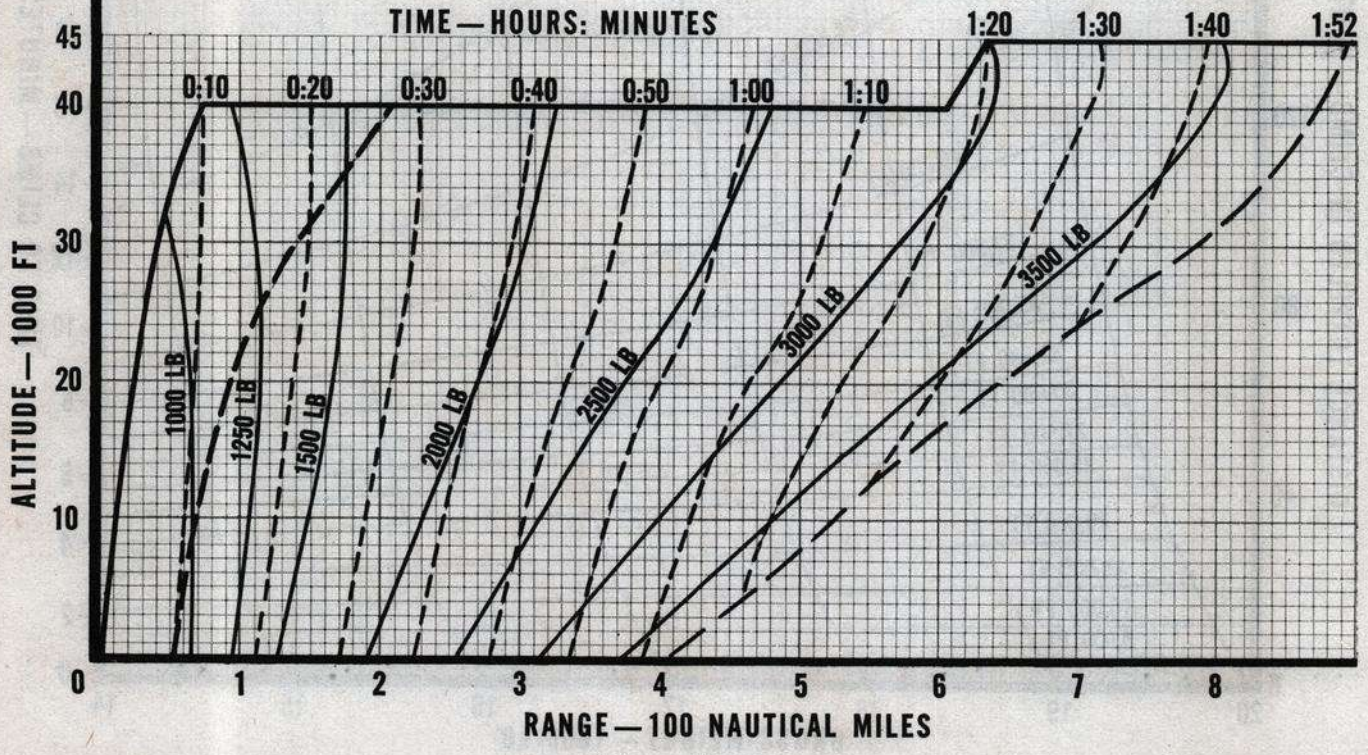


Figure A—16

F-84F-25 and later • J65-W-3 or B-3 Engines • Standard Day •

MAXIMUM ENDURANCE PROFILE



CONFIGURATION: CLEAN
GROSS WEIGHT: 14,936 — 16,136 LB

ALT-FT	MACH NO.	APPROXIMATE			
		CAS-KNOTS	TAS-KNOTS	LB/HR	% MIL RPM
45,000	.77	210	445	1400	96
40,000	.76	230	435	1300	89
35,000	.65	220	375	1300	84
30,000	.59	220	345	1300	82
25,000	.52	210	310	1300	80
20,000	.46	210	280	1350	79
15,000	.42	210	265	1450	77
10,000	.37	205	235	1550	76
5,000	.33	200	215	1700	76
SEA LEVEL	.32	210	210	1900	76

1. Loiter at recommended CAS.
2. Maintain constant altitude.

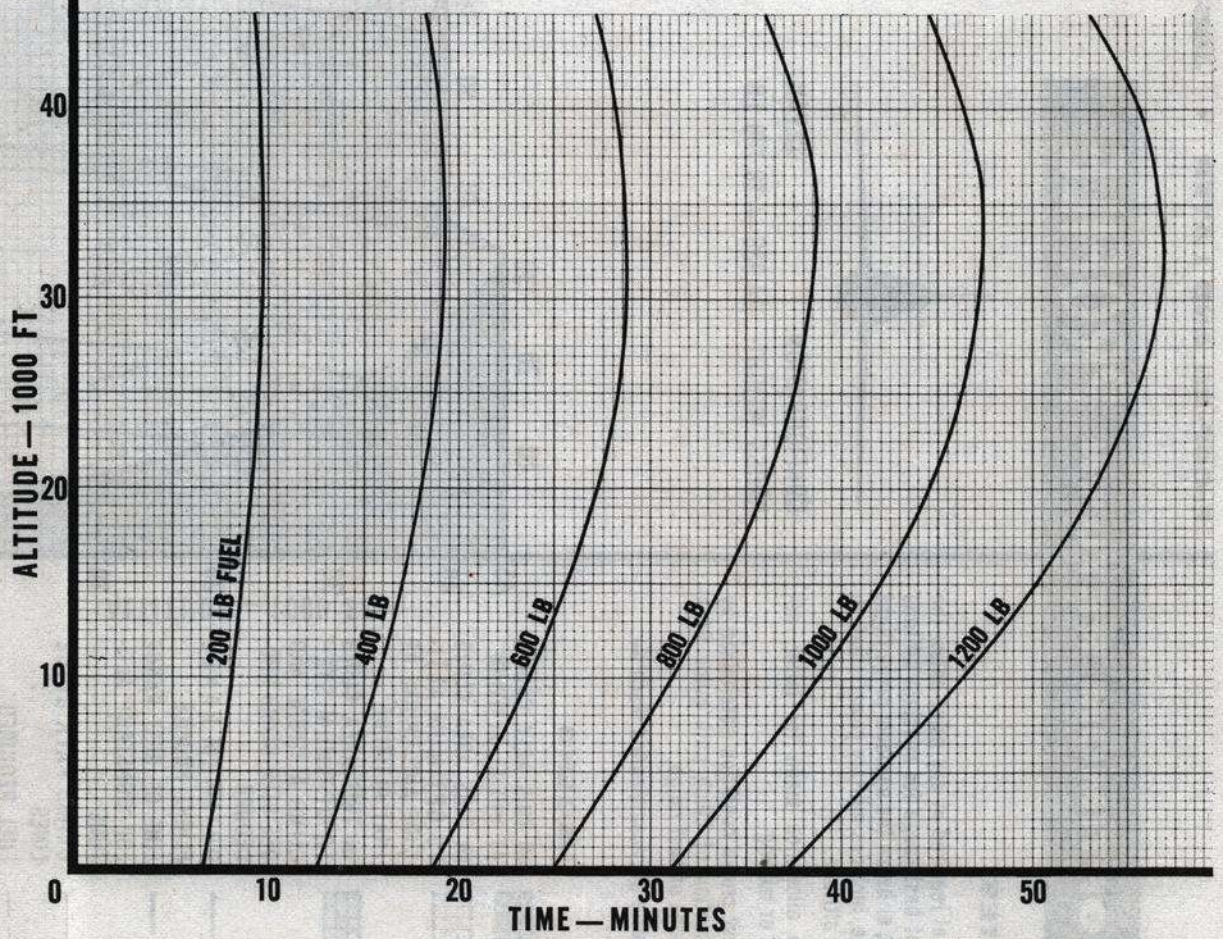


Figure A—18

F-84F-25 AND LATER • J65-W-3 OR B-3 ENGINES • STANDARD DAY •

OPTIMUM MAXIMUM ENDURANCE PROFILE



ALT-FT	MACH NO.	APPROXIMATE CAS-KNOTS	TAS-KNOTS	LB/HR	% MIL RPM
45,000	.77	210	445	1400	96
40,000	.76	230	435	1300	89
35,000	.65	220	375	1300	84
30,000	.59	220	345	1300	82
25,000	.52	210	310	1300	80
20,000	.46	210	280	1350	79
15,000	.42	210	265	1450	77
10,000	.37	205	235	1550	76
5,000	.33	200	215	1700	76
SEA LEVEL	.32	210	210	1900	76

CONFIGURATION: CLEAN
GROSS WEIGHT: 14,926 — 16,136 LB

NOTES

1. Maximum range descent. (Use idle power, speed brakes closed) Descend at 200 knots CAS.
2. Loiter at recommended CAS
3. Use normal power for climb. (See "Normal Power Climb" chart for detailed information.)
4. No allowance or reserve made for landing.

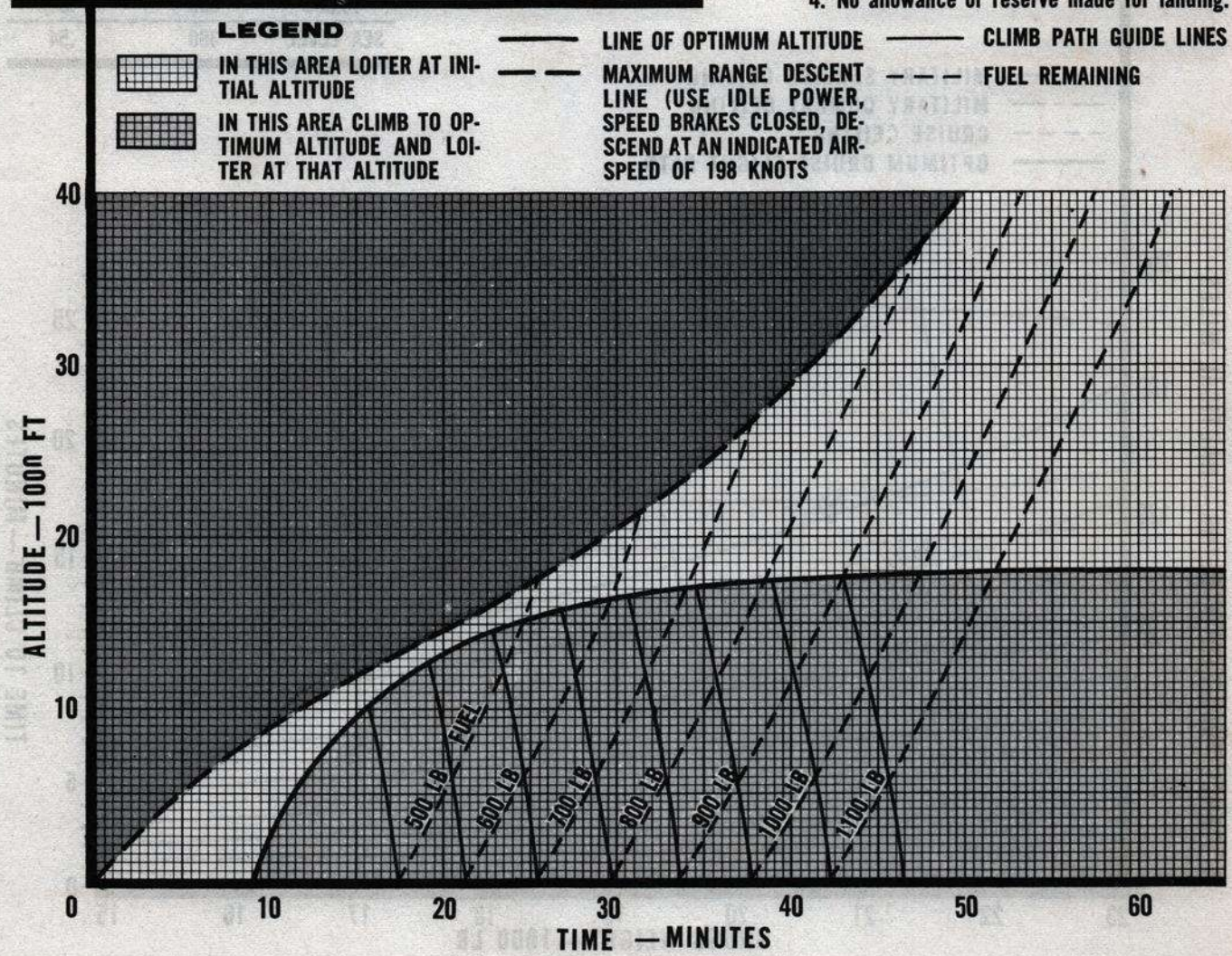


Figure A-10

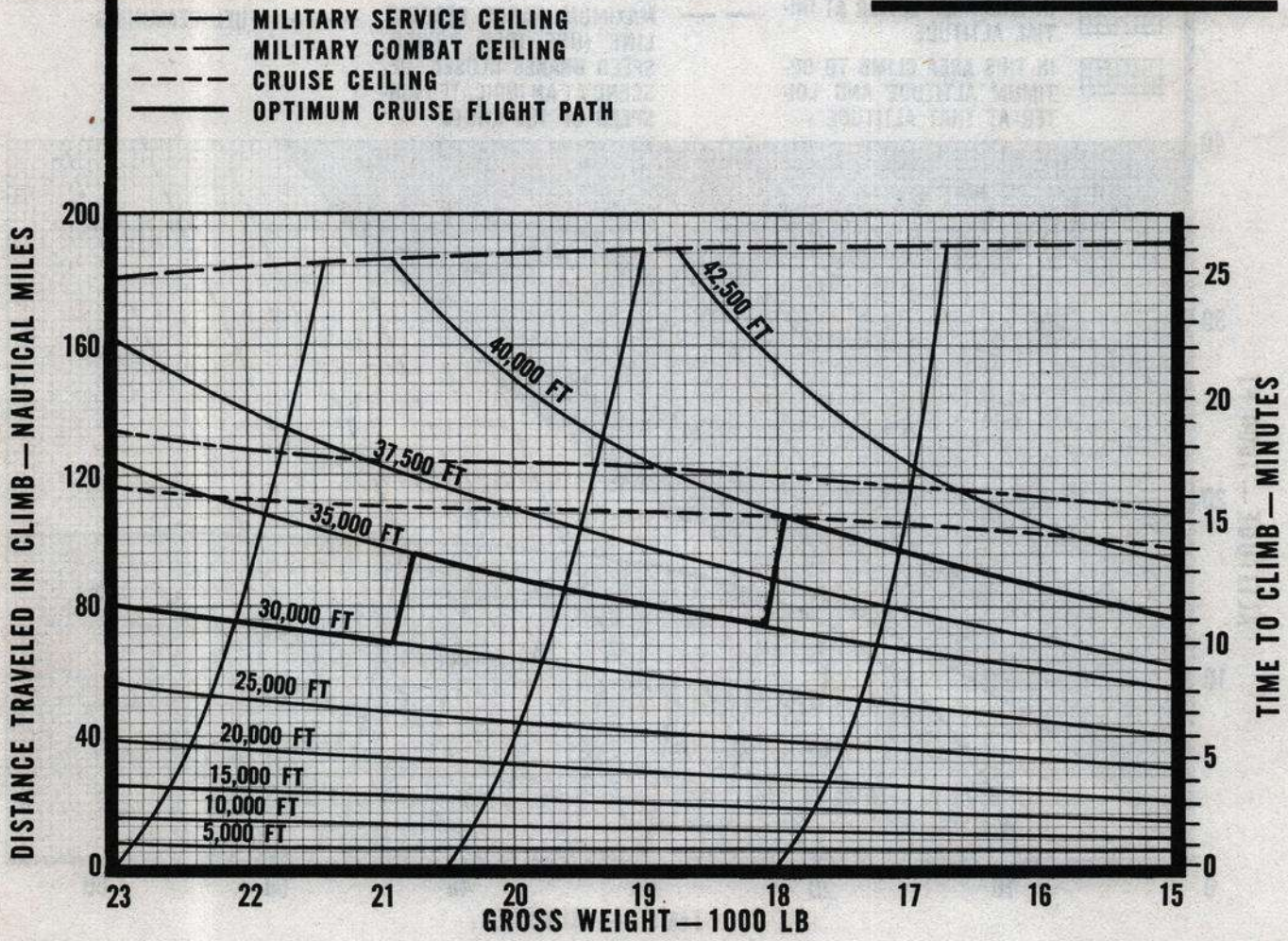
F-84F-25 AND LATER • J65-W-3 OR B-3 ENGINES • STANDARD DAY •

MILITARY POWER (8300 RPM) CLIMB



CONFIGURATION
CLEAN + 2(230) GAL CLASS I TANKS

ALT-FT	CAS-KNOTS	MACH NO.
45,000	210	.78
40,000	235	.78
35,000	265	.78
30,000	290	.76
20,000	315	.68
10,000	335	.61
SEA LEVEL	360	.54



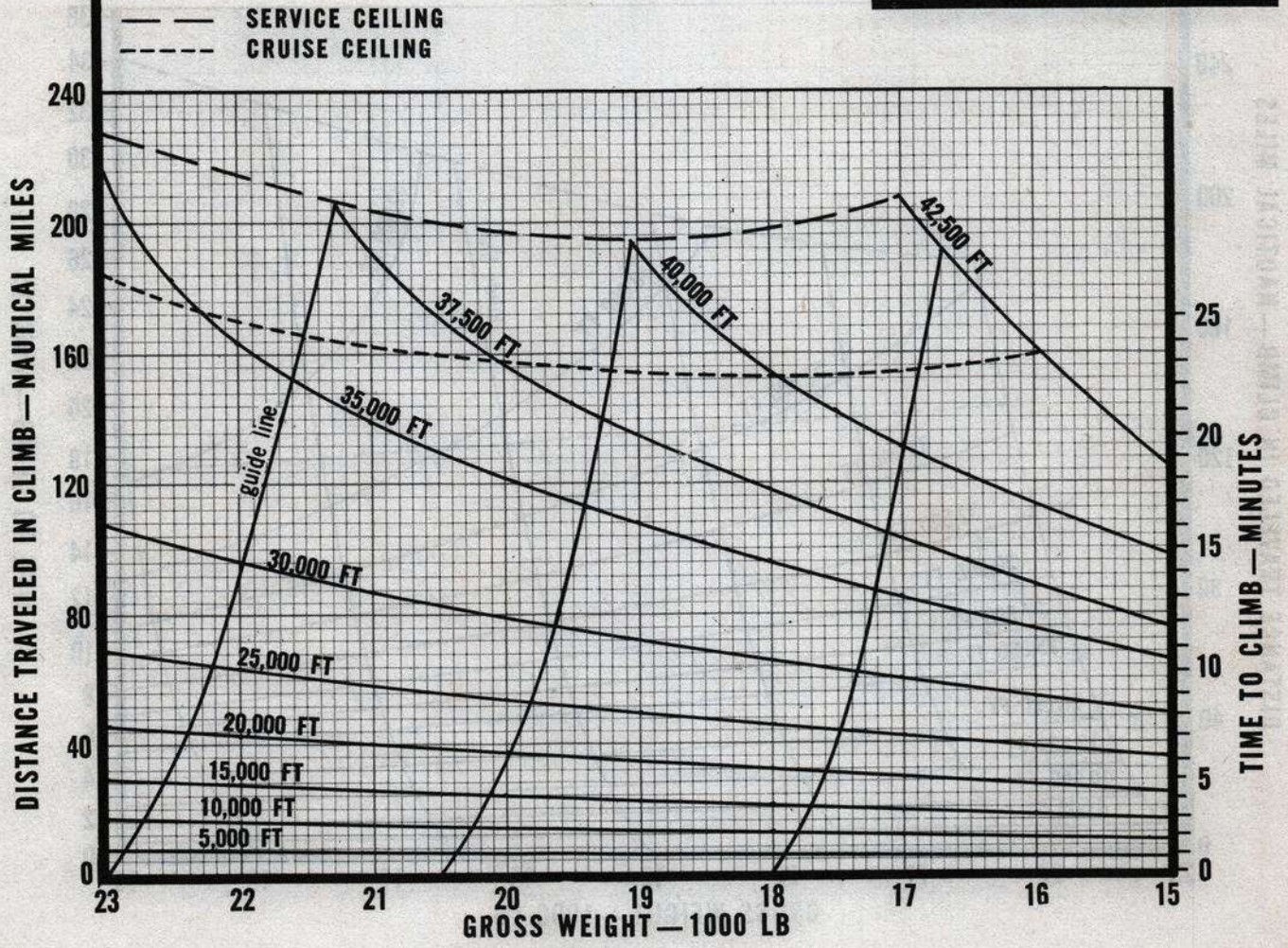
F-84F-25 AND LATER • J65-W-3 OR B-3 ENGINES • STANDARD DAY •

NORMAL POWER (8000 RPM) CLIMB



CONFIGURATION
CLEAN + 2(230) GAL CLASS I TANKS

ALT-FT	CAS-KNOTS	MACH NO.
45,000	210	.78
40,000	235	.78
35,000	265	.78
30,000	275	.73
20,000	295	.64
10,000	305	.56
SEA LEVEL	320	.48



F-84F-25 AND LATER • J65-W-3 OR B-3 ENGINES • STANDARD DAY •

98% MILITARY RPM CLIMB



CONFIGURATION
CLEAN + 2(230) GAL CLASS I TANKS

ALT-FT	CAS-KNOTS	MACH NO.
45,000	210	.78
40,000	235	.78
35,000	265	.78
30,000	275	.73
20,000	300	.65
10,000	320	.58
SEA LEVEL	340	.51

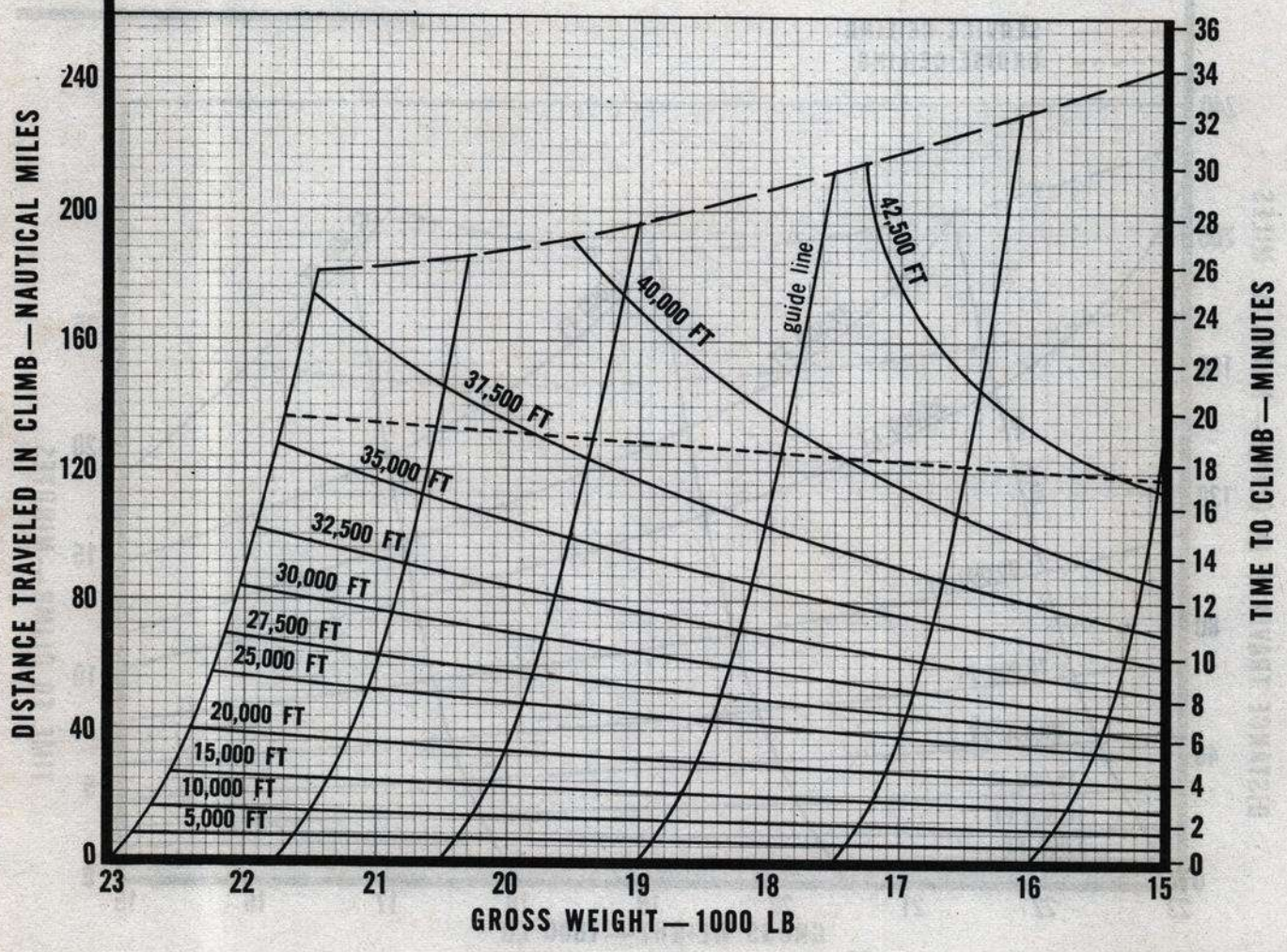


Figure A–22

F-84F-25 AND LATER • J65-W-3 OR B-3 ENGINES • STANDARD DAY •

OUTBOUND PROFILE



CONFIGURATION: CLEAN + 2(230) GAL CLASS I TANKS
TAKE-OFF GROSS WEIGHT: 22,204 LB

NOTES

1. Fuel allowance for start, taxi and take-off (465 lb) included.
2. No allowance or reserves for loiter, descent or landing.
3. Use military power for climb. (see "Military Power Climb" chart for detailed information.)
4. Cruise at recommended Mach No.

LEGEND

- OPTIMUM CRUISE FLIGHT PATH
- LINE OF BEST RANGE FOR CONSTANT ALTITUDE
- TIME (START, TAXI AND TAKE-OFF NOT INCLUDED)
- FUEL CONSUMED
- 6754 LB FUEL CONSUMED, ZERO FUEL REMAINING

ALT-FT	MACH NO.	APPROXIMATE			
		CAS-KNOTS	TAS-KNOTS	LB/HR	% MIL RPM
40,000	.87	270	500	1600	91
35,000	.78	270	445	1850	90
30,000	.74	280	435	2050	88
25,000	.69	290	415	2150	87
20,000	.64	290	390	2200	85
15,000	.58	295	365	2300	84
10,000	.54	300	345	2450	84
5,000	.50	305	325	2650	83
SEA LEVEL	.48	315	315	2900	83

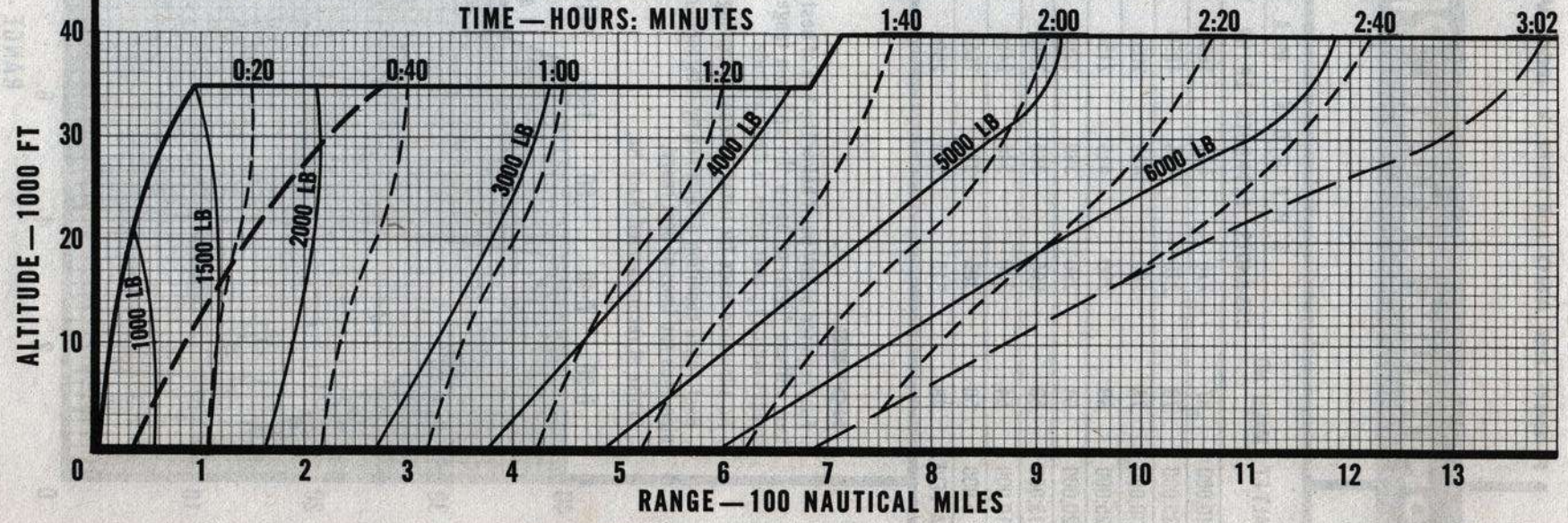


Figure A—23

F-84F-25 AND LATER • J65-W-3 OR B-3 ENGINES • STANDARD DAY •

OPTIMUM RETURN PROFILE



CONFIGURATION

CLEAN + 2(230) GAL CLASS I TANKS

GROSS WEIGHT: 15,450—22,204 LB

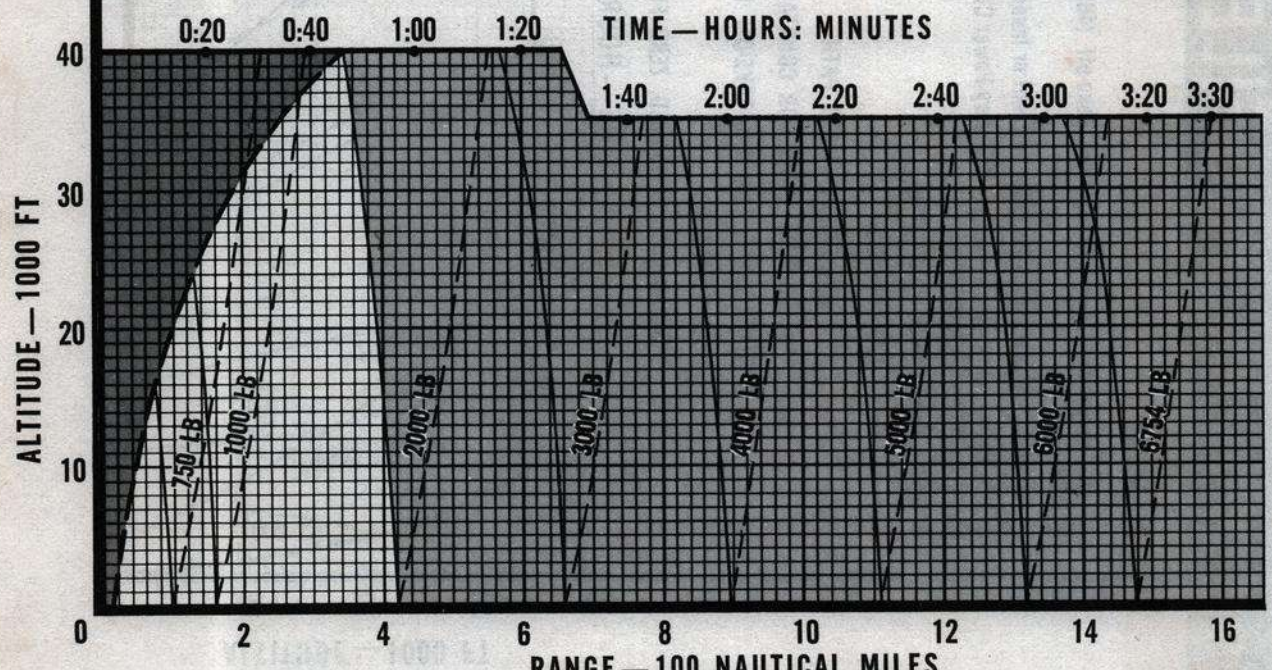
ALT-FT	MACH NO.	APPROXIMATE			
		CAS-KNOTS	TAS-KNOTS	LB/HR	% MIL RPM
40,000	.87	270	500	1600	91
35,000	.78	270	445	1850	90
30,000	.74	280	435	2050	88
25,000	.69	290	415	2150	87
20,000	.64	290	390	2200	85
15,000	.58	295	365	2300	84
10,000	.54	300	345	2450	84
5,000	.50	305	325	2650	83
SEA LEVEL	.48	315	315	2900	83

NOTES

1. Fuel required at any point below the line of best range for constant altitude flight, or below the optimum range flight profile, includes military power climb to flight altitude.
2. No allowance made for loiter, descent or landing.
3. Best cruise condition determined by intersection of climb path guide lines and lines of best range.
4. Cruise at recommended Mach No.

LEGEND

- IN THIS AREA CRUISE AT INITIAL ALTITUDE
- IN THIS AREA CLIMB TO OPTIMUM ALTITUDE AND CRUISE AT THAT ALTITUDE
- IN THIS AREA CLIMB TO OPTIMUM STEP CLIMB ALTITUDE AND USE STEP CLIMB PROCEDURE
- ——— OPTIMUM RANGE FLIGHT PROFILE
- — — LINE OF BEST RANGE FOR CONSTANT ALTITUDE
- ——— CLIMB PATH GUIDE LINES
- — — — FUEL REQUIRED
- • • • TIME AT CRUISING ALTITUDE



• F-84F-25 AND LATER •
• J65-W-3 OR B-3 ENGINES •
• STANDARD DAY •

MAXIMUM ENDURANCE PROFILE



CONFIGURATION
CLEAN + 2(230) GAL CLASS I TANKS
GROSS WEIGHT: 15,450 — 17,450 LB

ALT-FT	MACH NO.	APPROXIMATE			
		CAS-KNOTS	TAS-KNOTS	LB/HR	% MIL RPM
35,000	.64	205	370	1750	89
30,000	.58	205	345	1700	86
25,000	.52	205	310	1750	84
20,000	.48	205	295	1750	83
15,000	.42	205	265	1800	81
10,000	.37	200	235	1900	79
5,000	.35	205	225	2050	78
SEA LEVEL	.32	210	210	2250	77

1. Loiter at recommended CAS.
2. Maintain constant altitude.

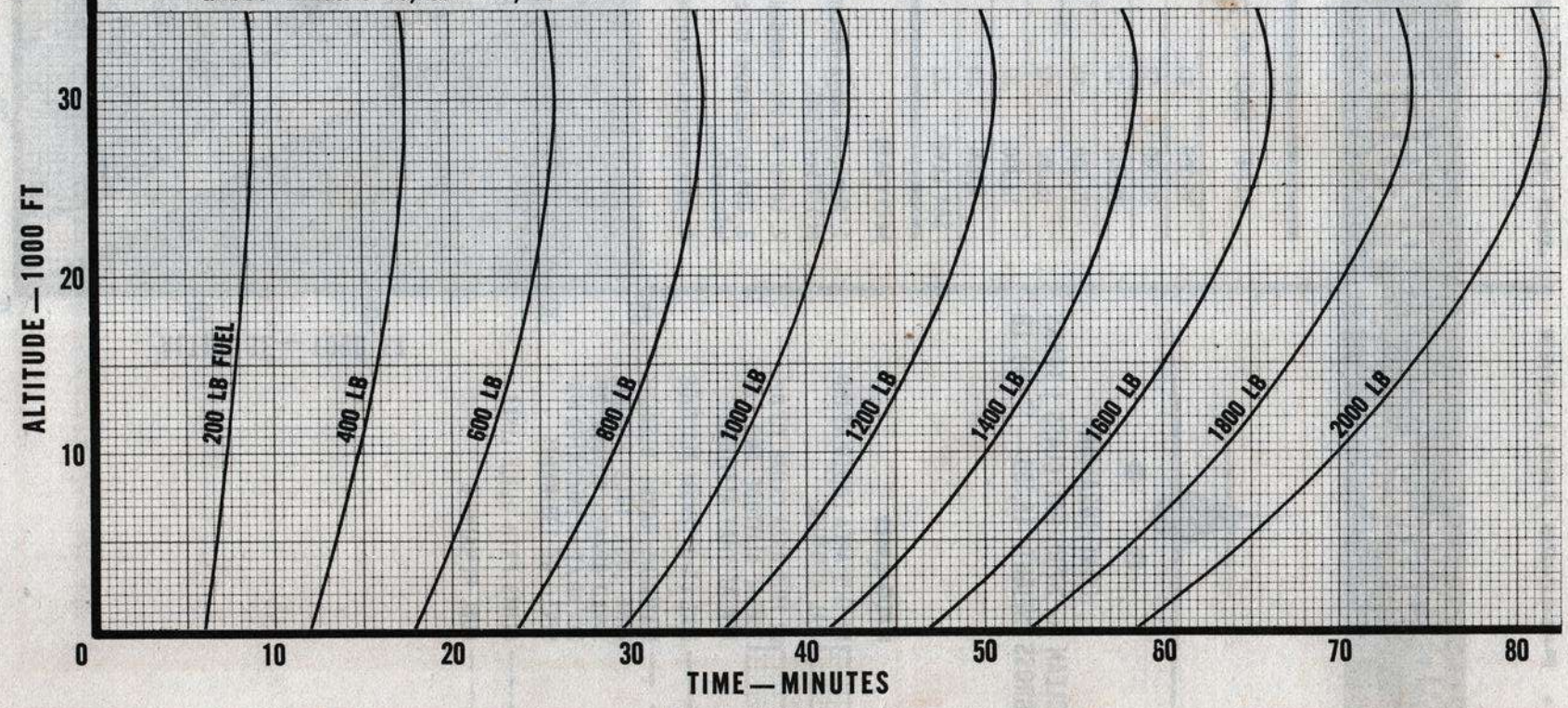


Figure A—25

• F-84F-25 AND LATER | J65-W-3 OR B-3 ENGINES • STANDARD DAY •

OPTIMUM MAXIMUM ENDURANCE PROFILE



CONFIGURATION
CLEAN + 2(230) GAL CLASS I TANKS
GROSS WEIGHT: 15,450 — 17,450 LB

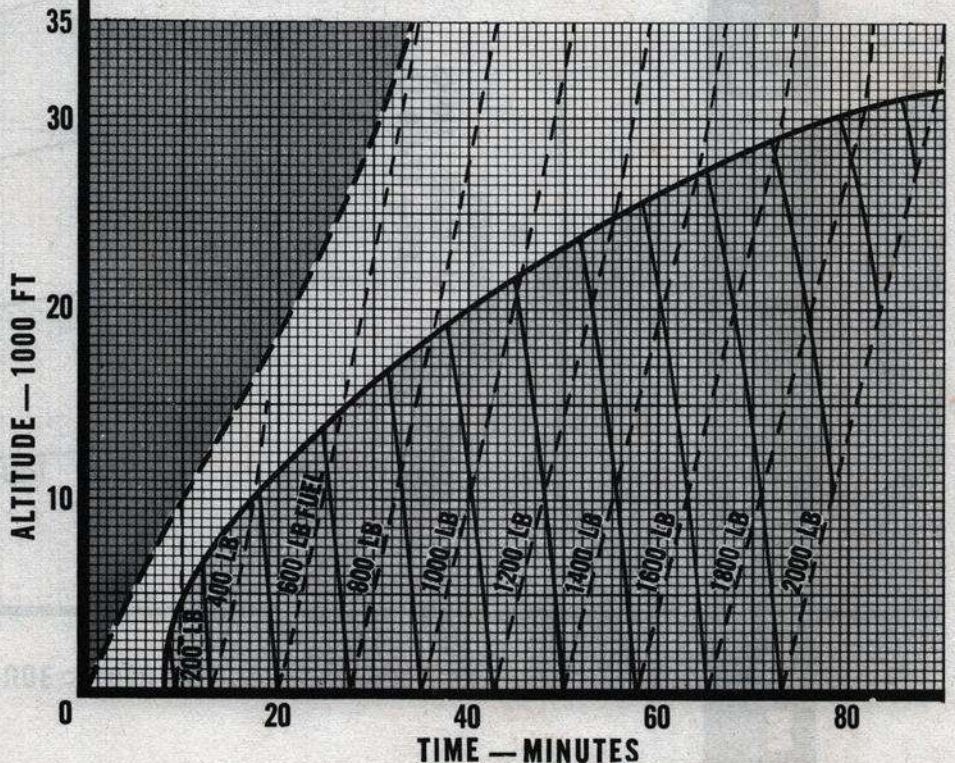
ALT-FT	MACH NO.	APPROXIMATE			
		CAS-KNOTS	TAS-KNOTS	LB/HR	% MIL RPM
35,000	.64	205	370	1750	89
30,000	.58	205	345	1700	86
25,000	.52	205	310	1750	84
20,000	.48	210	295	1750	83
15,000	.42	205	265	1800	81
10,000	.37	200	235	1900	79
5,000	.35	205	225	2050	78
SEA LEVEL	.32	210	210	2250	77

LEGEND

- IN THIS AREA LOITER AT INITIAL ALTITUDE
- IN THIS AREA CLIMB TO OPTIMUM ALTITUDE AND LOITER AT THAT ALTITUDE
- LINE OF OPTIMUM ALTITUDE
- MAXIMUM RANGE DESCENT LINE (USE IDLE POWER, SPEED BRAKES CLOSED, DESCEND AT AN INDICATED AIRSPEED OF 198 KNOTS
- CLIMB PATH GUIDE LINES
- FUEL REMAINING

NOTES

1. Maximum range descent. (Use idle power, speed brakes closed) Descend at 198 knots CAS.
2. Loiter at recommended CAS
3. Use normal power for climb. (See "Normal Power Climb" chart for detailed information.)
4. No allowance or reserve made for landing.



