FLIGHT MANUAL

USAF SERIES
F-100C
AIRCRAFT

Commanders are responsible for bringing this publication to the attention of all personnel cleared for operation of affected aircraft.

PUBLISHED UNDER AUTHORITY OF THE SECRETARY OF THE AIR FORCE.

This change replaces Safety of Flight Supplements -1FC, -1FD, -1FJ, and -1FK, and Confidential Supplement T.O. 1F-100C-1A. See Basic Index, T.O. 0-1-1, and Weekly Index, T.O. 0-1-1A, for current status of Safety of Flight Supplements.

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F-100C-1-0-64A

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USAF

ADDITIONAL COPIES OF THIS PUBLICATION MAY BE OBTAINED AS FOLLOWS:

USAF ACTIVITIES.—In accordance with T.O. 00-5-2.

NAVY ACTIVITIES.—Submit request to nearest supply point listed below, using form NavAer 140; NASD, Philadelphia, Pa.; NAS, Alameda, Calif.; NAS, Jacksonville, Fla.; NAS, Norfolk, Va.; NAS, San Diego, Calif.; Aviation Supply Annex, NSD, Guam.

For listing of available material and details of distribution see Naval Aeronautics Publications Index NavAer 00-500.

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F-100C-1-0-35A

These pages tell you how to use the manual.

Scope. This manual contains all the information necessary for safe and efficient operation of the F-100C. The instructions do not teach basic flight principles, but are designed to provide you with 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 manual are designed to provide for the needs of a pilot inexperienced in the operation of this airplane. 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 make it necessary to modify the procedures given in the Manual.

Permissible Operations. The Flight Manual 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 Manual. Clearance must be obtained from ARDC before any questionable operation is attempted which is not specifically covered in the Flight Manual.

Standardization. Once you have learned to use one Flight Manual, you will know how to use them all. Closely guarded standardization ensures that the scope and arrangement of all Flight Manuals are identical.

Arrangement. The manual 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 to read the book straight through when it is first received and then 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 three sections cover the minimum information required to get the airplane safely into the air and back down again. Before flying any new airplane, these three sections must be read thoroughly and fully understood. Section IV covers all equipment not essential to flight but which permits the airplane to perform special functions. The contents of Sections V and VI are obvious from their titles. Section VII covers lengthy discussions on any technique or theory of operation which may be applicable to the particular airplane in question. The experienced pilot may be aware of the information in this section, but he should check it for any possible new information. The contents of the remaining sections are obvious from their titles.

Your Responsibility. Flight Manuals are kept current through an extremely active revision program. Frequent conferences with operating personnel and constant review of UR's, accident reports, flight test reports, etc, ensure that the latest data is included in the manuals. 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 errors we don't know exist.

Personal Copies, Binders, and Tabs. In accordance with the provisions of AFR 5-13, each pilot is entitled to have a personal copy of the Flight Manual. Flexible, loose-leaf binders and tabs have been provided to hold your personal copy of the Flight Manual. These good-looking, simulated-leather binders will make it much easier for you to revise your manual as well as to keep it in good shape. These binders and tabs are secured through your local materiel staff and contracting officers.

How to Get Copies. If you want to be sure of getting your manuals on time, order them before you need them. Early ordering will ensure that enough copies are printed to cover your requirements. Technical Order 00-5-2 explains how to order Flight Manuals, classified supplements to the Flight Manuals, and Safety of Flight Supplements, so that you automatically will get all original issues, changes, and revisions. Basically, all you have to do is order the required quantities in the Publication Requirements Table (T.O. 0-3-1). Talk to your Senior Materiel Staff Officer. It is his job to fulfill your Technical Order requests. Establish some system that will rapidly get the manuals and Safety of Flight Supplements to the pilots once they are received on the base.

Safety of Flight Supplements. Safety of Flight Supplements are used to get information to you in a hurry. Safety of Flight Supplements use the same number as your Flight Manual, except for the addition of a suffix letter. Supplements covering loss of life will get to you in 48 hours; those concerning serious damage to equipment will make it in 10 days. 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). This is the only way you can determine whether a supplement has been rescinded. The title page of the Flight Manual and 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. It is critically important that you remain constantly aware of the status of all supplements. You must comply with all existing supplements, but there is no point in restricting the operation of your airplane by complying with a supplement that has been replaced or rescinded. Technical Order 00-5-1 covers some additional information regarding these supplements.

Warnings, Cautions, and Notes. For your information, the following definitions apply to the "Warnings," "Cautions," and "Notes" found throughout the manual:

Warning Operating procedures, practices, etc, which will result in personal injury or loss of life if not carefully followed.

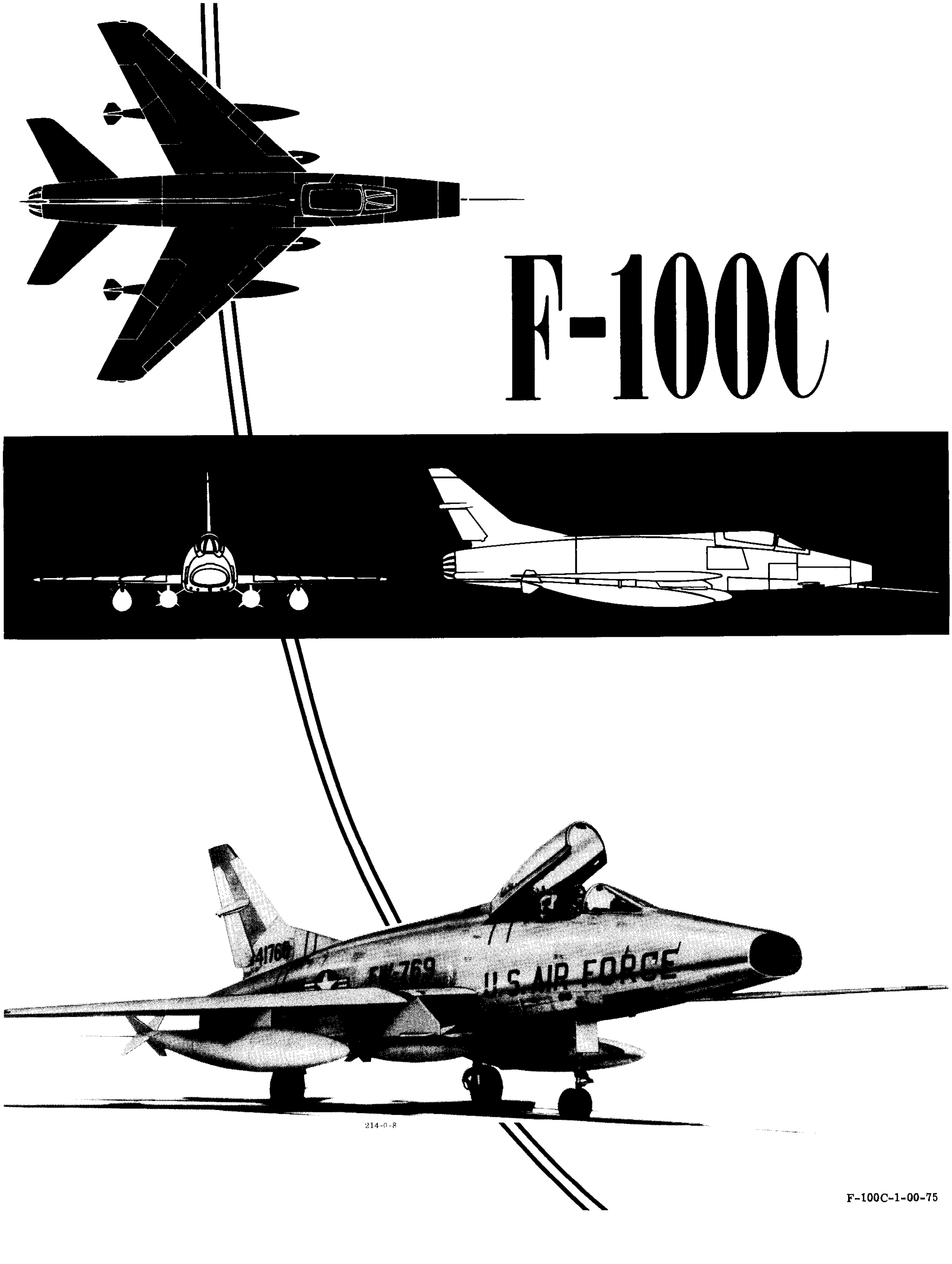
Caution Operating procedures, practices, etc, which if not strictly observed will result in damage to equipment.

NOTE An operating procedure, condition, etc, which it is essential to emphasize.

Maintenance Manuals. One more thing. If you desire more detailed information on the various airplane systems and components than is provided within the scope of the Flight Manual, refer to the Maintenance Technical Manuals (T.O. 1F-100C-2 Series) for your airplane.

MB-8 Flight Computer. The MB-8 flight computer for this airplane is presently available. This computer provides compact cruise control data to aid in preparation of flight plans, in-flight operation, and emergency in-flight planning and operation. The computer is a five-disc, metal and plastic circular computer with a canvas carrying case. Three of the discs can be used with any airplane and are referred to as "standard discs." The remaining discs contain data only for this airplane and are described as "data discs." The standard discs and carrying case are carried in Class 05-A and are available through normal supply channels. The data discs are distributed automatically to all bases having this airplane. New or revised discs are issued each time the performance data in the Flight Manual is revised. The performance data in the computer and the manual is always kept current and consistent. If you have not yet received your computer, see your Base Operations Officer or T.O. 5F5-1-1. Reference should also be made to T.O. 5F5-1-1 and the Appendix of this manual for information on the operation of the computer.

Comments and Questions. Comments and questions regarding any phase of the Flight Manual program are invited and should be forwarded through your Command Headquarters to ARDC Engineering Office, Attention WCLODSG, McClellan AFB, California.



F-100C-1-00-75

F-100C-1-00-8A

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AIRPLANE.

The F-100C, built by North American Aviation, Inc, is a single-place, supersonic fighter-bomber with secondary use as a limited air superiority fighter. It is powered by an axial-flow turbojet engine with afterburner. The swept-back wing has automatic slats, and two-section, inboard-mounted ailerons. The horizontal stabilizer is a one-unit control surface and all control surfaces are actuated by irreversible hydraulic systems. Pilot feel is simulated by an artificial-feel system. Fuel is carried in the fuselage and integral wing tanks. Drop tanks can be installed on the wing. The fuel system is serviced by single-point refueling and can be refueled in flight by probe and drogue refueling. A speed brake is on the lower surface of the fuselage and a drag chute is installed in the bottom of the aft fuselage to reduce the landing roll.

AIRPLANE DIMENSIONS.

The over-all dimensions of the airplane (on landing gear at normal weight and at normal ground attitude, with specified tire and gear strut inflation) are as follows:

Span .... 38 feet 9 inches
Length (pitot boom extended) .... 53 feet 11 inches
Length (pitot boom folded for ground handling) .... 47 feet
Height (to top of fin) .... 15 feet 6 inches

NOTE Refer to "Taxiing" in Section II for turning radius and ground clearance dimensions.

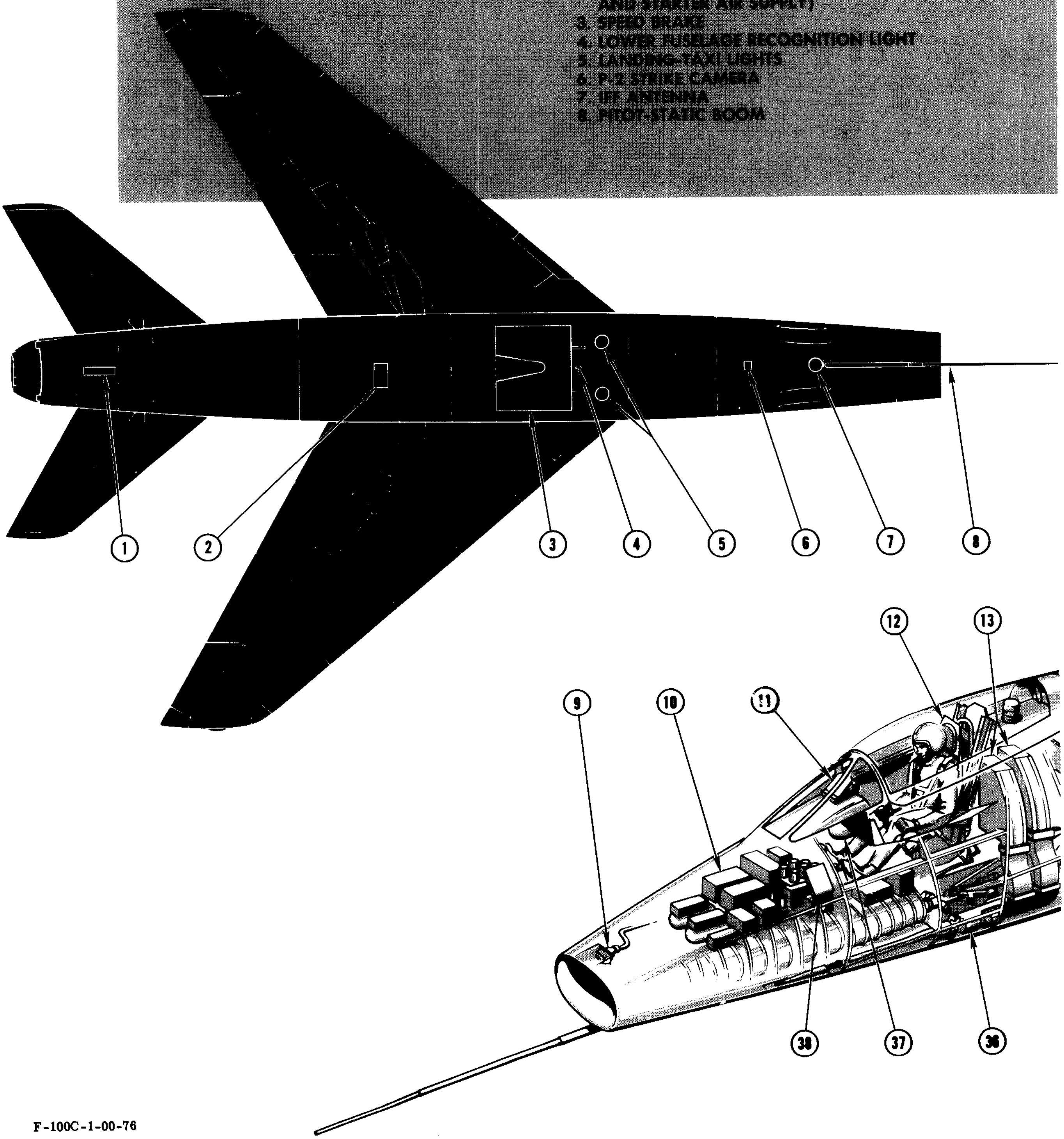
AIRPLANE GROSS WEIGHT.

The approximate take-off gross weight of the airplane (including full internal load and pilot) is as follows:

No external load .... 28,800 pounds
With two 200-gallon drop tanks, one 275-gallon drop tank, and one special store .... 35,700 pounds

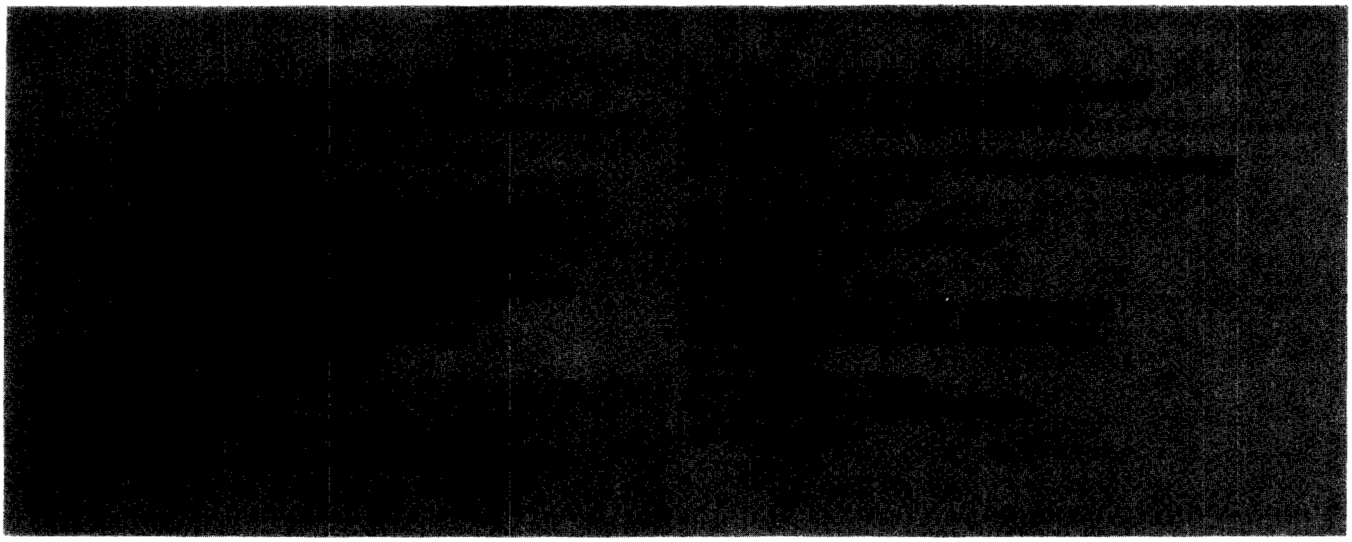
GENERAL ARRANGEMENT

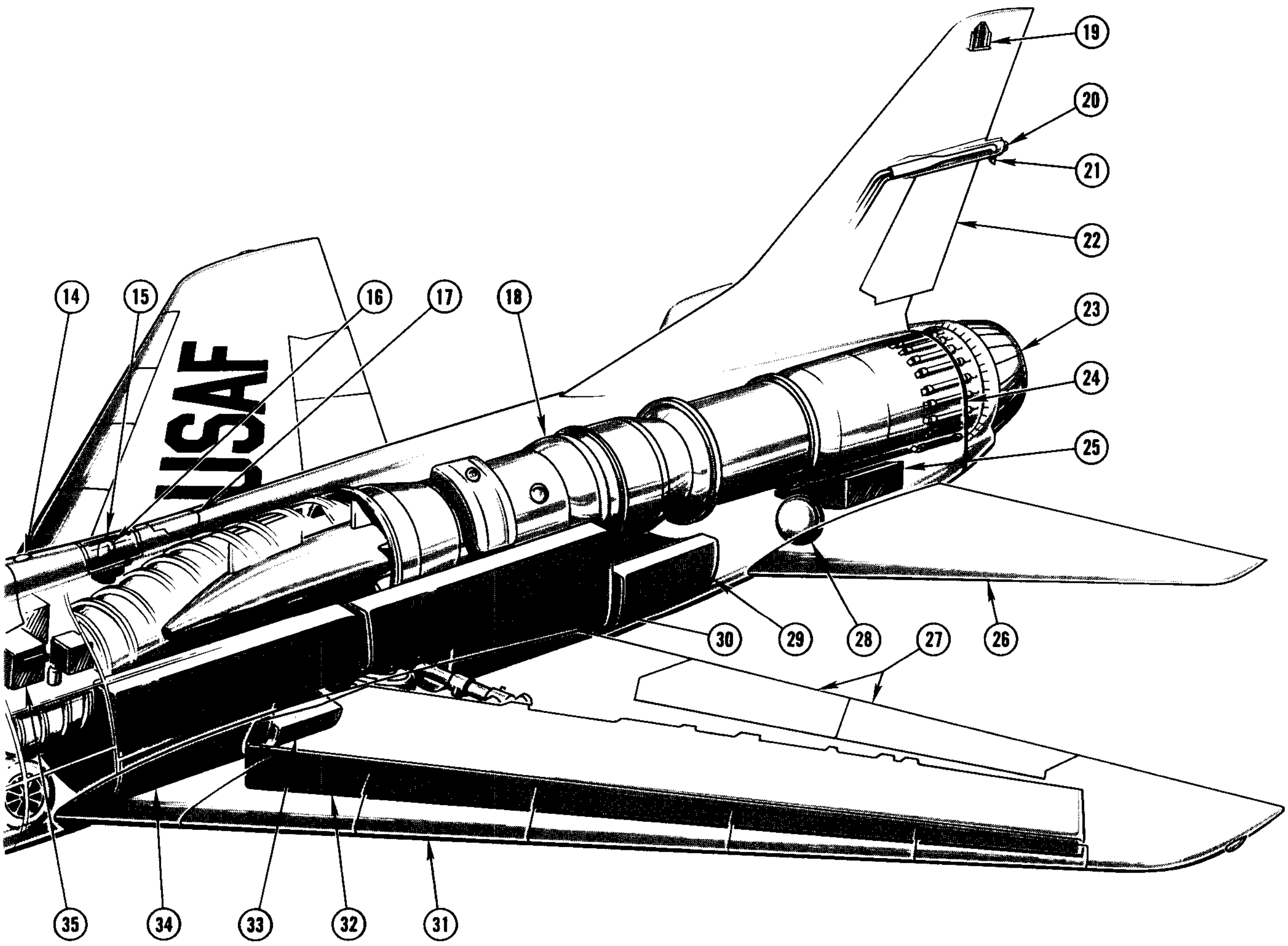
1. RETRACTABLE TAIL SKID
2. EXTERNAL POWER RECEPTACLES (ELECTRICAL AND STARTER AIR SUPPLY)
3. SPEED BRAKE
4. LOWER FUSELAGE RECOGNITION LIGHT
5. LANDING-TAXI LIGHTS
6. P-2 STRIKE CAMERA
7. IFF ANTENNA
8. PITOT-STATIC BOOM



F-100C-1-00-76

Figure 1-1





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BLOCK NUMBER DESIGNATION

F-100C-1-NA
AF53-1709 thru -1778
and
AF54-1740 thru -1769

F-100C-5-NA
AF54-1770 thru -1814

F-100C-10-NH
AF55-2709 thru -2733

F-100C-15-NA
AF54-1815 thru -1859

F-100C-20-NA
AF54-1860 thru -1969

F-100C-25-NA
AF54-1970 thru -2120

NOTE

- The AF serial numbers for later block numbers may be lower than the serial numbers for an early block number. (Compare serial numbers of blocks -10 and -15.) Therefore, the airplane coding throughout this handbook should be interpreted as follows: "and later airplanes" applies to all later block numbers (not necessarily later serial numbers).
- F-100C Airplanes with manufacturer's code letters "NA" are built by North American Aviation at Los Angeles, California.
- F-100C Airplanes with manufacturer's code letters "NH" are built by North American Aviation at Columbus, Ohio.

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Figure 1-2

ARMAMENT.

Four 20 mm automatic guns are in the lower surface of the forward fuselage section, two on each side, outboard of the nose wheel well. Bombs, rockets, or chemical tanks can be carried on removable pylons that mount on the lower surface of the wings. An automatic lead-computing sight, coupled with a radar ranging system is used for gun, bomb, and rocket aiming.

NOTE Refer to "Armament Equipment" in Section IV.

BLOCK NUMBERS.

Block numbers are used to identify airplanes in accordance with production changes that affect the airplane or its equipment. Airplanes with a given block number are usually identical with respect to production changes. The block numbers and Air Force serial numbers assigned to F-100C Airplanes are shown on figure 1-2.

ENGINE.

The airplane is powered by a Pratt & Whitney J57 Series axial-flow gas turbine engine equipped with an afterburner. (See figure 1-5.) Some airplanes have the J57-7 or J57-39 engine with a rated sea-level static thrust of about 9700 pounds at Military Thrust and about 14,800 pounds at Maximum Thrust (afterburning). Other airplanes use the J57-21 engine having a rated sea-level static thrust of about 10,200 pounds at Military Thrust and about 16,000 pounds at Maximum Thrust. Airplanes changed by T.O. can have a -21A engine, which is the same as the -21 engine except for an improved afterburner ignition system and afterburner fuel metering system. This change ensures satisfactory afterburner operation at high altitudes.

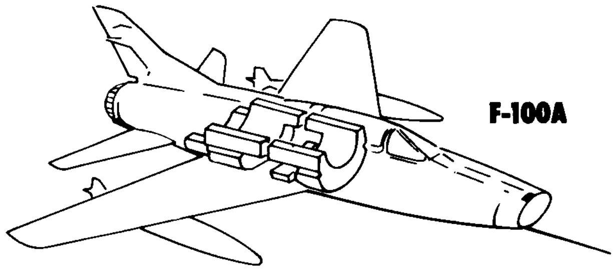
NOTE J57 Series engines built by Pratt & Whitney are identified with the letter "P" preceding the dash number, and J57 engines built by the Ford Motor Company are identified with the letter "F." These engines are identical in operation, and all references in this manual apply to either engine.

The J57 engine has two multistage ("two-spool") compressors, an eight-unit semiannular combustion chamber, a split, three-stage turbine, and an afterburner system with a two-position exhaust nozzle.

NOTE Refer to "Engine Afterburner System" in this section for complete information on the afterburner.

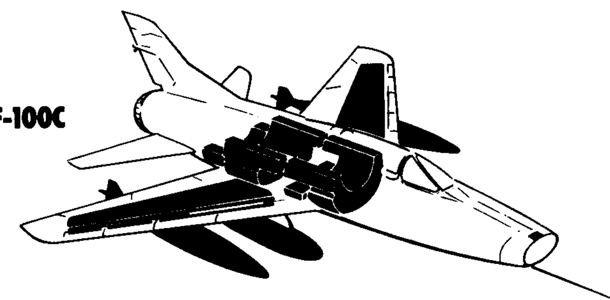
The two-spool compressor section consists of a nine-stage low-pressure unit and a seven-stage high-pressure unit. The rotor assembly of each unit is mechanically

MAIN DIFFERENCES TABLE



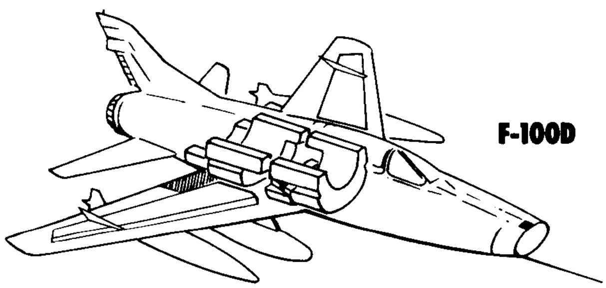
F-100A

ENGINE	J57-7 OR -39 WITH AFTERBURNER
AC ELECTRICAL POWER SOURCE	THREE INVERTERS
ARMAMENT	FOUR GUNS, AND ON SOME AIRPLANES, VARIOUS EXTERNAL LOADS
CAMERAS	SIGHT
DROP TANKS	TWO 275-GALLON
INTERNAL FUEL	FUSELAGE
REFUELING PROVISIONS	GRAVITY TANK FILLING
FLAPS	NO
OXYGEN SYSTEM	GASEOUS, WITH D-2 REGULATOR
AUTOPILOT	NO
WHEEL BRAKE ANTISKID	SOME AIRPLANES



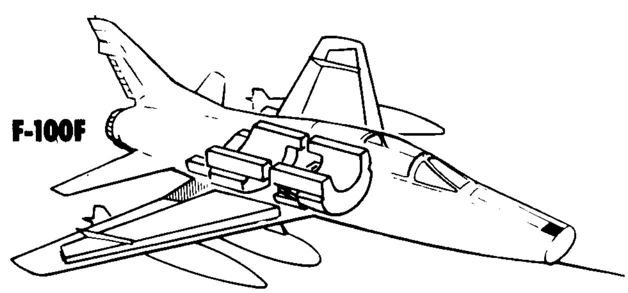
F-100C

ENGINE	J57-7,-39, -21, OR -21A WITH AFTERBURNER
AC ELECTRICAL POWER SOURCE	THREE INVERTERS
ARMAMENT	FOUR GUNS AND VARIOUS COMBINATIONS OF EXTERNAL LOADS INCLUDING BOMBS AND ROCKETS MOUNTED ON REMOVABLE PYLONS
CAMERAS	SIGHT AND STRIKE
DROP TANKS	TWO 275-GALLON AND/OR COMBINATION OF 200-GALLON (TWO 450-GALLON ON SOME AIRPLANES)
INTERNAL FUEL	FUSELAGE AND WING
REFUELING PROVISIONS	PRESSURE TYPE (SINGLE-POINT AND AIR REFUELING)
FLAPS	NO
OXYGEN SYSTEM	LIQUID, WITH D-2A REGULATOR
AUTOPILOT	NO
WHEEL BRAKE ANTISKID	SOME AIRPLANES



F-100D

ENGINE	J57- 21 OR -21A WITH AFTERBURNER
AC ELECTRICAL POWER SOURCE	ONE ENGINE-DRIVEN AC GENERATOR WITH ONE STAND-BY INVERTER
ARMAMENT	FOUR GUNS AND VARIOUS COMBINATIONS OF EXTERNAL LOADS INCLUDING BOMBS AND ROCKETS (MISSILES ON SOME AIRPLANES) MOUNTED ON FORCE EJECTION PYLONS
CAMERAS	SIGHT AND STRIKE
DROP TANKS	TWO 275-GALLON AND/OR COMBINATION OF 200-GALLON (TWO 450-GALLON ON SOME AIRPLANES)
INTERNAL FUEL	FUSELAGE AND WING
REFUELING PROVISIONS	PRESSURE-TYPE (SINGLE-POINT AND AIR REFUELING)
FLAPS	YES
OXYGEN SYSTEM	LIQUID WITH MD-1 REGULATOR
AUTOPILOT	SOME AIRPLANES
WHEEL BRAKE ANTISKID	YES



F-100F

ENGINE	J57-21 OR -21A WITH AFTERBURNER
AC ELECTRICAL POWER SOURCE	ONE ENGINE-DRIVEN AC GENERATOR WITH ONE STAND-BY INVERTER
ARMAMENT	TWO GUNS AND VARIOUS COMBINATIONS OF EXTERNAL LOADS INCLUDING BOMBS, ROCKETS, AND MISSILES (SOME AIRPLANES) MOUNTED ON FORCE-EJECTION PYLONS
CAMERAS	SIGHT AND STRIKE
DROP TANKS	TWO 450-GALLON OR TWO 275-GALLON AND/OR COMBINATION OF 200-GALLON
INTERNAL FUEL	FUSELAGE AND WING
REFUELING PROVISIONS	PRESSURE-TYPE (SINGLE-POINT AND AIR REFUELING)
FLAPS	YES, WITH DUCTED FLAPS ON F-100F-20 AIRPLANES
OXYGEN SYSTEM	LIQUID WITH MD-1 REGULATOR
AUTOPILOT	YES
WHEEL BRAKE ANTISKID	YES

F-100C-1-00-79C

Figure 1-3

INDICATOR-CAUTION-WARNING LIGHT PANELS

Lights shown illuminated for nomenclature information only.

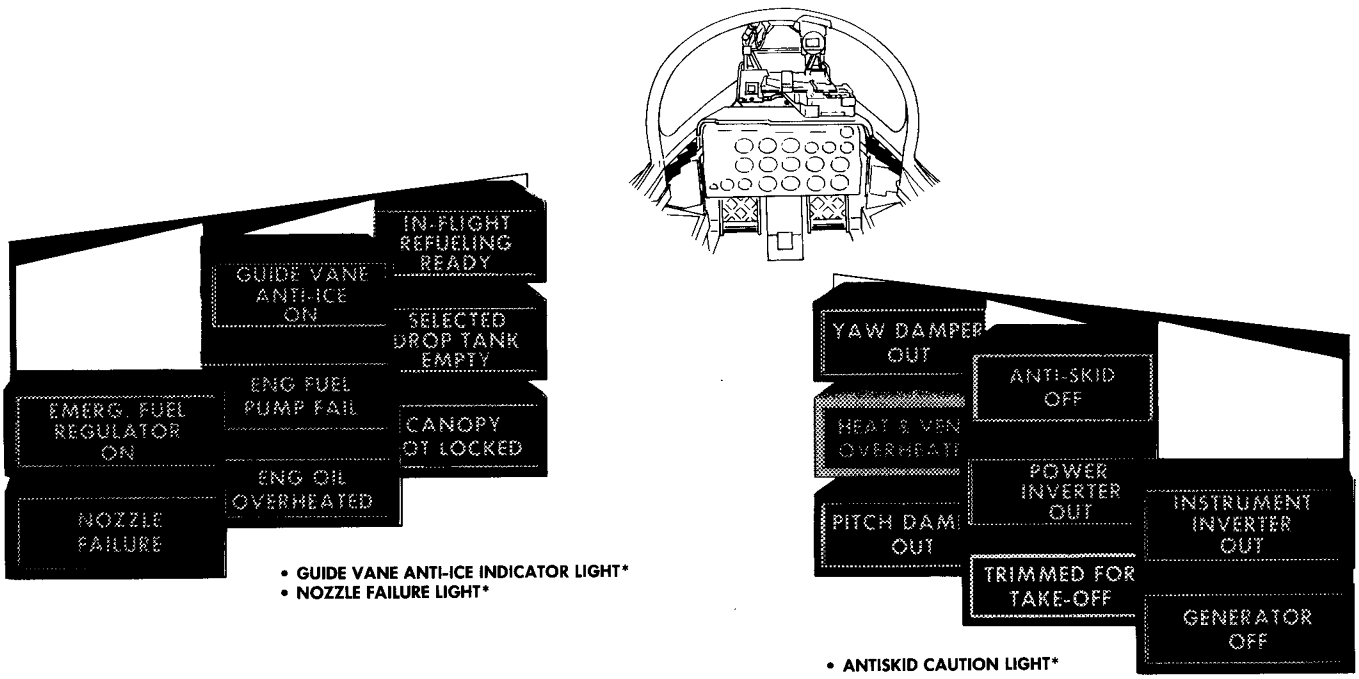


Figure 1-4

independent of the other. The first-stage turbine wheel turns the high-pressure compressor rotor by means of a hollow drive shaft. Another drive shaft, rotating within the hollow shaft, joins the low-pressure compressor rotor to the second- and third-stage turbine wheels. A compressor air bleed system is used to direct part of the low-pressure compressor air overboard at low engine rpm to provide stall-free, fast engine accelerations and decelerations. The air-bleed system is automatically controlled by a governor driven by the low-pressure compressor rotor. An anti-icing system protects the engine guide vanes from ice formation. The engine-driven accessories are grouped on the engine nose section and at the bottom of the engine. The low-pressure compressor rotor drives the nose section accessories. The accessories at the bottom of the engine are driven by the high-pressure compressor rotor through a bevel gear and shaft system which also serves as the input system during starting.

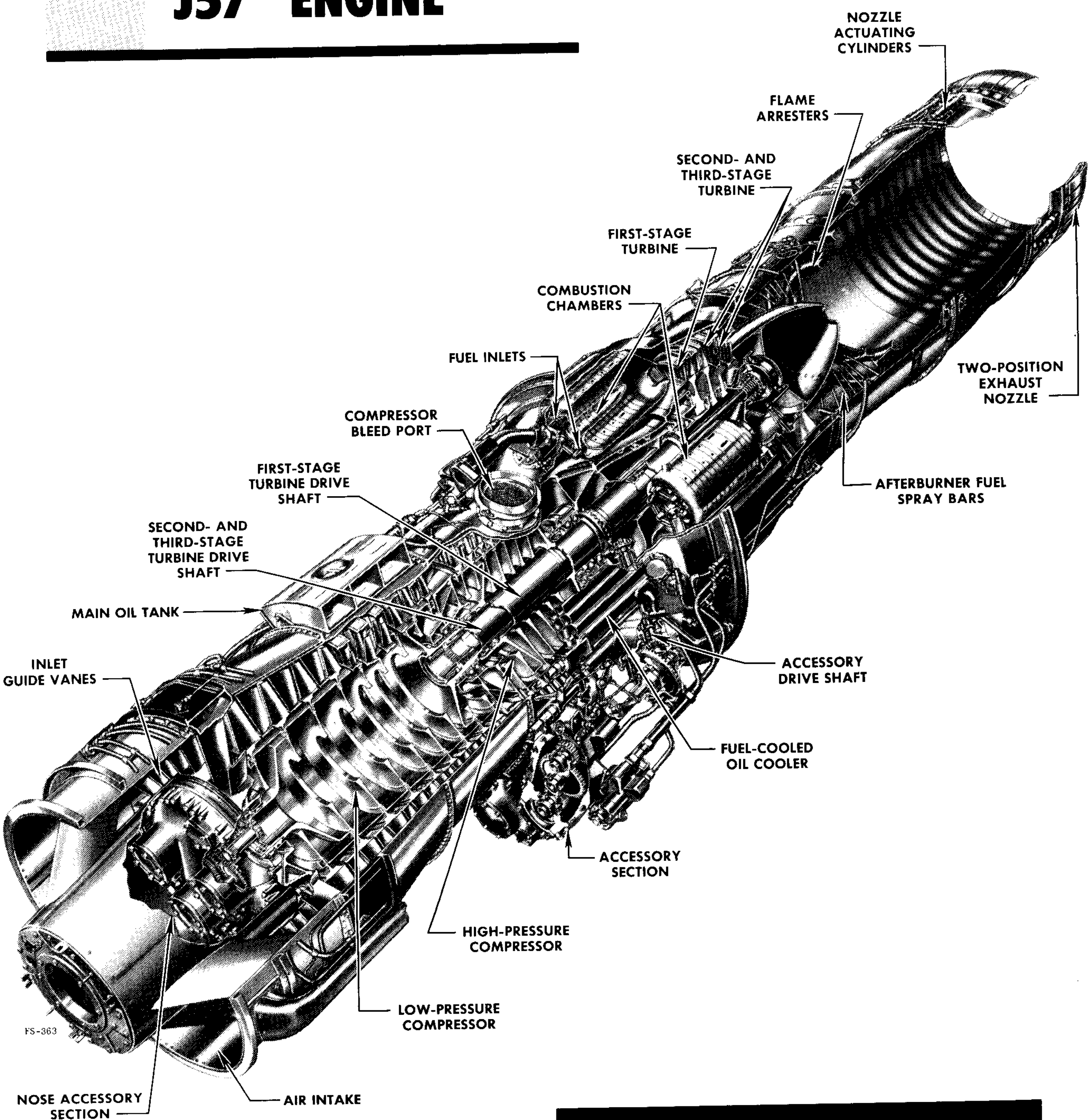
ENGINE COMPARTMENT.

The engine compartment is divided into two sections. The forward section encloses the compressor and accessory sections of the engine; the aft section houses the engine combustion and turbine sections and the afterburner.

ENGINE FUEL CONTROL SYSTEM.

Fuel flow to the engine is mechanically controlled by throttle movement and is delivered and regulated by the engine fuel control system. This system includes the engine-driven fuel pump unit, the hydromechanical fuel control unit, and the afterburner system. (For details of the afterburner, refer to "Engine Afterburner System," in this section.) The engine fuel control system is shown schematically in figure 1-10.

J57 ENGINE

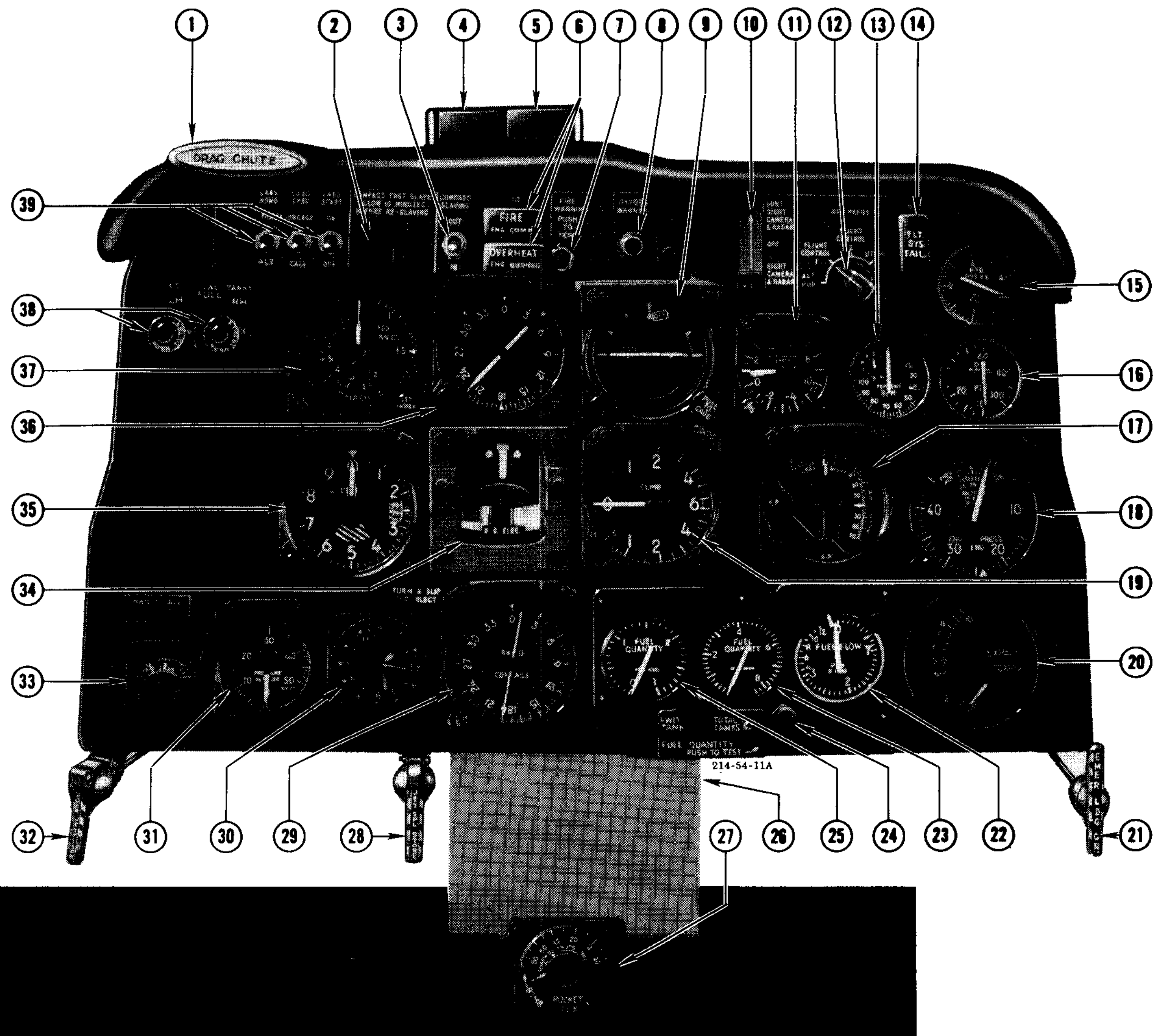


WITH AFTERBURNER

F-100C-1-40-1B

Figure 1-5

INSTRUMENT PANEL



1. DRAG CHUTE HANDLE
2. DIRECTIONAL INDICATOR (SLAVED) FAST SLAVE BUTTON
3. DIRECTIONAL INDICATOR SLAVING CUTOUT SWITCH
4. SPECIAL STORE INDICATOR LIGHT
5. M-1 BOMBING SYSTEM INDICATOR LIGHT
6. FIRE- AND OVERHEAT-WARNING LIGHTS
7. FIRE-AND OVERHEAT-WARNING SYSTEM TEST BUTTON
8. OXYGEN WARNING LIGHT*
9. ATTITUDE INDICATOR
10. TRIGGER SAFETY SWITCH
11. ACCELEROMETER
12. HYDRAULIC PRESSURE GAGE SELECTOR SWITCH
13. TACHOMETER
14. FLIGHT CONTROL HYDRAULIC SYSTEM PRESSURE FAILURE CAUTION LIGHT
15. HYDRAULIC PRESSURE GAGE
16. OIL PRESSURE GAGE
17. LABS DIVE-AND-ROLL INDICATOR
18. ENGINE DIFFERENTIAL PRESSURE GAGE * (ENGINE PRESSURE RATIO GAGE*)
19. VERTICAL VELOCITY INDICATOR
20. EXHAUST TEMPERATURE GAGE
21. LANDING GEAR EMERGENCY LOWERING HANDLE
22. FUEL FLOW INDICATOR
23. FUEL QUANTITY GAGE (TOTAL TANKS)
24. FUEL QUANTITY GAGE TEST BUTTON
25. FUEL QUANTITY GAGE (FORWARD TANK)
26. CENTER PEDESTAL
27. BOMB-TARGET WIND CONTROL
28. SPECIAL STORE EMERGENCY JETTISON HANDLE
29. RADIO COMPASS INDICATOR
30. CLOCK
31. COCKPIT PRESSURE ALTITUDE INDICATOR
32. EXTERNAL LOAD EMERGENCY JETTISON HANDLE
33. LOADMETER
34. TURN-AND-SLIP INDICATOR
35. ALTIMETER
36. DIRECTIONAL INDICATOR (SLAVED)
37. AIRSPEED AND MACH NUMBER INDICATOR
38. DROP TANKS-FULL INDICATOR LIGHTS*
39. LABS CONTROL SWITCHES*

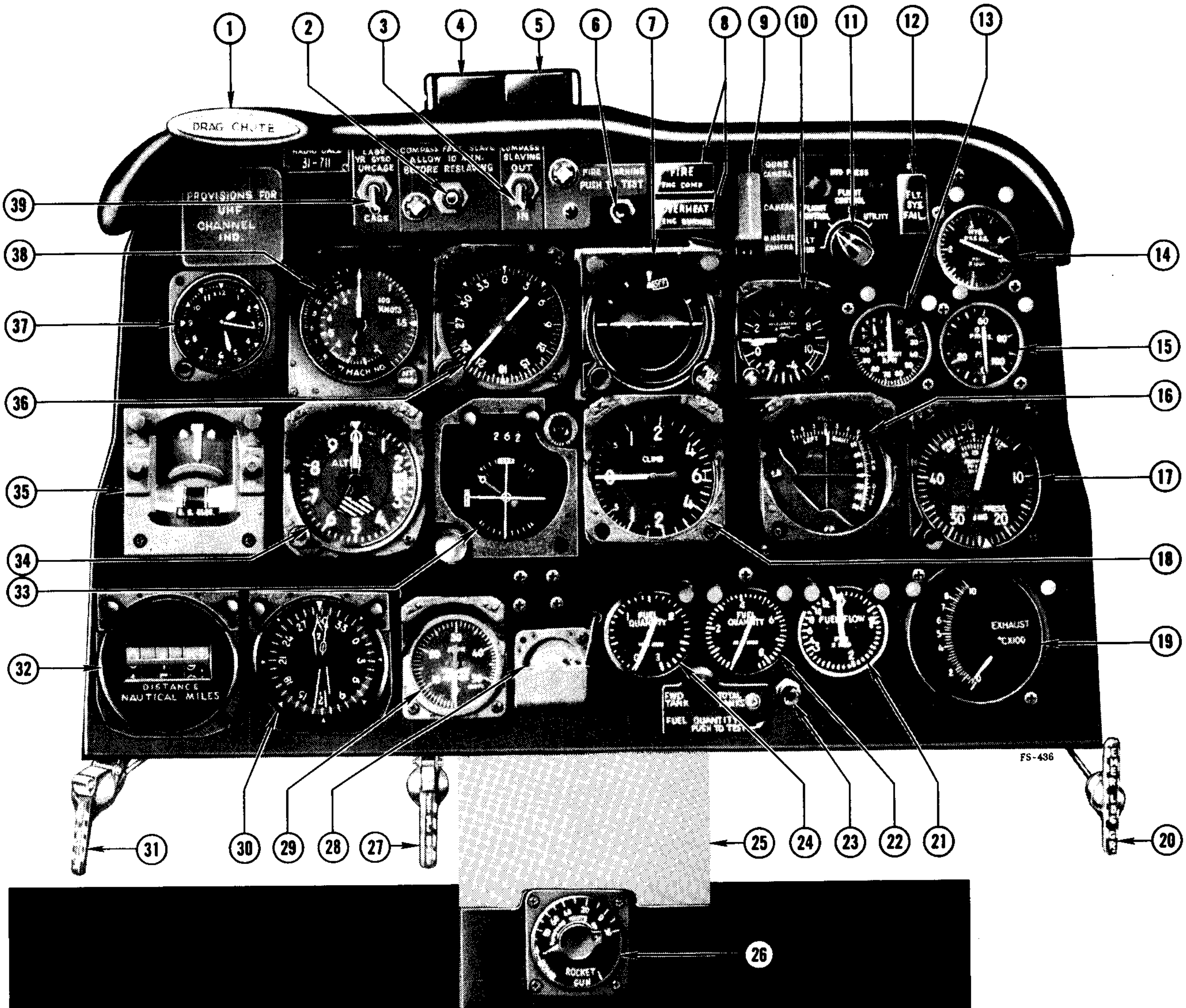
***Some airplanes (refer to applicable text).**

F-100C-1-00-86C

Figure 1-6

INSTRUMENT PANEL

AIRPLANES CHANGED BY T.O. 1F-100-734



1. DRAG CHUTE HANDLE
2. DIRECTIONAL INDICATOR (SLAVED) FAST SLAVE BUTTON
3. DIRECTIONAL INDICATOR SLAVING CUTOUT SWITCH
4. SPECIAL STORE INDICATOR LIGHT
5. M-1 BOMBING SYSTEM INDICATOR LIGHT
6. FIRE- AND OVERHEAT-WARNING SYSTEMS TEST BUTTON
7. ATTITUDE INDICATOR
8. ENGINE COMPARTMENT FIRE- AND OVERHEAT-WARNING LIGHTS
9. TRIGGER SAFETY SWITCH
10. ACCELEROMETER
11. HYDRAULIC PRESSURE GAGE SELECTOR SWITCH
12. FLIGHT CONTROL HYDRAULIC SYSTEM PRESSURE FAILURE CAUTION LIGHT
13. TACHOMETER
14. HYDRAULIC PRESSURE GAGE
15. OIL PRESSURE GAGE
16. LABS DIVE-AND-ROLL INDICATOR
17. ENGINE PRESSURE RATIO GAGE
18. VERTICAL VELOCITY INDICATOR
19. EXHAUST TEMPERATURE GAGE
20. LANDING GEAR EMERGENCY LOWERING HANDLE
21. FUEL FLOW INDICATOR
22. FUEL QUANTITY GAGE (TOTAL TANKS)
23. FUEL QUANTITY GAGE TEST BUTTON
24. FUEL QUANTITY GAGE (FORWARD TANK)
25. CENTER PEDESTAL
26. BOMB-TARGET WIND CONTROL
27. SPECIAL STORE EMERGENCY JETTISON HANDLE
28. LOADMETER
29. COCKPIT PRESSURE ALTITUDE INDICATOR
30. RADIO MAGNETIC INDICATOR
31. EXTERNAL LOAD EMERGENCY JETTISON HANDLE
32. TACAN RANGE INDICATOR
33. COURSE INDICATOR
34. ALTIMETER
35. TURN-AND-SLIP INDICATOR
36. DIRECTIONAL INDICATOR (SLAVED)
37. CLOCK
38. AIRSPEED AND MACH NUMBER INDICATOR
39. LABS YAW-ROLL GYRO SWITCH

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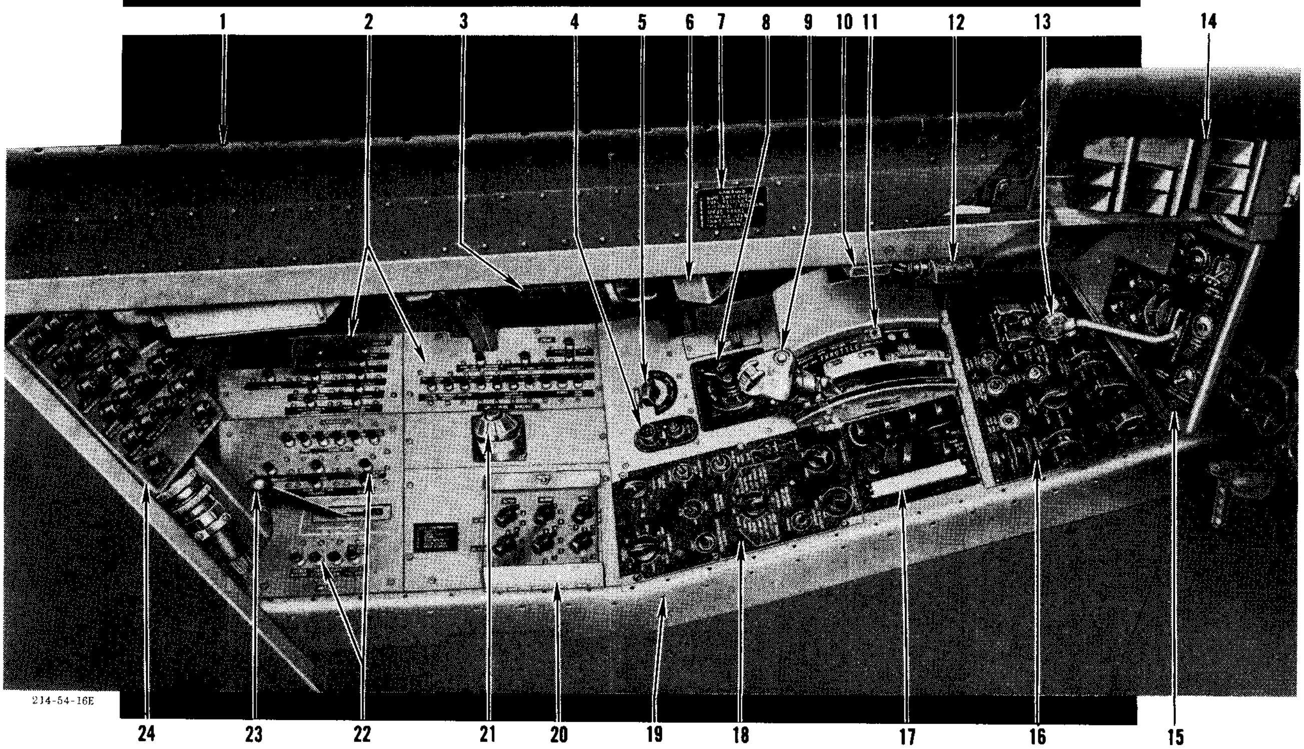
Figure 1-7

COCKPIT—LEFT SIDE



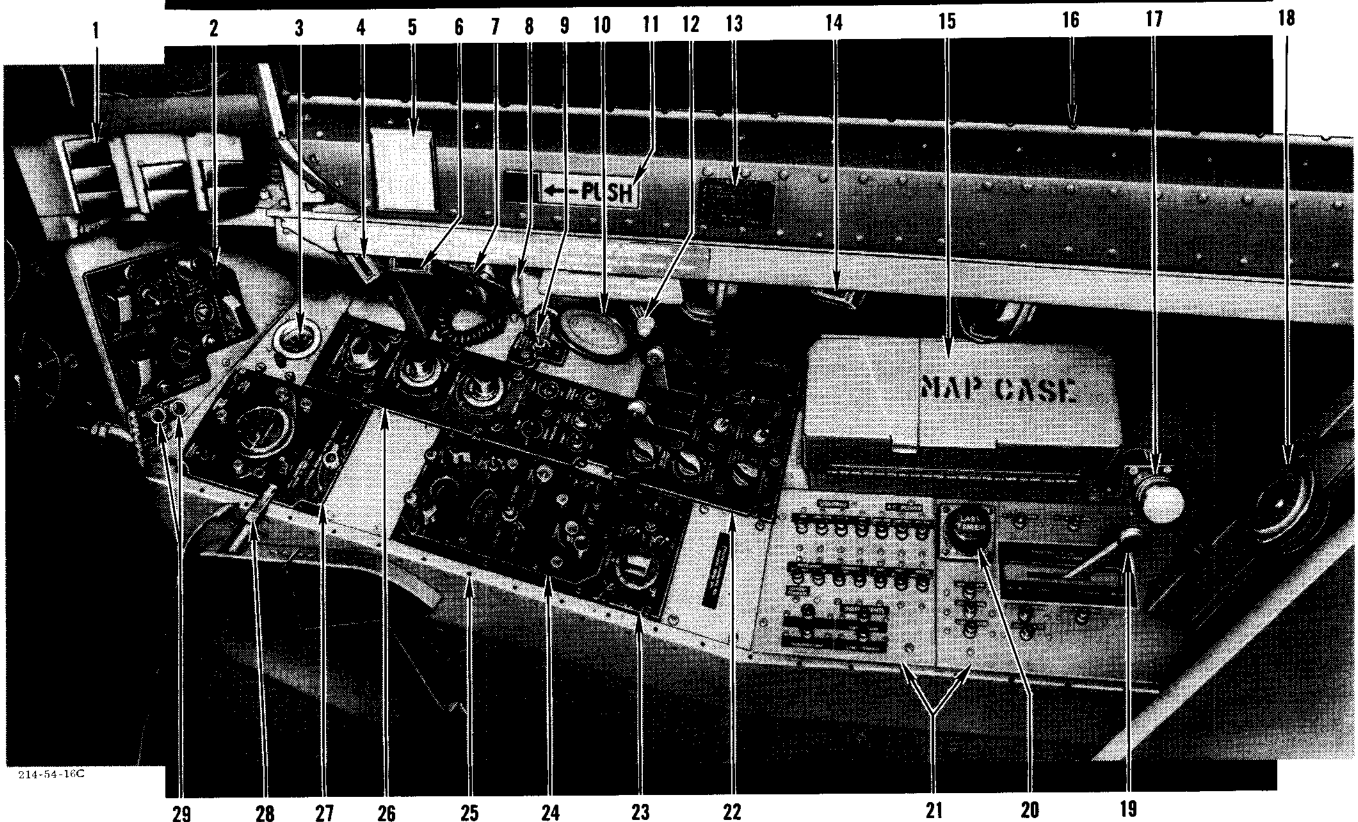
1. CANOPY DEFROST AIR OUTLETS
2. CIRCUIT-BREAKER PANELS
3. CONSOLE FLOODLIGHT
4. P-2 STRIKE CAMERA TIMER
5. CAMERA SHUTTER SELECTOR SWITCH
6. THUNDERSTORM LIGHT
7. LANDING CHECK LIST *
8. SIGHT SELECTOR UNIT
9. THROTTLE
10. CONSOLE FLOODLIGHT
11. THROTTLE FRICTION LEVER
12. INSTRUMENT PANEL FLOODLIGHT
13. LANDING GEAR HANDLE
14. INDICATOR- CAUTION-WARNING LIGHT PANEL
15. LANDING GEAR CONTROL PANEL
16. ENGINE AND FLIGHT CONTROL PANEL
17. COMMAND RADIO CONTROL PANEL
18. ARMAMENT CONTROL PANEL
19. CONSOLE AIR OUTLETS
20. PYLON LOADING CONTROL PANEL
21. ANTI-G SUIT PRESSURE-REGULATING VALVE
22. CIRCUIT-BREAKER PANELS
23. SPEED BRAKE EMERGENCY DUMP LEVER
24. FUSE PANEL

* Some airplanes. (Refer to applicable text.)

F-100C-1-00-36C

Figure 1-8

COCKPIT - RIGHT SIDE



1. INDICATOR- CAUTION - WARNING LIGHT PANEL
2. ELECTRICAL CONTROL PANEL
3. LIQUID OXYGEN QUANTITY GAGE
4. INSTRUMENT PANEL FLOODLIGHT
5. STAND-BY COMPASS CORRECTION CARD
6. CONSOLE FLOODLIGHT
7. COCKPIT UTILITY LIGHT
8. THUNDERSTORM LIGHT
9. REFUELING PROBE LIGHT SWITCH *
10. NAVIGATION COMPUTER
11. CANOPY INTERNAL MANUAL EMERGENCY RELEASE HANDLE
12. EMERGENCY HYDRAULIC PUMP LEVER *
13. TAKE-OFF CHECK LIST *
14. CONSOLE FLOODLIGHT
15. MAP CASE
16. CANOPY DEFROST AIR OUTLETS
17. SIGHT GROUND TEST PLUG
18. LANDING GEAR WARNING HORN
19. EMERGENCY HYDRAULIC PUMP LEVER *
20. LABS TIMER *
21. CIRCUIT-BREAKER PANELS
22. AIR CONDITIONING CONTROL PANEL
23. IFF CONTROL PANEL
24. RADIO COMPASS CONTROL PANEL
25. CONSOLE AIR OUTLETS
26. LIGHTING CONTROL PANEL
27. OXYGEN REGULATOR PANEL
28. CANOPY ALTERNATE EMERGENCY JETTISON HANDLE
29. DROP-TANKS-FULL INDICATOR LIGHTS *

* Some airplanes. (Refer to applicable text.)

F-100C-1-00-35F

Figure 1-9

Fuel Pump Unit.

The engine-driven fuel pump unit (figure 1-10) supplies the high fuel pressure required by the engine and afterburner systems. The unit has a centrifugal element, a gear-type engine element, and a gear-type afterburner element, and includes the afterburner system shuttle valve. All the fuel from the tanks passes through the centrifugal element, which provides the required inlet fuel pressure boost to the gear-type elements for take-off conditions if the tank-mounted electrical fuel booster pumps fail. Fuel discharged from the centrifugal element goes to both the engine and afterburner elements of the pump unit. The engine element maintains pressure for the fuel control unit; the afterburner element provides the pressure required by the afterburner fuel system. When the afterburner is not engaged, the afterburner shuttle valve in the fuel pump unit is closed, and the total output of the afterburner element goes to the centrifugal element discharge. When the afterburner is selected, the valve opens to supply afterburner element output to the afterburner system. If the engine element fails, a transfer valve in the pump unit opens automatically to send part of the afterburner element output to the engine fuel control. During this condition, only a limited fuel flow is available for the afterburner, and the output of the afterburner element permits Military Thrust operation or partial afterburner thrust. However, if the afterburner element fails, the engine element cannot supply fuel for afterburner operation.

Engine Fuel Control Unit.

The engine-driven hydromechanical fuel control (figure 1-10), incorporating both the normal and emergency fuel control systems, regulates fuel flow to the engine. During normal operation, the fuel flow is determined by the position of a variable-orifice metering valve in the fuel control that is governed by control signals from a mechanical computer. The computer (also in the fuel control unit) senses flight operating conditions and is mechanically controlled by the throttle. The computer sets the metering valve so that the fuel flow is automatically compensated for variations in flight conditions by sensing the throttle position, engine speed, engine burner pressure, and compressor inlet temperature.

Normal Fuel Control System. The normal fuel control system adjusts the fuel flow for altitude changes and, during rapid engine accelerations, schedules the fuel flow to protect the engine from overspeed and overtemperature conditions and to prevent compressor stall or engine flame-out. Excess fuel is bypassed to the discharge side of the centrifugal element of the fuel pump.

Emergency Fuel Control System. The emergency fuel control system provides regulation of engine fuel flow if the normal system fails, and must be selected by the pilot. A switch in each cockpit permits selection of either the normal or emergency fuel control system by either pilot. When the emergency system is selected, the normal system is disengaged. Fuel flow is then metered by the emergency fuel metering valve in the fuel control unit that is mechanically connected to the throttles. Fuel flow is automatically compensated for airspeed changes and for altitude changes up to about 30,000 feet. At higher altitudes, the throttle must be successively retarded to prevent engine overspeed and overtemperature. The emergency bypass valve routes excess fuel back to the discharge side of the centrifugal element of the fuel pump.

NOTE There are no provisions for automatic transfer to the emergency fuel control system upon failure of the normal fuel control system.

Burner Pressure Limiter. The burner pressure limiter in the engine fuel control unit automatically reduces fuel flow when burner pressure approaches the maximum safe limit, based on engine case strength. Limiter action occurs only at low altitude and produces a slight rpm loss which may be accompanied by a mild engine surge or "choo-choo." This surge, which should not be confused with a compressor stall, is not harmful and can be eliminated by a slight reduction in engine rpm or airspeed. Under extreme cold-weather conditions, limiter action may occur just after take-off and before initial climb. At outside air temperatures of 60°F and above, the limiter will operate at about .80 to .85 Mach at sea level. (Refer to "Compressor Stall" in Section VII.)

Fuel Cutoff Valve. A cutoff valve in the fuel control unit is closed mechanically when the throttle is retarded to OFF, shutting off all fuel flow to the engine.

Fuel Pressurizing and Dump Valve.

The engine fuel pressurizing and dump valve (figure 1-10) automatically directs fuel to one or both fuel manifolds, depending on engine operating conditions. During engine shutdown, when the cutoff valve in the fuel control unit is closed by throttle movements, the dump valve is opened to permit fuel remaining in both manifolds to drain overboard.

ENGINE CONTROLS.

Throttle.

Engine thrust is controlled by the throttle (figure 1-11) which is mechanically linked to the fuel control unit for regulating engine output. The throttle also controls various engine and fuel system units. When the engine master switch is ON, the first outboard and forward movement of the throttle from OFF (stopcock) starts the tank-mounted electrical fuel booster pumps, the fuel transfer pump in the intermediate tank, and partially opens the fuel cutoff valve. In addition, if the starter and ignition

ENGINE FUEL CONTROL SYSTEM

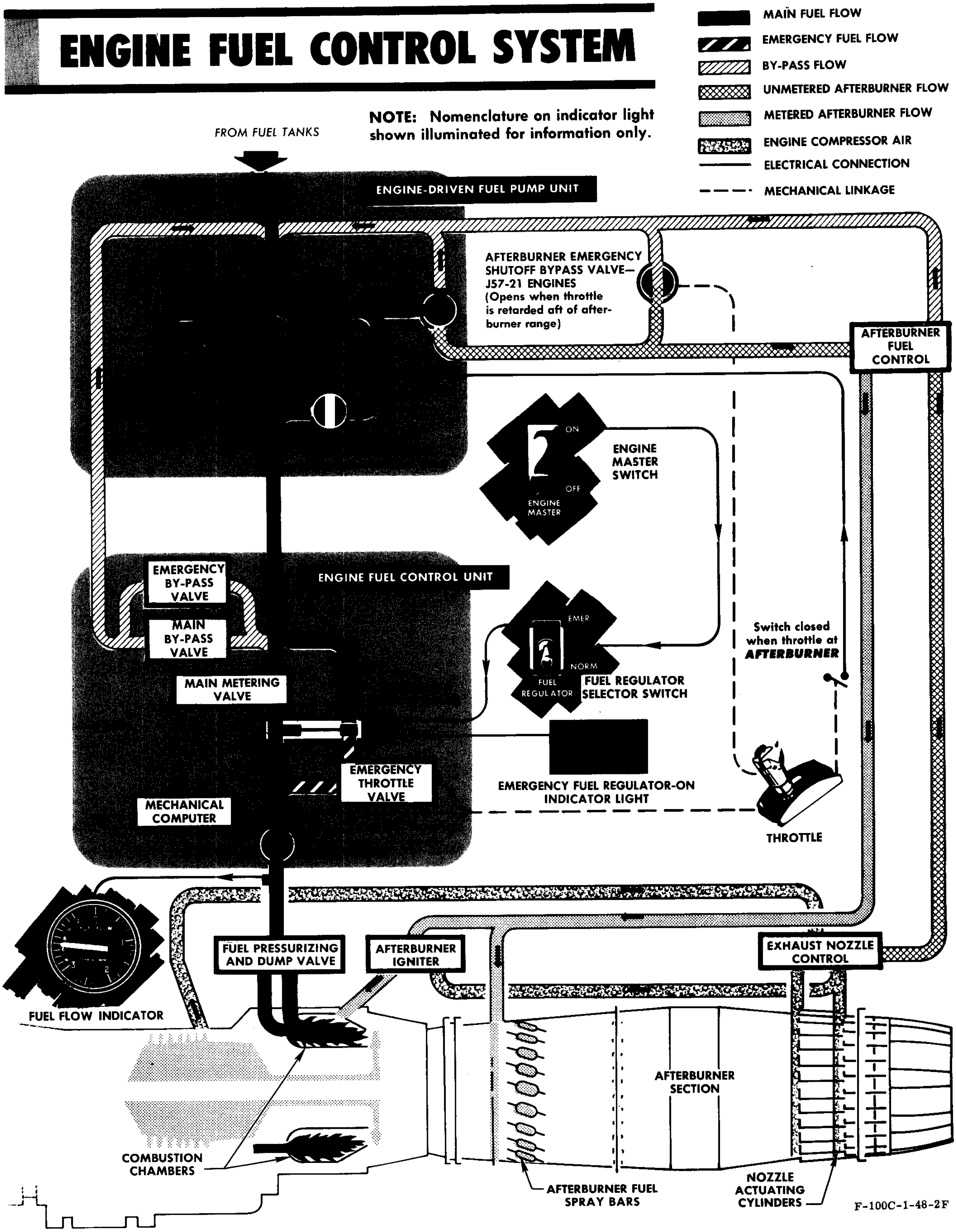


Figure 1-10

THROTTLE

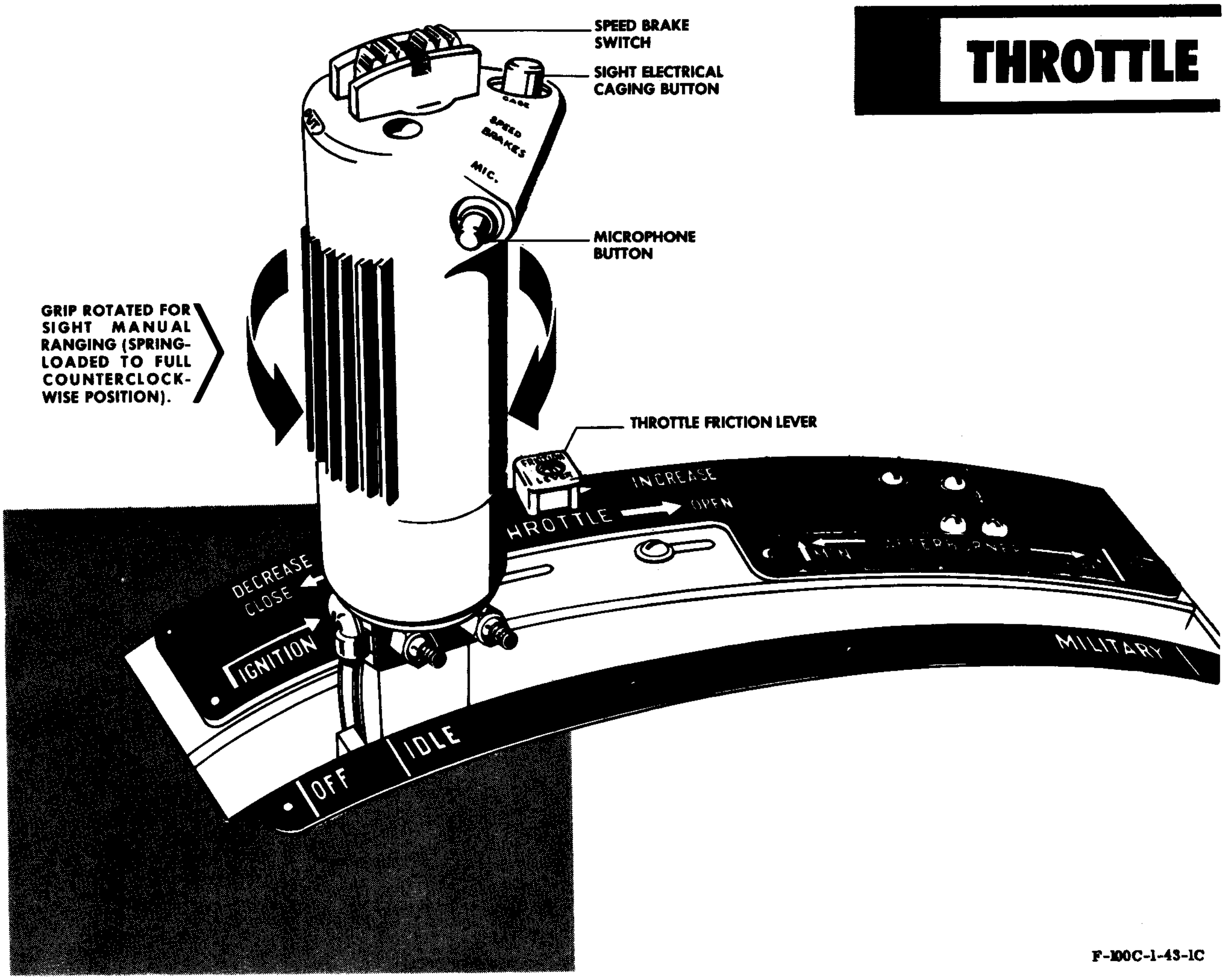


Figure 1-11

button has been pressed, this initial throttle movement energizes the engine ignition circuit. Additional forward and inboard movement of the throttle to IDLE fully opens the fuel cutoff valve, and the fuel control system then automatically meters fuel to the engine according to throttle setting. When the throttle is moved outboard in the forward part of the quadrant from MILITARY to AFTERBURNER, the tank-mounted afterburner fuel booster pump is energized and the afterburner system is actuated. (Refer to "Engine Afterburner System" in this section.) An override spring prevents the throttle from being moved inadvertently into the afterburner range and holds the throttle outboard in the quadrant when the afterburner has been selected.