F-84F-25 AND LATER • J65-W-3 OR B-3 ENGINES • STANDARD DAY

MILITARY POWER (8300 RPM) CLIMB



ALT-FT	CAS-KNOTS	MACH NO.
45,000	210	.78
40,000	235	.78
35,000	265	.78
30,000	275	.74
20,000	300	.66
10,000	320	.58
SEA LEVEL	335	.51

— — MILITARY SERVICE CEILING
— - — MILITARY COMBAT CEILING
------ CRUISE CEILING
——— OPTIMUM CRUISE FLIGHT PATH

CONFIGURATION CLEAN + 2(450) GAL CLASS I TANKS

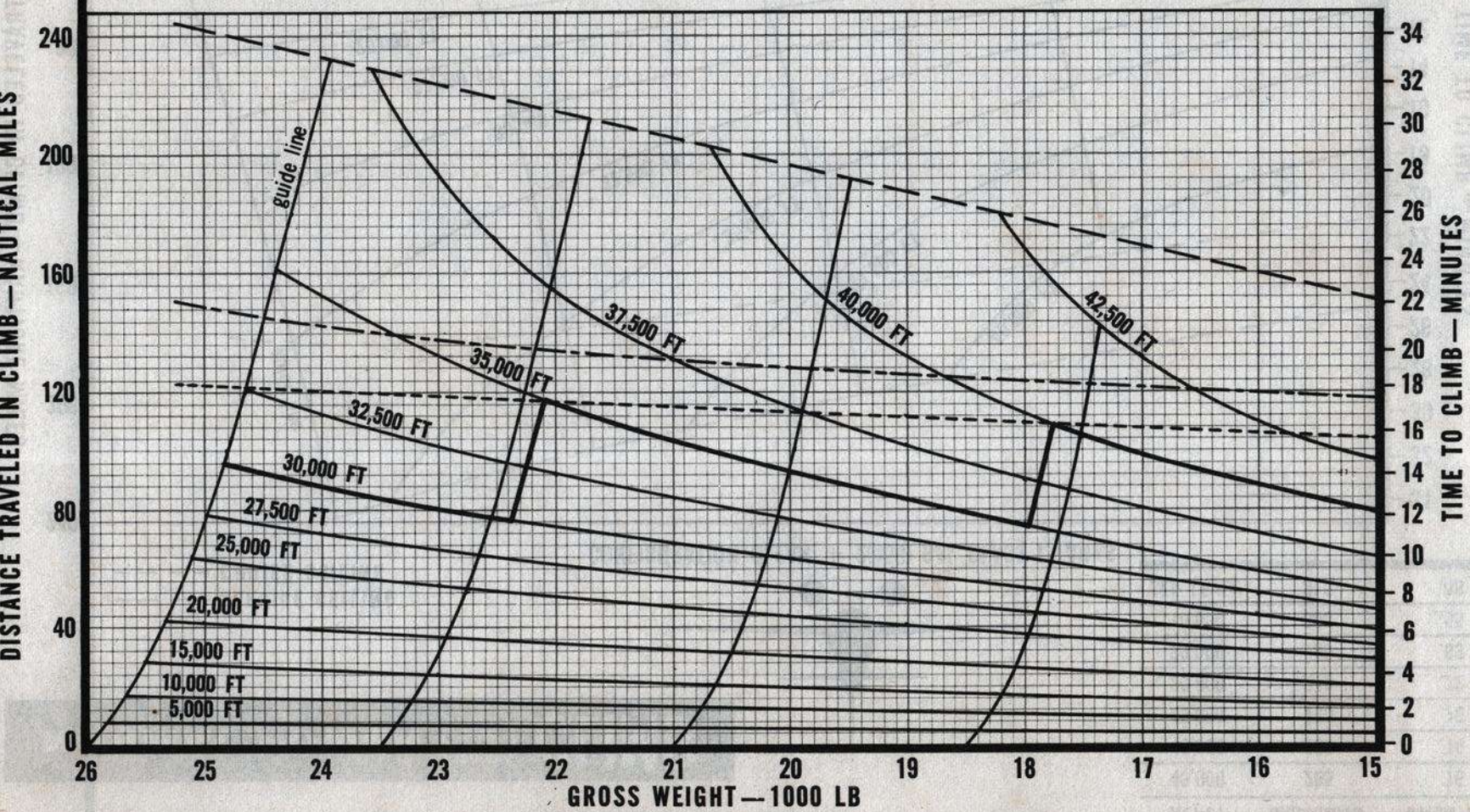


Figure A—27

F-84F-25 AND LATER • J65-W-3 OR B-3 ENGINES • STANDARD DAY

98% MILITARY RPM CLIMB



CONFIGURATION
CLEAN + 2(450) GAL CLASS I TANKS

ALT-FT	CAS-KNOTS	MACH NO.
45,000	210	.78
40,000	235	.78
35,000	265	.78
30,000	275	.73
20,000	300	.65
10,000	320	.58
SEA LEVEL	340	.51

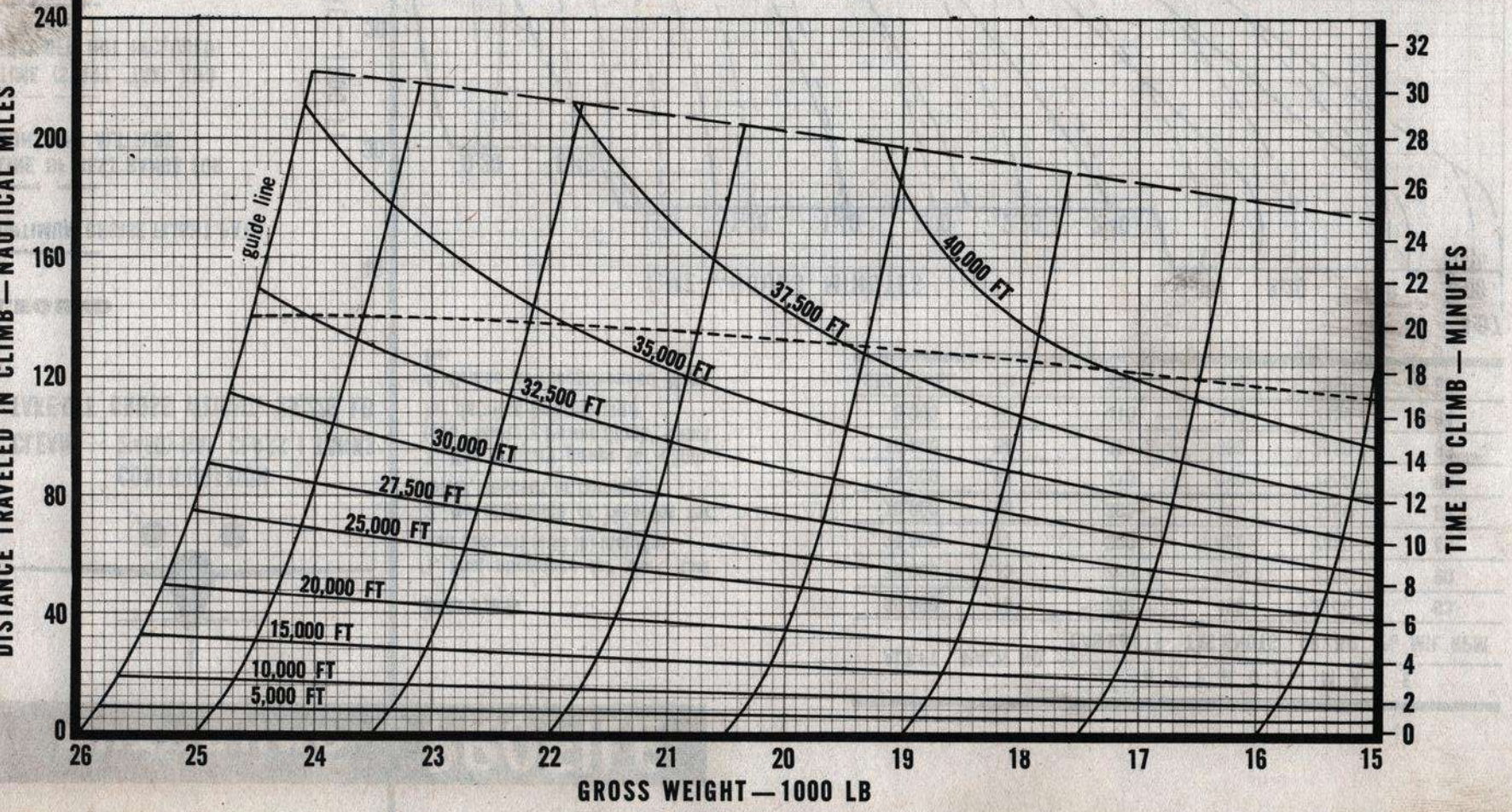


Figure A—29

F-84F-25 AND LATER • J65-W-3 OR B-3 ENGINES • STANDARD DAY

NORMAL POWER (8000 RPM) CLIMB

ALT-FT	CAS-KNOTS	MACH NO.
45,000	205	.76
40,000	230	.76
35,000	260	.76
30,000	270	.72
20,000	290	.63
10,000	305	.55
SEA LEVEL	315	.48



— — SERVICE CEILING
- - - - CRUISE CEILING

CONFIGURATION CLEAN + 2(450) GAL CLASS I TANKS

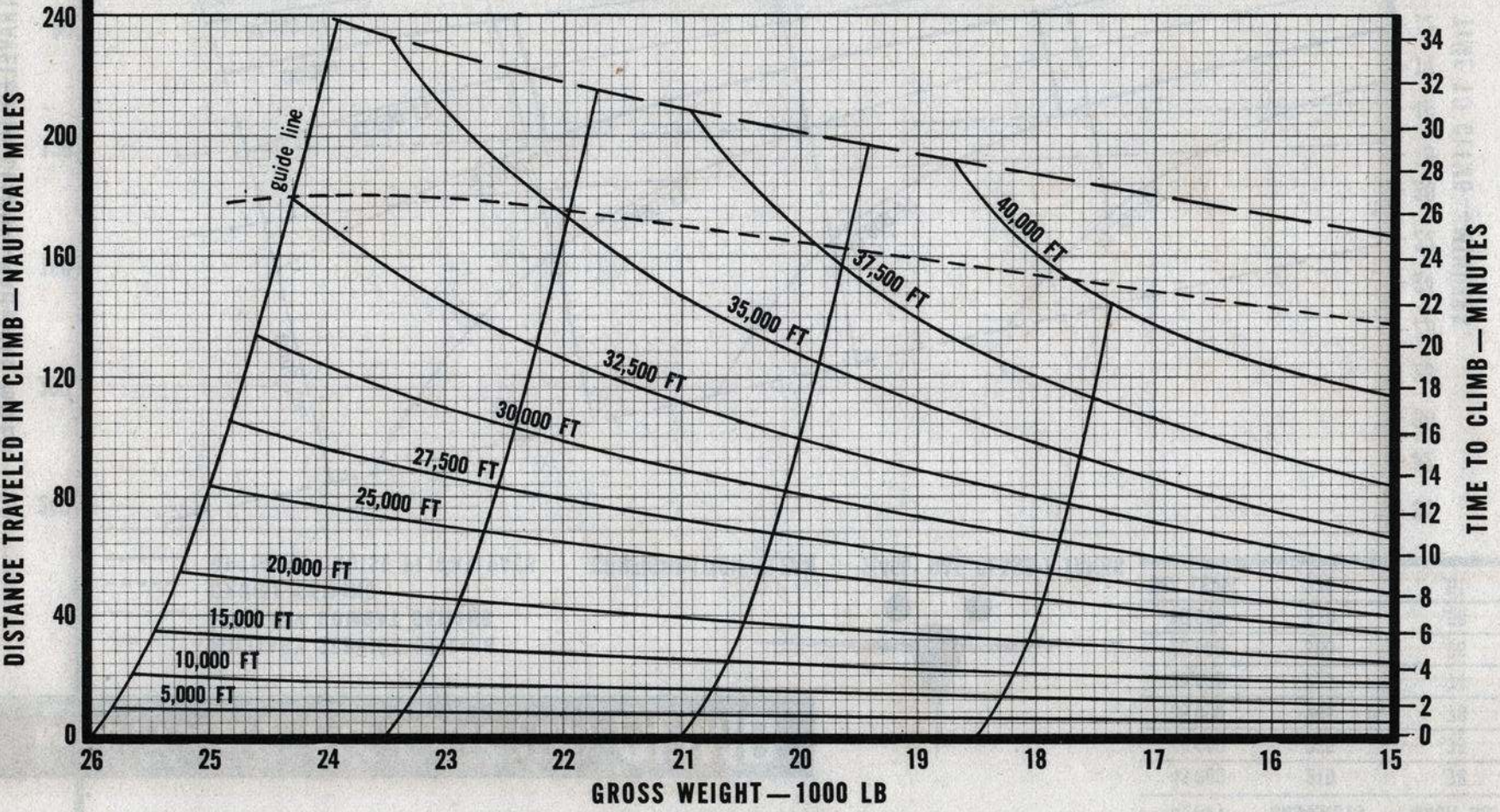


Figure A—28

OPTIMUM RETURN PROFILE

NOTES

1. Fuel required at any point below the line of best range for constant altitude flight, or below the optimum range flight profile, includes military power climb to flight altitude.
2. No allowance made for loiter, descent or landing.
3. Best cruise condition determined by intersection of climb path guide lines and lines of best range.
4. Cruise at recommended Mach No.



CONFIGURATION
CLEAN + 2(450) GAL CLASS I TANKS
GROSS WEIGHT: 15,612 — 25,226 LB

ALT-FT	MACH NO.	APPROXIMATE			
		CAS-KNOTS	TAS-KNOTS	LB/HR	% MIL RPM
35,000	.79	270	455	2150	93
30,000	.75	280	445	2200	90
25,000	.71	300	425	2350	89
20,000	.66	305	405	2450	87
15,000	.61	310	380	2550	86
10,000	.56	310	360	2650	85
5,000	.52	315	340	2850	84
SEA LEVEL	.48	320	320	3050	83

LEGEND

- IN THIS AREA CRUISE AT INITIAL ALTITUDE
- IN THIS AREA CLIMB TO OPTIMUM ALTITUDE AND CRUISE AT THAT ALTITUDE
- IN THIS AREA CLIMB TO OPTIMUM STEP CLIMB ALTITUDE AND USE STEP CLIMB PROCEDURE
- OPTIMUM RANGE FLIGHT PROFILE
- LINE OF BEST RANGE FOR CONSTANT ALTITUDE
- CLIMB PATH GUIDE LINES
- FUEL REQUIRED
- TIME AT CRUISING ALTITUDE

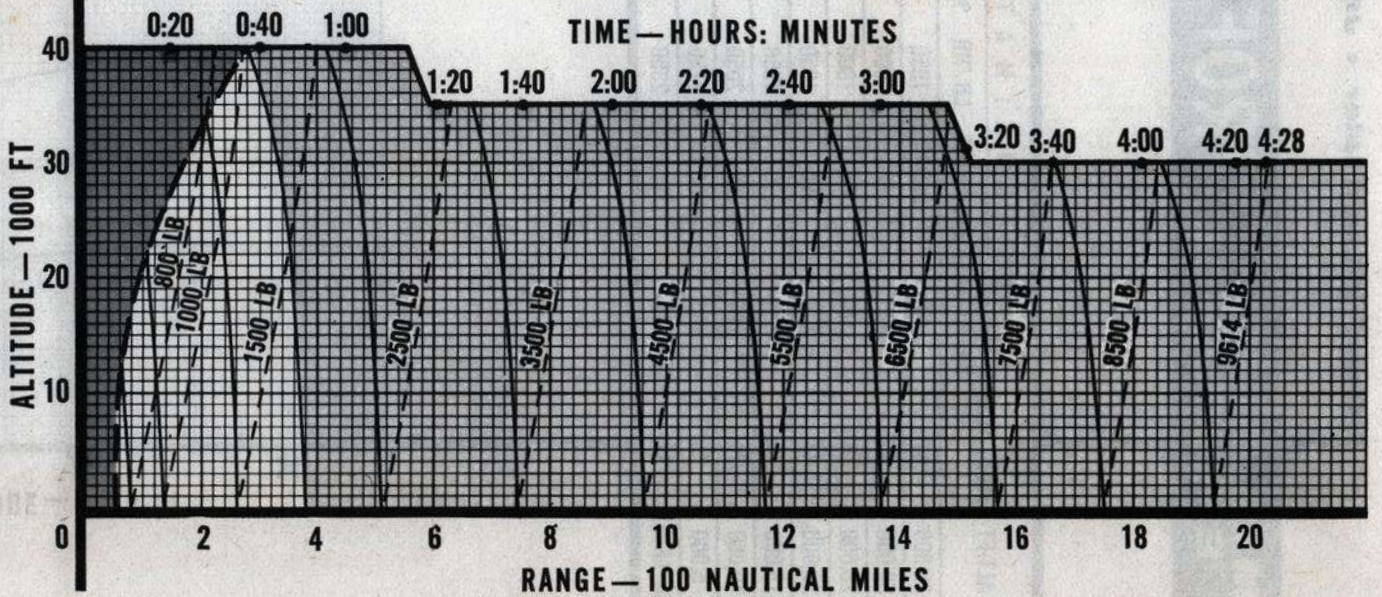
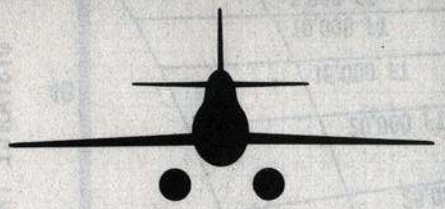


Figure A—31

OUTBOUND PROFILE



CONFIGURATION

CLEAN + 2(450) GAL CLASS I TANKS

TAKE-OFF GROSS WEIGHT: 25,226 LB

LEGEND

OPTIMUM CRUISE FLIGHT PATH

LINE OF BEST RANGE FOR CONSTANT ALTITUDE

TIME (START, TAXI AND TAKE-OFF NOT INCLUDED)

FUEL CONSUMED

9614 LB FUEL CONSUMED, ZERO FUEL REMAINING

NOTES

1. Fuel allowance for start, taxi and take-off (465 lb) included.
2. No allowance or reserves for loiter, descent or landing.
3. Use military power for climb. (see "Military Power Climb" chart for detailed information.)
4. Cruise at recommended Mach No.

ALT-FT	MACH NO.	APPROXIMATE			
		CAS-KNOTS	TAS-KNOTS	LB/HR	% MIL RPM
35,000	.79	270	455	2150	93
30,000	.75	280	445	2200	90
25,000	.71	300	425	2350	89
20,000	.66	305	405	2450	87
15,000	.61	310	380	2550	86
10,000	.56	310	360	2650	85
5,000	.52	315	340	2850	84
SEA LEVEL	.48	320	320	3050	83

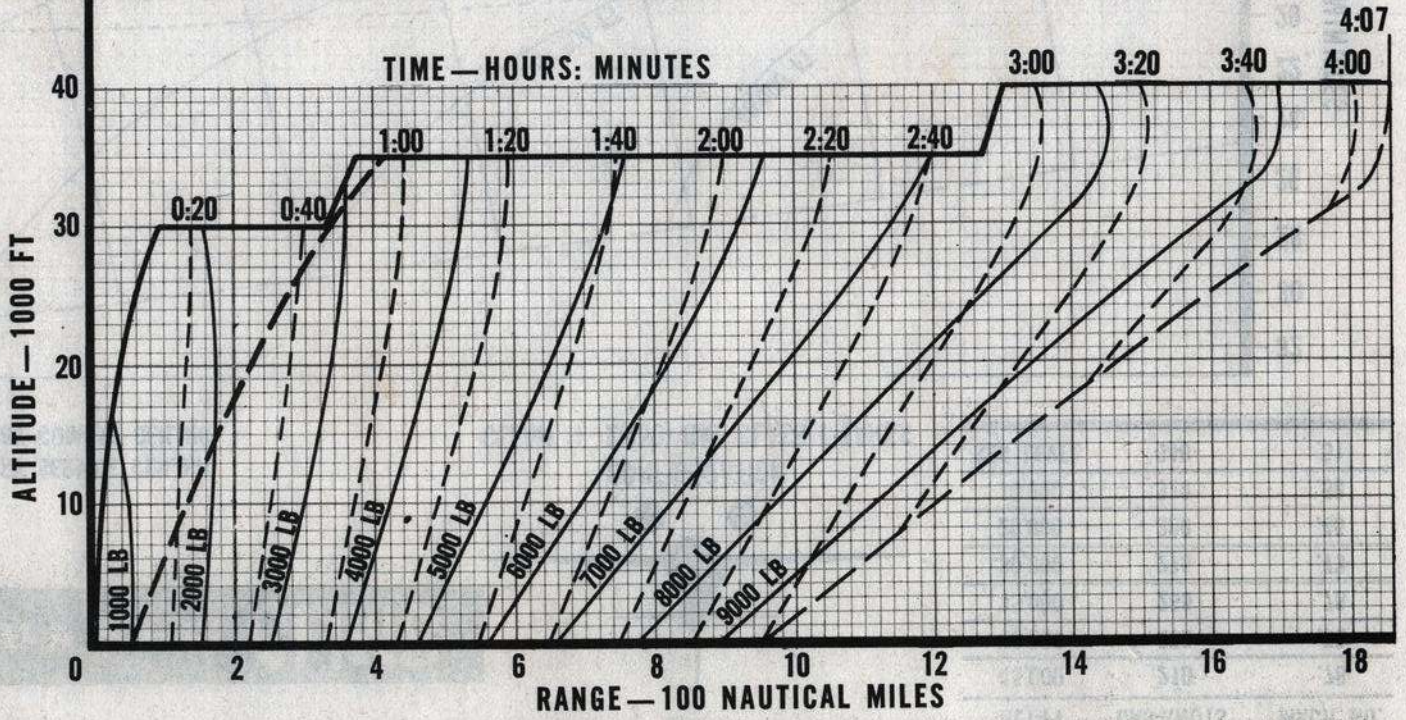
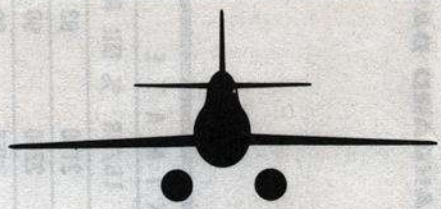


Figure A–30

F-84F-25 and later • J65-W-3 or B-3 Engines • Standard Day •

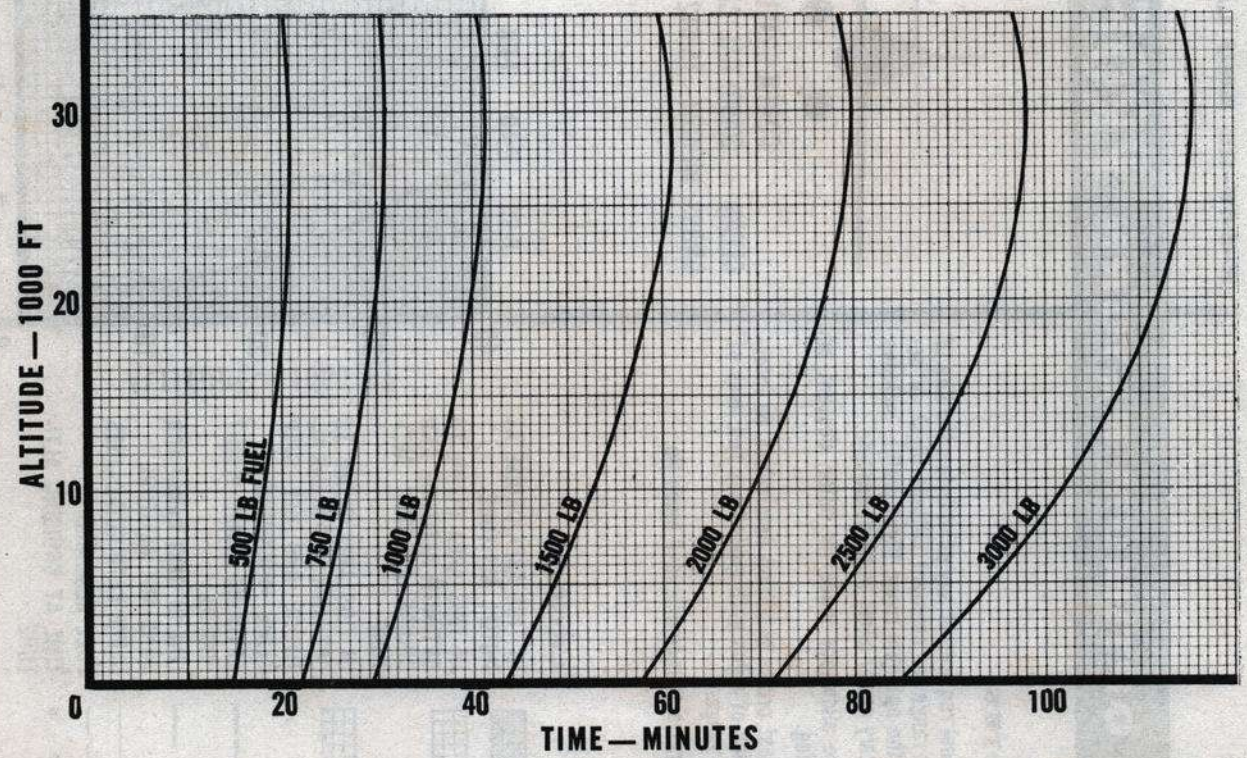
MAXIMUM ENDURANCE PROFILE



CONFIGURATION
CLEAN + 2(450) GAL CLASS I TANKS
GROSS WEIGHT: 15,612 — 18,612 LB

ALT-FT	MACH NO.	APPROXIMATE			
		CAS-KNOTS	TAS-KNOTS	LB/HR	% MIL RPM
35,000	.67	225	385	1950	92
30,000	.61	225	360	1900	88
25,000	.54	220	325	1900	85
20,000	.47	220	290	1950	84
15,000	.43	220	270	1950	82
10,000	.39	215	250	2050	81
5,000	.35	215	230	2150	80
SEA LEVEL	.32	215	210	2350	78

1. Loiter at recommended CAS.
2. Maintain constant altitude.



F-84F-25 AND LATER • J65-W-3 OR B-3 ENGINES • STANDARD DAY •

OPTIMUM MAXIMUM ENDURANCE PROFILE



CONFIGURATION
CLEAN + 2(450) GAL CLASS I TANKS
GROSS WEIGHT: 15,612 — 18,612 LB

ALT-FT	MACH NO.	APPROXIMATE			
		CAS-KNOTS	TAS-KNOTS	LB/HR	% MIL RPM
35,000	.67	225	385	1950	92
30,000	.61	225	360	1900	88
25,000	.54	220	325	1900	86
20,000	.47	220	290	1950	84
15,000	.43	220	270	1950	82
10,000	.39	215	250	2050	81
5,000	.35	215	230	2150	80
SEA LEVEL	.32	210	210	2350	78

NOTES

1. Maximum range descent. (Use idle power, speed brakes closed) Descend at 197 knots CAS.
2. Loiter at recommended CAS
3. Use normal power for climb. (See "Normal Power Climb" chart for detailed information.)
4. No allowance or reserve made for landing.

LEGEND

- IN THIS AREA LOITER AT INITIAL ALTITUDE
- IN THIS AREA CLIMB TO OPTIMUM ALTITUDE AND LOITER AT THAT ALTITUDE
- LINE OF OPTIMUM ALTITUDE
- MAXIMUM RANGE DESCENT LINE (USE IDLE POWER, SPEED BRAKES CLOSED, DESCEND AT AN INDICATED AIRSPEED OF 197 KNOTS
- CLIMB PATH GUIDE LINES
- FUEL REMAINING

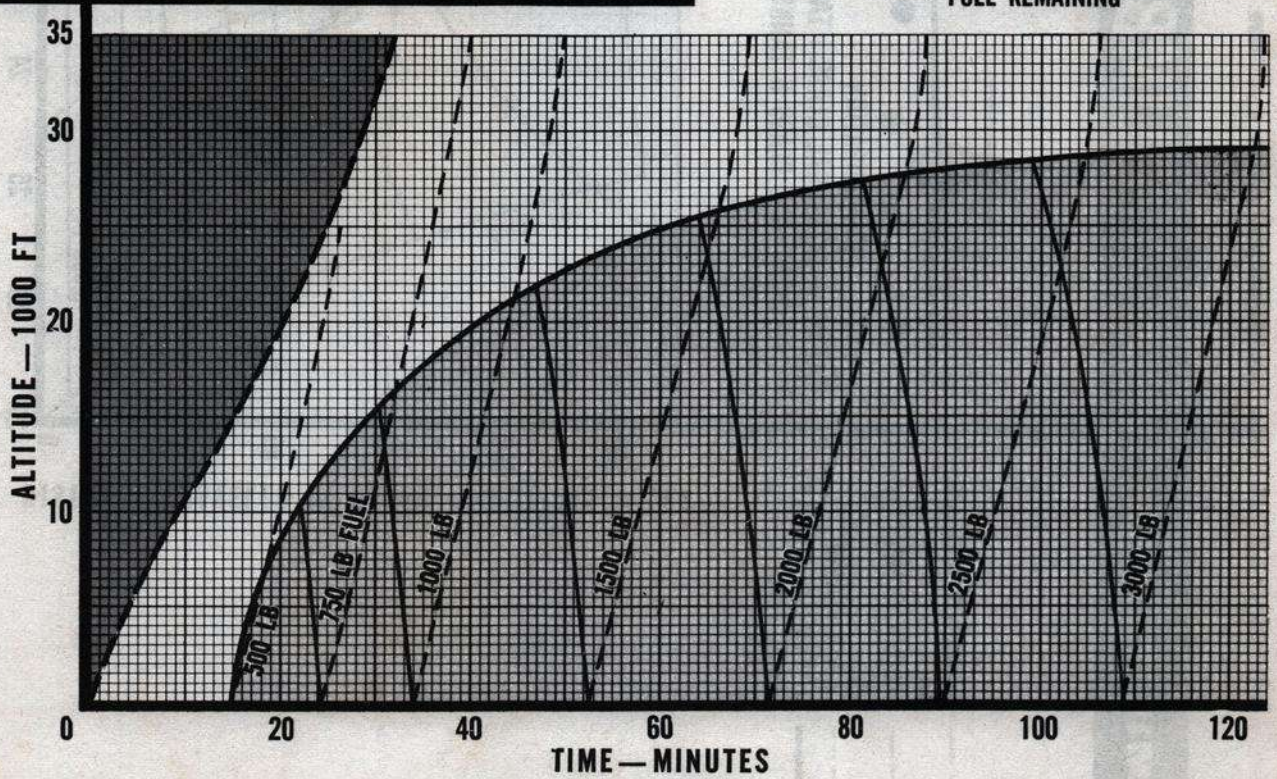


Figure A-33

MILITARY POWER (8300 RPM) CLIMB

— — MILITARY SERVICE CEILING
— - — MILITARY COMBAT CEILING
- - - - - CRUISE CEILING
——— OPTIMUM CRUISE FLIGHT PATH



CONFIGURATION
CLEAN + 2(230) GAL CLASS I TANKS
+ 2(230) GAL CLASS II TANKS

ALT-FT	CAS-KNOTS	MACH NO.
45,000	195	.73
40,000	220	.73
35,000	245	.72
30,000	255	.69
20,000	285	.62
10,000	305	.56
SEA LEVEL	330	.50

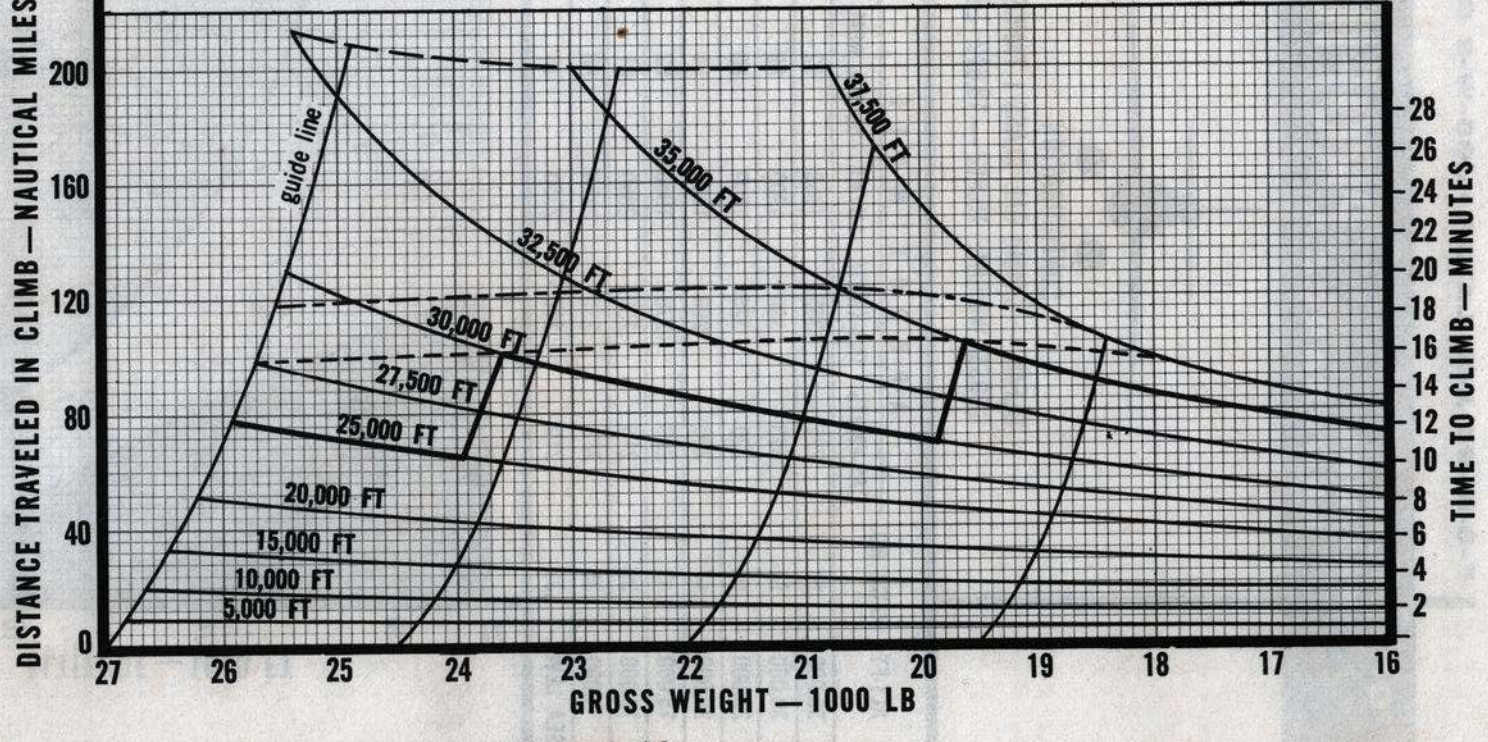


Figure A—34

F-84F-25 and later • J65-W-3 or B-3 Engines • Standard Day •

OUTBOUND PROFILE



CONFIGURATION
CLEAN + 2(230) GAL CLASS I TANKS
+ 2(230) GAL CLASS II TANKS
GROSS WEIGHT: 15,949 — 25,693 LB

ALT-FT	MACH NO.	APPROXIMATE			
		CAS-KNOTS	TAS-KNOTS	LB/HR	% MIL RPM
35,000	.73	250	420	2050	92
30,000	.71	265	420	2400	92
25,000	.67	280	405	2500	90
20,000	.63	290	385	2600	89
15,000	.58	295	365	2750	87
10,000	.53	295	340	2850	86
5,000	.49	300	320	3000	85
SEA LEVEL	.47	310	310	3250	80

NOTES

1. Fuel allowance for start, taxi and take-off (465 lb) included.
2. No allowance or reserves for loiter, descent or landing.
3. Use military power for climb. (see "Military Power Climb" chart for detailed information.)
4. Cruise at recommended Mach No.

LEGEND

- ——— OPTIMUM CRUISE FLIGHT PATH
- — — LINE OF BEST RANGE FOR CONSTANT ALTITUDE
- – – – TIME (START, TAXI AND TAKE-OFF NOT INCLUDED)
- ——— FUEL CONSUMED
- — — 9744 LB FUEL CONSUMED, ZERO FUEL REMAINING

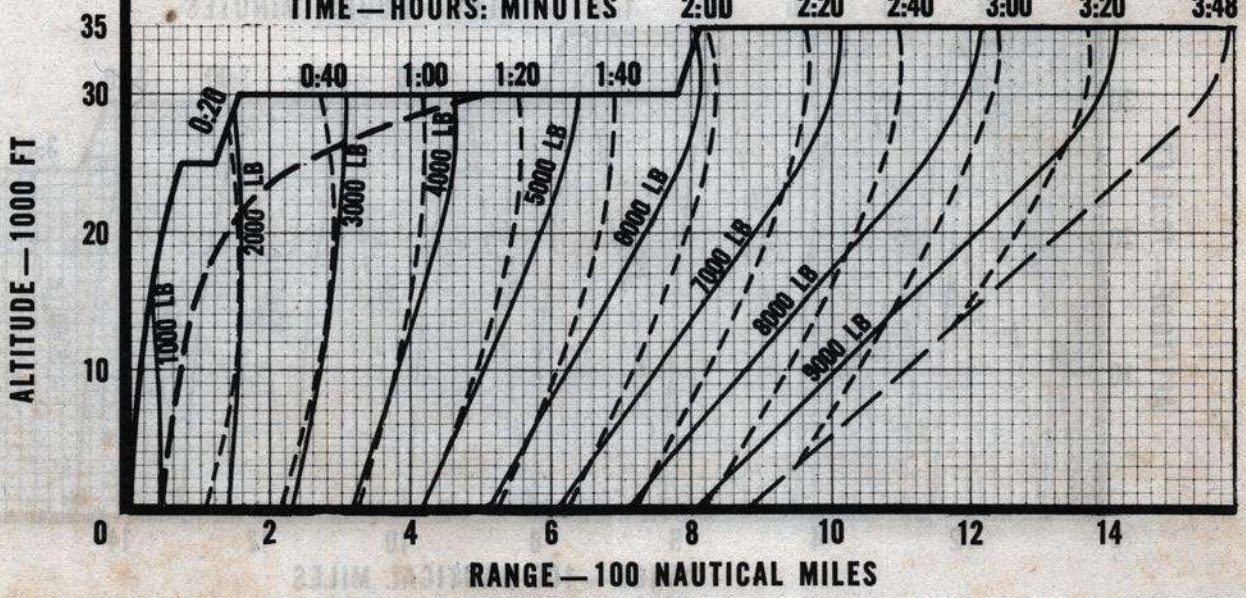


Figure 4-17

F-84F-25 AND LATER • J65-W-3 OR B-3 ENGINES • STANDARD DAY •

OPTIMUM RETURN PROFILE



CONFIGURATION
CLEAN + 2(230) GAL CLASS I TANKS
+ 2(230) GAL CLASS II TANKS
GROSS WEIGHT: 15,949 — 25,693 LB

ALT-FT	MACH NO.	APPROXIMATE			
		CAS-KNOTS	TAS-KNOTS	LB/HR	% MIL RPM
35,000	.73	250	420	2050	92
30,000	.71	265	420	2400	92
25,000	.67	280	405	2500	90
20,000	.63	290	385	2600	89
15,000	.58	295	365	2750	87
10,000	.53	295	340	2850	86
5,000	.49	300	320	3000	85
SEA LEVEL	.47	310	310	3250	80

NOTES

1. Fuel required at any point below the line of best range for constant altitude flight, or below the optimum range flight profile, includes military power climb to flight altitude.
2. No allowance made for loiter, descent or landing.
3. Best cruise condition determined by intersection of climb path guide lines and lines of best range.
4. Cruise at recommended Mach No.

LEGEND

- IN THIS AREA CRUISE AT INITIAL ALTITUDE
- IN THIS AREA CLIMB TO OPTIMUM ALTITUDE AND CRUISE AT THAT ALTITUDE
- IN THIS AREA CLIMB TO OPTIMUM STEP CLIMB ALTITUDE AND USE STEP CLIMB PROCEDURE
- OPTIMUM RANGE FLIGHT PROFILE
- LINE OF BEST RANGE FOR CONSTANT ALTITUDE
- CLIMB PATH GUIDE LINES
- FUEL REQUIRED
- TIME AT CRUISING ALTITUDE

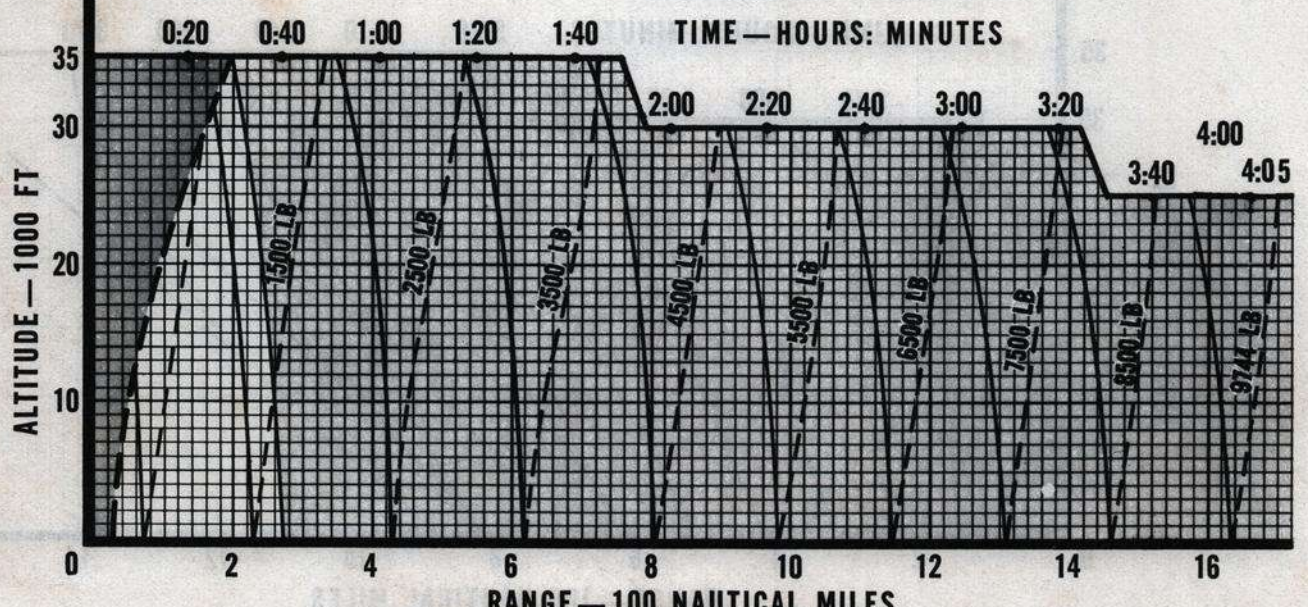


Figure A-38

F-84F-25 and later • J65-W-3 or B-3 Engines • Standard Day •

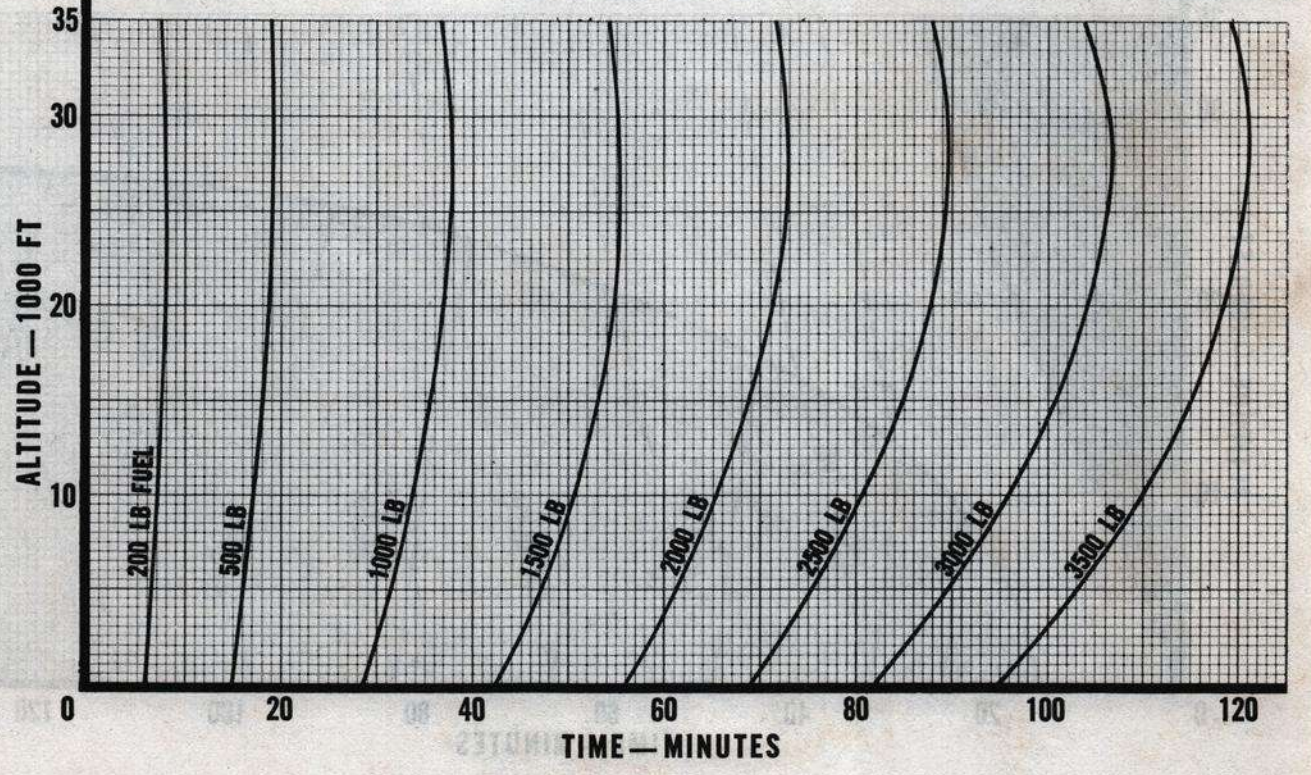
MAXIMUM ENDURANCE PROFILE



CONFIGURATION
CLEAN + 2(230) GAL CLASS I TANKS
+ 2(230) GAL CLASS II TANKS
GROSS WEIGHT: 15,949 — 19,449 LB

ALT-FT	MACH NO.	APPROXIMATE			
		CAS-KNOTS	TAS-KNOTS	LB/HR	% MIL RPM
35,000	.65	215	375	2200	93
30,000	.59	215	350	2100	90
25,000	.52	210	315	2050	87
20,000	.47	210	290	2100	85
15,000	.42	210	265	2150	84
10,000	.39	210	245	2200	82
5,000	.35	210	225	2300	80
SEA LEVEL	.32	210	215	2450	79

1. Loiter at recommended CAS.
2. Maintain constant altitude.



F-84F-25 AND LATER • J65-W-3 OR B-3 ENGINES • STANDARD DAY •

OPTIMUM MAXIMUM ENDURANCE PROFILE



CONFIGURATION: CLEAN + 2(230) GAL CLASS I TANKS + 2(230) GAL CLASS II TANKS
GROSS WEIGHT: 15,949 — 19,449 LB

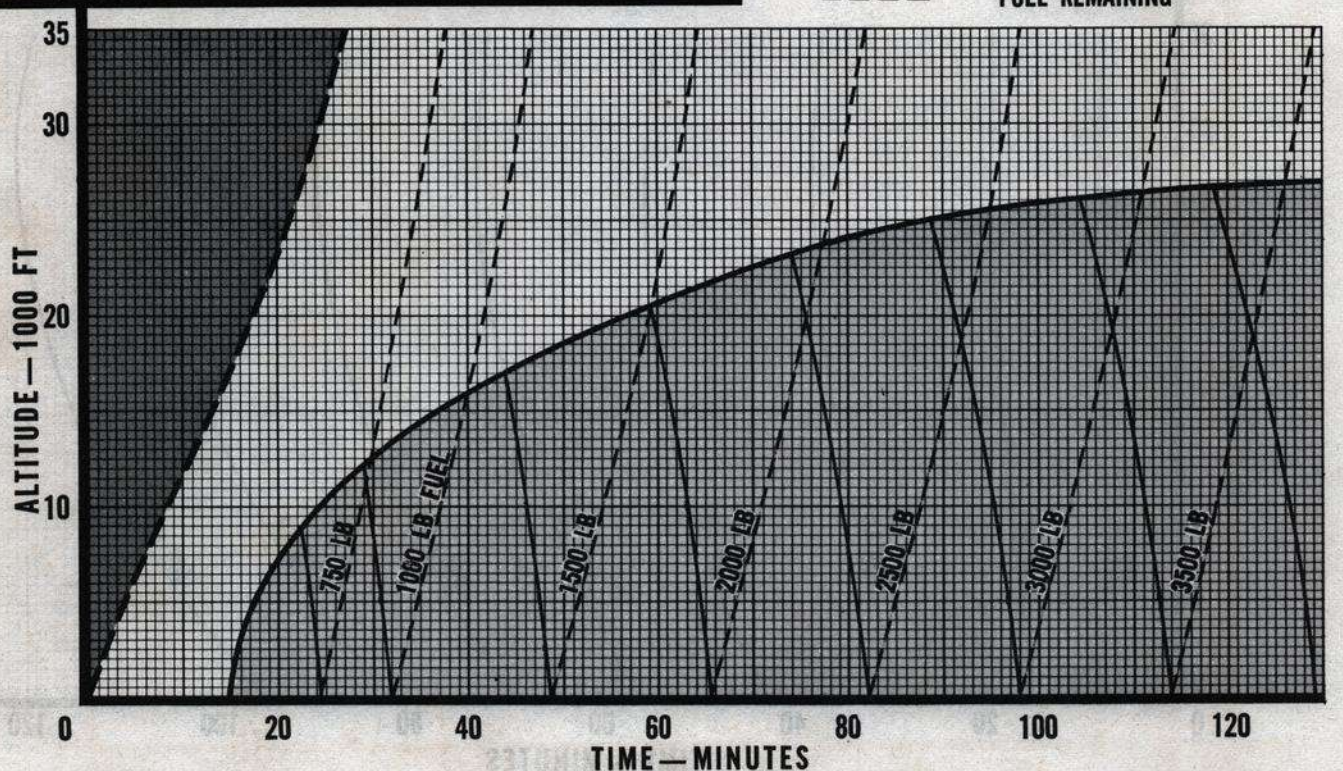
ALT-FT	MACH NO.	APPROXIMATE			
		CAS-KNOTS	TAS-KNOTS	LB/HR	% MIL RPM
35,000	.65	215	375	2200	93
30,000	.59	215	350	2100	90
25,000	.52	210	315	2050	87
20,000	.47	210	290	2100	85
15,000	.42	210	265	2150	84
10,000	.39	210	245	2200	82
5,000	.35	210	225	2300	80
SEA LEVEL	.32	210	215	2450	79

NOTES

1. Maximum range descent. (Use idle power, speed brakes closed) Descend at 198 knots CAS.
2. Loiter at recommended CAS
3. Use normal power for climb. (See "Normal Power Climb" chart for detailed information.)
4. No allowance or reserve made for landing.

LEGEND

- IN THIS AREA LOITER AT INITIAL ALTITUDE
- IN THIS AREA CLIMB TO OPTIMUM ALTITUDE AND LOITER AT THAT ALTITUDE
- LINE OF OPTIMUM ALTITUDE
- MAXIMUM RANGE DESCENT LINE (USE IDLE POWER, SPEED BRAKES CLOSED, DESCEND AT AN INDICATED AIRSPEED OF 198 KNOTS
- CLIMB PATH GUIDE LINES
- FUEL REMAINING



F-84F-25 AND LATER • J65-W-3 OR B-3 ENGINES • STANDARD DAY

MILITARY POWER (8300 RPM) CLIMB



CONFIGURATION
CLEAN + 2(450) GAL CLASS I TANKS
+ 2(230) GAL CLASS II TANKS

ALT-FT	CAS-KNOTS	MACH NO.
45,000	195	.74
40,000	220	.74
35,000	250	.74
30,000	260	.70
20,000	285	.62
10,000	305	.55
SEA LEVEL	315	.48

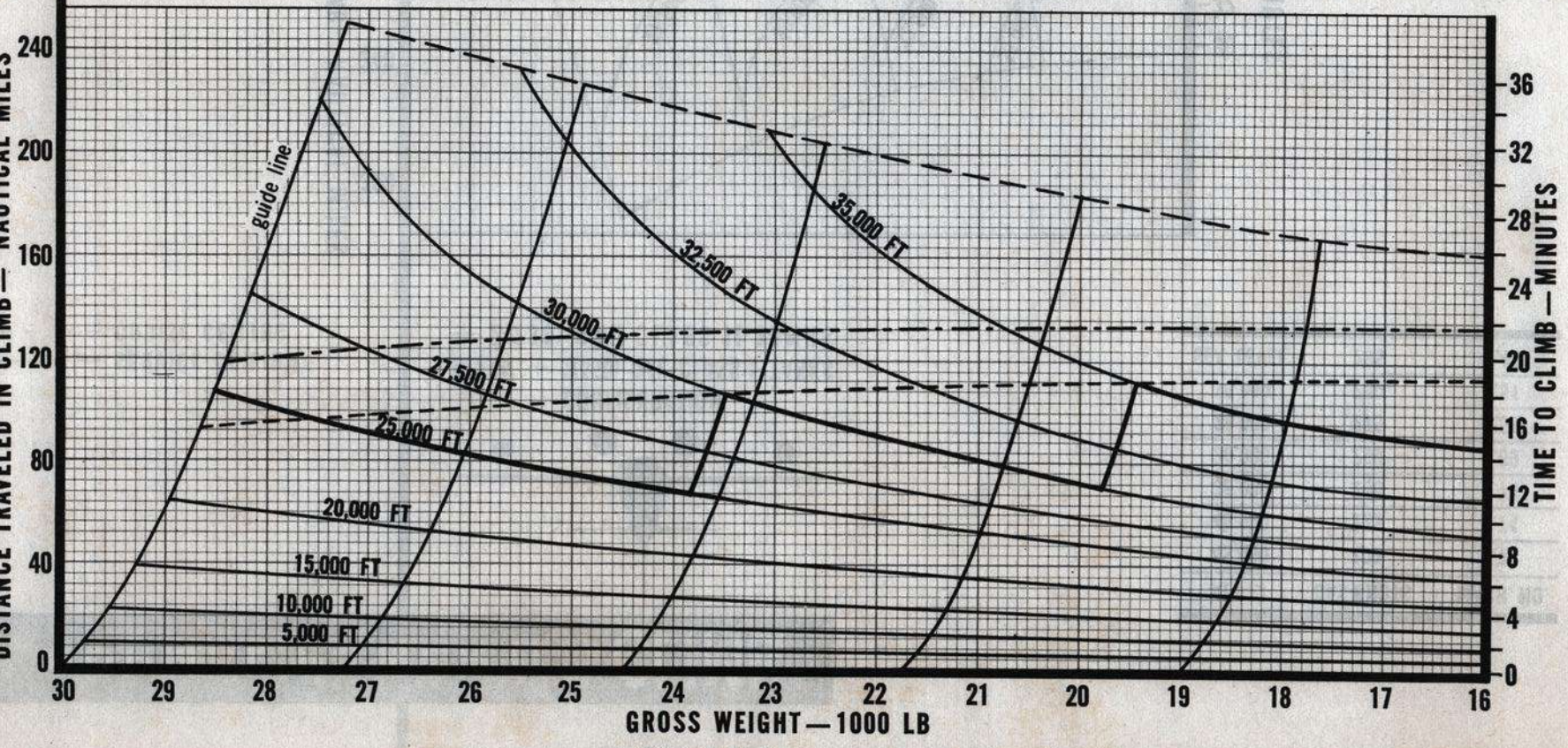


Figure A—41

NORMAL POWER (8000 RPM) CLIMB



CONFIGURATION
CLEAN + 2(450) GAL CLASS I TANKS
+ 2(230) GAL CLASS II TANKS

ALT-FT	CAS-KNOTS	MACH NO.
45,000	200	.74
40,000	225	.74
35,000	250	.74
30,000	260	.69
20,000	275	.59
10,000	280	.51
SEA LEVEL	285	.43

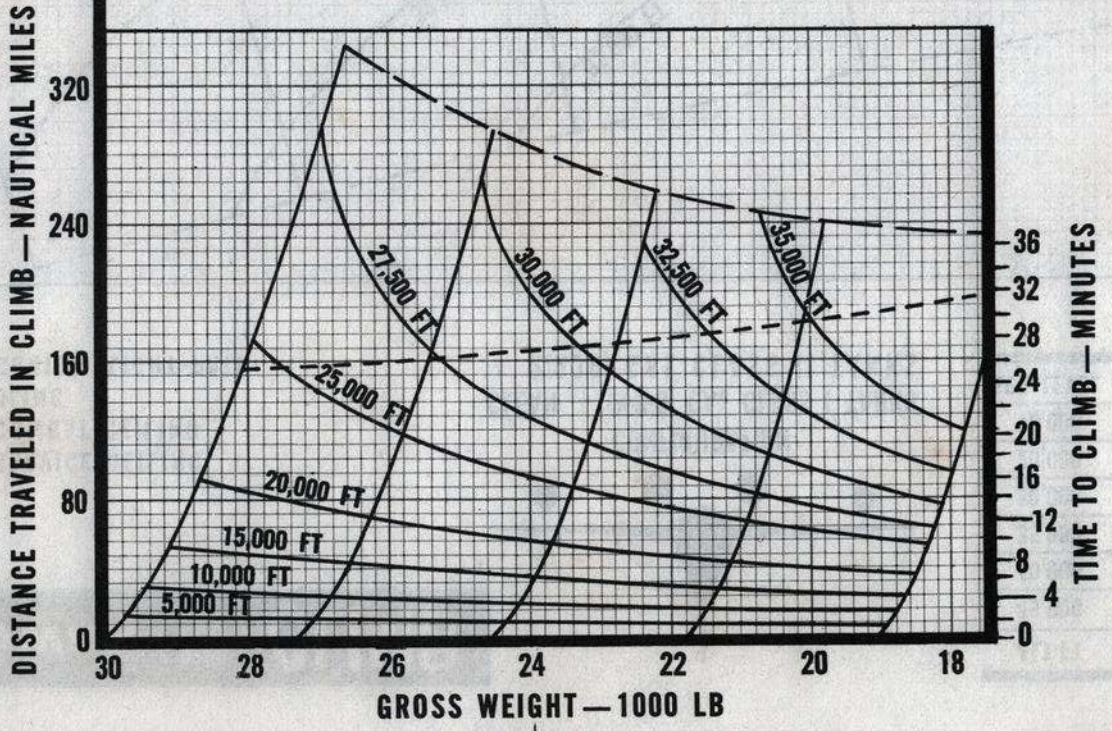


Figure A–42

F-84F-25 AND LATER • J65-W-3 OR B-3 ENGINES • STANDARD DAY

98% MILITARY RPM CLIMB



CONFIGURATION
CLEAN + 2(450) GAL CLASS I TANKS
+ 2(230) GAL CLASS II TANKS

ALT-FT	CAS-KNOTS	MACH NO.
45,000	200	.75
40,000	225	.75
35,000	250	.75
30,000	265	.70
20,000	280	.61
10,000	290	.52
SEA LEVEL	295	.44

— — 98% MILITARY SERVICE CEILING
- - - - - 98% MILITARY COMBAT CEILING

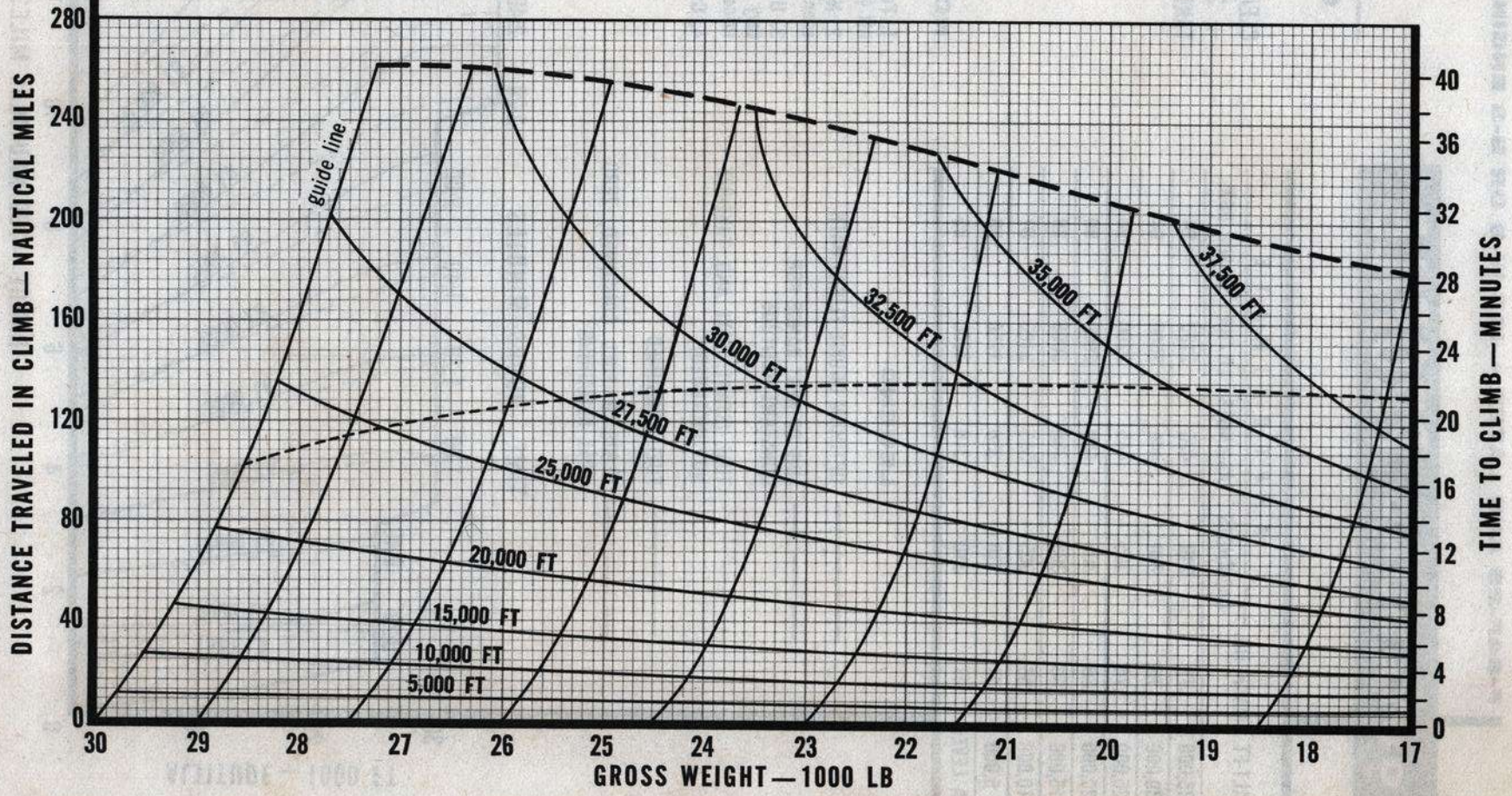


Figure A–43

F-84F-25 AND LATER • J65-W-3 OR B-3 ENGINES • STANDARD DAY •

OUTBOUND PROFILE



CONFIGURATION

CLEAN + 2(450) GAL CLASS I TANKS + 2(230) GAL CLASS II TANKS

TAKE-OFF GROSS WEIGHT: 27,000 LB

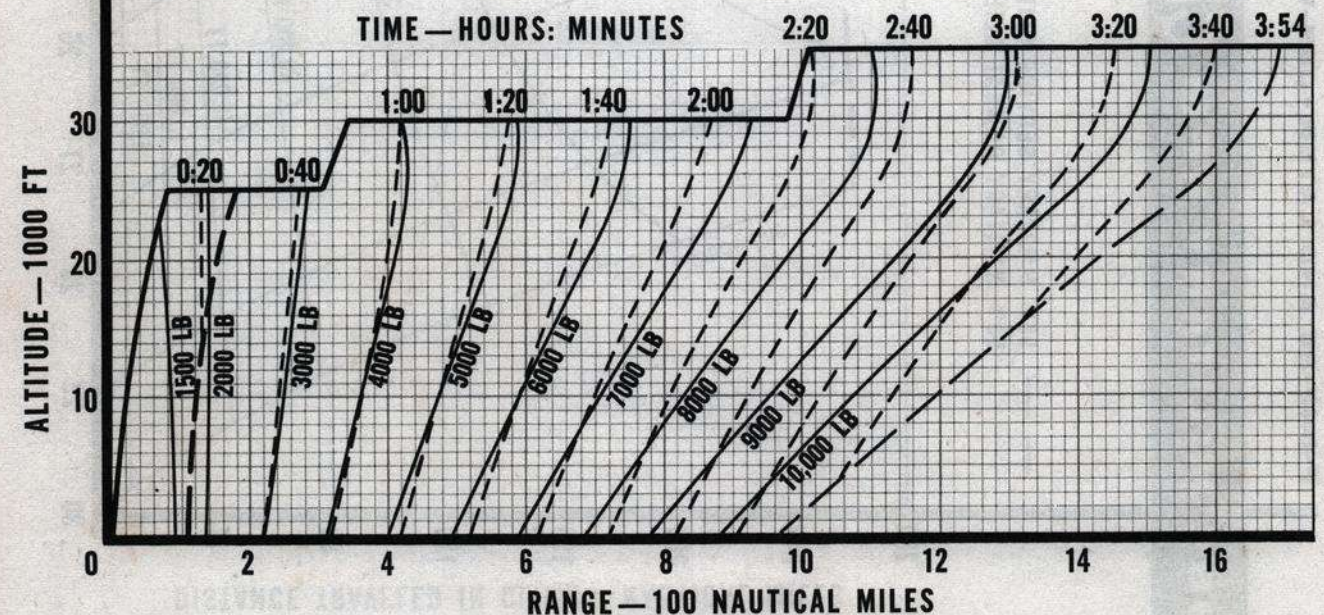
ALT-FT	MACH NO.	APPROXIMATE			
		CAS-KNOTS	TAS-KNOTS	LB/HR	% MIL RPM
35,000	.71	240	435	2100	94
30,000	.75	280	440	2500	94
25,000	.74	305	445	3200	94
20,000	.66	305	400	2900	90
15,000	.60	305	380	3000	89
10,000	.56	305	355	3100	87
5,000	.51	310	330	3250	86
SEA LEVEL	.47	310	310	3350	85

NOTES

1. Fuel allowance for start, taxi and take-off (465 lb) included.
2. No allowance or reserves for loiter, descent or landing.
3. Use military power for climb. (see "Military Power Climb" chart for detailed information.)
4. Cruise at recommended Mach No.

LEGEND

- OPTIMUM CRUISE FLIGHT PATH
- LINE OF BEST RANGE FOR CONSTANT ALTITUDE
- TIME (START, TAXI AND TAKE-OFF NOT INCLUDED)
- FUEL CONSUMED
- 10,889 LB FUEL CONSUMED, ZERO FUEL REMAINING



F-84F-25 AND LATER • J65-W-3 OR B-3 ENGINES • STANDARD DAY •

OPTIMUM RETURN PROFILE



CONFIGURATION

CLEAN + 2(450) GAL CLASS I TANKS
+ 2(230) GAL CLASS II TANKS
GROSS WEIGHT: 16,111 — 28,715 LB

ALT-FT	MACH NO.	APPROXIMATE			
		CAS-KNOTS	TAS-KNOTS	LB/HR	% MIL RPM
35,000	.71	240	435	2100	94
30,000	.75	280	440	2500	94
25,000	.74	305	445	3200	94
20,000	.66	305	400	2900	90
15,000	.60	305	380	3000	89
10,000	.56	305	355	3100	87
5,000	.51	310	330	3250	86
SEA LEVEL	.47	310	310	3350	85

NOTES

1. Fuel required at any point below the line of best range for constant altitude flight, or below the optimum range flight profile, includes military power climb to flight altitude.
2. No allowance made for loiter, descent or landing.
3. Best cruise condition determined by intersection of climb path guide lines and lines of best range.
4. Cruise at recommended Mach No.