When the throttle is moved inboard, the afterburner is shut down. J57-21 and -21A engines have an afterburner emergency shutoff, which mechanically shuts down the afterburner when the throttle is retarded beyond the minimum afterburner setting. (Refer to "Engine Afterburner System" in this section.) When the throttle is retarded to OFF, the fuel booster and transfer pumps are de-energized, the circuit to the wing tank scavenge pumps is opened, and the fuel cutoff valve in the fuel control unit is closed mechanically to shut off fuel to the engine.

NOTE To stopcock the throttle, it is necessary to move the throttle outboard to clear the IDLE stop, then straight back to the limit of rearward motion, and then inboard to OFF.

The throttle grip contains the speed brake switch, the microphone button, and the electrical caging button for the sight. Rotation of the throttle grip supplies manual range data to the sight. (See figure 1-11.)

Throttle Friction Lever. Adjustment of throttle travel friction is controlled by a lever. (See figure 1-11.) The friction on throttle travel is increased when the friction lever is moved forward.

Engine Master Switch.

The two-position primary bus power engine master switch (figure 1-12) controls the electrical power sources for various engine and fuel system units. When the switch is ON, the fuel system shutoff valve is opened by primary bus power, and the electrically driven fuel transfer pump in the aft fuselage tank is actuated if tertiary bus power is available. Moving the switch to ON also completes the electrical circuits to the starter and ignition button, to the fuel regulator selector switch, and to the throttle-actuated limit switch, so that the tank-mounted electrically driven fuel booster pumps and the intermediate tank transfer pump will operate when the throttle is moved from OFF. The power circuit to the electrically driven wing tank scavenge pumps is also completed when the engine master switch is ON (if the throttle is not OFF) to permit these pumps to function when actuated by the float switches in the forward fuselage tank. When the engine master switch is moved to OFF (switch guard raised), the fuel system shutoff valve is closed, the fuel booster, fuel transfer, and scavenge pumps are inoperative, and the ignition circuit is interrupted. If the master switch is used in an emergency to shut down the engine, the time required for thrust to decrease to idle at sea level varies between about 13 seconds from Military Thrust and about 10 seconds from 70% rpm. (These figures will be altered slightly by altitude and by temperatures that differ from standard day conditions.)

Fuel Regulator Selector Switch.

The primary-bus-powered fuel regulator selector switch (figure 1-12) positions the emergency shuttle transfer valve in the fuel control unit to select either the normal or emergency fuel control system. When the switch is at NORM, the valve is positioned so that fuel flow is controlled by the normal fuel control system. If the normal fuel control fails or does not function properly, moving the switch to EMER positions the valve so that fuel flow is regulated by the emergency fuel system. (The normal fuel control system is inoperative when the emergency system is engaged.) The fuel regulator selector switch is independent of throttle positioning and is effective when the engine master switch is ON. An indicator light in the cockpit comes on when the regulator selector switch is at EMER.

ENGINE INDICATORS.

Engine Differential Pressure Gage.*

The engine differential pressure gage (18, figure 1-6; 17, figure 1-7, figure 1-13), also called the "delta P" (ΔP) gage, is used to check that engine thrust output on the ground at full throttle is acceptable for take-off. (Refer to "Thrust-RPM Relationship" in Section VII.) It is also used as a guide for in-flight cruise thrust settings. The gage shows the differential between pitot pressure (taken from the pitot-static boom) and engine turbine discharge pressure. This differential is shown in inches of mercury (in. Hg) on a dial calibrated from 0 to 50. A green index marker at the edge of the dial indicates the minimum allowable take-off thrust. The setting of the index marker is adjustable. A movable free air temperature scale (in the dial face) and a fixed ambient pressure scale (on the upper arc of the dial) are used to obtain proper index marker settings. The index marker is adjusted by a knob at the left corner of the instrument ring. It must be emphasized that the index marker is applicable only for ground run-up, and should be disregarded in flight. The gage can be used, however, to select *approximate* in-flight cruise thrust settings. Refer to cruise performance charts in Appendix I for setting values.

Caution The engine differential pressure gage system uses three-phase ac power. If this power source fails, the gage becomes inoperative; however, the indicating pointer will remain fixed at the setting prevailing at the time of power failure.

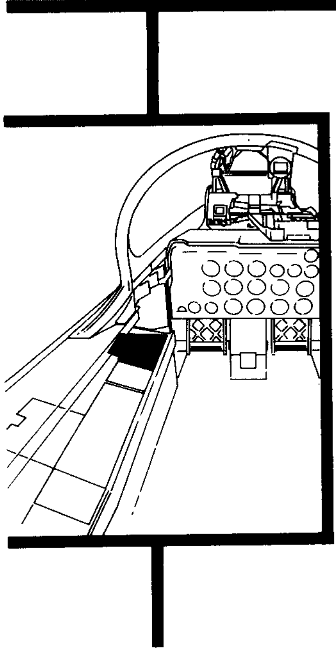
Engine Pressure Ratio Gage.†

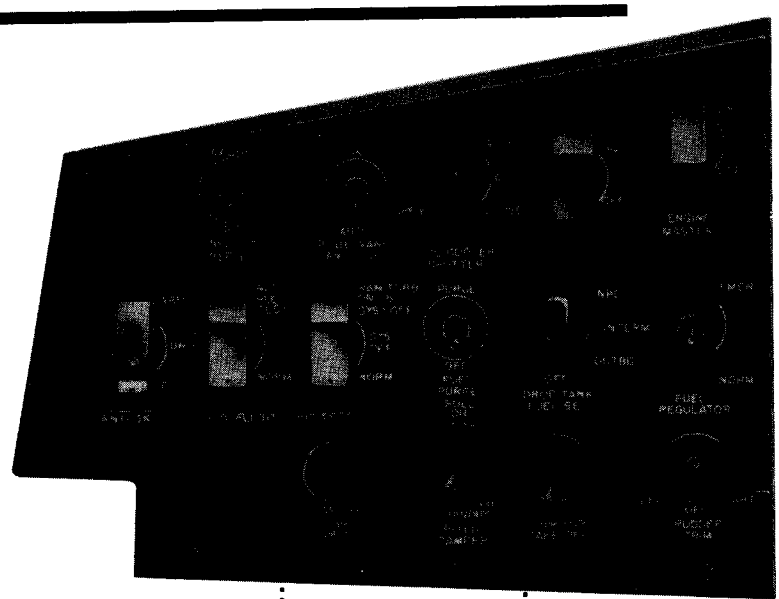
The engine pressure ratio gage (18, figure 1-6; 17, figure 1-7; figure 1-13) shows the ratio of engine turbine discharge pressure to pitot pressure. The gage is used to determine whether engine thrust at full throttle is acceptable for take-off. (Refer to "Thrust-RPM Relationship" in Section VII.) Windows in the dial face show the take-off pressure ratio and the cruise pressure ratio, which are adjustable by the index marker adjustment knob. *Pushing in* and turning the knob sets the take-off pressure ratio (figure 2-6) and moves the take-off index marker to the dial setting that corresponds to the figures in the "TAKE-OFF" window. *Pulling out* and turning the knob sets the cruise pressure ratio and moves the cruise index marker to correspond with the figures in the "CRUISE" window. Because of the lag in the instrument, the indicating pointer may be slow to respond to throttle movements and is not satisfactory for cruise use. The pressure ratio gage is powered by single-phase ac power.

Caution If electrical power (single-phase ac) fails, the gage becomes inoperative, but the indicating pointer remains fixed at the setting prevailing at the time of power failure.

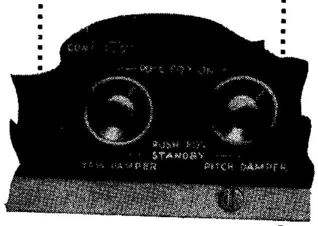
***F-100C-1 through F-100C-15 Airplanes and F-100C-20 Airplanes AF54-1860 through -1914**
†F-100C-20 Airplane AF54-1915 and later airplanes

ENGINE AND FLIGHT CONTROL PANEL





FS-29



F-100C-25 AIRPLANES FS-30

NOTE

- The oil cooler switch is removed on all airplanes changed by T.O. 1F-100-668.
- The antiskid switch is on F-100C-15 Airplane AF54-1833 and all later airplanes, and airplanes changed by T.O. 1F-100-534.
- The fuel purge switch is inoperative on airplanes changed by T.O. 1F-100-609.

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Figure 1-12

Exhaust Temperature Gage.

The exhaust temperature gage (20, figure 1-6; 19, figure 1-7) indicates engine exhaust temperature in degrees centigrade. Gage indications are received from thermocouples in the tail pipe. The temperature indicator system is of the self-generating type and therefore does not require power from the airplane electrical system.

Oil Pressure Gage.

The engine oil pressure gage (16, figure 1-6; 15, figure 1-7) indicates the oil pump discharge pressure above the gear case pressure in pounds per square inch. The gage is electrically operated by single-phase (ac) power obtained through a step-down transformer from one phase of the three-phase (ac) bus. (Refer to "Oil Pressure" in Section VII.)

Tachometer.

The tachometer (13, figures 1-6 and 1-7) registers engine speed in percentage of the approximate maximum rpm (9980) of the high-pressure compressor rotor. The tachometer receives its power from a tachometer generator that is geared to the engine accessory section driven by the high-pressure compressor rotor, and is therefore independent of the airplane electrical system.

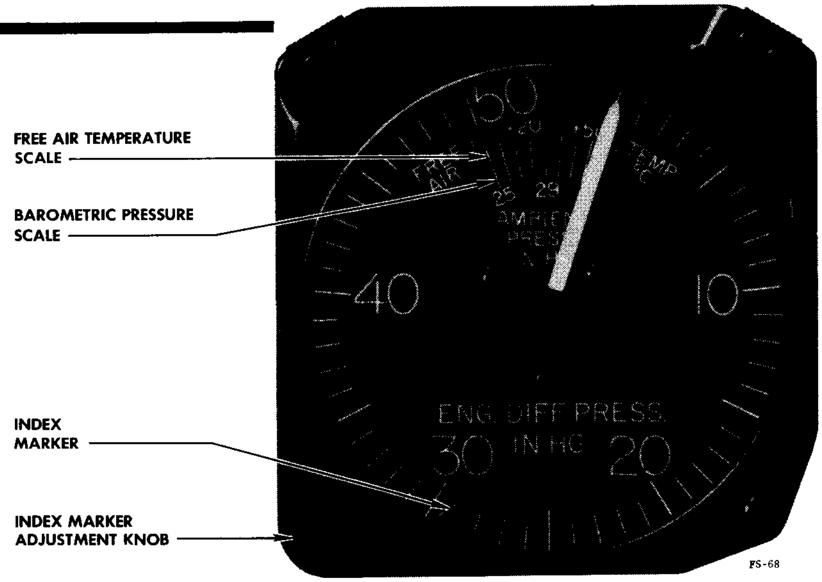
NOTE Refer to "Thrust-RPM Relationship" in Section VII.

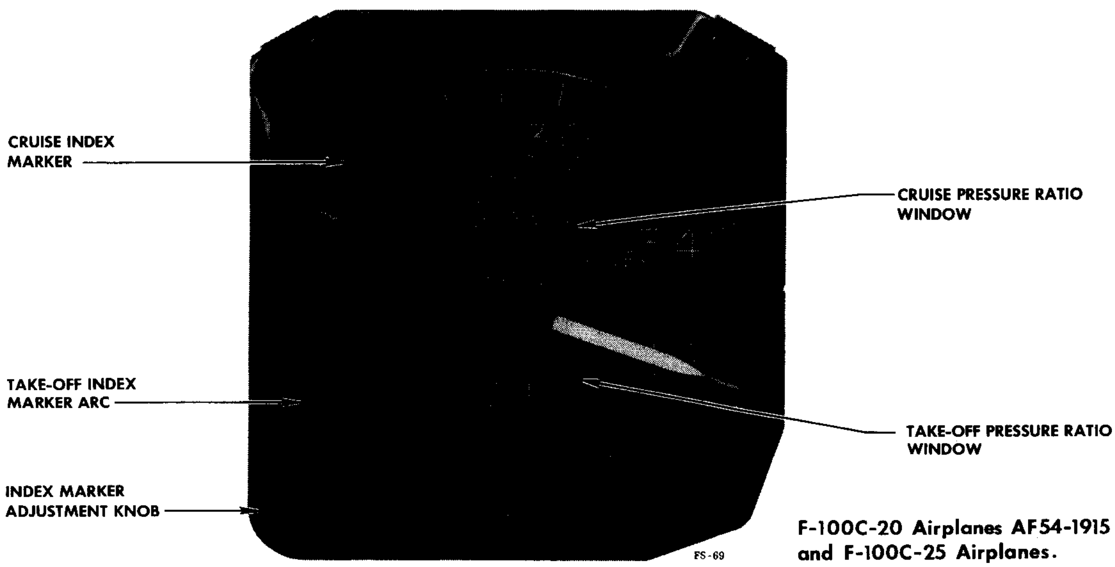
Fuel Flow Indicator.

The fuel flow indicator (22, figure 1-6; 21, figure 1-7) shows the rate of fuel flow from the fuel control unit to the engine in pounds per hour. The flow indicator is electrically operated by single-phase (ac) power obtained

ENGINE DIFFERENTIAL PRESSURE GAGE

F-100C-1 through F-100C-15 Airplanes and F-100C-20 Airplanes AF54-1860 through -1914.





F-100C-20 Airplanes AF54-1915 through -1969 and F-100C-25 Airplanes.

NOTE

The take-off index marker consists of the entire arc of the marker, including the triangle.

F-100C-1-51-5D

ENGINE PRESSURE RATIO GAGE

Figure 1-13

through a step-down transformer from one phase of the three-phase (ac) bus.

NOTE The flow indicator does not register fuel flow to the afterburner system.

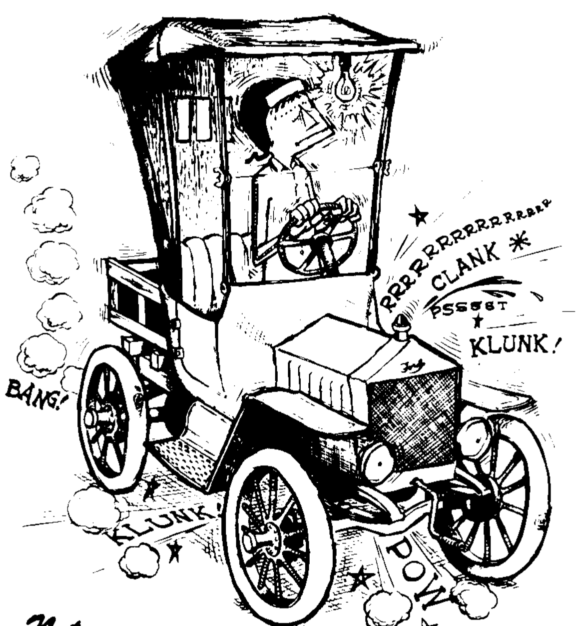
- The fuel flow indicator indicates approximate fuel flow and is not for exact in-flight planning.

Emergency Fuel Regulator-on Indicator Light.

The emergency fuel regulator-on indicator light (figure 1-4) comes on when the emergency fuel control system is engaged by the fuel regulator selector switch. The light is powered by the primary bus, and bulb operation may be tested by the indicator light test circuit.

Engine Fuel Pump Failure Caution Light (Some Airplanes).

Failure of the gear-type engine element in the engine-driven fuel pump unit is indicated by the placard-type engine fuel pump failure caution light. (See figure 1-4.) The light is powered by the primary bus. The light is operable only when the engine master switch is ON and the throttle is advanced from OFF. Bulbs within the light can be checked by the indicator light test circuit. On some airplanes, the pump failure light has been disconnected.



Note

During engine start, the fuel pump failure caution light remains on until fuel pressure is about 115 psi.

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ENGINE STARTER AND IGNITION SYSTEMS.

Starter System.

The air-driven, turbine-type starter requires a continuous flow of compressed air from an external source for operation. (The receptacle for connecting the air supply line is within an access door on the lower surface of the fuselage, behind the main gear wheel wells.) If the engine fails to start, the starter air supply can be shut off.

Ignition System.

The engine ignition system is used only during engine starting, because combustion is continuous after the engine is operating. The system has two high-frequency ignition units (which convert dc power from the primary bus to high-tension ac) and two igniter plugs. If the engine fails to start and the starter is shut off, the ignition circuit is de-energized at the same time. A separate switch permits the ignition circuit to be engaged for air starts.

Starter and Ignition System Controls and Indicator.

Throttle. Refer to "Engine Controls" in this section.

Engine Master Switch. Refer to "Engine Controls" in this section.

Starter and Ignition Button. The starter and ignition button (figure 1-18) controls normal ground starts. When the engine master switch is ON, momentarily pressing the button supplies primary bus power to open the starter air valve (so that the starter can be turned by compressed air from an external source) and, when the throttle is moved outboard from OFF, primary bus power energizes the ignition circuit. (If the engine master switch is ON and the throttle OFF, pressing the starter and ignition button opens the starter air valve only.) An electrical holding relay keeps the starter and ignition circuits energized until engine rpm (high-pressure compressor rotor) reaches about 50%. Both circuits then are automatically opened by centrifugal switches. An ignition-on indicator light is in the cap of the starter and ignition button.

Air Start Switch. A two-position air start switch (figure 1-12) is used to energize the ignition circuit for in-flight engine starts. Moving this switch to ON, when the engine master and battery switches are ON and the throttle is moved from OFF, directs primary bus power to the ignition units. While the air start switch is ON, the generator is automatically cut out of the electrical system. (The secondary and tertiary busses therefore become de-energized.) The air start switch should be returned to OFF as soon as a start is completed. Generator output is automatically restored when the air start switch is moved to OFF.

Starter and Ignition Stop Button. The starter and ignition stop button (figure 1-18) is used during ground starting to shut off the starter and ignition circuits if the engine fails to start or whenever it is necessary to abort a ground start. Pressing the button cuts off primary bus power to the ignition and starter control circuits to close the valve in the starter air supply line and de-energize the ignition circuit. It is not necessary to use the button after normal starts or after an air start.

Ignition-on Indicator Light. The red ignition-on indicator light is in the cap of the starter and ignition button. (See figure 1-18.) The light is illuminated by primary bus power whenever the ignition circuit is energized. The bulb in the ignition-on light may be tested by the indicator light test circuit.

ENGINE AFTERBURNER SYSTEM.

Afterburning increases exhaust temperature and pressure, which increases the exhaust velocity for additional thrust. Because of its high fuel consumption, the afterburner is intended to be used for short operational periods only. Afterburner operation is controlled by inboard and outboard movement of the throttle.

AFTERBURNER FUEL CONTROL.

Fuel flow to the afterburner system is controlled and regulated by the afterburner fuel control. (See figure 1-10.) When the throttle is moved outboard, the afterburner shuttle valve in the engine-driven fuel pump unit is opened to send fuel to the afterburner fuel control. The control meters fuel to actuate the afterburner igniter and supplies fuel to the afterburner fuel spray bars. Unmetered afterburner fuel from the control actuates the exhaust nozzle control unit to open the nozzle. Fuel flow from the afterburner fuel control is controlled by compressor discharge pressure. Because this pressure is governed by airspeed, altitude, and engine speed, the pilot has no direct control of afterburner fuel flow. However, during afterburner operation, a thrust variation ranging between the maximum available thrust and the equivalent of about 50 percent afterburning can be obtained by advancing or retarding the throttle (in the AFTERBURNER range) to change engine speed. When the throttle is moved inboard, to shut down the afterburner, the afterburner shuttle valve shuts off all fuel flow to the afterburner fuel control and the control assumes a full bypass condition. Afterburner fuel pressure drops enough to shut down the afterburner system and close the exhaust nozzle.

EXHAUST NOZZLE.

The two-position, multiple-segment type exhaust nozzle, at the end of the tail pipe, provides the proper exhaust nozzle area for either normal (fully closed) or afterburner engine operation (fully opened). The nozzle segments are positioned automatically by means of the exhaust nozzle control unit. A series of short-iris, nozzle-seal fingers, between afterburner nozzle and the tail pipe, prevents the leakage of exhaust gases back into the aft fuselage area. These fingers should be checked before each flight, and, if any are broken or missing, the airplane should not be flown.

Exhaust Nozzle Control Unit.

The exhaust nozzle is controlled by pressure of the unmetered fuel from the afterburner fuel control through the exhaust nozzle control unit. (See figure 1-10.) When afterburner operation is selected, this pressure moves a spring-loaded valve in the nozzle control which directs compressor discharge air pressure to 24 nozzle actuators to open the segments. Moving the throttle inboard to shut down the afterburner shuts off unmetered afterburner fuel pressure to the nozzle control unit. The valve in the control unit then returns to its normal position and routes engine compressor air to the "close" side of the nozzle actuators to close the nozzle segments for normal engine operation.

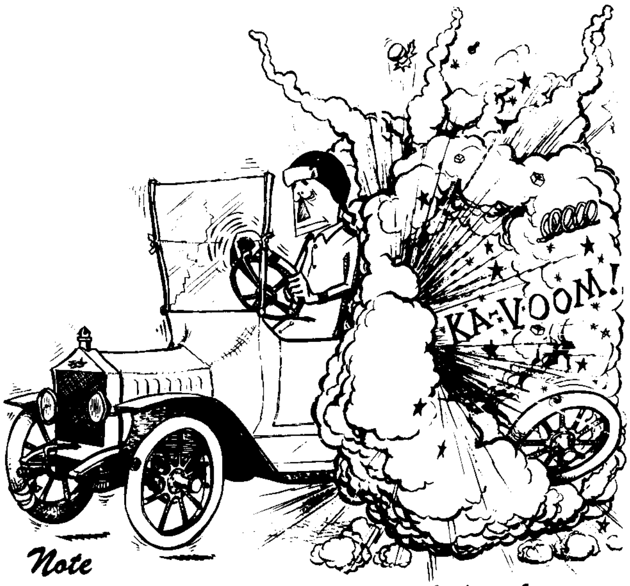
AFTERBURNER IGNITER.

Metered fuel from the afterburner fuel control goes to the igniter unit. (See figure 1-10.) This metered fuel fills the igniter discharge chamber and is injected into one burner can of the engine. An excessively rich fuel-air mixture is created and forms a longer than normal flame front that continues to burn past the turbines. The extended flame provides "hot-streak" ignition to ignite the fuel being discharged from the afterburner fuel spray bars. The igniter is actuated only when full pressure is built up in the afterburner manifold. No repeater mechanism is incorporated in the igniter, and the unit does not recycle until the afterburner fuel pressure is shut off and restored (throttle moved inboard, then outboard).

NOTE A recirculating-type afterburner igniter and associated afterburner improvements, on -21A engines, ensure satisfactory afterburner ignition above 45,000 feet and blow-out-free operation to service ceiling.

AFTERBURNER EMERGENCY SHUTOFF (J57-21 OR -21A ENGINES).

The afterburner is shut off mechanically by the throttle if the normal electrical control fails to close the afterburner shuttle valve. This shutoff also permits pilot selection of in-flight cruise power settings that offer low fuel consumption in case of an electrical afterburner shutoff failure. The emergency shutoff shuts down the afterburner indirectly by a bypass valve that is positioned mechanically by the throttle. (See figure 1-10.) When the throttle has been moved inboard and then retarded to a setting that gives about 1% rpm less than that at



Note

If normal electrical control of the afterburner has failed and the system has been shut down mechanically, readvancing the throttle closes the by-pass valve, causing the exhaust nozzle to open and the afterburner to relight.

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minimum afterburner, the bypass valve opens. If the afterburner did not shut down electrically when the throttle was moved inboard, the open bypass valve will bypass all fuel entering the afterburner system and return it to the discharge of the centrifugal element of the engine-driven fuel pump. This shuts down afterburner operation and closes the exhaust nozzle. (If the afterburner had shut off normally, the open bypass valve would not affect the system.) Whenever the throttle is advanced through the afterburner cutoff range, the bypass valve is closed to permit afterburner operation.

EXHAUST NOZZLE FAILURE CAUTION LIGHT.*

If the exhaust nozzle does not open during afterburner operation, the placard-type nozzle failure caution light (figure 1-4) comes on by primary bus power. The afterburner should be shut off immediately if the nozzle failure caution light comes on. The light may be tested by the indicator light test circuit.

NOTE The exhaust nozzle failure caution light system is inoperative and the light does not provide an indication if the nozzle does not open. The light comes on, however, when the indicator light test button is used to check bulb operation.

OIL SYSTEM.

The dry-sump, recirculating, pressure-type engine oil system is supplied from two interconnected tanks. The main tank, with a capacity of 5.5 US gallons, is mounted on the left side of engine compressor section; the 2-gallon auxiliary oil tank, on the right side of engine, is connected to the main tank by a gravity-feed line. (Total usable oil supply is 5 US gallons.) Oil flows from the tanks to a gear-type pump which supplies oil under pressure to lubricate and cool bearings and gears within the engine. Scavenged oil is picked up by six gear-type pumps and, on some airplanes,† sent through a ram-air-cooled oil cooler. The oil is then sent through a fuel-cooled oil cooler and returned to the tanks to repeat the oil flow cycle. The fuel-cooled oil cooler has a conventional regulator valve that allows the oil to bypass or go through the cooler, depending on oil temperature. The ram-air-cooled oil cooler† is provided as a secondary cooler in the oil system. All the oil goes through the ram-air oil cooler. The flow of cooling air through that unit is regulated by an electrically actuated movable shutter. Shutter position is normally selected automatically by a thermostatic control in the oil return line. However, the shutter position can be adjusted by the oil cooler shutter switch. (See figure 1-33 for oil specification.)

OIL COOLER SHUTTER SWITCH.†

The oil cooler shutter switch (figure 1-12) provides automatic or selective control of the shutter on the ram-air-cooled oil cooler. When set at an operative position, the primary bus powers the shutter actuator. Normally, the oil temperature will not exceed 250°F, but if it does, when the switch is at AUTO, the automatic shutter control will regulate the shutter opening to maintain the oil temperature below about 250°F (121°C). When the switch is held at either OPEN or CLOSE, the automatic circuit is bypassed. If the shutter is opened by means of the OPEN position of the switch, the switch must be held at CLOSE to close the shutter. The switch is spring-loaded from OPEN or CLOSE positions to OFF. The shutter control system is inoperative when the switch is OFF, and the shutter remains in the last selected position.

OIL OVERHEAT CAUTION LIGHT.

The placard-type oil overheat caution light (figure 1-4) comes on by primary bus power when the engine oil temperature is higher than about 260°F (127°C), and may indicate an engine malfunction as well as a malfunction of the oil cooling system. The bulbs in the light can be checked by the indicator light test circuit.

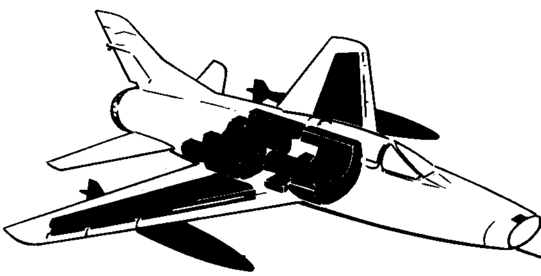
***F-100C-1 Airplanes AF53-1739 through -1778, and F-100C-5 and F-100C-10 Airplanes**
†Airplanes not changed by T.O. 1F-100-668

FUEL QUANTITY DATA POUNDS AND US GALLONS

NOTE
Weights given are for JP-4 based on a Standard Day fuel weight of 6.5 pounds per gallon.

	USABLE FUEL IN LEVEL FLIGHT		FULLY SERVICED	
	POUNDS	GALLONS	POUNDS	GALLONS
FORWARD FUSELAGE TANK	2620	403	2639	406
INTERMEDIATE FUSELAGE TANK	1436	221	1469	226
AFT FUSELAGE TANK	689	106	702	108
INTEGRAL WING TANKS	2743	422	2769	426
DROP TANKS (275 GAL EACH)	1787	275	1800	277
DROP TANKS (200 GAL EACH)	1300	200	1313	202
DROP TANKS * (450 GAL EACH)	2925	450	2938	452

*Airplanes changed by T.O.



TOTAL USABLE FUEL

	POUNDS	GALLONS
WITHOUT DROP TANKS	7488	1152
FULL INTERNAL FUEL PLUS TWO 275-GALLON DROP TANKS	11,063	1702
FULL INTERNAL FUEL PLUS ONE 275-GALLON AND TWO 200-GALLON DROP TANKS	11,875	1827
FULL INTERNAL FUEL PLUS TWO 450-GALLON DROP TANKS*	13,338	2052

1166

BASED ON: CALIBRATED DATA
DATA AS OF: FEBRUARY 1958

F-100C-1-48-5D

Figure 1-14

AIRPLANE FUEL SYSTEM.

Fuel is supplied to the engine fuel control system by the airplane fuel system, which includes three tanks in the fuselage and a tank in each wing outer panel. (See figure 1-15.) To increase the fuel supply, drop tanks may be installed on the lower surface of the wings. All internal fuel is sequenced automatically by gravity and electrical fuel transfer pumps to maintain the fuel distribution within the CG limits of the airplane. Fuel is transferred from all internal tanks and drop tanks to the forward fuselage tank. (Refer to "Fuel Transfer" in Section VII.) All fuel to the engine passes through an inverted-flight tank in the right cell of the intermediate tank. The inverted-flight tank retains about 1.6 gallons, which is enough for brief periods of flight at negative G. The internal tanks and 450-gallon drop tanks on airplanes changed by T.O. are serviced by single-point pressure refueling and can be refueled in flight through a probe which can be mounted on the underside of the right wing. (Refer to "Pressure Refueling System" in Section IV.) Fuel tank capacities are listed in figure 1-14; fuel specifications are given in figure 1-33.

FUEL TANK VENTING.

All internal fuel tanks are climb- and dive-vented to maintain the proper internal pressure during all flight conditions. The fuselage tanks are vented by manifold lines to the vent system outlet, at the trailing edge of the vertical stabilizer, above the rudder. The integral wing tanks are climb-vented through the forward fuselage tank upper cell and are dive-vented by vent inlets in the lower surface of each wing.

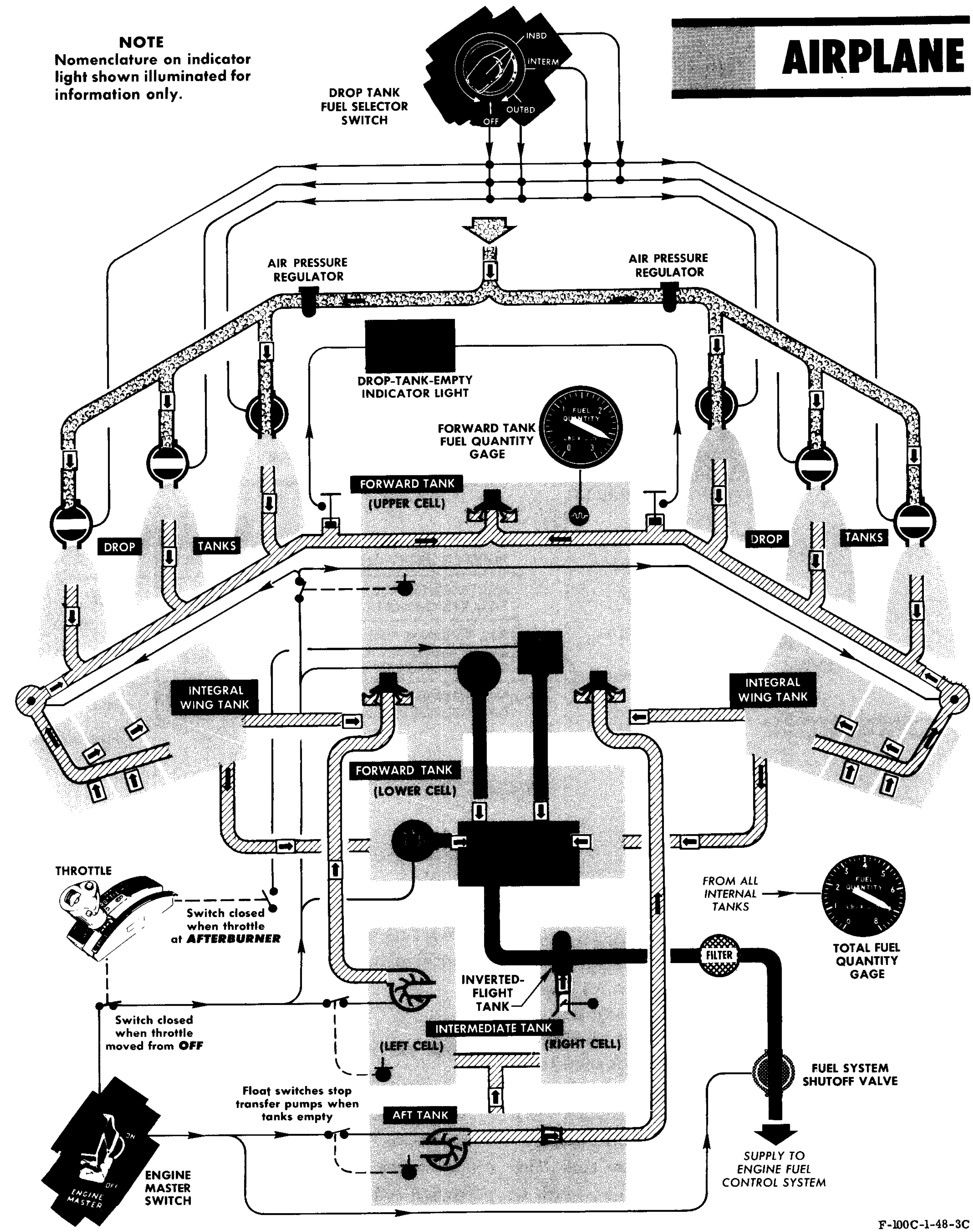
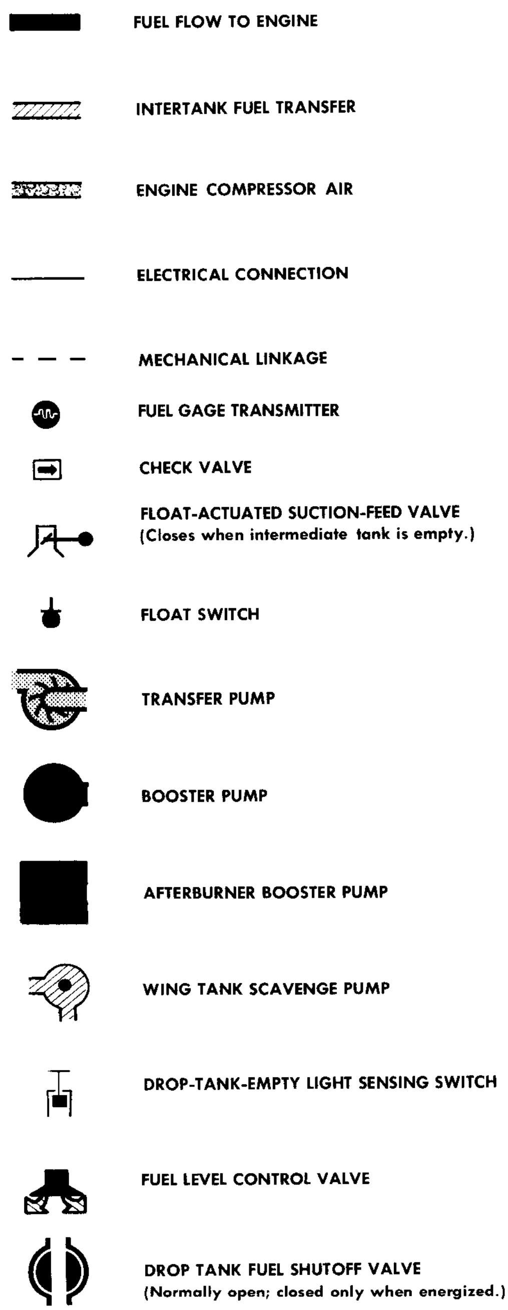

AIRPLANE
NOTE
Nomenclature on indicator light shown illuminated for information only.
DROP TANK FUEL SELECTOR SWITCH
INBD
INTERM
OUTBD
OFF
AIR PRESSURE REGULATOR
AIR PRESSURE REGULATOR
DROP-TANK-EMPTY INDICATOR LIGHT
FORWARD TANK FUEL QUANTITY GAGE
FORWARD TANK (UPPER CELL)
DROP
TANKS
DROP
TANKS
INTEGRAL WING TANK
INTEGRAL WING TANK
FORWARD TANK (LOWER CELL)
THROTTLE
Switch closed when throttle at AFTERBURNER
FROM ALL INTERNAL TANKS
TOTAL FUEL QUANTITY GAGE
FILTER
INVERTED-FLIGHT TANK
INTERMEDIATE TANK
(LEFT CELL)
(RIGHT CELL)
Switch closed when throttle moved from OFF
Float switches stop transfer pumps when tanks empty
AFT TANK
FUEL SYSTEM SHUTOFF VALVE
SUPPLY TO ENGINE FUEL CONTROL SYSTEM
ENGINE MASTER SWITCH
ON
OFF
ENGINE MASTER
F-100C-1-48-3C

Figure 1-15

FUEL SYSTEM

NOTE
Refer to "Pressure Refueling System" in Section IV.



F-100C-1-48-4C

DROP TANKS.

The lower surface of each wing has three drop tank mounting stations: inboard, intermediate, and outboard. Each inboard and outboard station can carry a 200-gallon drop tank. The intermediate drop tank station, however, has two individual mounting locations. One is used for carrying a 200-gallon drop tank, and the other for installation of a 275-gallon drop tank. A 450-gallon drop tank can be hung on the 200-gallon drop tank intermediate mounting station of airplanes changed by T.O.

NOTE The installation of drop tanks affects the airplane operating limitations. These operating limitations are affected not only by the size and number of tanks carried, but also by the tank type designation. Because of tank structural differences, drop tanks are classified in one of four types, Type I, II, III, or IV. Type II and IV drop tanks are limited-service tanks which are generally identified by stencil markings that can be seen from the cockpit. Because of their construction, these tanks (Type II and IV) have lower operating limitations than the Type I and III tanks of corresponding size.

The 200-gallon and 450-gallon drop tanks are hung on jettisonable pylons attached to the wings; the 275-gallon drop tanks have integral-type mounting pylons which are released with the tanks. Although the drop tanks are usually mounted in symmetrical pairs, certain asymmetrical installations of tanks are permissible. (See figure 5-4.) When the drop tank fuel supply is selected, engine compressor air pressurizes the selected drop tanks and forces fuel into the upper cell of the fuselage forward tank. Drop tank fuel transfer is controlled automatically by a fuel level control valve in the forward tank. The 200-gallon and 275-gallon drop tanks cannot be serviced by single-point or air refueling. They must be filled individually through their conventional filler openings; however, airplanes changed by T.O. have provisions for single-point or air refueling of the 450-gallon drop tanks. Electrical and mechanical jettison systems are provided for drop tank release.

FUEL TRANSFER PUMPS.

Fuel is transferred from the aft and intermediate fuselage tanks into the forward fuselage tank by two electrically driven, tank-mounted transfer pumps. One transfer pump is in the aft fuselage tank; the other is in the left cell of the intermediate fuselage tank. The transfer pump in the aft tank is actuated when the engine master switch is ON, and the pump in the intermediate tank operates when the engine master switch is ON and the throttle has been moved from OFF. Each pump is shut off automatically by a float switch in the respective tank about 2 minutes after the tank empties. Even though the transfer pumps are running continuously, they cannot transfer fuel until the necessary amounts have been consumed from the forward fuselage tank to allow the fuel level control valves to open. The fuel transfer pumps are powered from the primary bus, provided the tertiary bus is energized.

NOTE If the aft tank transfer pump fails, fuel from this tank is transferred to the intermediate tank by gravity flow. If the intermediate tank transfer pump fails, suction feed of the engine-driven fuel pump will open the suction-feed valve in the inverted-flight tank to supply fuel to the engine from the intermediate fuselage tank.

FUEL BOOSTER PUMPS.

Fuel is supplied, under pressure, from the forward fuselage tank through the fuel supply manifold and inverted-flight tank to the engine by two electrically driven, submerged, tank-mounted booster pumps in the forward tank. (One pump is in the upper cell of the forward tank, and one is in the lower cell.) Operation of these pumps is continuous when the engine master switch is ON and the throttle is moved from OFF. An additional fuel booster pump, in the upper cell of the forward tank, is energized automatically only when the throttle is moved outboard into the AFTERBURNER range. The afterburner booster pump is shut off when the throttle is moved inboard to shut down the afterburner. The booster pump in the forward tank upper cell and the afterburner booster pump are powered by the primary bus, although the tertiary bus must be energized for the primary bus power to be supplied to these pumps. (The tertiary bus is energized only by generator output or an external power unit.) Thus, these booster pumps are operative only if generator or external power is supplied. The booster pump in the forward tank lower cell, however, is powered by the primary bus, through a primary-bus-controlled relay.

NOTE If booster pump failure occurs, the check valves in the fuel manifold and in the inverted-flight tank permit the engine-driven fuel pump to supply fuel to the engine by suction feed.

WING TANK FUEL SCAVENGE PUMPS.

Fuel that does not transfer from the integral wing tanks to the fuselage forward tank upper cell by gravity flow is transferred to this cell by two electrically driven fuel pumps, one in each wing. Both scavenge pumps are powered and controlled by the primary bus. The pumps are energized (if the engine master switch is ON and the throttle is moved from OFF) by float switches in the forward tank upper cell, and are operated by the lowering of the fuel level in this cell. If the control circuit for the scavenge pumps is inoperative, and the primary bus power is available, the float switches are bypassed and the scavenge pumps run continuously regardless of the fuel level.

NOTE Operation of the scavenge pumps can be checked on the ground by a test switch in the right main gear wheel well.

FUEL SYSTEM SHUTOFF VALVE.

The electric-motor-actuated fuel shutoff valve, in the fuel supply line between the tanks and the engine-driven fuel pump unit, is controlled by the engine master switch. When the switch is ON, primary bus power opens the valve, allowing fuel to feed to the engine fuel control system. The shutoff valve is closed when the engine master switch is moved to OFF, provided primary bus power is available to operate the valve.

AIRPLANE FUEL SYSTEM CONTROLS AND INDICATORS.

Drop Tank Fuel Selector Switch.

Use of drop tank fuel is controlled by a four-position selector switch. (See figure 1-12.) When the selector is in the OFF position, tertiary bus power closes all the normally open solenoid-operated shutoff valves that control the flow of air from the engine compressor to the drop tanks. When a station is selected, the shutoff valves for the selected drop tanks are de-energized and open to allow engine compressor air to pressurize both drop tanks and force fuel from the tanks into the forward fuselage tank.

Caution If tertiary bus power fails, all drop tank shutoff valves open and fuel is transferred from all drop tanks simultaneously.

- To maintain proper CG conditions and desirable lateral stability when symmetrically or asymmetrically mounted external loads are carried, fuel from the drop tanks should be used in the manner prescribed under "Drop Tank Fuel Sequencing Limitations" in Section V.

Armament Selector Switch.

Refer to "Bombing Equipment Controls and Indicator" in Section IV.

External Load Emergency Jettison Button.

Refer to "Bombing Equipment Controls and Indicator" in Section IV.

External Load Auxiliary Release Buttons.

Refer to "Bombing Equipment Controls and Indicator" in Section IV.

External Load Emergency Jettison Handle.

Refer to "Bombing Equipment Controls and Indicator" in Section IV.

Fuel Quantity Gages.

The fuel quantity gages (23 and 25, figure 1-6; 22 and 24, figure 1-7) show the total internal fuel and the amount of fuel in the forward fuselage tank. Because all fuel (internal, as well as fuel from the drop tanks) is transferred to the forward tank, the forward tank gage gives an indication of the proper operation of the fuel transfer system. It also prevents possible misinterpretation, based solely on the total quantity gage reading, of fuel available to the engine. (Refer to "Fuel Quantity Gages" in Section VII.) The fuel quantity indicating system, powered by one phase of the three-phase ac bus, is of the capacitor type. The system automatically compensates for changes in fuel density so that the quantity gage readings will show the actual number of pounds of fuel, regardless of the type of fuel used or regardless of fuel expansion or contraction caused by temperature changes.

NOTE When drop tank fuel is used before internal fuel, the fuel quantity gage will show a continuous decrease in fuel supply only after the drop tanks have been emptied and the engine begins to use fuel from the internal tanks.

- Because of the high rate of fuel flow to the engine during afterburner operation at low altitudes, the transfer rate of fuel from the drop tanks will not be sufficient to maintain a constant fuel level in the internal tanks, and use of internal fuel may occur before drop tank fuel is exhausted.

450-gallon Drop Tank Fuel Quantity Gages (Airplanes Changed by T.O.).

Refer to "Pressure Refueling System" in Section IV.

Fuel Quantity Gage Test Button.

When the quantity gage test button (24, figure 1-6; 23, figure 1-7) is held down, the pointers of both gages should move counterclockwise toward "0" (empty). When the button is released, the pointers should return to their former positions. If either pointer fails to move or does not return to its previous setting, the fuel quantity gage or gage system is faulty.

NOTE Rate of pointer movement does not indicate proper operation of the gage or the gage system.

Drop-tank-empty Indicator Light.

A tertiary-bus-powered placard-type light (figure 1-4), comes on when the selected drop tanks become empty. The drop-tank-empty indicator light is inoperative when the drop tank fuel selector is at OFF. Bulbs within the light can be checked by the indicator light test circuit.

NOTE The drop-tank-empty indicator light may blink before the selected drop tanks are empty.

- The light does not come on when an asymmetrically mounted tank (drop tank at any wing station without a tank at the corresponding station on the opposite wing) becomes empty.

450-gallon Drop Tank Fuel Quantity Gages (Airplanes Changed by T.O.).

Refer to "Pressure Refueling System" in Section IV.

FUEL TANK PURGING SYSTEM.*

The fuel tank purging system introduces nitrogen into the internal fuel tanks during combat, to reduce the potential fire hazard of combustible fuel vapors in the tanks. (The drop tanks cannot be purged.) The purging system is controlled by a switch in the cockpit. Nitrogen is distributed to the system from a shatterproof bottle in the aft section of the fuselage. When the system is engaged, the fuel vent is closed. The nitrogen flows through the tank vent lines into the tanks. Purging system nitrogen pressure can be checked by a pressure gage inside the fire-fighting access door on the left side of the fuselage, just forward of the horizontal stabilizer. (See figure 1-33.)

Fuel Tank Purge Switch.*

The fuel tank purging system is controlled by a two-position switch. (See figure 1-12.) When the switch is at PURGE, tertiary bus power closes the normally open pressure relief valve in the fuel tank vent manifold and, at the same time, opens the nitrogen supply valve.

Caution Before the purge switch is moved to PURGE, the drop tank fuel selector switch must be OFF, because the compressed-air flow to the forward fuselage tank from the drop tanks would prevent the purge system from establishing and maintaining an inert condition in the internal tanks.

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*Airplanes not changed by T.O. 1F-100-609

The purge system continues to cycle automatically when the purge switch is at PURGE until the nitrogen supply is exhausted. With the purge switch OFF, the nitrogen control valve is closed, and the pressure relief valve is de-energized and returns to its normal open position.

NOTE To prevent inadvertent operation of the purging system while the airplane is on the ground, the electrical circuit to the purge switch is automatically held open when the weight of the airplane is on the gear.

ELECTRICAL POWER SUPPLY SYSTEM.

The 28-volt dc system is powered by an engine-driven generator, and has a 24-volt, 24-ampere-hour battery for a stand-by power source. Power for the ac system is furnished by a single-phase inverter and either of two three-phase inverters. An ac external power receptacle on F-100C-25 Airplanes permits the single- and three-phase busses to be energized for ground operations by an external ac power source.

DC ELECTRICAL POWER DISTRIBUTION.

Direct-current power is distributed from four electrical busses: battery, primary, secondary and tertiary. (See figure 1-16.)

Battery Bus.

The battery bus (figure 1-16) is connected directly to the battery, so that the essential equipment powered by this bus is operable whenever there is battery power. The battery bus can be powered by the generator or dc external power when the battery switch is ON (if enough battery power is available to close the bus tie-in relay that connects the battery bus to the primary bus).

Primary Bus.

The primary bus (figure 1-16) is powered directly by the generator or dc external power source, and can be energized by the battery when the battery switch is ON.

Secondary Bus.

The secondary bus (figure 1-16) is powered by the primary bus, but, under normal conditions, only if generator output is available or dc external power is applied. If power from either of these sources is not available, a tie-in switch in the cockpit permits the secondary bus to be connected to the primary bus for emergency operation.

Tertiary Bus.

The tertiary bus (figure 1-16) is powered by the primary bus whenever generator power or external dc power is available. There is no emergency means of energizing the tertiary bus.

AC ELECTRICAL POWER DISTRIBUTION.

Alternating current is normally supplied by a single-phase inverter and one of two three-phase inverters. F-100C-25 Airplanes have an ac external receptacle so that single-phase and three-phase power can be supplied during ground operations from an external ac power source.

Power (Single-phase) Inverter.

The power (single-phase) inverter is powered by the primary bus, but its output is controlled by the tertiary bus. Therefore, output of this inverter is available only when there is generator power or when dc external power is connected.

Instrument (Three-phase) Inverters.

Both instrument (three-phase) inverters (No. 1 and 2) are controlled and powered by the primary bus. Instrument inverter selection is controlled by a switch in the cockpit. Either three-phase inverter powers a step-down transformer, which powers the single-phase instrument bus. Should either three-phase inverter fail, the units powered by it can be transferred to the other three-phase inverter by means of the selector switch.

ELECTRICALLY OPERATED EQUIPMENT.

See figure 1-16.

EXTERNAL ELECTRICAL POWER RECEPTACLES.

The dc external electrical power receptacle is within an access door on the lower surface of the fuselage, behind the main gear wheel wells. (See figure 1-33.) All dc busses except the battery bus are energized automatically when the dc external power source is connected to the receptacle. (The battery bus can be energized by the dc external power source when the battery switch is ON, provided there is enough battery power to close the tie-in relay that connects the battery bus to the primary bus. The ac busses can be energized if the inverter switches are on.) Although dc external electrical power is not required for engine start, it should be connected to conserve the battery during starting and all ground operations. On F-100C-25 Airplanes, an ac external power receptacle is next to the dc receptacle. When an external ac power source is connected to this receptacle, all ac busses are energized, provided the inverter switches are on. The inverters are bypassed when ac external power is applied. However, dc power is necessary for the inverter lockout relays. Some ac external power sources do not supply dc power for these relays. Therefore, it is recommended that the battery switch be ON when external ac power is applied so that primary bus power will be available for the inverter lockout relays.

CIRCUIT BREAKERS AND FUSES.

All the dc electrical distribution circuits are protected by push-to-reset type trip-free circuit breakers, and all the ac distribution circuits are equipped with fuses. The trip-free circuit breakers cannot be reset as long as the overload condition exists. (Refer to "Circuit-breaker Use" in Section VII.) The power supply circuits to the ac and dc busses are not protected. The circuit breakers and fuses that are accessible in the cockpit are on panels at each side of the cockpit. (See figure 1-17.)

ELECTRICAL POWER SUPPLY SYSTEM CONTROLS.

Battery Switch.

When the battery switch (figure 1-18) is at ON, the primary bus is connected to the battery bus and is powered by the battery, provided no other source (generator or external power) is supplying the electrical system. The battery bus can be energized through the primary bus by the generator or dc external power when the battery switch is ON if enough battery power is available to close the battery-to-primary-bus tie-in relay. When the battery switch is OFF, the primary bus is disconnected from the battery bus and battery power is furnished only to those units connected to the battery bus.

Generator Switch.

A three-position switch (figure 1-18) controls the generator. The switch is spring-loaded from RESET to OFF. When engine speed is above about 40% rpm, and the generator switch is ON, generator output is supplied to the dc electrical system. The generator is "off the line" when the switch is OFF.

NOTE When the air start switch is turned ON to supply ignition for an air start, the generator is automatically cut out of the electrical system. If the generator switch is ON, generator output is automatically restored when the air start switch is returned to OFF.

Power (Single-phase) Inverter Switch.

Single-phase ac power is controlled by the guarded power inverter switch. (See figure 1-18.) When the tertiary bus is energized, moving the switch to ON supplies voltage from the primary bus to energize the power (single-phase) inverter. The inverter is inoperative when the switch is OFF.

NOTE The ON position of the power inverter switch is effective only when the tertiary bus is "hot."

On F-100C-25 Airplanes, which have an external ac power receptacle, the power inverter switch must be ON when external ac power is applied, to permit the single-phase bus to be energized by this source.

Instrument (Three-phase) Inverter Switch.

The instrument inverter switch (figure 1-18) is used to select, by means of primary bus power, the source of three-phase ac power. When the switch is at NO. 1, three-phase ac power is supplied by the No. 1 instrument inverter. Transfer to the No. 2 instrument inverter occurs when the switch is moved to its NO. 2 position. Both instrument inverters are inoperative when the switch is OFF.

NOTE To ensure maximum service life of both inverters, use No. 1 and No. 2 inverters alternately.

When external ac power is applied (F-100C-25 Airplanes), the instrument inverter switch should be at either NO. 1 or NO. 2 position to permit the three-phase bus to be energized by external power.

Secondary Bus Emergency Tie-in Switch.

The secondary bus emergency tie-in switch (figure 1-18) is used to energize the secondary bus by primary bus power if the generator fails. (The secondary bus is normally "hot" only when generator or dc external power output is available.) When generator failure has occurred, the secondary bus emergency tie-in switch must be moved to EMERG. This connects the secondary bus to the primary bus.

ELECTRICAL POWER SUPPLY SYSTEM INDICATORS.

Loadmeter.

The loadmeter (33, figure 1-6; 28, figure 1-7) shows the electrical load being drawn from the generator in terms of percentage of generator output amperage.

Generator Caution Light.

The placard-type generator caution light (figure 1-4) is powered by the primary bus and comes on whenever the main contacts of the reverse-current relay are open. This shows a relay or generator failure, or generator undervoltage (generator voltage less than battery voltage). Should generator voltage output become excessive (over 31 volts), the generator is automatically cut out of the circuit and the generator caution light comes on. Illumination of the generator caution light shows that the secondary and tertiary busses are inoperative and that the primary bus is dependent on battery output. Bulbs within the generator caution light can be checked by the indicator light test circuit.

NOTE
Nomenclature on caution lights shown illuminated for information only.

ELECTRICAL

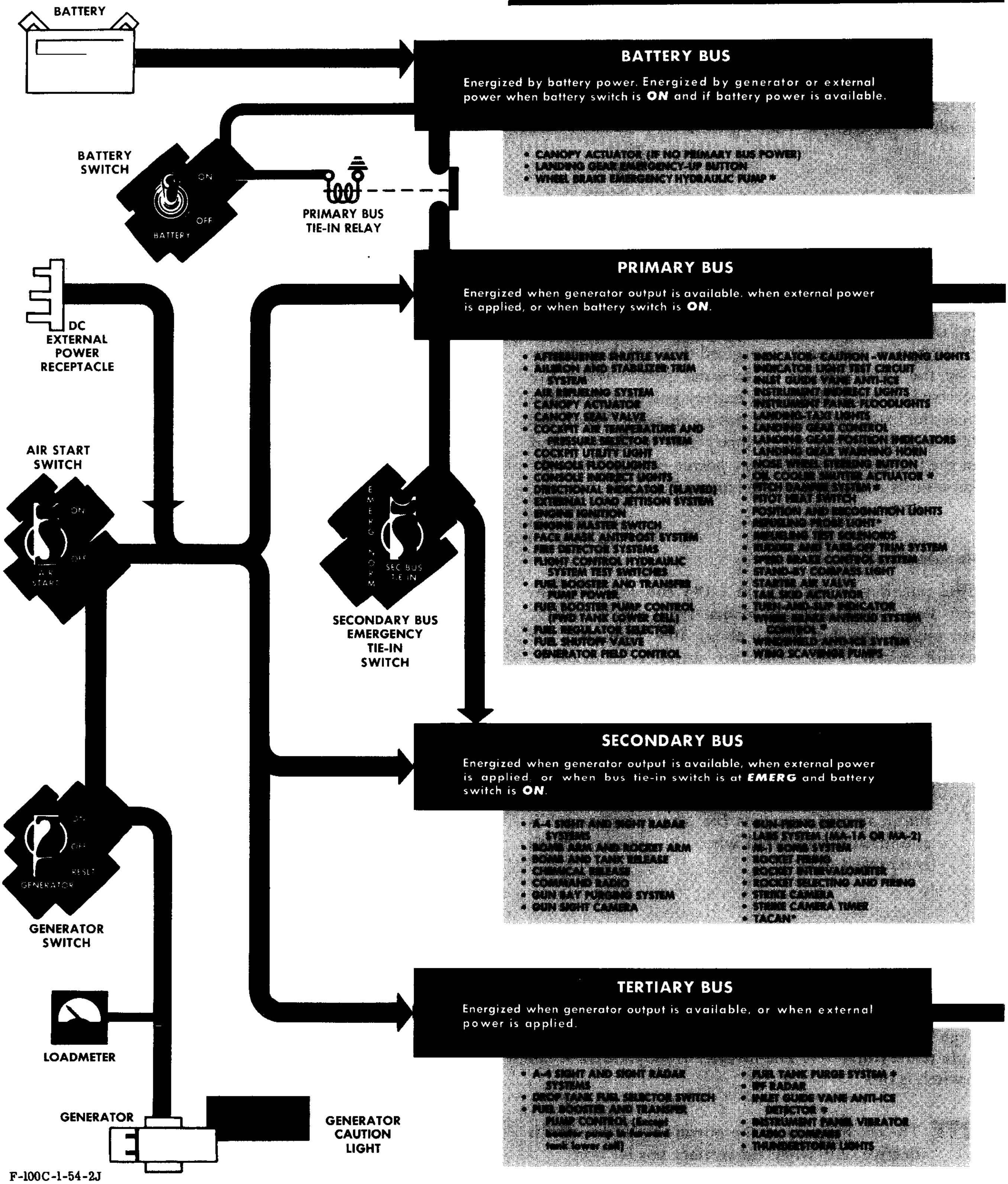
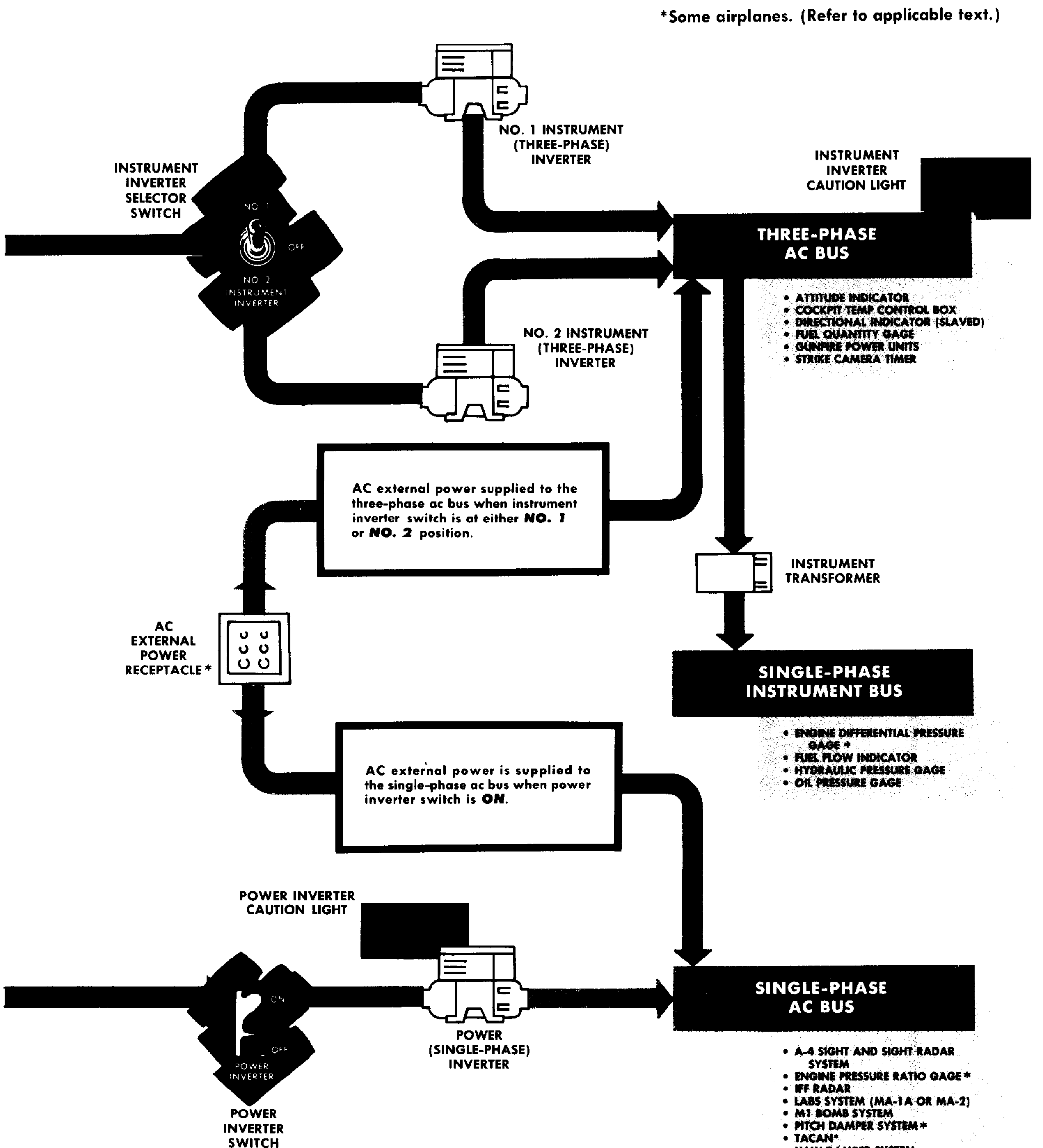


Figure 1-16

POWER DISTRIBUTION

FUNCTIONAL FLOW DIAGRAM



F-100C-1-54-3G

CIRCUIT-BREAKER PANELS (TYPICAL)

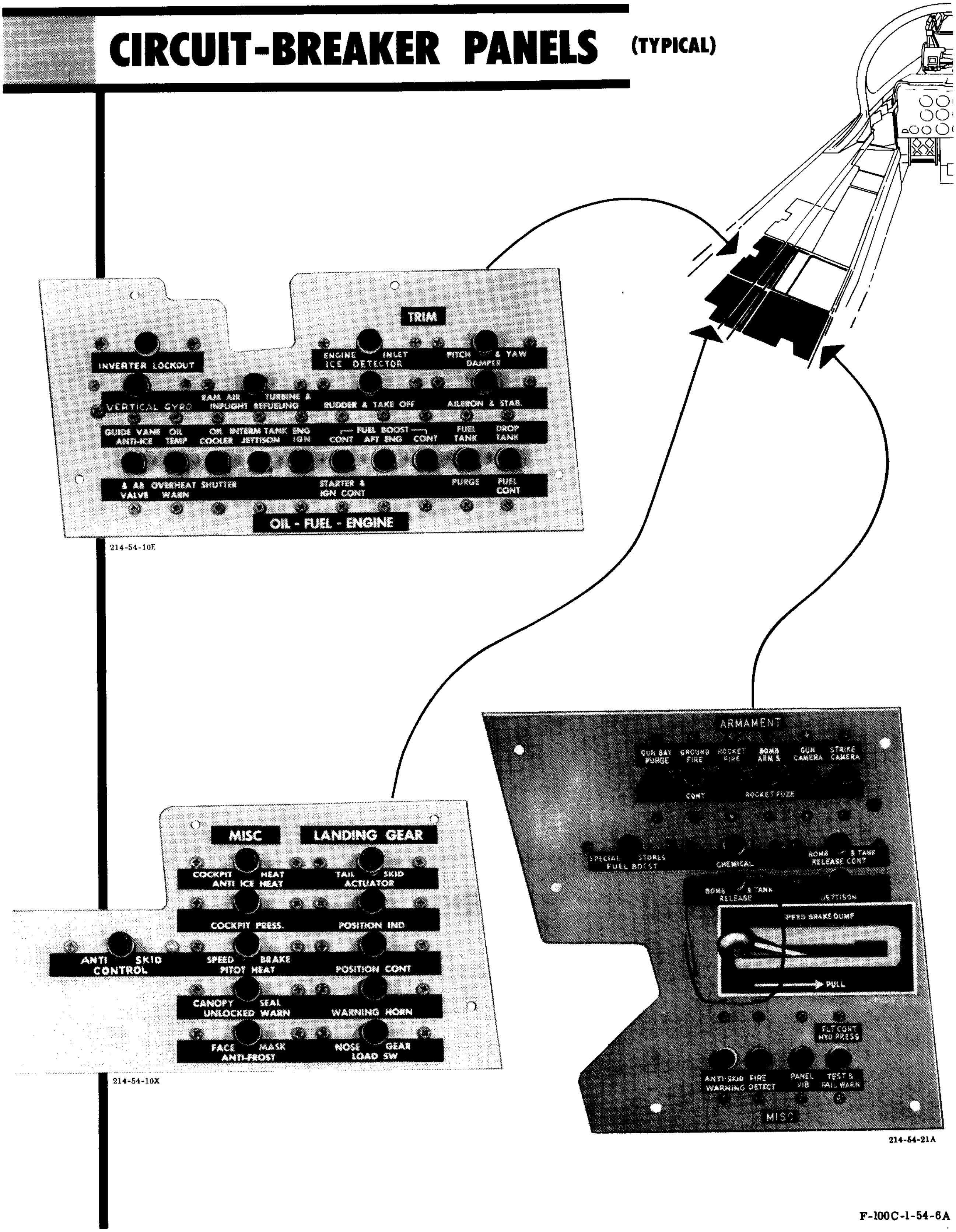
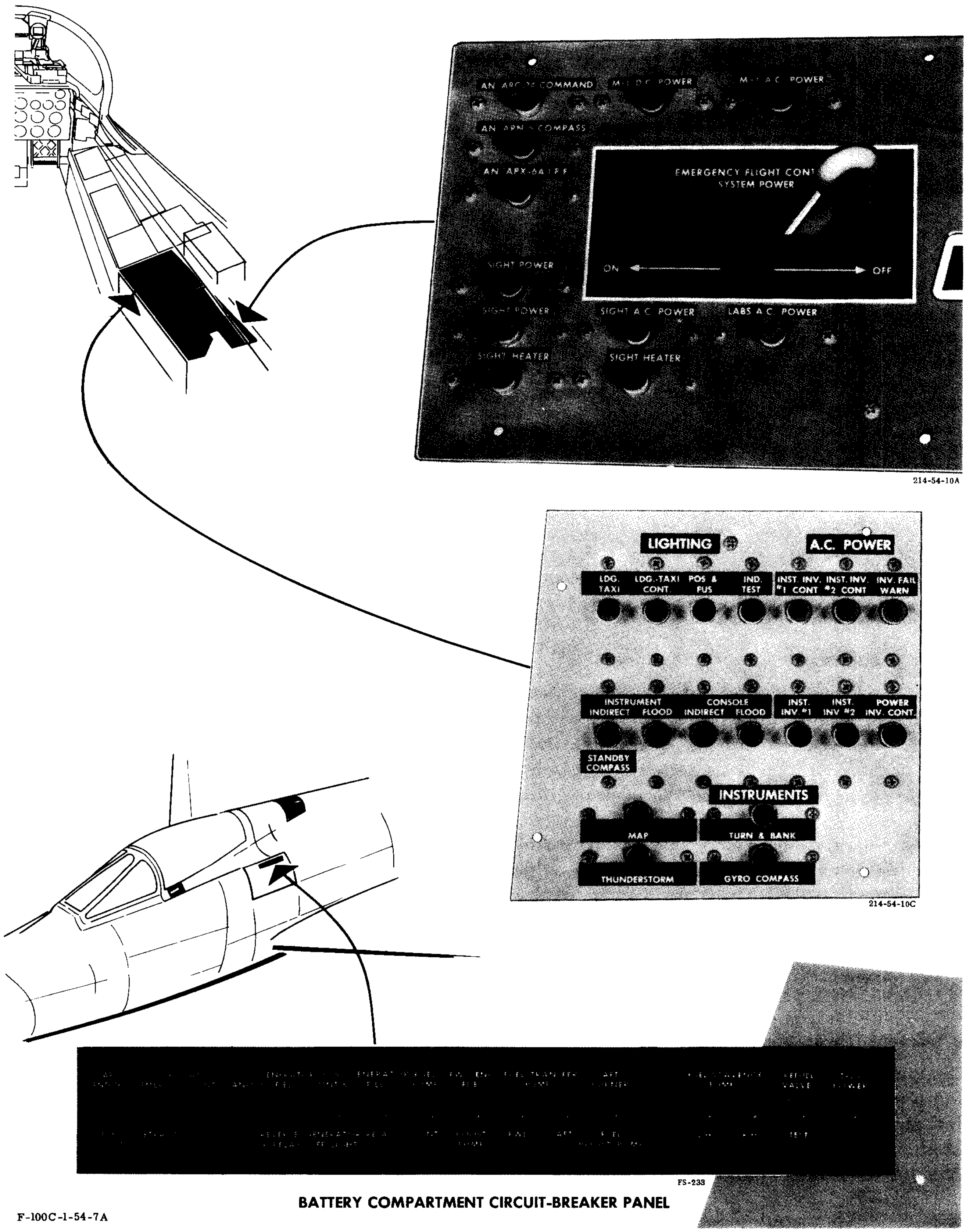


Figure 1-17



BATTERY COMPARTMENT CIRCUIT-BREAKER PANEL

F-100C-1-54-7A

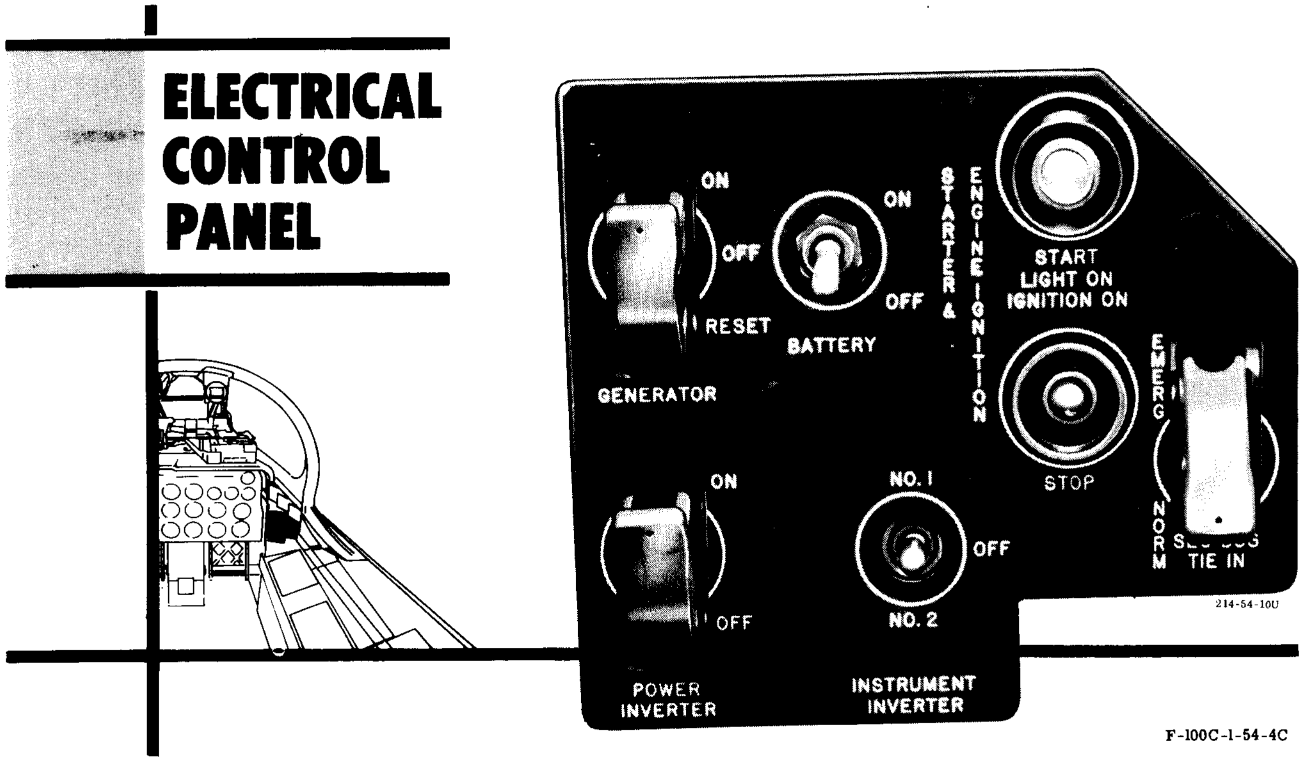


Figure 1-18

Power (Single-phase) Inverter Caution Light.

Failure of the power inverter is indicated by a primary-bus-powered placard-type caution light. (See figure 1-4.) The light also comes on when the power inverter switch is OFF or the tertiary bus is not energized. The bulbs in the light can be tested by the indicator light test circuit.

NOTE During normal starting of the power inverter, the power inverter caution light will be on (for several seconds) until the voltage regulator vacuum tubes warm up.

- There is no alternate source of single-phase ac power.

Instrument (Three-phase) Inverter Caution Light.

The placard-type instrument inverter caution light (figure 1-4) is powered by the primary bus and comes on when three-phase ac power fails. Operation of the instrument inverter caution light bulbs can be checked by the indicator light test circuit.

NOTE During normal starting of either instrument inverter, the instrument inverter caution light will be on (for several seconds) until voltage regulator vacuum tubes warm up.

HYDRAULIC POWER SYSTEMS.

The airplane has three separate constant-pressure-type hydraulic systems: the utility hydraulic system, and two flight control hydraulic systems (identified as flight control system No. 1 and flight control system No. 2). The utility system and the flight control systems are independently pressurized by engine-driven, 3000 psi hydraulic pumps. There is also an emergency power supply system to pressurize flight control system No. 1 by using a ram-air turbine, which drives a constant-displacement hydraulic pump. A hydraulic system ground test panel is on the right side of the fuselage. (See figure 1-33.) The hydraulic fluid specification is also shown in figure 1-33.

UTILITY HYDRAULIC SYSTEM.

The utility hydraulic system (figure 1-19) is a 3000 psi, pressure-type (closed-center) system. It supplies hydraulic pressure to the following units: landing gear and fairing doors, wheel brakes, nose wheel steering, speed brake, gun purge and ram-air turbine doors, horizontal stabilizer trim impulse system and the yaw and pitch damper systems. The rudder is normally pressurized by flight control system No. 1, however, if this system pressure fails, or becomes too low, utility system pressure is automatically supplied to the rudder. The utility system also supplies pressure to the emergency accumulators: one accumulator for emergency lowering of the nose gear, one accumulator for emergency operation of the ram-air turbine doors, and two accumulators for wheel brake emergency operation. Fluid is supplied to the utility hydraulic system from a 4.2-gallon reservoir (3.8 gallons of hydraulic fluid, to allow for air space), and system pressure is maintained by the variable-volume, engine-driven hydraulic pump.

FLIGHT CONTROL HYDRAULIC SYSTEMS.

Refer to "Flight Control System" in this section.

HYDRAULIC PRESSURE GAGE AND GAGE SELECTOR SWITCH.

A hydraulic pressure gage (15, figure 1-6; 14, figure 1-7) and a four-position gage selector switch (12, figure 1-6; 11, figure 1-7) are used to show selectively the pressure in either flight control hydraulic system, the utility hydraulic system, or the rudder alternate pressure system. When the selector switch is moved to any one position, its respective gage indicates the pressure of the system selected. When the selector is set at ALT. RUD. the gage shows pressure in the section of the utility system that serves as the alternate source of hydraulic pressure for the rudder. The hydraulic pressure indicating system is energized by single-phase ac power supplied through a step-down transformer from one phase of the three-phase ac bus.

FLIGHT CONTROL SYSTEM.

The primary flight control surfaces (ailerons, rudder, and horizontal stabilizer) are operated by conventional stick and rudder pedal controls through an irreversible hydraulic control system. Each aileron consists of an inboard and an outboard panel that are actuated as one unit. This allows lateral control to be unimpaired by normal in-flight wing deflections. The horizontal tail surface is a controllable one-piece surface. Some airplanes* have a splitter-plate rudder which has a tapered plate trailing edge with external stiffening webs. The cross-sectional shape of this rudder controls airflow separation off the trailing edge to reduce rudder flutter. (Airplanes without the splitter-plate rudder have a flutter damper unit to dampen any rudder flutter.) To prevent rudder binding as a result of vertical stabilizer deflection, the splitter-plate rudder is divided chordwise into upper and lower sections that are joined by a hinge.

***F-100C-25 Airplanes AF54-2025 through -2120**

Yaw and pitch damper systems are provided to improve the basic aerodynamic directional and longitudinal damping of the airplane. Both the horizontal stabilizer and the ailerons are actuated by two complete, independent, simultaneously operating hydraulic systems. The irreversible characteristic of the hydraulic control system holds the control surfaces against any forces that do not originate from control movements and prevents these forces from being transmitted back to the controls. Thus, aerodynamic loads of any kind cannot reach the pilot through the controls. Because of this irreversibility, an artificial-feel system is built into each control system to simulate feel at the controls. There are no trim tabs, as trimming is done by changing the neutral (no-load) position of the stick and the pedals. No control surface gust locks are necessary, because of the irreversible characteristics of the flight control hydraulic systems.

ARTIFICIAL-FEEL AND TRIM SYSTEMS.

The use of an irreversible hydraulic system for actuation of the flight controls prevents air loads and resultant feel from reaching the stick and rudder pedals. Therefore, an artificial-feel system is used. Normal stick and rudder pedal forces are simulated by spring-loaded bungees which apply loads to the controls in proportion to stick or pedal movement; however, the resultant feel has no relation to actual air loads. The bungees of the artificial-feel system are also used for trim purposes. Operation of the trim switches causes an electrical actuator to reposition the neutral (no-load) position of the bungees until the desired stick or pedal force is obtained. A trim impulse actuator, in the stabilizer control system, reduces trim system lag and trim system overshoot. A single switch trims all control surfaces to their take-off positions.

YAW DAMPER SYSTEM.

The hydraulically actuated, electrically controlled yaw damper actuator improves the normal aerodynamic directional damping of the airplane. When the system is engaged, electrical signals determine the position of the yaw damper actuator control valve, which causes utility hydraulic system pressure to operate the yaw damper actuator (extendible link). The yaw damper actuator is connected to the rudder actuating cylinder control valve so that the yaw damper actuator can move the control valve without moving the entire rudder control system. This provides control surface response without movement of the rudder pedals. Hydraulic pressure operates the yaw damper actuator linkage, moving the rudder control valve as necessary. When the yaw oscillations have been corrected, the rudder returns to the position corresponding to rudder pedal position. The yaw damper system is altitude-compensated in that the rudder travel

UTILITY HYDRAULIC SYSTEM

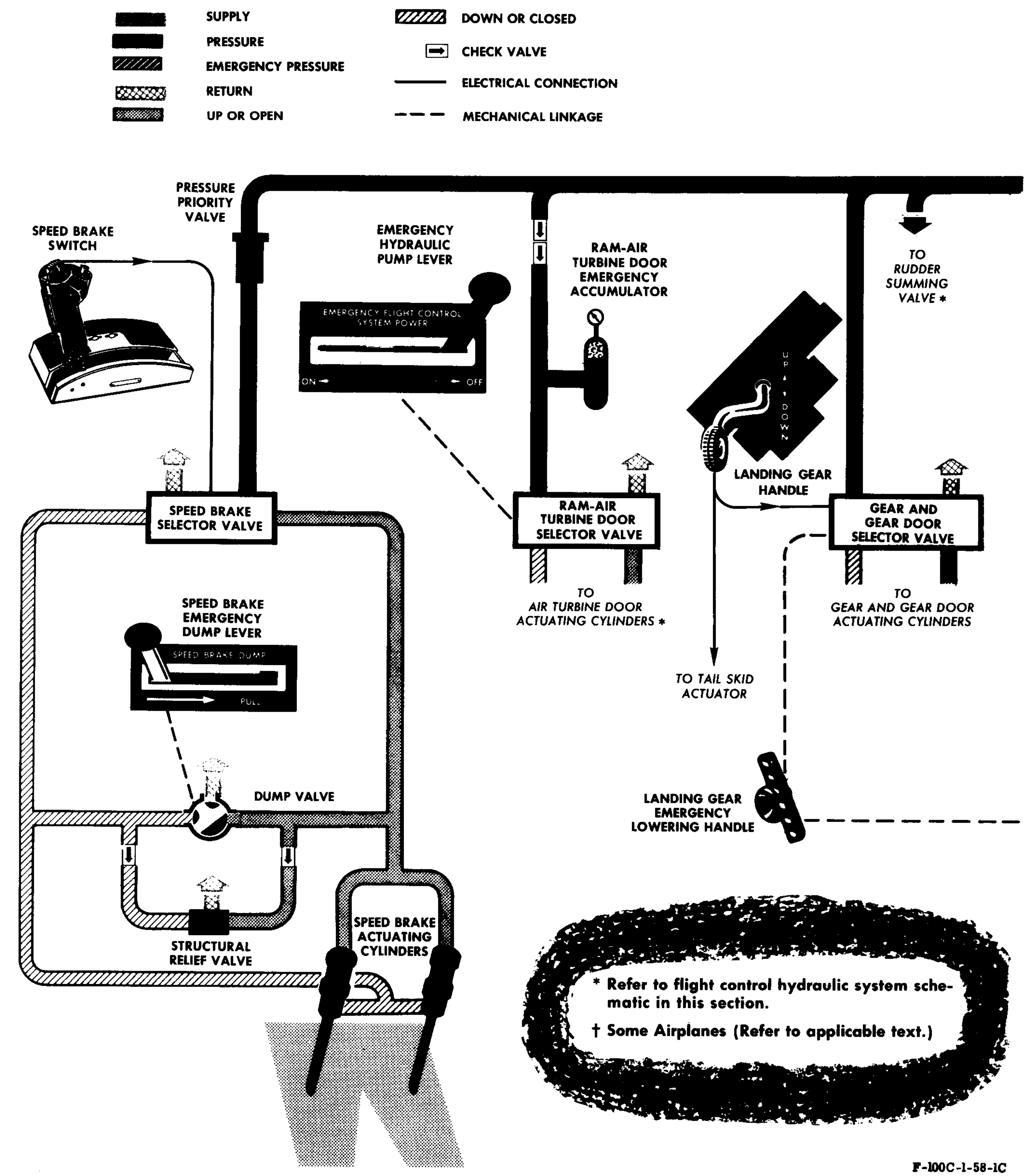
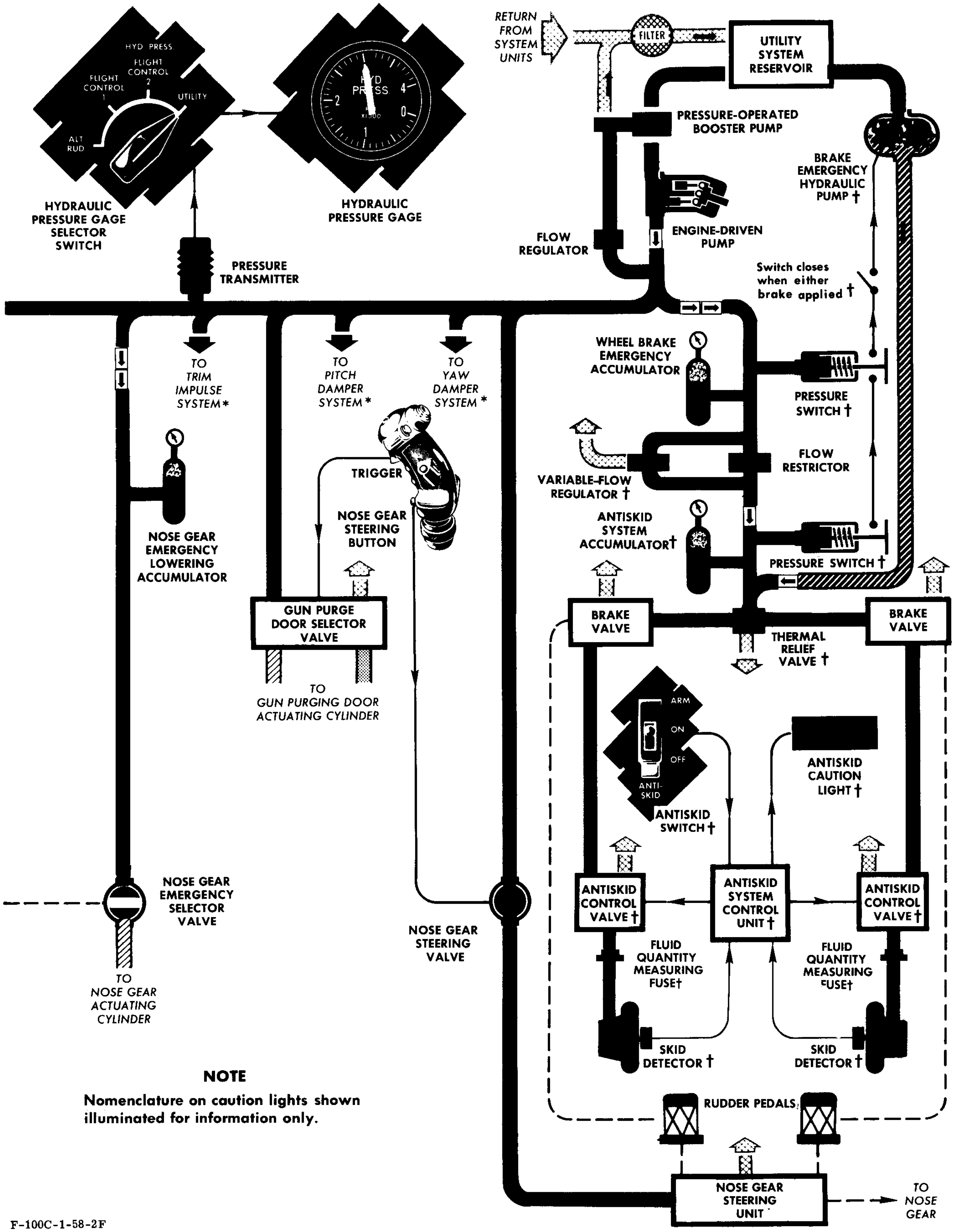


Figure 1-19



NOTE

Nomenclature on caution lights shown illuminated for information only.

F-100C-1-58-2F

FLIGHT CONTROL SYSTEM

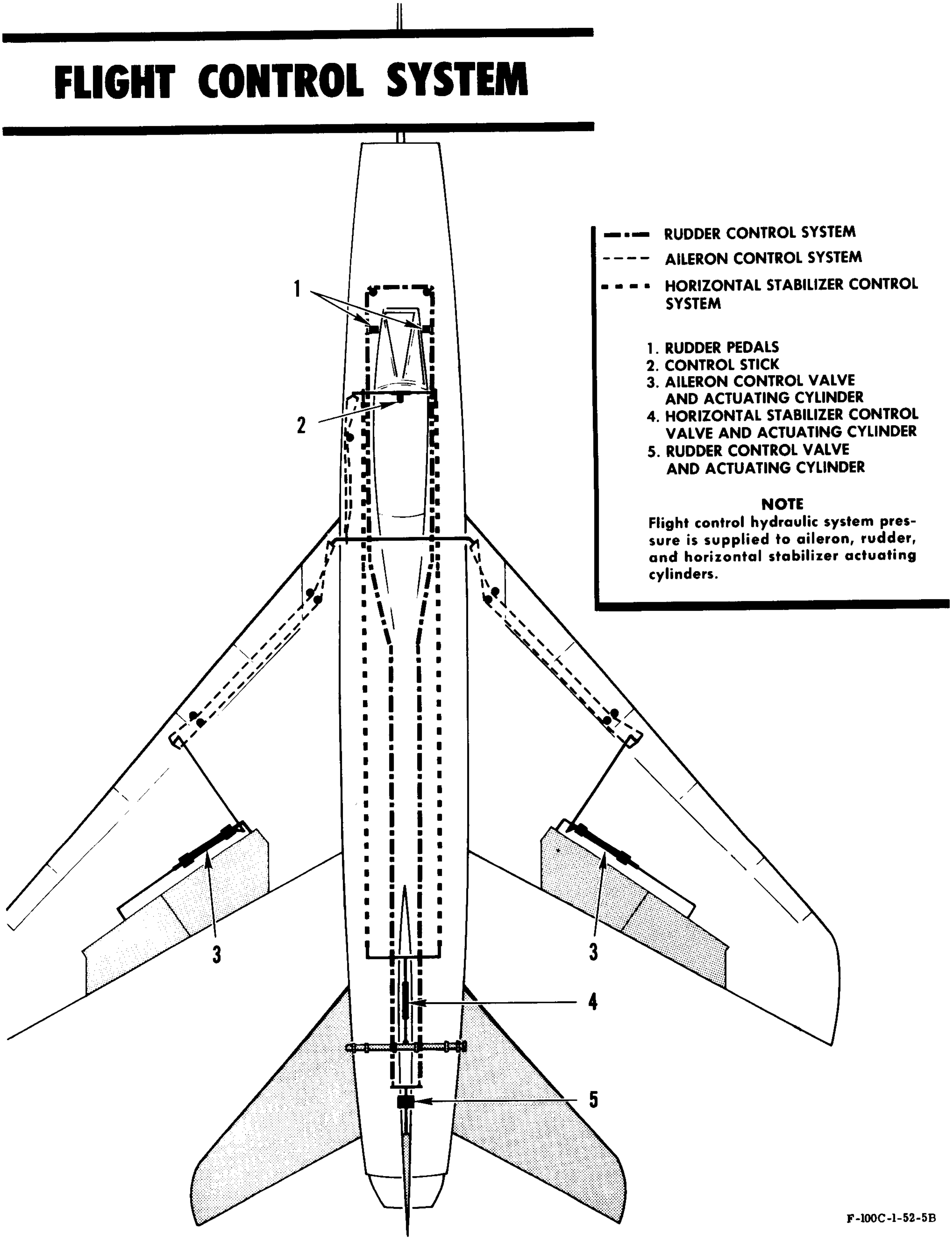


Figure 1-20

it applies is increased with increases in altitude. If utility hydraulic system pressure fails or becomes too low, or if electrical power fails, a centering valve is opened to permit hydraulic pressure (from the utility system or the centering accumulator) to center and lock the yaw damper actuator at its neutral length. The actuator linkage then serves as part of the conventional control linkage to allow normal rudder control. A monitor circuit in the yaw damper system automatically shuts off the system and recenters the actuator linkage if the actuator does not follow the electrical control signals. The yaw damper system uses utility hydraulic system pressure, single-phase ac power, and primary bus dc power.

PITCH DAMPER SYSTEM (F-100C-25 AIRPLANES).

The electrically controlled, hydraulically actuated pitch damper system improves damping of longitudinal oscillations. When the pitch damper is engaged, electrical signals position the pitch damper actuator control valve which causes utility hydraulic system pressure to operate the pitch damper actuator (extendible link). The pitch damper actuator positions the horizontal stabilizer control valve so that the stabilizer actuator will move the stabilizer without a corresponding movement of the control stick. Hydraulic pressure operates the pitch damper actuator linkage to move the stabilizer as necessary to damp the pitch oscillations. When the pitch oscillations have been corrected, the stabilizer returns to a position corresponding to control stick position. The pitch damper system is altitude-compensated, increasing the stabilizer travel with increases in altitude. Mechanical stops in the actuator prevent extreme control surface deflections. A monitor circuit automatically shuts off hydraulic pressure to the pitch damper actuator and recenters the linkage in a neutral position if the stops fail. (If stop malfunction is temporary, the system may be reset and operation restored.) If a malfunction occurs in the pitch damper system, hydraulic pressure to the damper actuator is shut off automatically, and the linkage is locked in the position it was in at the time of failure. The pitch damper system uses single-phase ac power, primary bus dc power, and utility hydraulic system pressure.

NOTE The pitch damper circuit is wired through the pylon loading selector switches and is operative only when the airplane is clean or when 275-gallon drop tanks are carried. When external loads other than these tanks are carried, the pitch damper remains inoperative (when weight of airplane is off the nose gear) until the loads are released or jettisoned.

STICK GRIP

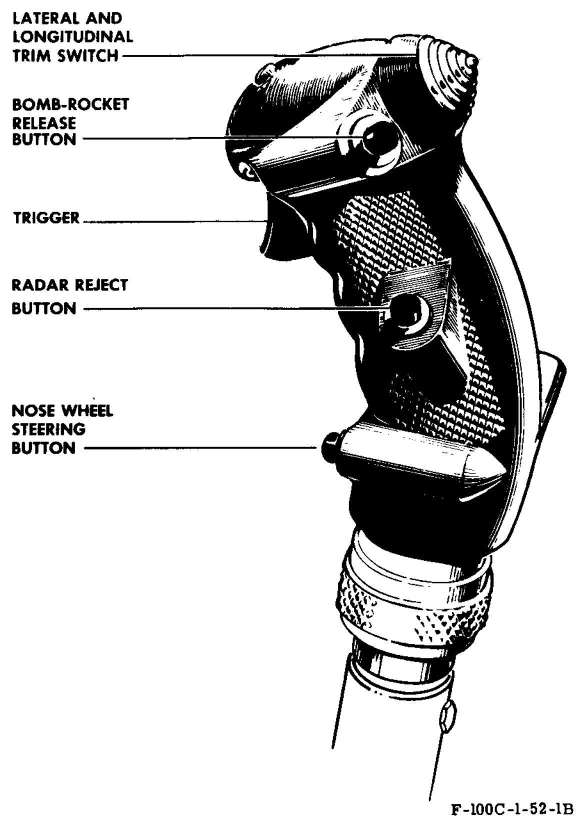


Figure 1-21

FLIGHT CONTROLS.

Control Stick.

The control stick is mechanically connected (by push-pull rods and cable assemblies) to hydraulic control valves at the aileron and horizontal stabilizer hydraulic actuators. Movement of the stick positions these control valves so that flight control hydraulic system power is directed to the control surface actuators to move the control surfaces. A follow-up system automatically closes off the hydraulic fluid to the actuators when the desired control surface deflection is obtained. The stick grip (figure 1-21) incorporates the lateral and longitudinal trim switch, nose wheel steering button, gun trigger switch, bomb-rocket release button, and radar reject button.

Rudder Pedals.

The hanging-type rudder pedals are mechanically linked to hydraulic control valves at the rudder actuator. As the pedals are moved, the control valves are positioned to route power from one flight control hydraulic system to the rudder actuating cylinder. When the desired rudder position is reached, a follow-up system cuts off the hydraulic flow to the actuating cylinder. The wheel brakes are applied by toe action on the rudder pedals. Rudder pedal movement also controls nose wheel steering. (Refer to "Nose Wheel Steering System" in this section.)

Pedal Adjustment. The rudder pedals can be individually adjusted fore and aft by an adjustment lever outboard of each pedal. Coordinated pedal alignment during adjustment is obtained by index numbers on each pedal adjustment ratchet. When the index numbers at each pedal correspond, the pedals are evenly adjusted.

Lateral and Longitudinal Trim Switch.

Lateral and longitudinal trim is controlled by a five-position, thumb-actuated switch. (See figure 1-21.) The trim circuit is powered by the primary bus. Holding the trim switch to either side energizes the electrical lateral trim actuator; holding the switch forward or aft energizes the longitudinal trim actuator. When a trim actuator is energized, it repositions its respective artificial-feel bungee to a new neutral (no-load) position. The hydraulically operated trim impulse actuator, included in the stabilizer trim system to reduce trim response time, is actuated by the trim switch. When the stabilizer trim circuit is energized, utility hydraulic system power causes the impulse actuator to move the stabilizer control valve before the electrical trim actuator responds to the trim switch.

The trim switch is spring-loaded to OFF (center). When the switch is released, the trim action stops, and the trim impulse actuator returns to its normal position. This reduces overtravel of the stabilizer electrical trim actuator.

NOTE There is no alternate trim system.

Note

When the switch is positioned for longitudinal trim, a slight jolt in the stick will be noticed. This is normal and is caused by the action of the trim impulse actuator.

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Rudder Trim Switch.

The rudder trim circuit is controlled by a primary-bus-powered three-position switch. (See figure 1-12.) When the switch is held at either LEFT or RIGHT, the rudder trim actuator is energized accordingly and repositions the rudder system artificial-feel bungee to a new neutral (no-load) position. The rudder trim switch is spring-loaded to OFF (center), and trim action stops when the switch is released.

Take-off Trim Button.

All control surfaces can be trimmed at the same time to proper position for take-off by a push-button switch. (See figure 1-12.) Pressing the button supplies primary bus power to the trim actuators, which reposition the artificial-feel bungees to obtain the correct control surface settings for take-off. (The take-off trim position of the ailerons and rudder is within ± 1 degree of neutral; the horizontal stabilizer leading edge is set down about 4 degrees from neutral, or 5 degrees from neutral on airplanes changed by T.O. 1F-100C-547, to give an airplane nose-up condition.) The airplane is then trimmed for about 260 knots IAS with the 4-degree trim, or about 230 knots IAS with the 5-degree trim. These speeds are for a clean airplane of about 26,000 pounds gross weight. The trim speed can vary considerably with changes in gross weight, center of gravity, altitude, external store loading, and friction within the control system. Above this trim speed, it may be necessary to retrim the airplane because of the trim tolerance. When the take-off trim button is held down, an indicator light comes on when all the control surfaces have reached the proper position for take-off. To stop trim operation, the button must be released.

NOTE The take-off trim setting of the horizontal stabilizer is identified by a white triangle painted on the left side of fuselage, just forward of the stabilizer. During preflight check of trim system, have ground crew check that leading edge of stabilizer is aligned with aft apex of triangle when take-off trim button is pressed.

Caution Normally, the take-off trim button should not be used in flight, as an undesirable flight attitude may result.

Yaw Damper Switch.

The yaw damper system is controlled by a two-position switch. (See figure 1-12.) On F-100C-1 through F-100C-20 Airplanes, the yaw damper switch is a toggle switch; on F-100C-25 Airplanes, a push-pull switch is used. Although the electronic sensing units of the systems function whenever single-phase power from the main ac bus is available, the yaw damper switch must be ON to engage the system. When the yaw damper switch is set at (or pulled up to) ON, primary bus power opens a valve so that utility hydraulic system power goes to the yaw damper actuator, permitting it to respond to signals from the system sensing units. When the switch is set at (or pushed in to) STANDBY, the system is warming up (if electrical power is available) but is inoperative as hydraulic pressure is removed from the actuator, and the actuator is locked in a neutral position.

NOTE The yaw damper system requires a 1½-minute warm-up period after the electrical and hydraulic power sources are energized. At the end of this time, yaw damper response to switch positioning is immediate.

The STANDBY position is also used to reset the system after electrical malfunction has occurred, as shown by illumination of the yaw damper caution light. (If hydraulic failure occurs, the system drops out automatically, but the caution light does not come on. The system is automatically reset if hydraulic power is restored.) If the monitor circuit has shut off the system automatically, moving (or pushing in) the switch momentarily to STANDBY will reset the yaw damper for immediate operation when the switch is returned to ON. After an interruption of ac or dc power, 1½ minutes must elapse to provide adequate warm-up time, with the switch at STANDBY before the system can be reset.

NOTE The yaw damper system cannot be reset unless the malfunction is no longer present.

Caution The yaw damper switch should be at STANDBY during take-off and landing so that system will not cause objectionable heading changes during these conditions.

Pitch Damper Switch.

The two-position push-pull type pitch damper switch (figure 1-12) controls operation of the pitch damper system. When the switch is pressed into STANDBY and if ac and dc electrical power is available, the sensing units of the system receive power for warm-up. When the switch is pulled up to ON, primary bus power permits utility hydraulic system pressure to be routed to the pitch damper actuator, which will respond to signals from the sensing units. If system failure occurs, hydraulic power to the system is shut off automatically and the actuator is locked in the position it was in at time of failure. (If the automatic stops in the pitch damper system fail, the monitor circuit shuts off hydraulic power to the system and recenters the actuator.) When the pitch damper has been locked out because of system malfunction, it is necessary to press the switch in to STANDBY and then pull it up to ON to reset the system. Under such conditions, the system cannot be reset unless the malfunction is no longer present (system caution light out).

NOTE F-100C-1 through F-100C-20 Airplanes, at present, are not equipped with a pitch damper system. The pitch damper switch on these airplanes is therefore inoperative.

- The pitch damper system requires a 1½-minute warm-up period after the power sources are energized. At the end of this time, pitch damper response to switch position is immediate.

Caution The pitch damper switch should be at STANDBY during take-off and landing, to prevent the possibility of a dangerous flight attitude resulting if pitch damper system fails and gives a maximum signal before automatic recentering of the pitch damper actuator occurs.

- To prevent the limit load factor of the tanks from being exceeded by a pitch damper failure that results in a "hard-over" signal, the pitch damper switch must be at STANDBY (pushed in) when Type II 275-gallon drop tanks are installed at the intermediate stations and no other external loads are installed. After the drop tanks are released, the pitch damper system may be engaged.

FLIGHT CONTROL SYSTEM INDICATORS.

Take-off Trim Indicator Light.

When the take-off trim button is held down to trim the controls for take-off, and all controls are properly trimmed, a placard-type indicator light (figure 1-4) comes on. The indicator light is illuminated by primary bus power. Bulbs in the light can be tested by the indicator light test circuit.

Yaw Damper Out Caution Light.

If electrical malfunction causes the yaw damper system to fail or become inoperative when the yaw damper switch is ON, a placard-type caution light (figure 1-4) comes on. The light is powered by the primary bus. When the

FLIGHT CONTROL HYDRAULIC SYSTEM

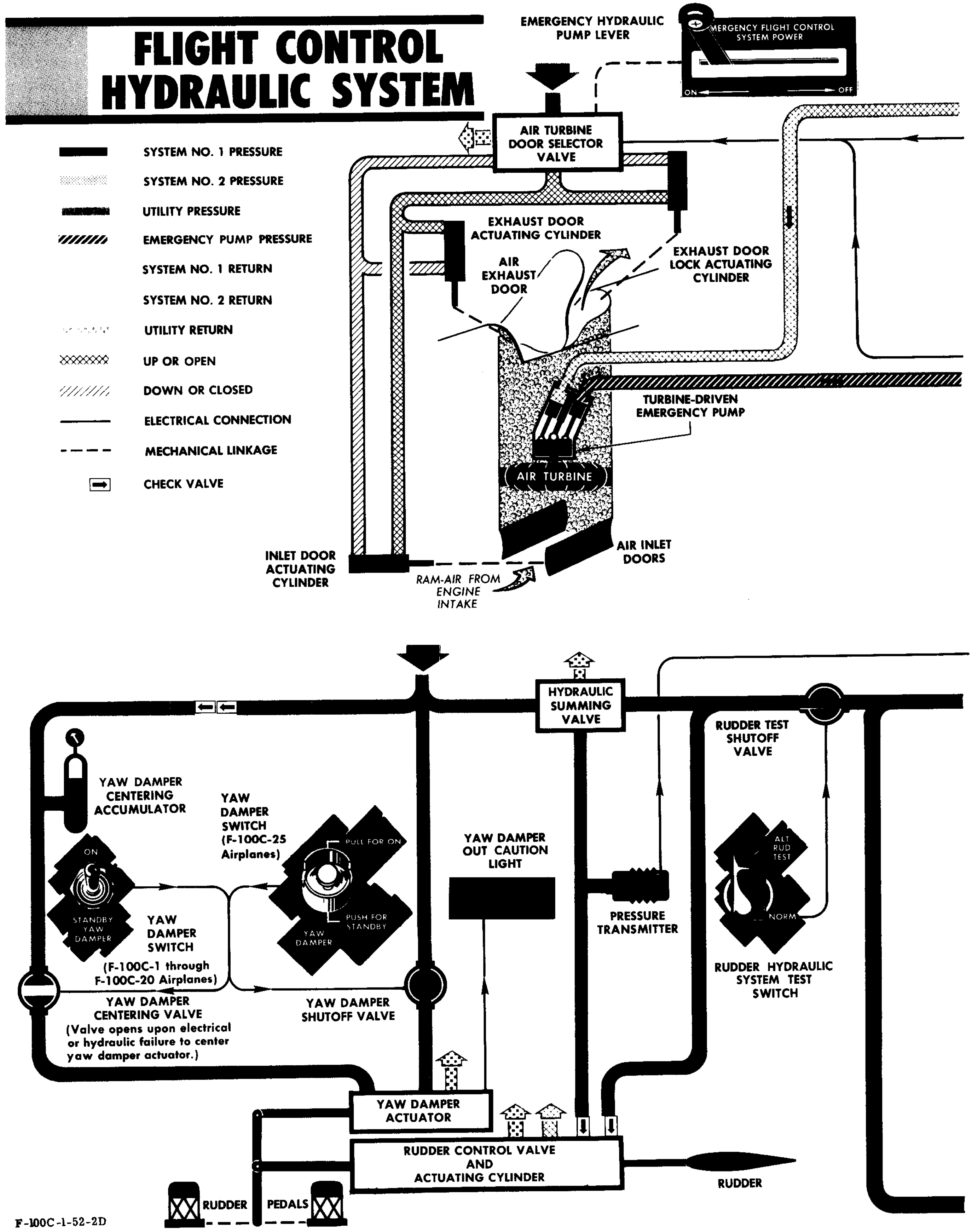
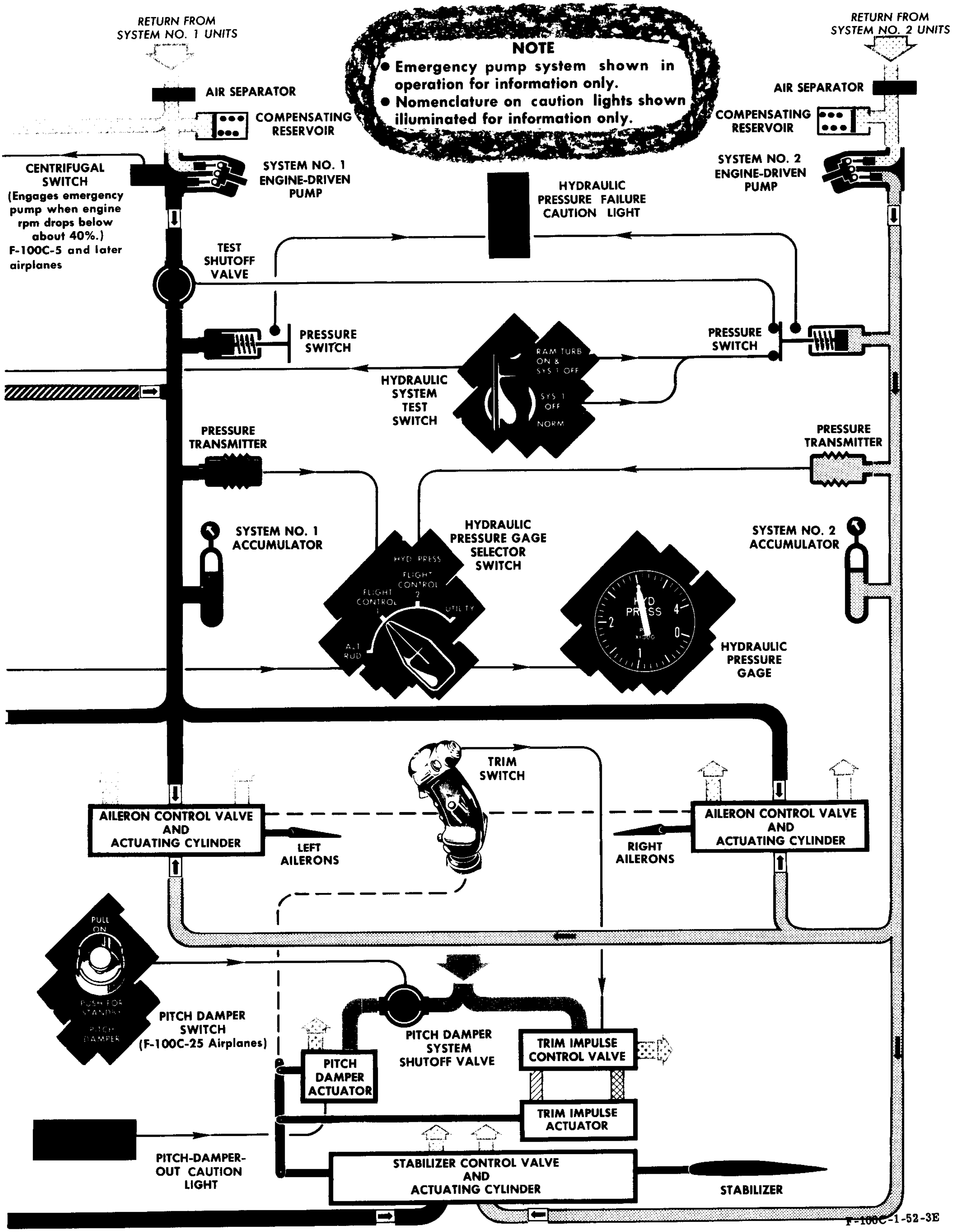


Figure 1-22


NOTE
● Emergency pump system shown in operation for information only.
● Nomenclature on caution lights shown illuminated for information only.
RETURN FROM SYSTEM NO. 1 UNITS
AIR SEPARATOR
COMPENSATING RESERVOIR
CENTRIFUGAL SWITCH (Engages emergency pump when engine rpm drops below about 40%.) F-100C-5 and later airplanes
SYSTEM NO. 1 ENGINE-DRIVEN PUMP
RETURN FROM SYSTEM NO. 2 UNITS
AIR SEPARATOR
COMPENSATING RESERVOIR
SYSTEM NO. 2 ENGINE-DRIVEN PUMP
HYDRAULIC PRESSURE FAILURE CAUTION LIGHT
TEST SHUTOFF VALVE
PRESSURE SWITCH
PRESSURE SWITCH
HYDRAULIC SYSTEM TEST SWITCH
RAM TURB ON & SYS 1 OFF
SYS 1 OFF
NORM
PRESSURE TRANSMITTER
PRESSURE TRANSMITTER
SYSTEM NO. 1 ACCUMULATOR
SYSTEM NO. 2 ACCUMULATOR
HYDRAULIC PRESSURE GAGE SELECTOR SWITCH
HYD PRESS
FLIGHT CONTROL 1
FLIGHT CONTROL 2
UTILITY
ALT RUD
HYD PRESS
HYDRAULIC PRESSURE GAGE
TRIM SWITCH
AILERON CONTROL VALVE AND ACTUATING CYLINDER
LEFT AILERONS
RIGHT AILERONS
AILERON CONTROL VALVE AND ACTUATING CYLINDER
PULL ON
PITCH DAMPER SWITCH (F-100C-25 Airplanes)
PITCH DAMPER SYSTEM SHUTOFF VALVE
TRIM IMPULSE CONTROL VALVE
PITCH DAMPER ACTUATOR
TRIM IMPULSE ACTUATOR
PITCH-DAMPER-OUT CAUTION LIGHT
STABILIZER CONTROL VALVE AND ACTUATING CYLINDER
STABILIZER
F-100C-1-52-3E

yaw damper switch is moved to STANDBY, to reset the system, the light goes out. If the light remains out when the switch is returned to ON, the system malfunction no longer exists, and system operation is restored. However, if the light comes back on when the yaw damper switch is returned to ON, the switch should be set at STANDBY for 1½ minutes and then back to ON. Then, if the light comes on, the malfunction still exists and the system cannot be reset. (The light does not come on when the system drops out because of hydraulic failure.) The bulbs in the light are tested by means of the indicator light test circuit.

Pitch Damper Out Caution Light.

This placard-type caution light (figure 1-4) comes on when a malfunction has shut off the pitch damper system. The light also comes on when the pitch damper switch is in the ON position and electrical power is first applied to the airplane, but will go out if the pitch damper switch is cycled after the system warm-up period (about 1½ minutes) is completed. The pitch damper caution light is powered by the primary bus and the bulbs in the light can be tested by the indicator light test circuit.

NOTE Since F-100C-1 through F-100C-20 Airplanes do not have a pitch damper system, the caution light on these airplanes is temporarily inoperative, but will come on when the indicator light test button is used to check bulb operation.

FLIGHT CONTROL HYDRAULIC SYSTEMS.

Two complete, independent, simultaneously operating hydraulic systems (identified as systems No. 1 and No. 2) actuate both the controllable horizontal stabilizer and the ailerons. (See figure 1-22.) Each is a constant-pressure type system, powered by a separate engine-driven pump, and each system supplies half the demand of the control surface actuators. Failure of one system normally does not affect the operation of the other system. However, there is one case that can affect both systems and cause the horizontal stabilizer to lock. This can occur if a quick-disconnect coupling in either return line from the horizontal stabilizer actuator becomes disconnected at the fuselage field break, thereby shutting off the return flow. If any other type of failure occurs, the other system assumes the entire load of flight control operation. Under such a condition, maximum force output is limited to half that of normal dual system operation. With a frozen engine, or if No. 1 engine-driven pump failure occurs, power in this system can be maintained by a ram-air turbine-driven emergency pump. The rudder is actuated by flight control hydraulic system No. 1 pressure; however, if this pressure fails or falls below 2900 psi, a summing valve automatically directs utility pressure to the rudder actuator to add to the flight control system power. The control surface hydraulic control valves are positioned mechanically by stick or rudder pedal movement. These valves then direct hydraulic power to the actuating cylinders to move the control surfaces. (The dual control valves and tandem-type actuating cylinders are hydraulically independent of each other.) When the control surface moves, a follow-up mechanism returns the control valve to a neutral position, so that hydraulic flow to the actuating cylinder is shut off. The pressure in the actuating cylinder serves to hold the control surface in the desired position, and maintain irreversibility by means of check valves.

Flight Control Hydraulic System Emergency Pump.

The emergency hydraulic pump in flight control system No. 1 provides pressure for this system in case of engine failure or if failure of the system No. 1 engine-driven pump occurs. The emergency pump is powered by a ram-air driven turbine. (See figure 7-1.) A manual control in the cockpit is used to start or shut down the pump. In addition to this manual control, an electrical system (primary bus power) automatically starts the emergency pump if engine rpm drops below about 40% on F-100C-5 and later airplanes.

NOTE The flight control emergency pump automatic starting system on F-100C-1 Airplanes is inoperative.

- The manual control actuates the turbine door selector valve mechanically, while the automatic system actuates the selector valve electrically by primary bus power.

To start the emergency pump (either manually or automatically), utility hydraulic system pressure opens air inlet doors in the engine intake duct, and an air outlet door on top of the fuselage. Ram air from the engine inlet duct then flows through and drives the turbine. (Refer to "Flight Control System Emergency Hydraulic Pump" in Section VII.) If the ram-air, turbine-driven emergency pump is started or operating when the outside air pressure at the ram-air turbine air outlet door exceeds the pressure in the engine intake duct (such as occurs during high engine rpm at low airplane speed), airflow through the turbine will be reversed. This action will lower or cut off the output of the emergency pump and may, on F-100C-1 Airplanes, damage the turbine. F-100C-5 and later airplanes have a turbine which is not subject to damage if the airflow is reversed.

Caution If an increase in engine speed is anticipated on F-100C-1 Airplanes (such as would occur during a go-around when landing), the emergency pump must be shut down to prevent turbine damage.

If utility hydraulic system pressure is not available to open the doors, an accumulator in the system provides positive door opening. If the pump is no longer needed, it must be shut down manually, at which time utility hydraulic pressure closes the ram-air inlet and outlet doors to stop the turbine. (There is no automatic system for shutting off the emergency pump.) The pump can be shut down only when engine rpm is above about 45% rpm for sufficient output from the engine-driven pump in flight control hydraulic system No. 1. The nose gear load switch prevents automatic operation of the emergency pump when the airplane is on the ground. However, an externally mounted switch button permits the load switch to be overriden for a postflight operational check of the pump automatic starting system during engine shutdown.

Flight Control Emergency Hydraulic Pump Lever.

The flight control emergency hydraulic pump can be controlled manually by a lever. (See 12 and 19, figure 1-9.) Pushing the lever forward to ON mechanically positions a hydraulic selector valve, so that the utility hydraulic system pressure opens the ram-air turbine air inlet and air outlet doors. This allows the flow of ram air from the engine air intake duct to drive the turbine for operation of the emergency pump. (When the flight control hydraulic system test switch is held at its RAM TURB ON & SYS 1 OFF position for an in-flight test of the pump, the lever moves automatically to the ON position.) To shut down the pump, the lever must be manually returned to OFF. When the lever is moved aft to its OFF position, utility hydraulic pressure closes the inlet and exhaust outlet doors to stop the turbine and shut down the pump.

Rudder Hydraulic System Test Switch.

A preflight operational check of the summing valve in the rudder hydraulic control system can be made by means of the two-position test switch. (See figure 1-12.) When the switch is held at ALT RUD TEST, primary bus power closes the test valve in the flight control system No. 1 pressure line to the rudder actuator. This shuts off flight control hydraulic power to the rudder and allows the summing valve to direct utility hydraulic system flow to the rudder. Check of rudder operation can then be made. The switch is spring-loaded to NORM, and when released to this position, the test valve returns to its normal position so that flight control hydraulic system No. 1 pressure is supplied to the rudder.

Ram-air Turbine Test Button.

The automatic starting system of the ram-air, turbine-driven flight control emergency hydraulic pump can be tested during engine shutdown by means of an externally-mounted push-button type switch. The button is flush-mounted on the left side of the fuselage, below the ram-air turbine air outlet door. During engine shutdown deceleration, the button should be held down by a ground crew member. This overrides the nose gear load switch which normally prevents the pump automatic starting system from operating at low-speed engine operation when the airplane is on the ground. With the button pressed, the air inlet and outlet doors open to start the ram-air turbine-driven flight control emergency pump as engine speed drops below about 40% rpm. (The emergency hydraulic pump lever in the cockpit automatically moves forward to ON when the air inlet and outlet doors open.) Releasing the button restores the safety circuit that prevents ground operation of the pump automatic starting system. (The emergency hydraulic pump lever must be moved to OFF to close the doors.)

NOTE As the flight control emergency pump automatic starting system is inoperative on F-100C-1 Airplanes, the test button on these airplanes is also inoperative.

Flight Control Hydraulic System Test Switch.

The guarded primary-bus-powered, three-position switch (figure 1-12), is spring-loaded to NORMAL. It is used only for making an in-flight operational test of the ram-air turbine-driven emergency hydraulic pump after certain periodic inspections, or after maintenance has been performed on the ram-air turbine system. When the switch is held at SYS 1 OFF, the test valve in flight control hydraulic system No. 1 closes, shutting off hydraulic pressure in this system.

NOTE A pressure switch prevents system No. 1 from being shut off if system No. 1 fails or does not have enough pressure (less than about 650 psi).

- A nose gear load switch prevents system No. 1 from being shut off for test purposes while the airplane is on the ground.

When the switch is held at RAM TURB ON SYS 1 OFF, the test valve in system No. 1 remains closed, and a hydraulic selector valve opens that allows utility hydraulic system pressure to open the ram-air turbine air inlet and air outlet doors. (The emergency hydraulic pump lever in the cockpit automatically moves to ON when the doors open.) When the switch is at NORMAL, the test valve is de-energized for normal operation of both flight control hydraulic systems. Releasing the test switch to NORMAL does not shut down the emergency pump; the pump must be stopped by moving the emergency pump lever to OFF.

NOTE The RAM TURB ON & SYS 1 OFF position is inoperative on F-100C-1 Airplanes.

Hydraulic Pressure Gage and Gage Selector Switch.

Refer to "Hydraulic Power Systems" in this section.

GROUND SAFETY LOCKS

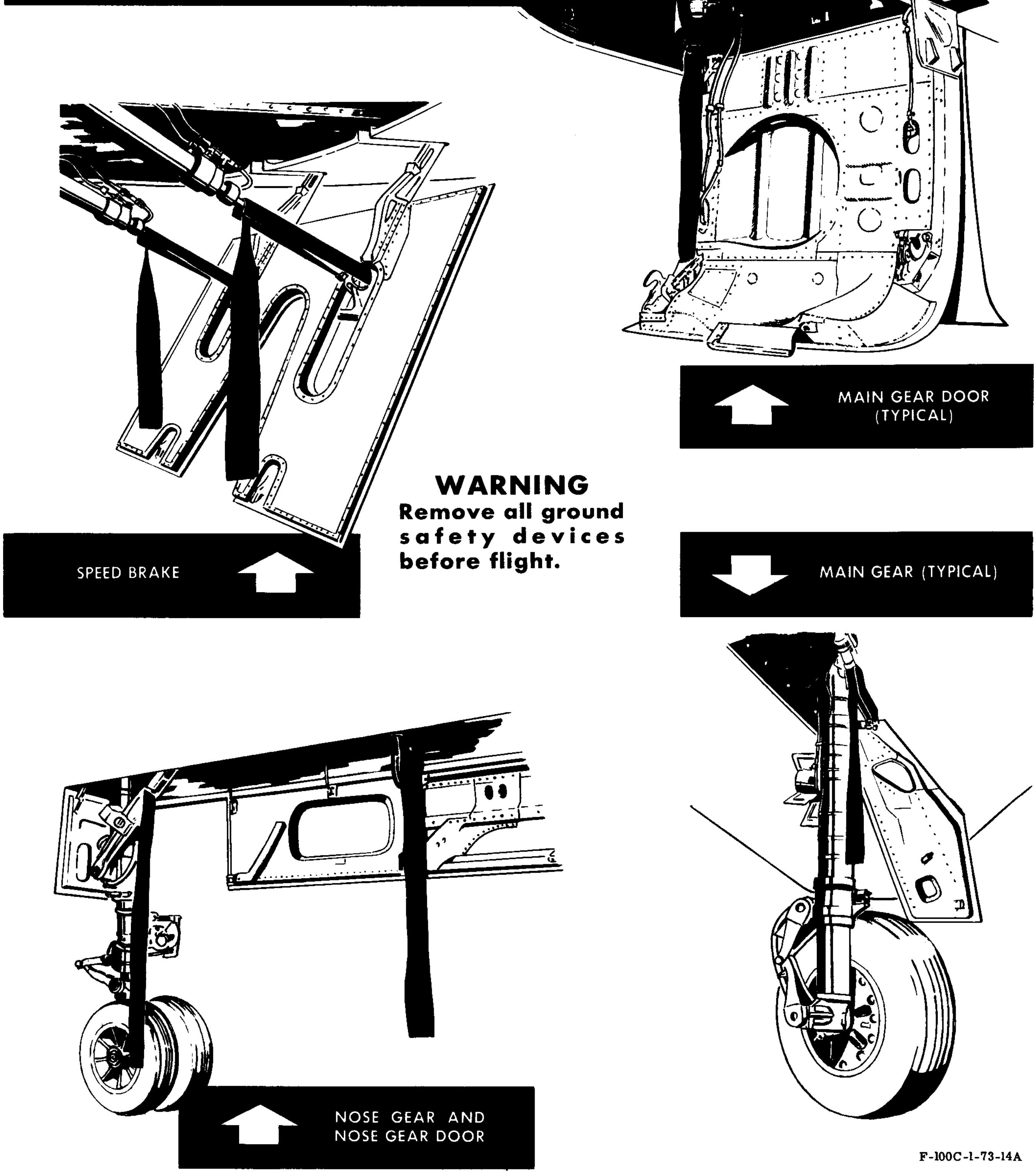


Figure 1-23

Hydraulic Pressure Failure Caution Light.

The placard-type pressure failure caution light (14, figure 1-6; 12, figure 1-7) is illuminated by primary bus power when pressure in either or both flight control hydraulic systems drops below about 600 psi. The indicator light test circuit provides a test of the bulbs in the pressure failure caution light.

WING SLATS.

The movable wing slats, consisting of five sections interconnected in two groups, extend spanwise along the leading edge of the wings. The slats are actuated automatically by aerodynamic forces. An increase in airspeed closes the slats; the slats extend when airspeed is reduced. When the slats are extended, the slot formed along the leading edge changes airflow characteristics to reduce stalling speeds in both accelerated and unaccelerated flight. Depending on the angle of attack, the slats float to either closed, partly open, or full open positions. Except at extreme altitudes, the slats remain closed in climbing or cruising flight to offer minimum drag for maximum flight performance.

SPEED BRAKE SYSTEM.

A hydraulically operated, electrically controlled speed brake is on the lower surface of the fuselage, behind the nose gear well. At high engine rpm, the speed brake opens in about 2½ seconds and closes in about 1¾ seconds. On the ground with the engine at idle rpm, about 4 seconds is required to close the speed brake. A pressure priority valve, in the speed brake hydraulic pressure line, prevents speed brake operation if utility hydraulic system pressure drops below 1300 psi. (This is the minimum pressure needed for wheel brake and nose wheel steering systems.) Speed brake operation when utility hydraulic pressure is 1300 to 1850 psi is slow; at pressures above 1850 psi, speed brake operation is normal.

Caution If the speed brake operates when utility hydraulic system pressure is below 1300 psi, the pressure priority valve is faulty and should be replaced before the next flight.

The speed brake system has an emergency control to close the speed brake to trail position in flight, in case of utility hydraulic system failure. There is no speed brake position indicator.

NOTE Although the speed brake can be used at any speed, a relief valve in the speed brake hydraulic system prevents speed brake extension or allows speed brake to retract, as necessary, under excessive aerodynamic loads, to prevent structural damage. It is possible at extremely high speeds that the speed brake may not open sufficiently to be effective.

SPEED BRAKE GROUND SAFETY LOCKS.

A removable ground safety lock may be installed on each of the two speed brake actuating cylinders to keep the speed brake in the out position when the airplane is on the ground. (See figure 1-23.) The lock assemblies, which have conventional red warning streamers, must be removed before flight.

SPEED BRAKE SWITCH.

A serrated switch (figure 1-11) controls speed brake operation. The OFF (center) position is indicated by a white alignment mark on the switch guide. Moving the switch to IN or OUT supplies primary bus power to position the speed brake control valve accordingly so that utility hydraulic system pressure actuates the speed brake. After the speed brake has been opened or closed, the switch must be returned to OFF (center).

SPEED BRAKE EMERGENCY DUMP LEVER.

The speed brake can be retracted in flight, if normal operation fails, by a dump lever. (See 23, figure 1-8.) Moving the lever forward mechanically opens a dump valve, which relieves hydraulic pressure from the speed brake actuating cylinders. Air loads then return the speed brake to a trail position. This occurs regardless of speed brake switch position, because the emergency dump lever overrides the speed brake switch. The speed brake system is reset for normal operation when the emergency dump lever is moved full aft to the off position. No emergency method for opening the brake is provided.

LANDING GEAR SYSTEM.

The retractable tricycle landing gear is electrically controlled and hydraulically actuated. The main gear retracts inboard into the lower surface of the wing and fuselage; the dual-wheel nose gear retracts aft into the fuselage. An electrically actuated retractable tail skid operates simultaneously with the landing gear. The wheel well doors are closed after the gear is extended and locked down. A load switch on each main gear shock strut prevents the landing gear from being retracted when the weight of the airplane is on the gear. An emergency gear lowering system is also provided. During normal or emergency operation, gear lowering time is about 6 to 8 seconds (it should not exceed 10 seconds); normal gear retraction requires about the same time. A steering unit attached to the nose gear assembly serves as a conventional shimmy damper when the steering is not engaged.

LANDING GEAR CONTROL PANEL

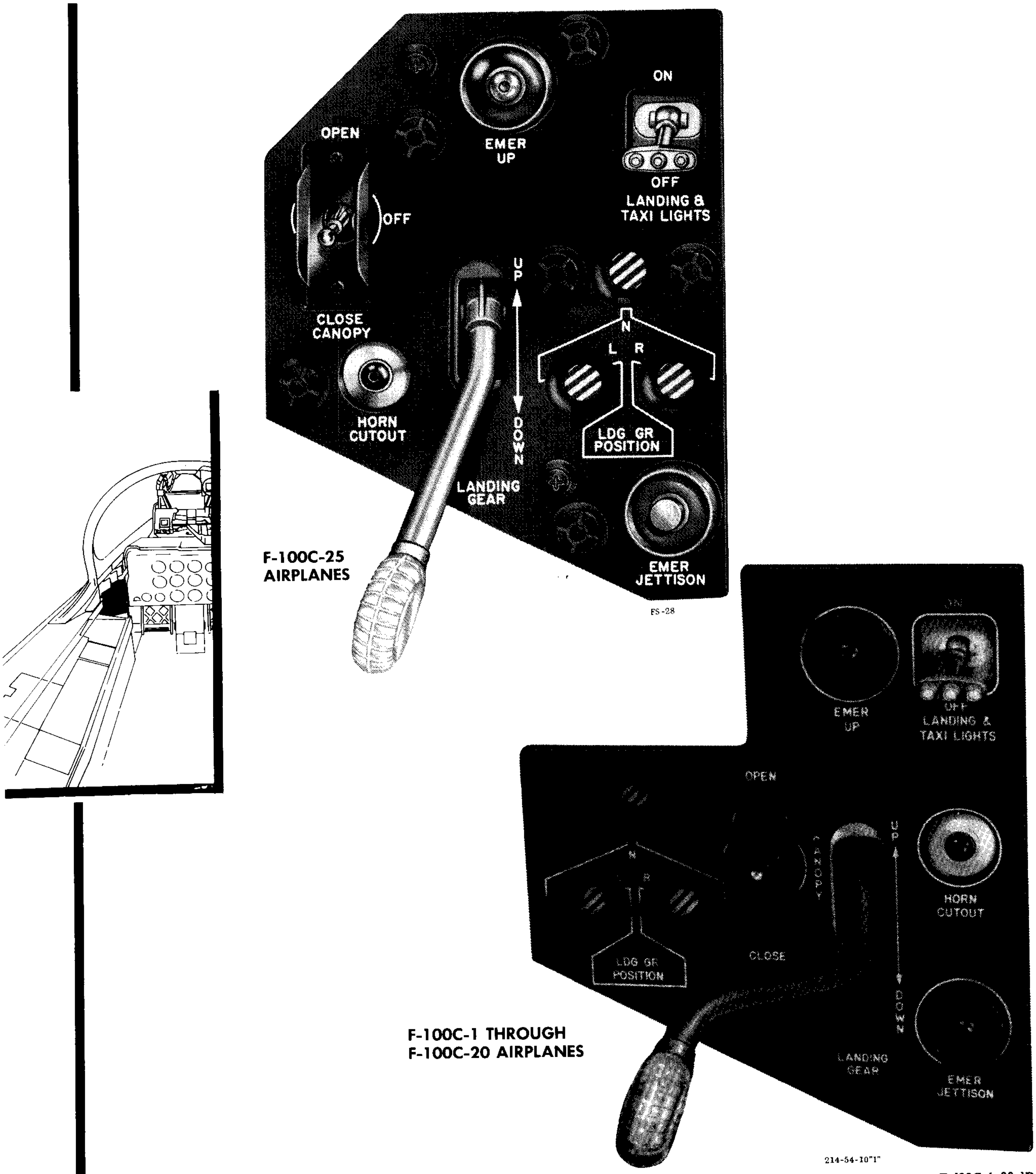


Figure 1-24

The main gear wheels have hydraulically operated, multiple-disk type brakes and some airplanes have anti-skid provisions.

LANDING GEAR GROUND SAFETY LOCKS.

Removable ground safety locks may be installed in the main and nose gear assemblies to prevent possible collapsing of the gear while the airplane is on the ground. (See figure 1-23.) Ground safety locks are also provided for the open position of the main and nose gear wheel well doors. The locks have regulation red warning streamers. All gear ground safety locks must be removed before flight.

LANDING GEAR CONTROLS.

Landing Gear Handle.

The landing gear handle (figure 1-24) controls the gear and gear door hydraulic selector valves and the tail skid electric actuator by primary bus power. When the air-plane is air-borne, moving the handle to UP positions the door selector valve so that utility hydraulic pressure opens the wheel well doors. After the doors are open, the gear selector valve applies pressure to retract the gear. When the gear reaches the up and locked position, the door selector valve is repositioned to close the doors. After the doors are closed and locked, the landing gear system is automatically depressurized. When the landing gear handle is moved to DOWN, both the door and gear selector valves are energized to permit hydraulic pressure to open the wheel well doors and lower the gear. When the gear reaches its down-and-locked position, the door selector valve is repositioned to close and lock the doors.

Landing Gear Emergency Lowering Handle.

The landing gear emergency lowering handle (21, figure 1-6; 20, figure 1-7) is used to extend the landing gear and wheel well doors in case of failure of the normal lowering system. Pulling the handle full out (after the landing gear handle has been moved to DOWN) mechanically unlocks all gear and wheel well door uplocks and positions the hydraulic selector valves to open the doors and lower the gear. To provide positive nose gear lowering, pulling the emergency lowering handle also directs hydraulic pressure from an emergency accumulator to lower and lock the nose gear. If the gear fails to lower because of a malfunction in the electrical system, and the hydraulic system is operating, pulling the emergency lowering handle lowers and locks the gear by hydraulic pressure as in a normal extension cycle. (The handle must be held in the fully extended position until the gear is down and locked.) If utility hydraulic system failure prevents normal gear lowering, pulling the emergency lowering handle allows the main gear to fall free and lock by gravity while the nose gear lowers and locks by pressure from the nose gear emergency lowering accumulator. The nose gear emergency accumulator provides enough pressure for one emergency lowering only. The emergency accumulator selector valve must be reset on the ground before normal gear operations can continue. A red rod protrudes from the fuselage lower skin at the left of the nose wheel well when the landing gear emergency lowering handle has been pulled. The selector valve is reset by pushing on the rod until it is in flush with the fuselage skin.