LEGEND

- IN THIS AREA CRUISE AT INITIAL ALTITUDE
- IN THIS AREA CLIMB TO OPTIMUM ALTITUDE AND CRUISE AT THAT ALTITUDE
- IN THIS AREA CLIMB TO OPTIMUM STEP CLIMB ALTITUDE AND USE STEP CLIMB PROCEDURE
- OPTIMUM RANGE FLIGHT PROFILE
- LINE OF BEST RANGE FOR CONSTANT ALTITUDE
- CLIMB PATH GUIDE LINES
- FUEL REQUIRED
- TIME AT CRUISING ALTITUDE

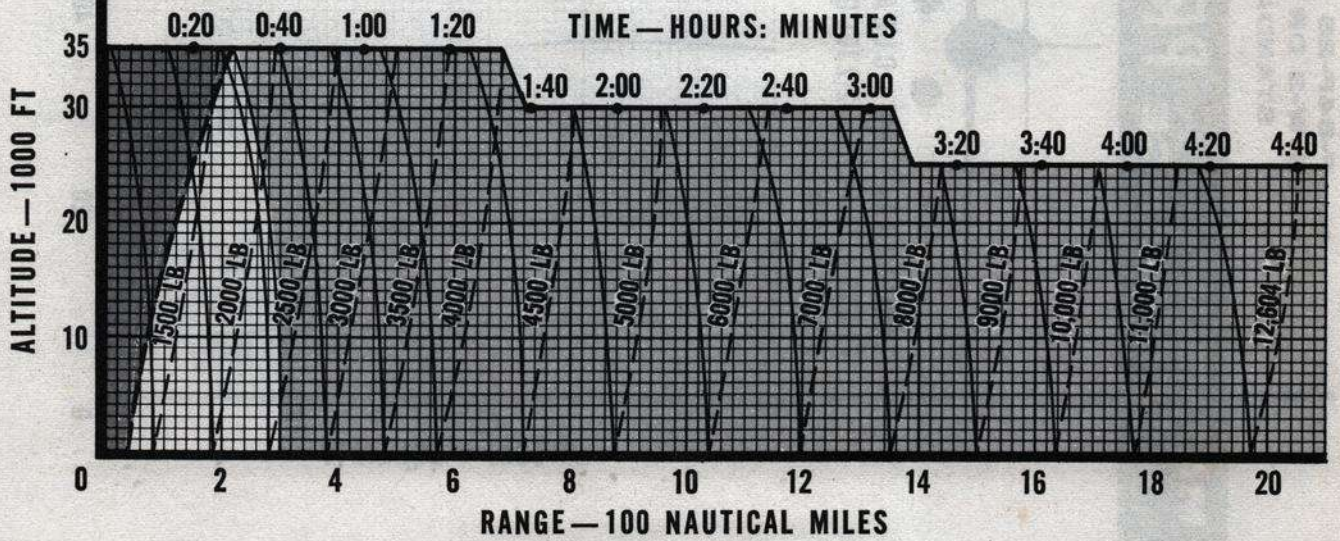


Figure A—45

• F-84F-25 AND LATER •
• J65-W-3 OR B-3 ENGINES •
• STANDARD DAY •

MAXIMUM ENDURANCE PROFILE



CONFIGURATION: CLEAN + 2(450) GAL CLASS I TANKS + 2(230) GAL CLASS II TANKS
GROSS WEIGHT: 16,111 — 20,111 LB

ALT-FT	MACH NO.	APPROXIMATE			
		CAS-KNOTS	TAS-KNOTS	LB/HR	% MIL RPM
35,000	.68	230	395	2450	96
30,000	.62	230	355	2300	93
25,000	.54	225	325	2300	89
20,000	.49	220	300	2300	87
15,000	.44	220	275	2300	85
10,000	.39	220	250	2400	83
5,000	.36	220	235	2500	81
SEA LEVEL	.33	220	220	2600	80

1. Loiter at recommended CAS.
2. Maintain constant altitude.

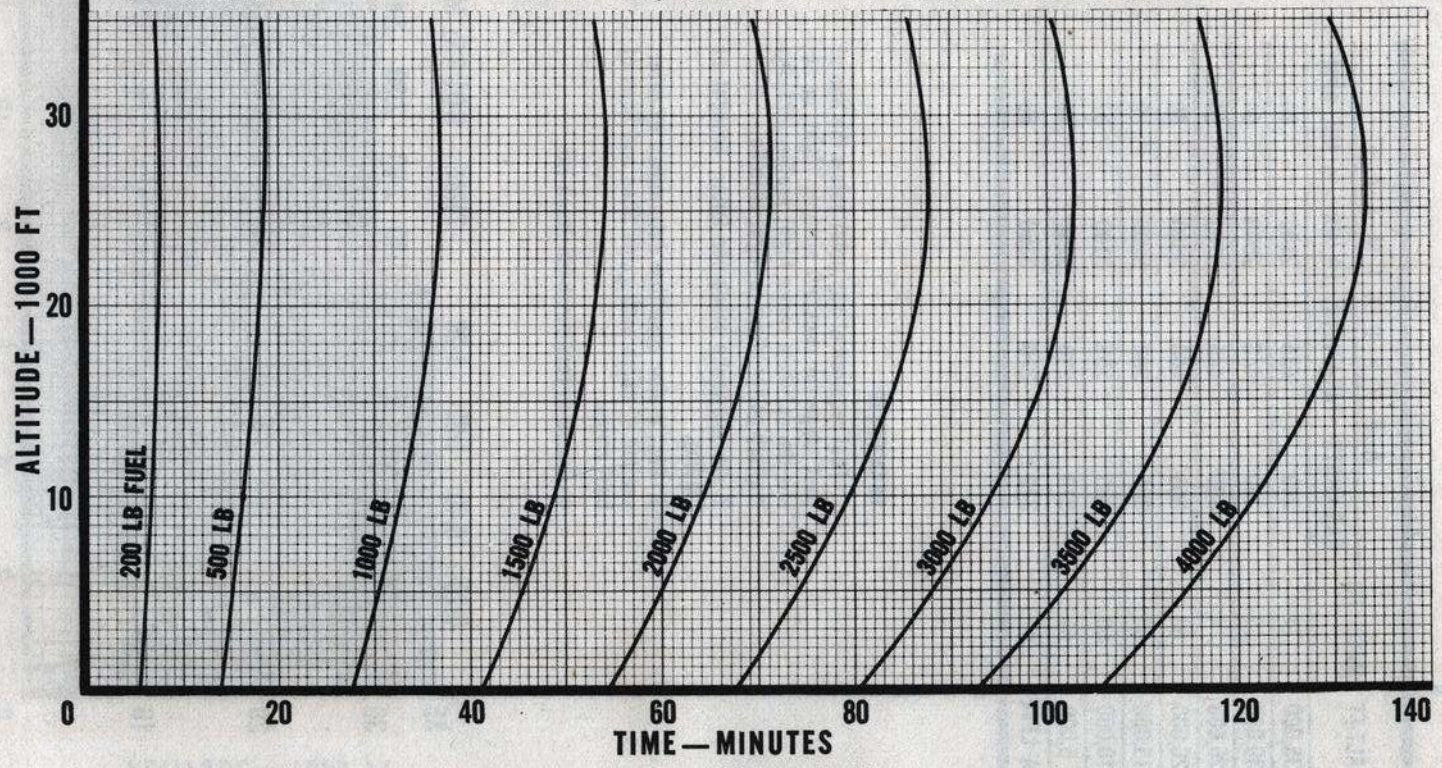


Figure A–46

F-84F-25 AND LATER • J65-W-3 OR B-3 ENGINES • STANDARD DAY •

OPTIMUM MAXIMUM ENDURANCE PROFILE



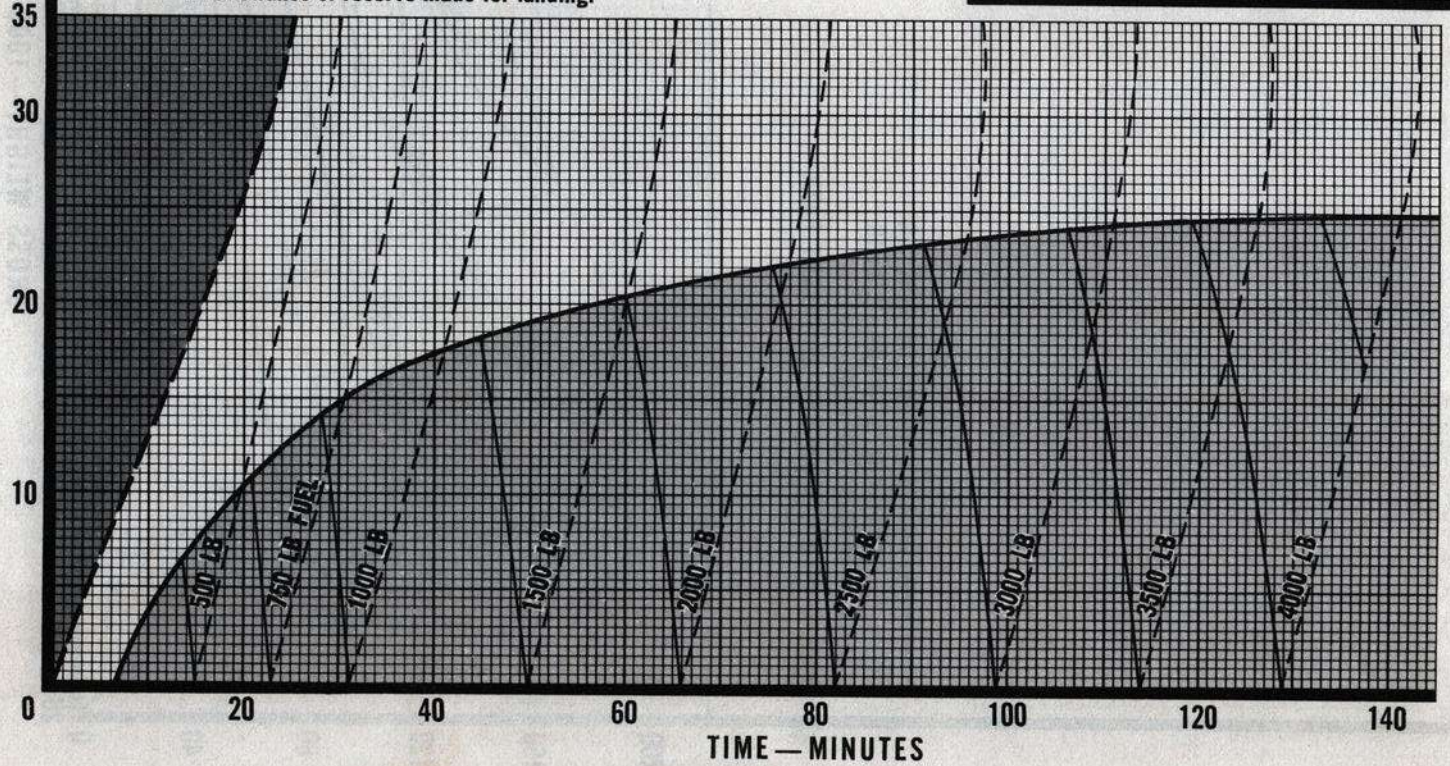
CONFIGURATION

CLEAN + 2(450) GAL CLASS I TANKS
+ 2(230) GAL CLASS II TANKS
GROSS WEIGHT: 16,111 — 20,111 LB

NOTES

1. Maximum range descent. (Use idle power, speed brakes closed) Descend at 200 knots CAS.
2. Loiter at recommended CAS
3. Use normal power for climb. (See "Normal Power Climb" chart for detailed information.)
4. No allowance or reserve made for landing.

ALT-FT	MACH NO.	APPROXIMATE			
		CAS-KNOTS	TAS-KNOTS	LB/HR	% MIL RPM
35,000	.68	230	395	2450	96
30,000	.62	230	355	2300	93
25,000	.54	225	325	2300	89
20,000	.49	220	300	2300	87
15,000	.44	220	275	2300	85
10,000	.39	220	250	2400	83
5,000	.36	220	235	2500	81
SEA LEVEL	.33	220	220	2600	80



LEGEND

IN THIS AREA LOITER AT INITIAL ALTITUDE

IN THIS AREA CLIMB TO OPTIMUM ALTITUDE AND LOITER AT THAT ALTITUDE

LINE OF OPTIMUM ALTITUDE

MAXIMUM RANGE DESCENT LINE (USE IDLE POWER, SPEED BRAKES CLOSED, DESCEND AT AN INDICATED AIR SPEED OF 202 KNOTS

CLIMB PATH GUIDE LINES

FUEL REMAINING

Figure A—47

F-84F-25 AND LATER • J65-W-3 OR B-3 ENGINES • STANDARD DAY •

NORMAL POWER (8000 RPM) CLIMB



CONFIGURATION
CLEAN + 2(230) GAL CLASS I TANKS + 2 1000 LB BOMBS + 4 HVARS

ALT-FT	CAS-KNOTS	MACH NO.
45,000	175	.66
40,000	195	.66
35,000	220	.67
30,000	230	.62
20,000	250	.55
10,000	265	.48
SEA LEVEL	280	.42

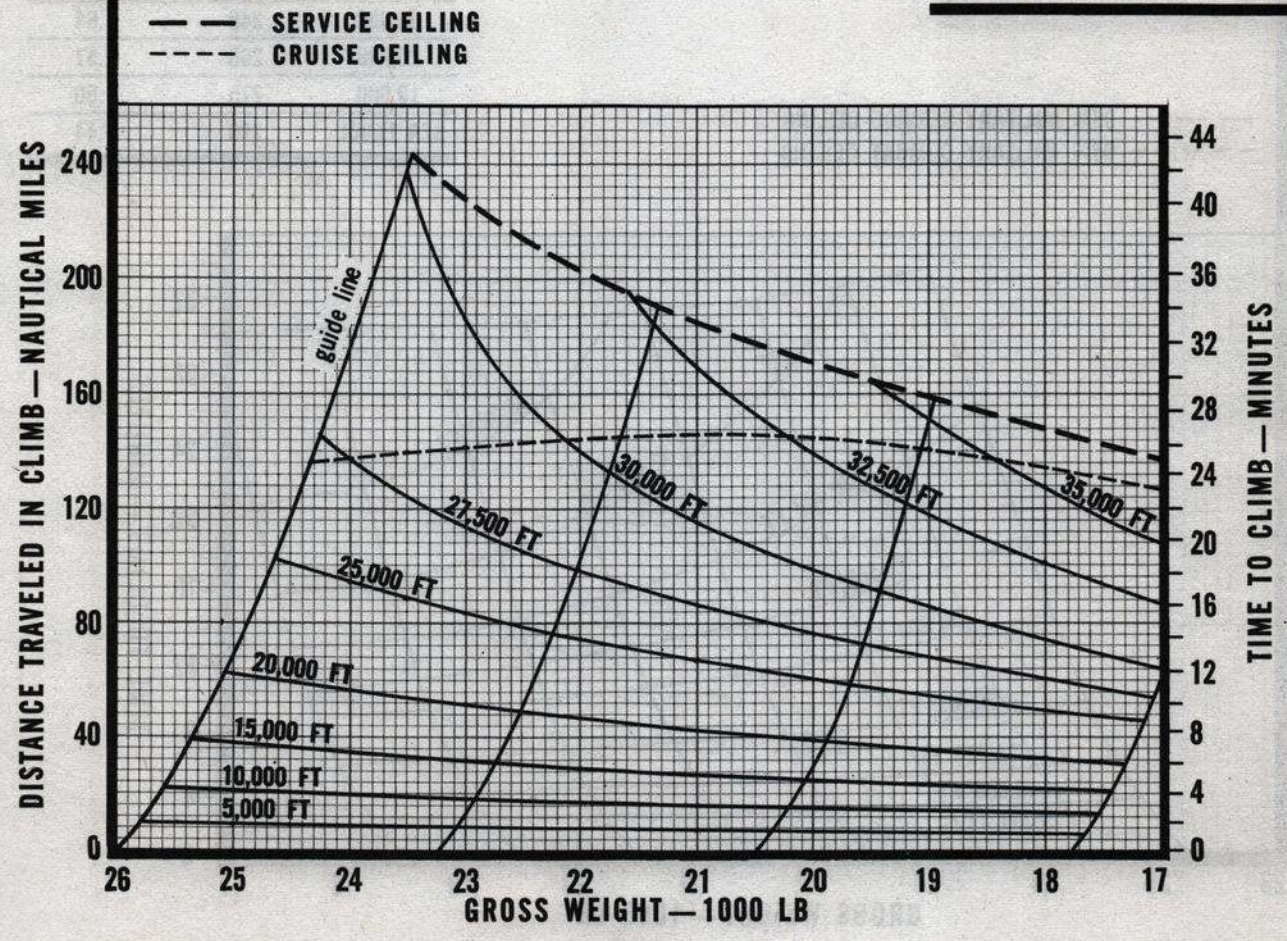


Figure A-48

F-84F-25 AND LATER • J65-W-3 OR B-3 ENGINES • STANDARD DAY •

MILITARY POWER (8300 RPM) CLIMB



CONFIGURATION
CLEAN + 2(230) GAL CLASS I TANKS + 2 1000 LB BOMBS + 4 HVARS

ALT-FT	CAS-KNOTS	MACH NO.
45,000	175	.66
40,000	200	.66
35,000	220	.66
30,000	245	.64
20,000	260	.57
10,000	285	.51
SEA LEVEL	305	.46

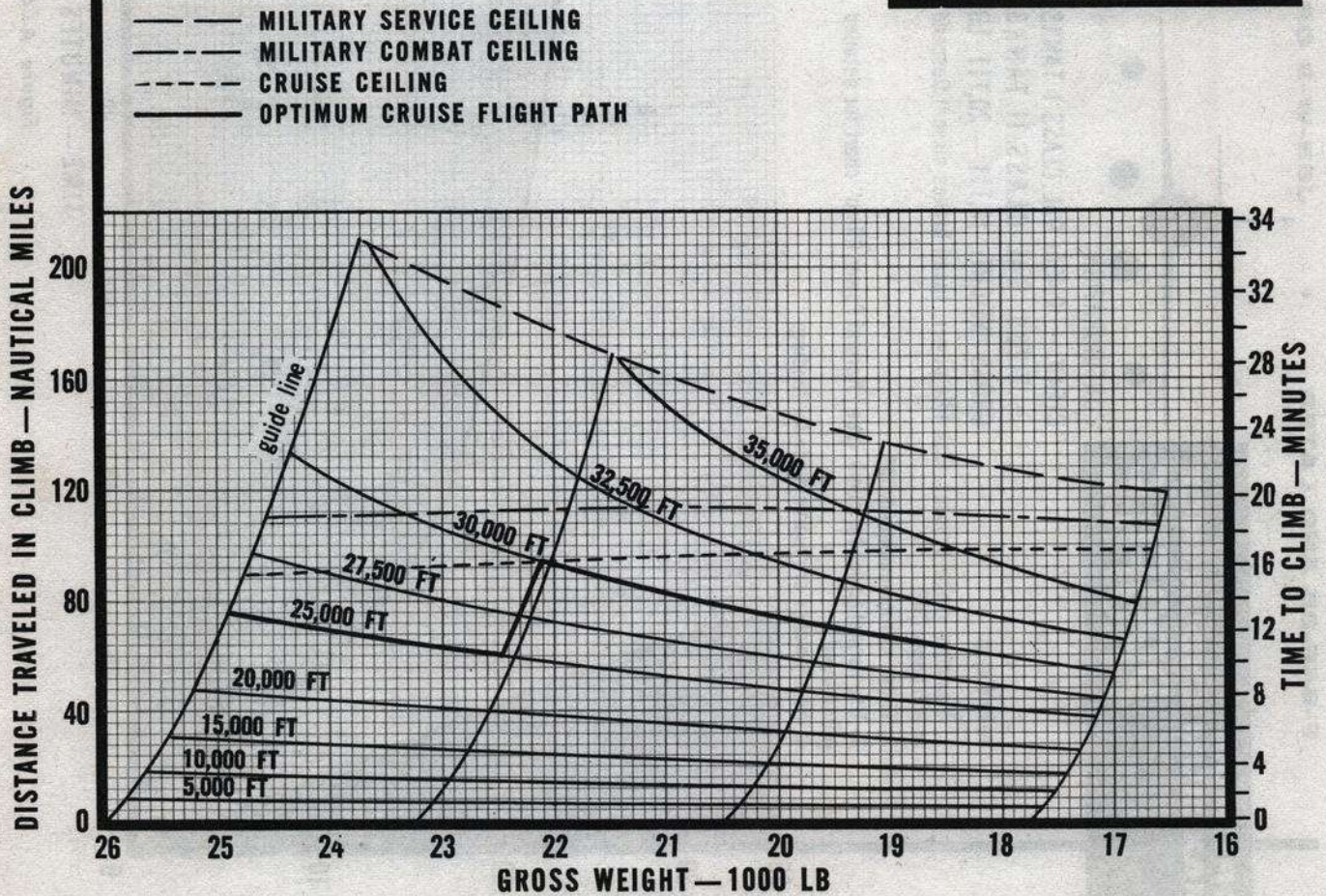
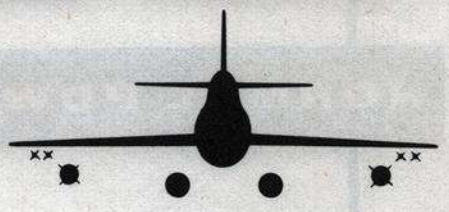


Figure A-48

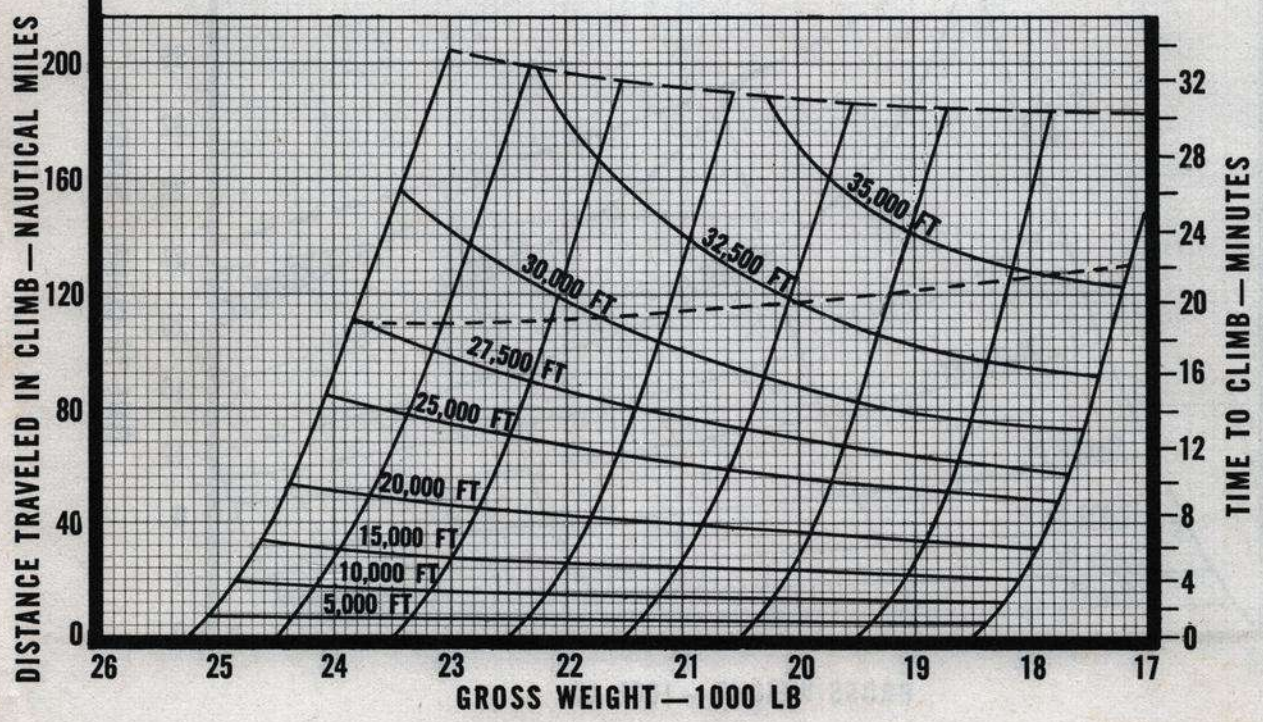
F-84F-25 AND LATER • J65-W-3 OR B-3 ENGINES • STANDARD DAY •

98% MILITARY RPM CLIMB



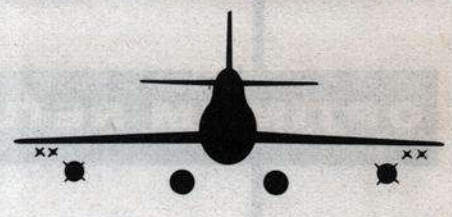
CONFIGURATION
CLEAN + 2(230) GAL CLASS I TANKS
+ 2 1000 LB BOMBS + 4 HVARS

ALT-FT	CAS-KNOTS	MACH NO.
45,000	180	.67
40,000	200	.67
35,000	225	.67
30,000	240	.64
20,000	260	.57
10,000	275	.50
SEA LEVEL	290	.44



F-84F-25 AND LATER • J65-W-3 OR B-3 ENGINES • STANDARD DAY •

OUTBOUND PROFILE



CONFIGURATION

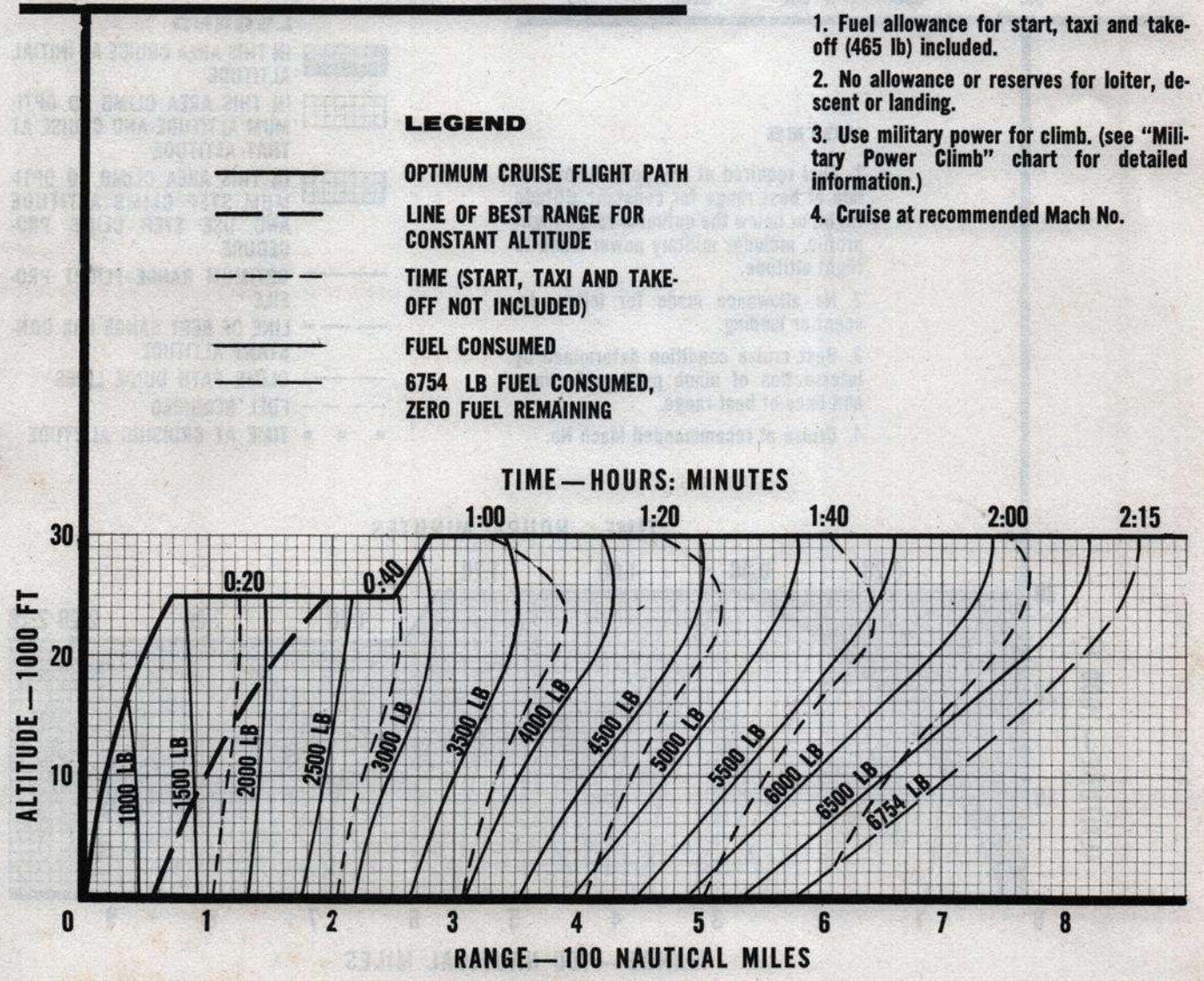
CLEAN + 2(230) GAL CLASS I TANKS + 2 1000 LB BOMBS + 4 HVARS

TAKE-OFF GROSS WEIGHT: 25,252 LB

ALT-FT	MACH NO.	APPROXIMATE			
		CAS-KNOTS	TAS-KNOTS	LB/HR	% MIL RPM
30,000	.68	250	400	2500	94
25,000	.65	270	390	2600	92
20,000	.61	280	375	2700	89
15,000	.56	285	355	2800	87
10,000	.52	285	330	2850	87
5,000	.48	290	315	3000	86
SEA LEVEL	.46	300	300	3200	85

NOTES

1. Fuel allowance for start, taxi and take-off (465 lb) included.
2. No allowance or reserves for loiter, descent or landing.
3. Use military power for climb. (see "Military Power Climb" chart for detailed information.)
4. Cruise at recommended Mach No.



F-84F-25 AND LATER • J65-W-3 OR B-3 ENGINES • STANDARD DAY •

OPTIMUM RETURN PROFILE



CONFIGURATION

CLEAN + 2(230) GAL CLASS I TANKS + 2 1000 LB BOMBS + 4 HVARS

GROSS WEIGHT: 18,498 — 25,252 LB

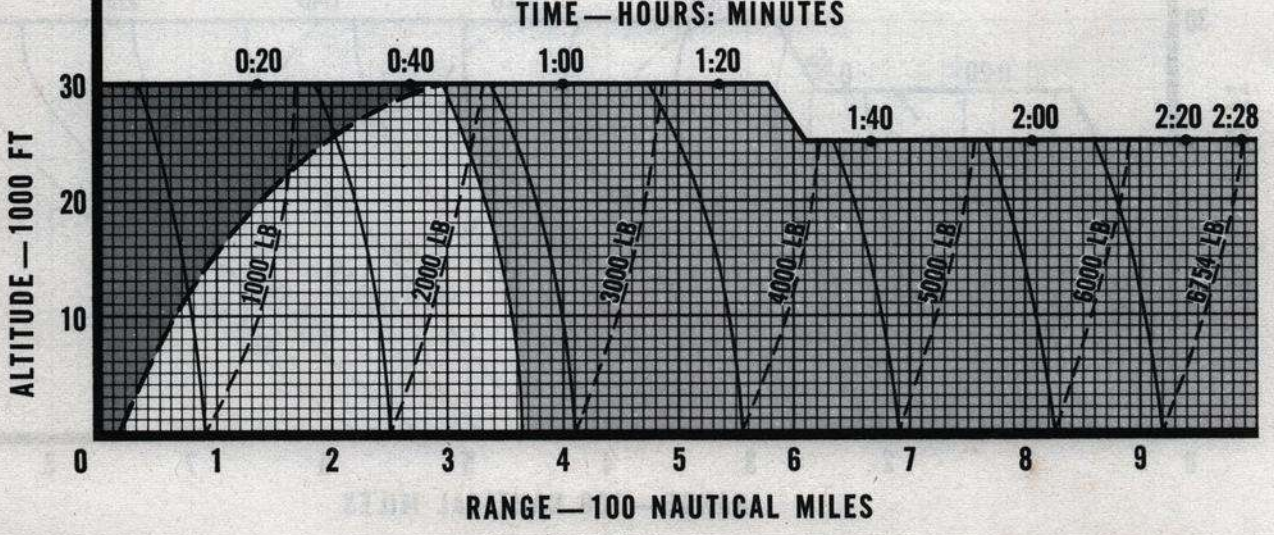
ALT-FT	MACH NO.	APPROXIMATE			
		CAS-KNOTS	TAS-KNOTS	LB/HR	% MIL RPM
30,000	.68	250	400	2500	94
25,000	.65	270	390	2600	92
20,000	.61	280	375	2700	89
15,000	.56	285	355	2800	87
10,000	.52	285	330	2850	87
5,000	.48	290	315	3000	86
0	.46	300	300	3200	85

NOTES

1. Fuel required at any point below the line of best range for constant altitude flight, or below the optimum range flight profile, includes military power climb to flight altitude.
2. No allowance made for loiter, descent or landing.
3. Best cruise condition determined by intersection of climb path guide lines and lines of best range.
4. Cruise at recommended Mach No.

LEGEND

- IN THIS AREA CRUISE AT INITIAL ALTITUDE
- IN THIS AREA CLIMB TO OPTIMUM ALTITUDE AND CRUISE AT THAT ALTITUDE
- IN THIS AREA CLIMB TO OPTIMUM STEP CLIMB ALTITUDE AND USE STEP CLIMB PROCEDURE
- OPTIMUM RANGE FLIGHT PROFILE
- LINE OF BEST RANGE FOR CONSTANT ALTITUDE
- CLIMB PATH GUIDE LINES
- FUEL REQUIRED
- TIME AT CRUISING ALTITUDE



F-84F-25 and later • J65-W-3 or B-3 Engines • Standard Day •

MAXIMUM ENDURANCE PROFILE



CONFIGURATION

CLEAN + 2(230) GAL CLASS I TANKS + 2 1000 LB BOMBS + 4 HVARS

GROSS WEIGHT: 18,498 — 20,498 LB

ALT-FT	MACH NO.	APPROXIMATE			
		CAS-KNOTS	TAS-KNOTS	LB/HR	% MIL RPM
30,000	.58	210	345	2250	93
25,000	.51	210	305	2200	89
20,000	.47	210	290	2200	87
15,000	.41	210	260	2200	84
10,000	.39	210	250	2250	83
5,000	.35	210	230	2350	82
SEA LEVEL	.31	210	210	2500	80

1. Loiter at recommended CAS.
2. Maintain constant altitude.

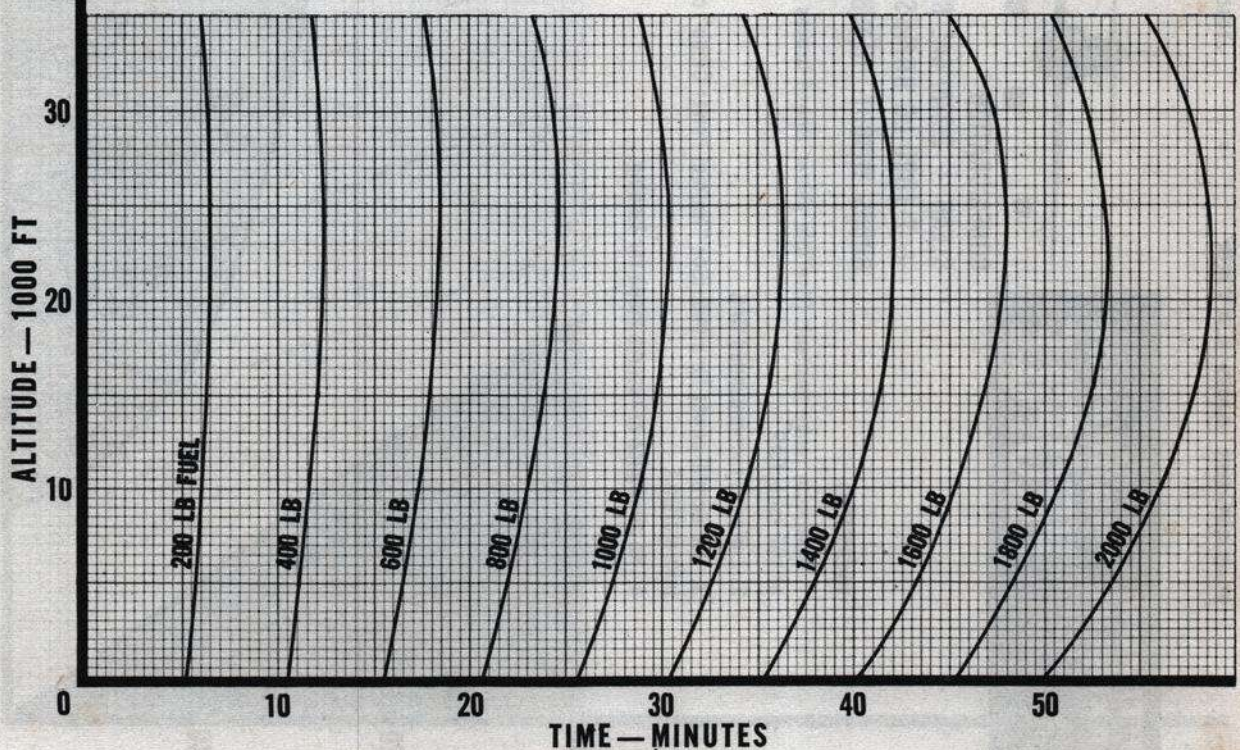
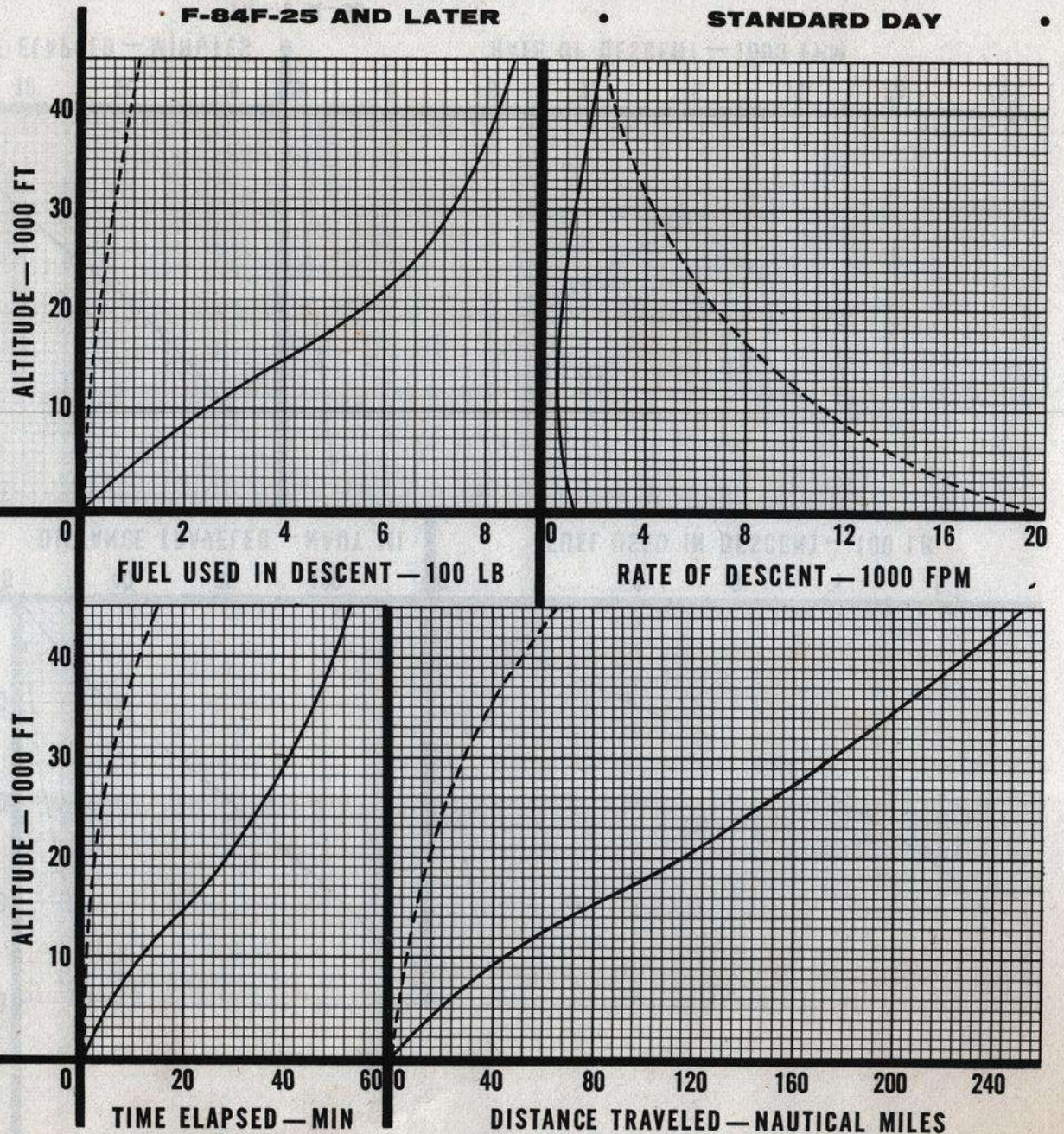


Figure A-53

J65-W-3 OR B-3 ENGINES • F-84F-25 AND LATER • STANDARD DAY

DESCENTS

CONFIGURATION: CLEAN



NOTES

Maximum range descent is at constant indicated airspeed of 200 knots

Recommended descent is at Mach .88

Descend at idle power

----- RECOMMENDED DESCENT

——— MAXIMUM RANGE DESCENT

Figure A-55

OPTIMUM MAXIMUM ENDURANCE PROFILE



CONFIGURATION
CLEAN + 2(230) GAL CLASS I TANKS
+ 2 1000 LB BOMBS + 4 HVARS
GROSS WEIGHT: 18,498 — 20,498 LB

NOTES

1. Maximum range descent. (Use idle power, speed brakes closed) Descend at 197 knots CAS.
2. Loiter at recommended CAS
3. Use normal power for climb. (See "Normal Power Climb" chart for detailed information.)
4. No allowance or reserve made for landing.