Caution The nose gear cannot be retracted in flight after being lowered by the emergency lowering handle. The emergency accumulator selector valve must be reset manually (on the ground) before the next flight, if the gear has been lowered by the emergency handle.

Landing Gear Emergency-up Button.

Warning To prevent damage to the airplane and possible pilot injury, do not use the landing gear emergency-up button.

The emergency-up button (figure 1-24) permits the gear to be collapsed while the weight of the airplane is on the gear. After the landing gear handle has been moved to UP, pressing the emergency-up button (which bypasses the landing gear sequencing and ground safety switches) directs battery bus power directly to the gear-up side of the landing gear selector valve. Hydraulic power is then supplied to the landing gear actuators. Experience has shown, however, that the design characteristics of the main gear give a positive loading on the wheels that prevents the main gear from retracting. The nose gear retracts immediately when the emergency-up button is pressed and the airplane will drop on its nose.

Caution Do not use the landing gear emergency-up button to retract the gear in flight. The wheel well doors will not open and the gear will crush the doors.

LANDING GEAR INDICATORS.

Landing Gear Position Indicators.

The position of the landing gear is shown by three indicators (figure 1-24) which are powered by the primary bus. (There is no tail skid position indicator.) Each respective gear indicator unit displays the word "UP" when its gear is up and locked (with doors closed and

NOSE GEAR TORQUE LINK

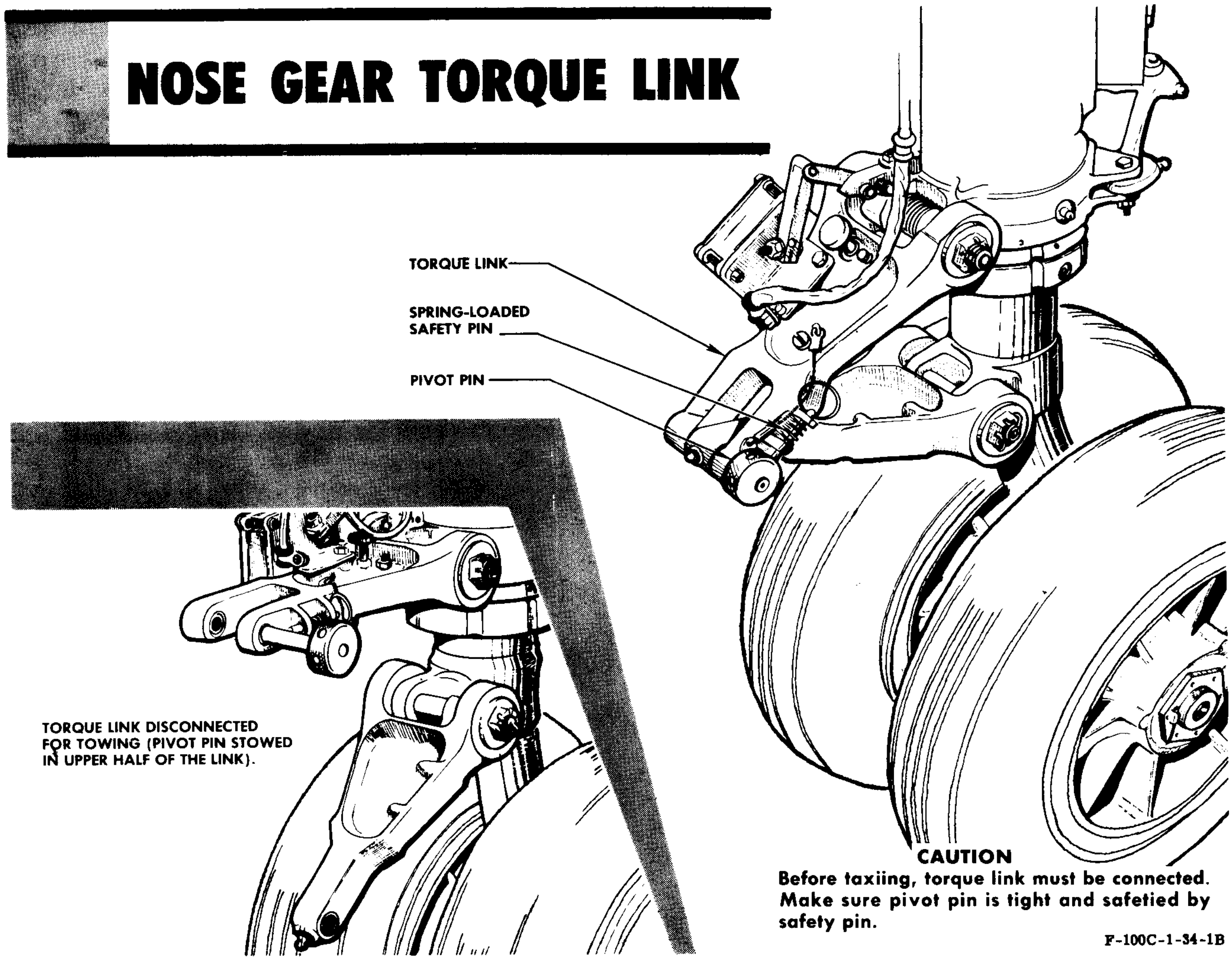


Figure 1-25

locked), a symbolized wheel when its gear is down and locked, and parallel red and yellow diagonal lines when its gear is in any unlocked condition.

NOTE The diagonal lines also appear in the indicator units whenever the primary bus is not energized.

Landing Gear Warning Light.

A red light in the plastic knob of the landing gear handle (figure 1-24) is illuminated by primary bus power to warn of an unsafe condition of the landing gear or wheel well door. The light also comes on if the gear is up and locked when the throttle is retarded below minimum cruising rpm. The gear warning light is dimmed automatically when the instrument panel indirect lights are turned on. The bulb of the landing gear warning light can be tested by the indicator light test circuit.

Landing Gear Warning Horn.

A warning horn, mounted on the right seat ejection rail, sounds if any gear is not down and locked when the throttle is retarded below cruising rpm. The horn can be silenced by pressing the horn cutout button. (See figure 1-24.) The horn circuit, powered by the primary bus, is automatically reset when the throttle is advanced.

NOSE WHEEL STEERING SYSTEM.

The nose wheel steering system affords directional control of the airplane during taxiing, take-off, and landing. It is engaged by primary bus power and actuated by utility hydraulic pressure. Steering is mechanically controlled by movement of the rudder pedals and is engaged or disengaged by a push-button switch on the control stick grip. An irreversible hydraulic steering unit permits the nose wheels to be turned about 35 degrees each side of center. A nose gear load switch prevents engagement of the steering system when the weight of the airplane is off the nose gear. A mechanically operated valve depressurizes the steering unit as the gear retracts. This ensures that the unit does not remain engaged upon gear retraction if the nose gear load switch or hydraulic shutoff valve fails. When the steering system is not engaged, the steering unit serves as a conventional shimmy damper.

NOSE GEAR TORQUE LINK.

The nose gear shock strut and nose wheel assembly are connected by a torque link ("scissors"), which keeps the strut and wheel assemblies in alignment. (See figure 1-25.) The torque link assembly has a quick-release pivot pin, which allows the link to be disconnected for towing the airplane. When the torque link is disconnected, the nose wheels can swivel freely. The torque link is disconnected by pulling out on the spring-loaded safety pin and then unscrewing the pivot pin. The pivot pin should be replaced in the upper section of the torque link when the link is disconnected. The torque link is connected by pulling out on the safety pin and inserting the pivot pin through both sections of the link. The pivot pin is then tightened finger-tight to the nearest safety pin hole and safetied by releasing the spring-loaded safety pin into the hole.

NOSE WHEEL STEERING BUTTON.

A push-button switch (figure 1-21) engages the nose wheel steering system. When the button is pressed and held, primary bus power energizes a valve, which directs utility hydraulic system pressure to the nose wheel steering unit. A clutch in the steering unit is then engaged hydraulically to link the rudder cables with the steering unit.

NOTE If rudder pedals are not neutral when the button is pressed, the steering may or may not engage (depending on the engagement of the steering unit clutch) and move the nose wheels to agree with pedal position. If the steering does not engage, it is necessary to move the pedals in the direction of nose wheel setting to obtain steering.

The nose wheel steering will remain engaged as long as the button is held down. However, if the button is momentarily released, it may be necessary to move the pedals so that they are positioned according to the setting of the nose wheels to re-engage the steering. On airplanes changed by T.O. 1F-100-738, momentarily pressing the steering button energizes the steering system and, once the steering system is engaged, momentarily pressing the steering button again de-energizes the control circuit and disengages the steering system. However, the steering system is engaged as long as the steering button is held down. Once the steering system is engaged, pressing and holding the button in keeps it engaged. Then *releasing* the steering button de-energizes the circuit and disengages the steering system.

NOTE The nose wheel steering button is operable only if primary bus power is available and the weight of the airplane is on the nose gear.

WHEEL BRAKE SYSTEM.

The multiple-disk type, hydraulically operated brakes are on the outboard side of the main wheels. Braking action on each wheel is independently controlled by the corresponding rudder pedal. (Refer to "Wheel Brake Operation" in Section VII.) Toe action on the rudder pedals actuates the brake valves, which meter pressure from the utility hydraulic system to apply the brakes. The hydraulic pressure applied to the brakes is proportional to the force applied at the pedal, up to the maximum pressure admitted through the brake valve. After this condition is attained, additional pedal pressure does not increase the pressure to the brakes. When the brakes are released, hydraulic pressure from the brakes is returned to the utility system reservoir through the brake valves. Airplanes changed by T.O. 1F-100-664 have a thermal relief valve to prevent excessive pressure build-up in the brake system during letdowns from altitude. (Refer to "Descent" in Section II.) An emergency hydraulic accumulator in the brake system has sufficient capacity for two full brake applications if the utility hydraulic system pressure fails.

On some airplanes,* however, master cylinders are included in the brake valves and provide enough braking action to steer and stop the airplane if frequent applications of brakes have exhausted accumulator fluid. This permits an unlimited number of brake applications as long as there is fluid in the utility system reservoir. These airplanes also have a wheel brake antiskid system which automatically prevents excessive wheel skidding. On these airplanes, there is a restrictor in the hydraulic line to the brakes that modulates brake pressure during antiskid operation. Because of this restrictor, excessive pumping of the brake pedals causes the brake valves to change over from power braking to manual braking, which requires additional pedal pressure by the pilot to attain the desired braking. Braking action is relatively poor

***F-100C-15 Airplanes AF54-1833 and all later airplanes not changed by T.O. 1F-100-534**

during the time the system is on manual braking. About 3 seconds after pumping has stopped, power braking returns when enough pressure has entered the system through the restrictor.

On airplanes changed by T.O. 1F-100-534, if the pressure to the brake valves drops below 500 psi, a variable-flow regulator ("run-around valve") opens up to permit additional pressure (flow) to bypass the flow restrictor and maintain pressure to the brake valves. Airplanes changed by T.O. 1F-100-534 have an antiskid system and an electrically-driven emergency hydraulic pump. This pump, powered by the battery bus, provides brake operating pressure (for power braking) if the utility system fails, as long as fluid is available from the utility reservoir. (On these airplanes, the master cylinders have been removed.) Emergency pump operation is controlled by pressure switches which sense low brake operating pressures, and mechanical switches attached to the brake operating linkages. If, because of antiskid cycling or repeated application of brakes, the wheel brake emergency accumulator pressure drops to 750 psi and the antiskid system accumulator pressure drops to 450 psi, the pressure switches close. With the switches closed, and with either brake pedal depressed (so that either or both pedal switches are actuated), the emergency pump operates to supply brake pressure. The pump shuts off when pressure is again built back up to 750 psi in the antiskid system accumulator.

NOTE An operational check of the emergency pump can be made before the engine is started, by operating the brake pedals and listening for pump operation.

- There are no parking brakes on this airplane.

Airplanes changed by T.O. 1F-100-715 have a fluid quantity measuring fuse installed between the antiskid control valve and the brakes. This fuse stops all flow to the affected brake if there is no return flow from that brake. In case of a damaged hydraulic line, there will be no loss of utility system pressure.

WHEEL BRAKE ANTISKID SYSTEM.*

An electrically controlled, hydraulically operated antiskid system in the wheel brake system prevents excessive skidding. The system detects the start of a skid condition or a near-locked condition and automatically releases hydraulic pressure at the brakes. The system is not an automatic braking system, and, therefore, maximum brake pedal pressure should not be applied at touchdown and maintained throughout the landing roll during a normal landing. The system functions automatically, when engaged, to release the brakes as the wheels approach a skid. A skid detector unit, on each main gear, senses the rate of change of wheel speed as well as rotation of the wheel. These detectors supply electrical signals to the system control unit, which controls the antiskid control valves in the brake lines. The control valves regulate the hydraulic pressure applied by the pilot to the brakes. (See figure 1-19.) If either wheel approaches a skid condition after the brakes are applied, the detector sends a "skid" signal to the control unit. The control unit actuates the antiskid control valve to release the brakes by shutting off pressure to *both* brakes and dumping the pressure to return. As the skid condition is corrected by this automatic brake release, the detector stops sending a "skid" signal. This causes the control valves to open and restore pressure to the brake. The antiskid system maintains this "on-off" cycling of the brakes as long as the brakes are applied and skid conditions prevail. The detector units are sensitive within a speed range from the highest possible landing speed to about 10 knots. Below this speed, the system should not be depended upon to give antiskid protection. An "arming" circuit in the antiskid system, that keeps the brake system inoperative until the wheels touch down and start to rotate, prevents landing with the brakes on. The arming circuit gives locked-wheel protection for 4 to 16 seconds after the first recovery signal (which occurs at touchdown or when wheels are accelerated) on landing. When the locked-wheel protection has dropped out, it is not available until the system has been rearmed by moving the landing gear handle to UP. If either brake is released by the system for a continuous period of 3 seconds, the antiskid control unit automatically shuts off the antiskid system and normal braking technique is necessary.

Antiskid Switch.

Primary bus power to the antiskid system is controlled by a three-position switch. (See figure 1-12.) When the switch is ON, antiskid protection is available. In addition, with the switch ON, moving the landing gear handle to UP after take-off engages the arming circuit that prevents landing with the brakes on. This gives locked-wheel protection for about 4 to 16 seconds after the first recovery signal on landing. Moving the switch to OFF shuts off the antiskid system. (Power braking or power emergency braking is still available when the switch is OFF.) The ARM position is used to "arm" the system for maintenance and adjustment purposes only. The switch is spring-loaded from ARM to ON.

Antiskid Caution Light.

When the skid protection has been lost on either wheel, the antiskid caution light (figure 1-4) is illuminated by primary bus power. The bulbs in the light can be tested by the indicator light test circuit.

***F-100C-15 Airplane AF54-1833 and all later airplanes, and airplanes changed by T.O. 1F-100-534**

DRAG CHUTE SYSTEM.

The 16-foot, ring-slot type parachute, packed in a deployment bag, is stowed in a compartment in the lower surface of the aft fuselage, outboard of the tail skid. A riser cable joins the drag chute to a coupling in the trailing edge of the vertical stabilizer, below the rudder. The riser is stowed externally within a faired recess on the left side of the fuselage. The drag chute is mechanically controlled from the cockpit and can be jettisoned, if desired, after being deployed. On some airplanes,* the drag chute release mechanism has a safe arming device that automatically releases the chute from the airplane if it is deployed by any action other than movement of the drag chute handle in the cockpit.

DRAG CHUTE HANDLE.

When the drag chute handle (1, figure 1-6 and 1-7) is pulled straight back about 3 inches to deploy the chute, the spring-loaded to open drag chute compartment doors are mechanically unlocked. A pilot chute springs from the compartment when the doors open, and pulls the drag chute out of the deployment bag into the air stream, where it is inflated. To jettison the drag chute at any time after it has been deployed, the handle should be rotated 90 degrees counterclockwise and then pulled back another 2 inches from the deploy position. A release mechanism at the coupling assembly is then mechanically unlatched to release the chute and riser cable.

INSTRUMENTS.

Most of the instruments are powered by the ac or dc electrical system. The exhaust temperature gage and tachometer systems, however, are of the self-generating type and therefore do not require power from the airplane electrical systems. An instrument panel vibrator, energized automatically by the tertiary bus, prevents instrument lag or sticky pointer indications.

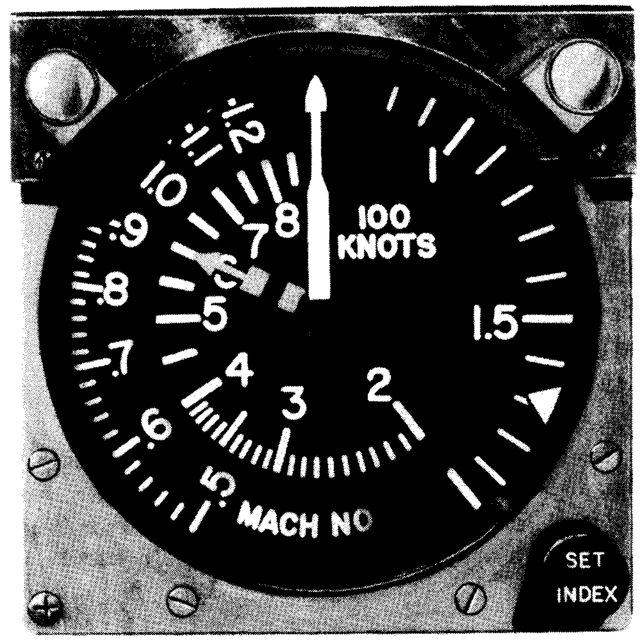
NOTE For information regarding instruments that are an integral part of a particular system, refer to applicable paragraphs in this section and in Section IV.

PITOT-STATIC BOOM.

Pitot and static pressures for various flight instruments are obtained from the pitot-static boom. (See figure 1-1.) Because the length of the boom makes it vulnerable during towing or other ground operations, the boom is hinged forward of its attach point, allowing it to be folded upward. Boom anti-icing protection is provided by heated air from the engine compressor. (Refer to "Defrosting, Anti-icing, and Rain Removal Systems" in Section IV.)

AIRSPEED AND MACH NUMBER INDICATOR.

The airspeed and Mach number indicator (37, figure 1-6; 38, figure 1-7) has a conventional pointer to show indicated airspeed through a range of 80 to 850 knots. This pointer also shows Mach number on a movable Mach scale when airspeed is above 200 knots. The Mach



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scale (with a range from Mach .5 to Mach 2.2) rotates in the left arc of the indicator dial. It moves with altitude changes so that the indicating pointer shows the Mach number that equals the indicated airspeed for the particular flight altitude. For example, at sea level, the Mach 1.0 graduation on the Mach scale might be opposite the 650-knot graduation of the IAS dial. If a climb were made to 40,000 feet, the Mach dial would rotate counterclockwise so that the Mach 1.0 graduation would then be opposite the 312-knot graduation. Each type of indicator has an airspeed setting index marker that is moved to the desired position by a knurled knob at the lower right corner of the instrument ring. The index marker on the indicator can be set within a range of 110

***F-100C-20 and later airplanes and airplanes changed by T.O. 1F-100-569**

to 200 knots IAS and should be set to identify the recommended landing speed for the airplane in various external load configurations. A movable red and black hand is ground-set to indicate 700 knots EAS (equivalent airspeed). As altitude is increased, changes in outside air density cause the hand to move to a higher IAS reading. Since this hand will always indicate a speed greater than the IAS that is clean airplane limit airspeed, it should be ignored.

ACCELEROMETER.

A three-pointer accelerometer (11, figure 1-6; 10, figure 1-7) shows positive and negative G-loads. In addition to the indicating pointer there are two recording pointers (one for positive G-loads and one for negative G-loads) which follow the indicating pointer to its maximum attained travel. The recording pointers remain at the maximum travel positions reached by the indicating pointer to give a record of the maximum G-loads encountered. To return the recording pointers to the normal (1 G) position, it is necessary to press the knob on the lower left corner of the instrument ring.

ALTIMETER.

The altimeter (35, figure 1-6; 34, figure 1-7) has the standard 100- and 1000-foot pointers, and a 10,000 foot pointer which extends from a center disk to the edge of the dial, so that it cannot be obscured by the other pointers. The center disk has a wedge-shaped cutout through which warning stripes appear at altitudes below 16,000 feet.

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STAND-BY COMPASS.

A conventional magnetic compass, suspended from the windshield bow, is furnished for navigation in case of instrument or electrical system failure. The stand-by compass light is independently controlled. (Refer to "Lighting Equipment" in Section IV.) The compass correction card is on the right forward canopy rail.

DIRECTIONAL INDICATOR (SLAVED).

Refer to "Navigation Equipment" in Section IV.

TYPE J-8 ATTITUDE INDICATOR.*

A visual indication of the flight attitude of the airplane in pitch and roll is provided by the Type J-8 attitude indicator (9, figure 1-6; 7, figure 1-7). The unit is electrically (three-phase ac) operated and has an "OFF" indicator flag, which appears in the upper right arc of the dial whenever power is not being supplied or the gyro is not up to speed. The pitch attitude of the airplane within a range of 27 degrees in a climb or dive, is shown by movement of the horizon bar in relation to the miniature reference airplane. When the pitch attitude of the airplane exceeds 27 degrees, the horizon bar remains in the extreme position and the sphere then serves as the reference. If the climb or dive angle is further increased with the airplane approaching a vertical position, the attitude is indicated by graduations on the sphere. A controlled precession of 180 degrees occurs, which is not an upsetting of the gyro, when the airplane approaches 90 degrees in pitch. In a roll, the attitude of the airplane is shown by the angular setting of the horizon bar with respect to the miniature reference airplane and by the relation of the bank index to the degree markings on the indicator mask. After certain maneuvers, the attitude indicator will "lag" about 5 degrees upon return to straight-and-level flight. The unit begins to correct these errors immediately. The Type J-8 attitude indicator may be manually caged by use of the caging knob on the lower right side of the instrument ring. Caging is done by smoothly pulling the knob away from the instrument and releasing it quickly as soon as it reaches the limit of travel. Manual caging permits fast gyro erection for scramble take-offs or for erecting the gyro to correct in-flight errors caused by turns or aerobatics. For scramble take-offs, 30 seconds should be allowed after power is applied to bring the gyro up to speed, and then the gyro should be caged immediately. When the gyro is caged to correct in-flight errors, caging should be used only when the airplane is in straight-and-level flight as determined by visual reference to a true horizon, since the indicator cages to the attitude of the airplane. A knob

***F-100C-1 through F-100C-15 Airplanes**

on the lower left side of the indicator ring permits the miniature reference airplane to be adjusted to compensate for longitudinal trim changes of the airplane.

Warning Accelerations or decelerations cause the Type J-8 attitude indicator to show a slight amount of pitch error. When the airplane is flying straight and level, this error will appear as a slight climb indication after a forward acceleration and as a slight dive indication after deceleration. The error will be most noticeable when the airplane breaks ground during take-off. At this time, a climb indication error of about $1\frac{1}{2}$ bar widths will normally be noticed. The exact amount of error, however, will depend upon the acceleration and the elapsed time of each individual take-off. The erection system will automatically remove the error after the acceleration ceases.

MM-2 ATTITUDE INDICATOR.*

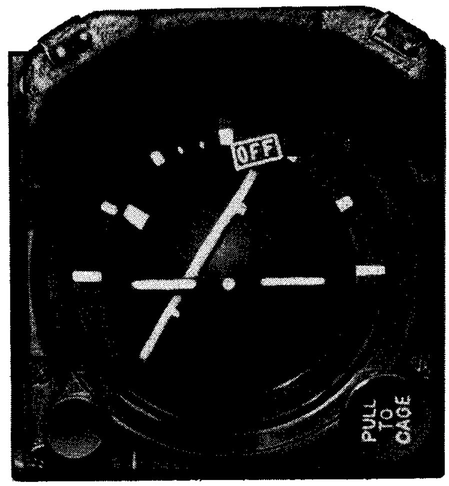
The MM-2 attitude indicator (9, figure 1-6; 7, figure 1-7) is a remote reference instrument. Attitude signals are electrically supplied to the indicator by a K-4B controller which uses both dc and three-phase ac power. After dc power and three-phase ac power are applied, the indicator starts to erect. After about $2\frac{1}{2}$ minutes, the OFF flag should retract and the indicator can be used. If the "OFF" flag requires longer than this to retract, it may indicate the possibility of a malfunction. (Any minor oscillations noted on the indicator after the "OFF" flag retracts are cause for rejection of the indicator, and it should be noted in Form 781.) The completely automatic operation also eliminates manual caging. Failure of either dc or three-phase ac power causes the "OFF" flag to reappear.

Warning Failure of certain components in the K-4B assembly could cause loss of roll indication. Therefore, periodically in flight, the attitude indications given by the MM-2 should be checked against other flight instruments, such as the stand-by magnetic compass or the turn-and-slip and vertical velocity indicators.

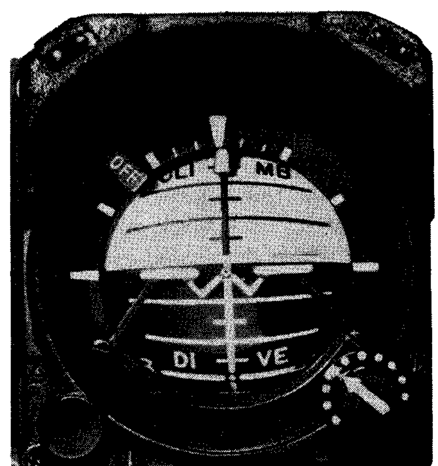
Pitch and roll attitudes are shown by the circular motion of a universally mounted sphere displayed as the back-

*F-100C-20 and -25 Airplanes

ATTITUDE INDICATOR



TYPE J-8
(F-100C-1 through F-100C-15 Airplanes)



FS-228

TYPE MM-2
(F-100C-20 and 25 Airplanes)

F-100C-1-51-6B

Figure 1-26

ground for a miniature reference airplane. The miniature reference airplane is always in proper physical relationship to the simulated earth, horizon, and sky areas of the background sphere. On the sphere, the horizon is represented as a solid fluorescent line, the sky indicated by a light gray area, and the earth by a dull black area. Horizontal markings with 5 degrees of separation on the face of the sphere show accurate airplane attitudes up to 85 degrees of climb or dive. The 5-degree scale is slightly expanded for greater accuracy. This provides quick readability to within one degree of climb or dive. Used for this purpose, the attitude indicator is an accurate aid in GCA and ILS approaches. Bank angles are read on a semicircular bank scale on the upper half of the instrument. The adjustment knob on the lower right side of the instrument electrically rotates the sphere to the proper position in relation to the fixed miniature airplane to correct for pitch attitude changes. This adjustment is necessary, since the level-flight attitude of the airplane varies with weight and speed. The gyros, in the K-4B controller, have 360 degrees of freedom in roll and ±85 degrees in pitch. Turn error is eliminated by the pitch-bank erection system, also in the K-4B controller. The instrument is capable of nearly errorless performance in all pitch flight attitudes up to ±85 degrees. A slight amount of pitch error results from acceleration or deceleration. This is especially noticeable on take-off. There is very little error accumulation during multiple rolls or loops. All acrobatic maneuvers that the airplane is capable of performing are well within the performance capabilities of the system. When the airplane climbs and exceeds +85 degrees in pitch, the sphere rolls 180 degrees and presents to the pilot a series of concentric circles on a gray, or simulated solid-sky, background. When the airplane dives and exceeds −85 degrees in pitch, the sphere rolls 180 degrees and presents a series of concentric circles on a black, or simulated solid-earth, background. When the airplane reaches an inverted position, the instrument reads the reverse of straight-and-level flight; that is, the horizon line shows, but the earth and sky are transposed. As the airplane continues to ±270 degrees in pitch, the sphere again rolls 180 degrees, displays the series of concentric circles, and then remains fixed as the airplane flies around it and once more presents to the pilot a normal horizon with sky (gray) and earth (black) in their proper relationship. The gyro is not likely to tumble, even during extreme maneuvers. However, should the gyro tumble or show more than 5 degrees precession, it erects in about 2½ minutes, if the circuit breaker labeled "VERTICAL GYRO," on the left console circuit-breaker panel, is momentarily pulled out and then pushed back in. If the circuit breaker is not reset, the gyro requires about 15 minutes to erect through each 45 degrees. Indication error is less than ½ degree in level flight, and, up to a turn rate of 40 degrees per minute, the indication error compares to that of a conventional gyro. In turns of 40 degrees or more per minute, a compensating mechanism in the instrument limits turn error to 2 degrees.

Warning

A slight amount of pitch error in the indication of the Type MM-2 attitude indicator results from accelerations or decelerations. This error appears as a slight climb indication after acceleration, or as a slight dive indication after deceleration, when the airplane is flying straight and level. This error is most noticeable when the airplane breaks ground during take-off. At this time, a climb error of about 1½ bar widths is normally indicated. However, the exact amount of error depends upon the acceleration and elapsed time of each individual take-off. The error is only temporary and the erection system automatically removes the error after the acceleration stops.

TURN-AND-SLIP INDICATOR.

The conventional turn-and-slip indicator (34, figure 1-6; 35, figure 1-7) is electrically driven by dc power from the primary bus. The indicator is not normally used in banks exceeding 30 degrees. The instrument is calibrated so that one standard needle-width turn will accomplish a 360-degree turn in 4 minutes (1½-degree-per-second rate of turn). Because of the tilt of the turn-and-slip indicator required on the instrument panel, the indicator will show a turn in the opposite direction to that of actual airplane attitude during a high rate of roll. Airplanes changed by T.O. 1F-100-739 have a 10-degree wedge installed behind the indicator. When the attitude indicator is inoperative and the turn-and-slip indicator is being used as a primary flight instrument, observe the following instructions:

1. Avoid excessive rate of roll. The turn needle indicates a turn in the opposite direction during all entries into turns, and the error increases as rate of roll increases. The turn needle indicates correctly only when no movement occurs around the longitudinal axis.

2. Maintain a constant bank angle during turn. Then the indicator will show correct direction and rate of turn.

INDICATOR LIGHT TEST CIRCUIT.

The indicator light test circuit provides a means of testing the operation of the bulbs in the caution, warning, and indicator lights simultaneously. All caution, warning, and indicator light bulbs are included in this test circuit except the oxygen regulator warning light, which is tested separately.

NOTE Use of the indicator light test circuit is not an operational check-out of any caution, warning, or indicator system.

INDICATOR LIGHT TEST SWITCH.

A three-position switch (figure 4-5) permits testing the illumination and brilliancy of the warning, caution and indicator lights. When the switch is held at TEST BRIGHT or TEST DIM, primary bus power illuminates the lights at the selected brilliancy. The switch is spring-loaded to its OFF (center) position.

NOTE Releasing the indicator light test switch from either position changes the indicator light circuit to the last tested position if the instrument light rheostat is on. If the instrument light rheostat is OFF, the indicator lights will come on bright regardless of the last tested position.

INDICATOR LIGHT DIMMER SWITCH.

The brilliancy of the warning, caution, and indicator lights is selected by means of a three-position switch (figure 4-5), if the instrument light rheostat is on.

NOTE When the switch is momentarily held at BRIGHT or DIM and released to its center position, a holding circuit remains energized and the lights will come on at the selected brilliancy. If the instrument light rheostat is OFF, the lights will always come on bright, regardless of the brilliancy selected.

- If the indicator light test switch is used after the light dimmer switch is used, and the instrument light rheostat is on, the indicator light circuit will be changed to the last tested brilliancy.

EMERGENCY EQUIPMENT.

ENGINE FIRE AND OVERHEAT DETECTOR SYSTEMS.

Fire and overheat detector systems indicate fire and overheating in the forward or aft engine compartment.

Engine Compartment Fire- and Overheat-warning Lights.

An abnormal temperature rise in either engine compartment is shown by placard-type warning lights. (See 6, figure 1-6; 8, figure 1-7). Two lights, one for the forward and one for the aft compartment, come on by primary bus power to show excessive temperature condition or fire in the respective engine compartment. The forward compartment light reads "FIRE ENG COMP." when it comes on; the aft compartment light, "OVERHEAT ENG BURNER."

Engine Compartment Fire- and Overheat-warning System Test Button.

A single primary-bus-powered test button (7, figure 1-6; 6, figure 1-7) permits testing the continuity of the fire- and overheat-warning systems, and provides an operational test of the bulbs within the fire- and overheat-warning lights. The fire- and overheat-warning lights should come on as the test button is pressed. Failure of each bulb in warning light to come on bright during these tests indicates a malfunction of the respective system and the system should be checked before flight.

CANOPY.

The one-piece canopy (figure 1-27) is a clamshell type with an electromechanical mechanism for normal operation and a cartridge-type charge for emergency jettisoning. The canopy is hinged at the rear; in opening, it moves directly back about one inch and then the forward end rises to provide a maximum opening of about 27 degrees. Normal operation of the canopy is controlled by a switch in the cockpit and external switches on both sides of the fuselage. Emergency jettisoning of the canopy is accomplished when either of the ejection seat handgrips is raised, or, on airplanes changed by T.O., when the canopy alternate emergency jettison handle is pulled. If the canopy is raised more than about 4 degrees (4 inches), the canopy remover will not jettison the canopy. A seal in the rim of the canopy contacts the airplane structure, allowing cockpit pressurization. Handles in the canopy frame permit mechanical release of the canopy in emergencies, both from within the cockpit and externally. The mechanical release is independent of the ejector charge or the normal electrical actuator.

CANOPY SEAL.

An inflatable rubber seal (figure 1-27), built into the edge of the canopy frame and bow, seats against mating surfaces of the fuselage and windshield bow to provide sealing for cockpit pressurization. The seal pressurization switch is actuated just before the complete locking of the canopy. The switch controls primary bus power to a valve that directs engine compressor air to inflate the seal. (This air is passed through the primary heat exchanger in the air conditioning system.) Operation of the canopy mechanism, during the opening cycle, dumps the seal pressure just before the initial aft movement of the canopy.

Caution If primary bus failure occurs, the canopy seal control closes and the canopy seal deflates.

CANOPY

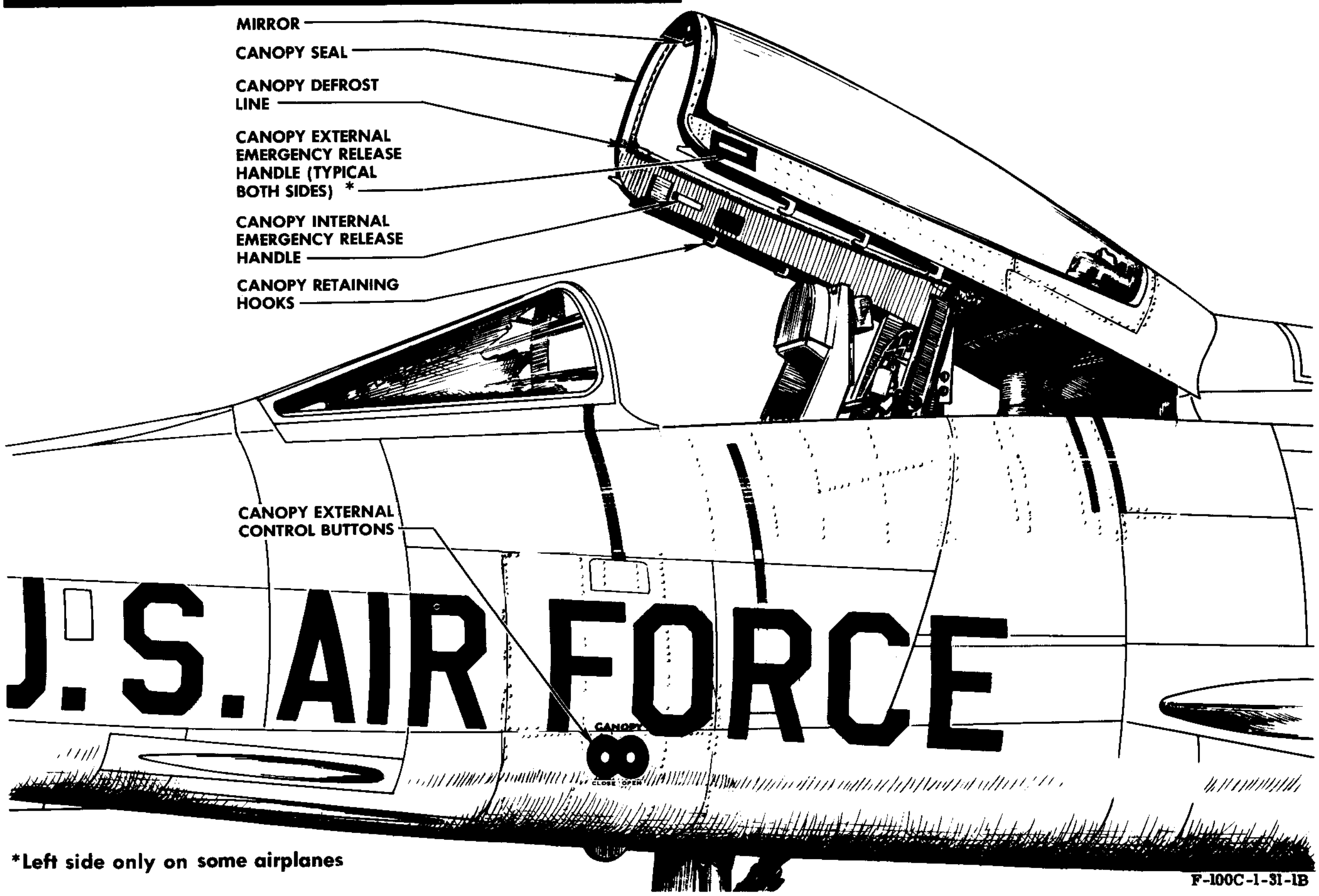


Figure 1-27

CANOPY CONTROLS AND INDICATOR.

Canopy External Control Buttons.

Two push buttons (figure 1-27), on each side of the airplane, marked "OPEN" and "CLOSE," control electrical power to the canopy actuator.

NOTE The canopy actuator is normally powered by the primary bus. If primary bus power is not available, however, the battery bus automatically becomes the power source for the canopy actuator.

The selected button must be held down until the canopy reaches the desired position, then released. Limit switches in the canopy actuator automatically cut off power to the actuator when the canopy reaches the full open or full closed position.

Canopy Switch.

A three-position switch (figure 1-24) controls canopy operation from the cockpit.

NOTE The canopy actuator is normally powered by the primary bus. If this power is not available, the battery bus automatically becomes the power source for the canopy actuator.

The switch is spring-loaded to OFF from both the CLOSE and OPEN positions. To fully open the canopy, the switch must be held at OPEN until canopy travel is completed, at which time electrical power to the actuator is automatically cut off. Releasing the switch stops the canopy at any point throughout its normal travel. On some airplanes,* the canopy switch is spring-loaded only from

***F-100C-1 Airplanes AF54-1740 through -1750 and -1752 through -1757**

OPEN to the center (OFF) position. The switch must be returned to its center (OFF) position after the canopy is fully closed. Otherwise, when the external control button is used to open the canopy, the canopy will reclose when the button is released. If the canopy fails to jettison during in-flight emergency procedures, this switch can be used to open the canopy, allowing it to be blown off by the slipstream. However, at certain flight conditions, air loads may prevent canopy from opening by this method.

Canopy Emergency Jettison Release (Ejection Seat Handgrips).

Refer to "Ejection Seat" in this section.

Canopy Alternate Emergency Jettison Handle.

A canopy alternate emergency jettison handle (28, figure 1-9) jettisons the canopy without arming the seat catapult. When this handle is pulled to its full extended position (about one inch), a mechanical linkage fires a cartridge in the canopy initiator. This causes the canopy remover to fire, jettisoning the canopy.

Warning If the canopy has been raised more than about 4 inches at the canopy bow, the canopy remover will not jettison the canopy.

NOTE This handle is intended only as an alternate means of removing the canopy when it is desired to jettison the canopy *only*, as in case of a forced landing. It should *not* be used instead of the seat handgrip when ejection from the airplane is intended.

Canopy Internal Manual Emergency Release Handle.

Opening the canopy internal emergency release handle (11, figure 1-9) to its extended position deflates the canopy seal and allows the canopy to be pulled back manually (by means of the handle) to an unlocked position. The forward end of the canopy may then be raised manually. Although this handle is intended for use while the airplane is on the ground, it may be used in an attempt to open the canopy if the canopy fails to jettison during emergency procedures.

Canopy External Manual Emergency Release Handles.

The two canopy emergency release handles (figure 1-27) are on the outside of the canopy. Releasing either handle to an extended position allows the canopy to be moved back manually about one inch, thereby unlocking it. The canopy may then be lifted at its forward end to allow entrance to the cockpit. It is possible to then remove the canopy from the airplane, if desired, by lifting the canopy up and rotating it back as far as possible.

NOTE F-100C-1 Airplanes AF53-1709 and -1710 have a canopy external emergency release handle on the left side only.

Canopy-not-locked Caution Light.

A placard-type caution light (figure 1-4) is illuminated by primary bus power when the canopy is in any position other than full closed and locked. The bulbs can be checked by the indicator light test circuit.

Caution If canopy-not-locked caution light comes on during flight, actuation of the canopy switch may cause the canopy to leave the airplane. A landing should be made as soon as possible after the canopy-not-locked light comes on.

EJECTION SEAT.

The ejection seat (figure 1-28) permits ejection at any speed or flight attitude. An explosive cartridge-type catapult supplies the propulsion force to eject the seat and pilot from the airplane. The seat has an automatic opening safety belt and accommodates a back-type parachute. *One* of the following items or combination of items may be placed in the seat bucket:

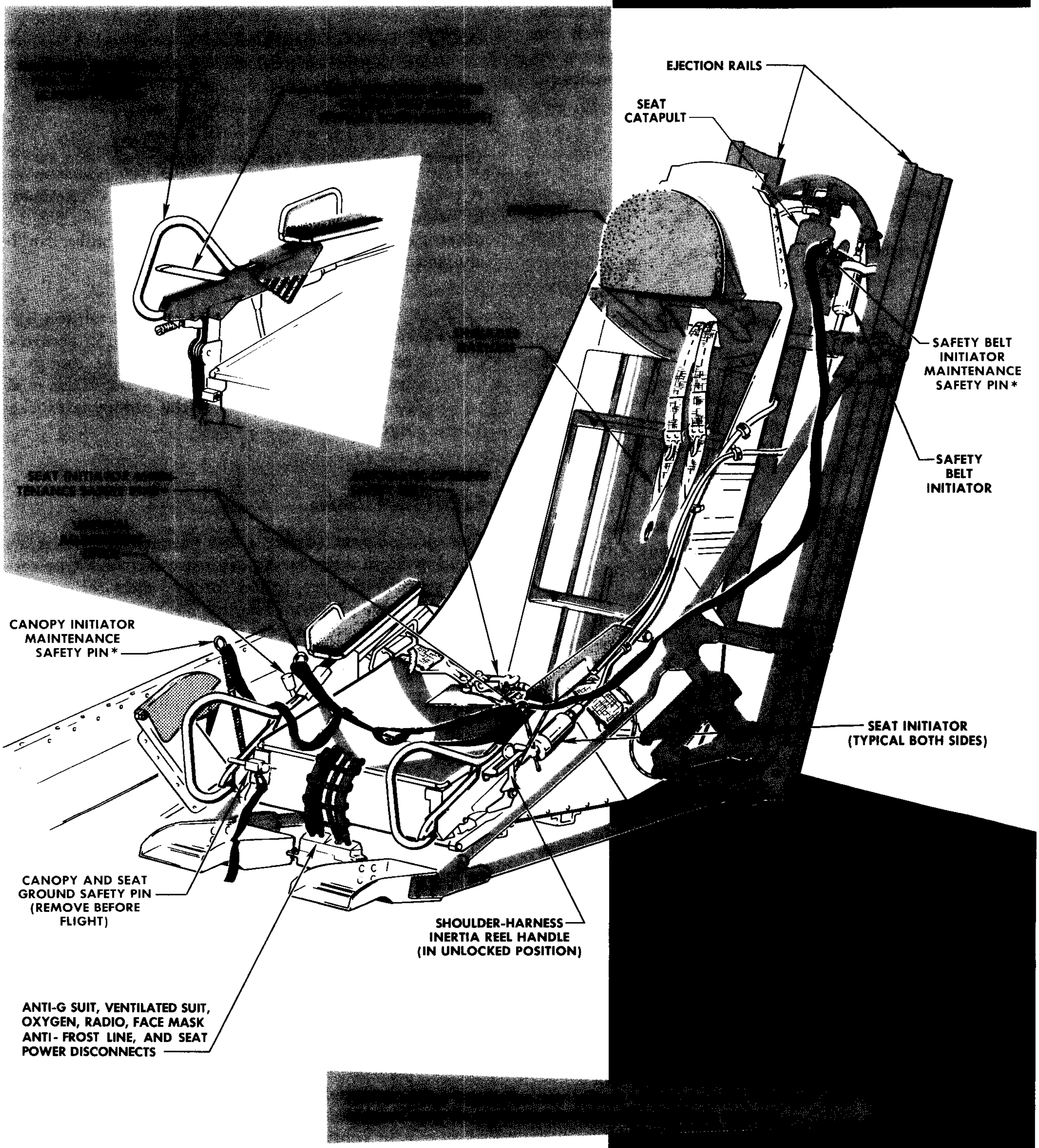
1. A contractor-furnished cushion (Part No. 165-53085 or 192-53285).
2. A C-2A life raft.
3. An MD-1 survival kit with MA-1 contoured seat cushion. (A one-man life raft or survival kit may be used in place of the seat cushion.)

NOTE If additional height is needed when a life raft or survival kit is carried, use a solid filler block, provided the combined thickness does not exceed 5 inches.

Caution Do not use the A-5 seat cushion, or any similar sponge rubber cushion, when equipped with a one-man life raft or survival kit. If ejection is necessary, serious spinal injuries can result when the ejection force compresses the cushion and enables the seat to gain considerable momentum before exerting a direct force on the pilot. Chance of injury during forced landing is also increased.

Vertical adjustment of the seat is done mechanically. The headrest and footrests are fixed to the seat assembly.

ECTION



*For maintenance use only; remove before flight.

F-100C-1-73-9C

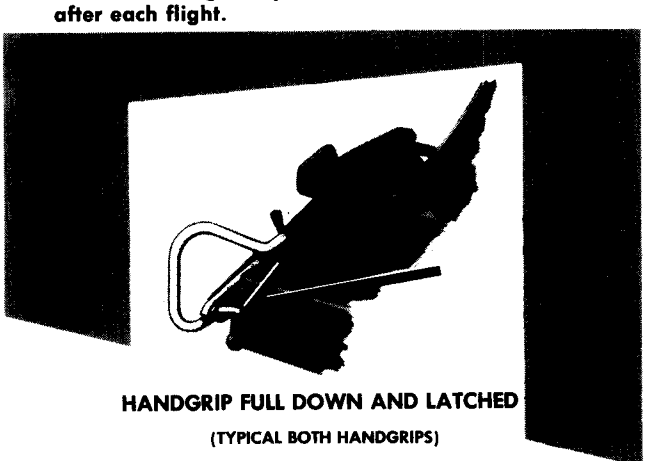
Figure 1-28

SEAT

HANDGRIP POSITION MARKINGS

WARNING

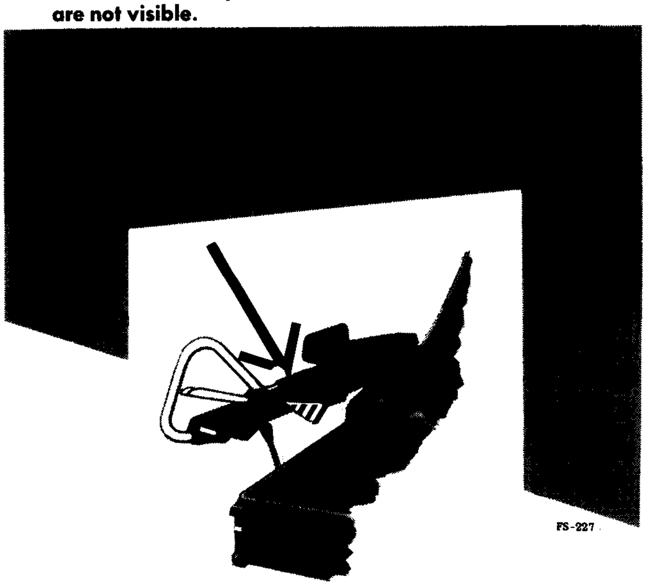
Check that handgrips are full down and latched before entering cockpit and before leaving cockpit after each flight.



HANDGRIP FULL DOWN AND LATCHED

(TYPICAL BOTH HANDGRIPS)

Note that white stripes on front face of seat and inner face of handgrip are in perfect alignment and that the red and white stripes on inner face of handgrip bracket are not visible.



HANDGRIP RAISED TO FULL UP POSITION—CANOPY FIRED. SEAT EJECTION TRIGGER COCKED FOR FIRING.

(TYPICAL BOTH HANDGRIPS)

F-100C-1-73-12B

The seat armrests on later airplanes* have forearm guards which are raised when the armrests are pulled up for seat ejection. The personal leads are fitted into a disconnect block on the center forward edge of the seat. The lines fitted into the lower disconnect block are separated automatically when the seat is ejected. During the ejection sequence, the canopy is jettisoned before the seat is ejected; however, if the canopy fails to release, the seat will be ejected through the canopy.

SHOULDER HARNESS INERTIA REEL.

A unidirectional-type inertia reel is mounted on the back of the seat. The reel automatically locks the shoulder harness when forward deceleration force exceeds 2 to 3 G. A manual control lever is provided to permit pilot selection of reel locking. When either ejection seat handgrip is raised during the seat ejection sequence, the inertia reel is locked automatically.

NOTE There is no preflight operational check possible of the inertia feature of the reel.

EJECTION SEAT CONTROLS.

Ejection Seat Handgrips.

Raising either the right or the left handgrip (figure 1-28) on the seat jettisons the canopy. Since the handgrip assemblies are linked together by a torque tube, pulling up on either handgrip automatically raises the other to the full up position. When either handgrip is raised to the full up position, it fires a cartridge in an initiator unit located outboard of the seat, at the right side of the cockpit. The expanding gases thus produced are discharged from the initiator through a flexible hose to an exactor unit on the canopy remover. The gas pressure moves a piston in the exactor which pulls the sear pin from the canopy remover, causing the remover to fire and jettison the canopy.

The handgrips, in the full down position, guard the seat catapult triggers to prevent unintentional seat ejection. When the ejection seat handgrips are raised, the seat catapult triggers are lifted into the firing position, and the shoulder harness is automatically locked for ejection. If the handgrips are not full down and latched, low spring tension may cause them to move up, jettisoning the canopy and exposing the seat ejection triggers. To give a positive indication of handgrip position, the inside face of each handgrip bracket is painted with diagonal red and white stripes. (See figure 1-28.) If these stripes are not visible above the edge of the seat

***F-100C-20 Airplane AF54-1915 and all later airplanes**

bucket, the handgrips are full down and latched. In addition, a white stripe is painted at each end of the front face of the seat bucket and a matching white stripe is on the forward inner face of each handgrip. When each pair of white stripes is in perfect alignment, the handgrips are full down and latched.

Caution During each preflight check and after each flight, the position of the handgrips should be checked. The top of the red and white stripes on the inside face of each handgrip must not extend above the edge of the seat bucket, and the white stripes on the front face of the seat bucket and inner face of each handgrip must be in perfect alignment.

Seat Catapult Triggers.

A seat catapult trigger (figure 1-28) is enclosed in a guard in the lower portion of each handgrip. As the handgrips are pulled up, the triggers raise out of the guards and are then within reach of the fingers. Squeezing either trigger fires a cartridge in an initiator. (One initiator is connected to each trigger, and each is independent of the other.) A flexible hose directs the gases from the initiator unit to the ejection seat catapult. The pressure of the expanding gases actuates the striker pin, which fires the seat catapult cartridge, ejecting the seat. The seat ejection system is independent of the canopy jettison system. If raising the handgrips fails to fire the canopy, the seat is ejected through the canopy when either trigger is squeezed.

Seat Vertical Adjustment Handle.

Vertical adjustment of the seat is controlled mechanically by a handle on the right side of the seat, outboard of the armrest. (See figure 1-28.) Moving the handle forward to the UNLOCKED position releases the seat for adjustment. With the handle at UNLOCKED, the spring-loaded seat is raised when the pilot lifts his weight off the seat, or lowered when pilot pushes seat down by means of his weight.

Caution When adjusting the seat on the ground, the handle must not be moved to UNLOCKED, if no one is in the seat. Release of the empty seat may cause the handgrips to spring up and eject the canopy if the ground safety pin is not in the right handgrip.

The seat is locked when adjustment handle is aligned with a white index marker at LOCKED position. If, when released, the handle does not return to LOCKED, one of the two seat locking pins is not engaged. Slight movement of the seat to right or left will align and engage the remaining locking pin. This will allow the handle to move to the LOCKED position.

NOTE The seat is locked when the adjustment handle is aligned with the index marker at the LOCKED position.

Shoulder Harness Inertia Reel Handle.

Manual control of the shoulder harness inertia reel is provided by a handle (figure 1-28) outboard on the left handgrip assembly. The shoulder harness inertia reel is actuated mechanically when the handle is moved. Forward is the LOCKED position; aft is UNLOCKED. It is recommended that the shoulder harness be locked manually during maneuvers and flight in rough air, or as a safety precaution in event of a forced landing. The shoulder harness locks automatically under a 2 to 3 G forward deceleration, as in a crash landing, when the handle is in the UNLOCKED position. When the reel is locked, any movement of the pilot toward the seat will release tension on the cable and it will automatically retract. As the cable retracts it locks at each ½ inch of retraction. Once the reel has been locked automatically, the handle must be moved forward to LOCKED and then aft to UNLOCKED to unlock the reel and permit the pilot to move forward.

NOTE Adjust shoulder harness with inertia reel handle in the LOCKED position before placing handle at UNLOCKED; otherwise, it may become necessary to unfasten the safety belt in flight to unlock the shoulder harness reel.

AUTOMATIC-OPENING SAFETY BELT.

The ejection seat is equipped with any one of the following automatic-opening safety belts: MA-1, MA-4, or MA-5. In high-altitude ejections (above 15,000 feet), use of the automatic belt, *in conjunction with the automatic-opening parachute*, avoids parachute deployment at an altitude where sufficient oxygen would not be available to permit safe parachute descent. In a low-altitude ejection, use of the automatic belt greatly reduces the time required for separation from the seat. If an automatic parachute is used in conjunction with the automatic belt, the time for full parachute deployment also is reduced. *Under no circumstances should the automatic belt be manually opened before ejection, regardless of altitude.* (The M-12 automatic belt initiator opens the belt one second after ejection.) Since the drag-to-weight ratio of the seat is considerably greater than that of the pilot, immediate separation would result if the belt were opened manually before ejection. This could result in the parachute pack being blown open, and the high opening shock of the parachute could cause serious or fatal injuries.

MA-1 AUTOMATIC-OPENING SAFETY BELT

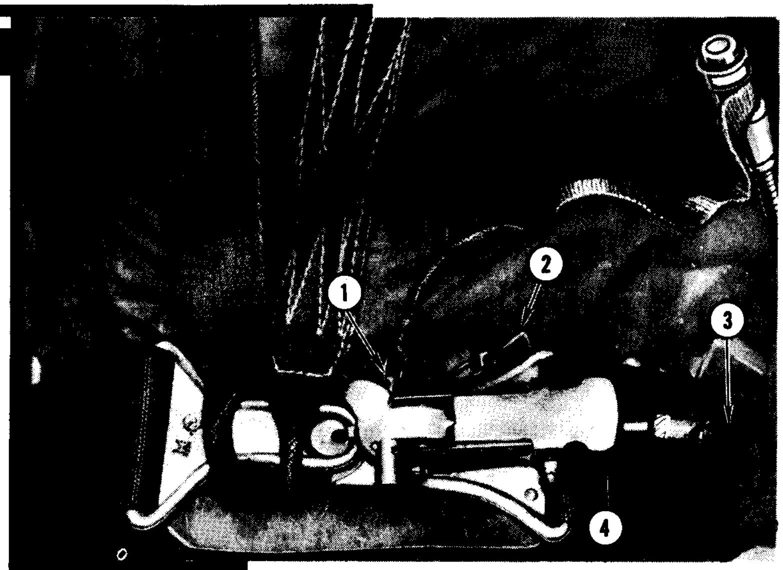
LOCKED

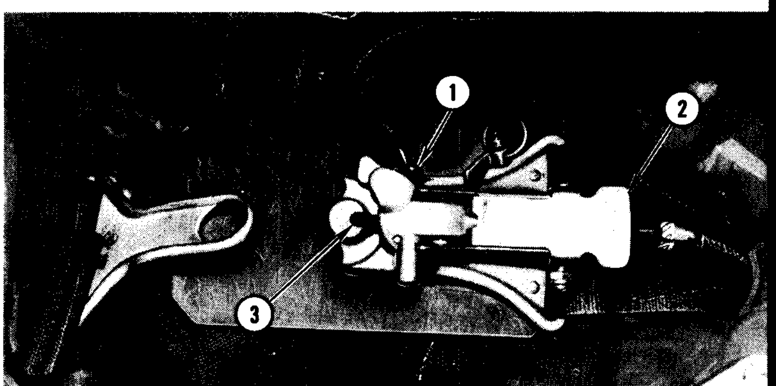
1. Belt locking key (attached to automatic parachute arming lanyard) inserted in belt locking mechanism.

WARNING

- This key must be used when an automatic parachute is worn, in order for the parachute to function automatically if ejection is necessary. Be sure the key is properly inserted and will not pull out.
- Lanyard must be outside parachute harness and not fouled on any equipment, to permit clean separation from seat.

2. Belt locking key (attached to belt). Used to close belt only when automatic parachute is *not* worn.
3. Initiator hose.
4. Manual release lever closed (shown with NAA type handle extension).





AUTOMATICALLY OPENED

1. Belt locking key (from automatic parachute arming lanyard) retained in belt locking mechanism.
2. Manual release lever closed.
3. Belt latch opened by gas pressure from initiator.

MANUALLY OPENED

1. Belt locking key ejected from locking mechanism when manual release lever is opened.

WARNING

If automatic parachute is worn and belt is manually opened during ejection, parachute will *not* open automatically upon separation from seat.

2. Manual release lever opened.
3. Belt latch opened by manual release lever.

NOTE

Manual release lever can be used to unlock belt at any time, even if automatic-opening sequence already has been initiated.

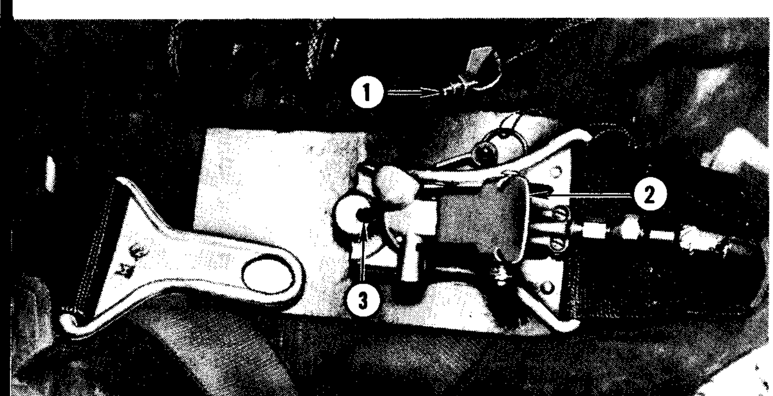


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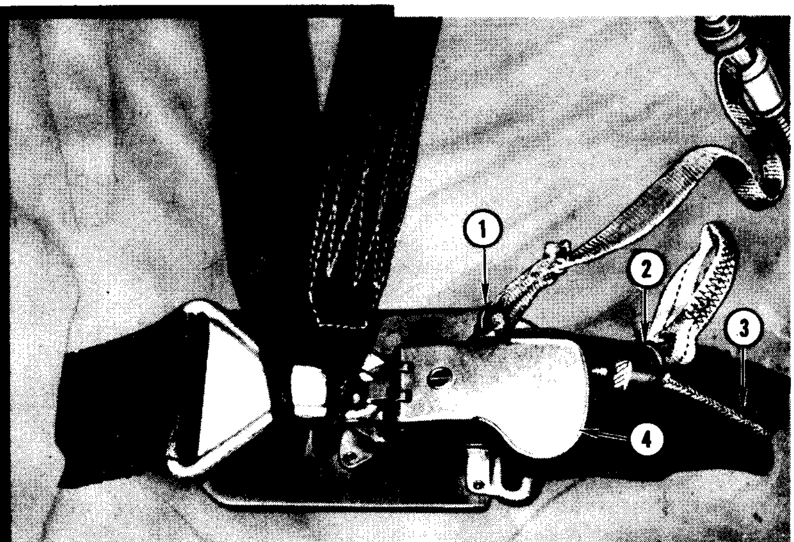
Figure 1-29

MA-4 AUTOMATIC-OPENING SAFETY BELT



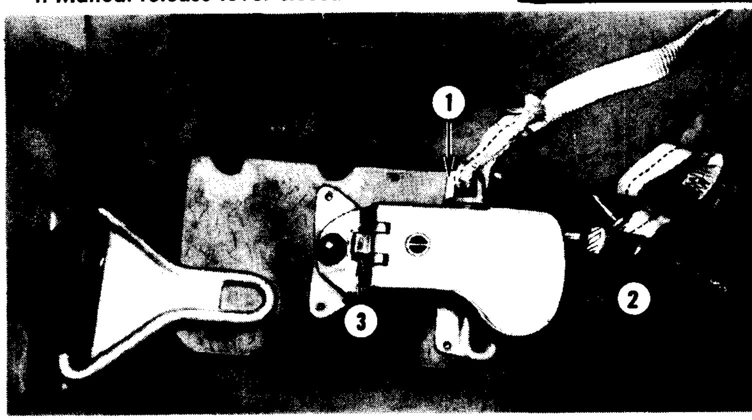
LOCKED

1. Belt locking key (attached to automatic parachute arming lanyard) inserted in belt locking mechanism.

WARNING

- This key must be used when an automatic parachute is worn, in order for the parachute to function automatically if ejection is necessary. Be sure the key is properly inserted and will not pull out.
- Lanyard must be outside parachute harness and not fouled on any equipment, to permit clean separation from seat.

2. Belt locking key (attached to belt). Used to close belt only when automatic parachute is *not* worn.
3. Initiator hose.
4. Manual release lever closed.



AUTOMATICALLY OPENED

1. Belt locking key (from automatic parachute arming lanyard) retained in belt locking mechanism.
2. Manual release lever closed.
3. Belt latch opened by gas pressure from initiator.

MANUALLY OPENED

1. Belt locking key ejected from locking mechanism when manual release lever is opened.

WARNING

If automatic parachute is worn and belt is manually opened during ejection, parachute will *not* open automatically upon separation from seat.

2. Manual release lever opened.
3. Belt latch opened by manual release lever.

NOTE

Manual release lever can be used to unlock belt at any time, even if automatic-opening sequence already has been initiated.

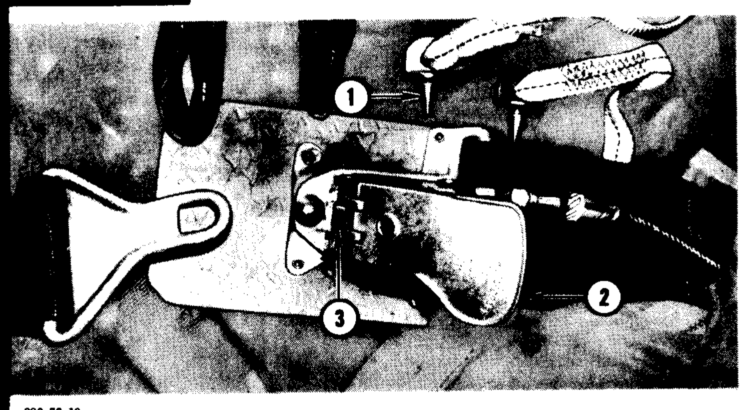


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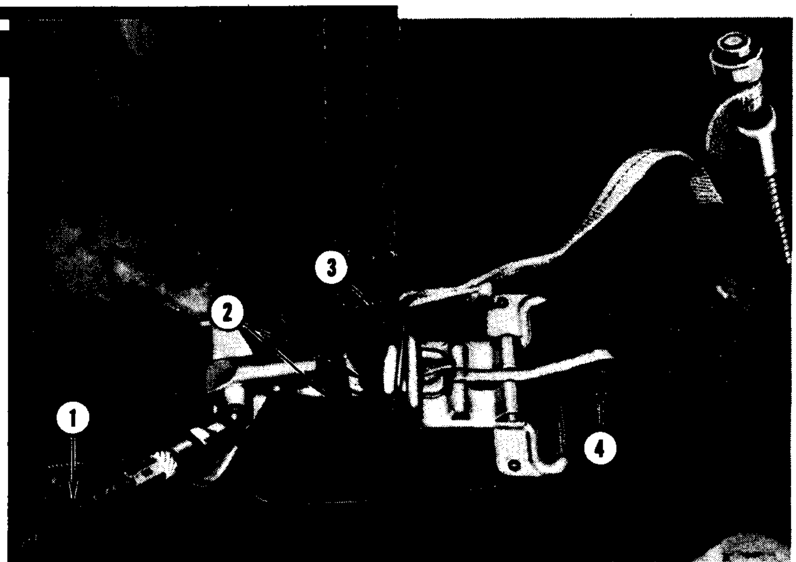
Figure 1-30

MA-5 AUTOMATIC-OPENING SAFETY BELT

LOCKED



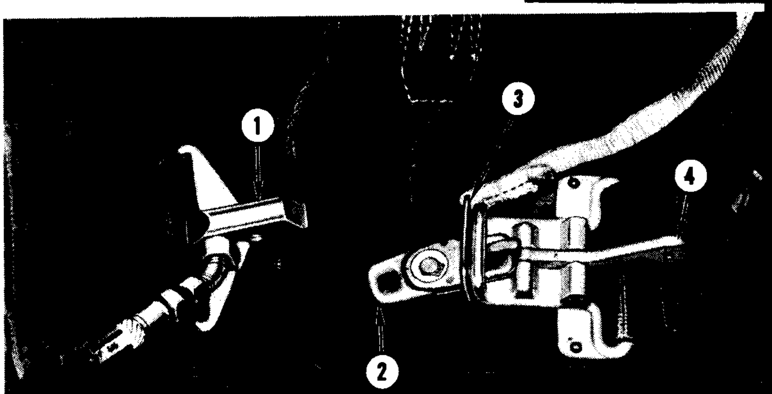
1. Initiator hose to automatic release mechanism.
2. Shoulder harness loops over swivel link.
3. Anchor (from automatic parachute arming lanyard) slipped over swivel link.

   WARNING

   - Although not necessary to close belt, anchor must be installed, when automatic parachute is worn, so that parachute will function automatically if ejection is necessary.
   - Lanyard must be outside parachute harness and not fouled on any equipment, to permit clean separation from seat.

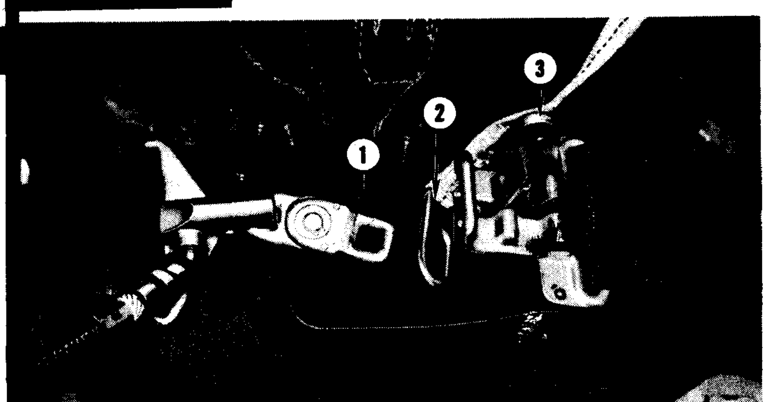
4. Manual release lever closed.

AUTOMATICALLY OPENED



1. Automatic release mechanism actuated by gas pressure from initiator, detaching swivel link on automatic release side.
2. Swivel link retained by manual release lever.
3. Anchor (from automatic parachute arming lanyard) retained by swivel link.
4. Manual release lever closed.

MANUALLY OPENED



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1. Swivel link released by manual release lever (automatic release mechanism not actuated).
2. Anchor (from automatic parachute arming lanyard) freed from swivel link.

   WARNING

   If automatic parachute is worn and belt is manually opened during ejection, parachute will not open automatically upon separation from seat.

3. Manual release lever opened.

   NOTE

   Manual release lever can be used to unlock belt at any time, even if automatic-opening sequence has been initiated.

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Figure 1-31

MA-1 and MA-4 Automatic-opening Safety Belts.

The Type MA-1 or MA-4 automatic-opening safety belt is a cartridge-operated device. Release of the MA-1 or MA-4 belt is accomplished either by manual operation by the pilot, or by gas pressure from a separate automatically controlled source (the M-12 initiator, on the back of the seat). The initiator supplies gas pressure through a high-pressure hose which actuates the release mechanism inside the belt. The release incorporates a key which is attached to a lanyard leading to the automatic rip cord release. The key provides an anchor for the static line to the timer of the automatic parachute. The release is designed so that the belt cannot be locked until the key is first inserted into the belt locking mechanism. The key is necessary for proper operation of the automatic belt. If the automatic parachute is used, the key attached to the parachute lanyard is inserted into the belt locking mechanism. If the automatic parachute is not used, a spare key which is attached to the automatic belt must be inserted into the belt locking mechanism. (This spare key must not be removed from the belt.) When the belt is manually opened, the key is ejected automatically so that inadvertent actuation of the automatic parachute will not occur. During automatic operation of the safety belt, the key remains firmly locked in the belt release, thereby arming the automatic parachute aneroid-timer as the pilot separates from the seat. Manual operation of the automatic belt can override the automatic function at any time. For example, it is possible to manually open the belt even though initiator action has started. The parachute automatic feature may likewise be overridden by manually pulling the "D" ring, even though the automatic parachute rip cord release has been actuated.

Warning If the safety belt is opened manually, the parachute *must* be opened manually. (For automatic-opening parachutes, the aneroid-timer arming lanyard should be pulled to open the parachute, if above 14,000 feet.)

Figure 1-29 shows the MA-1 automatic belt closed with the shoulder harness attached, automatically opened, and manually opened. Figure 1-30 shows the MA-4 automatic belt for the same conditions.

MA-5 Automatic-opening Safety Belt.

The MA-5 automatic safety belt (figure 1-31) is a cartridge-operated device. Release of the MA-5 belt is accomplished either by manual operation by the pilot, or by gas pressure from a separate automatically controlled source. The initiator supplies gas pressure through a high-pressure hose which actuates the release mechanism inside the belt. The MA-5 belt is equipped with a swivel link which is designed to retain a ring-type anchor for actuating the automatic parachute. When the belt is fully locked, the swivel link is attached on one end to the manual release lever and on the other end to the automatic release. The swivel link is detached from the automatic release by actuation of the automatic release initiator. It is not mechanically necessary that the anchor, which slips over the manual release end of the swivel link, be used to close the belt. However, when the MA-5 belt is used in conjunction with an automatic parachute, the ring-type anchor *must* be attached to the parachute arming lanyard and then slipped over the swivel link in order for the parachute to function automatically when ejection is necessary. Figure 1-31 shows the MA-5 belt closed with shoulder harness and automatic parachute anchor attached, automatically opened, and manually opened. Manual operation of the automatic belt can override the automatic function at any time. For example, it is possible to manually open the belt even though initiator action has started. The parachute automatic feature may likewise be overridden by manually pulling the "D" ring even though the automatic parachute rip cord release has been actuated.

Warning If the safety belt is opened manually, the parachute *must* be opened manually. (For automatic-opening parachutes, the aneroid-timer arming lanyard should be pulled to open parachute if above 14,000 feet.)

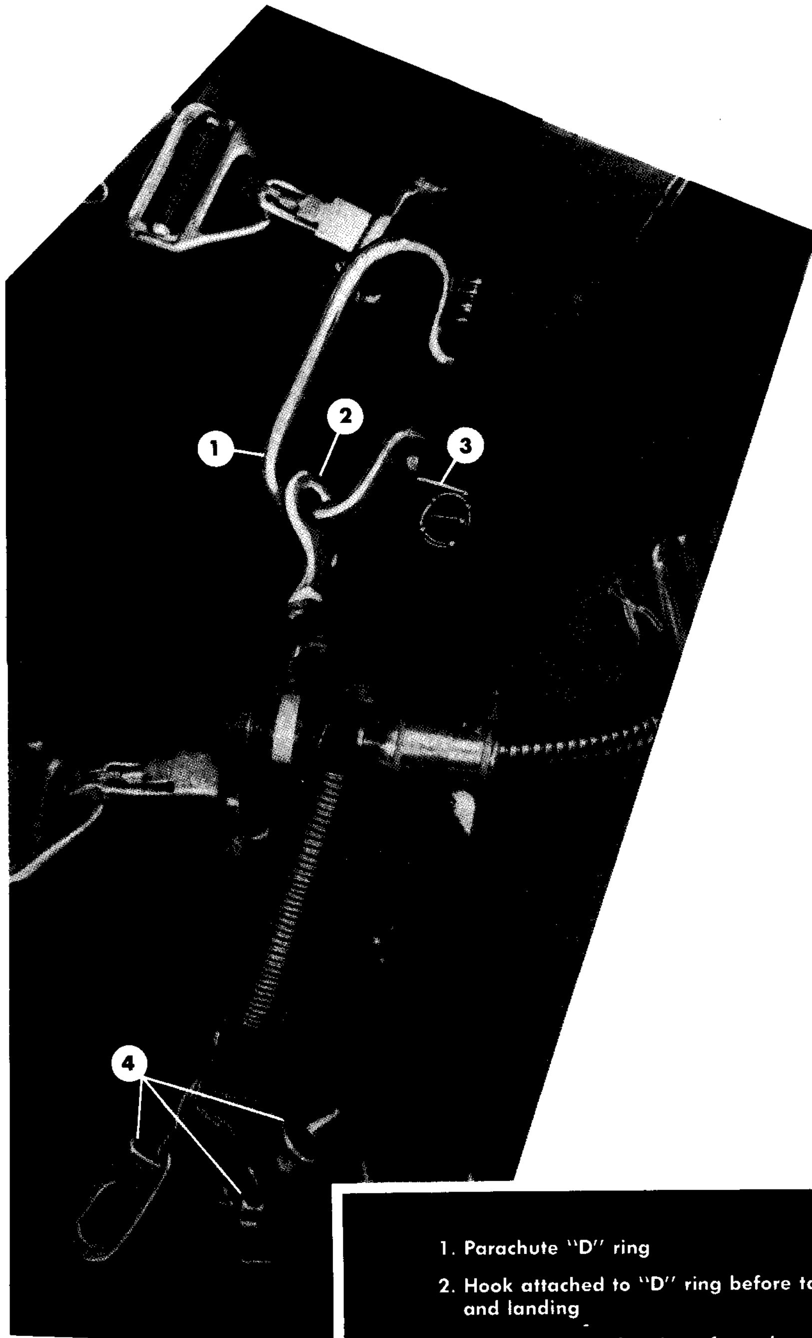
LOW-ALTITUDE ESCAPE EQUIPMENT.

To provide an improved low-altitude escape capability, a system incorporating a one-second safety-belt initiator and a zero-second parachute (1-0 system) has been developed. The zero-second parachute delay is accomplished by means of a hook and lanyard which is attached to the parachute arming lanyard at one end and can be attached to the parachute "D" ring. (See figure 1-32.)

NOTE The "D" ring hook and lanyard may be installed on the parachute before the one-second safety belt initiator is installed on the airplane. This will temporarily provide a 2-0 system, with higher minimum safe ejection altitudes.

The 1-0 system makes use of a detachable hook and lanyard that connects the parachute timer lanyard to the parachute "D" ring. At very low altitude and airspeeds, the hook must be connected to the "D" ring, thus providing parachute actuation immediately after separation from the ejection seat. At other altitudes and airspeeds, the hook must be disconnected from the "D" ring, thus allowing the parachute timer to actuate the parachute below the critical parachute opening speed and below

PARACHUTE ARMING LANYARD AND "D" RING HOOKUP



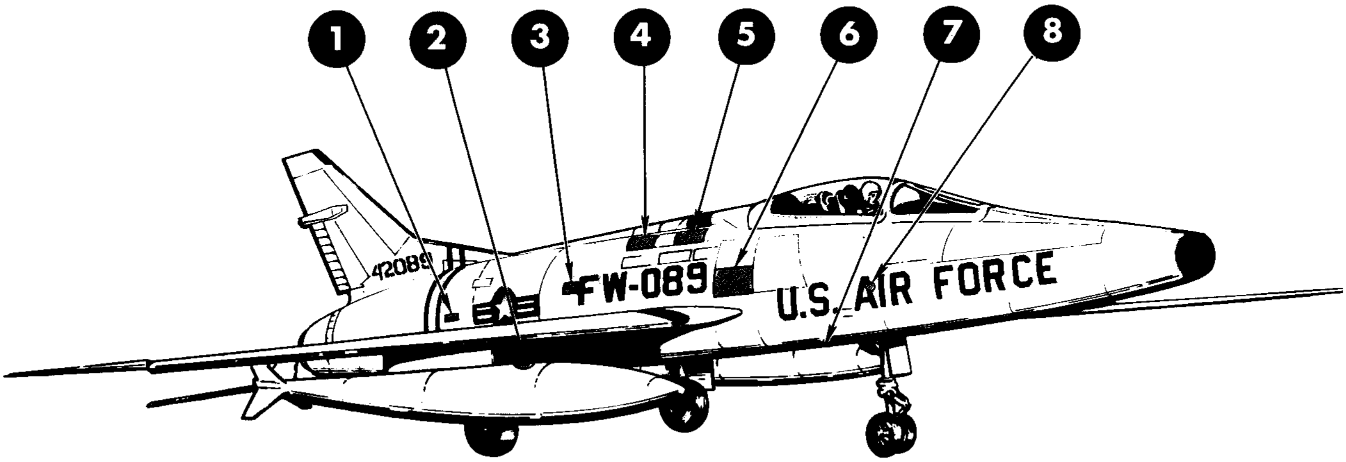
1. Parachute "D" ring
2. Hook attached to "D" ring before take-off and landing
3. Retain hook in this ring after take-off
4. Automatic safety belt keys and anchor

NOTE

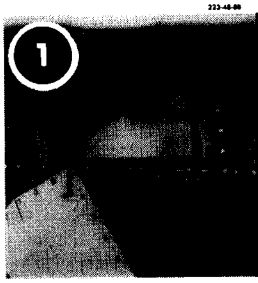
If manual parachute is used, zero-second hook-up is accomplished with a special lanyard which hooks to parachute "D" ring at one end and attaches to belt (by anchor or key) at the other end.

Figure 1-32

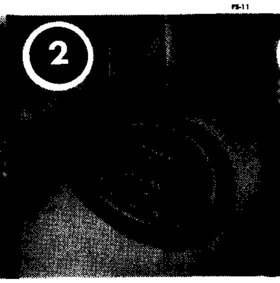
SERVICING DIAGRAM



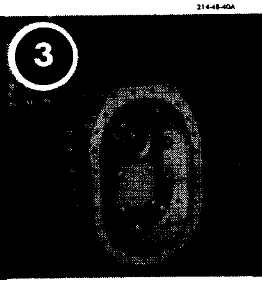
RIGHT SIDE



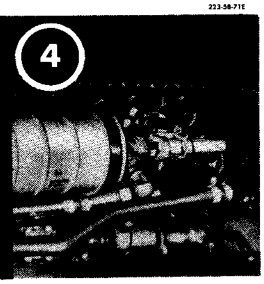
- Aft tank fuel level control valve access door. (Remove access door and cover plate on tank to refuel internal tanks if single-point refueling equipment is not available.)



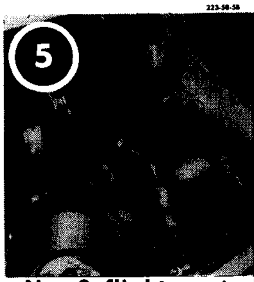
- Drop tank filler. (Typical all drop tanks.)



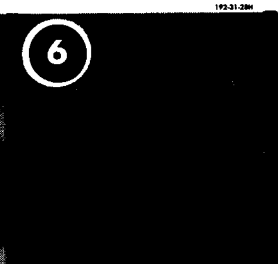
- Intermediate tank fuel level control valve access door. (Remove access door and cover plate on tank to speed refueling if refueling is done through aft tank control valve access.)



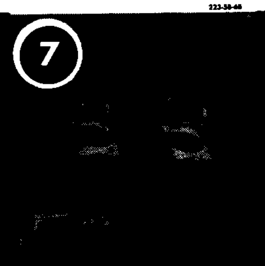
- Flight control hydraulic system compensating reservoirs.



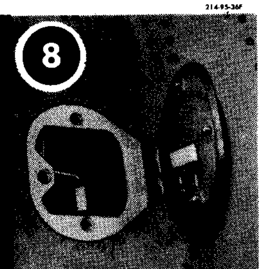
- No. 2 flight control hydraulic system accumulator air pressure gage, air filler valve, and dump valve.
- Utility hydraulic system reservoir.



- Hydraulic system ground-test connections.



- Antiskid* and wheel brake emergency accumulator air pressure gages, air filler valves, and dump valve. (In right side of nose wheel well.)



- Liquid oxygen filler valve.

* Some airplanes.

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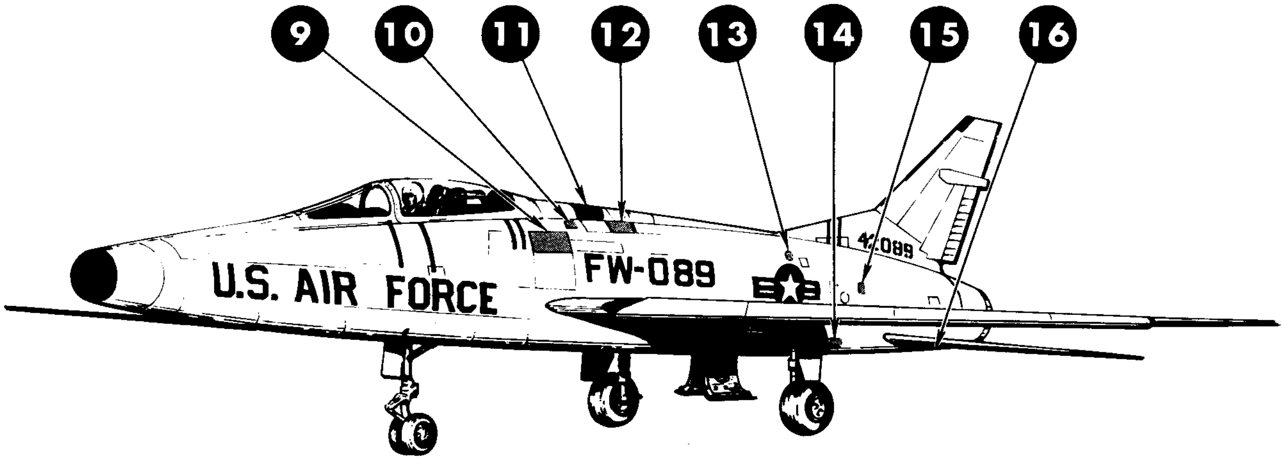
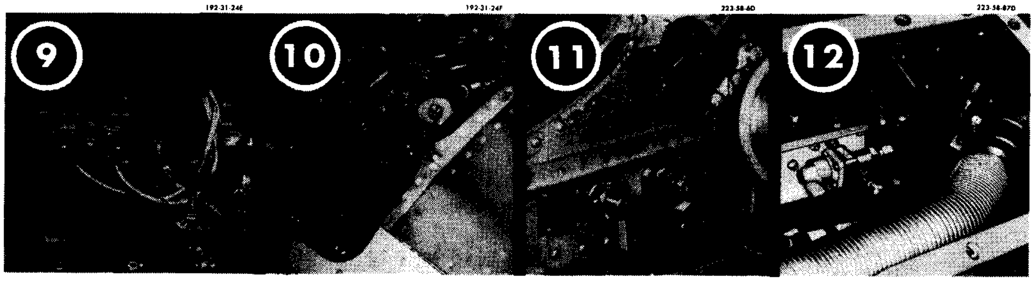
Figure 1-33 (Sheet 1 of 3)

SPECIFICATIONS

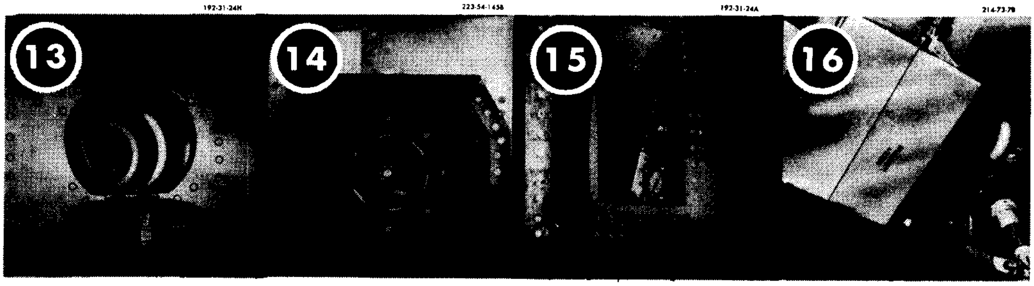
FUEL • JP-4 (MIL-F-5624) No alternate fuel recommended.
OIL • MIL-L-7808
HYDRAULIC FLUID • MIL-O-5606
LIQUID OXYGEN • BB-O-925



LEFT SIDE



- **9** • Battery and battery compartment circuit-breaker panel.
- **10** • Cockpit pressure and canopy seal ground test, and pressure gage connections.
- **11** • No. 1 flight control hydraulic system accumulator air pressure gage, air filler valve, and dump valve.
  • Hand-pump selector valve.
- **12** • Ram-air turbine door emergency accumulator air pressure gage, air filler valve, and dump valve.

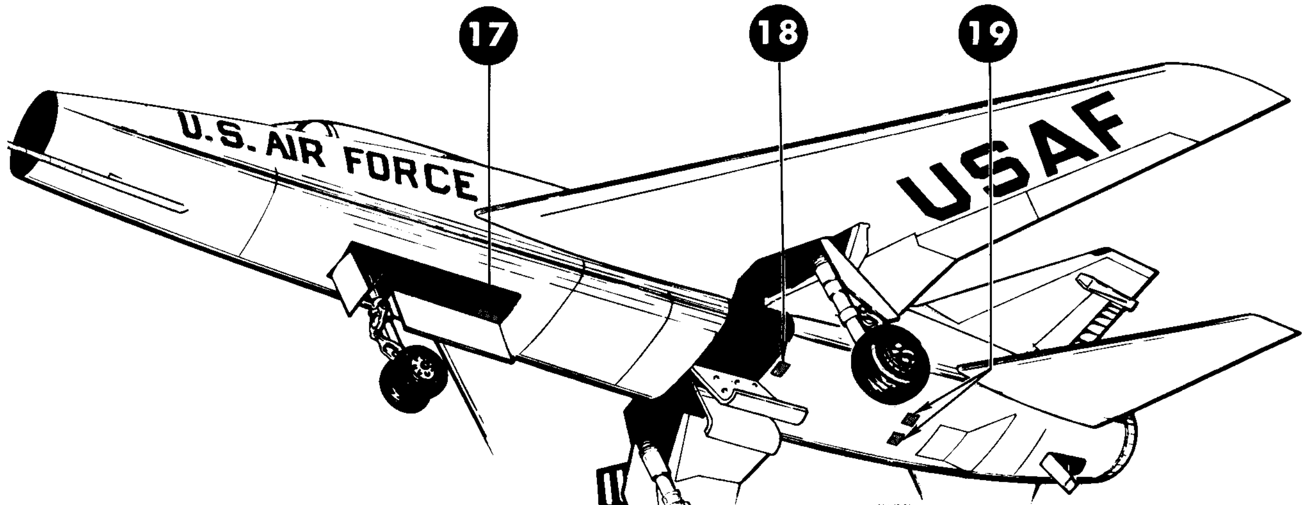


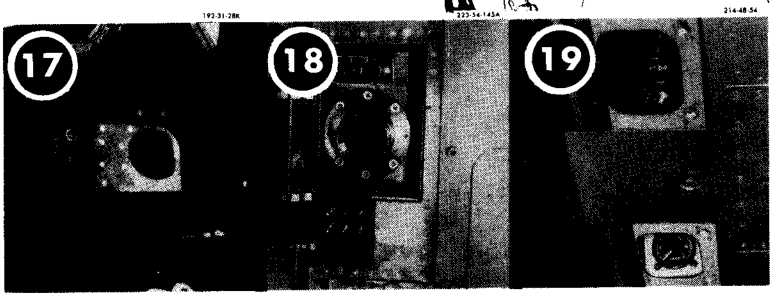
- **13** • Engine oil tank filler.
- **14** • Single-point refueling receptacle.
- **15** • Fuel tank purging system nitrogen bottle filler valve and pressure gage. (Some airplanes).
- **16** • Drag chute compartment doors.

F-100C-1-00-81B

Figure 1-33 (Sheet 2 of 3)

SERVICING DIAGRAM





- Nose gear emergency lowering accumulator air pressure gage, air filler valve, and dump valve.
- External power receptacles for electrical and starter air supply. (AC external power receptacles on F-100C-25 airplanes only.)
- Yaw damper centering accumulator air pressure gage, air filler valve, and dump valve.

ACCUMULATOR PRECHARGE PRESSURE (PSI)

PLACARDED ACCUMULATOR PRECHARGE (70 °F column)

TEMPERATURE (°F)	−20	−10	0	10	20	30	40	50	60	70	80	90	100	110	120
YAW DAMPER CENTERING AND NOSE GEAR EMERGENCY LOWERING ACCUMULATORS	980	1015	1025	1055	1080	1105	1130	1150	1175	1200 (±50)	1225	1250	1275	1300	1320
WHEEL BRAKE EMERGENCY ACCUMULATOR	415	420	430	440	450	460	470	480	485	500 (±50)	510	520	530	540	550
NO. 1 AND NO. 2 FLIGHT CONTROL HYDRAULIC SYSTEM ACCUMULATORS	495	510	520	530	545	555	565	580	590	600 (±50)	610	625	635	645	655
RAM-AIR TURBINE DOOR EMERGENCY ACCUMULATOR	1480	1515	1550	1585	1620	1660	1695	1730	1765	1800 (±50)	1835	1870	1905	1945	1980
ANTISKID ACCUMULATOR*	255	260	268	275	280	285	290	298	305	310 (±15)	315	322	330	335	340

Some airplanes. *

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Figure 1-33 (Sheet 3 of 3)

the parachute timer altitude setting. A ring, attached to the parachute harness, is provided for stowage of the hook when it is not connected to the "D" ring. This "hookup" must be done manually. The hook configuration shown in figure 1-32 is one of several which will be in service use. Although each configuration differs in appearance, the attaching positions are the same. Refer to "Ejection" in Section III for maximum safe ejection speeds and emergency minimum ejection altitudes for various combinations of ejection equipment. Figure 3-4 shows a plot of three parameters: altitude, speed, and sequence time of the parachute-automatic safety belt combination. The graph indicates safe ejection speeds with regard to parachute capability and body injury because of parachute opening shock. The sequence lines (slanting lines) indicate the limits above which the parachute will probably be damaged on opening or the pilot will probably suffer body injury resulting from deceleration effects. The lower chart of figure 3-4 shows the minimum altitude for a successful ejection with different combinations of automatic safety belt and automatic parachute timing sequence.

AUXILIARY EQUIPMENT.

Information concerning the following auxiliary equipment is supplied in Section IV: air conditioning, pressurization, defrosting, anti-icing, and rain removal systems; communication and associated equipment; lighting equipment; oxygen system; navigation equipment; armament equipment; refueling systems; and miscellaneous equipment.

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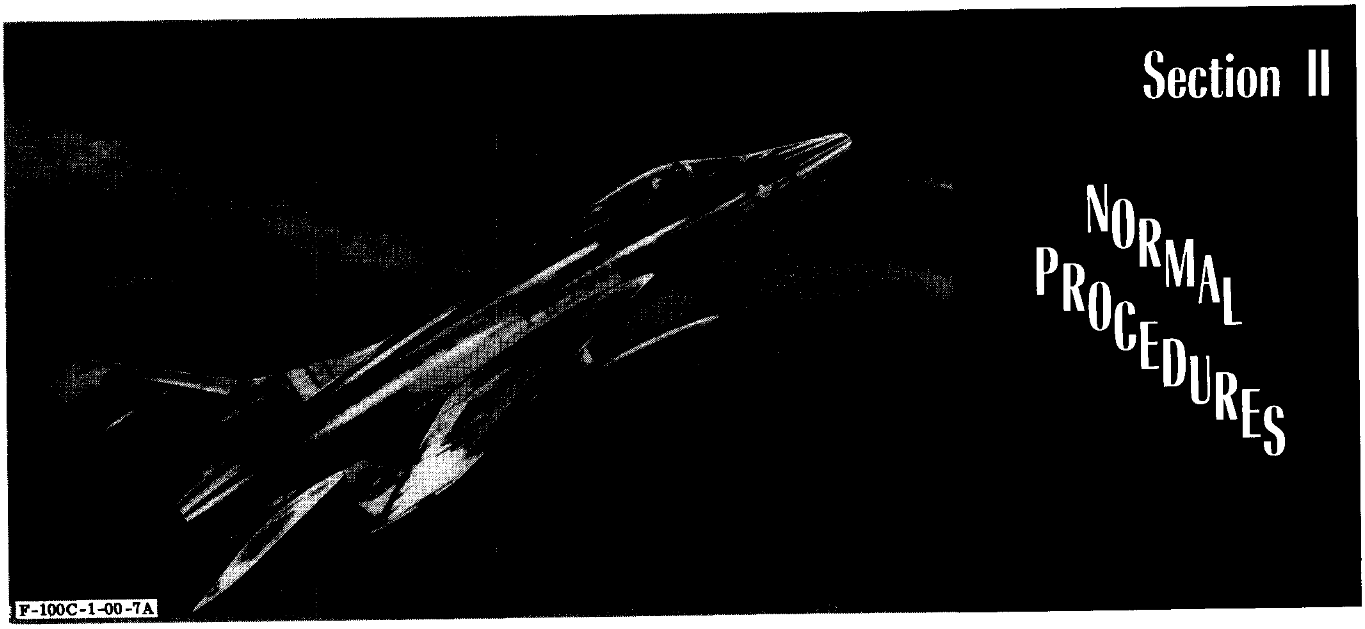


TABLE OF CONTENTS

PREPARATION FOR FLIGHT.

FLIGHT RESTRICTIONS.

Refer to Section V for detailed airplane and engine limitations.

FLIGHT PLANNING.

Refer to Appendix I for the information to determine the fuel quantity, engine settings, and airspeeds that are required to complete the proposed mission.

TAKE-OFF AND LANDING DATA CARDS.

Refer to Appendix I for the information necessary to fill out the Take-off and Landing Data Cards before each flight.

WEIGHT AND BALANCE.

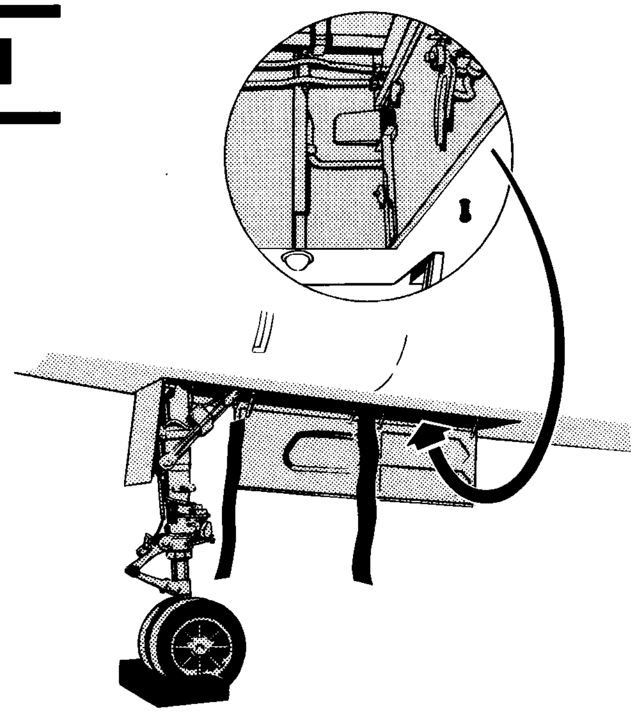
Refer to Section V for weight and balance limitations. For loading information, refer to Weight and Balance Technical Manual, T.O. 1-1B-40. Before each flight, check take-off and anticipated landing gross weight and balance. Check Form 365F for weight and balance clearance. If guns and/or ammunition are not installed, check for installation of proper ballast. Make sure airplane is

EXTERIOR INSPECTION

NOTE:

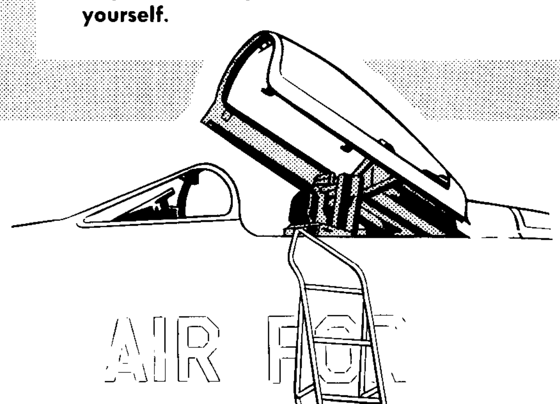
Starting at the nose of the airplane while making exterior inspection check all surfaces for cracks, distortion, loose rivets, and signs of damage; Check for signs of fuel, oil, and hydraulic fluid leaks; Check main wheels chocked and strut extension; Check each drop tank for fuel level and amount. If quantity is questionable, use dip stick to determine the amount. All ground safety locks should be removed except the nose gear ground safety lock during exterior inspection. Accumulator gage pressures (given on placards next to gage) are for 70°F; pressure will be higher on hot days. All ground plugs, chocks, locks, and covers are shown in place for illustration purposes only.

*You may rely on your crew chief to check the items marked with an asterisk if you desire. However, if preflight inspection or servicing was performed at a base where ground personnel are not completely familiar with your airplane, then you should check these items yourself.



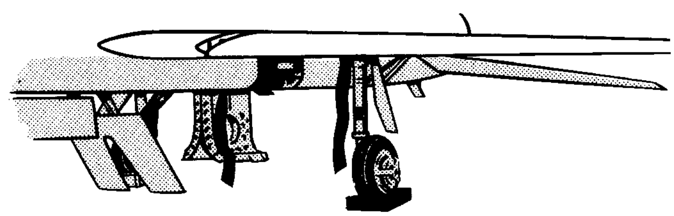
1 NOSE WHEEL WELL

- Nose gear emergency lowering selector valve reset rod in.
- Nose gear emergency lowering accumulator pressure.
- Wheel brake emergency accumulator pressure.
- Antiskid accumulator pressure.
- Nose wheel tires for general condition, slippage, and proper inflation.
- Nose wheel steering pulley and cable for tautness.
- Nose gear torque links connected; pivot pin safetied.
- Nose wheel chock removed.
- Nose gear door uplocks and microswitch.



8 TOP FUSELAGE

- Utility hydraulic reservoir.*
- Flight control hydraulic system accumulator pressures.*
- Flight control hydraulic system compensating reservoir fluid level.*
- Ram-air turbine door emergency accumulator pressure.*
- Fuel booster and transfer pump operation.*
- Afterburner circuit breaker.*
- Battery compartment circuit breakers.*



7 LEFT WING

- Speed brake ground safety locks removed (if speed brake is out).
- External load for installation and mounting; ground safety locks removed.
- Antiskid sensing unit.
- Main gear wheel well.
- Pip pin installed.
- Main gear; ground safety locks removed.
- Main gear door uplocks and microswitch.
- Main wheel tire for general condition, slippage, and proper inflation.
- Main wheel brake for loose or broken drive keys, and broken hydraulic lines.
- Slats and rollers for freedom of movement.

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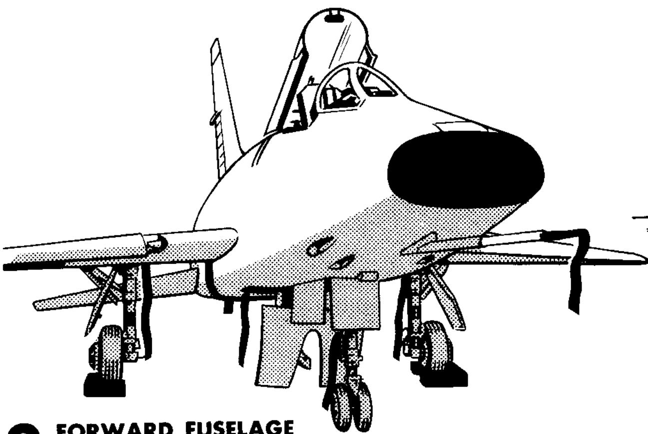
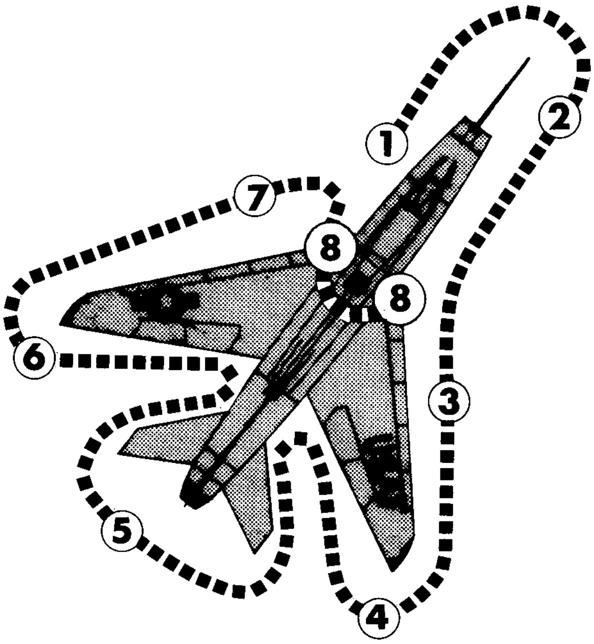
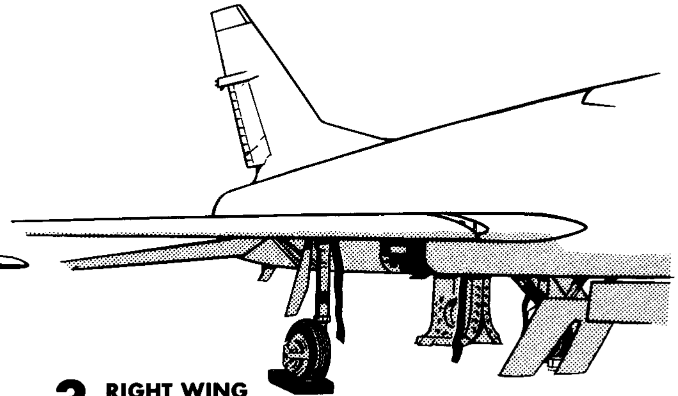
Figure 2-1



2 FORWARD FUSELAGE

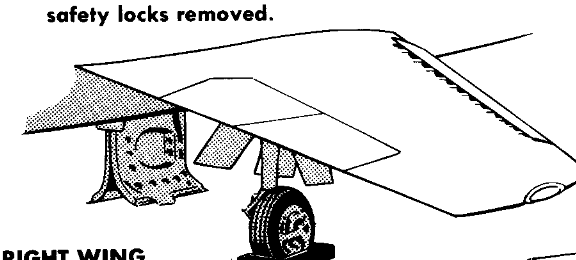
- Pitot boom secure; spring locks extended, cover removed.
- Intake duct clear; plug removed.
- Gun port plugs installed (removed for firing mission).
- Oxygen system filler access door secure.





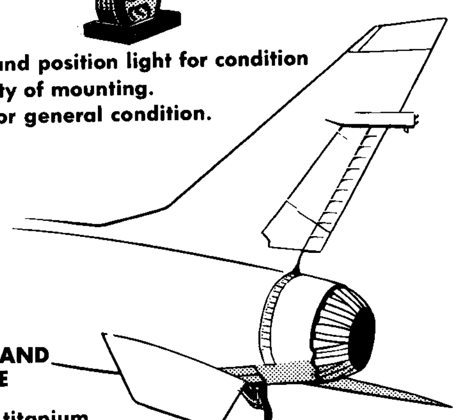
3 RIGHT WING

- Air refueling probe installation and mounting; cover removed.
- Slats and rollers for freedom of movement.
- Main wheel brake for loose or broken rotor drive keys and broken hydraulic lines.
- Main wheel tire for general condition, slippage, and proper inflation.
- Main gear door uplocks and microswitch.
- Main gear; ground safety locks removed.
- Pip pin installed.
- Main gear wheel well.
- Antiskid sensing unit.
- External load for installation and mounting; ground safety locks removed.



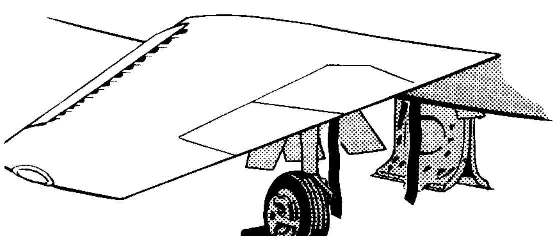
4 RIGHT WING

- Wing tip and position light for condition and security of mounting.
- Ailerons for general condition.



5 EMPENNAGE AND AFT FUSELAGE

- Cracks in titanium.
- Horizontal stabilizer, rudder, and position lights.
- Tail cone and exhaust nozzle for condition and hot spots.
- Iris nozzle seal fingers for condition.
- Turbine area for damage.
- Drag chute and cable stowed; doors locked, safety lock removed.
- Afterburner for alignment.
- Tail skid down; condition of tail skid shoe.
- Yaw damper accumulator pressure.*
- Fuel tank purging system pressure.*†
- Single-point refueling door secured.



6 LEFT WING

- Aileron for general condition.
- Wing tip and position light for condition and security of mounting.

† Some airplanes

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ENTERING COCKPIT

F-100C-1-00-5B

Figure 2-2

properly loaded (bombs, drop tanks, and ammunition) for intended mission.

ENTRANCE.

The cockpit can be entered from either side. (See figure 2-2.) A ladder hooks over the cockpit ledge for normal entry. There are kick-in steps and handgrips on the left side of the fuselage for leaving the cockpit if a ladder is not available.

PREFLIGHT CHECK.

BEFORE EXTERIOR INSPECTION.

1. Form 781—Check.
   Check Form 781 for engineering status, and make sure airplane has been serviced with required amounts of fuel, oil, hydraulic fluid, fuel tank purging nitrogen,* and oxygen for the mission. For servicing points, see figure 1-33.
2. Personal equipment—Check.
   Make sure personal equipment is complete and in good working order. A properly operating flashlight must be included for night flights. Also check that no miscellaneous items of clothing or equipment are stored in the electronics compartment.

Caution The equipment in the forward electronics compartment can be damaged by items stowed in the area.

EXTERIOR INSPECTION.

Perform exterior inspection as outlined in figure 2-1.

EJECTION SEAT AND CANOPY CHECK.

Before entering the cockpit, check ejection seat and canopy as follows:

1. Handgrips and triggers—Check.
   Both seat handgrips must be full down and latched.

Warning Do not raise the handgrips to determine whether they are latched, because the canopy may jettison.

2. Safety pins—Check.
   The single ground safety pin must be installed through the right handgrip, and on some airplanes, a ground safety pin must be installed in the canopy alternate emergency jettison handle. Make sure maintenance safety pins have been removed from seat, canopy, and safety belt initiators.

Warning If any ejection system *maintenance* safety pin is installed, do not remove it until you have checked the status of the ejection system with maintenance personnel.

3. Seat quick-disconnects—Check.
   Make sure seat quick-disconnects for personal leads are properly mated.

---

*Some airplanes

4. Tubing and hose fittings—Check.

   Check tubing and hose fittings from initiators to canopy remover and seat ejection catapult.

5. Canopy external emergency release handles—Check closed and latched.

INTERIOR CHECK (ALL FLIGHTS).

NOTE The take-off and landing check lists* are on the right and left side, respectively, of the canopy inner frame.

1. All electrical power—Check OFF.

   All electrical power should be off during the interior check.

2. Safety belt and shoulder harness—Secured and tight.

   When adjusting shoulder harness, place locking handle in LOCKED position before adjusting straps; then return locking handle to UNLOCK.

Caution Make sure that automatic-opening safety belt is properly fastened and, if an automatic parachute is worn, that the chute arming lanyard is properly attached to the safety belt latching mechanism, to ensure proper operation of this equipment if ejection is necessary. Refer to "Automatic-opening Safety Belt" in Section I for proper procedures for the various types of belts.

NOTE To prevent possible interference caused by the position of the initiator hose leading to the automatic-opening safety belt, the hose length can be varied by pushing or pulling the hose through the clamp on the side of the ejection seat.

3. Zero-second parachute hook—Attach to parachute "D" ring.
4. Survival equipment, ventilated suit,* and anti-G suit—Connected.
5. Rudder pedals—Adjust.
6. Wheel brake emergency hydraulic pump operation*—Check.

   Pump brake pedals one at a time to determine whether electrically driven pump is operating. The pump can be heard from the cockpit if the area is relatively quiet. Have crew chief listen for pump if noise level is too high to hear from cockpit.

7. Left console circuit breakers—IN.

   All circuit breakers in unless directed otherwise.

8. Speed brake emergency dump lever—OFF (aft).
9. Pylon loading selector switches—Check.

   Make sure pylon loading selector switches are at the correct position for the particular external load configuration.

Warning Do not change setting of pylon loading selector switches when external loads are installed, because loads may release when switches are reset. If selector switch settings do not correspond to external load, have maintenance personnel check system.

10. Anti-G suit pressure-regulator valve—As desired.
11. Strike camera timer—As desired.
12. Camera shutter selector switch—OFF.
13. Bomb release signal selector switch*—MANUAL.
14. Bomb mode selector switch*—OFF.
15. Armament selector switch—OFF.
16. Bomb-arming switch—SAFE.
17. Sight selector unit—As desired.
18. Ground gunfire switch—SAFE (lockpinned).
19. Throttle friction lever—As desired.
20. Throttle—OFF.
21. Speed brake switch—OFF (centered).
22. UHF radio controls—OFF.
23. Pitch damper switch—STANDBY.
24. Yaw damper switch—STANDBY.
25. Antiskid switch—OFF.
26. Rudder hydraulic test switch—NORM.
27. Flight control hydraulic system test switch—NORM.
28. Fuel tank purge switch—OFF.
29. Drop tank fuel selector switch—As required.

NOTE Refer to "Drop Tank Fuel Sequencing Limitations" in Section V.

30. Fuel regulator selector switch—NORM.
31. Engine master switch—OFF.
32. Air start switch—OFF.
33. Oil cooler shutter switch—AUTO.
34. Engine guide vane anti-ice switch—AUTO (OFF*).
35. Air refueling switch—OFF.
36. Landing gear handle—DOWN.
37. Landing and taxi light switch—OFF.
38. Drag chute handle—IN (stowed).
39. A-4 sight mechanical caging lever—CAGE.

*Some airplanes

40. LABS control switches—OFF.
41. Directional indicator slaving cutout switch—OUT.
42. Trigger safety switch—OFF* (CAMERA*).
43. Hydraulic pressure gage selector switch—UTILITY.
44. Airspeed and Mach number indicator—Check and set.
45. Accelerometer—Reset.
46. Altimeter—Set to field elevation.
47. Clock—Set and running; test stop watch.
48. External load emergency jettison handle—IN (clip on).
49. Special store emergency jettison handle—IN (clip on).
50. Landing gear emergency lowering handle—IN.
51. Canopy alternate emergency jettison handle*—IN.
52. Generator switch—ON.
53. Power inverter switch—ON.
54. Instrument inverter switch—No. 1 or No. 2.

    Use of No. 2 inverter should be alternated with use of No. 1 inverter.
55. Secondary bus emergency tie-in switch—NORM.
56. Oxygen supply lever—ON.
57. Radio compass controls—OFF.
58. IFF controls—OFF.
59. SIF controls*—As required.
60. TACAN controls*—OFF.
61. Face mask antifrost rheostat—OFF.
62. Cockpit temperature rheostat—As desired.
63. Cockpit pressure selector switch—As desired.
64. Pitot boom heat switch—ON.
65. Windshield anti-ice switch—OFF.
66. Console airflow lever—Full INCREASE.
67. Defrost lever—Full INCREASE.
68. Cockpit temperature master switch—AUTO.
69. Right console circuit breakers—IN.

    All circuit breakers in unless directed otherwise.
70. Map case—Check.

    Make sure the necessary publications are in the airplane.
71. Flight control emergency hydraulic pump lever—OFF.
72. Stick grip—Check for firmness of attachment.
73. Battery switch—ON (or dc and ac external power plugged in).

Caution During normal ground operation, the battery switch should be ON even though dc external power is supplied to the airplane. However, to prevent excessive charging and possible damage to the battery, for extended ground operation with dc external power connected, the battery switch should be OFF.

NOTE External dc power units suitable for use with this airplane are the A3, A4, C21, C-22, C-26, C-27, and V1. NC-5, MA-1, MA-1A, or MA-2 power units can supply both ac and dc power.

- The primary bus must be hot if the ac external power source does not supply its own dc power to make ac external power effective.

74. Caution and warning lights—Check ON.

    The generator, power inverter, instrument inverter, flight control hydraulic pressure caution lights, and canopy-not-locked warning light should be on.
75. Seat—Adjust.

Warning If the seat vertical adjustment locks are not in place, the seat may move during flight and cause pilot injury. Therefore, after adjusting the seat, make sure the locks are engaged. (The seat is locked when the adjustment lever is aligned with the index marker at the "LOCKED" marking.) If the locks are not engaged, a slight movement of the seat to right or left will permit the locks to engage.

76. Fire and overheat warning lights—Test.
77. Fuel quantity gages—Check.

    Check fuel quantity and test fuel quantity gage operation.
78. Thunderstorm lights—As desired.
79. Instrument lights—As desired.

    Check operation of lights before flight which will begin or terminate during darkness.
80. Console lights—As desired.

    Check operation of lights before flight which will begin or terminate during darkness.
81. Position lights—As desired.

    Check operation of lights before flight which will begin or terminate during darkness.
82. Indicator, caution, and warning lights—Test.
83. Indicator light dimmer switch—As desired.
84. Stand-by compass light—As desired.
85. Refueling probe light switch—OFF.

*Some airplanes

BEFORE STARTING ENGINE.

Before starting the engine, make sure main wheels are *securely* chocked and nose gear ground safety pin is installed. (The pin must be in to prevent possible nose gear retraction during engine start.) Danger areas in front of and behind the airplane and turbine disintegration areas must be clear of personnel, aircraft, and vehicles. (See figure 2-3.)

Warning If the landing gear wheel well doors are open, make sure the area is clear of personnel. The gear doors close as soon as hydraulic pressure is available during engine start.

Whenever practical, start and run up engine on a paved surface to minimize possibility of dirt and foreign objects being drawn into compressor and damaging engine. Whenever possible, start engine with airplane heading into, or at right angles to, the wind. It is not absolutely necessary to use dc external power for starting. However, if an external dc electrical power source is available, it should be used to conserve battery power.

STARTING ENGINE.

Recheck the throttle OFF; then start the engine as follows:

1. External air source—Connected.

   Make sure proper external compressed-air source is connected to starter system and that sufficient air pressure is available for start.

Note

When the external air unit is developing sufficient air volume for a start, the operator signals the pilot to engage the starter button.

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2. Engine master switch—ON.
3. Starter and ignition button—Press momentarily.

Caution The starter is limited to one minute of continuous operation during any 5-minute period.

- If there is no tachometer indication of engine rotation or rise in oil pressure within 30 seconds after starter and ignition button is pressed, stop starting cycle by pressing starter and ignition stop button momentarily.

4. Throttle—IDLE at 12% to 16% rpm.

   At 12% to 16% rpm, move throttle outboard and forward from OFF to IDLE. This energizes the ignition system (shown by the ignition-on indicator light), and starts the tank-mounted fuel booster pumps and the intermediate transfer pump.

5. Exhaust temperature—Check.

   Light-up should occur (as indicated by rising exhaust temperature) within 20 seconds after the throttle is moved to IDLE.

6. 40% to 50% rpm—Have external air power reduced and disconnected; ac and dc external power disconnected.

Caution Clear engine if smoke comes out of tail pipe. (Refer to "Clearing Engine," in this section.)

- If ignition does not occur within 20 seconds after throttle is advanced to IDLE, or if engine fails to accelerate to 55% to 60% (idle) rpm within one minute after light-up, or if exhaust temperature exceeds 610°C (630°C for -21 engines), return throttle to OFF and press starter and ignition stop button to abort the start. Except for exhaust overtemperature, another start may be attempted by allowing engine to stop rotating and waiting at least 30 seconds to permit fuel to drain from manifolds and engine burner section. Then, with throttle at OFF, turn engine over on starter for 10 to 20 seconds to clear the engine.

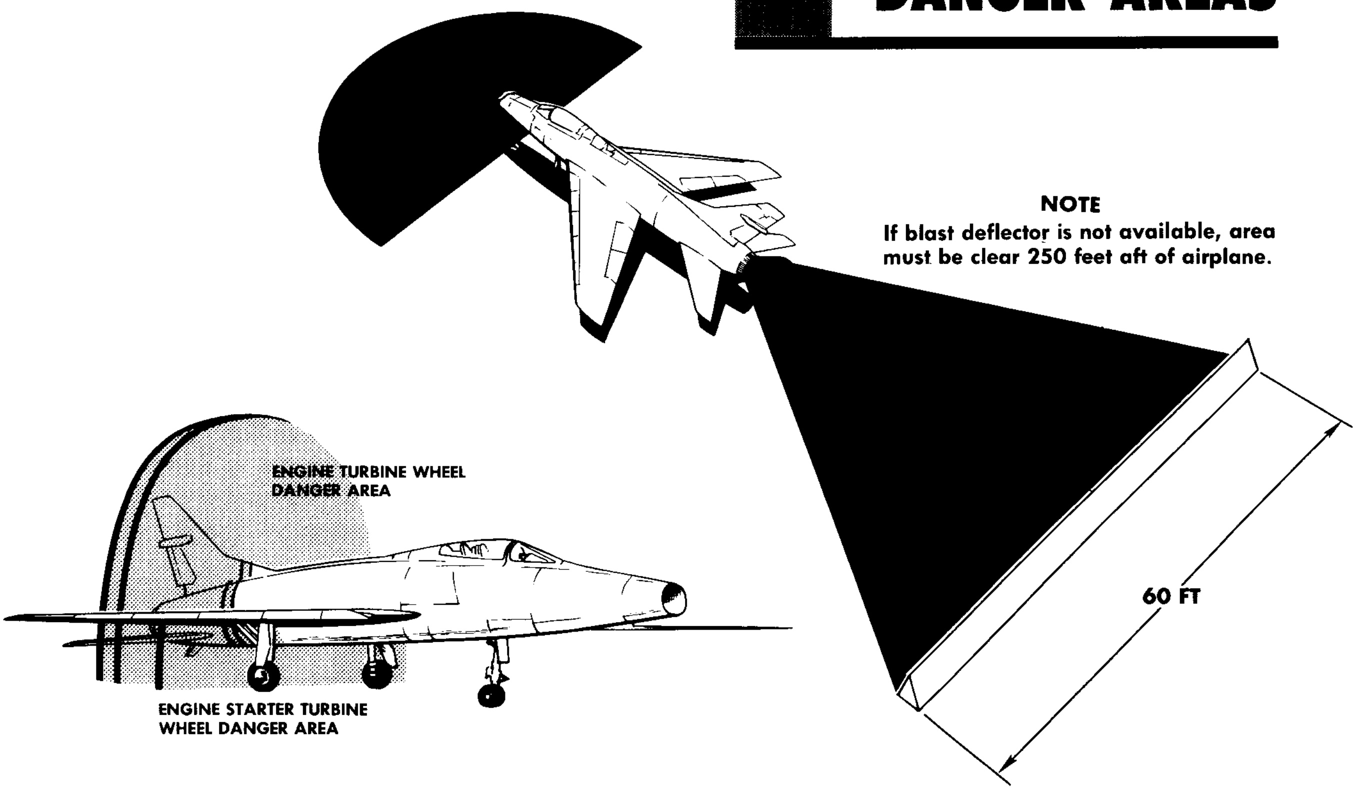
7. 55% to 60% rpm—Engine instruments stabilized.

   Engine rpm should increase steadily with throttle at IDLE, to 55% to 60%, and oil pressure should increase steadily to a minimum of 35 psi.

8. Engine instruments—Check.

   Check engine instruments for proper indications; make sure generator and inverter caution lights, as well as hydraulic pressure failure caution light, are not on.

DANGER AREAS



		DISTANCE AFT OF TAIL PIPE 0	25	50	75	100	125	150
J57-21 ENGINES	IDLE THRUST (DURING TAXIING)	238°C (400°F) 225	82°C (180°F) 105	52°C (125°F) 35				
	MILITARY THRUST	590°C (1100°F) 1325	179°C (355°F) 530	107°C (225°F) 260	71°C (160°F) 135	43°C (110°F) 75	27°C (80°F) 15	15°C (60°F) 0
	AFTERBURNER THRUST	1590°C (2900°F) 2050	704°C (1300°F) 1200	385°C (725°F) 580	260°C (500°F) 325	193°C (380°F) 205	154°C (310°F) 135	135°C (275°F) 115
J57-7 AND -39 ENGINES	IDLE THRUST (DURING TAXIING)	238°C (400°F) 225	82°C (180°F) 105	52°C (125°F) 35				
	MILITARY THRUST	582°C (1085°F) 1300	171°C (340°F) 510	101°C (215°F) 250	68°C (155°F) 130	40°C (105°F) 70	27°C (80°F) 15	15°C (60°F) 0
	AFTERBURNER THRUST	1535°C (2800°F) 1840	649°C (1200°F) 990	349°C (660°F) 450	249°C (480°F) 270	176°C (350°F) 190	121°C (250°F) 115	74°C (165°F) 55

Exhaust temperature in black figures.
Exhaust velocity (mph) in red figures.

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Figure 2-3

CLEARING ENGINE.

When it is necessary to clear engine of any trapped fuel or vapors during ground operation, proceed as follows:

1. Battery switch—ON (or OFF if external dc power is connected).
2. External air source—Connected.
3. Throttle—OFF.
4. Engine master switch—ON.
5. Starter and ignition button—Press (motor engine above 12% rpm for 30 seconds).
6. Starter and ignition stop button—Press.

   Allow engine rotation to stop before attempting another start.

GROUND OPERATION.

NOTE If engine run-up is made during ground operation, be sure main wheels are securely chocked, and hold wheel brakes on. Wheel brakes will not hold the airplane during afterburner operation.

- This airplane is not equipped with parking brakes.

Normally, engine warm-up is unnecessary. However, when outside air temperature is below −35°C (−31°F) and engine is started cold, it should be warmed up at idle rpm for about 2 minutes.

Caution If throttle is inadvertently retarded to OFF, a flame-out occurs immediately. Do not reopen throttle, because relight is impossible and the resultant flow of unburned fuel into the engine can create a fire hazard in the afterburner section of the tail pipe during ground operation.

FLIGHT CONTROL HYDRAULIC SYSTEM CHECK.

To ensure that the flight control systems are operating properly, perform the following checks with the throttle at IDLE.

1. Flight control hydraulic system servicing—Have ground crewman check.

   Ground personnel must check servicing before the first flight of the day.
2. Trim airplane for take-off.
3. Hydraulic pressure gage selector switch—FLIGHT CONTROL 1.

   a. Move stick slowly full aft, check for freedom of movement, and visually check control surface for proper movement. Visually check ailerons neutral; after pressure stabilizes, release stick completely and allow to return to trim. Pressure must drop at least 500 psi from stabilized pressure. Check for a smooth, rapid pressure build-up.

   b. Move stick slowly full right, check for freedom of movement and visually check control surfaces for proper movement. After pressure has stabilized, release stick completely and allow to return to trim. Pressure must drop at least 500 psi from stabilized pressure. Check for a smooth, rapid pressure build-up.

NOTE Momentary pressure drops below 1500 psi are permissible while step 3 is being performed. The amount of pressure drop varies with outside air temperature and from airplane to airplane.

4. Hydraulic pressure gage selector switch—FLIGHT CONTROL 2.

   a. Move stick slowly full forward, check for freedom of movement and visually check control surfaces for proper movement. Visually check ailerons neutral; after pressure stabilizes, release stick completely and allow to return to trim. Pressure must drop at least 200 psi from stabilized pressure. Check for a smooth, rapid pressure build-up.

   b. Move stick slowly full left, check for freedom of movement and visually check control surfaces for proper movement. After pressure has stabilized, release stick completely and allow to return to trim. Pressure must drop at least 200 psi from stabilized pressure. Check for a smooth, rapid pressure build-up.

NOTE Normally, the flight control hydraulic pressure failure caution light will not come on during the preceding steps. If the light does illuminate, stop all control movement and see whether both system pressures return to 2800-3200 psi before proceeding with further checks.

- Momentary overshoot above 3200 psi is allowed when pressure is building up.
- In steps 3 and 4, if little or no pressure drop is observed, the system is not functioning correctly or is connected improperly.

AIR START SYSTEM CHECK.

To ensure correct operation of the air start unit, do the following checks:

1. Air start switch—ON.
2. Ignition-on indicator light—Check on.

3. Generator caution light—Check on.
4. Loadmeter pointer—Zero.
5. Air start switch—OFF.
   Return air start switch to OFF immediately, to prevent ignition unit damage.

Caution If the indications do not appear when the air start switch is ON, the air start system is inoperative and the flight should be aborted.

UTILITY HYDRAULIC SYSTEM CHECK.

To ensure that the utility hydraulic system is operating correctly, proceed as follows:

1. Hydraulic pressure gage selector switch—UTILITY.
   Check pressure indication on the gage.
2. Wheel brakes—Check.
   On some airplanes, before taxiing and with engine at idle rpm, pump brake pedals smoothly with a full deflection cycle once each second for 5 seconds. If pedals do not drop full forward or stiffen, the hydraulic modulating system is operating satisfactorily. If pedals do drop full forward or stiffen before the fifth pedal pump has been completed, corrective maintenance should be performed. On airplanes with the power emergency system, check for proper braking action.
3. Nose wheel steering button—Press and move rudder pedals.
   Check for airplane response to nose wheel steering. (Determine which type of nose wheel steering button operation is available.)
4. Speed brake switch—Cycle; then move switch to IN.
   Have ground crew check for proper operation. Note hydraulic pressure drop. If pressure drops below 1300 psi, the mission should be aborted because the priority valve in the speed brake hydraulic line may be faulty. However, if the pressure drops below 1300 psi and remains there, check whether the speed brake dump lever is at the OFF (aft) position. Close speed brake and return switch to OFF (center) position.

RUDDER HYDRAULIC SYSTEM CHECK.

To ensure that the rudder system is operating properly, proceed as follows:

1. Hydraulic pressure gage selector switch—FLIGHT CONTROL 1. Move rudder pedals through full travel.
   Check rudder operation. Slight drop in hydraulic pressure should be noted during rudder movement.
2. Hydraulic pressure gage selector switch—ALT. RUD.
   While the rudder pedals are moved slowly, pressure should read less than 100 psi.
3. Rudder hydraulic system test switch—ALT RUD TEST.
   Check pressure and operation. Move rudder pedals through full travel. Pressure should build up to 2700 psi or more. Release pedals to neutral. A slight drop in hydraulic pressure should be noted during rudder movement. Release test switch to NORM. Pressure should return to less than 100 psi. Move rudder pedals to ensure that system is operating.
4. Hydraulic pressure gage selector switch—UTILITY.

TRIM SYSTEM CHECK.

To ensure that the trim system is operating properly, proceed as follows:

1. Trim operation—Check.
   Hold lateral and longitudinal trim switch on stick grip at each operative position, and hold rudder trim switch at RIGHT and LEFT to obtain full trim travel on all trim systems. Note that control and corresponding surface movements are correct. After completing full-travel trim check in both directions, release trim switches when stick is in full travel position.

Warning The trim switch may be subject to occasional sticking in an actuated position, resulting in application of extreme trim. When this condition occurs in flight, the trim switch must be returned manually to OFF (center), after the desired amount of trim is obtained. If this is noted during preflight check, an entry should be made in Form 781 with a red cross. Do not fly the airplane.

2. Trim for take-off—Check.
   Hold take-off trim button depressed until take-off trim indicator light remains on steadily for a minimum of 2 seconds. Observe control centering and have ground crew check proper setting of horizontal stabilizer and rudder.

NOTE The ground crew check of the horizontal stabilizer setting is facilitated by a white triangle painted on the left side of the fuselage. When the stabilizer is at the proper take-off trim setting, the leading edge is aligned within ±5/16 inch of the aft apex of the triangle.

OPERATIONAL CHECKS.

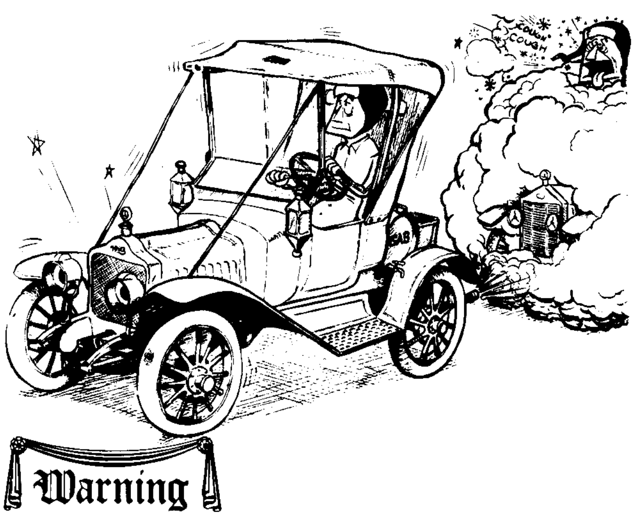
1. Personal equipment—Attach and check.

   Attach radio lead, face mask antifrost lead, and oxygen hose; check that bail-out oxygen bottle is connected. Make sure helmet chin strap is hooked and that oxygen mask fits properly.
2. UHF control switch—ON.
3. Flight instruments—Check.

   Check all flight instruments for proper setting and operation. Make sure the directional indicator needle stabilizes and that 180-degree error in reading does not appear 3 to 4 minutes after power is applied. (For quick erection, cage and uncage 30 seconds after power was applied.) Check attitude indicator for erection and that warning "OFF" flag has retracted.
4. Radio-navigation aids—Check.

   Check radio compass frequency alignment, antenna reception, and manual loop rotation. Tune to low-frequency range or "homer" that serves the field of departure. After identification of call letters, turn function switch to COMP, and check automatic direction finder for correct position. Check reception and indications of TACAN* on station serving field of departure.
5. IFF control switch—ON.
6. Oxygen system—Check.

   Refer to "Oxygen System Preflight Check" in Section IV.



Warning

*If the airplane is to be operated on the ground under conditions of possible carbon monoxide contamination, such as might occur during operation directly behind another operating jet airplane, or if downwind engine run-up is accomplished, set oxygen regulator diluter lever at **100% OXYGEN** for duration of suspected contamination.*

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BEFORE TAXIING.

1. Nose gear ground safety lock—Have ground crewman remove.

   With utility hydraulic pressure at 2800 psi and all gear doors closed, signal ground crewman to remove nose gear ground safety pin. The ground crewman should then present or show pin to the pilot.
2. Safety pins—Remove.

   Remove ground safety pin from right handgrip of ejection seat and remove ground safety pin from canopy alternate emergency jettison handle.*

Warning After the ground safety pin is removed from the handgrip, the seat and canopy ejection systems are fully armed.

NOTE Before taxiing, be sure there is proper clearance for the airplane. See figure 2-4 for minimum turning radius and ground clearance.

3. Emergency fuel control system—Check.

   Before first flight each day, test emergency fuel control system as follows: move fuel regulator selector switch to EMER at idle rpm. The emergency fuel regulator-on indicator light should be on and a slight fluctuation of fuel flow should be noted, indicating that the system has transferred from the normal to the emergency system. Then return fuel regulator selector switch to NORM.
4. Oxygen regulator diluter lever—100%.
5. Engine pressure gage—Set.

   On some airplanes, set engine differential pressure gage index marker. On other airplanes, set engine pressure ratio gage take-off index marker. (See figure 2-5.)
6. Main wheel chocks—Removed.

NOTE If engine run-up is made, be sure main wheels are securely chocked, and hold wheel brakes on. The wheel brakes will not hold the airplane when the afterburner is operating.

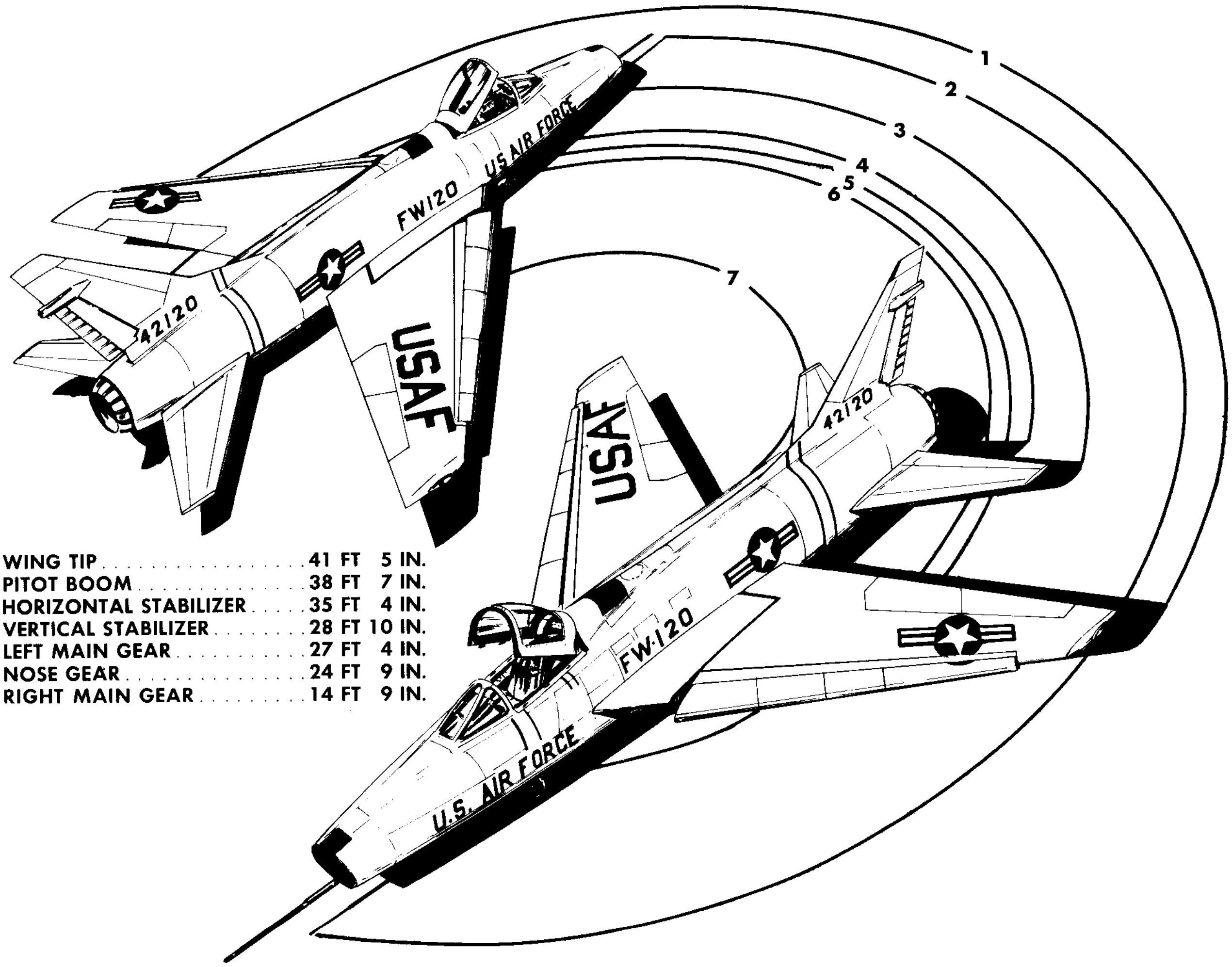
7. Altimeter—Set to field pressure.

   Check that 10,000-foot pointer is set correctly and note error against field elevation. This error should be considered when the altimeter is reset during flight.

Caution If the altimeter error is more than 75 feet, do not accept the airplane.