ALT-FT	MACH NO.	APPROXIMATE			
		CAS-KNOTS	TAS-KNOTS	LB/HR	% MIL RPM
30,000	.58	210	345	2250	93
25,000	.51	210	305	2200	89
20,000	.47	210	290	2200	87
15,000	.41	210	260	2200	84
10,000	.39	210	250	2250	83
5,000	.35	210	230	2350	82
SEA LEVEL	.31	210	210	2500	80

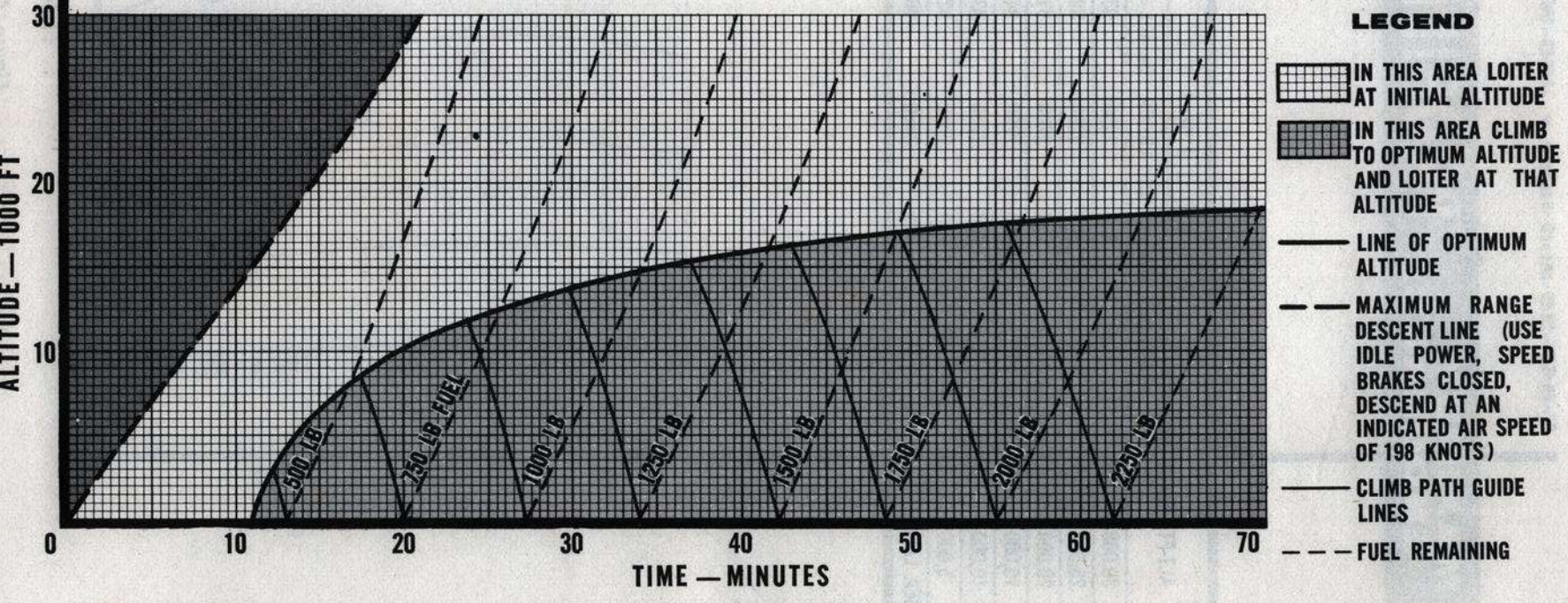


Figure A—54

NOTES

laximum range descent is at constant
ndicated airspeed of 198 knots
ecommended descent is at Mach .883
escend at idle power
peed brakes closed

DESCENTS



CONFIGURATION
LEAN + 2(230) GAL CLASS I TANKS



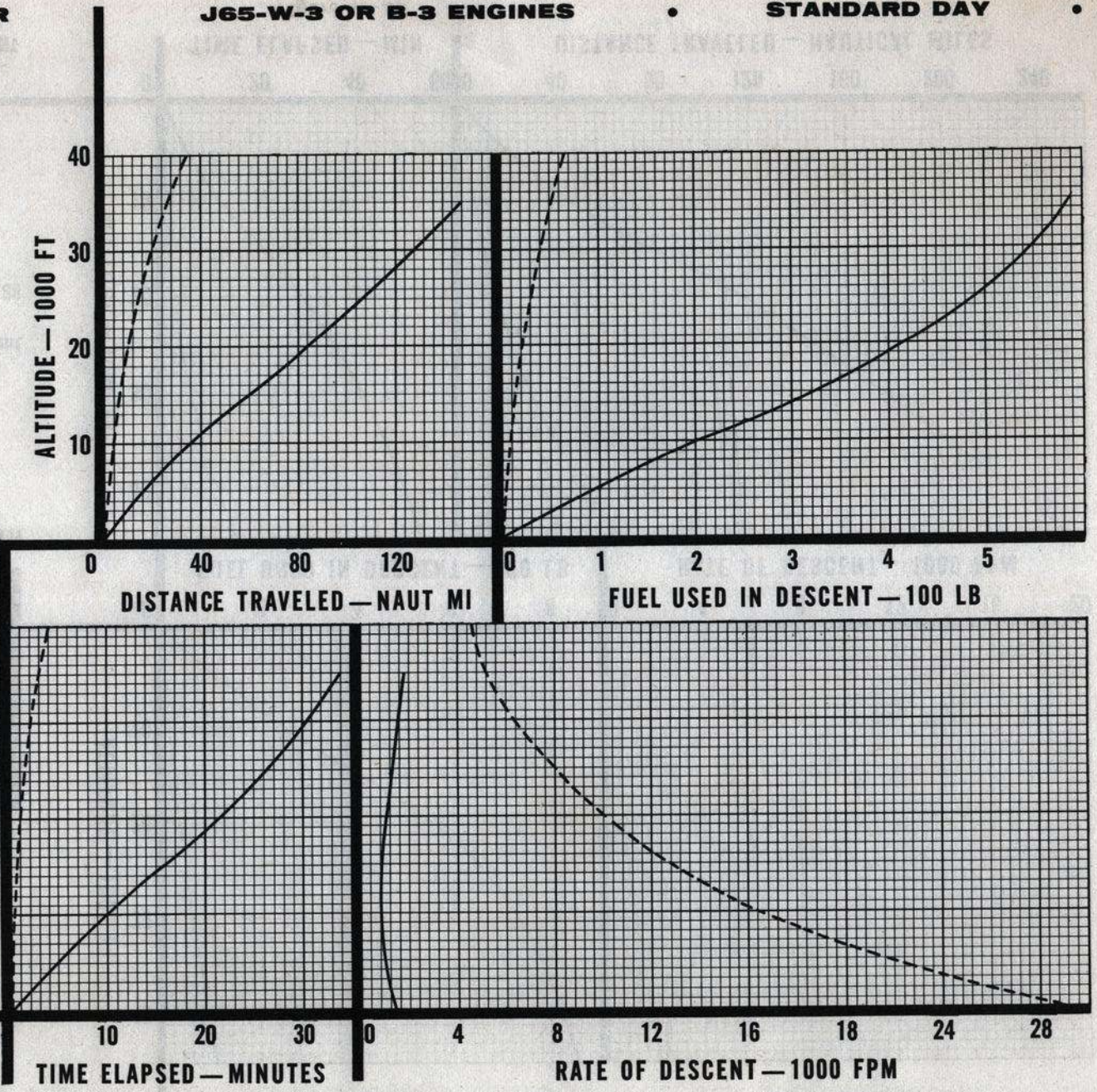


Figure A–56

DESCENTS

CONFIGURATION
CLEAN + 2(450) GAL CLASS I TANKS

NOTES

Maximum range descent is at constant indicated airspeed of 197 knots

Recommended descent is at Mach .875

Descend at idle power

Speed brakes closed

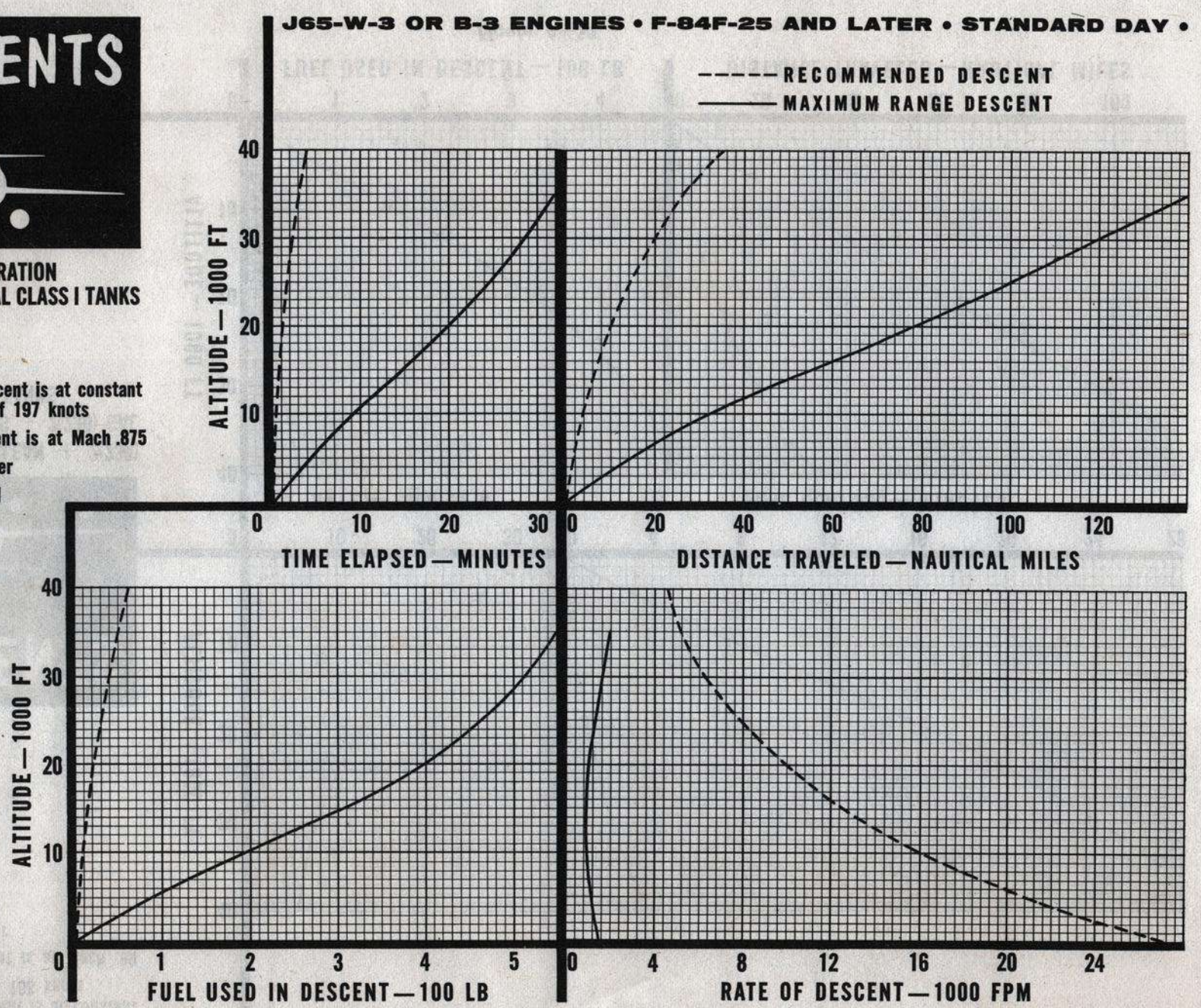


Figure A–57

NOTES

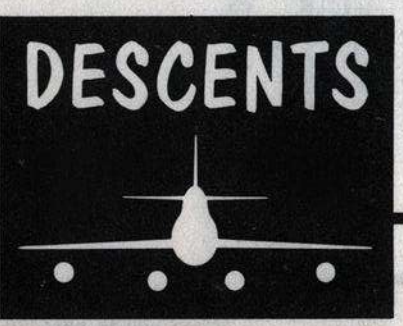
Maximum range descent is at constant indicated airspeed of 198 knots

Recommended descent is at Mach .89

Descend at idle power

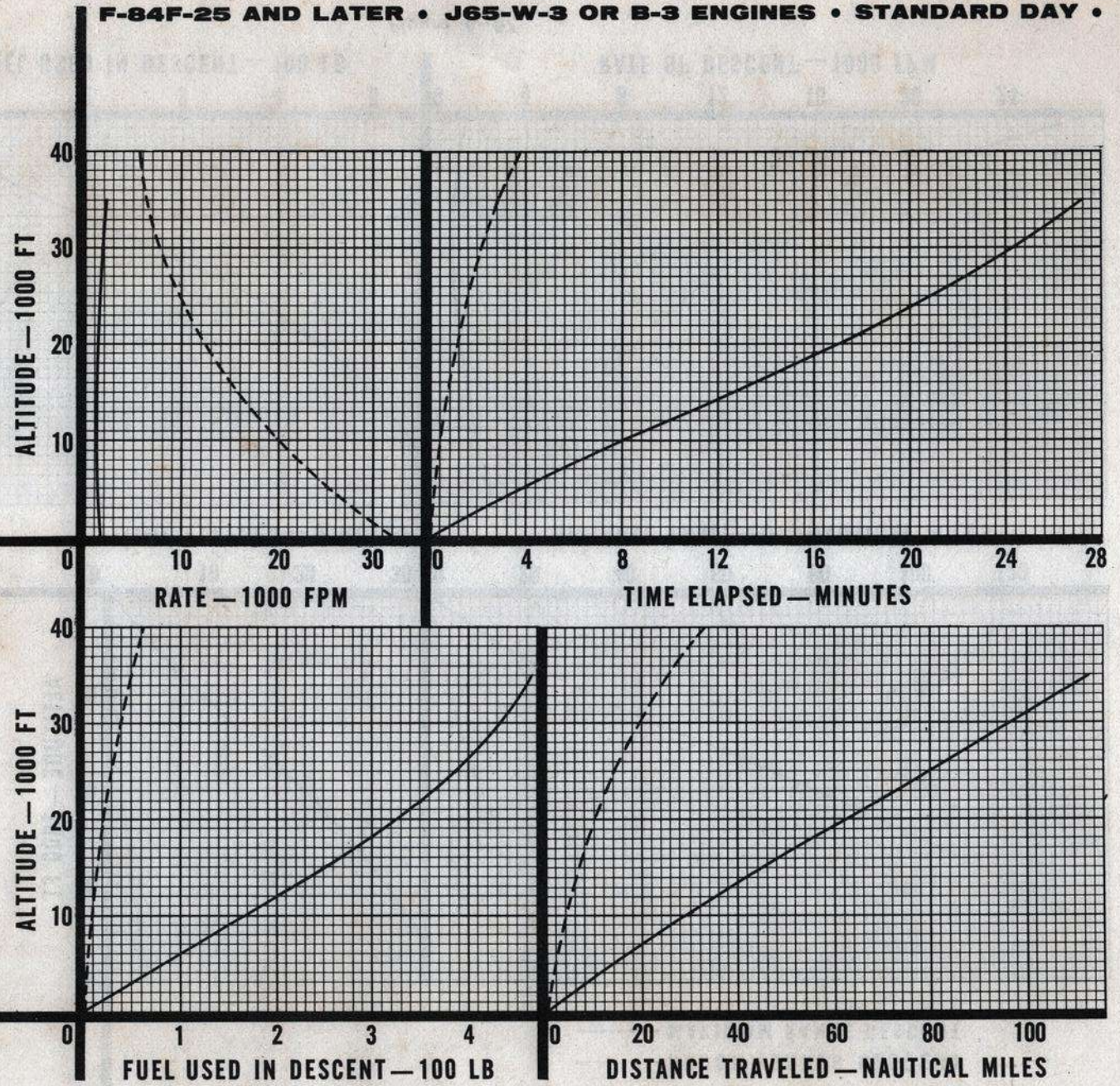
Speed brakes closed

DESCENTS



CONFIGURATION: CLEAN + 2(230) GAL CLASS I TANKS + 2(230) GAL CLASS II TANKS

F-84F-25 AND LATER • J65-W-3 OR B-3 ENGINES • STANDARD DAY •



----- RECOMMENDED DESCENT

——— MAXIMUM RANGE DESCENT

Figure A–58

NOTES

Maximum range descent is at constant indicated airspeed of 202 knots

Recommended descent is at Mach .89

Descend at idle power

Speed brakes closed



CONFIGURATION: CLEAN + 2(450) GAL CLASS I TANKS + 2(230) GAL CLASS II TANKS

----- RECOMMENDED DESCENT

——— MAXIMUM RANGE DESCENT

Figure A—59

NOTES

Maximum range descent is at constant indicated airspeed of 198 knots

Recommended descent is at Mach .88

Descend at idle power



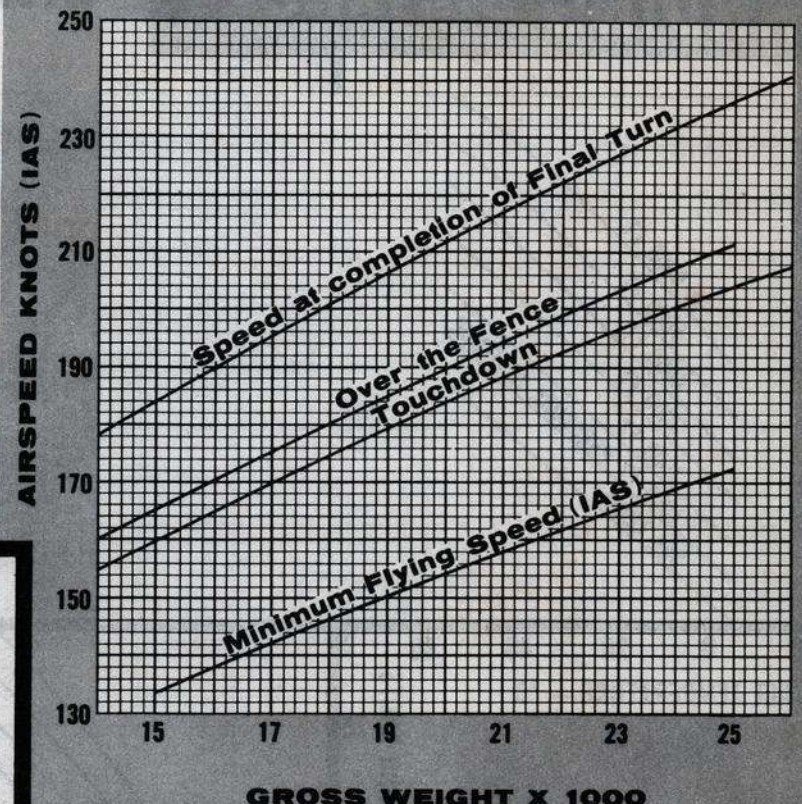
CONFIGURATION

CLEAN + 2(230) GAL CLASS I TANKS + 2 1000 LB BOMB + 4 HVARS

Figure A–60

APPROACH and LANDING SPEEDS

FLAPS UP
GEAR DOWN



FLAPS DOWN
GEAR DOWN

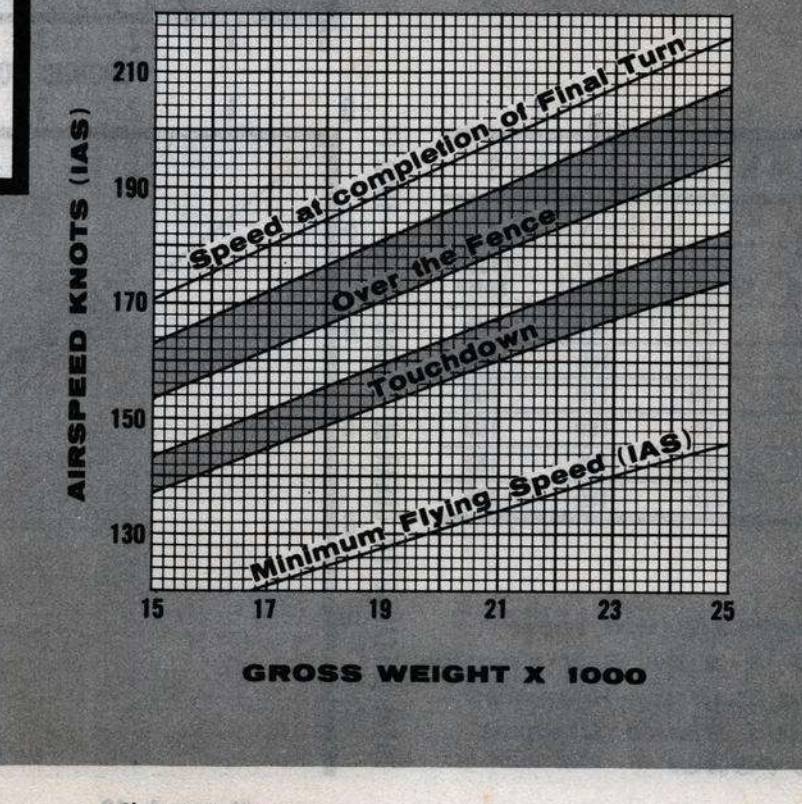
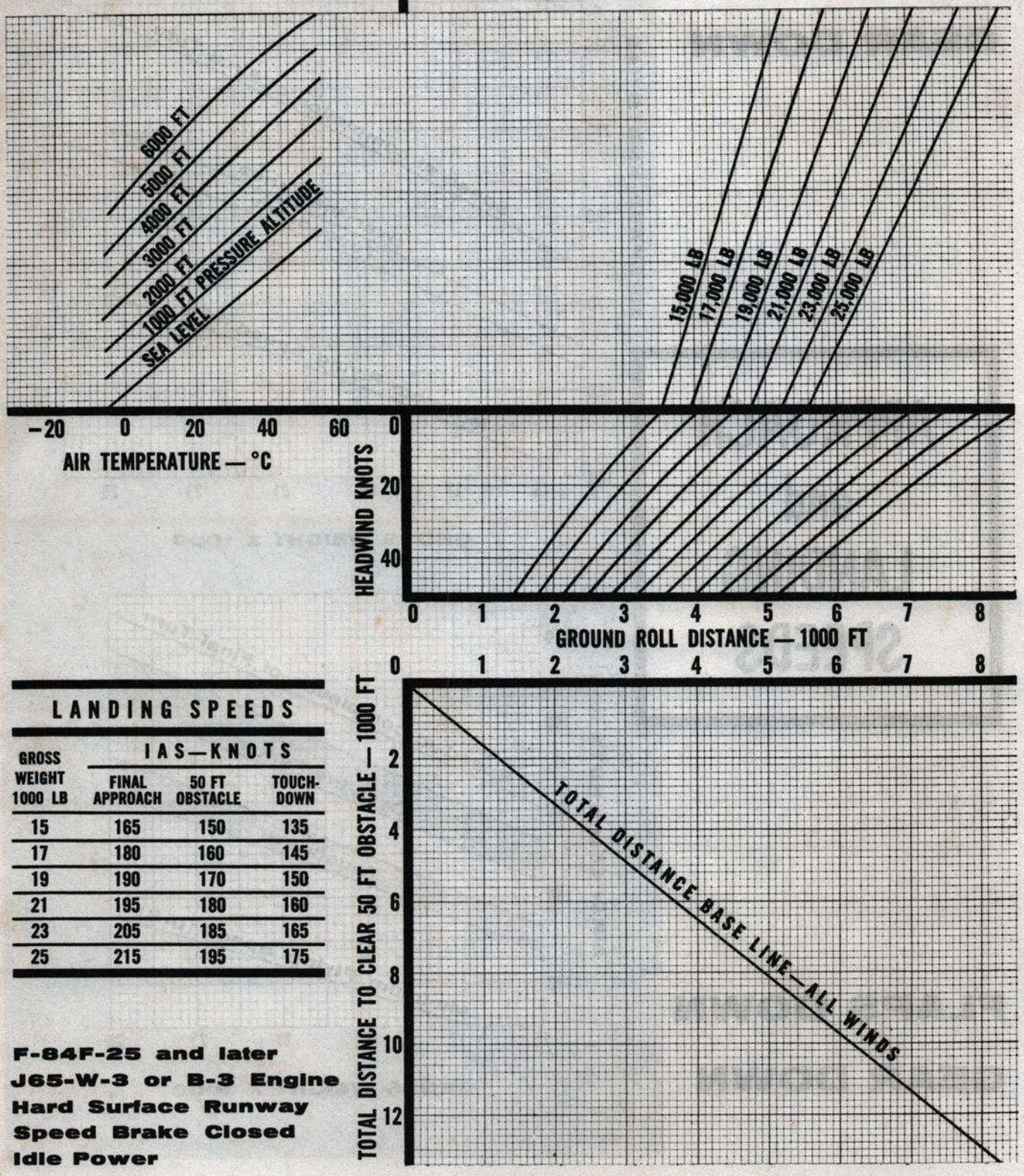


Figure A-61

LANDING DISTANCES

WITHOUT DRAG CHUTE



LANDING SPEEDS

GROSS WEIGHT 1000 LB	IAS—KNOTS		
	FINAL APPROACH	50 FT OBSTACLE	TOUCH-DOWN
15	165	150	135
17	180	160	145
19	190	170	150
21	195	180	160
23	205	185	165
25	215	195	175

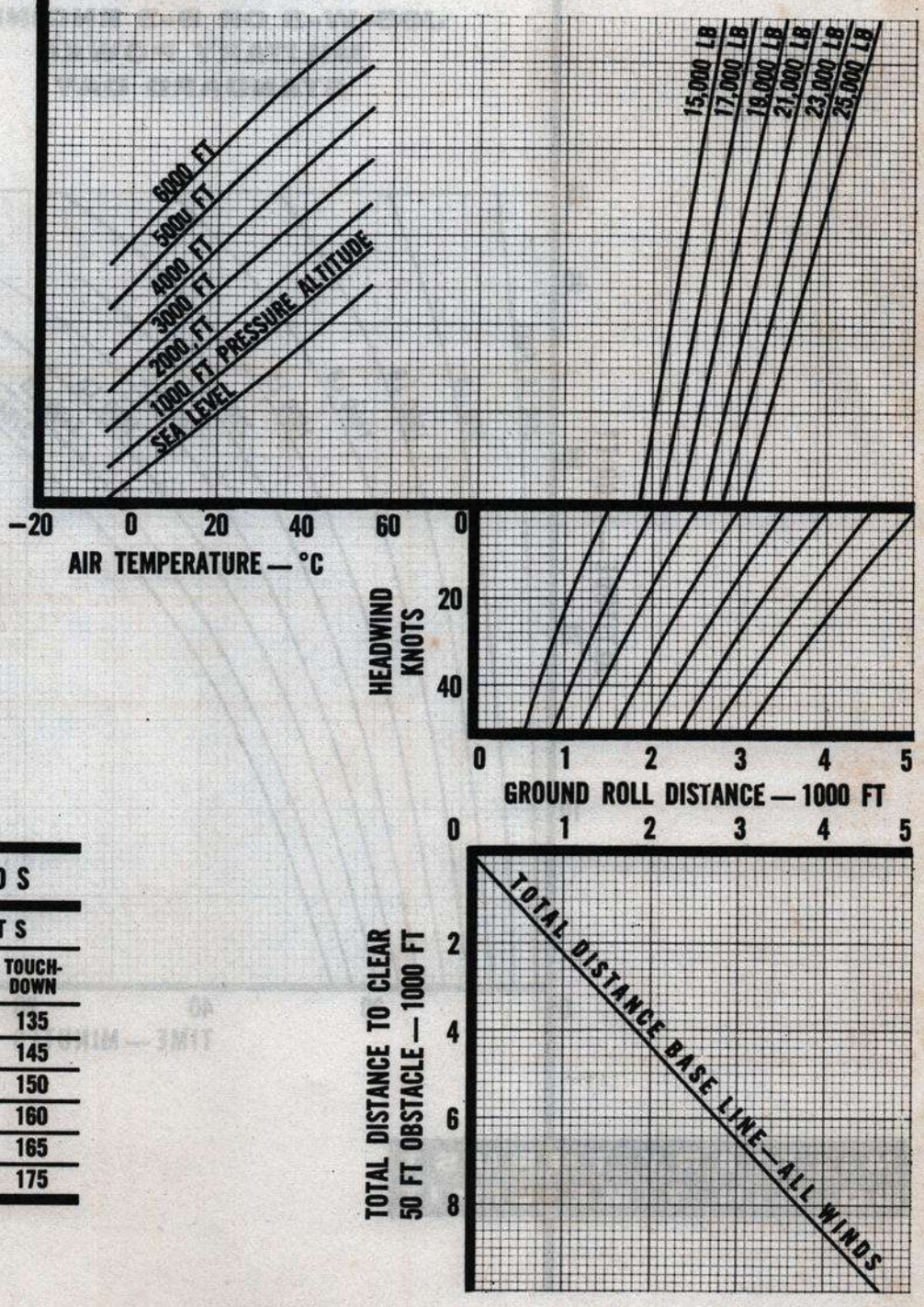
F-84F-25 and later
J65-W-3 or B-3 Engine
Hard Surface Runway
Speed Brake Closed
Idle Power

Figure A-62

• Idle Power | Hard Surface Runway • Speed Brake Closed • J65-W-3 or B-3 Engine • F-84F-25 and later •

LANDING DISTANCES

DRAG CHUTE INFLATED AT TOUCHDOWN



LANDING SPEEDS

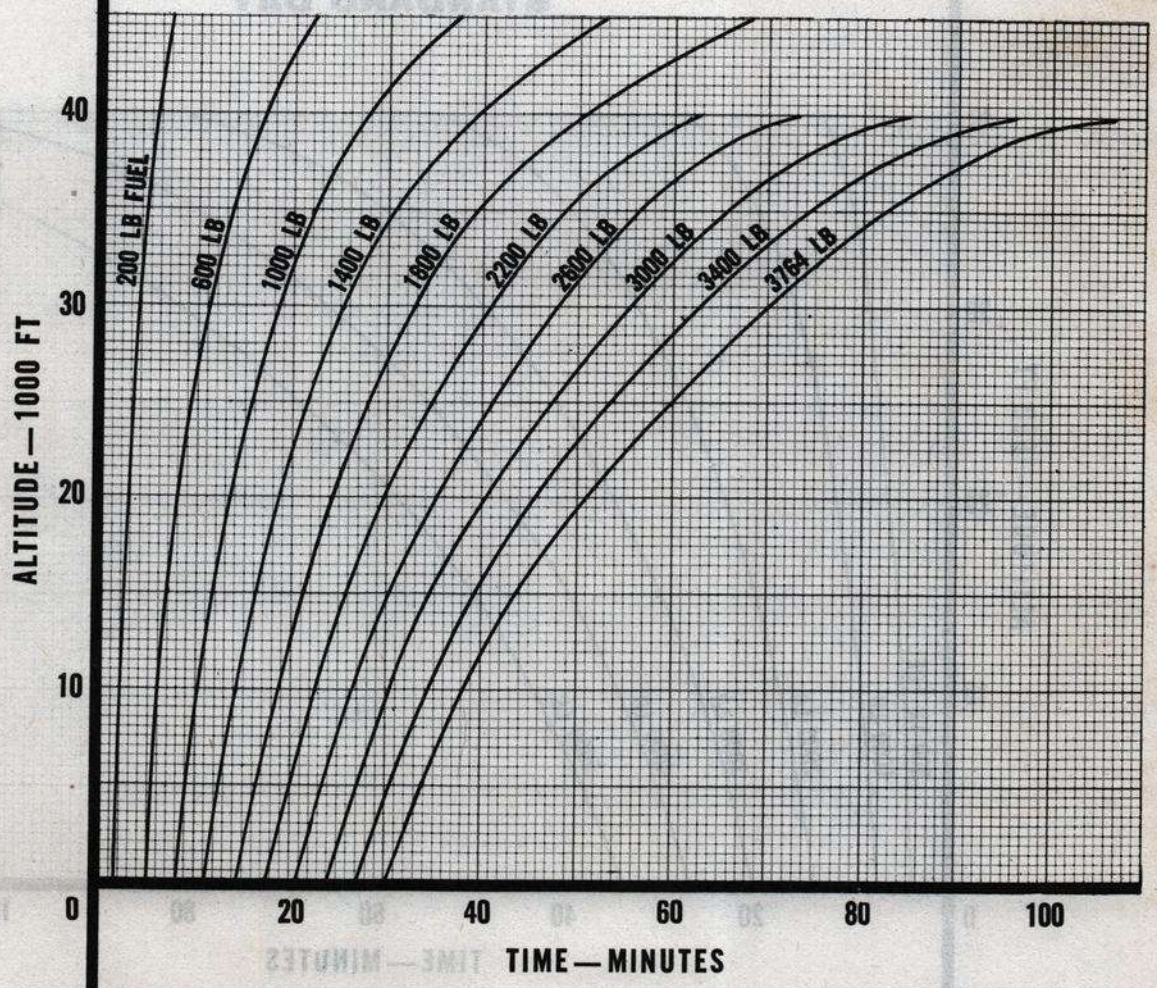
GROSS WEIGHT 1000 LB	IAS—KNOTS		
	FINAL APPROACH	50 FT OBSTACLE	TOUCH-DOWN
15	165	150	135
17	180	160	145
19	190	170	150
21	195	180	160
23	205	185	165
25	215	195	175

Figure A—63

COMBAT ALLOWANCE CHART



CLEAN AIRPLANE
F-84F-25 AND LATER
J65-W-3 OR B-3 ENGINES
NORMAL POWER
STANDARD DAY



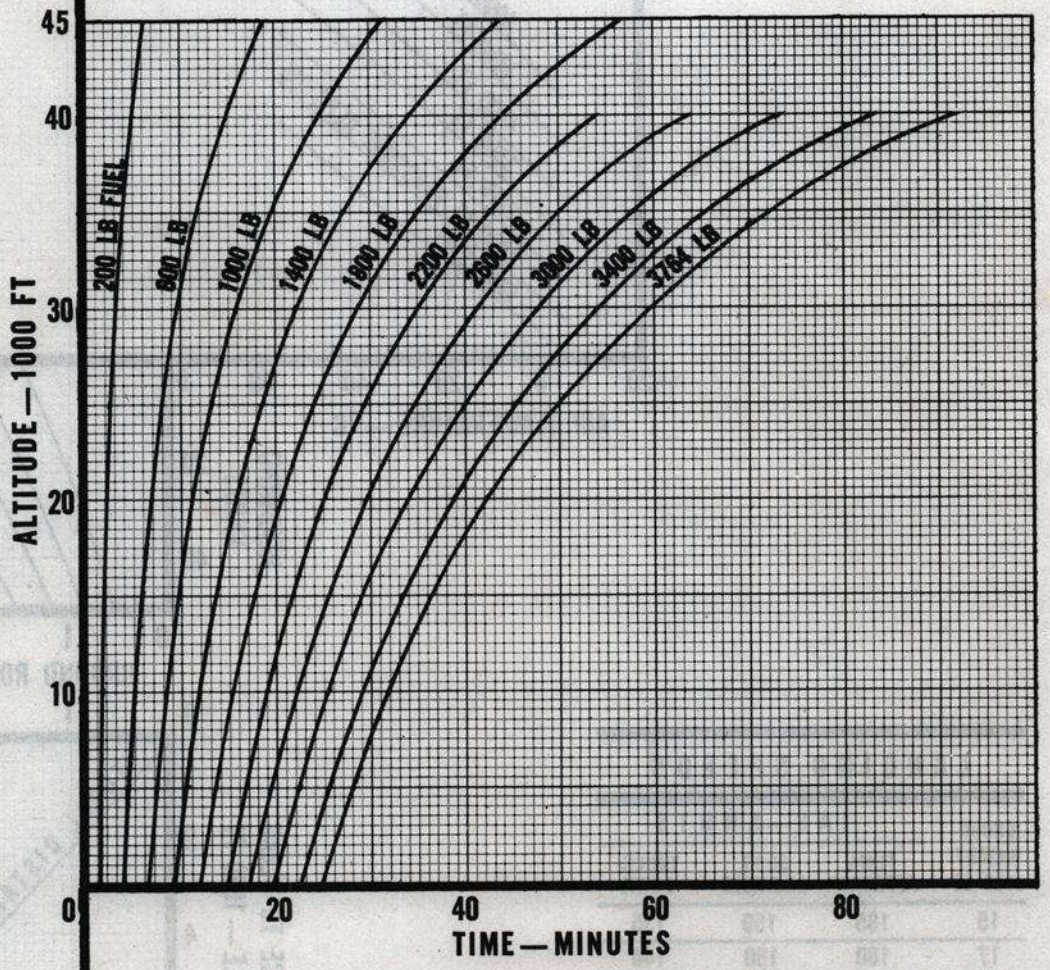
NORMAL THRUST
ZERO TIME LIMIT

Figure A—64 (Sheet 2 of 2)