***Some airplanes**

MINIMUM TURNING RADIUS AND GROUND CLEARANCE



1. WING TIP ....41 FT 5 IN.
2. PITOT BOOM ....38 FT 7 IN.
3. HORIZONTAL STABILIZER .....35 FT 4 IN.
4. VERTICAL STABILIZER ....28 FT 10 IN.
5. LEFT MAIN GEAR ....27 FT 4 IN.
6. NOSE GEAR ....24 FT 9 IN.
7. RIGHT MAIN GEAR ....14 FT 9 IN.

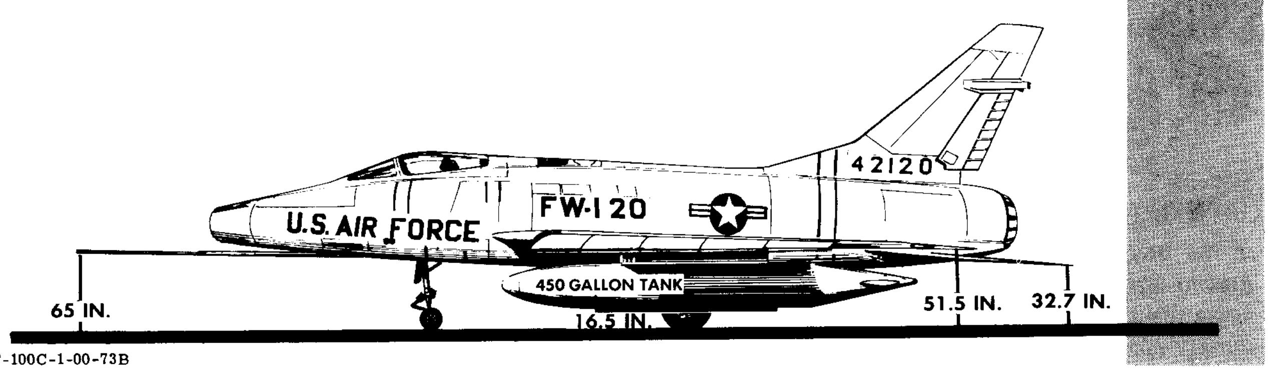


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Figure 2-4

ENGINE PRESSURE RATIO GAGE SETTING

OUTSIDE AIR TEMPERATURE °F	°C	TAKE OFF INDEX SETTING	°F	°C	TAKE OFF INDEX SETTING	°F	°C	TAKE OFF INDEX SETTING
122	50	1.86	64	18	2.04	7	−14	2.25
118	48	1.87	61	16	2.05	3	−16	2.26
115	46	1.88	57	14	2.07	0	−18	2.28
111	44	1.89	54	12	2.08	−4	−20	2.29
107	42	1.90	50	10	2.09	−8	−22	2.30
104	40	1.91	46	8	2.10	−11	−24	2.32
100	38	1.92	43	6	2.12	−15	−26	2.33
97	36	1.93	39	4	2.13	−18	−28	2.35
93	34	1.94	36	2	2.14	−22	−30	2.36
90	32	1.95	32	0	2.15	−26	−32	2.37
86	30	1.97	28	−2	2.17	−29	−34	2.38
82	28	1.98	25	−4	2.18	−33	−36	2.39
79	26	1.99	21	−6	2.19	−36	−38	2.41
75	24	2.00	18	−8	2.21	−40	−40	2.42
72	22	2.02	14	−10	2.22			
68	20	2.03	10	−12	2.23			

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Figure 2-5

TAXIING.

Observe the following instructions for taxiing:

1. Canopy—As desired.

   During taxiing, when the canopy is open, the canopy should not be set within 6 inches of either full open or full close position, to prevent possible damage to canopy mechanism and/or canopy seal as a result of bouncing. During taxiing, when the canopy is closed, the canopy must be in the full closed and locked position to prevent possible damage to the canopy seal.

2. Nose wheel steering—Engage.

   Maintain directional control through steerable nose wheel.

3. Taxi at lowest practical rpm.

   Once the airplane is moving, it can be taxied on a hard surface with the throttle at IDLE position (about 55% to 60% rpm).

4. Flight instruments—Check.

   Perform operational check of all flight instruments during taxiing. Check directional indicator (slaved) for incorrect or sluggish operation.

5. Antiskid switch*—ON.

   While taxiing in a clear area, move antiskid switch to ON and test brake operation. If no braking action is received and flight is to be continued, return antiskid switch to OFF.

Warning

Maintain a minimum distance of 75 feet to prevent damage to the canopy, when operating within the Military Thrust jet blast of another F-100 Airplane. When jet blast is from afterburner operation, maintain a minimum distance of 150 feet.

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***Some airplanes**

BEFORE TAKE-OFF.

PREFLIGHT AIRPLANE CHECK.

After taxiing to take-off area, complete the following checks:

1. Flight controls—Check.
   Check flight controls for correct operation and freedom of movement. Make sure oxygen and anti-G suit hoses do not interfere with stick travel.
2. Hydraulic pressure gage selector switch—UTILITY.
3. Speed brake switch—IN, then OFF (center).
4. Canopy switch—CLOSE.
   Hold switch in CLOSE position for an additional 2 or 3 seconds to ensure tight sealing. Make sure canopy-not-locked warning light goes out when canopy is closed.

Warning The canopy closes with considerable force. Make sure that hands and equipment are clear of sills.

- Because the canopy switch on some airplanes is not spring-loaded to the center (OFF) position from CLOSE, make sure switch is *moved* to the center (OFF) position when the canopy reaches the desired position. Personnel may be injured by the canopy closing if the switch is merely released.

5. Yaw and pitch damper switches—STANDBY.
   Recheck yaw and pitch damper switches at STANDBY. In addition, on F-100C-25 Airplanes, pull pitch damper switch ON (pitch damper caution light should remain out) and then push the switch in to STANDBY. This ensures that the pitch damper system actuator will be neutral during take-off and at pitch damper engagement.
6. Take-off trim—Check.
   Press take-off trim button until light remains on steadily for at least 2 seconds.
7. Take-off position and hold.
   Make sure airplane is lined up on the runway, and nose wheels are centered. Hold airplane with brakes.

PREFLIGHT ENGINE CHECK.

With throttle in IDLE position, proceed with the following checks:

NOTE Avoid making engine preflight check in jet wake of a preceding airplane; otherwise, a slightly low differential pressure (or pressure ratio) gage reading may occur.

1. Engine instruments—Check.
   Check engine instruments for proper reading at idle rpm:
   a. Tachometer: 55% to 60% rpm.
   b. Exhaust temperature: 200°C to 340°C.
   c. Oil pressure: 35 psi minimum.

NOTE With engine operating at any rpm above idle, oil pressure must be 40 psi minimum.

2. Throttle—MILITARY.
3. Adjust heat and vent system—As desired.
4. Engine pressure gage—Check.
   When engine speed (rpm) has stabilized, the pointer on the differential pressure gage should be within +3, −1 in. Hg of the center of the index marker. The pointer on the pressure ratio gage should fall within the arc of the take-off index marker. (See figure 5-2.) If Military Thrust check results in an acceptable reading and afterburner take-off is to be made, readjust take-off marker, while the engine is operating at Military Thrust, so that lower edge of index marker aligns with gage indicating pointer.

Warning If the gage pointer does not fall within the prescribed limits, the thrust output is not correct and take-off should not be made.

5. Engine instruments—Check.
   While throttle is at Military Thrust, check oil pressure at 40 psi minimum; make sure exhaust temperature does not exceed 660°C (680°C for -21 engines) during acceleration and stabilizes above 540°C.

Caution The temperature and duration of any engine operation during which any exhaust limit temperature limit is exceeded should be entered in Form 781. If acceleration temperature limit is exceeded, shut down engine immediately. Overtemperature operation requires engine inspection.

- Should engine rpm reach or exceed overspeed limit, either with or without overtemperature conditions, shut down engine immediately. The engine must be inspected for malfunction and possible damage, when overspeed occurs.

TAKE-OFF AND INITIAL CLIMB

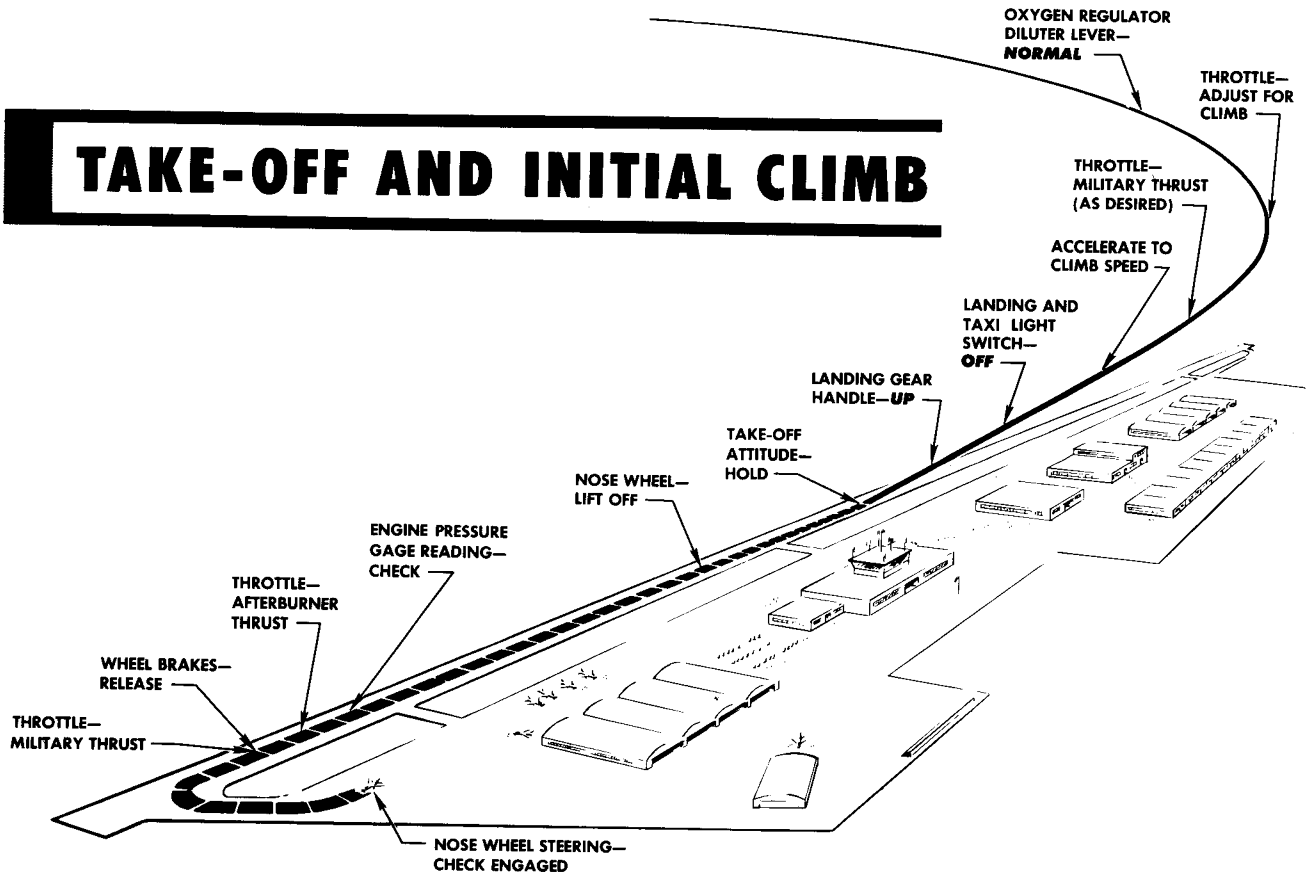


Figure 2-6

TAKE-OFF.

NORMAL TAKE-OFF.

NOTE Refer to take-off distance charts in Appendix I for take-off distances and speeds.

- During take-off run, nose wheel steering should be used for directional control at speeds up to 100 knots, at which time rudder control becomes effective. Avoid using brakes if at all possible, because excessive take-off distances will result.
- Take-off at Military Thrust is not recommended because of the excessive ground roll and slow acceleration rates. In addition, no fuel saving is realized on tactical-type missions.

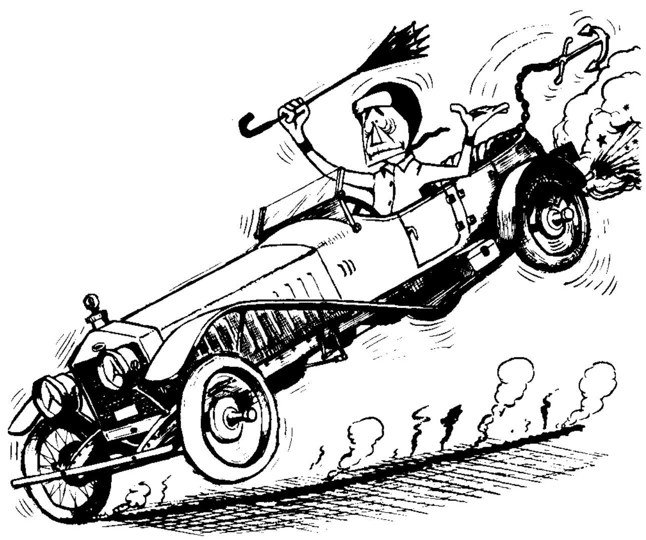
For normal take-off with or without external load, proceed as follows:

1. Throttle—MILITARY.
2. Wheel brakes—Release.
3. Throttle—AFTERBURNER.

   Afterburner ignition should occur within 2 seconds and is indicated by a definite increase in thrust. The exhaust temperature should not exceed the acceleration limit.

Caution If the exhaust nozzle fails to open when the afterburner is selected, a loud explosion and violent surging occur, accompanied by an rpm reduction and an increase in exhaust temperature. If these conditions are noted, shut down afterburner immediately to prevent possible damage to engine and exhaust nozzle.

NOTE If afterburner is selected repeatedly, ignition will take place before the nozzle opens, at which time pressure ratio (differential pressure) will increase momentarily, then drop back as the nozzle opens.



CAUTION
Wheel brakes will not hold the airplane when the afterburner is operating.

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4. Engine pressure gage—Check.

   Immediately after afterburner light-up, check engine pressure ratio (or differential pressure) gage. It is important to check the gage before take-off roll has progressed too far, because the pointer will continue to rise as the airspeed increases. On airplanes with J57-7 or -39 engines, the differential pressure gage reading should not be in excess of +2½, −1½ in. Hg from that obtained during the preflight Military Thrust check. On J57-21 engines, the gage reading should not be more than 4 in. Hg above, nor be below, the preflight check reading. The pressure ratio gage pointer should again fall within the arc of the take-off index marker.

Caution If engine differential pressure or pressure ratio gage reading is not within prescribed limits, abort take-off if conditions permit. However, if committed to take-off, continue in normal manner; then shut down afterburner as soon as airplane is safely air-borne. Land as soon as practicable. Whenever the gage readings are not within limits, the airplane must be returned to maintenance for corrective action.

5. Nose wheel—Lift off.

   At about 15 knots below take-off speed, apply back pressure to stick and hold take-off attitude, allowing airplane to fly off runway.

Warning Allowing the airspeed to build up above recommended speeds before pulling back on the stick increases the ground roll considerably.

- Premature nose wheel lift-off results in excessive ground run.

6. Take-off attitude—Hold.

   Maintain a nose-high attitude after breaking ground. The airplane assumes a more normal attitude as the speed increases.

MINIMUM-RUN TAKE-OFF.

For a minimum-run take-off, the technique is basically the same as for a normal take-off. However, the nose wheel lift-off speed and the take-off speed should be decreased by 5 knots. Care must be taken to ensure that the nose is not rotated to an excessively high attitude, as this increases the take-off distance.

NOTE Refer to take-off distance charts in Appendix I.

CROSS-WIND TAKE-OFF.

In addition to the procedures used in a normal take-off, be prepared to exert rudder pressure after releasing nose wheel steering, to keep airplane on a straight path until air-borne. Also be prepared to counteract airplane drifting by lowering wing into wind or by crabbing. To compute the effective cross wind during take-off, refer to take-off and landing cross-wind chart in Appendix I.

TAKE-OFF WITH HIGH OUTSIDE AIR AND RUNWAY TEMPERATURES.

During take-off with high outside air or runway temperature, caution must be used to prevent premature nose wheel and airplane lift-off. High outside air temperature increases the take-off roll distance. It is imperative that the recommended take-off speed (as given in take-off distance charts in Appendix I) be used.

TAKE-OFF WITH ASYMMETRICAL LOADS.

Refer to "Flight With External Loads," in Section VI.

AFTER TAKE-OFF—CLIMB.

When airplane is definitely air-borne, and there is no possibility of setting back onto the runway:

1. Landing gear handle—UP.

   Check gear position indicators.

Caution Landing gear and doors should be completely up and locked before gear-down limit is reached; otherwise, excessive air loads may damage gear fairing and prevent subsequent operation.

- If the landing gear handle was moved to UP while the weight of the airplane was still on the gear, the handle must be placed in the DOWN position and then returned to UP (with weight off the gear) before the gear can retract.

2. Landing and taxi light switch—OFF.

Caution If the landing lights are used for take-off, they should be retracted before the landing light limit airspeed is reached, to prevent air loads from inflicting structural damage.

3. Best climb speed—Establish.

   Accelerate to best climb speed while maintaining a shallow climb.

NOTE For best climb speed, refer to climb charts in Appendix I.

- Slats become fully closed at about 290 knots IAS, with or without drop tanks.

4. Zero-second parachute hook—Detach from parachute "D" ring and attach to stowage ring.

   Parachute hook must be stowed after a minimum safe ejection altitude for your particular escape system is reached.

5. Throttle—Inboard.

   As soon as added thrust is no longer needed, shut off afterburner by moving throttle inboard.

6. Pitch damper switch*—ON (up).

   Pull pitch damper switch to ON.

Caution When Type II 275-gallon or WADC 200-gallon drop tanks are carried at the intermediate stations and no other external loads are installed, the pitch damper switch should be at STANDBY. This will prevent the limit load factor of the tanks from being exceeded by a pitch damper failure that results in a "hard-over" signal. After drop tanks are released, pitch damper may be engaged.

7. Yaw damper switch—ON.

   Move yaw damper switch to ON.

8. Throttle—Adjust.

   Adjust throttle setting as necessary to prevent engine overtemperature during climb.

Caution Careful attention to exhaust temperature indications is necessary throughout the climb. Retard the throttle as necessary to prevent engine overtemperature.

9. Oxygen regulator diluter lever—NORMAL OXYGEN.

   Unless carbon monoxide contamination is suspected, return oxygen diluter lever to NORMAL OXYGEN.

10. Drop tank selector switch—As required.

    Move drop tank fuel selector switch as required when the drop-tank-empty indicator light comes on. (For proper fuel sequencing, refer to "Drop Tank Fuel Sequencing Limitations" in Section V.) The light does not come on if the tanks are asymmetrically mounted. In this case, the selector switch should be repositioned when the fuel quantity gage shows a decrease in internal fuel.

NOTE The drop-tank-empty indicator light may blink before the tanks are empty. Therefore, to make sure the tanks are empty, the selector switch should not be repositioned until the light stays on steadily for about 2 minutes.

- When all the drop tanks are empty, the drop tank fuel selector switch should be moved to OFF to shut off airflow to the drop tanks. Drop-tank-empty indicator light is out when the selector is off.

CLIMB.

Military Thrust is recommended for climb for maximum range conditions when minimum climbing time to altitude is not important. For minimum time to altitude, such as in a point-interception mission, Maximum Thrust (afterburner) should be used. Refer to climb charts in Appendix I for recommended indicated airspeeds to be used during climb, and for estimated rates of climb and fuel consumption. During Military Thrust climb to altitude, a drop of 2% to 4% rpm will normally occur.

CRUISE.

For cruise data, refer to Appendix I.

AFTERBURNER (AB) OPERATION DURING FLIGHT.

NOTE About 9 pounds of force is normally required to move the throttle into AB, and about 18 pounds is required to come out. If excessive forces are required, it should be recorded in Form 781. Excessive forces can cause the throttle to fail. (Refer to "Throttle Failure" in Section III.)

- During AB operation at low altitudes, the transfer rate of fuel from the drop tanks may not be sufficient to maintain a constant level in the internal tanks, and use of internal fuel may occur before drop tank fuel is exhausted.

The AB can be operated at any engine speed between that obtained at Military Thrust and about 3% rpm less than Military Thrust; however, the least fuel consumption per pound of thrust output is obtained when the engine is operating at maximum rpm. A momentary drop in pressure ratio (or differential pressure) when the throttle is moved outboard into AB indicates that the exhaust nozzle is open. However, if AB ignition occurs before the exhaust nozzle opens, a momentary increase in pressure ratio will occur. If AB light-up is not obtained within 2 seconds at sea level (5 seconds at altitude) after the throttle is moved into AB, the throttle should be moved inboard and then, after 3 to 5 seconds, returned outboard to recycle the AB igniter.

1. Throttle—Outboard into AFTERBURNER range.

   Move throttle outboard. An increase in thrust indicates AB light-up. During light-up, rapid acceleration may cause inadvertent aft pull on the stick, causing mild longitudinal porpoising. On airplanes equipped with the J57-21 engine, successful AB light-ups are improbable above 40,000 feet. Above 47,000 feet, AB light-ups cannot be obtained and AB blowout may occur because of an overrich fuel schedule. (Normal engine operation is not affected.) If blowout occurs, the AB should be shut down. Improvements in AB ignition and fuel metering, and an improved flame holder incorporated in the J57-21A engines provide satisfactory AB operation up to the service ceiling of the airplane.

Caution If the exhaust nozzle fails to open when the AB is selected, a loud explosion and violent surge will probably occur, accompanied by an rpm reduction and an increase in exhaust temperature. If these conditions appear, shut down AB immediately to prevent possible damage.

2. Throttle—Inboard, to shut down AB.

Caution If AB is selected within one minute after AB shutdown, AB ignition relative to nozzle opening may be faster than normal. This causes a "hard" light-up and jolting of the airplane, and a rise in the engine pressure ratio (or differential pressure) gage reading. In extreme cases, compressor stall may result.

FLIGHT CHARACTERISTICS.

Refer to Section VI for information regarding flight characteristics.

DESCENT.

Circumstances may arise which require a descent from high altitude in the shortest possible time. This may be accomplished by increasing the dive angle until limit airspeed is reached. For a given airspeed, dive angles can be increased by use of the speed brake. The windshield and canopy defrosting systems should be operated throughout the flight at the highest flow possible (as consistent with pilot comfort) so that a sufficiently high temperature is maintained to preheat certain canopy and windshield areas to keep the glass temperature above the cockpit dew point. It is necessary that preheating be done because there is insufficient time during rapid descents to heat these areas to temperatures which prevent the formation of frost or fog.

NOTE During severe icing conditions, even at the expense of pilot comfort, the canopy defrost lever must be at full INCREASE to obtain full available heat to the pitot boom. Engine speed should be at, or above, 83% rpm.

On airplanes not changed by T.O. 1F-100-664, during descent from any altitude above 25,000 feet where flight has been sustained for 20 minutes, the brake pedals must be moved four full strokes or more every 5 minutes. This pumping must be repeated every five minutes for any portion of flight that is sustained below 25,000 feet.

NOTE In case of loss of utility hydraulic system pressure, these instructions do not apply.

BEFORE LANDING.

During approach to the field, make the following checks:

1. Armament switches—OFF.
2. Sight mechanical caging lever—CAGE.

3. Pitch damper switch—STANDBY.

   The pitch damper system must be in STANDBY for landing.

4. Yaw damper switch—STANDBY.

   The yaw damper system must be in STANDBY for landing.

Caution Make sure pitch and yaw damper switches are at STANDBY during landing to preclude the possibility of a dangerous flight attitude resulting if system failure produces a "hard-over signal" (full extension or retraction of the actuator).

5. Oxygen regulator diluter lever—100% OXYGEN.
6. Fuel quantity—Check.
7. Hydraulic pressures—Check.

   Monitor utility system during approach and landing.

8. Zero-second parachute hook—Attach to parachute "D" ring.

   Parachute hook must be attached to "D" ring before descent below the minimum safe ejection altitude for your particular escape system.

9. Safety belt and shoulder harness—Tightened; shoulder harness inertia reel handle—UNLOCKED (aft).
10. Antiskid switch*— Check ON.
11. Speed brake switch—As desired. (Speed brake in for touchdown.)
12. Throttle—Adjust.

    Position throttle to maintain pattern speed and altitude.

13. Downwind—230 knots IAS.
14. Landing gear handle—DOWN.

    Lower gear and check for a down-and-locked indication.

NOTE When gear is lowered, the pitch and yaw damper caution lights come on. The pitch damper light goes out when the gear is completely down and pressure builds back up; however, the yaw damper light remains on until the switch is held momentarily at STANDBY.

15. Base.

    Reduce IAS 5 to 10 knots above final approach speed.

16. Final approach.

    After rolling out of turn onto final, adjust speed for the landing gross weight and reduce rate of descent to a minimum value. Fly a smooth, flat final. Adjust speed, thrust, and rate of descent as necessary to arrive at touchdown point at desired speed.

LANDING.

NORMAL LANDING.

1. Throttle—IDLE.

   Retard throttle to IDLE during flare or at touchdown.

2. Touchdown.
3. Directional control—Maintain by nose wheel steering.
4. Drag chute handle—Pull.

NORMAL LANDING TECHNIQUE.

Assume that the landing gross weight is 22,500 pounds. (Speeds quoted will vary with gross weight.) Following entry into the pattern, slow the airplane below 230 knots IAS and lower landing gear. Fly the base leg at 190 knots IAS and adjust pattern and thrust to control rate of descent to about 1500 feet per minute. This will require about 83% to 87% rpm. After rolling out of turn onto final, adjust speed to 180 knots IAS for a normal landing gross weight and reduce rate of descent to a minimum value. Fly a smooth, flat final. Adjust speed, thrust, and rate of descent as necessary to arrive at touchdown point at desired speed. Reduce power to idle. Immediately after touchdown, lower the nose wheel to the runway, engage nose wheel steering, deploy the drag chute, and check brakes for operation. The procedures for a normal landing are pictorially shown in figure 2-8. Several items involved in this technique are amplified in the following text.

Smooth, Flat Approach.

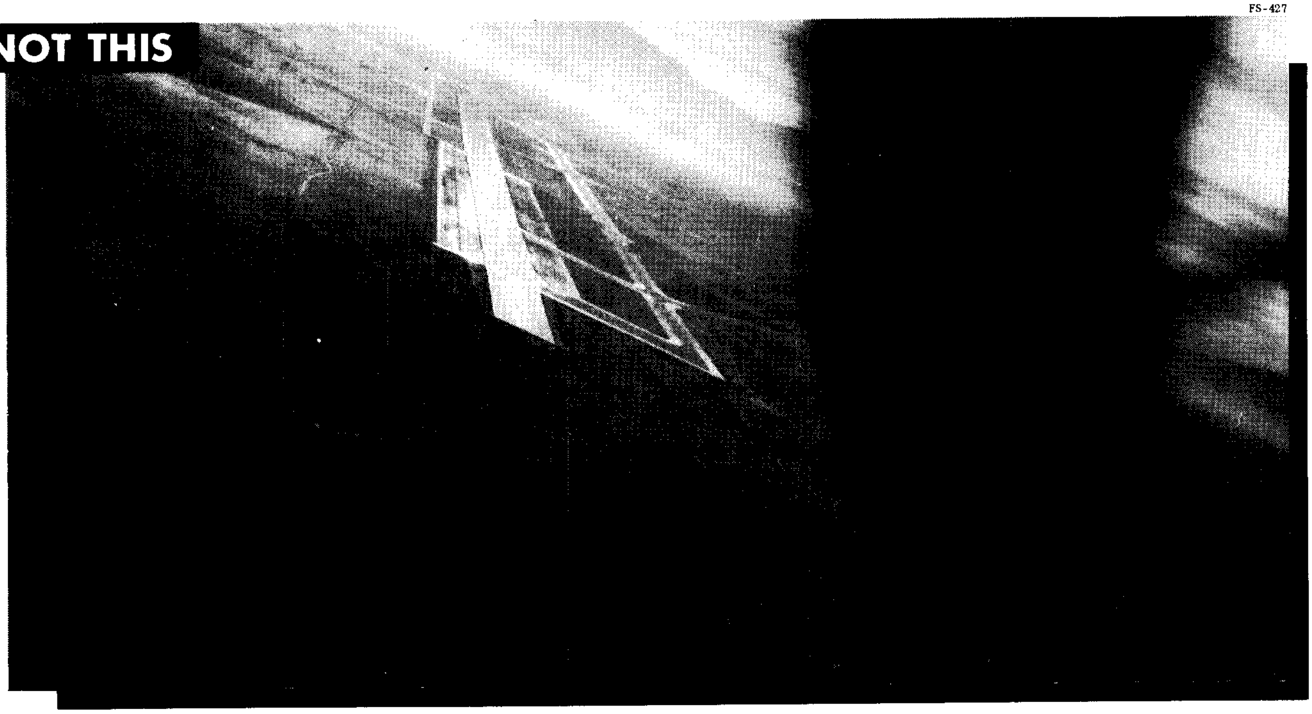
Several factors influence the recommendation for using a smooth, flat approach. First, if an approach is smooth and flat, airspeed control is generally improved. Great emphasis must be given to the use of proper touchdown speeds; thus, airspeed control during approach is important. Second, by using a relatively flat approach, the rate of descent is held to a reasonable value. Relatively low rates of sink, coupled with good speed control, ensure an approach with sufficient speed and power to flare the airplane. Flight tests have shown that the recommended power-on approach speeds are more than sufficient to flare the airplane from a 1000-foot-per-minute rate of sink. Flat approaches also minimize the necessity of demanding excessive airplane rotation to flare and generally make judging the flare easier. If a smooth approach is made, the necessity for abrupt last-minute corrections is minimized. This is an important factor in avoiding "stick stiffening" and illumination of the flight control

LANDING APPROACH

THIS

FS-427

NOT THIS



F-100C-1-00-89

Figure 2-7

system hydraulic pressure caution light. Another obvious advantage of the smooth, flat approach is that because higher power is required, greater flexibility in playing the approach is afforded the pilot. The engine is in its best acceleration range; therefore, rapid engine response is available if it is necessary to correct sink rates or to go around.

Speed Brake Operation.

If the speed brake is used as a speed control during the landing approach (its use is a matter of operational procedure), it must be retracted before touchdown so that the speed brake will be in if a barrier engagement becomes necessary.

Braking Technique.

Be prepared to start braking immediately after touchdown. This eliminates any time lag in decelerating the airplane if the drag chute fails. The brakes should, of course, be used as necessary. Maximum braking is achieved by smoothly applying brake pressure until antiskid cycling is felt and then relaxing pedal pressure slightly. The maximum pressure that does not result in antiskid cycling should then be held until the airplane is stopped. This requires an increase in brake pedal pressure as speed decreases.

Drag Chute Operation.

Drag chutes have been flight-tested at touchdown speeds up to 180 knots without failure; however, operational reliability is greatly increased at lower speeds. Whenever runway conditions permit, slow the airplane to 150 knots IAS before deploying the drag chute. The effects of service usage (i.e., runway abrasion and aft fuselage heat effects) can lower the chute strength to the point where failures may be encountered at speeds below 180 knots. However, with properly inspected chutes, no failures of this type should occur at normal landing speed or if a take-off is aborted. "Snapping" the chute handle out sometimes causes accidental chute jettisoning.

Tail Skid.

Some pilots hesitate to use recommended touchdown speeds for fear of touching the tail skid. The tail skid is installed for the express purpose of protecting the airplane from serious damage in the tail area during normal landing. Occasional contact of the tail skid is to be expected when the airplane is operated in the prescribed manner. However, the tail skid is not expected to protect the airplane from damage during landings which involve excessively high sink rates.

Other Landing Pointers.

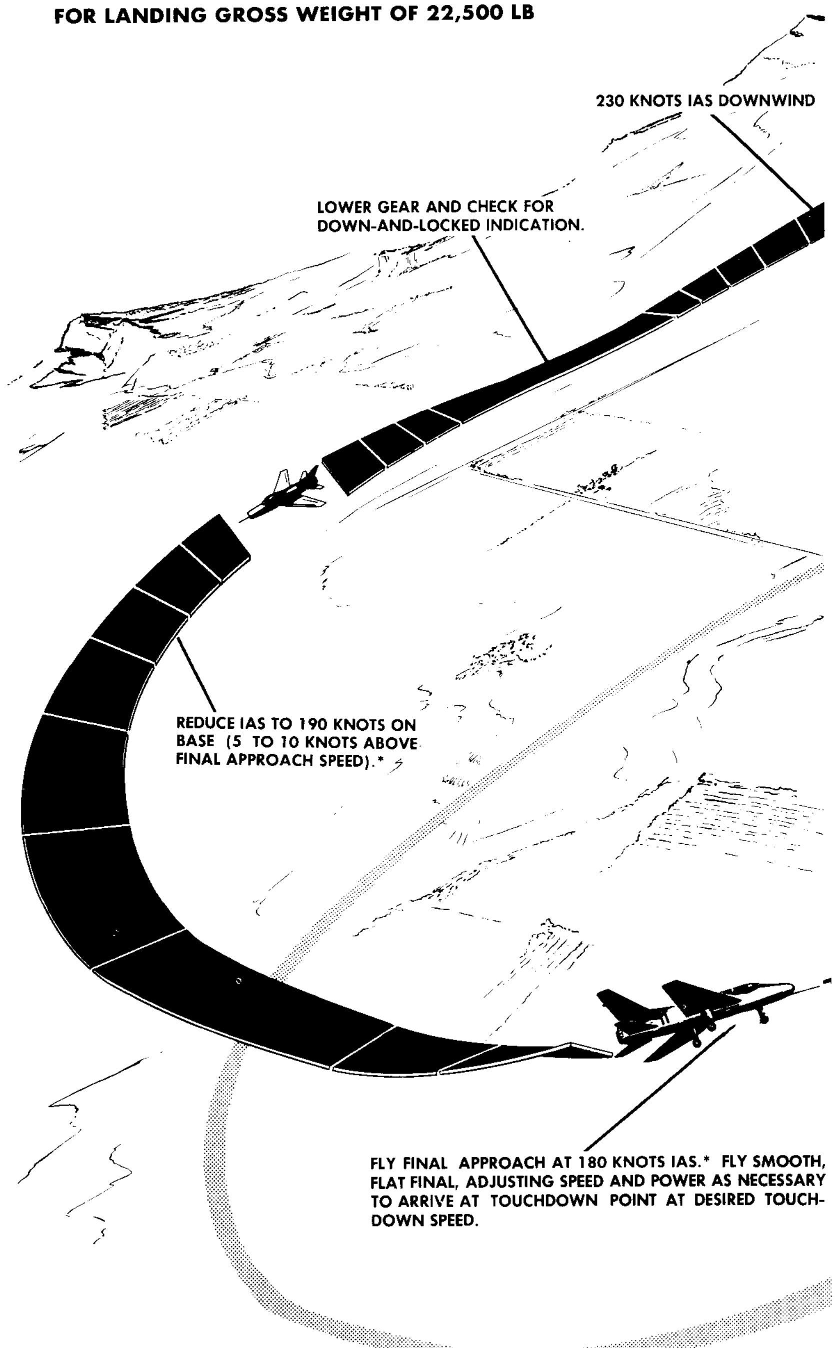
A stick-force lightening occurs about 5 knots IAS below the recommended touchdown speed for the 1 G condition. If stick-force lightening is encountered, normal flying techniques should be used, as the occurrence is not dangerous. Simply continue flying the airplane. Do not under any circumstance "jam" the nose of the airplane down, as this can cause porpoising. Porpoising also can be induced by excessive touchdown speed, excessive rate of descent, misuse of flight controls, or a combination of all three. If touchdown speed is too high, the nose wheel can strike the ground first, bouncing the airplane into a nose-high attitude. If the pilot then pushes forward abruptly, driving the nose gear into the runway again, the entire cycle will be repeated. On landing from an excessive rate of descent, a bounce landing on the main gear can change airplane pitch attitude abruptly and can set off a porpoise. Again, porpoising will not be encountered if the recommended touchdown speeds and techniques are observed. However, if porpoising is encountered, position the stick slightly aft of neutral and *hold it* while simultaneously advancing the throttle to Military Thrust. Attempts to counteract the bounce with opposite control movement should be avoided, as pilot reaction time combined with airplane response to control movement will aggravate the porpoising. Holding a constant control position minimizes the oscillation and allows the airplane to become air-borne again so as to reduce possible damage by further bouncing on the landing gear. After eliminating the porpoising, the pilot must immediately decide whether to maintain Military Thrust and execute a go-around or make a normal landing on the remaining runway. This decision will depend on such conditions as fuel quantity, weather, length and condition of the runway, availability of runway overrun barrier, etc.

Summary.

The smooth, flat approach at the recommended speeds and rates of descent will provide better engine accelerations and go-around characteristics, will ensure an ample speed and power margin for flare, will minimize stick stiffening, and will give the pilot more precise control over his touchdown point and speed. Using the recommended landing procedures, landing distances of less than 4000 feet, and under ideal conditions less than 3000 feet, have been demonstrated. Flight test data shows, however, that an increase in landing speed of 10 knots results in an increased ground roll of 20 to 25 percent. The use of recommended approach and touchdown speeds is based on practical conditions and, if used, will prevent unnecessary tire and brake wear, as well as reduce the number of barrier engagements. Remember: 10 knots too fast at touchdown means an additional 1000 feet of ground roll.

LANDING PATTERN TYPICAL

FOR LANDING GROSS WEIGHT OF 22,500 LB



NOTE

- To avoid stick force lightening, do not exceed a 50-degree bank turn or 1.6 G at recommended pattern speed.
- Do not exceed 1500 feet per minute on final approach. Control rate of descent with power to less than 1000 feet per minute before flare.
- Use caution during the flare in the presence of gusty winds or jet wash. These factors can cause stick force lightening.
- The drag chute may be deployed up to 180 knots IAS; however, operational reliability is greatly increased at lower speeds. When runway conditions permit, slow airplane to 150 knots IAS before drag chute is deployed.
- Yaw can occur immediately after drag chute is deployed. Counteract with rudder, nose wheel steering, and brakes.
- If drag chute fails, additional braking may be needed to stop.
- Avoid taxiing over previously jettisoned drag chutes.

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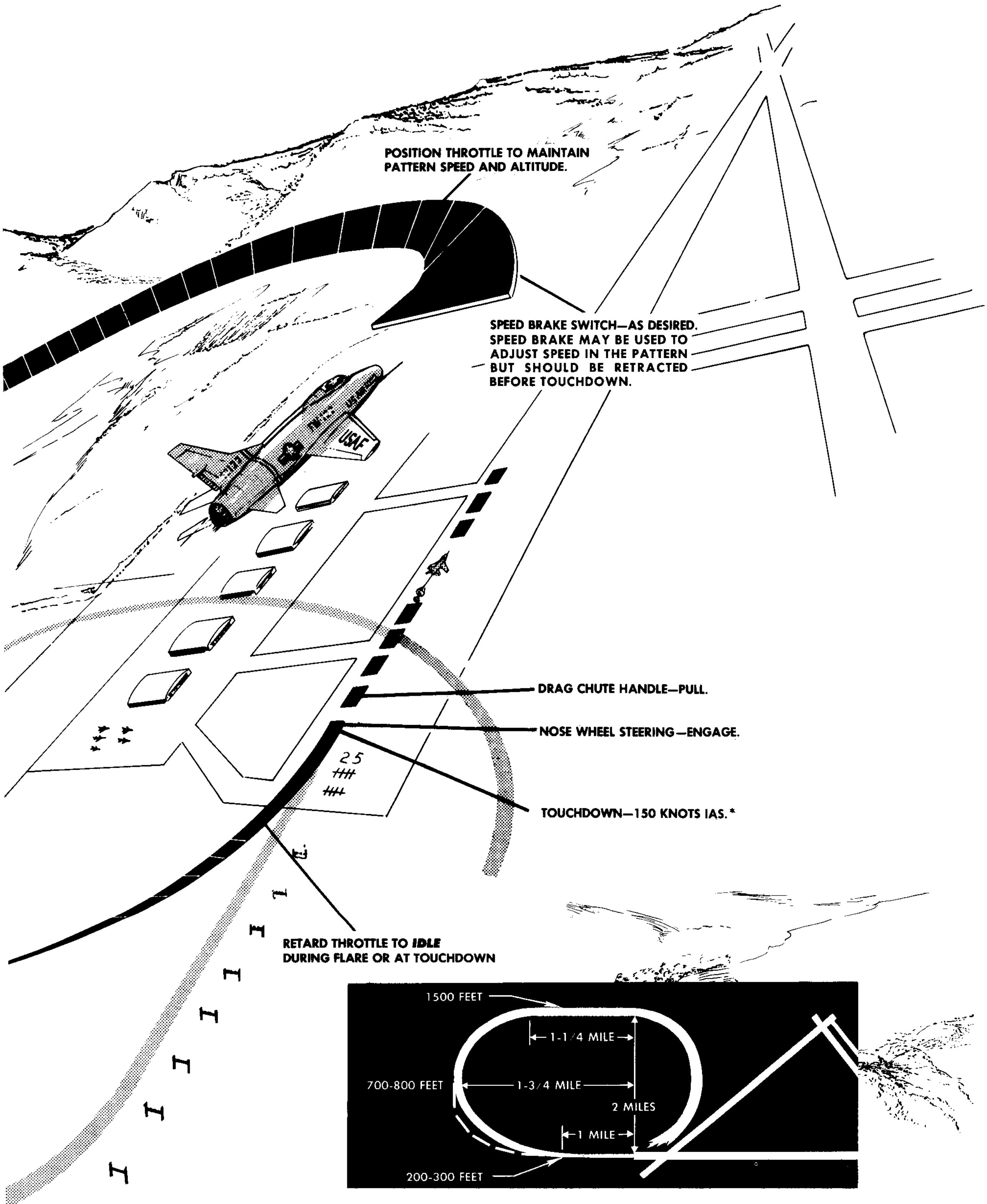
Figure 2-8



***Refer to landing distances chart in Appendix I for final approach and touchdown speeds at other gross weights.**

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LANDING WITHOUT DRAG CHUTE.

If a landing is made without the drag chute, use normal landing technique. Adequate braking will be available on a dry runway to stop the airplane. However, the landing distance will be increased. For landing distance without a drag chute, refer to Appendix I.

HEAVYWEIGHT LANDING.

For heavyweight landings, increase approach and touchdown speeds as listed in Appendix I. Landing distances will be longer, as shown in the landing charts.

MINIMUM-RUN LANDING.

On a minimum-run landing, touch down at the recommended speed for weight and configuration, as near the end of the runway as possible. As soon as main gear touchdown is felt, lower nose wheel, engage nose wheel steering, and deploy drag chute. On airplanes without the antiskid system, pump brakes lightly until deceleration is felt; then apply brakes for a longer period of time. With antiskid system* on, use brakes as required by applying a steady, light force on pedals and increase force slowly as airplane slows down. Do this until the airplane has slowed to 110 knots; then, fairly heavy braking may be used, attempting to remain just short of the brake pressure which causes the antiskid to cycle. This will require an increasing brake pressure as the airplane slows down. If antiskid does cycle, brake pressure should be decreased slightly.

NOTE Cycling of the antiskid can be recognized by slight changes in longitudinal deceleration. No harm is done by the cycling of the antiskid; however, stopping distance will be increased about 10 percent by cycling.

- With antiskid on, if full brakes are held until a complete stop is reached, abrupt pitching of the airplane may be encountered just before stopping. When pitching occurs, decrease pedal pressure.

SLIPPERY-RUNWAY LANDING.

On a slippery runway (wet or icy), braking effectiveness varies greatly. The condition of the runway (degree of slipperiness) must be determined by ground personnel, and the pilot must be advised accordingly so that the proper technique can be used. On rough ice or wet rough surface normal landing techniques will result in a braking coefficient which is more effective than aerodynamic braking. On smooth ice or a wet smooth surface, however, aerodynamic braking is more effective in reducing landing roll, as the braking coefficient on this type of surface is poor. In either case, use of the drag chute and antiskid braking is imperative. If the drag chute fails, raising the nose of the airplane will increase aerodynamic braking somewhat; however, care should be taken not to become air-borne again at the higher speeds. As speed is reduced, in either case after the nose wheel touches, attempt to obtain braking with the wheel brakes. Rudder may be used for directional control, and it will be effective on a slippery runway down to about 60 knots IAS. Make every effort to remain on the runway in case a barrier engagement becomes necessary.

Caution On wet or icy runways, brakes and nose wheel steering are relatively ineffective. Therefore, use of the drag chute is necessary for faster deceleration.

LANDING WITH ASYMMETRICAL LOADS.

Refer to "Flight With External Loads" in Section VI.

LANDING IN TURBULENCE OR JET WASH.

For landing in turbulence or jet wash, approach and touchdown speeds should be increased slightly to provide additional control margin.

CROSS-WIND LANDING.

In addition to the procedures used for a normal landing, the following steps should be accomplished: On final approach, crab or drop wing to keep lined up with runway. However, if crabbing, the airplane must be aligned with the runway just before touchdown. At touchdown, lower nose wheel to runway as soon as possible.

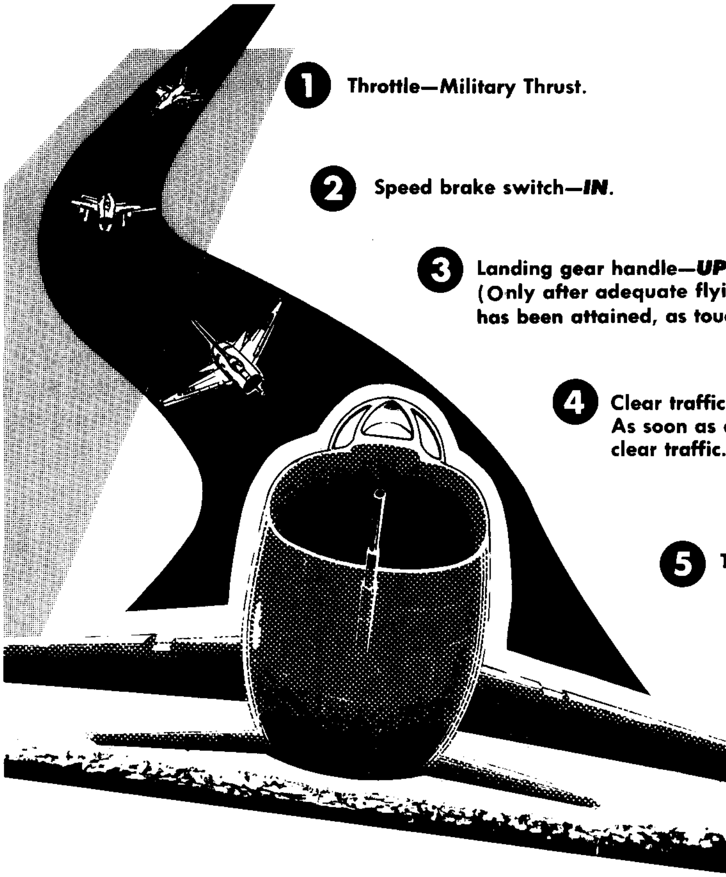
NOTE Approach and touchdown speeds should be increased with increase in cross-wind velocity. Touchdown speed should be increased about 5 knots for every 10 knots of direct cross-wind component.

Deploy drag chute only after nose wheels touch down and nose wheel steering is engaged. Because of the weather-cocking tendencies of the airplane with the drag chute deployed, care must be taken to ensure that nose wheel steering is engaged and operating before the drag chute is deployed on a cross-wind landing. However, if adverse yaw is encountered to the point that directional control is lost, the drag chute should be jettisoned and directional control should be maintained with nose wheel steering and brakes.

Caution If rudder pedals are displaced from neutral, and nose wheels are centered when nose wheel steering button is

*Some airplanes

GO-AROUND



1. Throttle—Military Thrust.
2. Speed brake switch—*IN*.
3. Landing gear handle—*UP*. (Only after adequate flying speed has been attained, as touchdown may be necessary).
4. Clear traffic. As soon as adequate airspeed has been attained, clear traffic.
5. Throttle— Adjust to obtain required thrust.

WARNING

- If operating on emergency fuel control system, advance throttle cautiously to prevent engine overspeed or compressor stall.
- Make decision to go around as soon as possible. Go-around should not be attempted if drag chute has been deployed.
- On normal go-around, Military Thrust will provide sufficient power. However, if the weight and/or external load configuration warrants, afterburner may be used.
- If afterburner is selected during go-around and light is not received, considerably less than Military Thrust will be available. Return throttle inboard immediately to close afterburner nozzle and regain Military Thrust.

NOTE

During go-around in Military Thrust, approximately 250 pounds of fuel will be required. If afterburner is used, approximately 300 pounds of fuel will be required.

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Figure 2-9

pressed to engage steering, nose wheel assembly may or may not align with the pedals.

- Jettison drag chute when taxiing in cross winds greater than 15 knots, to prevent collapsing and dragging chute where exhaust may burn the shroud lines.

TOUCH-AND-GO LANDING.

Touch-and-go landings may be practiced when authorized using the procedures outlined for a normal landing followed by a go-around. Care must be used during touch-and-go landings, as a significant element of danger exists because of the procedure which must be performed on the runway or in close proximity to the ground.

NOTE Touch-and-go landing should not be practiced with less than 1000 pounds of fuel reserve.

For touch-and-go landings, proceed as follows:

1. Normal touchdown.
2. Throttle—MILITARY.
3. Trim.
   Trim airplane for approximate take-off attitude with the stick grip trim switch.
4. Nose wheel—Lift off.
   At about 15 knots below take-off speed, apply back pressure to stick and establish take-off attitude.
5. Take-off attitude—Hold.
   Maintain take-off attitude after breaking ground. The airplane assumes a more normal attitude as the speed increases.
6. Landing gear handle—UP.

GO-AROUND.

For making a go-around, see figure 2-9 for complete procedure.

AFTER LANDING.

1. Antiskid switch*—OFF.

   Before entering parking area, place antiskid switch OFF.

2. Canopy switch—OPEN.

Caution If the canopy is opened during taxiing, do not exceed canopy-open limit speed of 50 knots, to prevent possible damage to the canopy or canopy operating mechanism.

- During taxiing, when the canopy is open, the canopy should not be set within 6 inches of either full open or full close position, to prevent possible damage to the canopy mechanism and/or canopy seal as a result of bouncing. During taxiing, when the canopy is closed, the canopy must be in the full closed and locked position to prevent possible damage to the canopy seal.

3. Drag chute—Jettison (on taxiway).

   To obtain the best drag chute service life, it is recommended that the drag chute be jettisoned immediately after taxiing off the runway onto the taxiway at the lowest possible taxi speed with the drag chute still inflated.

Caution Do not stop during taxiing, or the nylon riser will be severely damaged by exhaust heat. Use extreme care when taxiing for long distances with drag chute deployed, to prevent it from dragging on the ground or touching the hot exhaust nozzle area.

4. Parking area.

   After parking the airplane but before shutdown, perform a postflight check with the crew chief, if required.

NOTE T.O. 1F-100C-6 requires the crew chief to perform certain airplane checks while the engine is operating.

ENGINE SHUTDOWN.

The engine should be operated for about 5 minutes at reduced power (85% rpm or below) before shutdown, to stabilize engine temperatures. Operation during approach and taxi can be considered as reduced power time. At parking area, proceed as follows:

1. Wheel brakes—On.

1A. Throttle—70% rpm for 30 seconds.

   A scavenging run just before shutdown is necessary to ensure that oil in the sumps has been returned to the oil tank.

2. Speed brake switch—OUT.

3. Throttle—OFF.

   Make sure throttle is moved fully aft and then inboard to OFF.

4. Engine master switch—OFF.

Caution To prevent damage to the fuel system, make sure throttle is at OFF before moving engine master switch to OFF.

5. Battery switch—OFF.

NOTE The engine master switch must be turned off before the battery switch, so that power is available to close the fuel shutoff valve.

- Check that engine decelerates freely, and listen for any unusual engine noises during shutdown.

6. Control stick—Rotate.

   Immediately after engine has stopped turning, rotate stick to bleed off flight control hydraulic system pressure.

7. Landing gear doors—Open.

   Pull landing gear emergency lowering handle to open landing gear wheel well doors.

Warning Make sure ground personnel are clear of door area before pulling emergency lowering handle.

RAM-AIR TURBINE AUTOMATIC STARTING SYSTEM TEST.

An operational check of the automatic starting feature of the ram-air turbine-driven flight control emergency hydraulic pump should be made as follows during engine shutdown on the last flight of the day.

1. Ram-air turbine test button—Pressed (by ground crew).

   Have ground crew member hold ram-air turbine test button in. (The button is flush-mounted on the left side of the fuselage, above the wing.)

NOTE When engine speed drops to about 46% to 34% rpm, the ram-air turbine doors open and the pump starts. The emergency pump level in the cockpit moves forward automatically to its ON position.

2. Signal ground crew to release test button.
3. Flight control emergency hydraulic pump lever—OFF.

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*Some airplanes

NOTE The emergency pump automatic starting circuit is inoperative on F-100C-1 Airplanes; therefore, the preceding test cannot be performed on these airplanes.

BEFORE LEAVING AIRPLANE.

Make the following checks before leaving airplane:

1. Electrical switches—OFF.
   All electrical switches OFF, except generator switch.
2. Seat handgrips—Check.
   Make sure seat handgrips are full down and latched, by applying a moderate downward force on each handgrip.
3. Safety pins—Installed.
   The safety pin is installed through the right handgrip of the ejection seat, and in the canopy alternate emergency jettison handle.*

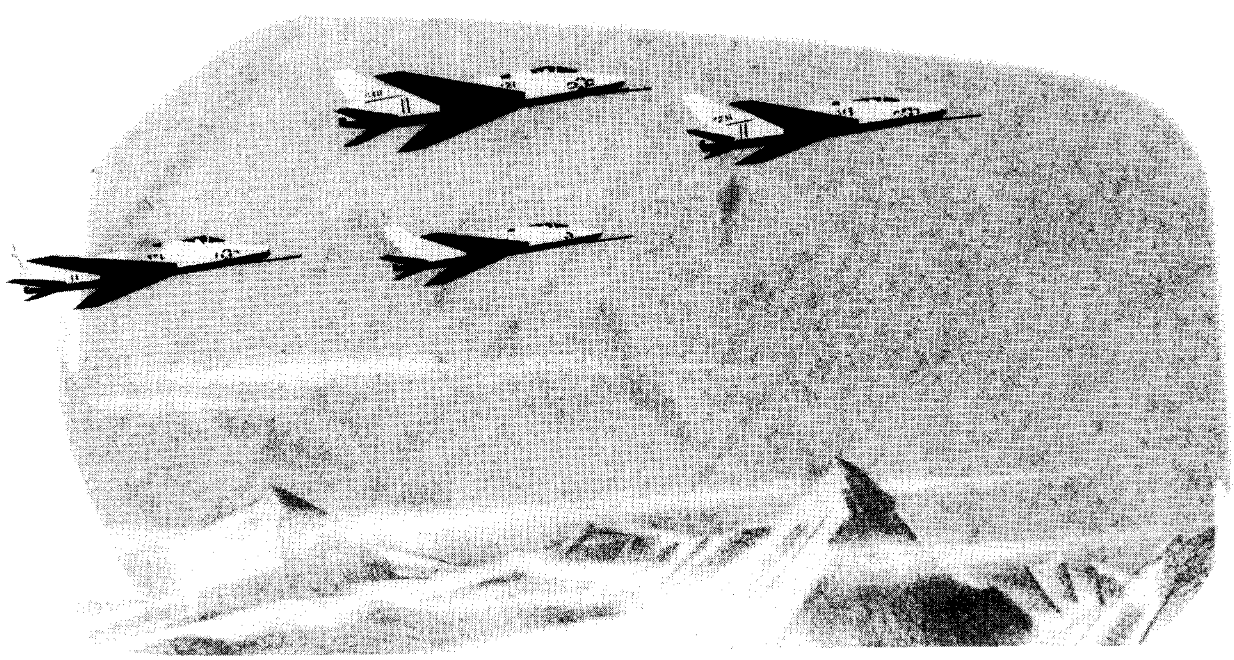
*Some airplanes

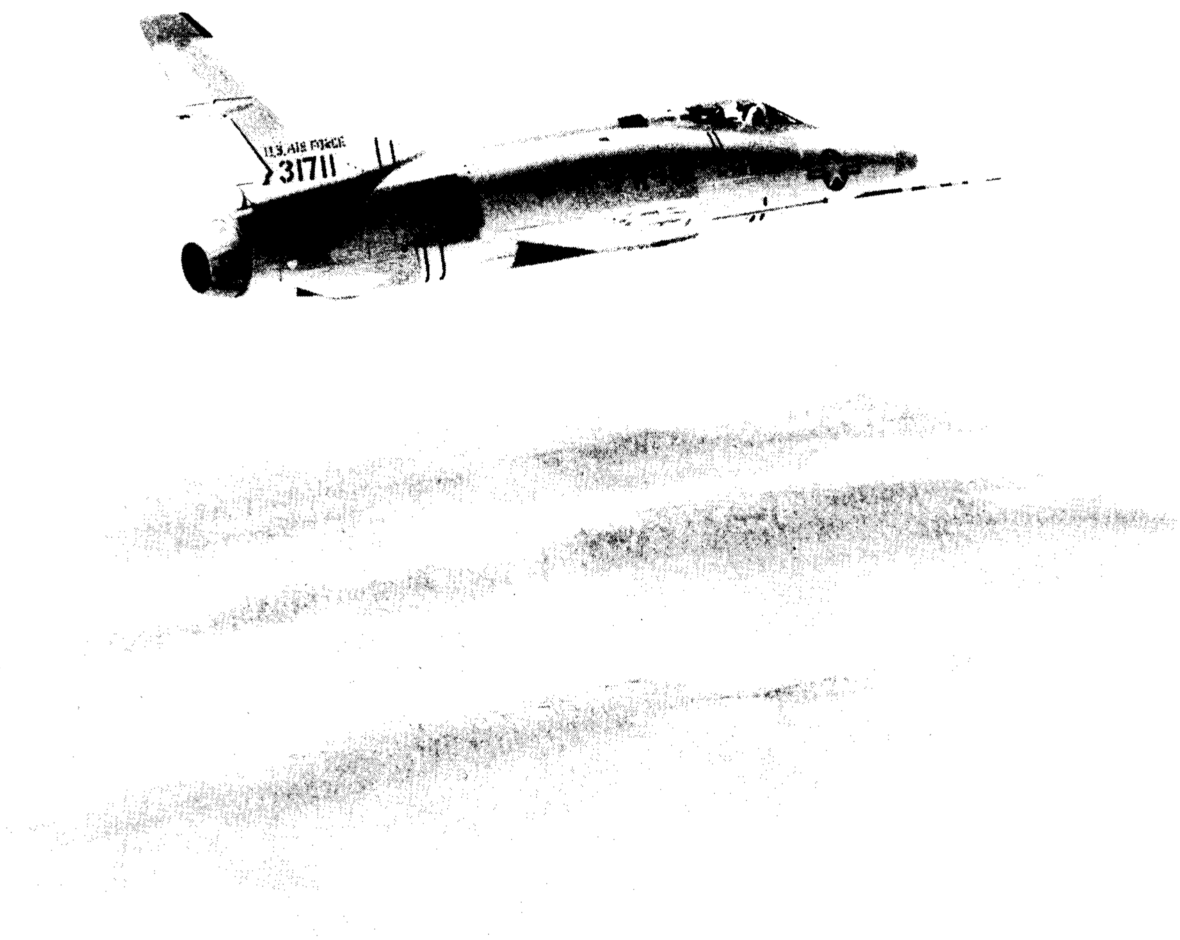
4. Drop tank fuel selector switch—OFF.
5. Wheel chocks and landing gear ground safety locks—In place.
6. Form 781—Complete.

Caution Make appropriate entries in Form 781 covering any limits in the Flight Manual that have been exceeded during the flight. Entries *must* also be made if the airplane has been operated in rain for extended periods of time, if any engine compressor stalls were encountered, or when, in the pilot's judgment, the airplane has been exposed to unusual or excessive operations such as hard landings, excessive braking action during aborted takeoffs, long and fast landings, long taxi runs at high speeds, etc.

ABBREVIATED CHECK LIST.

Refer to pages 2-29 through 2-44 for the abbreviated check list.





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CUT ON SOLID LINE

NORMAL PROCEDURES

F-100C ABBREVIATED CHECK LIST

NOTE

The following check list is an abbreviated version of the procedures presented in Section II. This abbreviated check list is arranged so that you may remove it from your Flight Manual and insert it into a flip pad for convenient use. It is arranged so that each action is in sequence with the expanded procedure given in Section II. Presentation of the abbreviated check list does not imply that you need not read and thoroughly understand the expanded version. To fly the airplane safely and efficiently, you *must* know the reason why each step is performed and why the steps occur in a certain sequence.

T.O. 1F-100C-1
7 AUGUST 1959
Changed 22 April 1960

1

CUT ON SOLID LINE

PREFLIGHT CHECK.

BEFORE EXTERIOR INSPECTION.

1. Form 781—Check.
2. Personal equipment—Check.

EXTERIOR INSPECTION.

1. Nose Wheel Well:

Nose gear emer valve reset rod.
Nose gear accumulator pressure.
Brake accumulator pressure.
Antiskid accumulator pressure.
Nose wheel tires for condition, slippage, and inflation.
Nose wheel steering pulley and cable.
Nose gear torque links connected; pivot pin safetied.
Nose wheel chock removed.
Nose gear door uplocks and microswitch.

2. Forward Fuselage:

Pitot boom secure; locks extended; cover removed.
Intake clear; plug removed.
Gun port plugs.
Oxygen filler door.

3. Right Wing:

Air refueling probe.
Slats and rollers.
Main wheel brake, loose or broken drive keys, broken hyd lines.
Main wheel tire for condition, slippage, and inflation.
Main gear door uplocks, and microswitch.
Main gear ground safety locks.
Pip pin in.
Main gear wheel well.
Antiskid sensing unit.
External load installation and mounting; ground safety lock.

4. Right Wing:

Wing tip and position light.
Ailerons.

T.O. 1F-100C-1
7 August 1959

2

CUT ON SOLID LINE

NORMAL PROCEDURES

F-100C ABBREVIATED CHECK LIST

NOTE

The following check list is an abbreviated version of the procedures presented in Section II. This abbreviated check list is arranged so that you may remove it from your Flight Manual and insert it into a flip pad for convenient use. It is arranged so that each action is in sequence with the expanded procedure given in Section II. Presentation of the abbreviated check list does not imply that you need not read and thoroughly understand the expanded version. To fly the airplane safely and efficiently, you *must* know the reason why each step is performed and why the steps occur in a certain sequence.

CUT ON SOLID LINE

PREFLIGHT CHECK.

BEFORE EXTERIOR INSPECTION.

1. Form 781—Check.
2. Personal equipment—Check.

EXTERIOR INSPECTION.

1. Nose Wheel Well:

Nose gear emer valve reset rod.
Nose gear accumulator pressure.
Brake accumulator pressure.
Antiskid accumulator pressure.
Nose wheel tires for condition, slippage, and inflation.
Nose wheel steering pulley and cable.
Nose gear torque links connected; pivot pin safetied.
Nose wheel chock removed.
Nose gear door uplocks and microswitch.

2. Forward Fuselage:

Pitot boom secure; locks extended; cover removed.
Intake clear; plug removed.
Gun port plugs.
Oxygen filler door.

3. Right Wing:

Air refueling probe.
Slats and rollers.
Main wheel brake, loose or broken drive keys, broken hyd lines.
Main wheel tire for condition, slippage, and inflation.
Main gear door uplocks, and microswitch.
Main gear ground safety locks.
Pip pin in.
Main gear wheel well.
Antiskid sensing unit.
External load installation and mounting; ground safety lock.

4. Right Wing:

Wing tip and position light.
Ailerons.

CUT ON SOLID LINE

5. Empennage and Aft Fuselage:

Cracks in titanium.
Horizontal stabilizer, rudder, and position lights.
Tail cone and exhaust nozzle.
Iris nozzle seal fingers.
Turbine area.
Drag chute.
Tail skid.
Afterburner.
Yaw damper accumulator pressure.
Purging system pressure.
Single-point refueling door.

6. Left Wing:

Ailerons.
Wing tip and position light.

7. Left Wing:

Speed brake ground safety lock.
External load installation and mounting; ground safety lock.
Antiskid sensing unit.
Main gear wheel well.
Pip pin in.
Main gear ground safety locks.
Main gear door uplocks and microswitch.
Main wheel tire for condition, slippage, and inflation.
Main wheel brake, loose or broken drive keys, broken hyd lines.
Slats and rollers.

8. Top Fuselage:

Utility hyd reservoir.
Flight control hyd accumulator pressures.
Flight control hyd compensating reservoirs.
Ram-air turbine door accumulator pressure.
Fuel boost and transfer pump.
Afterburner circuit breaker.
Battery compartment circuit breakers.

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7 August 1959

3

CUT ON SOLID LINE

EJECTION SEAT AND CANOPY CHECK.

1. Handgrips and triggers—Check.
2. Safety pins—Check.
3. Seat disconnects—Check.
4. Tubing and hose—Check.
5. Canopy external release—Check.

INTERIOR CHECK (ALL FLIGHTS).

1. Electrical power—OFF.
2. Safety belt and shoulder harness—Secure and tight.
3. Zero-second chute hook—Attach.
4. Survival equip., vent. suit,* G suit—Connect.
5. Rudder pedals—Adjust.
6. Wheel brake pump*—Check.
7. Left circuit breakers—IN.
8. Speed brake dump—OFF.
9. Pylon selectors—Check.
10. G suit pressure—As desired.
11. Strike camera—As desired.
12. Camera shutter—OFF.
13. Bomb release selector*—MANUAL.
14. Bomb mode selector*—OFF.
15. Armament selector—OFF.
16. Bomb arming—SAFE.
17. Sight selector—As desired.
18. Ground gunfire switch—SAFE.
19. Throttle friction—As desired.
20. Throttle—OFF.
21. Speed brake switch—OFF.
22. UHF—OFF.
23. Pitch damper—STANDBY.
24. Yaw damper—STANDBY.
25. Antiskid*—OFF.
26. Rudder test—NORM.
27. Flight control test—NORM.
28. Fuel purge switch*—OFF.
29. Drop tank fuel—As required.
30. Fuel regulator—NORM.
31. Master switch—OFF.
32. Air start switch—OFF.

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33. Oil cooler*—AUTO.
34. Engine guide vane anti-ice—AUTO (OFF*).
35. Air refueling—OFF.
36. Gear—DOWN.
37. Landing and taxi lights—OFF.
38. Drag chute handle—IN.
39. A-4 sight—CAGE.
40. LABS control—OFF.
41. Directional ind slaving cutout—OUT.
42. Trigger safety—OFF* (CAMERA*).
43. Hyd gage—UTILITY.
44. Airspeed & Mach indicator—Check and set.
45. Accelerometer—Reset.
46. Altimeter—Set.
47. Clock—Set.
48. External load jett handle—IN.
49. Spec. store jett handle—IN.
50. Gear emer handle—IN.
51. Canopy alternate jett*—IN.
52. Generator—ON.
53. Power inverter—ON.
54. Inst inverter—1 or 2.
55. Sec bus tie-in—NORM.
56. Oxygen—ON.
57. Radio compass—OFF.
58. IFF—OFF.
59. SIF controls*—As required.
60. TACAN*—OFF.
61. Face mask antifrost—OFF.
62. Cockpit temp rheostat—As desired.
63. Cockpit pressure—As desired.
64. Pitot heat—ON.

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65. Windshield anti-ice—OFF.
66. Console air—INCREASE.
67. Defrost—INCREASE.
68. Cockpit temp master—AUTO.
69. Right circuit breakers—IN.
70. Map case—Check.
71. Flight control emer pump—OFF.
72. Stick grip—Check.
73. Battery switch—ON.
74. Caution and warning lights—Check ON.
75. Seat—Adjust.
76. Fire warning lights—Test.
77. Fuel quantity—Check.
78. Thunderstorm lights—As desired.
79. Instrument lights—As desired.
80. Console lights—As desired.
81. Position lights—As desired.
82. Indicator, caution, and warning lights—Test.
83. Indicator light dimmer—As desired.
84. Stand-by compass light—As desired.
85. Refueling probe light*—OFF.

STARTING ENGINE.

1. External air—Connected.
2. Master switch—ON.
3. Starter and ignition—Press.
4. Throttle—IDLE at 12% to 16% rpm.
5. Exhaust temp—Check.
6. 40% to 50% rpm—External air power reduce and disconnect; ac and dc external power disconnect.
7. 55% to 60% rpm—Engine instruments stabilized.
8. Engine instruments—Check.

CLEARING ENGINE.

1. Battery switch—ON.
2. External air—Connected.
3. Throttle—OFF.
4. Master switch—ON.
5. Starter and ignition—Press (motor engine above 12% for 30 seconds.)
6. Starter and ignition stop—Press.