COMBAT ALLOWANCE CHART



CLEAN AIRPLANE
F-84F-25 AND LATER
J65-W-3 OR B-3 ENGINES
MILITARY POWER
STANDARD DAY

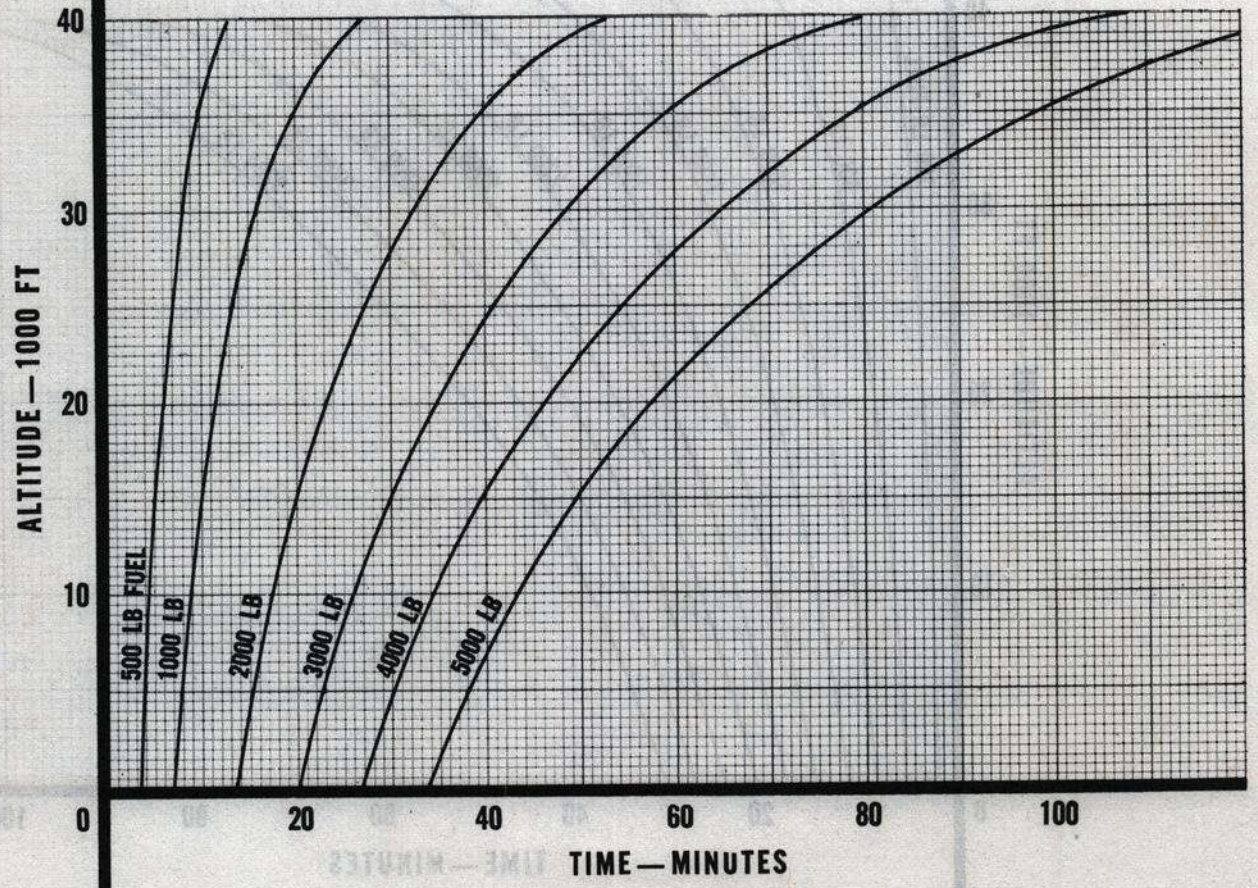


MILITARY THRUST
30 MIN TIME LIMIT

COMBAT ALLOWANCE CHART



CONFIGURATION:
CLEAN + 2(230) GAL CLASS I TANKS
F-84F-25 AND LATER
J65-W-3 OR B-3 ENGINES
MILITARY POWER
STANDARD DAY



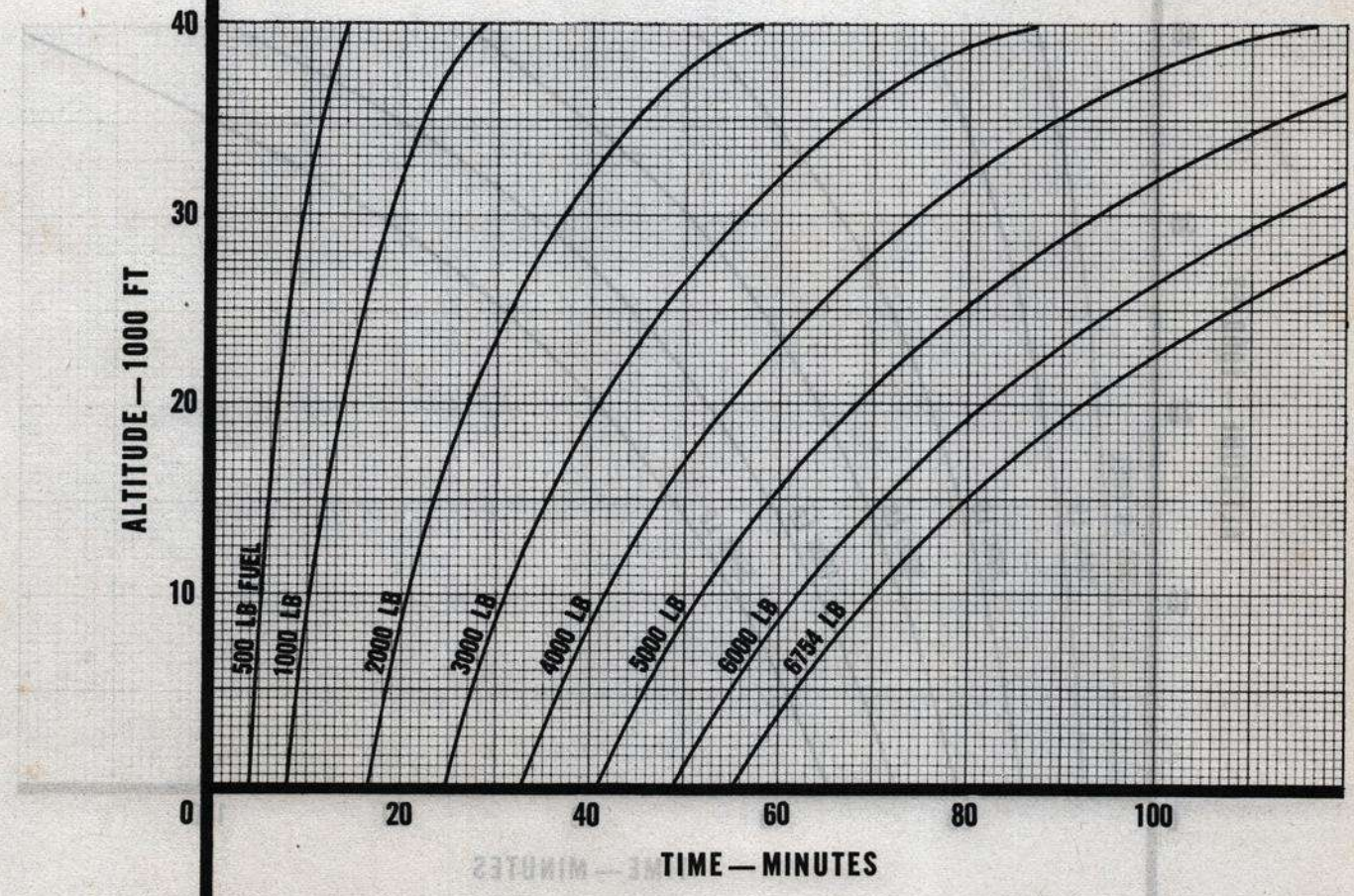
MILITARY THRUST
30 MIN TIME LIMIT

Figure A—65 (Sheet 1 of 2)

COMBAT ALLOWANCE CHART



CONFIGURATION:
CLEAN + 2(230) GAL CLASS I TANKS
F-84F-25 AND LATER
J65-W-3 OR B-3 ENGINES
NORMAL POWER
STANDARD DAY



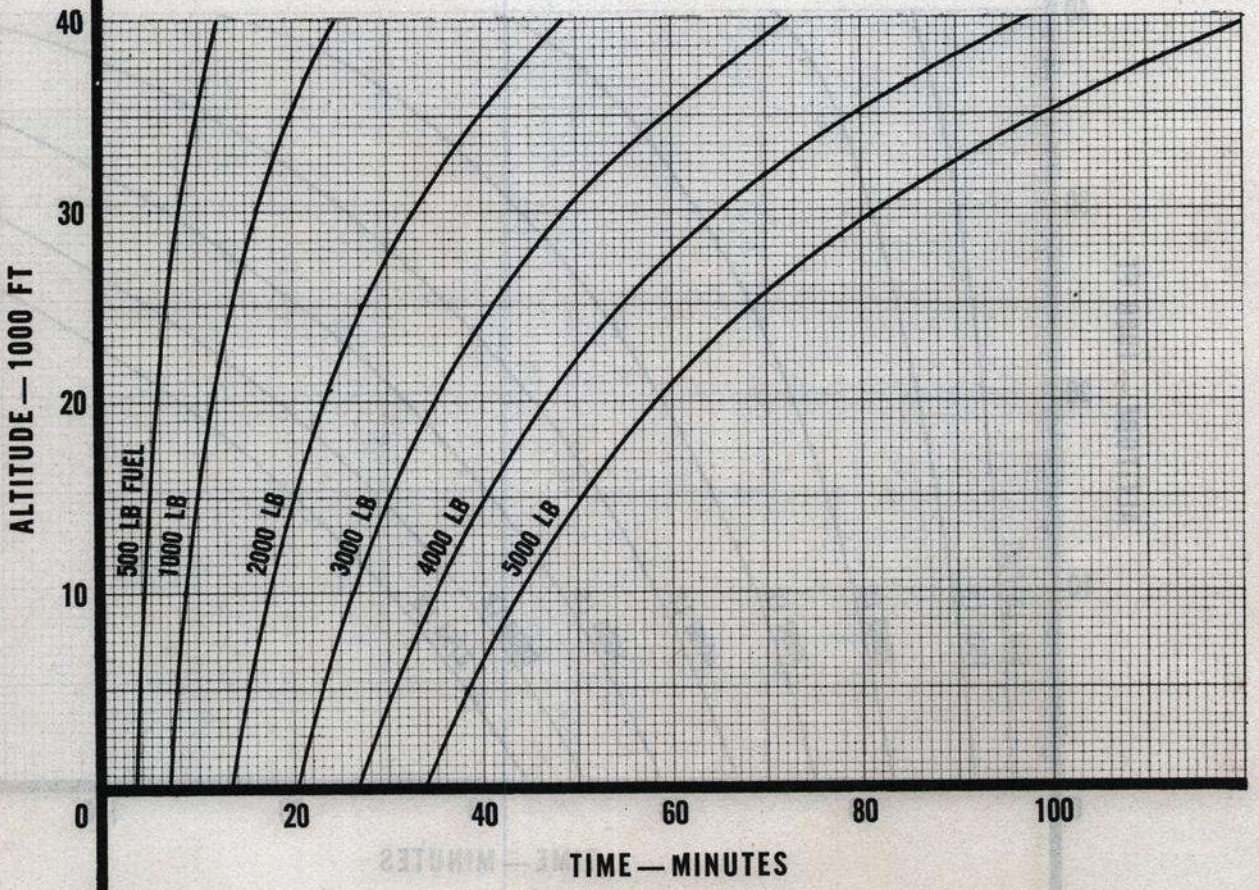
NORMAL THRUST
ZERO TIME LIMIT

Figure A—65 (Sheet 2 of 2)

COMBAT ALLOWANCE CHART



CONFIGURATION:
CLEAN + 2(450) GAL CLASS I TANKS
F-84F-25 AND LATER
J65-W-3 OR B-3 ENGINES
MILITARY POWER
STANDARD DAY



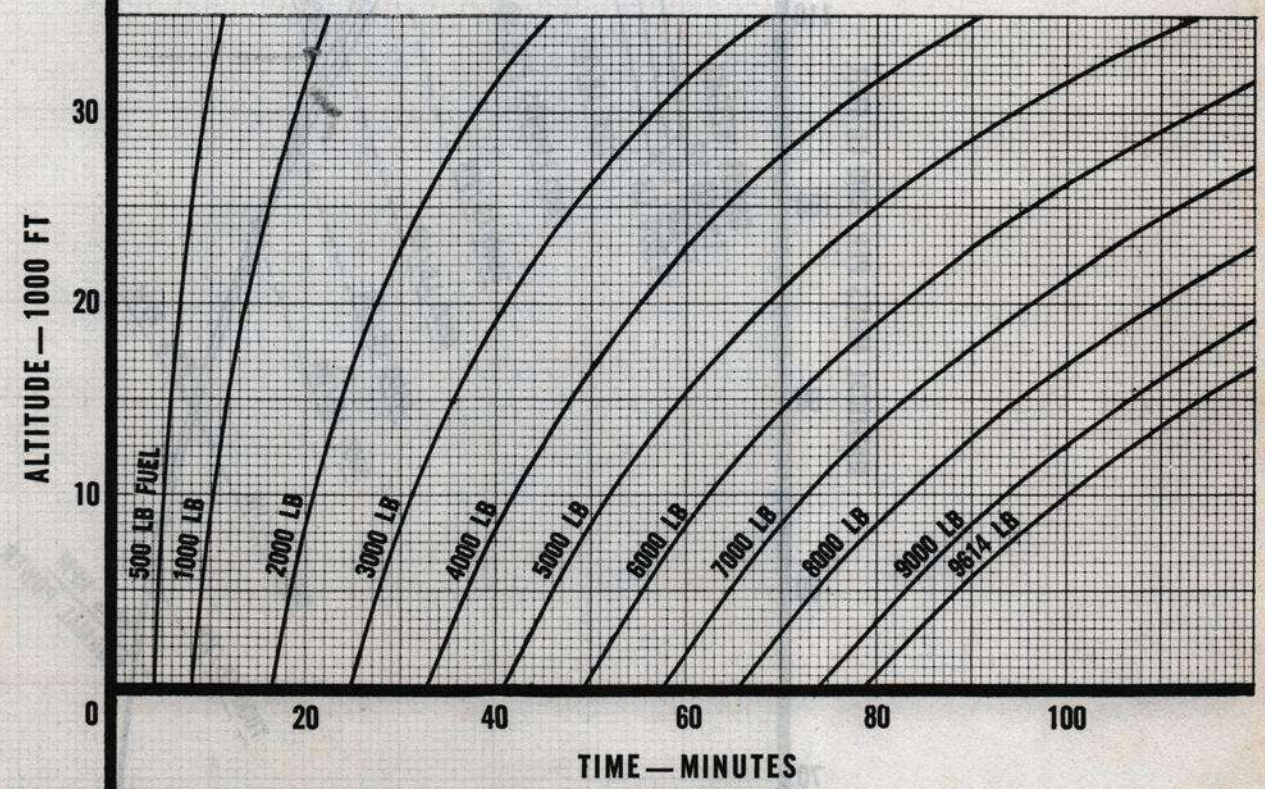
MILITARY THRUST
30 MIN TIME LIMIT

Figure A—66 (Sheet 1 of 2)

COMBAT ALLOWANCE CHART



CONFIGURATION:
CLEAN + 2(450) GAL CLASS I TANKS
F-84F-25 AND LATER
J65-W-3 OR B-3 ENGINES
NORMAL POWER
STANDARD DAY

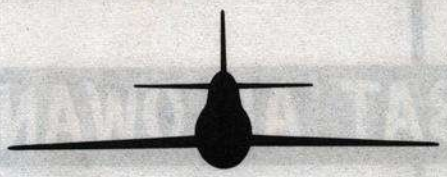


NORMAL THRUST
ZERO TIME LIMIT

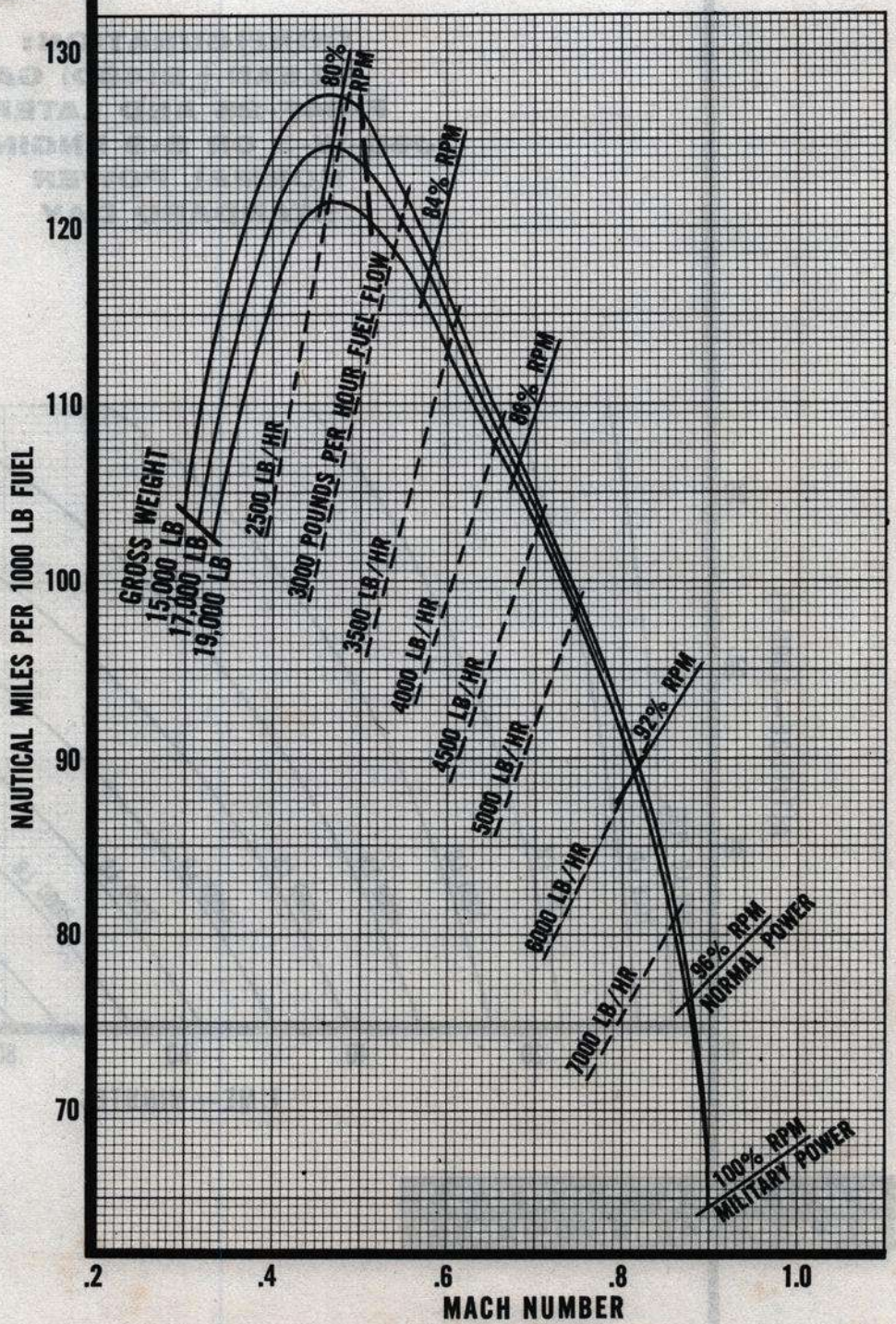
Figure A—66 (Sheet 2 of 2)

• F-84F-25 and later • J65-W-3 or B-3 Engines • Standard Day •

NAUTICAL MILES
PER 1000 POUNDS FUEL
SEA LEVEL



CONFIGURATION: CLEAN

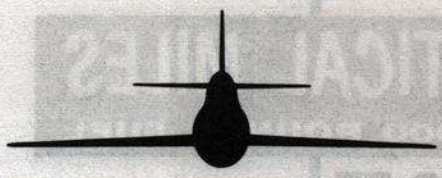


——— MAXIMUM ENDURANCE
— — RECOMMENDED CRUISE MACH NUMBER

Figure A—67 (Sheet 1 of 6)

F-84F-25 and later • J65-W-3 or B-3 Engines • Standard Day •

NAUTICAL MILES
PER 1000 POUNDS FUEL
15,000 FT



CONFIGURATION: CLEAN

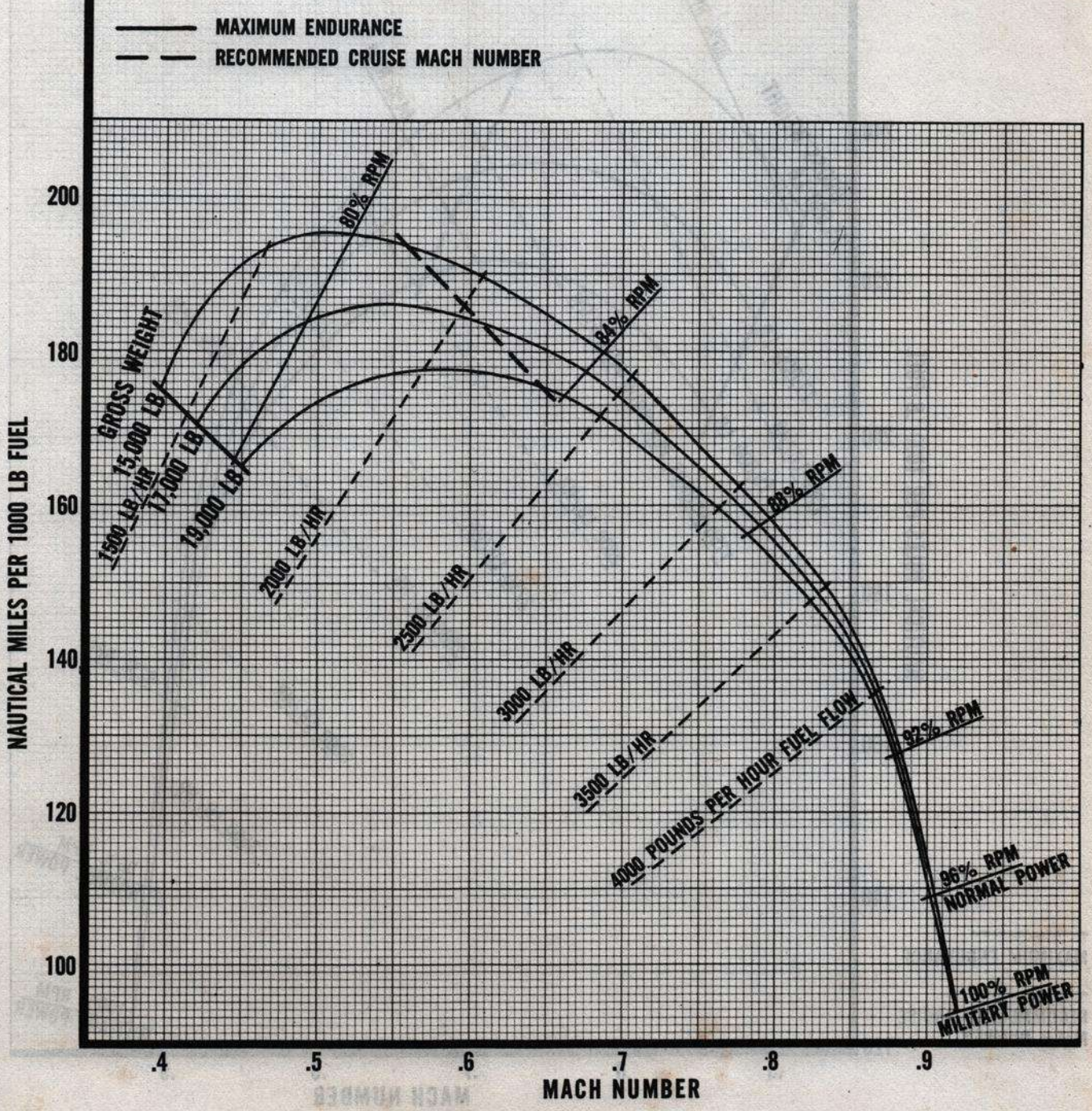


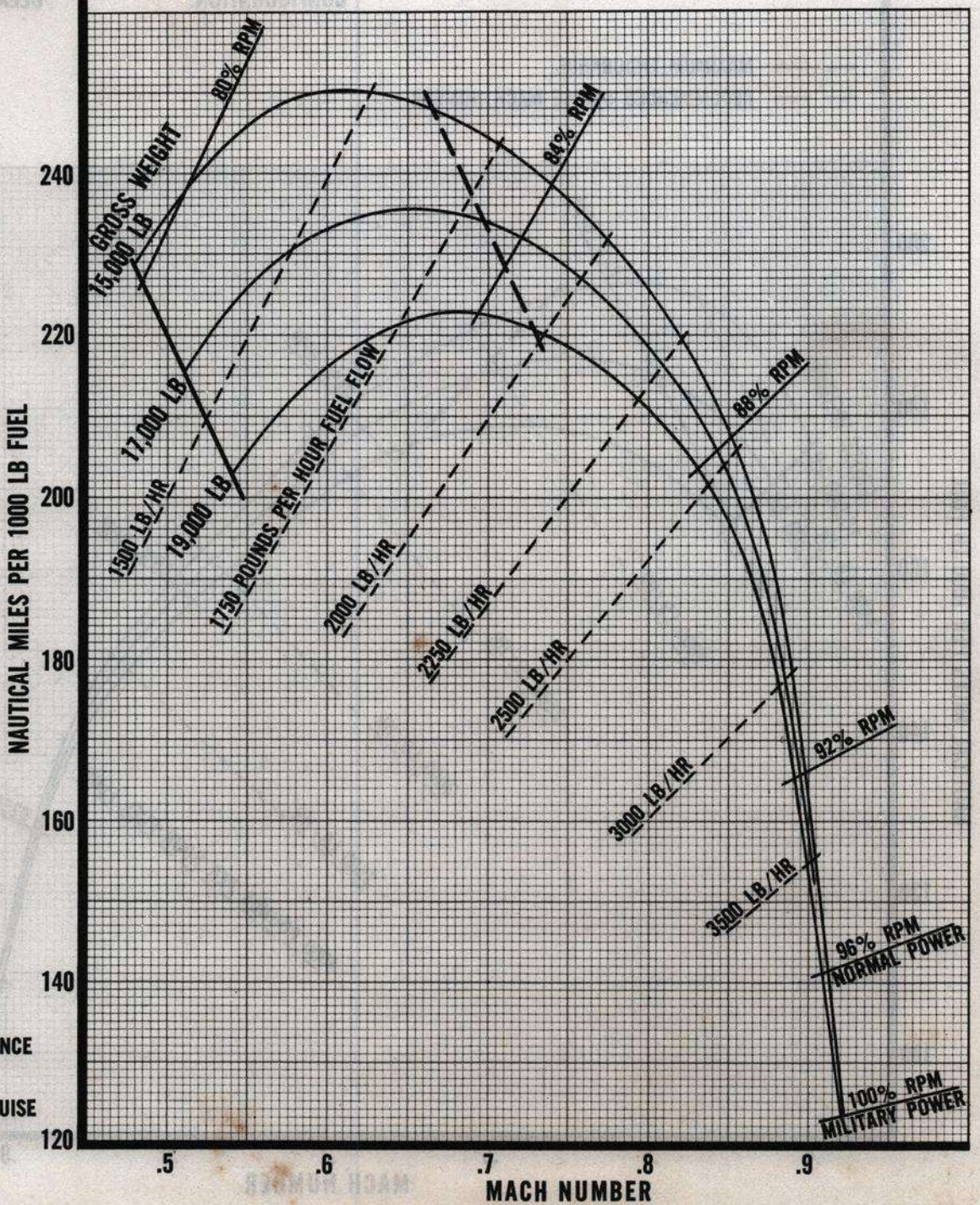
Figure A-67 (Sheet 2 of 6)

Standard Day **F-84F-25 and later** • **J65-W-3 or B-3 Engines** •

NAUTICAL MILES
PER 1000 POUNDS FUEL
25,000 FT



CONFIGURATION: CLEAN

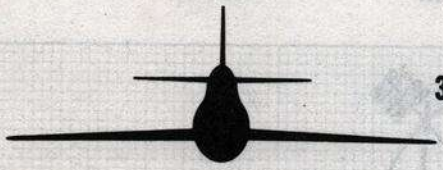


MAXIMUM ENDURANCE

RECOMMENDED CRUISE MACH NUMBER

• F-84F-25 and later | J65-W-3 or B-3 Engines • Standard Day •

NAUTICAL MILES
PER 1000 POUNDS FUEL
35,000 FT



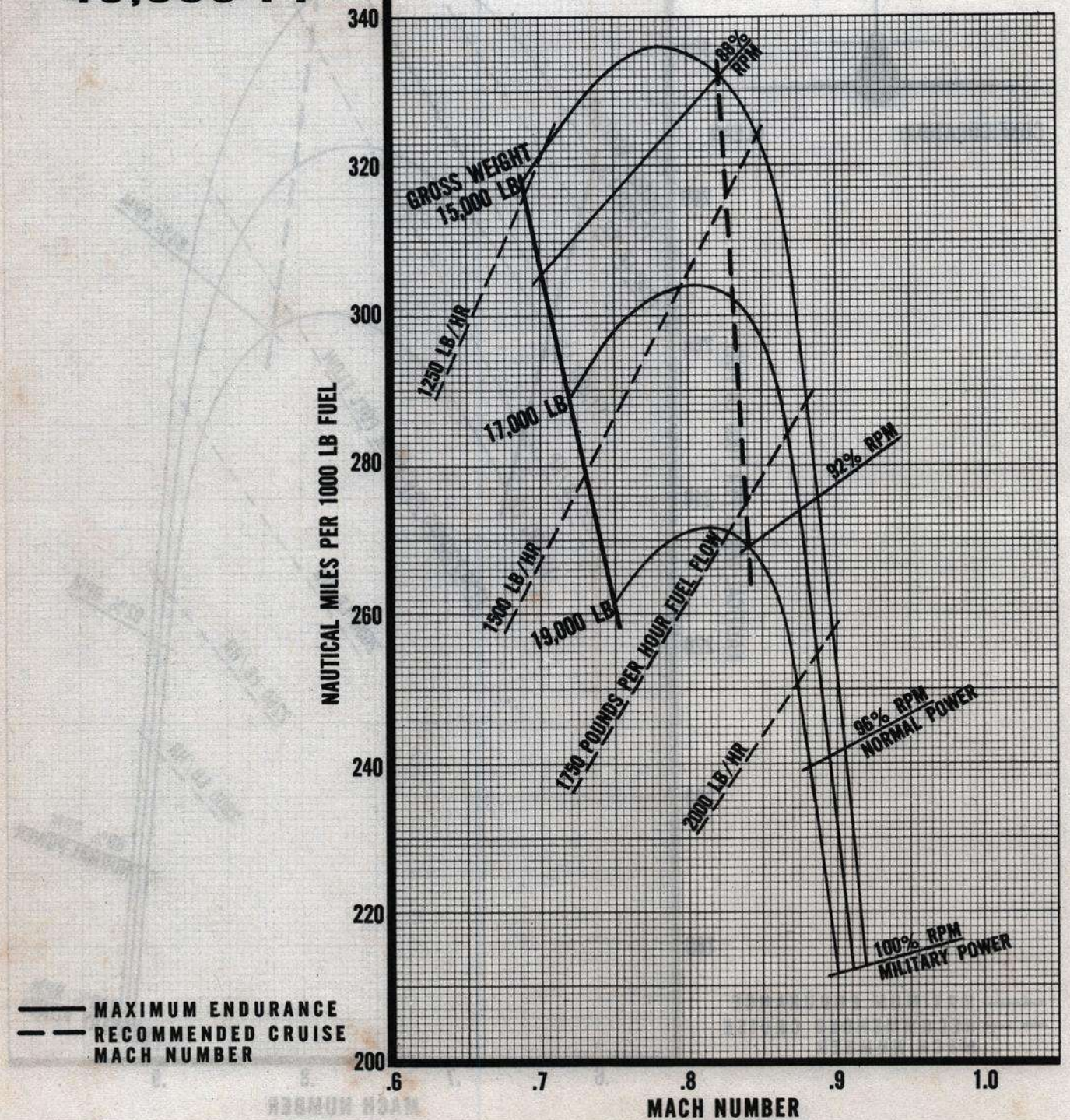
CONFIGURATION: CLEAN

• F-84F-25 and later • J65-W-3 or B-3 Engines • Standard Day •

NAUTICAL MILES
PER 1000 POUNDS FUEL
40,000 FT

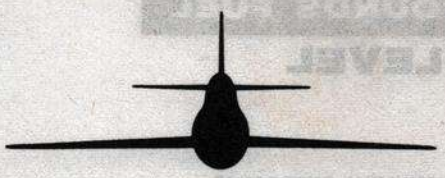


CONFIGURATION: CLEAN

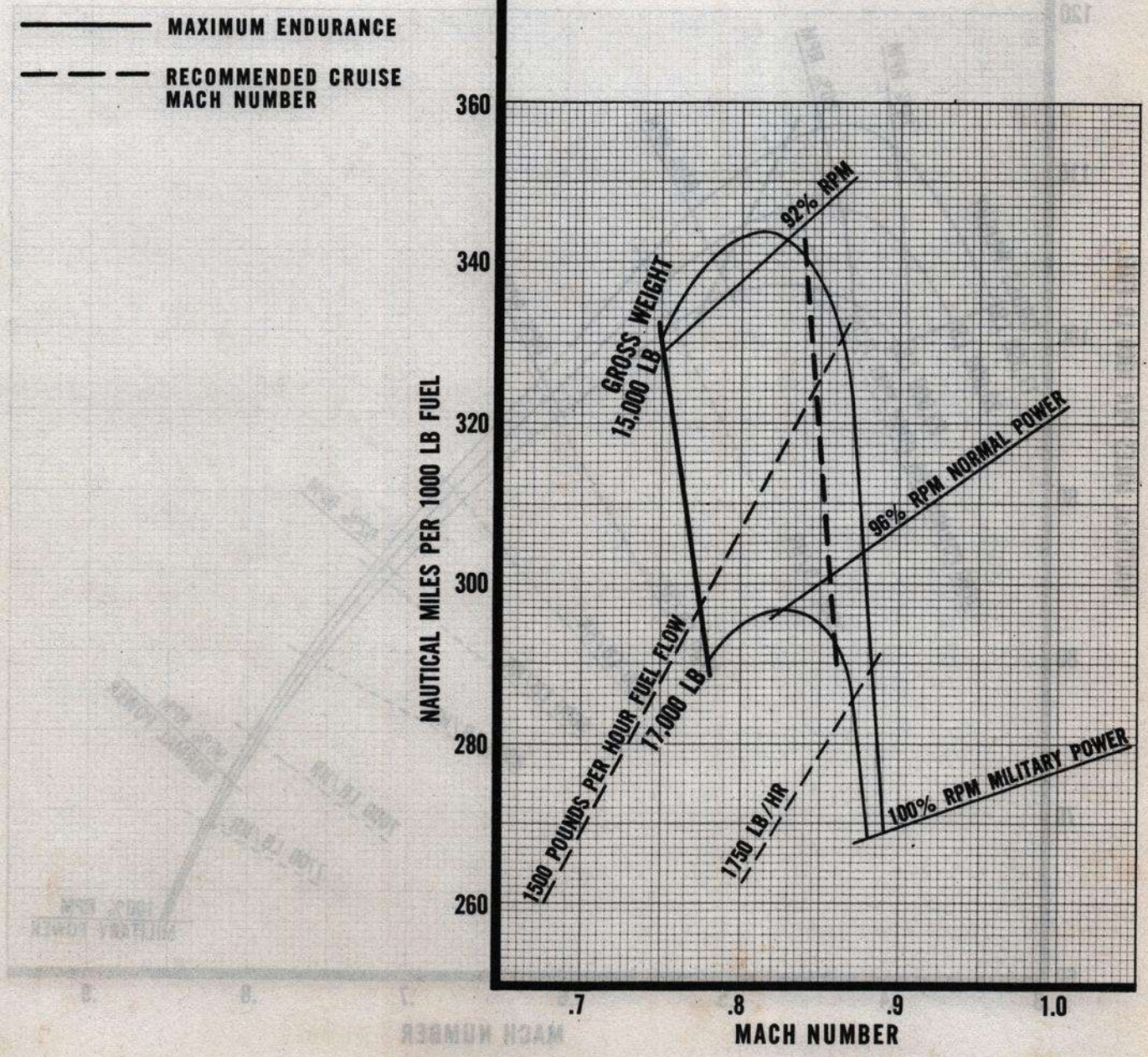


• J65-W-3 or B-3 Engines • F-84F-25 and later • Standard Day •

NAUTICAL MILES
PER 1000 POUNDS FUEL
45,000 FT



CONFIGURATION: CLEAN



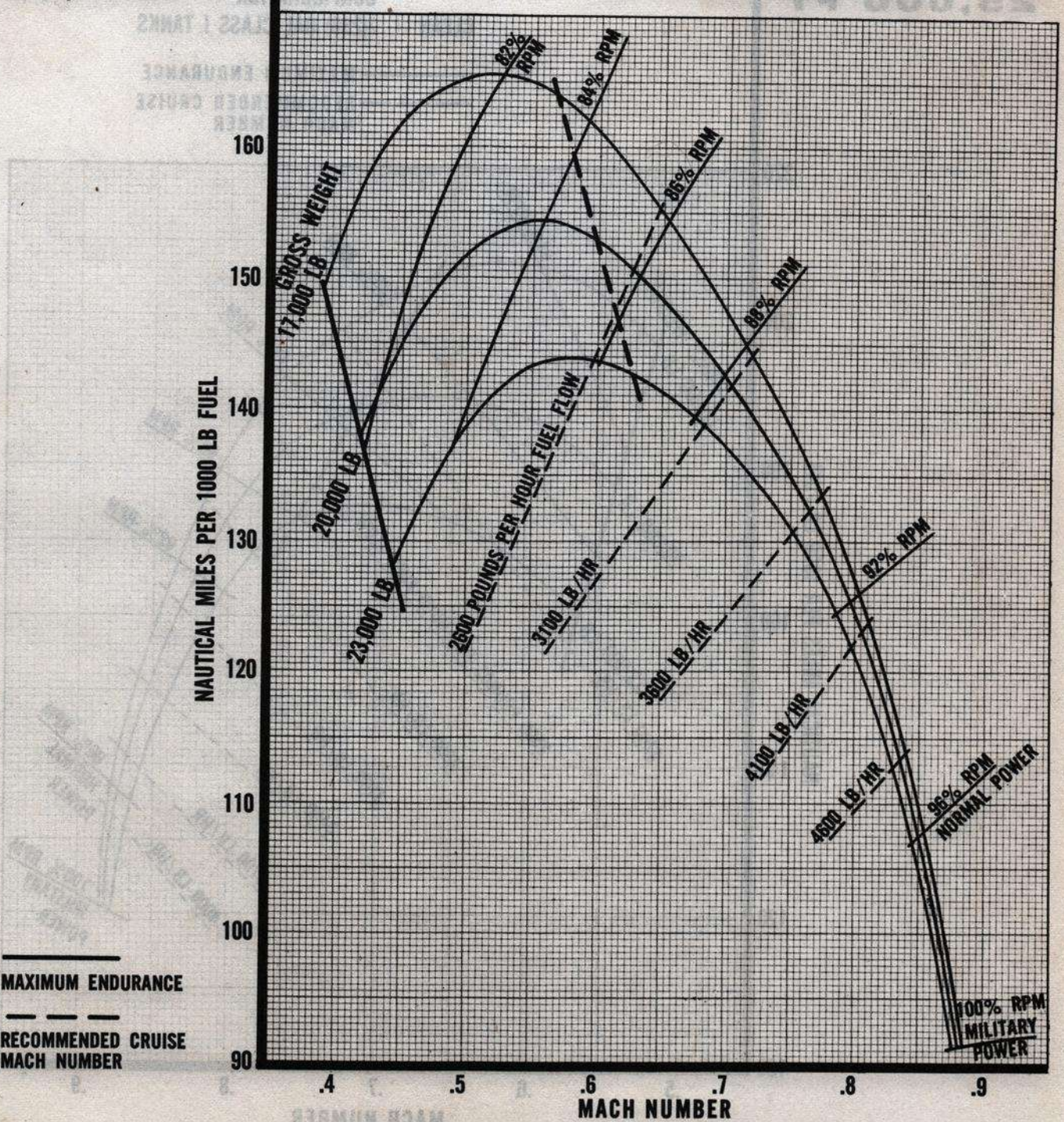
• Standard Day • F-84F-25 and later • J65-W-3 or B-3 Engines •