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CUT ON SOLID LINE

GROUND OPERATION.

FLIGHT CONTROL HYDRAULIC SYSTEM CHECK.

1. Flight control servicing—Checked (ground crew).
2. Trim airplane for take-off.
3. Hydraulic gage—FLIGHT CONTROL 1.
4. Hydraulic gage—FLIGHT CONTROL 2.

AIR START SYSTEM CHECK.

1. Air start—ON.
2. Ignition-on light—Check ON.
3. Gen caution light—Check ON.
4. Loadmeter—Zero.
5. Air start—OFF.

UTILITY HYDRAULIC SYSTEM CHECK.

1. Hydraulic gage—UTILITY.
2. Wheel brakes—Check.
3. Nose wheel steering button—Press and move rudder pedals.
4. Speed brake switch—Cycle; then move to IN.

RUDDER HYDRAULIC SYSTEM CHECK.

1. Hyd gage—FLIGHT CONTROL 1. Move pedals through full travel.
2. Hyd gage—ALT. RUD.
3. Rudder test switch—ALT. RUD. TEST.
4. Hyd gage—UTILITY.

TRIM SYSTEM CHECK.

1. Trim operation—Check.
2. Trim for take-off—Check.

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OPERATIONAL CHECKS.

1. Personal equipment—Attach and check.
2. UHF—ON.
3. Flight instruments—Check.
4. Radio navigation aids—Check.
5. IFF—ON.
6. Oxygen system—Check.

BEFORE TAXIING.

1. Nose gear safety lock—Have removed.
2. Safety pins—Remove.
3. Emer fuel sys—Check.
4. Oxygen—100%.
5. Engine pressure gage—Set.
6. Chocks—Removed.
7. Altimeter—Set.

TAXIING.

1. Canopy—As desired.
2. Nose wheel steering—Engage.
3. Taxi lowest rpm.
4. Flight inst—Check.
5. Antiskid*—ON.

BEFORE TAKE-OFF.

PREFLIGHT AIRPLANE CHECK.

1. Flight controls—Check.
2. Hyd gage—UTILITY.
3. Speed brake switch—IN, then OFF.
4. Canopy—Closed.
5. Yaw and pitch dampers—STANDBY.
6. Take-off trim—Check.
7. Take-off position and hold.

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CUT ON SOLID LINE

ENGINE PRESSURE RATIO GAGE SETTING

OUTSIDE AIR TEMPERATURE °F	°C	TAKE-OFF SETTING
122	50	1.86
118	48	1.87
115	46	1.88
111	44	1.89
107	42	1.90
104	40	1.91
100	38	1.92
97	36	1.93
93	34	1.94
90	32	1.95
86	30	1.97
82	28	1.98
79	26	1.99
75	24	2.00
72	22	2.02
68	20	2.03
64	18	2.04
61	16	2.05
57	14	2.07
54	12	2.08
50	10	2.09
46	8	2.10
43	6	2.12
39	4	2.13
36	2	2.14
32	0	2.15
28	−2	2.17
25	−4	2.18
21	−6	2.19
18	−8	2.21
14	−10	2.22
10	−12	2.23
7	−14	2.25
3	−16	2.26
0	−18	2.28
−4	−20	2.29
−8	−22	2.30
−11	−24	2.32
−15	−26	2.33
−18	−28	2.35
−22	−30	2.36
−26	−32	2.37
−29	−34	2.38
−33	−36	2.39
−36	−38	2.41
−40	−40	2.42

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CUT ON SOLID LINE

PREFLIGHT ENGINE CHECK.

1. Engine instruments—Check.
   a. Tach—55% to 60%.
   b. Exhaust temperature—200°C to 340°C.
   c. Oil pressure—35 psi minimum.
2. Throttle—MILITARY.
3. Heat and vent—As desired.
4. Engine pressure gage—Check.
5. Engine instruments—Check.

TAKE-OFF.

NORMAL TAKE-OFF.

1. Throttle—MILITARY.
2. Brakes—Release.
3. Throttle—AFTERBURNER.
4. Engine pressure gage—Check.
5. Nose wheel—Lift off.
6. Take-off attitude—Hold.

AFTER TAKE-OFF—CLIMB.

1. Gear—UP.
2. Landing and taxi lights—OFF.
3. Climb—Establish.
4. Zero-second chute hook—Detach.
5. Throttle—Inboard.
6. Pitch damper*—ON.
7. Yaw damper—ON.
8. Throttle—Adjust.
9. Oxygen—NORMAL OXYGEN.
10. Drop tanks—As required.

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CUT ON SOLID LINE

TAKE-OFF DATA

CONDITIONS

Runway air temp .... °F Runway length .... ft
Field press. alt .... ft Gross weight .... lb
Surface wind .... knots

TAKE-OFF

bar press. temp

Engine diff press. gage settings .... in. Hg .... °C
Engine press. ratio gage setting ....
Acceleration check .... knots IAS at .... ft
Refusal speed .... knots IAS at .... ft
Nose wheel lift-off .... knots IAS
Take-off speed .... knots IAS at .... ft

Is runway length sufficient for Military
Thrust take-off with afterburner failure? ....

Distance to clear 50 ft obstacle .... ft
Min control speed (at Military Thrust) .... knots IAS
Initial climb speed .... knots IAS

LANDING IMMEDIATELY AFTER TAKE-OFF

Final approach speed .... knots IAS
Touchdown speed .... knots IAS
Ground roll distance .... ft
Ground roll distance (no speed brake—no drag chute) .... ft

Barrier configuration (no external load—speed brake up)

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CUT ON SOLID LINE

LANDING DATA

CONDITIONS

Outside air temp..........°F

Runway length..........ft

Field press. alt..........ft

Gross weight..........lb

Surface wind..........knots

LANDING

Final approach speed..........knots IAS

Touchdown speed..........knots IAS

Ground roll distance..........ft

Total distance to clear 50 ft obstacle..........ft

Ground roll distance (no speed brake—no drag chute)..........ft

Total distance to clear 50 ft obstacle (no speed brake / no drag chute)..........ft

Barrier configuration (no external load—speed brake up)

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CUT ON SOLID LINE

BEFORE LANDING.

1. Armament switches—OFF.
2. Sight—CAGE.
3. Pitch damper—STANDBY.
4. Yaw damper—STANDBY.
5. Oxygen—100% OXYGEN.
6. Fuel—Check.
7. Hyd pressures—Check.
8. Zero-second chute hook—Attach.
9. Safety belt and shoulder harness—Check.
10. Antiskid*—ON.
11. Speed brake—As desired.
12. Throttle—Adjust.
13. Downwind—230 knots IAS.
14. Gear—DOWN.
15. Base.
16. Final approach.

LANDING.

NORMAL LANDING.

1. Throttle—IDLE.
2. Touchdown.
3. Directional control—Maintain by nose wheel steering.
4. Drag chute—Deploy.

TOUCH-AND-GO LANDING.

1. Normal touchdown.
2. Throttle—MILITARY.
3. Trim.
4. Nose wheel—Lift off.
5. Take-off attitude—Hold.
6. Gear—UP.

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CUT ON SOLID LINE

GO-AROUND.

1. Throttle—MILITARY.
2. Speed brake—IN.
3. Gear—UP.
4. Clear traffic.
5. Throttle—Adjust.

AFTER LANDING.

1. Antiskid*—OFF.
2. Canopy—OPEN.
3. Drag chute—Jettison (on taxiway).
4. Parking area.

ENGINE SHUTDOWN.

1. Brakes—ON.
1A. Throttle—70% rpm for 30 seconds.
2. Speed brake—OUT.
3. Throttle—OFF.
4. Master switch—OFF.
5. Battery switch—OFF.
6. Stick—Rotate.
7. Gear doors—Open.

RAM-AIR TURBINE AUTOMATIC STARTING SYSTEM TEST.

1. Ram-air turbine test button—Pressed (by ground crew).
2. Signal to release button.
3. Flight control emer pump—OFF.

BEFORE LEAVING AIRPLANE.

1. Switches—OFF.
2. Handgrips—Check.
3. Safety pins—Installed.
4. Drop tanks—OFF.
5. Chocks and gear safety locks—In place.
6. Form 781—Complete.

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*Some airplanes

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Changed 22 April 1960 **12**

Section III

Emergency Procedures

TABLE OF CONTENTS

ENGINE FAILURE.

Failures of jet engines are, as a rule, the result of improper fuel scheduling, caused by a malfunction of the fuel control system or incorrect operating techniques during certain critical flight conditions. Specific information on this type of failure is given in "Engine Fuel System Failure" in this section. Engine instruments often provide advance warning of fuel control system failure before the engine actually flames out. If engine failure is due to a malfunction of the fuel control system or improper operating technique, an air start can usually be made to restore engine operation, provided time and altitude permit. When a frozen engine is suspected because of zero rpm indication but no obvious mechanical failure has occurred, normal utility hydraulic pressure and engine oil pressure will indicate the engine is rotating and the accessory drive is operating, and an air start should be attempted. If there is no indication of utility pressure or of oil pressure, an air start probably cannot be accomplished, but if altitude permits, an air start could be attempted. In case of obvious mechanical failure within the engine, air starts should not be attempted.

NOTE In any emergency which may require quick aid or rescue, a radio call on a guarded frequency may save very important time.

ENGINE FAILURE DURING TAKE-OFF RUN.

If engine failure occurs before the airplane is air-borne or immediately after it is air-borne, and there is insufficient runway to stop, do as much of the abort procedure as possible. Refer to "Take-off and Landing Emergencies" in this section.

ENGINE FAILURE DURING TAKE-OFF (AIRPLANE AIR-BORNE).

If engine failure occurs on take-off after airplane is air-borne, do as much of the following as time permits:

1. Air start switch—ON.
   Move air start switch to ON to provide ignition in an attempt to catch the fire.
2. Fuel regulator selector switch—EMER.
   This should be done before engine rpm drops 10%. If this cannot be done, or if engine fails to respond, proceed to step 3.
3. Throttle—OFF.
4. External load—Jettison (if necessary).

NOTE Retain *empty* drop tanks to cushion landing shock and minimize airplane damage.

5. Landing gear handle—DOWN.
   If landing gear has been retracted, move landing gear handle DOWN.
6. Flight control emergency hydraulic pump lever—ON.
7. Canopy—Jettison.
8. Shoulder harness inertia reel lock handle—LOCKED (forward).
9. Engine master switch—OFF.

Caution Move engine master switch to OFF while battery switch is still ON, so that power is available to close fuel shutoff valve.

10. Generator switch—OFF.
11. Battery switch—OFF.
12. Land straight ahead.
    Change course only enough to miss obstacles.
13. Drag chute handle—Pull.
    Deploy drag chute as soon as airplane touches down.

ENGINE FAILURE DURING FLIGHT.

If engine failure occurs during flight, follow this procedure:

1. Air start switch—ON.
   Move air start switch to ON to provide ignition in an attempt to catch the fire.
2. Fuel regulator selector switch—EMER.
   Adjust throttle setting to match actual engine rpm as closely as possible. Do not make transfer at or near full throttle, because the emergency fuel flow may exceed engine requirements and produce compressor stall or engine overtemperature. This should be done first, in an attempt to restore engine operation unless an obvious mechanical failure has occurred, which emergency fuel flow might further aggravate or fail to correct. If the emergency fuel control system fails to restore engine operation, proceed to step 3.

Caution If the throttle setting and actual engine rpm are seriously mismatched, flame-out, compressor stall, or overtemperature may occur during transfer to the emergency fuel control system. Be prepared to reduce or advance power immediately, as required.

3. Throttle—OFF.
4. Flight control emergency hydraulic pump lever—ON.
   The emergency pump must be started to power flight control system No. 1 if the engine is frozen. If the engine is windmilling, the engine-driven pump output is sufficient for control during air start procedures. If an emergency landing is necessary, the emergency pump must be engaged during landing approach. If the engine is frozen, the emergency pump is the only source of hydraulic power; however, its output is sufficient to provide adequate control action for making an emergency landing. Because of the reduced total output, control movement must be kept to a minimum, whether the engine is windmilling or frozen, during operation on the emergency pump.

NOTE Although the emergency pump is started automatically (except on F-100C-1 Airplanes), when engine rpm drops to about 40% rpm, the emergency hydraulic pump lever should be actuated upon engine failure (engine frozen).

5. Pitch damper switch*—STANDBY.
6. Yaw damper switch—STANDBY.
7. Glide speed—220 knots IAS.
   Establish glide at 220 knots IAS with gear up and speed brake in for maximum glide distance. (Refer to "Maximum Glide" in this section.)
8. Electrical equipment—Off.
   Turn off all nonessential electrical equipment to reduce battery load.

Caution Do not turn engine master switch OFF if an air start is to be made, because the fuel shutoff valve will close and may remain closed, even if switch is returned to ON. In this case, an air start will be impossible.

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*Some airplanes

- At engine speeds below about 40% rpm, generator output is not available, and the battery becomes the only source of electrical power. Usable battery power is available for about 6 to 22 minutes.

9. Attempt air start.
   Refer to "Engine Air Start" in this section.

Engine Failure During Flight at Low Altitude.

If engine failure occurs during flight at low altitude and with sufficient airspeed available, the airplane should be pulled up (zoom-up) to exchange airspeed for an increase in altitude. This will allow more time for accomplishing subsequent emergency procedures (air start, establishing forced landing pattern, ejection, etc).

NOTE The point at which climb should be terminated will depend on whether the pilot intends to eject or whether he intends to continue attempting air starts, establish forced landing pattern, etc. In any event, it is recommended that an air start be attempted immediately upon detection of engine flame-out and repeated as many times as possible during the zoom-up. If the decision is to eject, the airplane should be allowed to climb as far as possible. *For this condition, the optimum zoom-up technique is to pull the airplane up with wings level until light buffet is encountered. Hold this condition until the speed drops to 140 knots IAS or the rate of climb reaches zero; then eject.* If the decision is to continue attempting air starts, the climb should be terminated before dropping below best glide speed, in order to obtain maximum glide distance and maintain adequate engine windmilling rpm for air start.

Maximum altitude can be achieved by jettisoning external loads before zoom-up. The further up the climbing flight path that external loads are jettisoned, the less additional altitude will be gained. However, when jettisoning external loads, consideration must be given to such factors as sufficient airspeed to allow time for pilot reaction and jettisoning external loads; the terrain where external loads will fall (populated areas, friendly or enemy territory, etc); the type of stores to be jettisoned (special store, conventional bombs, full or empty drop tanks, etc); controllability of the airplane if one or more stores fail to release, resulting in a dangerous asymmetrical condition at low altitude. Also of prime importance are the external load release limits outlined in Section V. These limits should be observed to prevent damage to the airplane. It is impossible to predict the extent of damage which may occur if the external loads are released outside the established limits because of the number of factors involved. Depending on the emergency, it may be advisable to jettison the external loads outside the release limits and risk some damage to the airplane in order to increase the probability of being able to accomplish subsequent emergency procedures. In any event, the decision to jettison or retain external loads must be made by the pilot on the basis of his evaluation of these factors and conditions existing at the time of the emergency.

ENGINE AIR START.

Successful air starts can be made at altitudes below 40,000 feet within a wide range of airspeeds. When starts are made above 30,000 feet, on the normal fuel control system, minor compressor stalls may occur when the engine speed is about 55% to 60% rpm. However, if the engine is accelerating, it is recommended that the start be continued. If severe stalls are encountered when the normal fuel control system is used, the engine should be shut down and the start be made on the emergency fuel control system. See figure 3-1 for airspeed-altitude ranges for air starts. The recommended air start procedure is as follows:

NOTE Initial procedures essential to setting up an air start will have to be accomplished as a result of engine failure. (Refer to "Engine Failure During Flight.") Battery switch must be ON to obtain air start ignition.

1. Air start switch—ON.
   Move air start switch to ON. (Ignition is not available until throttle is moved outboard and forward from OFF.)

NOTE If during an air start the ignition-on and generator caution lights do not come on, the air start switch may be defective. A start attempt should then be made using the starter and ignition button to provide engine ignition. However, if this button is used, the generator switch should be turned OFF during ignition to prevent possible premature discharge of the battery.

- All nonessential electrical equipment should be turned off to conserve battery power after the flame-out occurs. Generator power (which controls secondary and tertiary bus output) is not available at engine speeds below 40% rpm. However, when the air start switch is ON, the generator is automatically cut out of the electrical system. This prevents the battery from powering the generator at low engine rpm if reverse-current relay operation is faulty. Generator

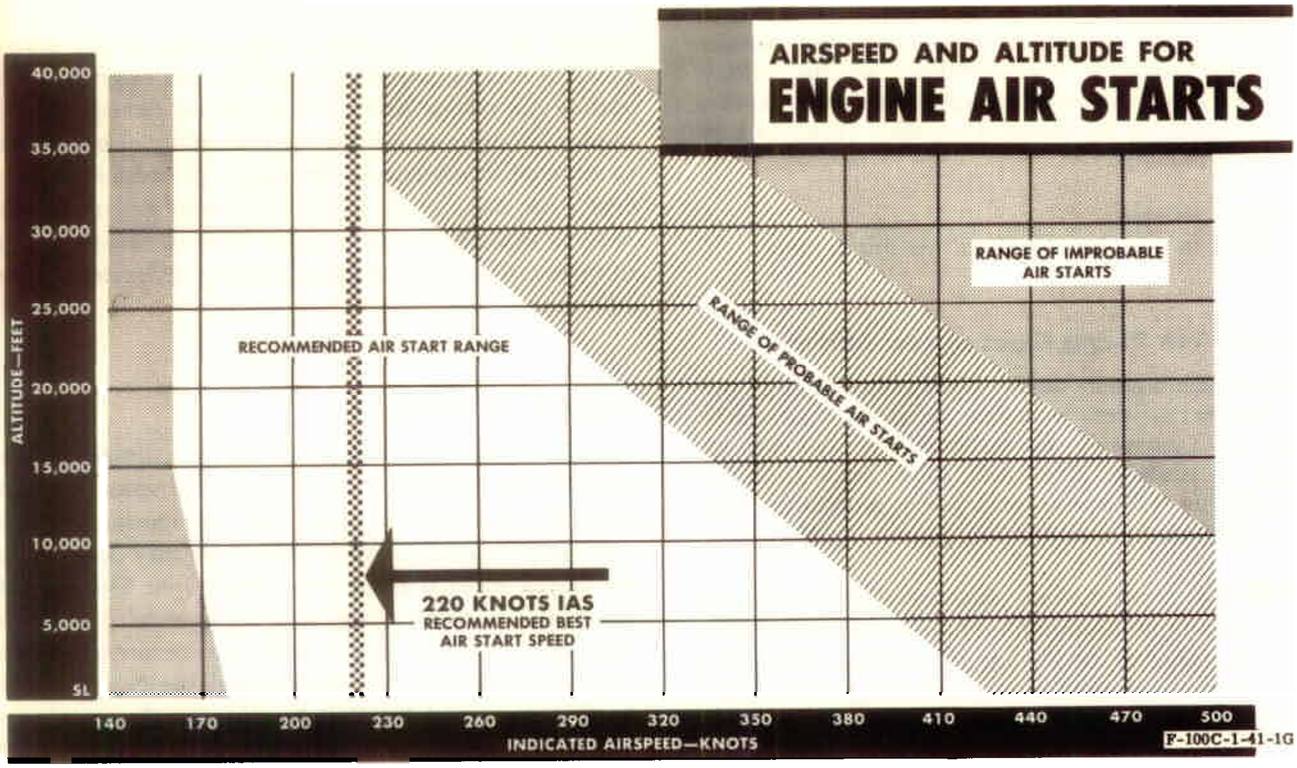


Figure 3-1

output is restored automatically when the air start switch is returned to OFF.

- All communication equipment is powered by the secondary bus and therefore is inoperative while the air start switch is ON.

2. Throttle—IDLE.

Fuel flow should be about 640 to 850 pounds per hour. Slowly advance throttle to the point where positive thrust is indicated by a pronounced increase in fuel flow and a corresponding increase in exhaust temperature. Then adjust throttle to desired rpm. If start attempt is to be made on the emergency fuel control system, move fuel regulator selector switch to EMER and advance throttle to IDLE. When engine rpm reaches 60%, advance throttle slowly to desired setting. This procedure is recommended at altitudes above 30,000 feet to prevent compressor stalls and engine overtemperature.

Caution If the emergency fuel control system has been used during an air start, retard the throttle to IDLE or 80% rpm, whichever is the lower, before returning to the normal fuel control. Transfer from the emergency to the normal fuel control at higher rpm settings can produce high fuel pressure surges that could rupture certain types of fuel-cooled oil coolers.

NOTE Light-up is indicated by rising exhaust temperature and rpm; however, immediately following light-up, the rise in exhaust temperature and rpm is very slow.

- Successful air starts can be made with an undamaged engine if the airspeed-altitude combinations in figure 3-1 are used. Actual engine windmilling speeds will vary with airspeed and altitude. At the recommended 220 knots IAS for air starts, the engine will windmill between 12% and 40% rpm, with the higher speed being noted at high altitude.

3. Air start switch—OFF.

Return air start switch to OFF to de-energize ignition system and restore normal generator operation as soon as air start is completed (engine at IDLE rpm).

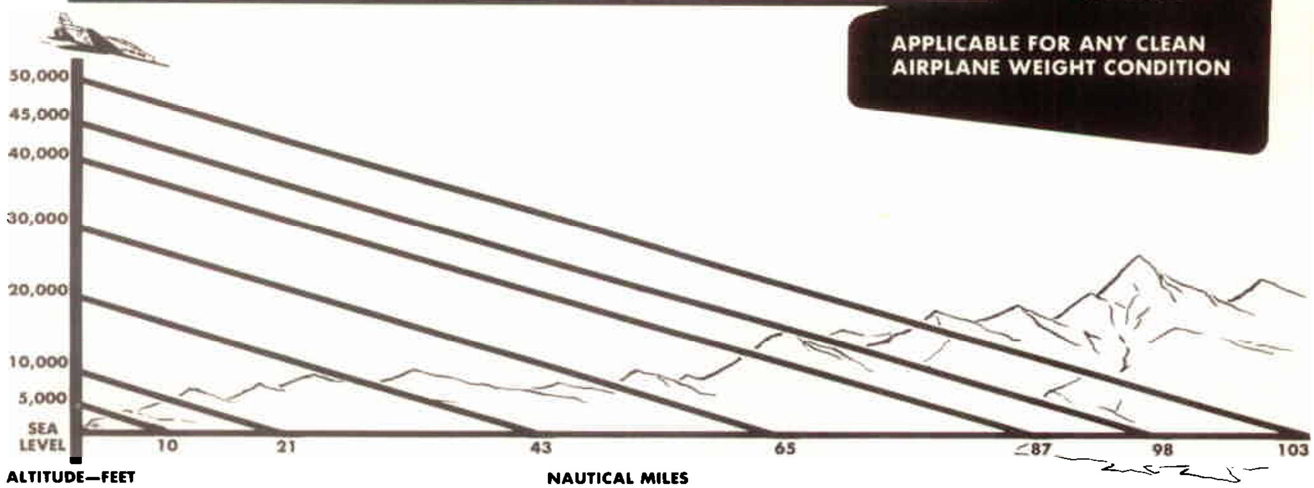
Caution Because the igniter units of the ignition system can be damaged if operated continuously for more than 5 minutes, they should not be energized any longer than is necessary to complete a start.

4. Flight control emergency hydraulic pump lever—OFF.

MAXIMUM GLIDE DISTANCES

—NO WIND

APPLICABLE FOR ANY CLEAN AIRPLANE WEIGHT CONDITION



NOTE

- Glide distance with gear up and speed brake in, approximately 21 nautical miles per 10,000 feet descent.
- Glide distance with gear down approximately one-half glide distance of clean airplane.
- Distances shown are for a wings-level glide from altitude to touchdown.

BEST GLIDE SPEED

220

KNOTS IAS

WINDMILLING OR "FROZEN" ENGINE

F-100C-1-00-64C

Figure 3-2

IF ENGINE FAILS TO START.

1. Start attempt—Repeat.

   Retard throttle to OFF if there is no indication of light-up within 20 seconds after throttle has been moved to IDLE, if engine fails to accelerate to idle rpm within 45 seconds after light-up.

NOTE If first start attempt is made on the normal fuel control system and start is not obtained, the next start attempt should be made using the emergency fuel control system.

2. Air start—Unsuccessful.
   a. Throttle—OFF.
   b. Air start switch—OFF.
3. Execute forced landing (dead engine) procedure.

   If terrain is unknown or unsuitable for forced landing, proceed to step 4.
4. Eject.

MAXIMUM GLIDE.

For maximum glide distance with windmilling or frozen engine, the estimated best gliding speed is 220 knots IAS for clean airplane with gear up and speed brake in. (See figure 3-2.) When speed is maintained at 220 knots IAS, the glide ratio of the clean airplane is approximately 13 to 1. Thus, for every 10,000 feet of sink, the airplane glides about 21 nautical miles. The glide ratio and glide distances of the airplane without drop tanks but with landing gear down are about half those obtainable with the gear up.

EJECTION VS FORCED LANDING.

Normally, ejection is the best course of action with a windmilling or frozen engine, or failure of both the No. 1 and No. 2 flight control hydraulic systems. However, because of the many variables encountered, the final decision to attempt a flame-out landing or to eject must remain with the pilot. It is impossible to establish a pre-

TYPICAL FORCED LANDING

WINDMILLING OR "FROZEN" ENGINE

SPEEDS GIVEN ARE APPLICABLE FOR ANY CLEAN AIRPLANE WEIGHT CONDITION

1 External load—Jettison.

2 Engine master and generator switches—***OFF***.

3 Emergency hydraulic pump lever—***ON***.

4 Shoulder harness inertia reel handle—Locked (forward).

5 Landing gear handle—***DOWN*** (at high key point).

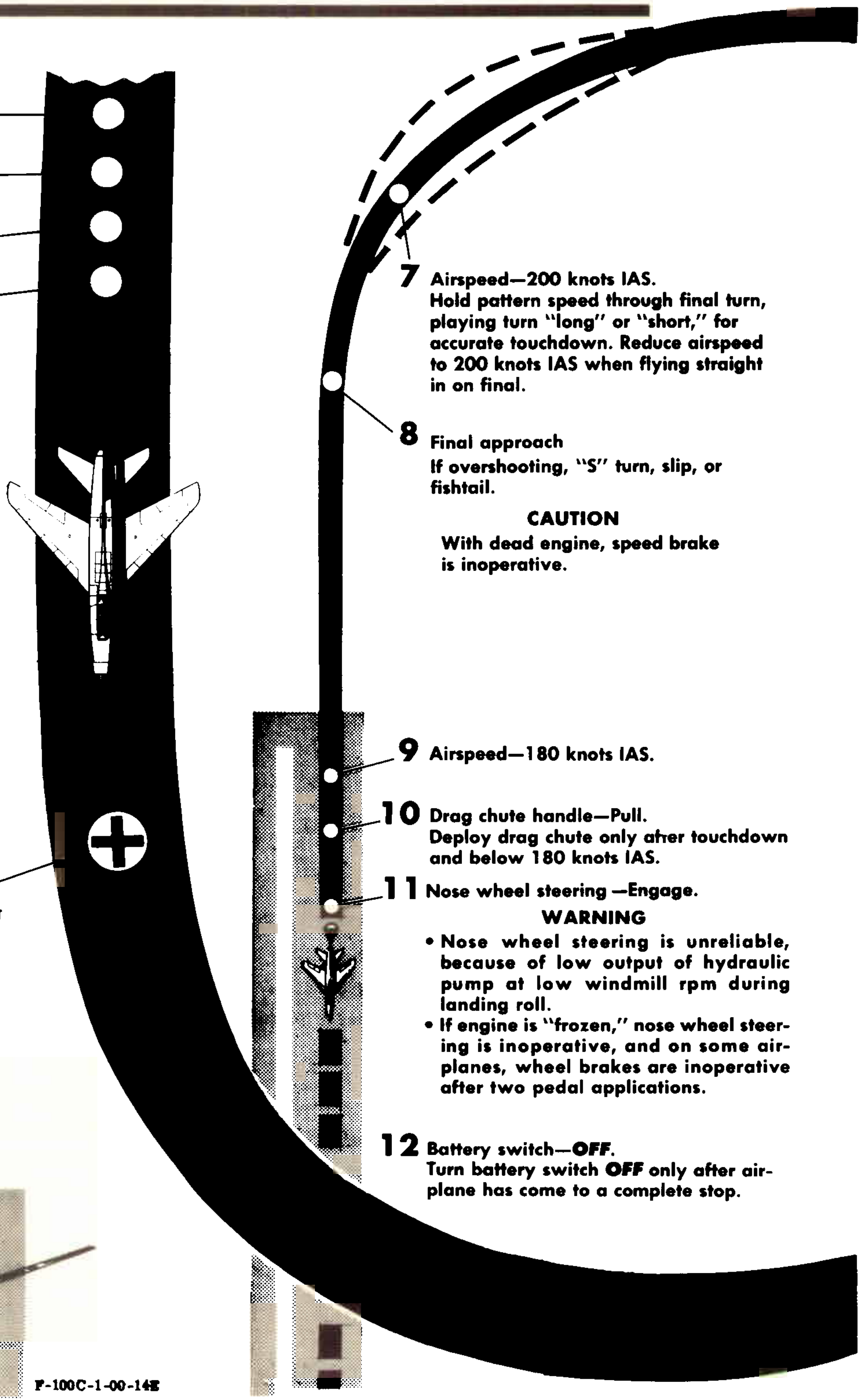
If altitude is too low to enter pattern at high key point, leave gear up until low key point is reached.

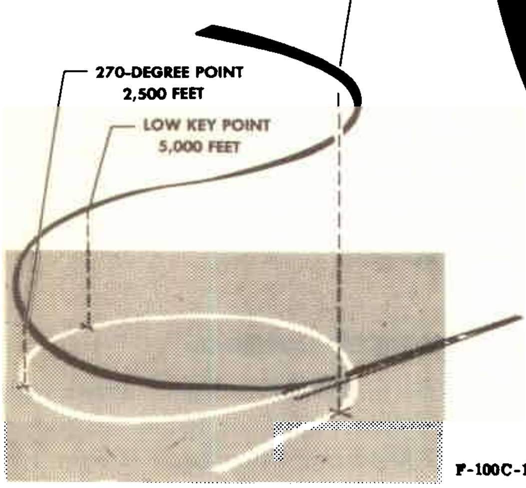
WARNING

Do not leave gear up for landing. Investigation has shown that emergency landings with gear down minimizes pilot injury and airplane damage.

NOTE

If engine is "frozen," lower landing gear by means of landing gear emergency lowering handle, because utility hydraulic pressure is not available. (Gear cannot be retracted.)





7 Airspeed—200 knots IAS.
Hold pattern speed through final turn, playing turn "long" or "short," for accurate touchdown. Reduce airspeed to 200 knots IAS when flying straight in on final.

8 Final approach
If overshooting, "S" turn, slip, or fishtail.

CAUTION

With dead engine, speed brake is inoperative.

9 Airspeed—180 knots IAS.

10 Drag chute handle—Pull.
Deploy drag chute only after touchdown and below 180 knots IAS.

11 Nose wheel steering—Engage.

WARNING

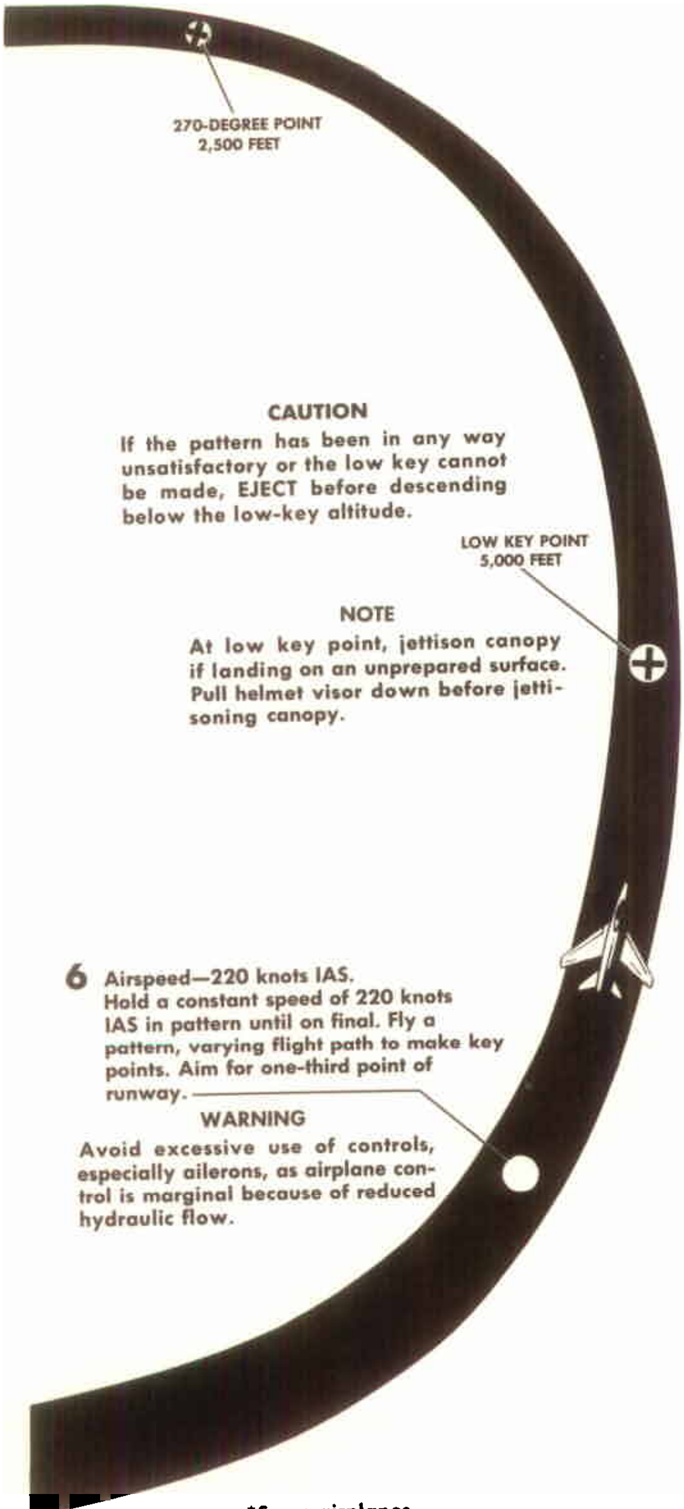
- Nose wheel steering is unreliable, because of low output of hydraulic pump at low windmill rpm during landing roll.
- If engine is "frozen," nose wheel steering is inoperative, and on some airplanes, wheel brakes are inoperative after two pedal applications.

12 Battery switch—***OFF***.
Turn battery switch ***OFF*** only after airplane has come to a complete stop.

Figure 3-3

WARNING

If terrain is unknown or unsuitable for forced landing, eject.



*Some airplanes.

F-100C-1-00-15E

determined set of rules and instructions which would provide a ready-made decision applicable to all emergencies of this nature. The basic conditions listed, combined with the pilot's analysis of the condition of the airplane, type of emergency, and his proficiency, are of prime importance in determining whether to attempt a flame-out landing, or to eject. These variables make a quick and accurate decision difficult. If the decision is made to eject, an attempt should be made before ejection to turn the airplane toward an area where injury or damage to persons or property on the ground or water is least likely to occur. Before a decision is made to attempt a flame-out landing, the following basic conditions should exist.

a. Flame-out landings should be attempted only by pilots who have satisfactorily completed simulated flame-out approaches in this airplane.

b. Flame-out landings should be attempted only on a prepared or designated suitable surface of at least 8000 feet.

c. Approaches to the runway should be clear and should not present a problem during a flame-out approach.

NOTE No attempt should be made to land a flamed-out airplane at any field whose approaches are over heavily populated areas, if a suitable area is available to abandon the airplane. If possible, before ejection, attempt to turn the airplane toward an area where injury or damage to persons or property on the ground or water is least likely to occur.

d. Weather and terrain conditions must be favorable. Cloud cover, ceiling, visibility, turbulence, surface wind, etc, must not impede in any manner the establishment of a proper flame-out landing pattern.

NOTE Night flame-out landings, or flame-out landings under poor lighting conditions such as at dusk or dawn, should not be contemplated, regardless of weather or field lighting.

e. Flame-out landings should be attempted only when either a satisfactory "High Key" or "Low Key" position can be achieved.

f. If at any time during the flame-out approach, conditions do not appear ideal for successful completion of the landing, ejection should be accomplished. EJECT no later than the "Low Key" altitude.

FORCED LANDING (DEAD ENGINE).

For forced landing procedures, see figure 3-3 and refer to "Ejection VS Forced Landing" in this section.

NOTE At engine speeds below about 40% rpm, generator power is not available.

- To prevent loss of the drag chute or slowing of the airplane to below landing speed, the drag chute should not be deployed in flight.

PRACTICE FORCED LANDING.

Since the engine continues to produce thrust with the throttle at IDLE, use of the speed brake is necessary to simulate the drag of a windmilling engine when forced landings are being practiced. The drag of the speed brake, however, is greater than that of a windmilling engine, and a certain amount of engine power is needed to accurately simulate a flame-out condition. Maintaining an engine rpm of 80% with the speed brake out produces flight conditions very similar to those encountered with the engine windmilling when gear is up and speed brake in. The speed brake should not be used for actual forced landings unless it is necessary to prevent overshooting. When forced landings are being practiced at 80% rpm, the effect of the speed brake on the gliding airplane can be closely simulated by retarding the throttle from 80% rpm to IDLE.

NOTE It is recommended that the applicable forced landing techniques and procedures (figure 3-3) be followed during practice forced landings.

FIRE OR EXPLOSION.

In case of a fire or explosion, the procedures given in the following paragraphs should be accomplished. However, an important factor in determining the course of action to be taken depends on the effect the fire or explosion may have had on the flight control system. Since a flight control system failure could occur as a result of the fire or explosion, a careful check of the flight control system should be made to determine whether a safe landing can be made.

Warning Do not re-engage afterburner if fire, explosion, or unusual thump, vibration, or noise was encountered during afterburner operation.

ENGINE FIRE DURING STARTING.

If a fire or overheat warning light comes on, or if there are other indications of fire during engine start, proceed as follows:

1. Throttle—OFF.
   If fire continues, proceed with step 2.

NOTE If fire or overheat warning lights go out, or fire indications cease, clear engine by pressing starter and ignition button, and motor engine (above 12% rpm) for 30 seconds.

2. Starter and ignition stop button—Press.
3. Engine master switch—OFF.
4. Battery switch—OFF.
5. External power sources—Disconnect.
6. Leave airplane.

FIRE DURING TAKE-OFF.

Illumination of the fire- or overheat-warning light indicates a fire or overheat condition in the engine compartment or aft section. If either light comes on during take-off, immediate action is required. The exact procedure to follow varies with each set of circumstances and depends upon altitude, airspeed, length of runway, and overrun remaining, location of populated areas, etc. The decisions to be made depend upon these factors. The following procedures are recommended as a guide in making a decision.

Fire During Ground Roll.

If either the fire- or overheat-warning light comes on during ground roll, and sufficient runway or overrun is available, abort the take-off. (Refer to abort procedures under "Take-off or Landing Emergencies" in this section.)

Fire After Lift-off.

If either the fire- or overheat-warning light comes on after the airplane is air-borne, and there is not sufficient runway and clear overrun available to abort the take-off, and altitude is too low for a safe ejection, proceed as follows:

1. External load—Jettison.
2. Throttle—Hold take-off position.
   Maintain thrust used for take-off and begin immediate climb.
3. Maximum climb.
   Immediately climb to safe ejection altitude.
4. Throttle—Adjust to minimum practical thrust.
   Adjust throttle to minimum practical thrust to maintain safe ejection altitude.
5. Check for fire.
   Determine whether a fire actually exists by a report from another airplane, abnormal instrument readings, or airplane or engine response to controls, explosion, unusual noise or vibration, fumes, heat, cockpit smoke, or trailing smoke noted following a turn.
6. If fire cannot be confirmed—Land as soon as possible.
   If existence of fire cannot be confirmed, maintain a safe ejection altitude at minimum practical thrust. Establish controllability of airplane and

try to obtain assistance from other aircraft in the area in determining existence of fire. If no assistance is available, reconfirm controllability before descent below safe ejection altitude, and land as soon as possible.

7. If fire is confirmed—Eject.

Warning When existence of fire is confirmed, prompt ejection will ensure the greatest chance for survival.

FIRE DURING FLIGHT.

If either the fire- or overheat-warning light comes on during flight, proceed as follows:

1. Throttle—Adjust to minimum practical thrust.
   Adjust throttle to minimum practical thrust to maintain safe ejection altitude.
2. Check for fire.
   Determine whether a fire actually exists by a report from another airplane, abnormal instrument readings, or airplane or engine response to controls, explosion, unusual noise or vibration, fumes, heat, cockpit smoke, or trailing smoke noted following a turn.
3. If fire cannot be confirmed—Land as soon as possible.
   If existence of fire cannot be confirmed, maintain a safe ejection altitude at minimum practical thrust. Establish controllability of airplane en route to nearest available base and try to obtain assistance from other aircraft in the area in determining existence of fire. If no assistance is available, reconfirm controllability before descent below safe ejection altitude, and land as soon as possible.
4. If fire is confirmed—Eject.

Warning When existence of fire is confirmed, prompt ejection will assure greatest chance for survival.

ENGINE FIRE AFTER SHUTDOWN.

If fire is suspected after shutdown, clear engine as follows:

1. Battery switch—ON.
   Battery switch OFF, if external dc power is connected.
2. External compressed-air source—Connected.
3. Throttle—OFF.
4. Engine master switch—ON.
5. Starter and ignition button—Press.
   Motor engine (above 12% rpm) for 30 seconds.
6. Starter and ignition stop button—Press.

ELECTRICAL FIRE.

Circuit breakers and fuses protect most of the circuits and tend to isolate electrical fires. However, if an electrical fire occurs, proceed as follows:

1. Battery switch—OFF.
2. Generator switch—OFF.
3. Land as soon as practical and investigate.

If a suitable air base is not available or if the mission cannot be aborted, turn on electrically operated equipment one at a time, in an attempt to determine or isolate the cause of the fire.

Caution With battery and generator switches OFF, the electrically driven fuel booster and transfer pumps are inoperative. Without these pumps, engine operation cannot be maintained above 25,000 feet and a flame-out results.

- The battery switch must be returned to ON, if speed brake operation is required for landing.
- The battery switch must be ON if nose wheel steering or antiskid is required.

WHEEL BRAKE FIRE.

The heat produced by maximum braking during a high-speed landing run is dissipated so slowly from the brake that a wheel fire can occur 15 minutes or longer after braking. This excessive heating is often not easy to detect just after shutdown. If the wheel assembly is not artificially cooled after a maximum braking operation, a brake fire may occur, with possible explosion of the tire and wheel assembly, endangering personnel and equipment. By using the full runway length and through skillful braking technique in using the minimum brake force necessary, serious brake overheating is normally prevented. If maximum braking was necessary, however, ground personnel should be directed to cool the wheels and brakes immediately following shutdown.

Warning Do not taxi into crowded parking areas when brakes are overheated.

- The use of CO_2, water spray, foam, or any other similar extinguishing agent to extinguish a fire in the wheel and tire assembly is not recommended, because thermal shock can cause the wheel to fail with explosive force. This failure can occur as long as 15 minutes after the use of these extinguishing agents.
- When approaching the wheel with cooling apparatus, with fire-fighting equipment, or for inspection purposes immediately after a maximum braking operation, the approach direction should

be in the plane of wheel rotation to minimize danger to personnel from possible explosion.

- Overheated wheel and brake assemblies should be cooled by means of an air blast from any source available, such as a fan blower, an air compressor (except ground starting unit compressor), a ground heater (utilizing the blower only, with the heating cycle turned OFF), etc. Cooling time may be accelerated by parking the airplane perpendicular to any surface wind.
- No attempt should be made to cool an overheated wheel and tire assembly with CO_2, water spray, foam, or any other extinguishing agents, because such a practice may cause the assembly to fail with explosive force.
- If immediate cooling is impossible, warn all personnel to remain clear of the wheel areas because of the danger of possible explosion.

NOTE In case of fire in the wheel or tire assembly, the fire should be extinguished with a minimum quantity of CB (chlorobromomethane). A guard should be maintained until the wheel has cooled enough so that there is no danger of a reflash.

ELIMINATION OF SMOKE OR FUMES.

If smoke or fumes enter the cockpit, proceed as follows:

NOTE When it is necessary to depressurize, first descend to 25,000 feet or below if conditions permit.

1. Oxygen regulator diluter lever—100% OXYGEN.
2. Oxygen emergency lever—EMERGENCY.
3. Cockpit pressure selector switch—EMER RAM.
4. Pitot heat switch—OFF.
5. Windshield anti-ice switch—OFF.
6. Windshield defrost and console air levers—DECREASE.
7. Cockpit pressure selector switch—RAM OFF, PRESS OFF. Because of the variety of places from which smoke could come, this procedure is recommended. Moving the pressure selector switch to EMER RAM ventilates the cockpit. However, if this makes the cockpit unbearably cold or the smoke condition worse, moving the pressure selector switch to RAM OFF PRESS OFF will cut off all ventilation to the cockpit.

Warning If the smoke and fumes cannot be cleared and visibility is restricted to the point that safe flight cannot be maintained, it may become necessary to jettison the canopy so that a landing can be made.

CAUTION

At low altitudes and high airspeed (especially with high outside temperature), the EMER RAM position can introduce air of excessive high temperature into the cockpit.

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- When pressure selector switch is at OFF, make sure 100% OXYGEN is being used to offset effect of possible cockpit contamination under this no-ventilation condition.

8. Land as soon as possible.

EJECTION.

If the decision to eject has been made (refer to "Ejection VS Forced Landing" in this section), escape from the airplane in flight should be made with the ejection seat. The basic seat ejection procedure is shown in figure 3-4.

Warning If overwater ejection is made, remove oxygen mask before hitting water, to prevent sucking water into mask.

- Ejection should not be delayed when the airplane is in a descending attitude and cannot be leveled out. The chance of a successful ejection at low altitude under this condition is greatly reduced.

Study and analysis of ejection techniques by means of the ejection seat have revealed that:

a. Ejection at airspeeds ranging from stall speeds to 525 knots IAS results in relatively minor forces being exerted on the body, thus reducing the injury hazard.

NOTE The most ideal ejection speed considering tumbling and parachute opening time is between 250 and 300 knots IAS.

b. The pilot will undergo appreciable forces on the body when ejection is performed at airspeeds of 525 to 600 knots IAS, and escape is more hazardous than at lower airspeeds.

c. Above 600 knots IAS, ejection is extremely hazardous because of excessive forces on the body.

For low-altitude ejections (below 2000 feet), the technique that results in highest possible altitude for parachute deployment is pulling the airplane nose above the horizon before ejection (zoom-up maneuver). Ejection seat trajectory is then more nearly vertical, resulting in an increase in altitude and time for separation from the seat and for parachute deployment. Therefore, using the zoom-up maneuver during low-altitude ejection helps obtain maximum altitude for parachute deployment, and slowing the airplane before ejection at any altitude reduces the forces exerted on the body. The automatic-opening safety belt should never be opened manually before ejection for the following reasons:

a. If the belt is opened manually, the escape operation is prolonged.

b. Manual opening of the belt creates an injury hazard during uncontrollable flight, because the pilot cannot stay in the seat if negative G is encountered.

c. Manual opening of the belt creates an injury hazard if the pilot decides to crash-land the airplane. He probably will not be able to refasten the belt and shoulder harness because both hands may be needed to control the airplane.

d. Manual opening of the belt eliminates the automatic-opening feature of the parachute (if automatic-opening type is worn). It then becomes necessary to manually arm the parachute-opening device by pulling the parachute arming lanyard.

e. If the belt is opened before ejection, tail clearance is reduced because there will likely be immediate separation from the seat.

f. At high speeds, the peak deceleration due to air loads on the pilot and seat together approaches the limits of human tolerance. Since deceleration of the pilot alone is considerably greater than that of the pilot and seat together, immediate separation at extremely high speeds could result in injury to the pilot.

g. Immediate separation of the pilot and seat at high speeds could result in the parachute pack being accidentally blown open at the time of ejection. In this event, fatal injuries probably would be incurred, because of the extremely high opening shock of the parachute, or because of serious damage to the parachute when it opens.

NOTE The automatic belt opens about one second after upward movement of the seat begins. This is sufficient time for safe deceleration of the pilot while still in the seat.

Figure 3-4 shows maximum safe ejection speeds, based on parachute restrictions, for the combinations of a one-second safety belt and zero-second parachute or a one-second safety belt and a one-second parachute. Also shown in figure 3-4 are emergency minimum ejection altitudes for various combinations of escape equipment. These charts should be used only as guides. Once a minimum ejection altitude has been determined for a particular configuration of equipment, the decision as to when to eject or not to eject in an emergency should not be rigidly determined by the fact that the airplane is above or below the minimum altitude as determined by these figures. Every emergency will have its particular set of circumstances involving such factors as airplane speed, attitude, and control, as well as altitude. Based on these figures and the escape equipment available, a decision should be made before take-off concerning actions to be taken in case of a low-altitude emergency.

Warning The emergency minimum ejection altitudes shown in figure 3-4 were determined through an extensive flight test program and are based on altitude above terrain on initiation of seat ejection. (Initiation of seat ejection is defined as the time the seat is fired.) However, human error and equipment malfunctions were not considered in determination of these altitudes. Therefore, whenever possible, ejection should be started at altitudes higher than the minimums shown in figure 3-4.

IF SEAT FAILS TO EJECT.

If seat does not eject when triggers are squeezed, proceed as follows:

1. Safety belt—Unfasten.
2. Bail-out bottle—Actuate.
3. Personal equipment leads—Disconnect.
4. Trim—Nose-down.
5. Invert airplane.
6. Release stick and push free of seat.

NOTE Keep positive-G load until inverted; then sharply release stick and push free of seat.
- If airplane is not controllable, slow airplane as much as possible and bail out over the side.

7. Parachute arming lanyard—Pull.
   If at low altitude, pull "D" ring.

EJECTION

1

PULL UP EITHER RIGHT OR LEFT HANDGRIP TO JETTISON CANOPY. (SHOULDER HARNESS LOCKS AUTOMATICALLY WHEN HANDGRIPS ARE RAISED.)

IF CANOPY FAILS TO JETTISON, ATTEMPT TO RELEASE CANOPY AS FOLLOWS . .

- Pull canopy alternate emergency jettison handle.
- Hold canopy switch at **OPEN** until canopy breaks away from airplane.
- Use canopy internal manual emergency release handle to pull canopy aft so that air stream can break it free.

WARNING

Manual opening of canopy may cause handle to inflict serious injury when canopy releases. (Canopy break-away is extremely rapid.) Grasp handle with palm of hand upward and with thumb under handle.

- As a last resort, if canopy does not release or if time and conditions do not permit, make sure chin is tucked in and head is against headrest. Then squeeze either seat trigger to eject through canopy.

AFTER SEAT EJECTS . . . .

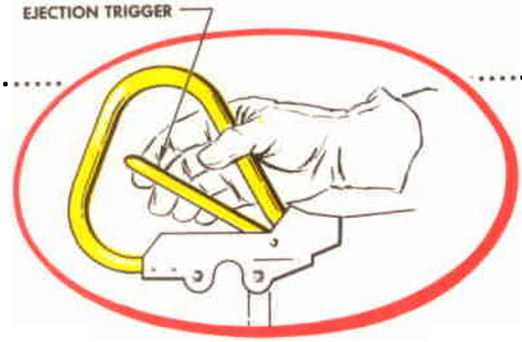
- *If safety belt fails to open automatically after 1 second*, manually unfasten belt and kick free of seat. Then pull parachute arming lanyard.
- *If wearing automatic parachute with lanyard attached to safety belt buckle*, parachute opens at a preset altitude after pilot kicks free of seat. (Parachute opens after a preset time interval if below preset altitude.)
- *If wearing automatic parachute without lanyard attached to safety belt buckle*, kick free of seat and pull parachute arming lanyard.
- *If wearing manually operated parachute*, kick free of seat; pull "D" ring at altitude where normal breathing is possible.

WARNING

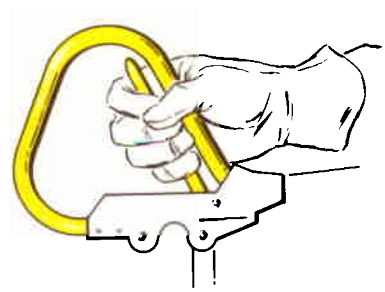
After leaving seat, manually pull "D" ring for all ejections below 14,000 feet to open parachute immediately.

Steps 1 and 2 are all that is necessary to eject. If time and conditions permit, do as much of the following as possible:

- Stow all loose equipment.
- Actuate bail-out bottle.
- Jettison tow target.
- Stopcock throttle.
- Brace for ejection:
  - Heels hooked firmly in footrests.
  - Arms braced in armrests.
  - Body erect.
  - Head hard against headrest.



2



SQUEEZE EITHER OR BOTH TRIGGERS TO EJECT SEAT.

WARNING

If one trigger fails to fire the seat, attempt to fire the seat with the other trigger, as each trigger has an independently operated initiator.

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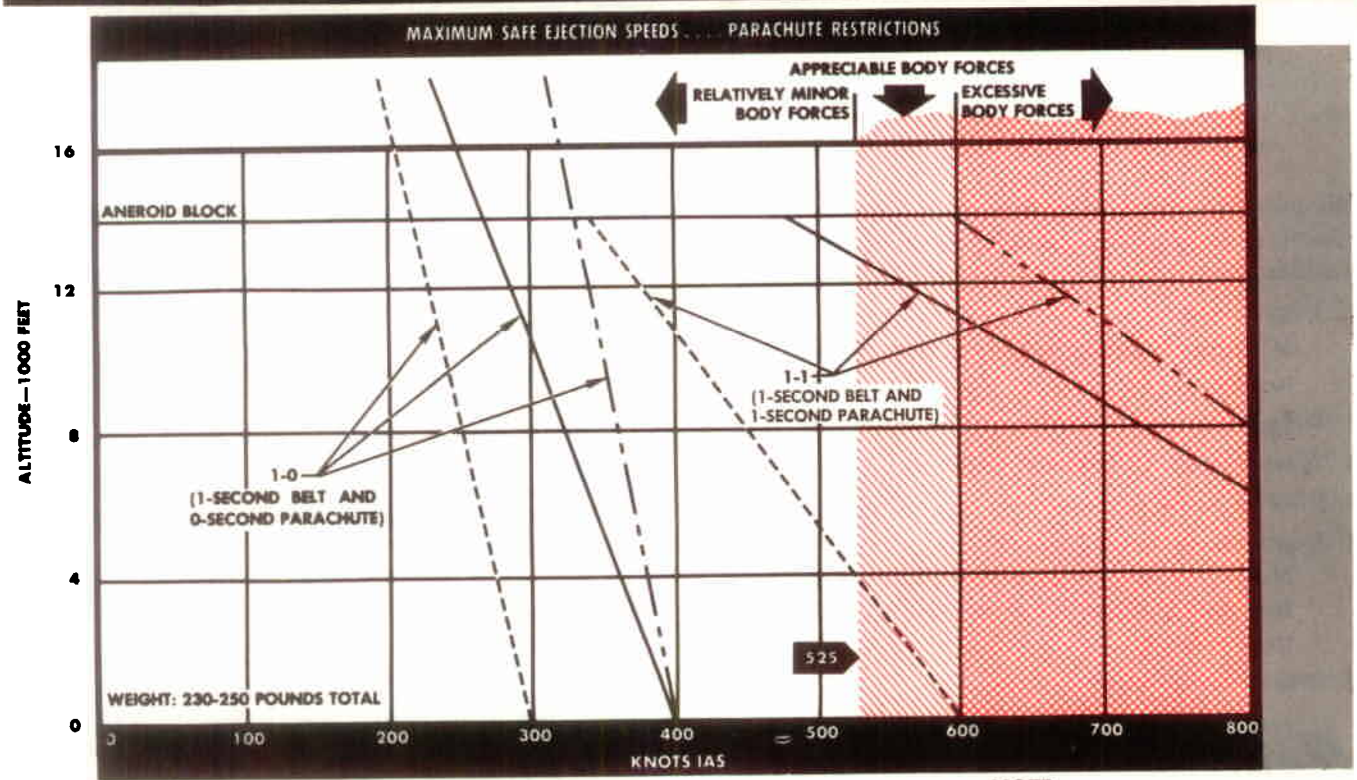
Figure 3-4

PROCEDURES

SAFE EJECTION SPEEDS AND ALTITUDES . . . (LEVEL FLIGHT)



- - - - - - TYPE C-9, 28 FT FLAT CANOPY, TYPE B-4 PACK

———— TYPE C-9, 28 FT FLAT CANOPY, TYPE B-5 PACK WITH 1/4 BAG

— — — — TYPE C-11, 30 FT GUIDE CANOPY, TYPE B-5 PACK

NOTE

The graph shows safe ejection speeds for ideal level flight and average parachute performance only; other ejection altitudes, tumbling, separation delays, variations in parachute opening time, etc, are not included.

EMERGENCY MINIMUM EJECTION ALTITUDES—FEET

BASED ON THE SPEED RANGE OF 140-300 KNOTS IAS

	2-SECOND PARACHUTE		2-SECOND PARACHUTE		1-SECOND PARACHUTE		1-SECOND PARACHUTE		0-SECOND PARACHUTE		0-SECOND PARACHUTE	
	F-1A TIMER		F-1A TIMER		F-1B TIMER		F-1B TIMER		LANYARD TO "D" RING		LANYARD TO "D" RING	
	B-4 OR B-5 PACK	C-9 CANOPY	B-5 PACK	C-11 CANOPY	B-4 OR B-5 PACK	C-9 CANOPY	B-5 PACK	C-11 CANOPY	B-4 OR B-5 PACK	C-9 CANOPY	B-5 PACK	C-11 CANOPY
1-SECOND AUTOMATIC LAP BELT (M-12 INITIATOR)	350		400		200		250		100		150	

NOTE

These are emergency minimums. Ejection should start above 2000 feet if possible.

WARNING

If the airplane is uncontrollable in a spin or dive condition, ejection should be accomplished above 10,000 feet.

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TAKE-OFF OR LANDING EMERGENCIES.

ABORT.

Warning Do not attempt to use the landing gear emergency up button that is installed on some airplanes. The nose gear will retract immediately, and the airplane will go down on its nose. One main gear will probably fold before the other, and severe structural damage and possible pilot injury can result.

The procedure for aborting is basically the same for any take-off emergency. Depending upon the severity of the situation, do as many of the following steps as necessary:

1. Throttle—OFF.
   If sufficient runway remains to stop, move throttle to IDLE.
2. Drag chute handle—Pull.
3. Wheel brakes—Maximum.
4. External load—Jettison.
5. Engine master switch—OFF.
   Moving the engine master switch to OFF closes the fuel shutoff valve and shuts off the aft tank fuel transfer pump.
6. Battery switch—OFF.

Caution The battery switch must be ON if nose wheel steering or antiskid braking is required.

7. Canopy—Jettison.

RUNWAY OVERRUN BARRIER ENGAGEMENT.

Warning If the canopy has been removed and a barrier engagement is imminent, with any landing gear configuration other than all gear down and locked, there is a possibility of the upper barrier strap entering the cockpit. To prevent injury if this should occur, lean as far forward as possible, so that the windshield covers the head and shoulders.

Flight tests using the Type MA-1A runway overrun barrier with various airplane configurations indicate that the minimum speed for successful engagement is 30 knots IAS. The maximum speed tested for barrier engagement was 90 knots IAS. All engagements in this speed range were successful with the airplane in a clean configuration. It has been determined that successful engagements with external loads installed or speed brake extended cannot be made. As barrier engagement usually cannot be predicted in flight (except in the case of a flame-out), the procedure given is for an airplane on the ground, either during landing or take-off roll. The procedure differs only slightly as to the steps to be taken. Some of the steps in the following procedure may already be part of a normal procedure but are repeated for purposes of continuity. In a take-off or landing emergency, if the airplane cannot be stopped or slowed to a safe taxiing speed and the runway has an overrun barrier, the following steps should be taken to ensure a clean catch:

NOTE The minimum barrier engagement speed is presented for information only. Engagements at low airspeed may or may not be successful. Below this speed, you can stop within a few hundred feet (using normal braking), in which case a barrier engagement will not be necessary.

1. Throttle—IDLE.
2. Speed brake switch—IN.
   If speed brake is out, the cable may be deflected under the tires.

NOTE Speed brake and nose wheel steering will be inoperative if utility hydraulic system failure occurs. Use differential braking and rudder for directional control and move speed brake emergency dump lever to its forward (dump) position.

3. Nose wheel steering—Engage.
   Aim for the center of the barrier.
4. Drag chute handle—Pull.

NOTE Drag chute failure can be anticipated above 180 knots IAS and may occur at lower speeds if risers have been damaged on a previous landing. Therefore, if sufficient runway is available, the airplane should be slowed as much below 180 knots IAS as possible to increase the chance of a successful deployment.

5. Wheel brakes—Avoid locking.
   Attempt to slow airplane so as to engage the barrier between 90 and 40 knots IAS. Use wheel brakes as during a minimum-run landing in Section II. (Refer to Section VII for additional information on wheel brake use.) Wheel brakes should be released just before engagement, to prevent veering.
6. External load—Jettison.
   Jettison external load, because cable striking load can be deflected under the main gear tires.

NOTE In cases of known emergency where barrier engagement is contemplated, jettison external load before landing.

7. Throttle—OFF just before engagement.
8. Engine master switch—OFF.
9. Generator switch—OFF.
10. Battery switch—OFF.

Caution Battery switch must be ON if nose wheel steering or antiskid is required.

TIRE FAILURE.

Tire failure on take-off may present more problems than tire failure on landing. Directional control is more difficult at the higher take-off gross weights during an abort; therefore, if speed is at or near take-off speed, continue take-off and burn fuel down before landing.

Nose Gear Tire Failure.

Nose Gear Tire Failure on Take-off. Because of the protection offered by the dual nose wheels, nose gear tire failure is serious only when both tires fail on the take-off or landing roll. If one tire has failed or lost pressure, the remaining tire is definitely overloaded and it is much more likely to fail, especially at high gross weights. In case of complete nose gear tire failure on the take-off run, and if speed is too slow to continue take-off, the take-off should be aborted. (Refer to "Take-off and Landing Emergencies" in this section.)

NOTE If nose gear tire failure occurs at or near nose wheel lift-off speed, the pilot may elect to continue the take-off in order to reduce the gross weight of the airplane. Directional control of the airplane with flat nose gear tires is improved at lighter gross weights.

- Even though heavy braking increases the load on the nose gear, it is considered more important that the airplane be stopped as quickly as possible than to attempt to lighten nose wheel loading at the expense of a longer roll. However, holding the stick full back during braking may reduce some of the load from the nose wheels.

Nose Gear Tire Failure on Landing. When landing is to be made with flat nose gear tire, lower gear in the normal manner and proceed as follows:

1. Normal approach.
2. Nose wheels—Hold off.
   Hold nose wheels off as long as possible. When nose wheels touch down, proceed to step 3.
3. Nose wheel steering—Engage.
4. Drag chute handle—Pull.
5. Brakes—Maintain directional control.

Main Gear Tire Failure.

Main Gear Tire Failure on Take-off. Tire failure on take-off may present more problems than tire failure on landing. Directional control is more difficult and braking efficiency is greatly reduced at higher gross weights with failure of one or both main gear tires. Therefore, under certain conditions, the take-off should be continued rather than aborted. If main gear tire failure occurs during take-off, the following instructions must be observed.

a. If nose wheel lift-off speed has been attained, external load should be retained and take-off continued.

b. If speed is greater than 150 knots IAS but below nose wheel lift-off speed, jettison external load and continue take-off.

c. If speed is less than 150 knots IAS, abort take-off. Retain external loads unless barrier engagement is anticipated.

Warning If take-off is continued, the landing gear should not be retracted, if tire has failed or suspected to have failed, until tire has been visually checked for fire by a report from another airplane or the tower. After the tire is checked and if the gear is to be retracted, the wheel brakes should be applied to stop wheel rotation before retraction, to prevent tire fragments from damaging equipment in the wheel well. Landing should be accomplished in accordance with the instructions given in "Main Gear Tire Failure on Landing."

Main Gear Tire Failure on Landing. When landing with a flat main gear tire, lower gear in the normal manner and proceed as follows:

1. Antiskid switch*—OFF.
2. Normal approach.
   Land on side of runway that is away from flat tire. This reduces the need for differential braking if the airplane pulls toward the low tire.
3. Normal touchdown.
4. Nose wheel steering—Engage.
5. Drag chute handle—Pull.
6. Brakes—Maintain directional control.
   Use the maximum braking needed away from swerve. Deliberately blowing the good tire may not be helpful in keeping the airplane on the run-

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*Some airplanes

way. The airplane will tend to roll straighter with both main gear tires blown, but it is very difficult to turn under this condition. Braking efficiency is greatly reduced when both the main gear tires are blown.

LANDINGS ON UNPREPARED SURFACES.

Landings on unprepared surfaces are not recommended. However, if an emergency landing on an unprepared surface is unavoidable, it should be made with as many landing gear down as possible. Investigation has shown that landings made on unprepared surfaces with the landing gear down have resulted in less pilot injury and less damage to the airplane than those made with gear up. Empty drop tanks should be retained to cushion impact loads and minimize airplane damage as much as possible.

LANDING GEAR UNSAFE INDICATIONS.

If an unsafe gear down indication still exists after the emergency lowering procedure (figure 3-6) has been accomplished, attempt to obtain a positive confirmation of the gear condition from the tower or chase plane. Either of two courses of action will be followed depending upon the gear condition. If an unsafe main gear condition is *positively* confirmed, follow the procedures in "Main Gear Up Landing (Prepared Surface Only)." If no positive confirmation can be obtained, then follow the procedure given in "Landing With Any One Gear Up or Unlocked."

LANDING WITH ANY ONE GEAR UP OR UNLOCKED.

If any one gear does not extend or lock down, leave remaining gear down and proceed as follows:

1. External load—Jettison.

NOTE If landing on a prepared surface, retain empty drop tanks to cushion landing shock. If time and conditions permit, fire all ammunition and expend excess fuel to lighten airplane and minimize fire hazard.

2. Canopy—Jettison.
3. Shoulder harness inertia reel handle—LOCKED (forward).
4. Throttle—Normal approach setting.
5. Speed brake switch—As required.
6. Throttle—OFF when landing is ensured.
7. Engine master switch—OFF.

Caution Turn engine master switch OFF before battery switch is turned OFF, so that battery power is available to close the fuel shutoff valve.

8. Generator switch—OFF.
9. Touch down on extended gear.
   Hold opposite wing, or nose, off ground as long as possible.
10. Drag chute handle—Pull.
11. Battery switch—OFF.

Caution Battery switch must be ON if nose wheel steering or antiskid is required.

12. When stopped—Leave airplane.

Main Gear Up Landing (Prepared Surface Only).

When one or both main gear cannot be lowered (and utility hydraulic pressure is available), the main gear should be retracted and a landing made on the nose gear and aft fuselage (or empty drop tanks) rather than on only one main gear and the nose gear. This should not be done unless the tower or chase plane can *positively* confirm that one or both main gears are not fully extended. If the main gear cannot be retracted, a landing with asymmetrical gear configuration may be made.

NOTE Whenever the gear cannot be lowered by the normal system, the emergency procedure will be used. (See figure 3-6.) However, once the emergency lowering procedure is used, the nose gear is extended and locked down and cannot be retracted.

If an unsafe condition is confirmed for the main gear after the emergency lowering procedure is used, the following procedure should be used:

1. Landing gear position control circuit breaker—In.
2. Landing gear handle—UP.
   Retract main gear so that landing can be made on nose gear and aft fuselage (or empty drop tanks).
3. Canopy—Jettison.
4. External load—Jettison (if necessary).

NOTE Retain empty drop tanks to cushion landing shock and minimize airplane damage.

5. Normal approach.
6. Normal touchdown.
7. Throttle—OFF.
8. Drag chute handle—Pull.
9. Engine master switch—OFF.
10. Generator switch—OFF.
11. Battery switch—OFF.
12. When stopped—Leave airplane.

LANDING WITH NOSE WHEEL IN FULL SWIVEL.

If a landing is to be made with the nose wheel in full swivel, the possibility is very remote that the wheels will be cocked from center, because the nose wheel centering cam should automatically center the nose wheels. During this type of landing, the nose wheels should be allowed to touch down lightly, the drag chute deployed, and the rudder and brakes used for directional control.

BELLY LANDING.