NAUTICAL MILES
PER 1000 POUNDS FUEL

15,000 FT



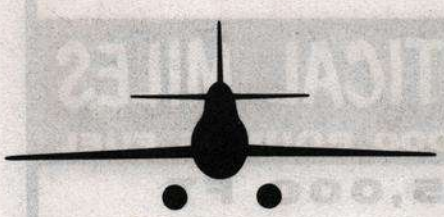
CONFIGURATION
CLEAN + 2(230) GAL CLASS I TANKS



F-84F-25 and later • J65-W-3 or B-3 Engines • Standard Day •

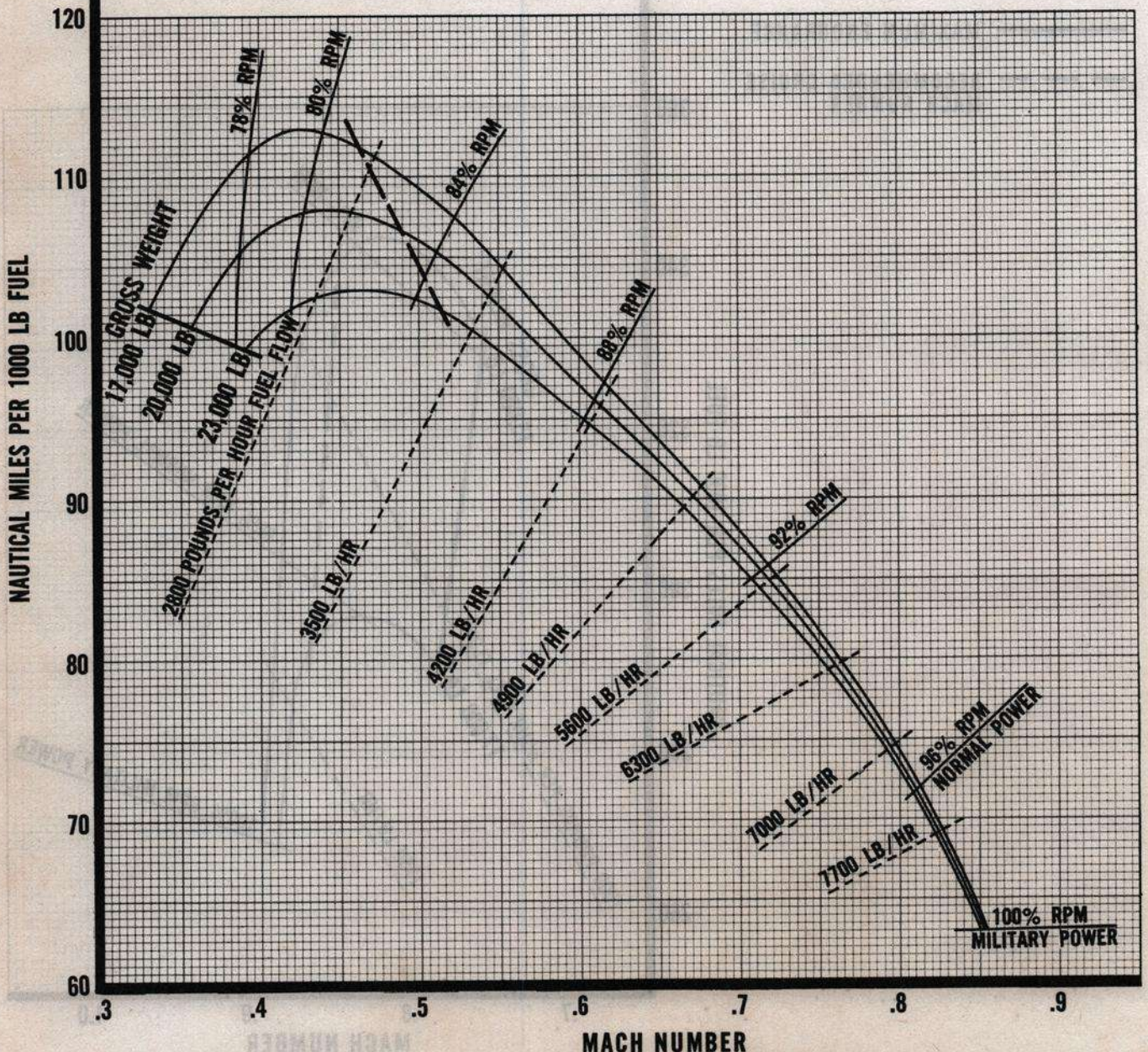
NAUTICAL MILES PER 1000 POUNDS FUEL

SEA LEVEL



CONFIGURATION
CLEAN + 2(230) GAL CLASS I TANKS

——— MAXIMUM ENDURANCE
— — RECOMMENDED CRUISE MACH NUMBER



• Standard Day • F-84F-25 and later • J65-W-3 or B-3 Engines •

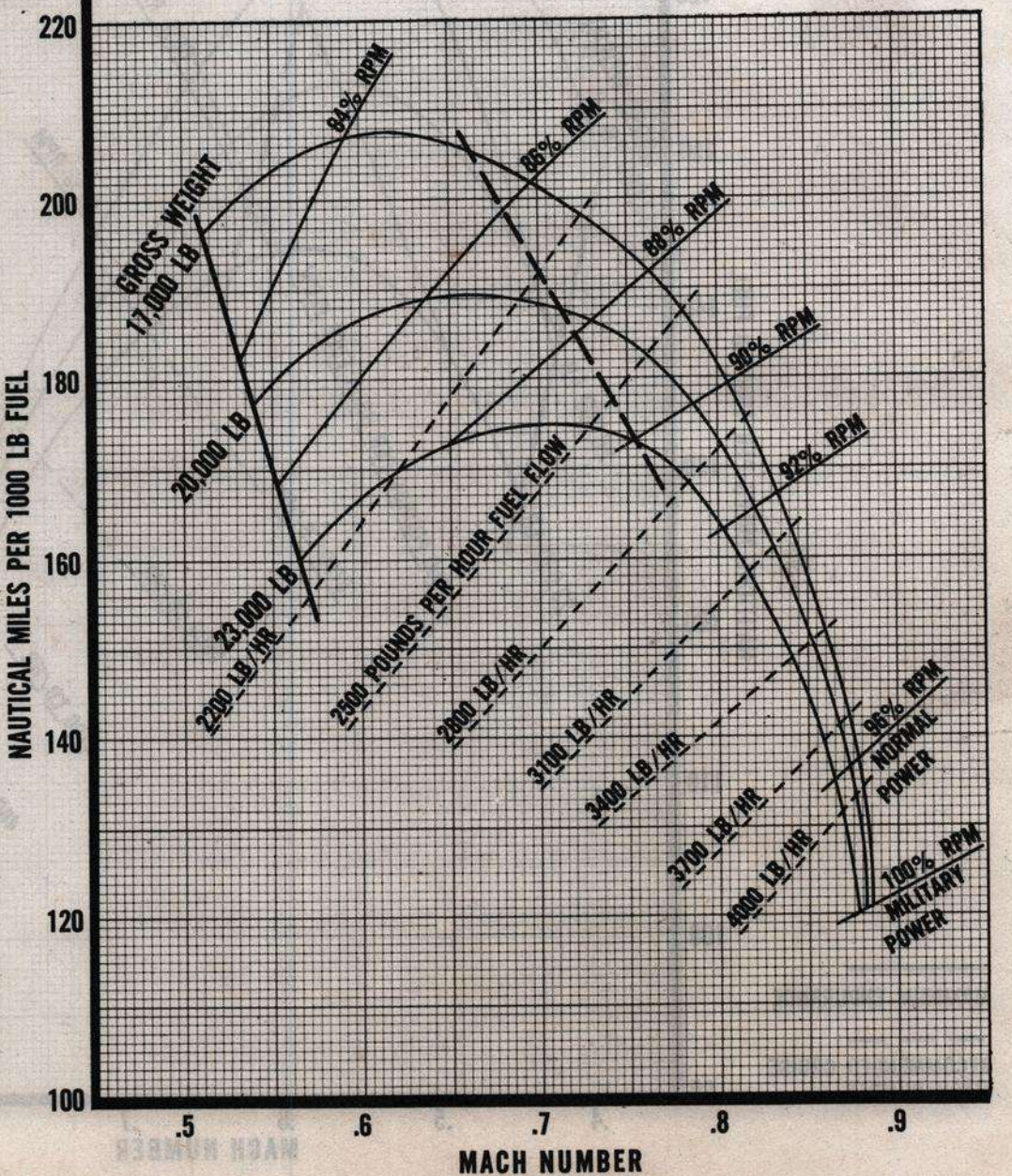
NAUTICAL MILES PER 1000 POUNDS FUEL

25,000 FT



CONFIGURATION
CLEAN + 2(230) GAL CLASS I TANKS

——— MAXIMUM ENDURANCE
— — — RECOMMENDED CRUISE MACH NUMBER

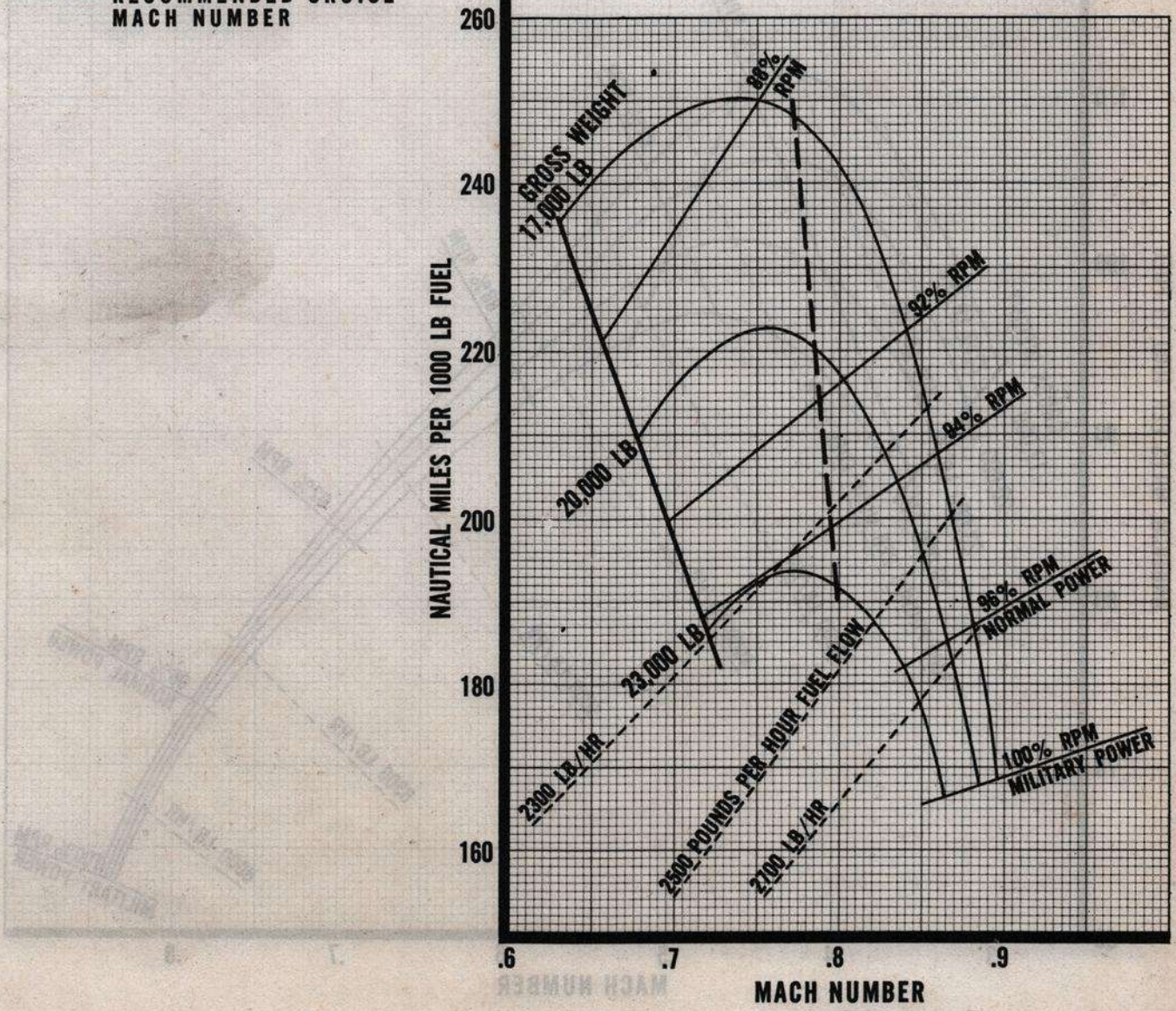


• J65-W-3 or B-3 Engines • F-84F-25 and later • Standard Day •

NAUTICAL MILES
PER 1000 POUNDS FUEL
35,000 FT



CONFIGURATION
CLEAN + 2(230) GAL CLASS I TANKS



• Standard Day • F-84F-25 and later • J65-W-3 or B-3 Engines •

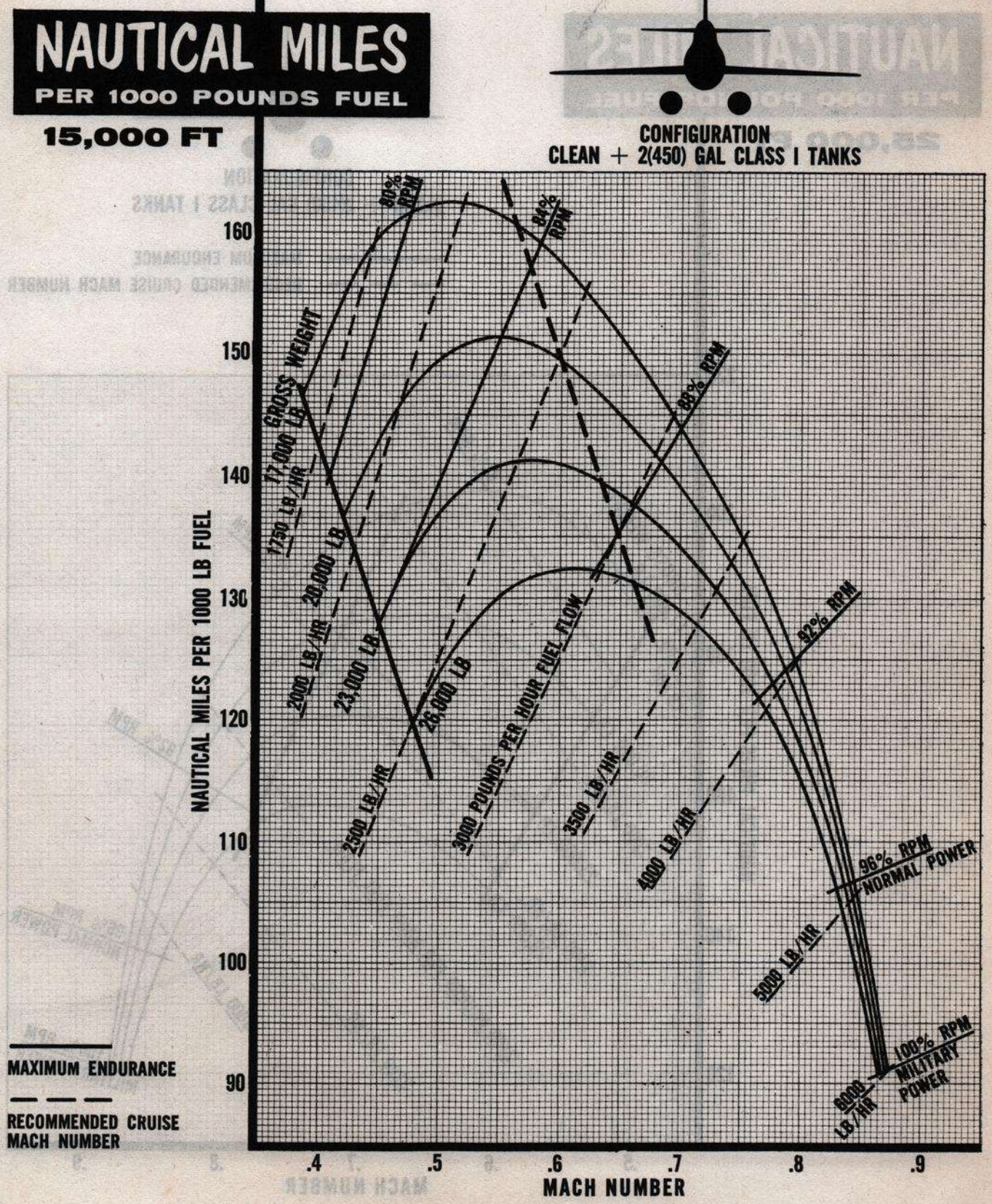


Figure A-69 (Sheet 2 of 4)

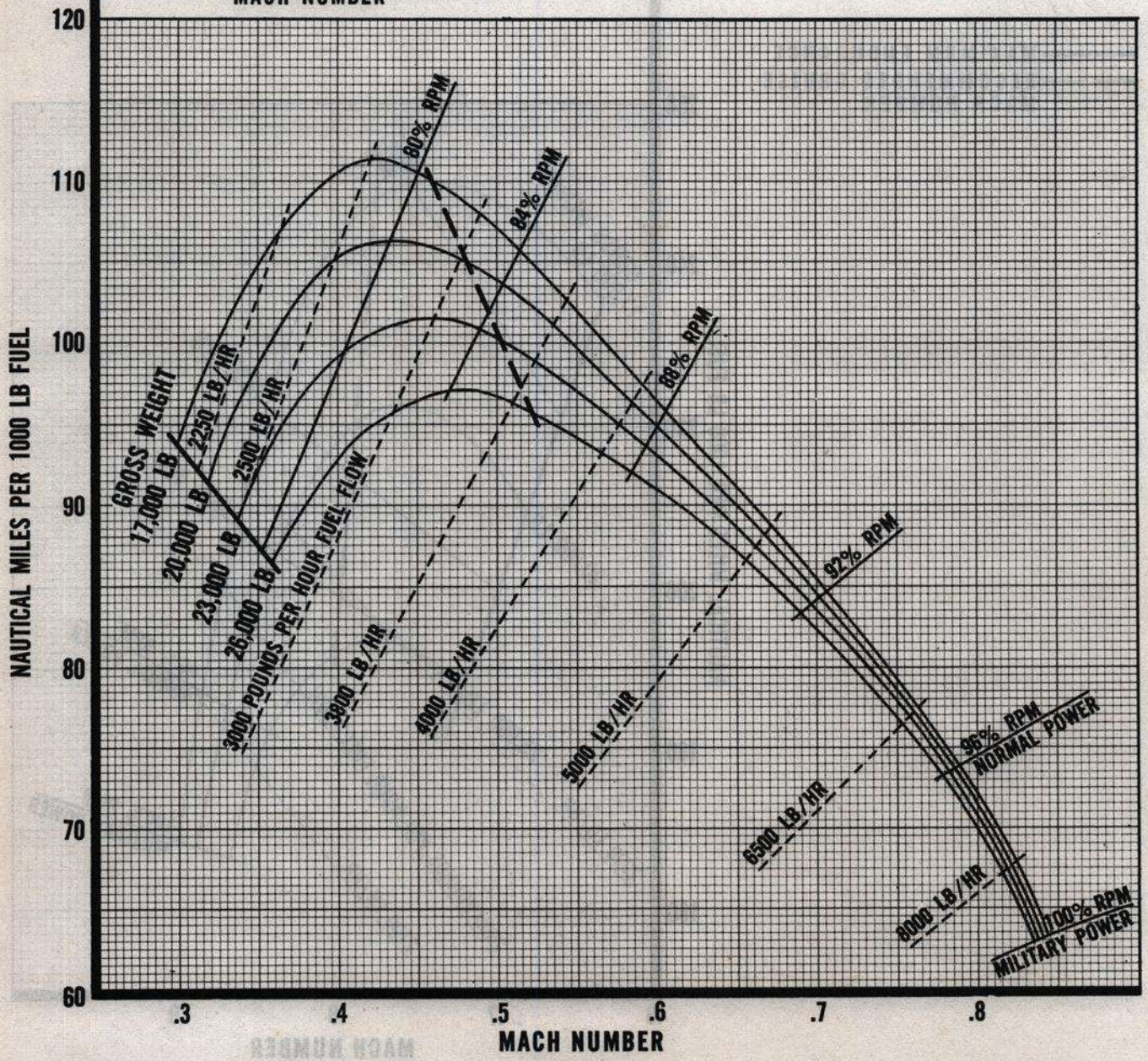
F-84F-25 and later • J65-W-3 or B-3 Engines • Standard Day •

NAUTICAL MILES
PER 1000 POUNDS FUEL

SEA LEVEL



CONFIGURATION
CLEAN + 2(450) GAL CLASS I TANKS



• J65-W-3 or B-3 Engines • F-84F-25 and later • Standard Day •

NAUTICAL MILES
PER 1000 POUNDS FUEL
35,000 FT



CONFIGURATION
CLEAN + 2(450) GAL CLASS I TANKS

——— MAXIMUM ENDURANCE

— — RECOMMENDED CRUISE MACH NUMBER

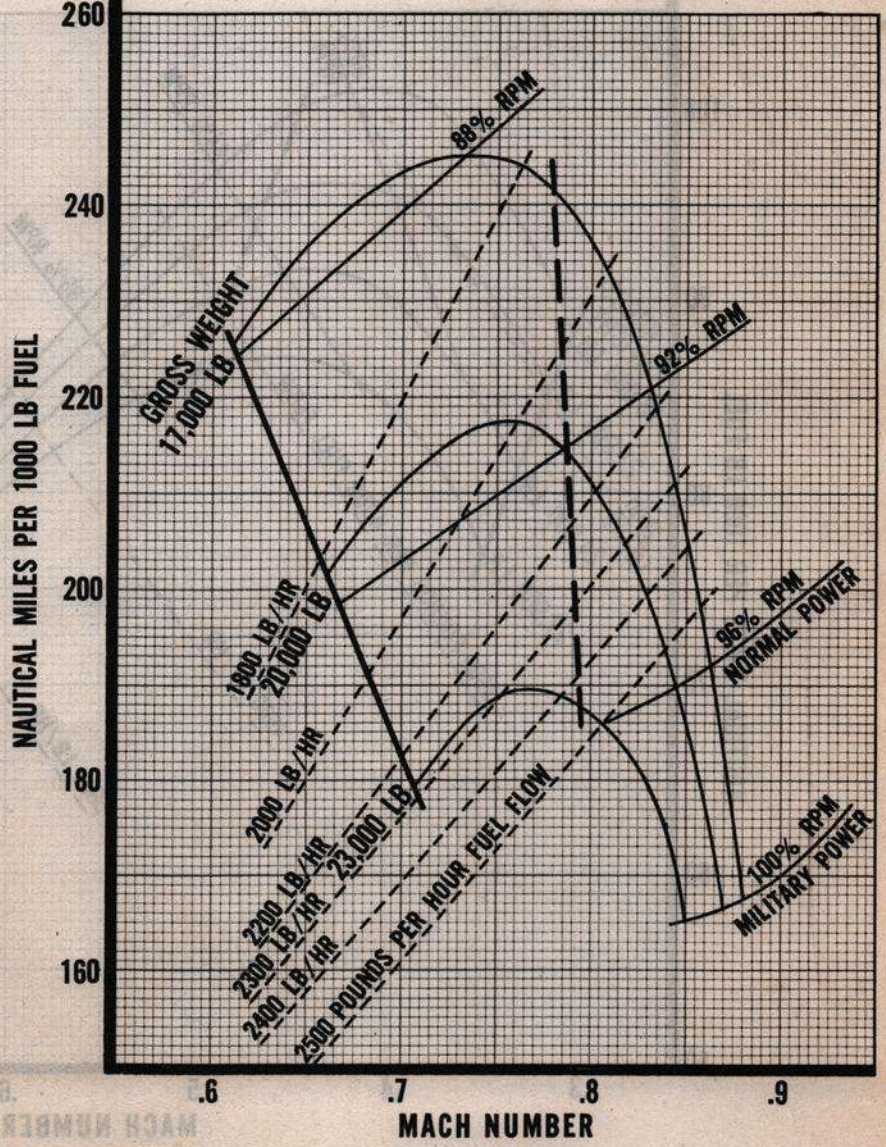


Figure A-69 (Sheet 4 of 4)

• Standard Day • F-84F-25 and later • J65-W-3 or B-3 Engines •

NAUTICAL MILES PER 1000 POUNDS FUEL

25,000 FT



CONFIGURATION
CLEAN + 2(450) GAL CLASS I TANKS

MAXIMUM ENDURANCE
RECOMMENDED CRUISE MACH NUMBER

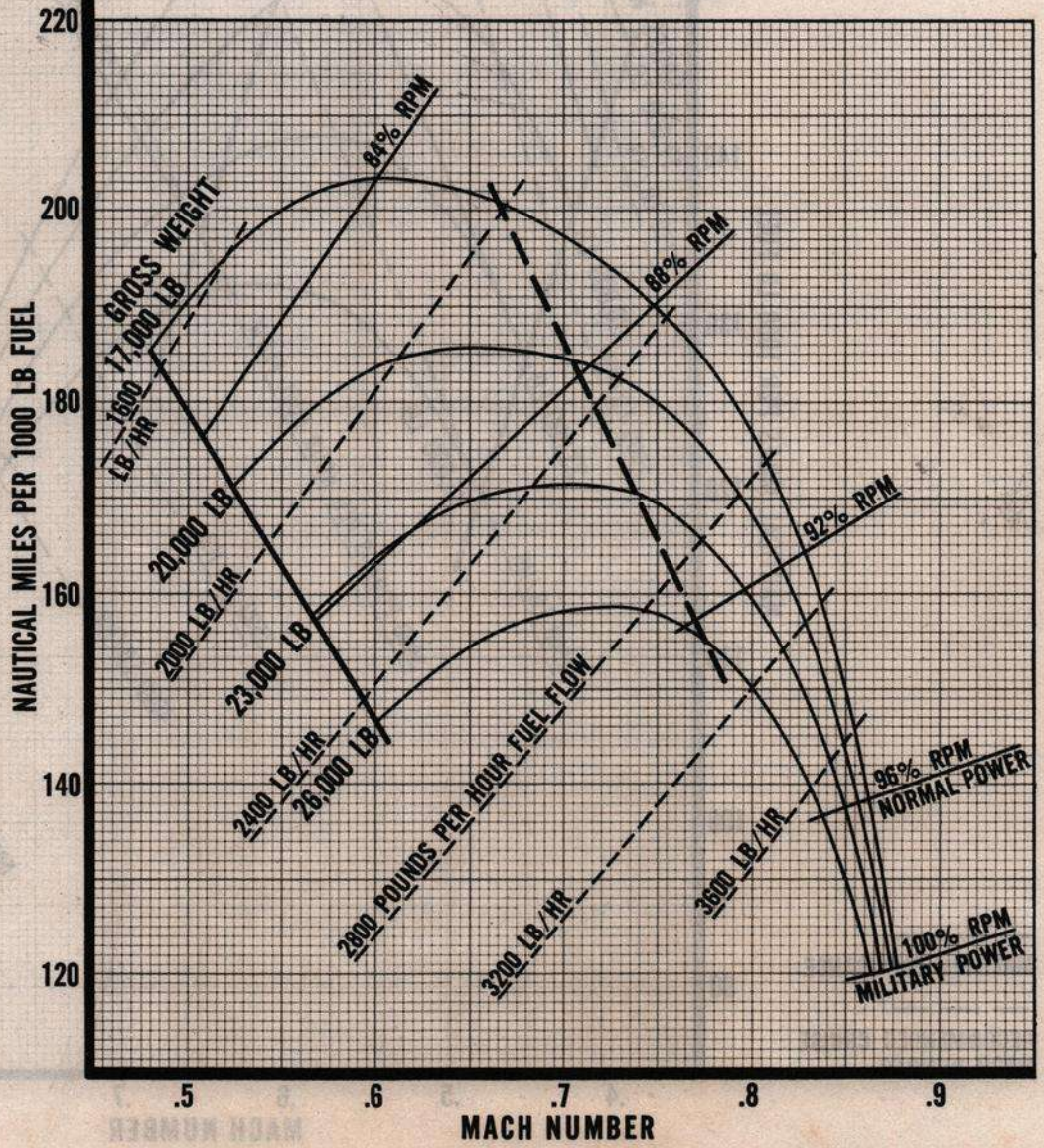


Figure A-68 (Sheet 3 of 4)

F-84F-25 and later • J65-W-3 or B-3 Engines • Standard Day •

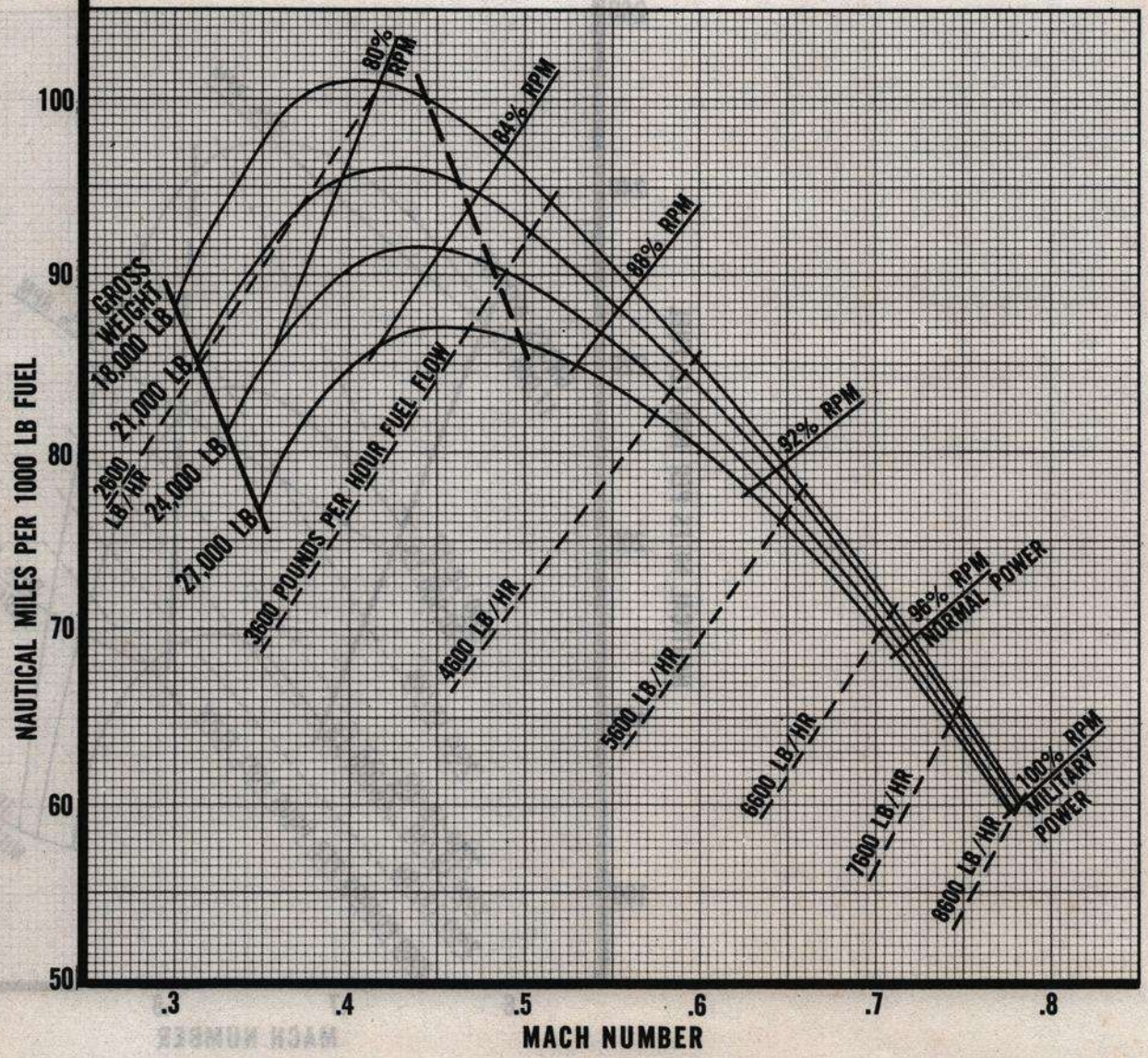
NAUTICAL MILES PER 1000 POUNDS FUEL

SEA LEVEL



CONFIGURATION
CLEAN + 2(230) GAL CLASS I TANKS
+ 2(230) GAL CLASS II TANKS

——— MAXIMUM ENDURANCE
— — — RECOMMENDED CRUISE MACH NUMBER



Standard Day • **F-84F-25 and later** • **J65-W-3 or B-3 Engines** •

NAUTICAL MILES
PER 1000 POUNDS FUEL

15,000 FT



CONFIGURATION: CLEAN + 2(230) GAL CLASS I TANKS + 2(230) GAL CLASS II TANKS

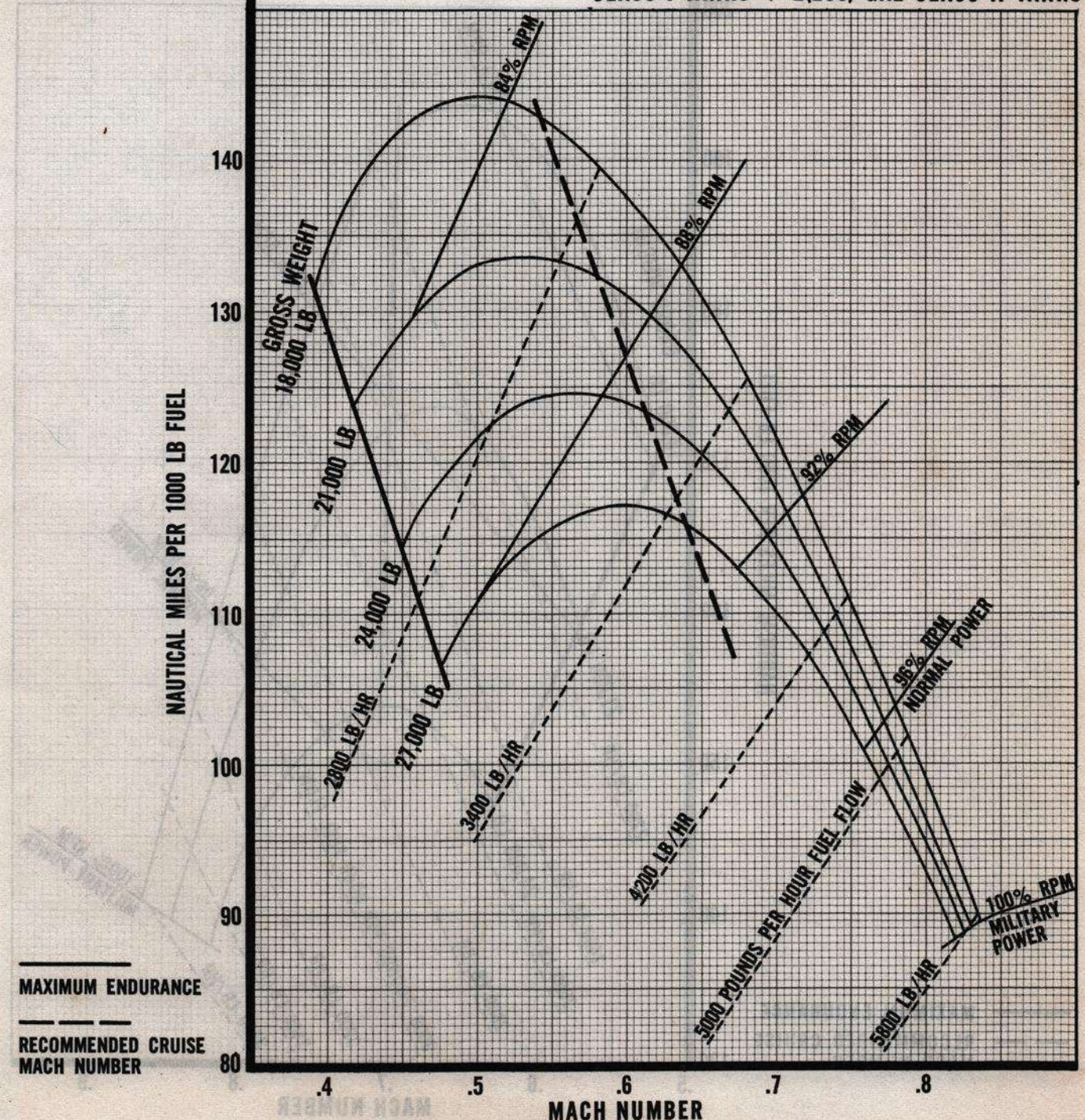


Figure A-70 (Sheet 2 of 4)

• F-84F-25 and later • J65-W-3 or B-3 Engines • Standard Day •

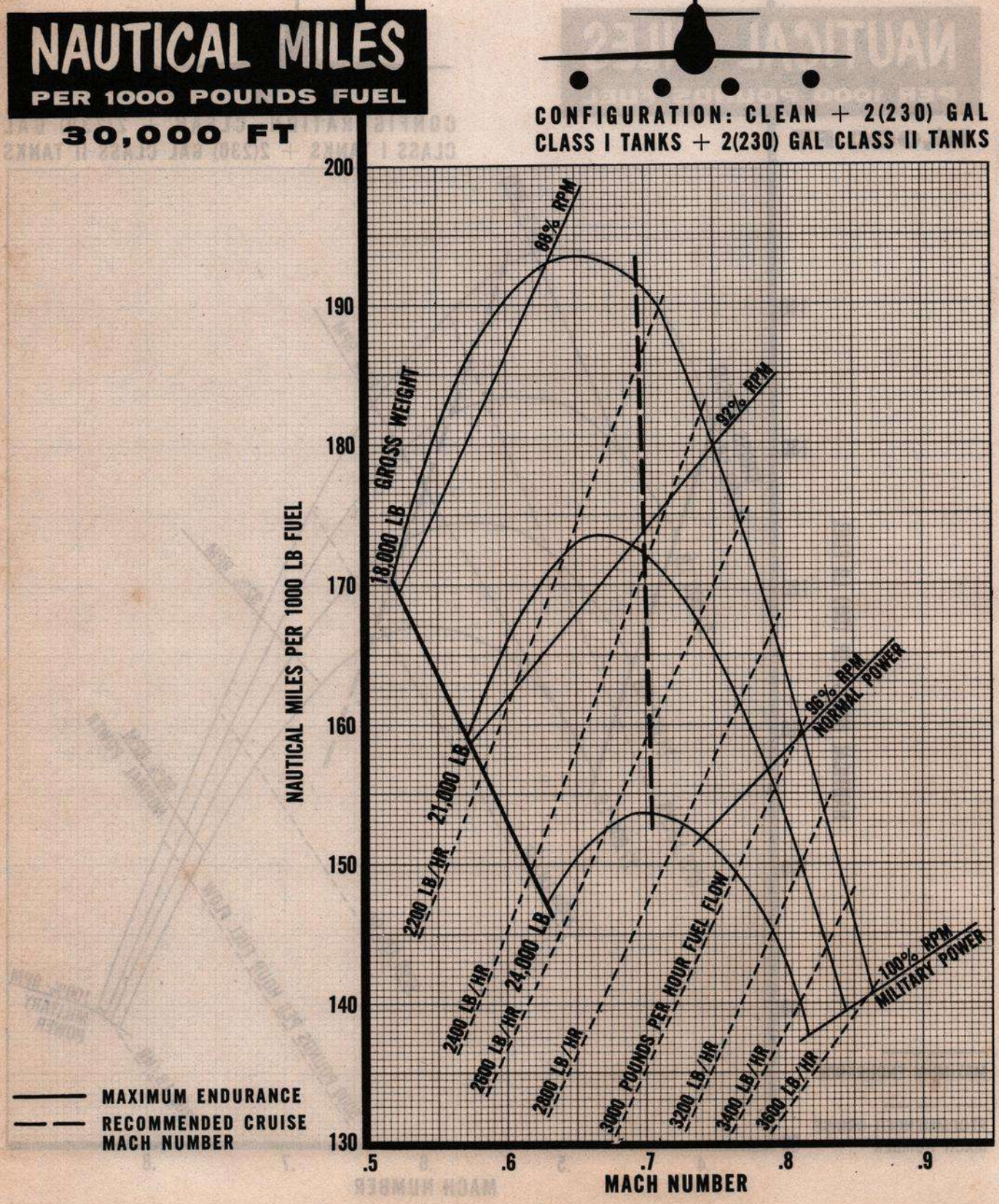


Figure A-70 (Sheet 3 of 4)

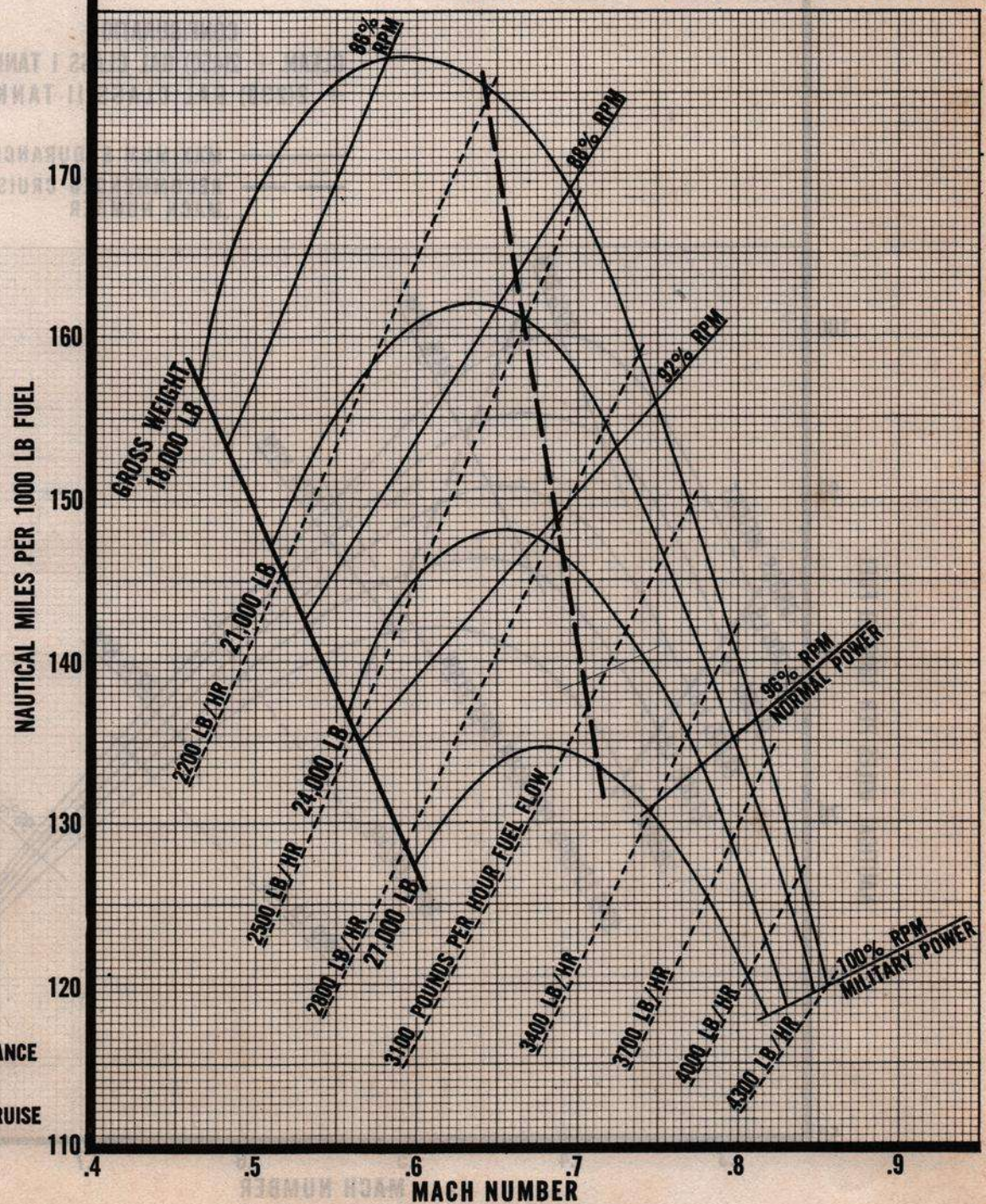
Standard Day **F-84F-25 and later** • **J65-W-3 or B-3 Engines** •

NAUTICAL MILES
PER 1000 POUNDS FUEL

25,000 FT



CONFIGURATION: CLEAN + 2(230) GAL CLASS I TANKS + 2(230) GAL CLASS II TANKS



MAXIMUM ENDURANCE

RECOMMENDED CRUISE MACH NUMBER

Figure A-70 (Sheet 1 of 4)

F-84F-25 and later • J65-W-3 or B-3 Engines • Standard Day •

NAUTICAL MILES PER 1000 POUNDS FUEL

SEA LEVEL



CONFIGURATION
CLEAN + 2(450) GAL CLASS I TANKS
+ 2(230) GAL CLASS II TANKS

——— MAXIMUM ENDURANCE
— — — RECOMMENDED CRUISE MACH NUMBER

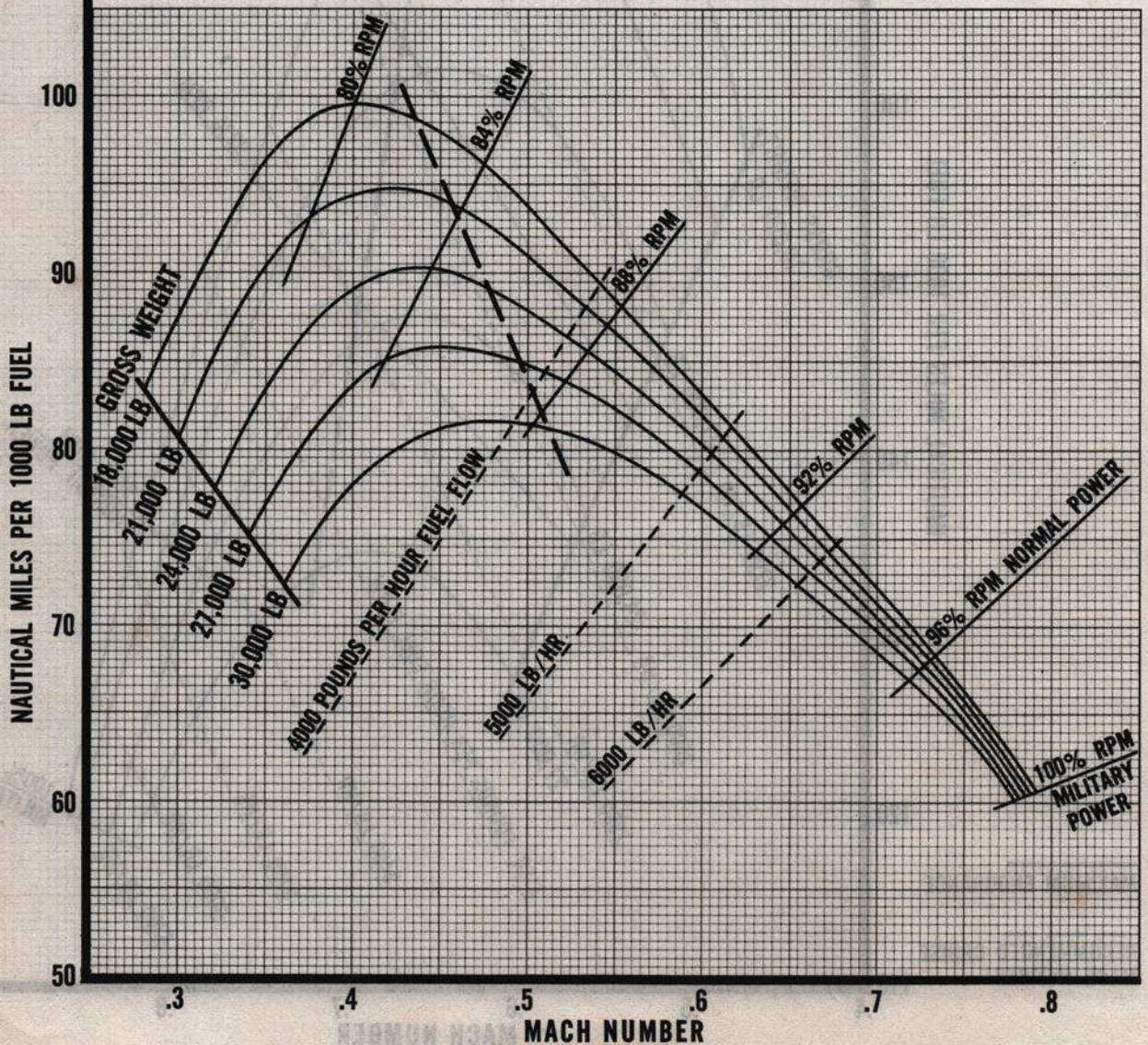


Figure 4-71 (Sheet 1 of 2)

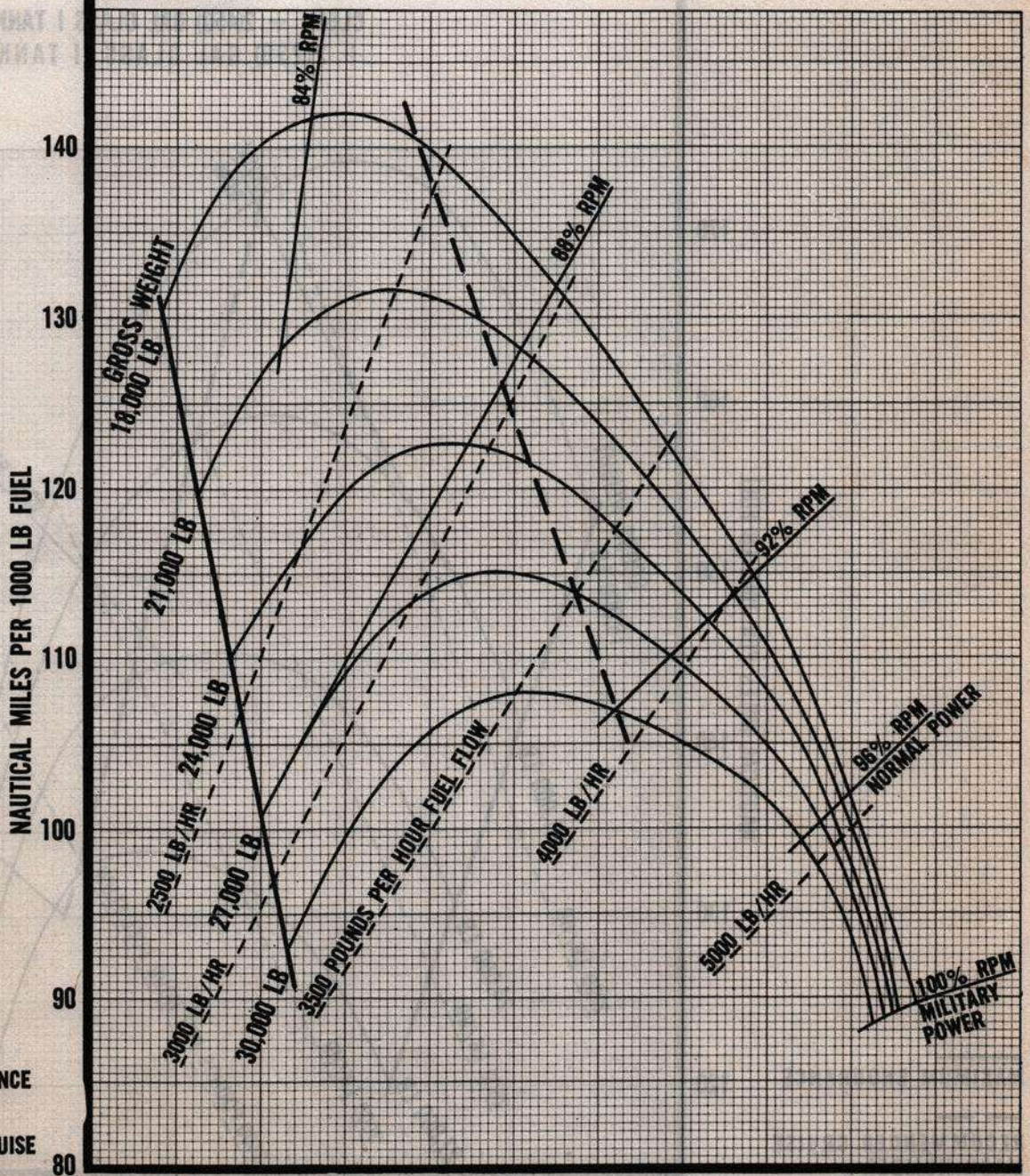
Standard Day • **F-84F-25 and later** • **J65-W-3 or B-3 Engines** •

NAUTICAL MILES
PER 1000 POUNDS FUEL

15,000 FT



CONFIGURATION: CLEAN + 2(450) GAL CLASS I TANKS + 2(230) GAL CLASS II TANKS

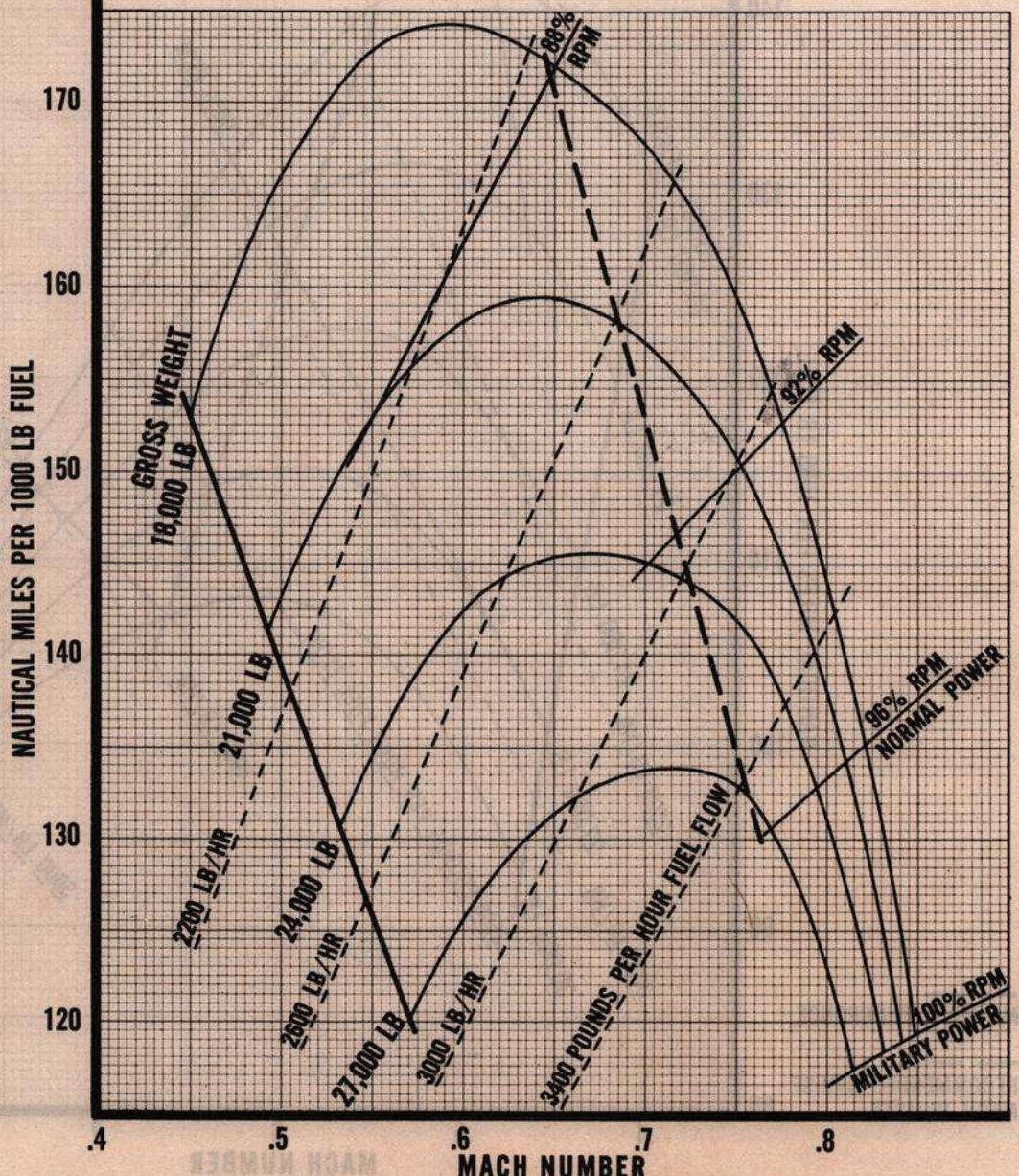


• Standard Day • F-84F-25 and later • J65-W-3 or B-3 Engines •

NAUTICAL MILES
PER 1000 POUNDS FUEL
25,000 FT



CONFIGURATION
CLEAN + 2(450) GAL CLASS I TANKS
+ 2(230) GAL CLASS II TANKS



MAXIMUM ENDURANCE

RECOMMENDED CRUISE MACH NUMBER

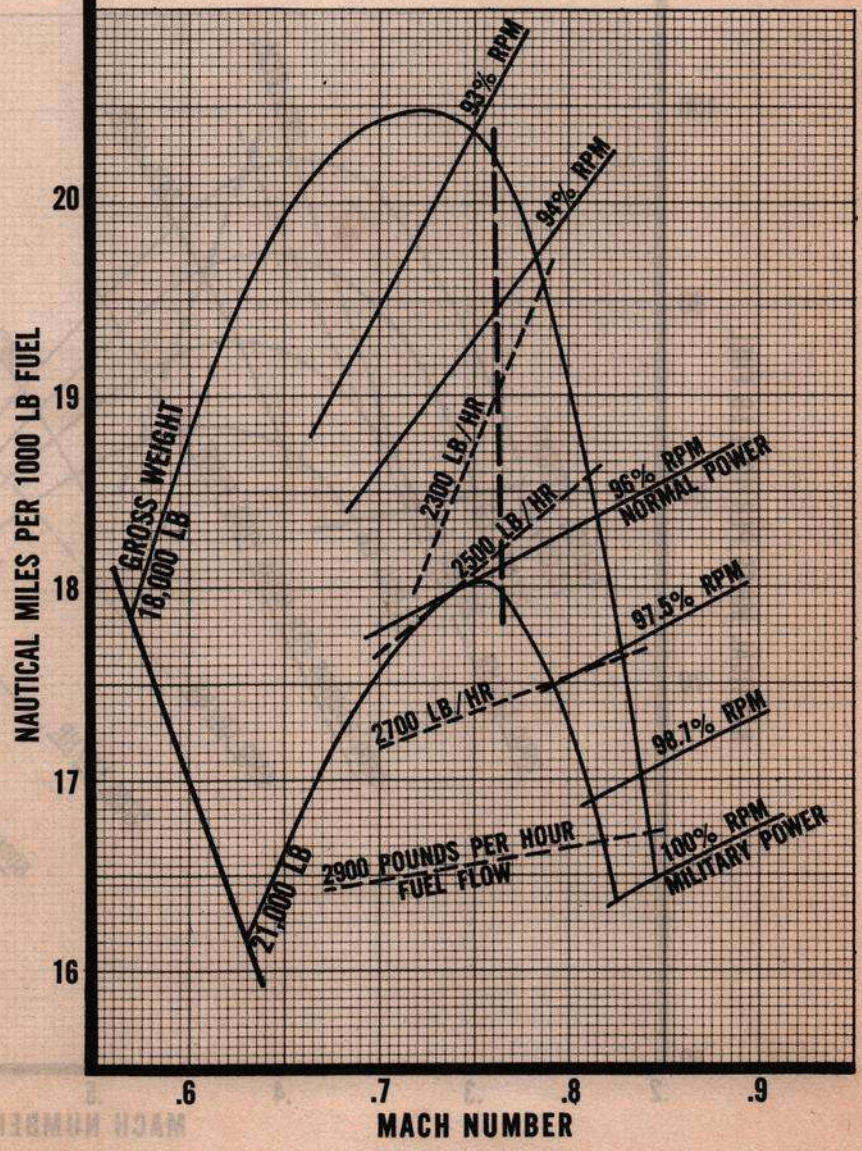
• J65-W-3 or B-3 Engines • F-84F-25 and later • Standard Day •

NAUTICAL MILES
PER 1000 POUNDS FUEL
35,000 FT



CONFIGURATION
CLEAN + 2(450) GAL CLASS I TANKS
+ 2(230) GAL CLASS II TANKS

——— MAXIMUM ENDURANCE
— — RECOMMENDED CRUISE MACH NUMBER



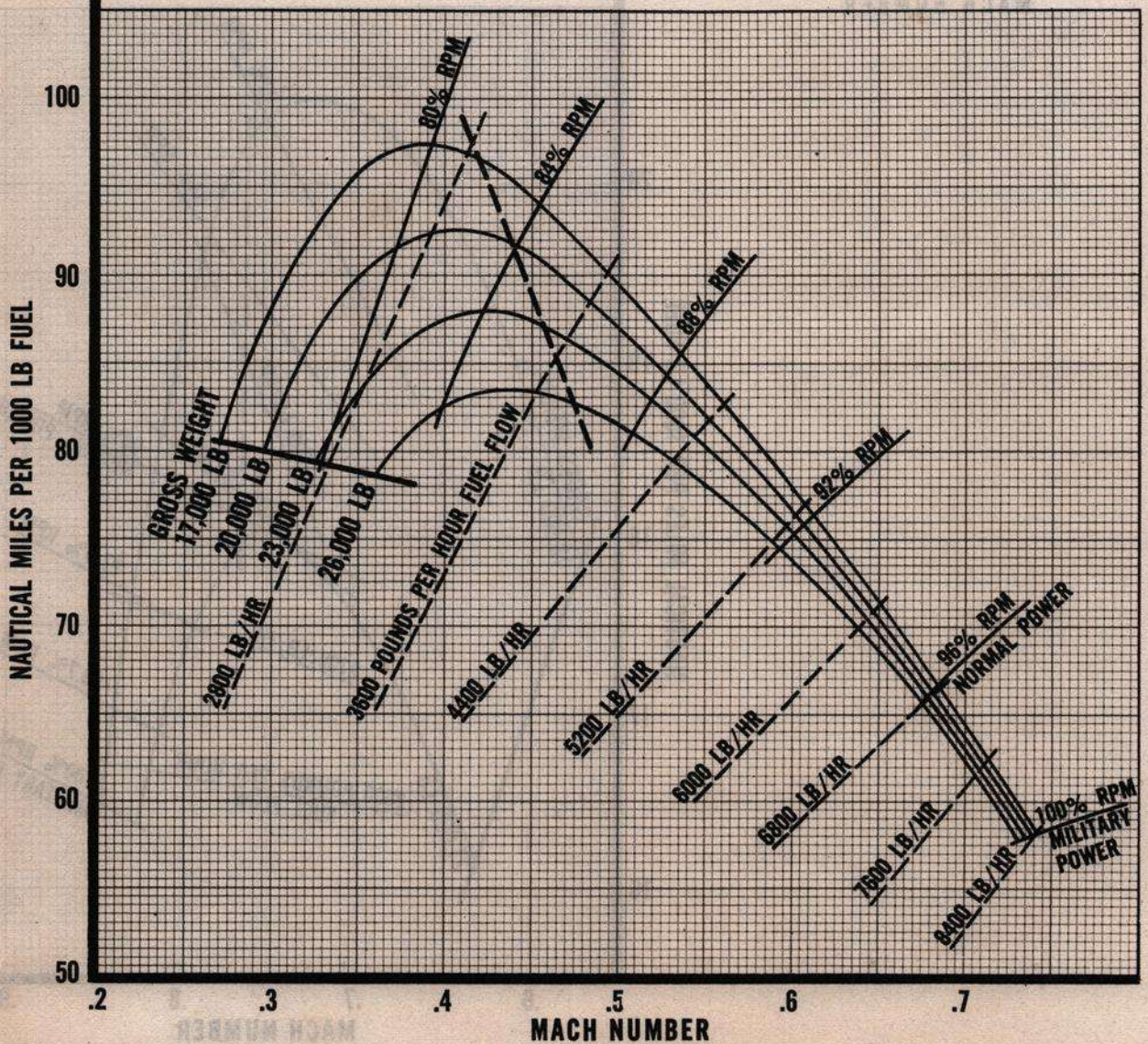
F-84F-25 and later • J65-W-3 or B-3 Engines • Standard Day •

NAUTICAL MILES
PER 1000 POUNDS FUEL
SEA LEVEL



CONFIGURATION
CLEAN + 2(230) GAL CLASS I TANKS + 2 1000 LB BOMBS + 4 HVARS

——— MAXIMUM ENDURANCE
– – – RECOMMENDED CRUISE MACH NUMBER



Standard Day • **F-84F-25 and later** • **J65-W-3 or B-3 Engines** •

NAUTICAL MILES
PER 1000 POUNDS FUEL

15,000 FT



CONFIGURATION: CLEAN + 2(230) GAL CLASS I TANKS + 2 1000 LB BOMBS + 4 HVARS

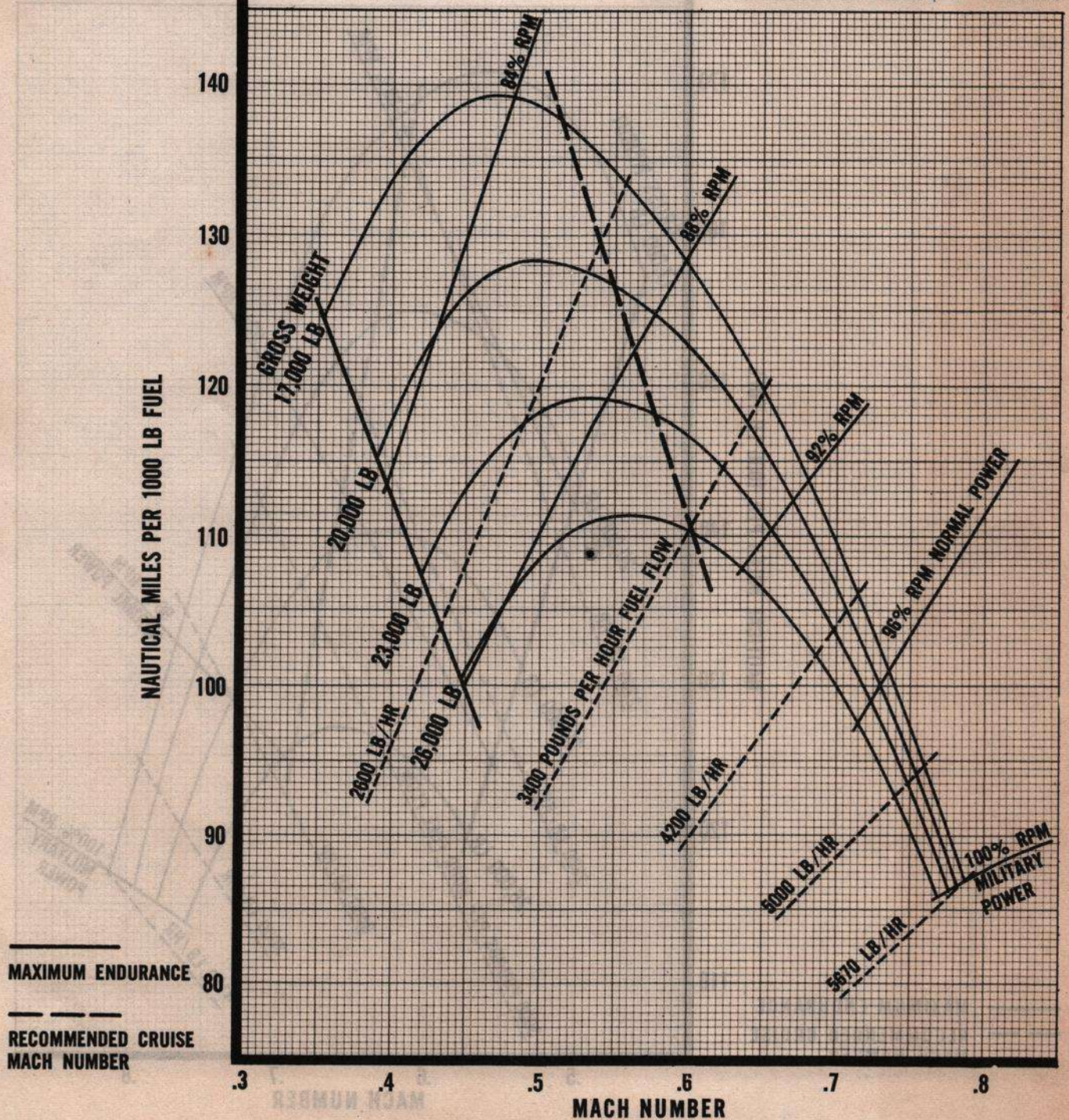


Figure A-32 (Sheet 2 of 4)

• F-84F-25 and later • J65-W-3 or B-3 Engines • Standard Day •

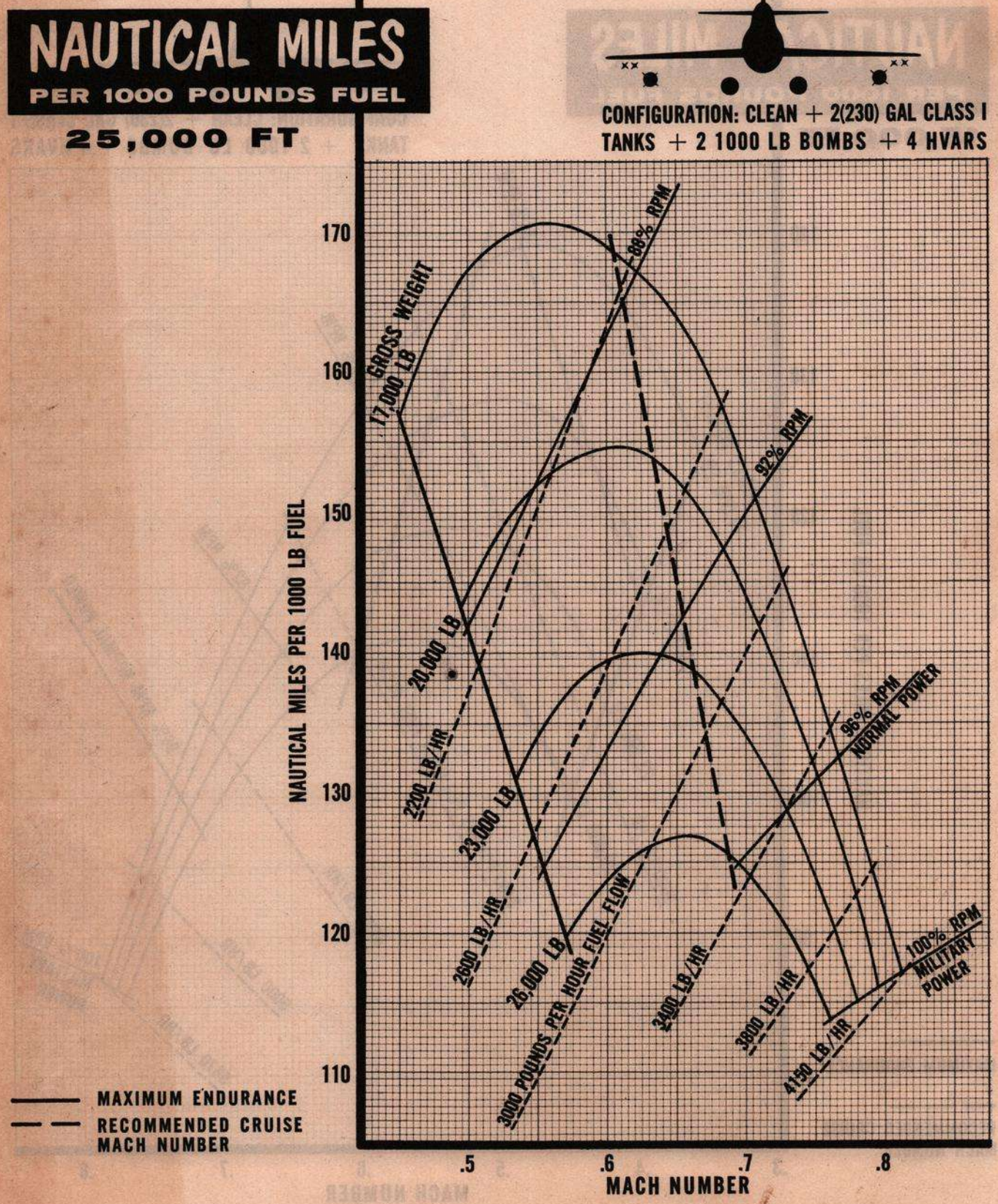


Figure A-72 (Sheet 3 of 4)

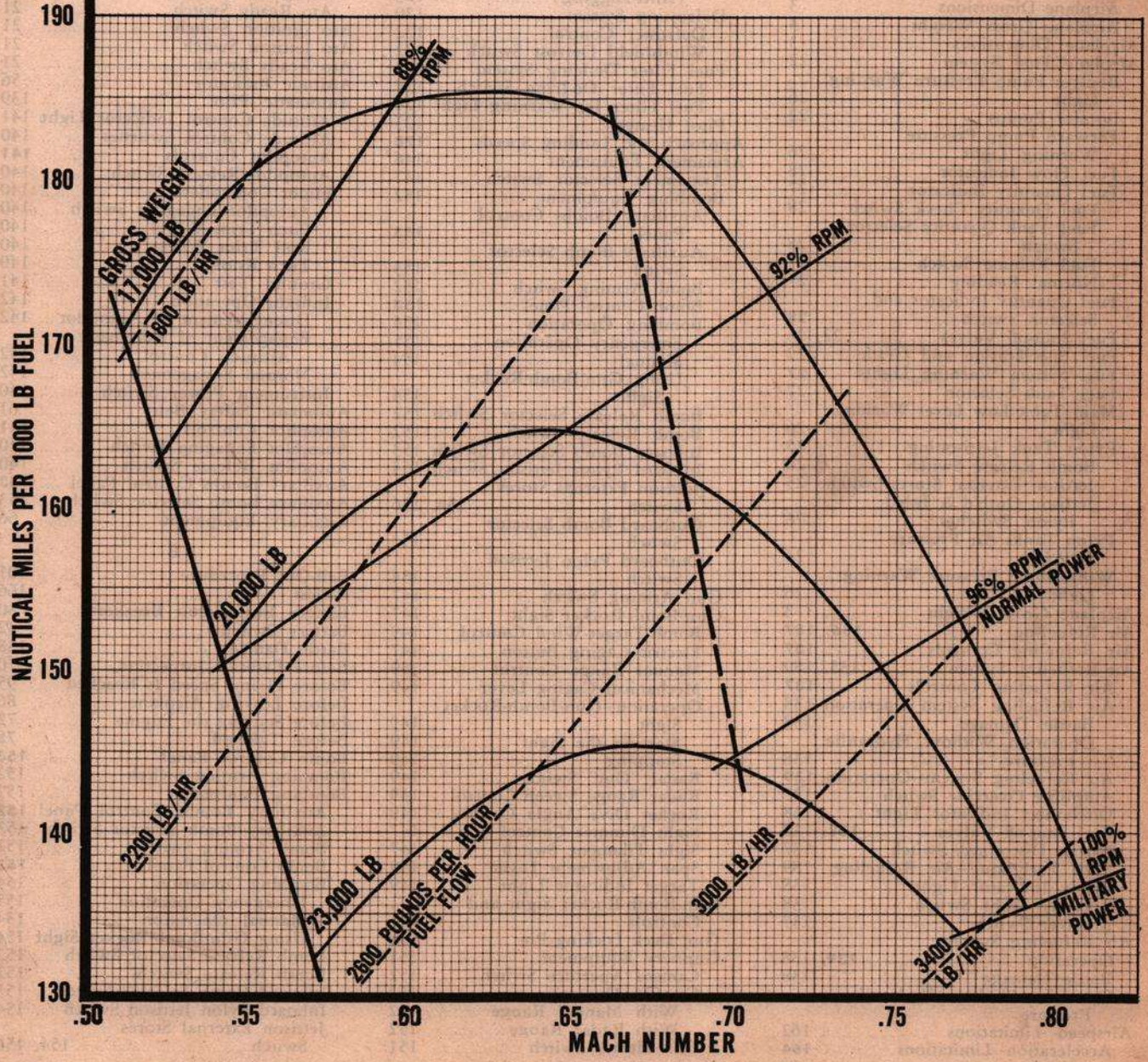
F-84F-25 and later • J65-W-3 or B-3 Engines • Standard Day •



CONFIGURATION
CLEAN + 2(230) GAL CLASS I TANKS
+ 2 1000 LB BOMBS + 4 HVARS

NAUTICAL MILES
PER 1000 POUNDS FUEL
30,000 FT

MAXIMUM ENDURANCE
RECOMMENDED CRUISE MACH NUMBER



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