A belly landing should be attempted only on a prepared or designated suitable surface. Investigation has shown that emergency landings made with the landing gear down have resulted in less pilot injury and damage to the airplane than those made with the gear up. However, if a belly landing is unavoidable and engine thrust is available, this procedure should be followed.

1. External load—Jettison.

NOTE If landing on a prepared surface, retain empty drop tanks to cushion landing shock and minimize airplane damage.

2. Canopy—Jettison.
3. Throttle—Normal approach setting.
4. Speed brake switch—OUT.
5. Throttle—OFF when landing is ensured.
6. Engine master switch—OFF.
7. Generator switch—OFF.
8. Battery switch—OFF.
9. Shoulder harness inertia reel handle—LOCKED (forward).
10. Touch down in normal attitude.
11. Drag chute handle—Pull.
12. When stopped—Leave airplane.

EMERGENCY ENTRANCE.

The procedure to be used by rescue personnel when assisting the pilot from the airplane following a crash landing is outlined in figure 3-5.

DITCHING.

NOTE Inspect emergency equipment, parachute, life vest, and raft pack before each overwater flight.

Ditch only as a last resort. All emergency survival equipment is carried by the pilot at ejection; consequently, there is no advantage in riding the airplane down. However, if altitude is not sufficient for ejection and ditching is unavoidable, proceed as follows:

1. Radio—Distress procedure.
2. Oxygen regulator diluter lever—100% OXYGEN.
3. External load—Jettison.
4. Personal equipment leads—Disconnect all except oxygen hose.
5. Shoulder harness inertia reel handle—LOCKED (forward).
6. Throttle—OFF.
7. Speed brake switch—OUT.
8. Engine master switch—OFF.
9. Generator switch—OFF.
10. Battery switch—OFF.
11. Canopy—Jettison.
12. Normal approach—Keep nose high.

Caution Unless wind is high or sea is rough, plan approach heading parallel to any uniform swell pattern, and try to touch down along wave crest or just after crest passes. If wind is as high as 25 knots or surface is irregular, the best procedure is to approach into the wind and touch down on the falling side of a wave.

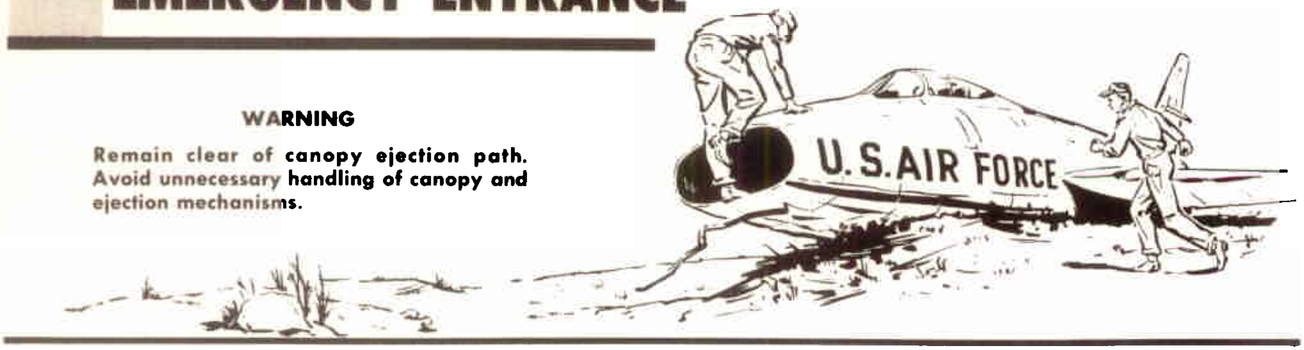
13. When stopped—Release belt.
14. Oxygen mask—Off.
15. Leave airplane.

NOTE If, for some reason, you are unable to escape from the cockpit of a sinking airplane after ditching, you can use the airplane oxygen equipment for temporary underwater survival. The pressure-demand type oxygen mask and the oxygen regulator are suitable underwater breathing devices when the regulator is set at 100% OXYGEN. It is essential that the mask be in place and tightly strapped, and that the regulator be set at 100% OXYGEN. Remember, the bail-out bottle cannot be used under water.

EXTERNAL LOAD EMERGENCY JETTISON.

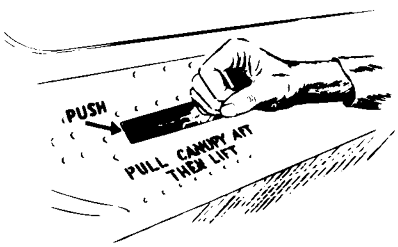
The external loads can be either electrically or mechanically jettisoned on the ground or during flight. If electrical power is not available, all loads requiring force ejection from the pylon will not be jettisoned. (On airplanes changed by T.O. 1F-100-630, the electrical function of the mechanical emergency jettison handle has been disconnected. However, on airplanes changed by T.O. 1F-100-677, the electrical function of the handle is restored.) External loads are dropped safe when jettisoned, but arming of the special store is determined by the special store control panel.

EMERGENCY ENTRANCE



WARNING

Remain clear of canopy ejection path. Avoid unnecessary handling of canopy and ejection mechanisms.



1 Unlatch emergency release handle and move canopy aft approximately one inch to release canopy locks. (Handle is on left side only on F-100C-1 airplanes AF53-1709 and -1710.)

NOTE

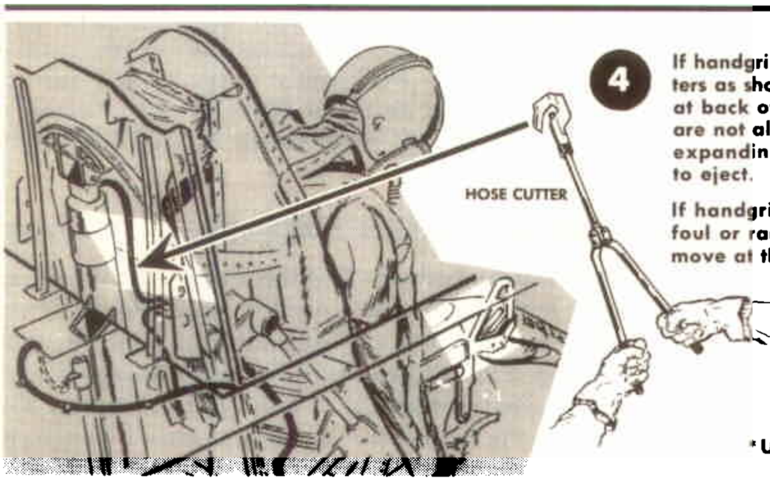
If canopy cannot be opened, break canopy glass aft of seat with a heavy implement. Strike canopy glass at shear point (in corner or along stiffener). Because of the thickness of the canopy glass, CO_2 may not be effective as a cooling agent to harden or crystallize the glass. Its use is recommended, however, as a final effort.

2 Lift canopy at forward end. Push canopy up and aft until it has completely separated from airplane. Proceed with step 3.

3 When access to cockpit is gained, check position of ejection seat handgrips.

WARNING

If pilot jettisoned canopy in preparation for crash landing, seat handgrips will be up or, on some airplanes, canopy alternate emergency handle will be pulled. (Raising either handgrip jettisons canopy.) When handgrips are up, seat ejection trigger in each handgrip is exposed. Subsequent movement of either trigger will fire catapult and eject seat from airplane.



4 If handgrips are up, disarm seat catapult by cutting (with cutters as shown) or disconnecting* hose leading from "T" fitting at back of seat to seat catapult. Make sure loose hose ends are not aligned; otherwise, if seat initiators fire accidentally, expanding gases may actuate seat catapult and cause seat to eject.

If handgrips are down in normal position, be careful not to foul or raise handgrips. (Handgrips are interconnected and move at the same time.)

*Use 9/16-inch open-end wrench.

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Figure 3-5

ON-THE-GROUND JETTISONING.

NOTE On some airplanes,* external loads cannot be jettisoned electrically when the weight of the airplane is on the nose gear.

To jettison external loads on the ground, use any or all of the following means of jettisoning.

1. External load emergency jettison button—Press.
2. External load emergency jettison handle—Pull. Pull this handle in case of electrical failure.
3. Special store emergency jettison handle—Pull. Pulling this handle in case of electrical failure jettisons only the special store.

IN-FLIGHT JETTISONING.

To jettison external loads during flight, the following methods can be used.

1. External load emergency jettison button—Press.
2. External load emergency jettison handle—Pull. Pull this handle in case of electrical failures.
3. Special store emergency jettison handle—Pull. Pulling this handle in case of electrical failure jettisons only the special store.
4. Armament selector switch at JETT ALL—Press bomb-rocket release button.
5. External load auxiliary release buttons—Press one at a time at intervals of one second or more.

Warning Do not press more than one button at a time. Combined recoil forces of the ejector cartridges produce stresses that can damage the wing structure.

THROTTLE FAILURE.

As a result of improper throttle adjustment, excessive forces may be required to move the throttle in or out of afterburner. On some airplanes, these forces may cause the throttle lever to fail inside of the throttle quadrant in such a manner that it may be impossible to retard the throttle.

Caution If throttle has failed, do not rotate throttle grip counterclockwise, as this may prevent retarding the throttle below about 85% rpm.

If attempts to move or retard throttle fail, set up recommended forced landing pattern. When landing is ensured, move engine master switch to OFF to reduce thrust.

Warning At sea level, about 13 seconds is required for thrust to decrease from Military to idle thrust and about 10 seconds for a decrease from 70% rpm to idle thrust. (These times are altered slightly by altitude and temperatures that differ from the standard 60°F day.)

Should the throttle breakage require an aborted take-off, immediately move engine master switch to OFF if throttle cannot be retarded; then deploy drag chute, and apply brakes as required.

Warning Thrust reduction is delayed when the engine master switch is used instead of the throttle to shut down the engine.

AFTERBURNER FAILURE.

AFTERBURNER FAILURE DURING TAKE-OFF (BEFORE REFUSAL POINT).

If the refusal point has not been reached, the take-off should be aborted upon failure of the afterburner. Refer to "Abort" under "Take-off or Landing Emergencies" in this section.

Warning Inadvertent drag chute deployment on take-off may be mistaken for an afterburner failure. Therefore, before taking action to abort or fly, check to see that the drag chute is not deployed.

*Airplanes within F-100C-1 through F-100C-20 Airplanes and F-100C-25 Airplanes AF54-1970 through -1998 not changed by T.O.

AFTERBURNER FAILURE DURING TAKE-OFF (AFTER REFUSAL POINT).

If the afterburner fails after the refusal point has been passed, the take-off should be continued if adequate runway remains.

NOTE In most instances, if external loads are jettisoned at the time of afterburner failure, the take-off can be successfully completed in Military Thrust. The actual runway length required for take-off under these conditions can be determined by use of the Military Thrust acceleration chart. Refer to "Take-off Continued With Afterburner Failure" in Appendix I for description and use of the Military Thrust acceleration charts (figures A2-6 and A2-12) and description of their use.

Caution If the afterburner has failed, do not attempt to relight.

1. Throttle—Inboard.

   Move throttle inboard out of AFTERBURNER range to Military immediately, to ensure exhaust nozzle closing.

Warning If the exhaust nozzle fails to close, considerably less than Military Thrust will be available.

2. External load—Jettison (if necessary).
3. Continue take-off.

   When the external load is jettisoned, acceleration should be felt and the take-off continued with Military Thrust. If the airplane stops accelerating or starts to decelerate, assume that the nozzle has failed to close. Proceed to step 4 and prepare for a barrier engagement.
4. Abort (if necessary). Refer to "Abort" under "Take-off or Landing Emergencies" in this section.

AFTERBURNER FAILURE DURING TAKE-OFF (AIRPLANE AIR-BORNE).

NOTE In most instances, if external loads are jettisoned at the time of afterburner failure, the take-off can be successfully completed in Military Thrust. The actual runway length required for take-off under these conditions can be determined by use of the Military Thrust acceleration chart. Refer to Appendix I for the Military Thrust acceleration charts (figures A2-6 and A2-12) and description of their use.

1. Throttle—Inboard.

   Move throttle inboard out of AFTERBURNER range to Military immediately to ensure exhaust nozzle closing.

Warning If the exhaust nozzle fails to close, considerably less than Military Thrust will be available.

2. Continue take-off.

   Continue take-off in Military Thrust. If the airplane starts to decelerate or altitude cannot be maintained, it must be assumed that the exhaust nozzle failed to close or that the gross weight is too great to continue flight; proceed to step 3.
3. External load—Jettison (if necessary).

LOSS OF AFTERBURNER DURING FLIGHT.

If loss of afterburner occurs during flight, proceed as follows:

1. Throttle—Inboard.

   Move throttle inboard out of the AFTERBURNER range immediately.

NOTE This closes the electrically operated afterburner shutoff valve in the engine-driven fuel pump unit, so that the fuel flow to the afterburner spray bars is shut off and the exhaust nozzle closes.

2. Overheat-warning light—Check light out.

   If the engine burner compartment overheat-warning light was not on when failure of the afterburner occurred, attempt to relight the afterburner, watching for any indications of abnormal operation.
3. Relight afterburner—Check afterburner operation.

   If all cockpit indications of afterburner operation are normal after relight, continue afterburner operation.

Warning Do not re-engage afterburner if fire, explosion, or unusual thump, vibration, or noise was encountered during afterburner operation.

NOTE If afterburner light-up is not obtained within 5 seconds after the throttle is moved outboard to the AFTERBURNER range, the throttle should be moved inboard from this position, and then, after 3 to 5 seconds, returned outboard to AFTERBURNER, to recycle the afterburner igniter.

AFTERBURNER NOZZLE FAILURE.

On the ground or at altitudes below 50,000 feet, if the exhaust nozzle fails to open as soon as afterburning takes place, a loud explosion and a violent surging of the engine occurs, together with a rapid rise in exhaust temperature and an rpm reduction. Above 50,000 feet, failure of the nozzle to open may be indicated only by a rise in exhaust temperature. If these conditions are noted when the afterburner has been selected, the throttle should be moved inboard immediately, to shut down the afterburner and prevent possible damage to the engine and the engine air inlet duct. Nc emergency override control is provided for the exhaust nozzle.

Caution If the exhaust nozzle fails to close when the afterburner is shut down, a loss in normally available thrust is evident throughout the entire speed range of the engine. The most appreciable thrust loss occurs at Military Thrust throttle settings.

IN-FLIGHT FAILURE OF AFTERBURNER SHUTOFF SYSTEM.

NOTE J57-21 Series engines have an afterburner emergency shutoff system that will shut down the afterburner system mechanically if the electrical control system fails. The afterburner is shut off mechanically when the throttle is moved out of the AFTERBURNER range and then retarded to a setting that is about the minimum afterburner setting. This thrust setting may or may not sustain flight for the airplane load configuration and altitude. If additional thrust is needed for short periods, the use of full afterburner is recommended. Approximate Military Thrust can be obtained from the combined engine and afterburner thrust with a throttle setting just above the emergency afterburner shutoff. However, operating at this thrust condition results in excessive fuel consumption for the thrust output.

- The following instructions apply to those engines not equipped with the afterburner emergency shutoff system.

If the afterburner fails to shut off when the throttle is moved inboard, thrust output (ranging from full afterburner to approximately idle thrust) will still be available. If afterburner does not shut off, proceed as follows:

1. Landing—Plan accordingly, as range is greatly reduced. Since airplane range is greatly reduced during this condition, even at reduced throttle settings, a landing should be planned accordingly.
2. After touchdown, immediately move engine master switch to OFF. Then move throttle to OFF and deploy drag chute. (This reduces fire hazard by shutting off all fuel flow to the engine and afterburner.)

Warning

Fire may destroy the drag chute if the chute is deployed while the afterburner is operating. Also, during ground operations at idle power, a long flame trails from the tailpipe creating a fire hazard to nearby objects and personnel.

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ENGINE OIL SYSTEM FAILURE.

NOTE Refer to "Oil Pressure" in Section VII for information concerning thrust reduction and oil pressure failure.

- Fluctuations within the normal range of 40 to 50 psi are acceptable. Flight with oil pressure above, or fluctuating above, 50 psi is permissible, but corrective action must be taken before the next flight.
- During maneuvers of less than 1 G, oil pressure may fall to as low as zero. Such pressures are permissible, provided these maneuvers do not exceed 15 seconds.

OIL PRESSURE (35 TO 40 PSI).

If oil pressure during steady flight drops to the 35 to 40 psi range, or fluctuates below 40 psi, proceed as follows:

1. Throttle—Reduce.
2. Altitude—Reduce.
   Maintain safe ejection altitude.
3. Land as soon as practical.

OIL PRESSURE (BELOW 35 PSI).

If oil pressure drops to, or fluctuates below, 35 psi, proceed as follows:

1. Throttle—Reduce.
2. Altitude—Reduce.
   Maintain safe ejection altitude.
3. Land as soon as possible.
   Land as soon as possible, using a flame-out pattern.

ENGINE OIL OVERHEAT.

The oil temperature regulator has a thermal lag which may cause a transient increase in oil temperature under some conditions. The engine oil overheat caution light comes on when oil temperature exceeds 127°C (260°F). Although oil temperature above 127°C (260°F) can be encountered under normal operating conditions when a combination of these factors exists, illumination of the caution light may indicate an engine or oil system malfunction. If the engine oil overheat caution light comes on, hold the oil cooler shutter switch* at OPEN for at least 35 seconds; then move it to OFF and proceed as follows:

Caution If the engine oil overheat caution light comes on within 5 minutes after take-off or within 2 minutes after a thrust reduction, and if there is no evidence of engine malfunction, a transient overtemperature condition is indicated. A precautionary landing is recommended even though the light goes out.

1. Check for evidence of malfunction.
   If the light is accompanied by evidence of a malfunction such as engine roughness, smoke compressor stalls, or loss of oil pressure, engine failure is indicated.
2. Throttle—Reduce.
3. Altitude—Reduce.
   Maintain safe ejection altitude.
4. Land as soon as possible.
   Land as soon as possible, using a flame-out pattern.

NOTE Satisfactory engine operation for an extended time period can be expected with overheat light on even though a malfunction exists, unless abnormal engine operation, such as roughness, vibration, oil pressure loss or fluctuation, high exhaust gas temperature, or power loss, is noted.

ENGINE FUEL SYSTEM FAILURE.

NORMAL FUEL CONTROL FAILURE.

If the normal fuel control system fails, as shown by abnormal reduction of engine rpm, thrust, or temperature, or by inability to reduce rpm, transfer to the emergency fuel control system by moving the fuel regulator selector switch to EMER. However, when time and conditions permit, avoid such an immediate transfer to the emergency system and make the transfer as follows:

1. Throttle setting—Adjust to engine rpm.
   Adjust throttle setting to match actual engine rpm as closely as possible. Do not make transfer at or near full throttle, because the emergency fuel flow may exceed engine requirements and produce compressor stall or engine overtemperature.

Caution If the throttle setting and actual engine rpm are seriously mismatched, flame-out, compressor stall, or overtemperature may occur during transfer to the emergency fuel control system. Be prepared to reduce or advance power immediately, as required.

2. Fuel regulator selector switch—EMER.
3. Throttle—Slowly reposition to desired setting.

Caution Careful and constant checking of engine rpm, fuel flow, and exhaust temperature is mandatory during operation on the emergency system. Move throttle cautiously to avoid compressor stall, engine surge, or overtemperature, because the emergency system cannot prevent these reactions.

- If the emergency fuel control system was selected because of in-flight failure of the normal system, *do not transfer back to normal system.*

NOTE Afterburner operation on the emergency fuel control system is permissible, but applicable precautions must be observed.

ENGINE FUEL PUMP FAILURE.

If the engine element of the engine-driven fuel pump unit fails (on early airplanes, this is shown by illumination of the engine fuel pump caution light), the afterburner element fuel output is then directed automatically to both the engine and the afterburner. When the engine element fails, full afterburner operation cannot be obtained below 15,000 feet.

AFTERBURNER FUEL PUMP FAILURE.

If the afterburner element of the engine-driven fuel pump unit fails, the afterburner cannot operate and the

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***Some airplanes**

exhaust nozzle closes because of low fuel pressure; however, the engine element of the fuel pump unit permits full Military Thrust operation.

AIRPLANE FUEL SYSTEM FAILURE.

If a fuel transfer or booster pump fails, fuel may not be transferred to the forward tank or supplied to the engine at the required rate, and thrust loss or flame-out can occur. Critical fuel pump failures are indicated by abnormal depletion of forward tank fuel.

NOTE Afterburner should not be used when fuel in forward tank is less than 250 pounds.

FORWARD GAGE INDICATES FUEL.

Above 25,000 Feet.

If the forward tank contains fuel, no *single* fuel pump failure (transfer pump or booster pump) above 25,000 feet can affect engine operation at any thrust setting. However, descend to 25,000 feet or below to prevent pump cavitation.

Below 25,000 Feet.

If the forward tank contains fuel, no possible combination of airplane system fuel pump failures below 25,000 feet can affect engine operation at any thrust setting, including Military Thrust.

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FORWARD GAGE APROACHES OR INDICATES ZERO.

When the *forward* tank gage indicates over 200 pounds less than the *total* gage (nonafterburning) at total fuel reading of 1500 pounds or less, a failure of the fuel transfer system is indicated and a part of the total fuel may not be available.

Above 25,000 Feet.

Flight above 25,000 feet can be maintained at Military Thrust or less, with the most critical single fuel transfer system malfunction (failure of the intermediate tank transfer pump), until the total fuel remaining is 1700 pounds.

NOTE Afterburner operation can be maintained under these conditions as long as the total fuel remaining is above 3100 pounds.

If flame-out occurs because of this failure, it is necessary to descend to 20,000 feet to make a successful air start. After the air start, normal operation through Military Thrust can be sustained up to 25,000 feet.

Below 25,000 Feet.

Flight below 25,000 feet can be maintained at Military Thrust or less, with the most critical single fuel transfer system malfunction (failure of one wing tank scavenge pump), until the total fuel remaining is 600 pounds.

NOTE Afterburner operation can be maintained under these conditions as long as the total fuel remaining is above 1700 pounds.

- Transfer of fuel by gravity from the wing tank can be increased by decelerations, yaws, and slips.

If flame-out occurs under these conditions, attempt an air start if altitude and fuel remaining permit.

NOTE It may be necessary to descend to below 20,000 feet to accomplish an air start.

DROP TANK FUEL TRANSFER FAILURE.

If the drop tank fuel selector switch fails in flight (such as internal failure of the switch or loss of the knob) and if there is not sufficient internal system fuel to abort the mission, pull the drop tank fuel control circuit breaker (on the left circuit-breaker panel). Pulling this circuit breaker de-energizes the tank pressurizing air shutoff valves to the open position and results in simultaneous transfer of fuel from all drop tanks. The circuit breaker is to be reset after fuel has been transferred, to prevent pressurization of the forward fuselage tank with resulting possible fuel loss out the vent system and to ensure that no difficulty will be encountered in accomplishing air refueling if attempted.

Warning For loading configurations which include a full drop tank at an outboard station, simultaneous transfer of drop tank fuel may cause a lateral control problem to develop. Therefore, maneuvering should be held to a minimum. If necessary to maintain adequate lateral control, the outboard drop tank should be jettisoned. This action will reduce lateral control requirements.

- If the drop tank fuel control circuit breaker has been pulled, the inboard drop tanks should be jettisoned before landing to ensure that the airplane CG will be within the landing limit.

ELECTRICAL POWER SYSTEM FAILURES.

COMPLETE ELECTRICAL SYSTEM FAILURE.

If a complete electrical failure occurs or if for any reason it becomes necessary to turn off both the battery and generator switches, only those systems powered by the battery bus are operable and are dependent on battery output. (See figure 1-16.) Flight under these conditions is limited. Land as soon as possible. The following precautions, however, should be observed:

NOTE In case of complete electrical failure, the cockpit pressurization system will be inoperative.

1. Reduce airspeed and readjust trim.

   If possible, reduce airspeed, readjust trim, and if engine does not have afterburner emergency shutoff, terminate use of the afterburner (if engaged) before turning off electrical power, as trim, afterburner shutdown, and closing of exhaust nozzle cannot be accomplished without electrical power.

NOTE The afterburner emergency shutoff system is on J57-21 engines only.

2. Electrical power—OFF.

   The yaw and pitch* damper systems become inoperative when electrical power is not available. (Refer to "Yaw Damper System Failure" or "Pitch Damper System Failure" in this section.)

3. Descend—To below 25,000 feet.

   With all electrically driven fuel booster and transfer pumps inoperative, normal engine operation

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***Some airplanes**

can be sustained below 25,000 feet by suction feed. Thrust control can be obtained during these conditions even though electrical failure prevents afterburner shutdown and closing of the exhaust nozzle. If the engine is not equipped with an afterburner emergency shutoff system and the afterburner cannot be shut down because of electrical failure, approximate Military Thrust can be obtained from the combined engine and afterburner thrust by retarding the throttle to its Maximum Continuous Power setting. Fuel consumption will be high, so a landing should be made as soon as possible.

NOTE Since the exhaust nozzle remains open when the afterburner cannot be shut down, normal throttle-thrust relationship is not available.

- The afterburner emergency shutoff system is on J57-21 engines only.

4. External load (bombs and 275-gallon drop tanks)—Jettison manually if necessary.

NOTE Failure of electrical power does not allow rockets, chemical or napalm tanks, or 200-gallon (450-gallon) drop tanks to be jettisoned by any method, as these loads must be forcibly ejected by means of electrically fired ejectors.

GENERATOR FAILURE.

Any malfunction that causes the generator to be cut out of the circuit (generator failure or an abnormal rise or drop in generator output) is indicated by illumination of the generator caution light. Whenever the generator is "off the line," all equipment powered by the primary bus is operated by battery power, provided the battery switch is ON. The secondary and tertiary bus, normally powered by the primary bus through automatic bus tie-in relays (controlled by generator output or external power), fail if the generator fails. In case of emergency, however, secondary bus power can be obtained by moving the secondary bus emergency tie-in switch to the EMERG position. This allows the secondary bus to be powered by the primary bus, provided the battery switch is ON.

Caution Use of the secondary bus tie-in switch to maintain radio operation drastically reduces available reserve battery power.

When generator output drops or fails (generator is inoperative at engine speeds below 40% rpm), all nonessential equipment should be turned off to reduce the load on the battery.

Caution Do not inadvertently apply wheel brakes in flight when the battery is the only source of power. Actuation of the brakes CAN turn on the emergency hydraulic pump if utility hydraulic pressure is low.

A landing should be made as soon as possible, since the length of time that usable battery power is available for continued operation is between approximately 6 and 22 minutes. Battery power duration may be decreased, however, by a number of variable factors, including low state of battery charge, excessive electrical loads, and low battery temperature.

NOTE Use landing gear emergency lowering handle to ensure that gear lowers and locks down. (See figure 3-6.) If generator fails and battery power is not available to the primary bus, or if battery switch is turned off, landing gear position indicators will be inoperative and will continuously show an unsafe gear condition.

Caution Compressor stall, engine surge or instability, or loss of thrust may occur when combined engine and afterburner fuel flows cannot be sustained because of inoperative tank-mounted fuel booster pumps.

Generator Reset Procedure.

When generator irregularity occurs, as shown by illumination of the generator caution light, try to bring generator back into circuit as follows:

1. Generator switch—RESET momentarily; then ON.
   Hold generator switch at RESET momentarily; then return switch to ON. If caution light remains out, the failure was temporary.
2. Generator caution light—Check (repeat reset procedure if necessary).
   If caution light is still on when generator switch is returned to ON, repeat reset procedure several times. If generator caution light remains on after several reset attempts, check loadmeter to determine generator output. Then proceed to step 3.
3. If loadmeter is normal and power inverter caution light is out—Continue flight (leave generator switch ON).
4. If loadmeter shows that generator is not charging—Abort flight.
   a. Generator switch—OFF.
   b. Reduce battery load.
   c. Land as soon as practical.

INVERTER FAILURE.

Instrument (Three-phase) Inverter Failure.

Failure of the instrument (three-phase) inverter is indicated by illumination of the instrument inverter caution light. If the selected inverter fails, illumination of the caution light indicates that the inverter selector switch should be moved to select the other instrument inverter, to maintain three-phase ac power. If one inverter has failed and the other inverter has been selected, the caution light goes out upon operation of the second inverter. The light then comes on if the second inverter fails, as the caution light depends upon primary bus power for illumination rather than inverter power. If primary bus power fails, both instrument inverters become inoperative, and the inverter caution lights are also inoperative. (See figure 1-16.)

Caution Loss of three-phase ac power results in failure of the oil and hydraulic pressure gages, fuel quantity gage, fuel flow indicator, directional indicator, engine differential pressure gage,* and attitude indicator. However, although inoperative, these instrument pointers continue to register the conditions that existed at time of power failure. As a result, a landing should be made as soon as possible.

NOTE The gun-firing, strike camera time-delay, and cockpit automatic temperature control circuits become inoperative if three-phase ac power fails. Upon loss of this power, automatic control of the cockpit temperature is inoperative and subsequent changes must be made by manual selection of the temperature master switch.

- If the instrument inverter caution light remains on when either inverter is selected, but ac-operated instruments appear to be functioning properly, check condition of fuses in ac power failure sensing circuit.

Power (Single-phase) Inverter Failure.

Failure of the power (single-phase) inverter is indicated by illumination of the power inverter caution light. This inverter provides power for the IFF radar, gun sight, and sight radar. The pitch and yaw damper systems are also powered by the single-phase inverter. Generator failure, loss of primary bus power, tertiary bus failure, or having the power inverter switch in the OFF position interrupts the operation of this inverter. There is no alternate source of single-phase ac power.

Caution Loss of single-phase ac power results in failure of the engine pressure ratio gage.* Although the gage becomes inoperative, the pointer registers the condition existing at time of power failure.

***Some airplanes**

UTILITY HYDRAULIC SYSTEM FAILURE.

There is no emergency utility hydraulic system. If the utility system fails, the speed brake, nose wheel steering, and pitch and yaw damper systems are inoperative. However, accumulators provide pressure for nose gear lowering, wheel braking, and opening the air inlet-outlet doors for operation of the ram-air turbine-driven flight control emergency hydraulic pump.

NOTE Some airplanes have an electrically driven emergency hydraulic pump in the brake system. This pump is powered by the battery bus and provides brake operating pressure in case of utility system failure, as long as fluid is available from the utility reservoir. Pump operation is controlled by pressure switches in the brake system which sense low brake operating pressures. When these pressure switches close because of low wheel brake accumulator pressure, the emergency pump is energized when either brake pedal is depressed.

In case of a utility hydraulic system failure, proceed as follows:

NOTE Nose wheel steering and the speed brake will be inoperative; however, wheel brakes will be available for directional control.

1. Fuel—Reduce.
   Remain air-borne to burn fuel down to normal landing weight.
2. Land as soon as practical.
3. Landing gear handle—DOWN.
4. Landing gear emergency lowering handle—Pull.
5. Throttle—OFF.
   Move throttle to OFF in case of a drag chute failure.

Caution No attempt should be made to taxi or park the airplane. Clear runway if possible and shut down.

BRAKING WITH UTILITY SYSTEM FAILURE.

Power Brakes.

If the utility system fails, the emergency brake accumulator provides pressure for limited wheel braking to the extent of only two full brake applications. There is no way to apply the brakes after the emergency brake accumulator pressure has been exhausted.

Caution If the utility hydraulic system has failed, the wheel brakes should not be tapped lightly, but applied and held, as each tap is equal to a full application and two such applications deplete the accumulator. If possible, do not use brakes until airplane is slowed to below 120 knots. Then apply brakes steadily and hold, until airplane stops.

Power-Manual Brakes With Antiskid.*

If the utility hydraulic system has failed, leave the antiskid switch in the ON position and apply brakes smoothly, with gradually increasing pedal force.

NOTE Do not pump brake pedals. Pumping action will rapidly deplete the accumulators, making it necessary to use manual braking much sooner during the landing roll. Four full pedal applications will deplete the accumulators. Ten cycles of the antiskid system are equal to one pedal application. (A maximum braking antiskid landing requires about 30 cycles or about three full pedal applications.)

If use of brakes has depleted the brake accumulator, the master cylinder portion of each brake valve will permit braking as long as hydraulic fluid is available. Changeover to manual braking is indicated by pedal stiffening or by a steady decrease in pedal resistance (pedal "drop-off" or "sink"). When this occurs, a definite increase in pedal pressure is required, and heavy pedal forces should be applied as long as braking action can be detected. The pedals will slowly drop during the brake application. When pedals have dropped so far that adequate leverage is no longer available, the pedals should be pumped at least three times to actuate the brakes. (Pedals should not be released more than 25 percent of their travel during each succeeding pump.) Repeat this procedure until the airplane is stopped. The antiskid system should remain on during manual braking to prevent skidding. Caution should be used when brakes are used to clear the runway, because of the time lag required by pumping to obtain braking action. No attempt should be made to taxi to the parking area.

Power Brakes With Antiskid and Brake Emergency Hydraulic Pump (Airplanes Changed by T.O.).

If the utility hydraulic system has failed, power braking action will be available as long as there is hydraulic fluid in the utility system, and electrical power (battery bus) is available to operate brake emergency pump.

FLIGHT CONTROL HYDRAULIC SYSTEM FAILURE.

Failure of one flight control hydraulic system normally does not affect the operation of the other system, which assumes the entire load of flight control operation. (Refer to "Flight Control Hydraulic Systems" in Section I.) The mission should be aborted and a landing made as soon as possible; however, under such a condition, flight control operation may be somewhat slower because of reduction of hydraulic flow. If either system fails, the flight system failure warning light will come on. Proceed as follows:

1. Determine which system has failed.
   a. If system No. 1 failed—System No. 2 will operate flight control system.
   b. If system No. 2 failed—System No. 1 will operate flight control system.

During landing approach:

2. Emergency hydraulic pump lever—ON.

   Place emergency hydraulic pump lever in ON position to supplement output of the engine-driven hydraulic pump during landing. Keep control movements to a minimum during entry onto final approach and on final. A long, straight-in final approach should be used, and rate of descent should be between 1000 and 1500 feet per minute (remaining above safe ejection altitude as long as practical). Reduce rate of descent to below 1000 feet per minute just before flare.

Caution If the ram-air turbine-driven emergency pump is started or operating when the outside air pressure at the ram-air exhaust door exceeds the pressure in the engine intake duct (such as occurs during high engine rpm at low airplane speed), airflow through the turbine is reversed. This action lowers or cuts off the output of the emergency pump, and may, on F-100C-1 Airplanes, unwind and damage the turbine. To prevent this flow reversal and possible turbine damage, and to ensure adequate pump output, it is necessary to vary the power settings when the airspeed is low at high engine rpm. If the emergency pump pressure drops, retard throttle until this pressure is restored.

- If an increase in engine speed is anticipated on F-100C-1 Airplanes (such as would occur during a go-around when landing), the emergency pump must be shut down to prevent turbine damage.

In case of engine failure, the ram-air, turbine-driven flight control emergency pump must be started during the landing approach to supplement the output of the engine-driven hydraulic pumps, to ensure effective control action while landing. (Refer to "Flight Control System Emergency Hydraulic Pump" in Section VII.) Should the engine freeze, preventing operation of the

***F-100C-15 Airplane AF54-1833 and all later airplanes, not changed by T.O.**

engine-driven pumps, power in flight control system No. 1 must then be supplied by the emergency hydraulic pump. When the emergency hydraulic pump lever is moved forward to ON, utility hydraulic pressure (or pressure from an emergency accumulator) opens the air inlet-outlet turbine doors so that ram air drives the turbine for emergency pump operation.

Caution Because of reduced total output, control movement must be kept to a minimum, particularly when the emergency pump is the only source of flight control power (engine frozen). The emergency pump as the only source of power will not provide normal maneuvering capability, but is adequate for a proficient pilot flying under normal conditions of visibility and turbulence with adequate runways to permit a well-planned approach. Under other cimcumstances, the pilot's judgment must prevail.

NOTE The rudder is normally actuated by hydraulic power from the No. 1 flight control hydraulic system. If this system fails, or pressure drops below 3000 psi, the summing valve admits enough utility hydraulic pressure to the rudder actuating cylinder to make up the difference for 3000 psi.

Warning If *complete* flight control hydraulic system failure occurs (i.e., pressure cannot be maintained by the emergency pump upon loss of the engine-driven pumps or because of other malfunctions in the systems), stick forces become extremely high. As a result, control of the airplane in cruising flight is very difficult, and control at high speeds or during maneuvers is impossible. Therefore, if such a failure is encountered, attempt to reduce airspeed to about 200 knots, and try to maintain control by steady push-and-pull force on the stick and by varying power settings. If control cannot be maintained, *eject.* If some control is available, however, and altitude and other conditions permit, attempt to return to a suitable area. Then eject, as extended flight and a landing with these high stick forces *should not be attempted under any circumstances.*

FLIGHT CONTROL ARTIFICIAL-FEEL SYSTEM FAILURE.

The artificial-feel system failure can be indicated by a lightening of stick forces (resulting in overcontrol), lack of trim response, and poor stick-centering characteristics. If failure of flight control artificial feel is encountered, proceed as follows:

1. Airspeed—Reduce.

   Reduction of airspeed may relieve severe oscillation of the airplane.

2. Eject.

   Ejection is recommended whenever failure of the artificial-feel system is evident by loss of adequate control.

TRIM FAILURE.

If any one of the three systems should fail in either extreme-travel position, the maximum force required by the pilot to move the control surface to the opposite extreme is not beyond physical capabilities. If trim failure occurs in the trim switch on the stick grip, proceed as follows:

1. Reduce airspeed to about 270 (255*) knots IAS.
2. Take-off trim button—Press for take-off trim.

   The take-off trim setting provides trim adjustments for level flight at a nominal speed of 270 (255*) knots IAS.

NOTE If this speed provides a more satisfactory attitude than the "failed" trim position, the take-off trim button should be used. The take-off trim position for the ailerons and rudder is neutral, and for the horizontal stabilizer it is about 4 (5*) degrees down from neutral to induce a nose-up condition. There is no alternate trim control.

3. Readjust trim before landing.

   If possible, trim adjustments should be made before entering the landing pattern.

Caution The trim switch may be subject to occasional sticking in an actuated position, resulting in application of extreme trim. When this condition occurs, the trim switch must be returned manually to the center (OFF) position, after the desired amount of trim is obtained. If trim switch sticks, a red cross entry must be made in Form 781.

YAW DAMPER SYSTEM FAILURE.

The yaw damper system becomes inoperative if electrical power (primary bus dc and single-phase ac) or utility hydraulic system failure occurs, or after an operation of the monitor system in the circuit. When electrical or hydraulic power is removed from the yaw damper

***Airplanes changed by T.O. 1F-100C-547**

system, the yaw damper actuator to the rudder is hydraulically centered and mechanically locked. Adequate directional control is still available. Yaw damper system electrical failure or a malfunction causing monitor relay operation is indicated by the yaw damper caution light coming on. When the light comes on, the yaw damper switch should be moved to STANDBY to reset the system, and then returned to ON. (The caution light will go out when the switch is at STANDBY.) If the light comes on when the switch is returned from STANDBY to ON, the malfunction still exists and the system cannot be re-engaged. If the failure occurred in the ac or dc electrical power supply, a 1½-minute delay is necessary (for system warm-up) before system can be re-engaged. When utility hydraulic system failure shuts off the yaw damper system, the yaw damper caution light will not come on, and use of the yaw damper switch will not reset the system. (If hydraulic failure occurs, the yaw damper system drops out automatically, and re-engages automatically if hydraulic power is restored.)

PITCH DAMPER SYSTEM FAILURE.*

The pitch damper system becomes inoperative if electrical power (primary bus dc or single-phase ac) or utility hydraulic system failure occurs. If such a malfunction occurs, hydraulic power to the pitch damper actuator is shut off, and the actuator is locked in the position it was in at time of failure. The pitch damper caution light then comes on. If the automatic stops (which limit link travel) are in a position which permits pitch damper actuator travel beyond the safe G-limits for the airplane, the stop monitor circuit shuts off hydraulic power, recenters the actuator to a neutral position, and turns on the pitch damper caution light.

NOTE If the pitch damper system cuts out, as indicated by the pitch damper caution light coming on, resetting for re-engagement may be accomplished by placing the pitch damper switch at STANDBY, to extinguish the light, before placing it at ON. If the light fails to go out when the switch is ON, the malfunction still exists and the pitch damper cannot be re-engaged. If the failure occurred in the ac or dc electrical power supply, a 1½-minute delay is necessary (for system warm-up) before the system can be re-engaged.

SPEED BRAKE SYSTEM FAILURE.

To close speed brake in flight, in case of electrical or hydraulic failure, move speed brake emergency dump lever forward and increase airspeed to above 300 knots IAS. This dumps the hydraulic pressure and allows air loads to return the speed brake to a trail position. Then return the emergency dump lever to OFF (aft). This creates a hydraulic lock that prevents the speed brake from lowering during landing.

Caution The speed brake will probably be extended at touchdown, with any failure, if the emergency dump lever is left in the DUMP position.

- With the loss of utility hydraulic system fluid while the speed brake is extended, the speed brake can be retracted by the emergency dump lever but cannot be locked in the retracted position. Therefore, the speed brake will start extending at about 200 knots IAS and will be full down by 150 knots IAS.

The speed brake cannot be opened if utility hydraulic system pressure has failed.

LANDING GEAR EMERGENCY OPERATION.

LANDING GEAR IN-FLIGHT EMERGENCY OPERATION.

If the landing gear warning light (enclosed in the landing gear handle knob) remains on after the gear has been retracted, proceed as follows:

1. Landing gear handle—Leave UP.

Caution Do not move landing gear handle when landing gear warning light is on and speed is above gear-down limit airspeed (230 knots IAS). Landing gear doors could be torn off when hydraulic pressure is removed from the door actuating cylinders.

2. Reduce airspeed.

   Slow airplane to below gear-down limit airspeed (230 knots IAS).

3. Fly-by check of gear and door position.

   Have a gear and door position check made by the tower on a fly-by or by another airplane in flight.

4. Cycle gear.

   If warning light remains on, after gear has been cycled, proceed to step 5.

5. Lower gear, and land.

LANDING GEAR EMERGENCY LOWERING.

The landing gear emergency lowering procedure is shown in figure 3-6.

*Some airplanes

LANDING GEAR EMERGENCY LOWERING

1 Airspeed—BETWEEN 230 AND 180 KNOTS IAS.

Reduce airspeed to between 230 and 180 knots IAS. Otherwise, air loads may hold gear doors closed. Below 180 knots, gear may not lock down.

BETWEEN 230 AND 180 KNOTS IAS

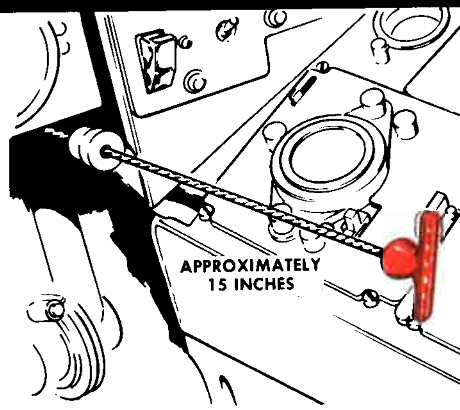
2 Landing gear handle—DOWN.

3 Landing gear emergency handle—PULL.

Pull to full extension to ensure release of all uplocks; hold handle extended until gear is down and locked.

CAUTION

Pull emergency handle to full extension to ensure release of all uplocks.



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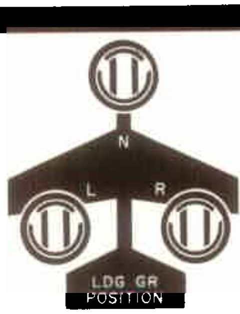

Landing gear position indicators—CHECK SAFE.

The red warning light in the landing gear control handle should go out when the gear is down and locked, and landing gear position indicators should show safe indication. If these conditions are not present, proceed to step 5.

NOTE

- Yaw airplane to lock main gear if gear down-and-locked indication does not appear after 15 seconds.
- Nose gear cannot be retracted in flight after being lowered by means of the landing gear emergency lowering handle.

CAUTION

Do not pull G in attempt to aid in locking gear down, as use of G increases gear lowering time and may cause damage to gear mechanism.

5

Circuit breaker—PULL.

Pull gear position control circuit breaker on left circuit-breaker panel and repeat steps 1 through 4.

CAUTION

Failure of the landing gear handle control switch may cause immediate gear retraction when the emergency lowering handle is released, regardless of the landing gear handle position. If this type of failure is encountered, pull the gear position control circuit breaker and repeat the emergency lowering procedure.

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Figure 3-6

CANOPY JETTISON (ALTERNATE HANDLE)

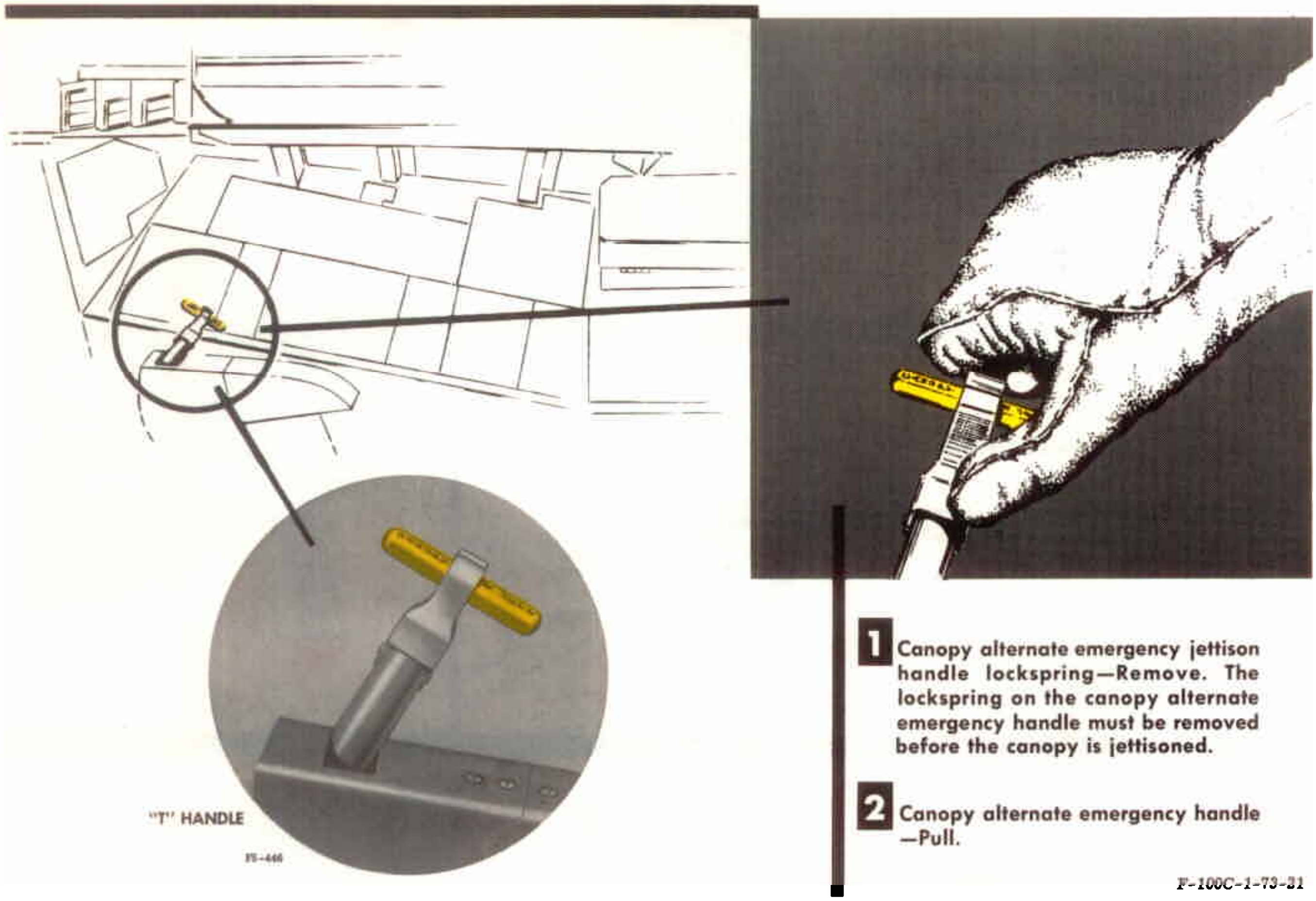

Figure 3-7

WHEEL BRAKE ANTISKID SYSTEM FAILURE (SOME AIRPLANES).

If antiskid system failure is suspected (no braking action when pedals are held full down or braking action causes excessive skidding), the pedals should be released and the antiskid switch moved to OFF. Since skid protection is not available, the brakes should be used cautiously to prevent skidding. Use brakes as required by feeling out braking action with a light pedal force and a tapping action, releasing brakes completely on each tapping cycle down to 110 knots. Below this speed, the pedal force should be increased as the airplane slows down.

NOTE At speeds above 110 knots IAS, locked wheels may not be detected before tire failure occurs. Caution must be used during brake operation at high speed.

CANOPY JETTISON (SOME AIRPLANES).

During an emergency when the canopy must be jettisoned, but ejection is not contemplated, it is recommended the canopy alternate emergency jettison handle be used. (See figure 3-7.) If the canopy fails to jettison or cannot be jettisoned in this manner, raise either seat handgrip to jettison the canopy. (The shoulder harness locks automatically when either handgrip is raised.) Before jettisoning canopy, pull helmet visor down. (Refer to "Flight Without Canopy" in Section VI.)

Warning If canopy has been partially opened (more than 4 inches at the forward canopy bow), do not attempt to force-jettison the canopy. The canopy may not jettison, and injury or fire may be caused by the firing of the canopy remover.

- When the handgrips are up and the ejection triggers are exposed, movement of either trigger will eject the seat.

ABBREVIATED CHECK LIST.

Refer to pages 3-31 through 3-43 for the abbreviated check list.

CUT ON SOLID LINE

EMERGENCY PROCEDURES

F-100C ABBREVIATED CHECK LIST

NOTE

- The following check list is an abbreviated version of the procedures presented in Section III. These pages are arranged so that you may remove them from your Flight Manual and insert them into a flip pad for convenient use. They are arranged so that each action is in sequence with the expanded procedure given in Section III. Presentation of the abbreviated check list does not imply that you need not read and thoroughly understand the expanded versions. To fly the airplane safely and efficiently, you *must* know the reason why each step is performed and why the steps occur in a certain sequence.
- The "†" code following a step signifies that the step will be performed *if necessary* depending upon the seriousness of the emergency.

CUT ON SOLID LINE

ENGINE FAILURE.

ENGINE FAILURE DURING TAKE-OFF RUN.

1. Abort.

ENGINE FAILURE DURING TAKE-OFF (AIRPLANE AIR-BORNE).

1. Air start switch—ON.
2. Fuel regulator selector—EMER.
3. Throttle—OFF.
4. External load—Jett.†
5. Gear—DOWN.
6. Flight control emer pump—ON.
7. Canopy—Jett.
8. Shoulder harness—LOCKED.
9. Master switch—OFF.
10. Generator—OFF.
11. Battery switch—OFF.
12. Land straight ahead.
13. Drag chute—Deploy.

ENGINE FAILURE DURING FLIGHT.

1. Air start switch—ON.
2. Fuel regulator selector—EMER.
3. Throttle—OFF.
4. Flight control emer pump—ON.
5. Pitch damper*—STANDBY.
6. Yaw damper—STANDBY.
7. Glide—220 knots IAS.
8. Electrical equipment—Off.
9. Attempt air start.

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CUT ON SOLID LINE

ENGINE AIR START.

1. Air start switch—ON.
2. Throttle—IDLE.
3. Air start switch—OFF.
4. Flight control emer pump—OFF.

IF ENGINE FAILS TO START.

1. Start attempt—Repeat.
2. Air start—Unsuccessful.
   a. Throttle—OFF.
   b. Air start switch—OFF.
3. Execute forced landing (dead engine) procedure.
4. Eject.

FORCED LANDING (DEAD ENGINE).

1. External load—Jett.
2. Master and generator switches—OFF.
3. Flight control emer pump—ON.
4. Shoulder harness—LOCKED.
5. Gear—DOWN.
6. Airspeed—220 knots IAS.
7. Airspeed—200 knots IAS.
8. Airspeed—180 knots IAS.
9. Drag chute—Deploy.
10. Nose wheel steering—Engage.
11. Battery switch—OFF.

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CUT ON SOLID LINE

FIRE OR EXPLOSION.

ENGINE FIRE DURING STARTING.

1. Throttle—OFF.
2. Starter and ignition stop button—Press.
3. Master switch—OFF.
4. Battery switch—OFF.
5. External power—Disconnect.
6. Leave airplane.

FIRE DURING TAKE-OFF.

Fire During Ground Roll.

1. Abort.

Fire After Lift-off.

1. External load—Jett.
2. Throttle—Hold take-off position.
3. Maximum climb.
4. Throttle—Adjust to minimum practical thrust.
5. Check for fire.
6. If fire cannot be confirmed—Land as soon as possible.
7. If fire is confirmed—Eject.

FIRE DURING FLIGHT.

1. Throttle—Adjust to minimum practical thrust.
2. Check for fire.
3. If fire cannot be confirmed—Land as soon as possible.
4. If fire is confirmed—Eject.

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CUT ON SOLID LINE

ENGINE FIRE AFTER SHUTDOWN.

1. Battery switch—ON.
2. External compressed air—Connected.
3. Throttle—OFF.
4. Master switch—ON.
5. Starter and ignition button—Press.
6. Starter and ignition stop button—Press.

ELECTRICAL FIRE.

1. Battery switch—OFF.
2. Generator—OFF.
3. Land as soon as practical and investigate.

ELIMINATION OF SMOKE OR FUMES.

1. Oxygen—100% OXYGEN.
2. Oxygen emergency lever—EMERGENCY.
3. Cockpit pressure selector—EMER RAM.
4. Pitot heat—OFF.
5. Windshield anti-ice—OFF.
6. Windshield defrost and console air levers—DECREASE.
7. Cockpit pressure selector—RAM OFF PRESS OFF.
8. Land as soon as possible.

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CUT ON SOLID LINE

EJECTION.

1. Pull up either right or left handgrip to jettison canopy.
2. Squeeze either trigger to eject seat.

IF SEAT FAILS TO EJECT.

1. Safety belt—Unfasten.
2. Bail-out bottle—Actuate.
3. Personal equipment leads—Disconnect.
4. Trim—Nose-down.
5. Invert airplane.
6. Release stick and push free of seat.
7. Parachute arming lanyard—Pull.

TAKE-OFF OR LANDING EMERGENCIES.

ABORT.

1. Throttle—OFF.†
2. Drag chute—Deploy.
3. Brakes—Maximum.†
4. External load—Jett.†
5. Master switch—OFF.†
6. Battery switch—OFF.†
7. Canopy—Jett.†

RUNWAY OVERRUN BARRIER.

1. Throttle—IDLE.
2. Speed brake—IN.
3. Nose wheel steering—Engage.
4. Drag chute—Deploy.
5. Wheel brakes—Avoid locking.
6. External load—Jett.
7. Throttle—OFF.
8. Master switch—OFF.
9. Generator—OFF.
10. Battery switch—OFF.

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CUT ON SOLID LINE

TIRE FAILURE.

Nose Gear Tire Failure on Landing.

1. Normal approach.
2. Nose wheels—Hold off.
3. Nose wheel steering—Engage.
4. Drag chute—Deploy.
5. Brakes—Maintain directional control.

Main Gear Tire Failure on Landing.

1. Antiskid*—OFF.
2. Normal approach.
3. Normal touchdown.
4. Nose wheel steering—Engage.
5. Drag chute—Deploy.
6. Brakes—Maintain directional control.

LANDING WITH ANY ONE GEAR UP OR UNLOCKED.

1. External load—Jett.
2. Canopy—Jett.
3. Shoulder harness—LOCKED.
4. Throttle—Normal approach setting.
5. Speed brake—As required.
6. Throttle—OFF when landing is ensured.
7. Master switch—OFF.
8. Generator—OFF.
9. Touch down on extended gear.
10. Drag chute—Deploy.
11. Battery switch—OFF.
12. When stopped—Leave airplane.

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CUT ON SOLID LINE

Main Gear Up Landing (Prepared Surface Only).

1. Gear position control circuit breaker—IN.
2. Gear—UP.
3. Canopy—Jett.
4. External load—Jett.†
5. Normal approach.
6. Normal touchdown.
7. Throttle—OFF.
8. Drag chute—Deploy.
9. Master switch—OFF.
10. Generator—OFF.
11. Battery switch—OFF.
12. When stopped—Leave airplane.

BELLY LANDING.

1. External load—Jett.
2. Canopy—Jett.
3. Throttle—Normal approach setting.
4. Speed brake—OUT.
5. Throttle—OFF when landing is ensured.
6. Master switch—OFF.
7. Generator—OFF.
8. Battery switch—OFF.
9. Shoulder harness—LOCKED.
10. Touch down in normal attitude.
11. Drag chute—Deploy.
12. When stopped—Leave airplane.

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CUT ON SOLID LINE

DITCHING.

1. Radio—Distress procedure.
2. Oxygen—100% OXYGEN.
3. External load—Jett.
4. Personal equipment leads—Disconnect all except oxygen hose.
5. Shoulder harness—LOCKED.
6. Throttle—OFF.
7. Speed brake—OUT.
8. Master switch—OFF.
9. Generator—OFF.
10. Battery switch—OFF.
11. Canopy—Jett.
12. Normal approach—Keep nose high.
13. When stopped—Release belt.
14. Oxygen mask—Off.
15. Leave airplane.

EXTERNAL LOAD EMERGENCY JETTISON.

ON-THE-GROUND JETTISONING.

1. External load emergency jettison button—Press.
2. External load emergency jettison handle—Pull.
3. Special store emergency jettison handle—Pull.

IN-FLIGHT JETTISONING.

1. External load emergency jettison button—Press.
2. External load emergency jettison handle—Pull.
3. Special store emergency jettison handle—Pull.
4. Armament selector switch at JETT ALL—Press bomb-release button.
5. External load auxiliary release buttons—Press one at a time at intervals of one second or more.

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CUT ON SOLID LINE

AFTERBURNER FAILURE.

AFTERBURNER FAILURE DURING TAKE-OFF (BEFORE REFUSAL POINT).

1. Abort.

AFTERBURNER FAILURE DURING TAKE-OFF (AFTER REFUSAL POINT).

1. Throttle—Inboard.
2. External load—Jett.†
3. Continue take-off.
4. Abort.†

AFTERBURNER FAILURE DURING TAKE-OFF (AIRPLANE AIR-BORNE).

1. Throttle—Inboard.
2. Continue take-off.
3. External load—Jett.†

LOSS OF AFTERBURNER DURING FLIGHT.

1. Throttle—Inboard.
2. Overheat-warning light—Check light out.
3. Relight afterburner—Check afterburner operation.

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CUT ON SOLID LINE

ENGINE OIL SYSTEM FAILURE.

OIL PRESSURE (35 TO 40 PSI).

1. Throttle—Reduce.
2. Altitude—Reduce.
3. Land as soon as practical.

OIL PRESSURE (BELOW 35 PSI).

1. Throttle—Reduce.
2. Altitude—Reduce.
3. Land as soon as possible.

ENGINE OIL OVERHEAT.

1. Check for evidence of malfunction.
2. Throttle—Reduce.
3. Altitude—Reduce.
4. Land as soon as possible.

ENGINE FUEL SYSTEM FAILURE.

NORMAL FUEL CONTROL FAILURE.

1. Throttle setting—Adjust to engine rpm.
2. Fuel regulator selector—EMER.
3. Throttle—Slowly reposition to desired setting.

CUT ON SOLID LINE

ELECTRICAL POWER SYSTEM FAILURES.

COMPLETE ELECTRICAL SYSTEM FAILURE.

1. Reduce airspeed and readjust trim.
2. Electrical power—OFF.
3. Descend—To below 25,000 feet.
4. External load (bombs and 275-gallon drop tanks)—Jett manually.†

GENERATOR FAILURE.

Generator Reset Procedure.

1. Generator switch—RESET momentarily; then ON.
2. Generator caution light—Check (repeat reset procedure if necessary).
3. If loadmeter is normal and power inverter caution light is out—Continue flight (leave generator switch ON).
4. If loadmeter shows that generator is not charging—Abort flight.

UTILITY HYDRAULIC SYSTEM FAILURE.

1. Fuel—Reduce.
2. Land as soon as practical.
3. Gear—DOWN.
4. Gear emer handle—Pull.
5. Throttle—OFF.

TRIM FAILURE.

1. Reduce airspeed to about 270 (255*) knots IAS.
2. Take-off trim button—Press.
3. Readjust trim before landing.

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CUT ON SOLID LINE

LANDING GEAR EMERGENCY OPERATION.

LANDING GEAR IN-FLIGHT EMERGENCY OPERATION.

1. Gear handle—Leave UP.
2. Reduce airspeed.
3. Fly-by check of gear and door position.
4. Cycle gear.
5. Lower gear, and land.

LANDING GEAR EMERGENCY LOWERING.

1. Airspeed—Between 230 and 180 knots IAS.
2. Gear handle—Down.
3. Gear emer handle—Pull to full travel and hold.
4. Gear position indicators—Check green.
5. Gear position control circuit breaker—Pull. (Repeat steps 1 thru 4.)

***Some airplanes**
†If necessary

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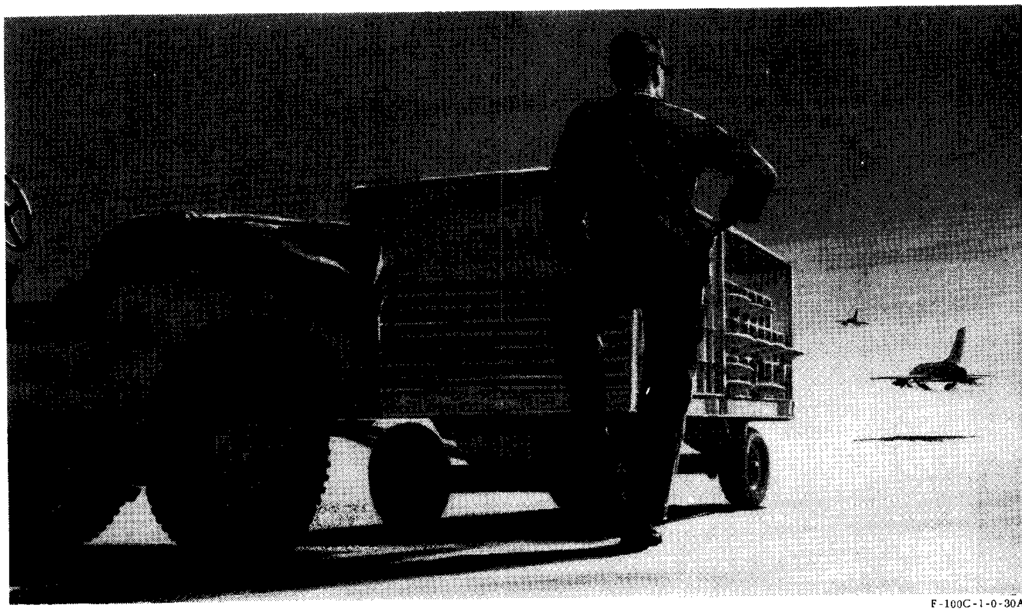

Section IV
AUXILIARY EQUIPMENT

TABLE OF CONTENTS

AIR CONDITIONING, PRESSURIZATION, DEFROSTING, ANTI-ICING, AND RAIN REMOVAL SYSTEMS.

Hot compressed air, bled from the final stage of the engine compressor, is used by the air conditioning and pressurization system to maintain the desired cockpit temperature and pressure, and to supply the air demanded by the defrosting, anti-icing, and rain removal systems. (See figures 4-1 and 4-3.) The air conditioning and pressurization system provides air for pressurization of the drop tanks, canopy seal, and anti-G suit, and is used for the pilot's ventilated suit* and for cooling the electronic equipment compartments. (Refer to "Electronic Equipment Compartment Cooling System" in this section.) An external pressure source may be connected to the system for testing or for cockpit air conditioning during ground operation.

COCKPIT AIR CONDITIONING.

The temperature of the air supplied to the cockpit is regulated by an automatic control system. The system directs the hot engine compressor bleed air through the ram-air-cooled primary and secondary heat exchangers. (Refer to "Heat Exchanger Cooling Airflow Circuits" in Section VII.) The temperature sensor and the auxiliary control box regulate the modulating valve to maintain a minimum temperature of 275°F at the primary heat exchanger air outlet. However, when the windshield anti-icing or defrosting system is not operating, the modulating valve can be manually controlled. Depending on the heat requirements of the system, part of the air from the primary heat exchanger is routed to, or around, the secondary heat exchanger and is ducted to the cockpit air outlets. The amount of bleed air flow through the secondary heat exchanger depends on the position of the hot air bypass valve. (As the bypass valve closes, more

*Airplanes changed by T.O.

COCKPIT AIR CONDITIONING AND PRESSURIZATION SYSTEM

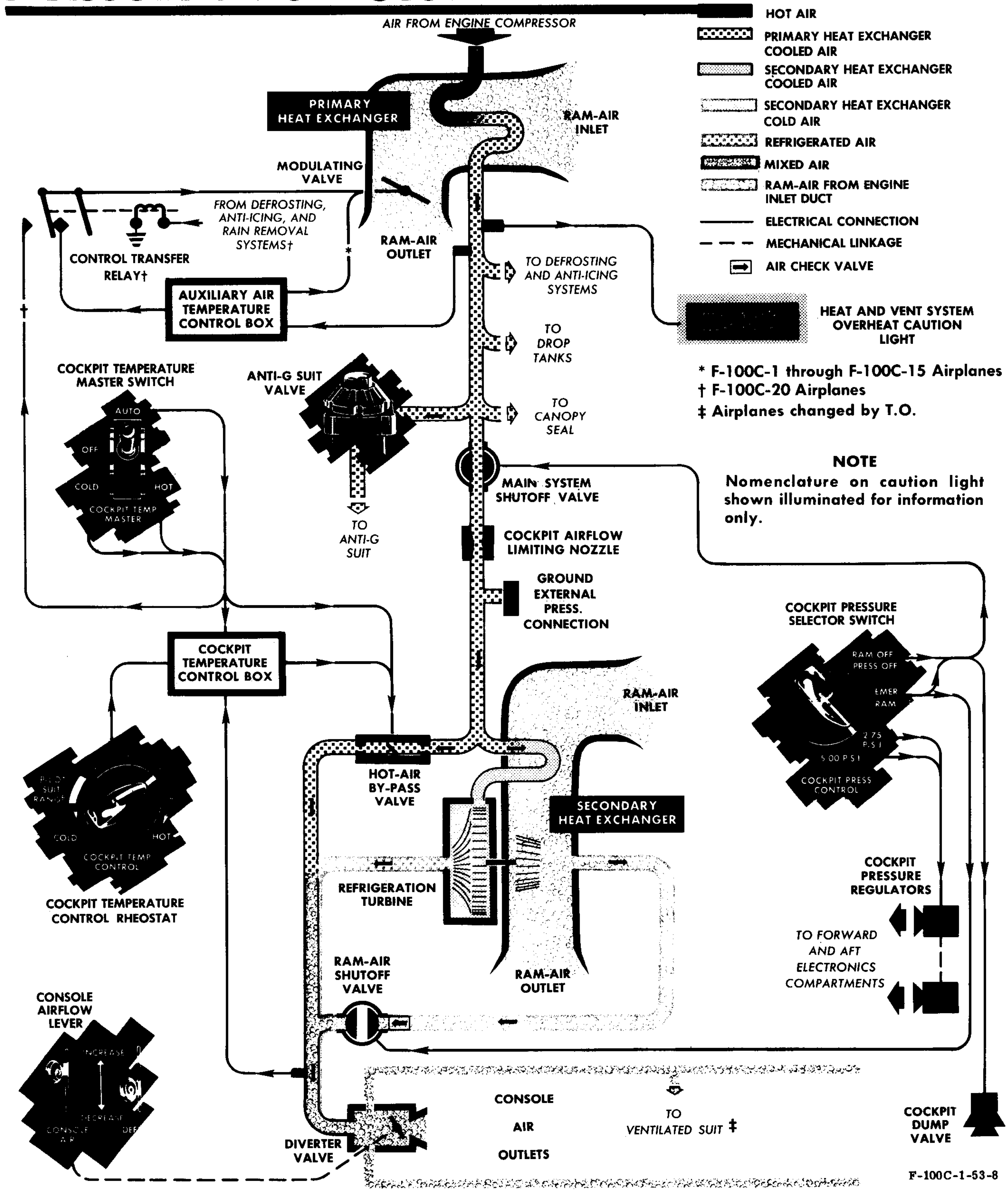

Figure 4-1

air goes to the heat exchanger.) The bypass valve is positioned by the cockpit temperature control box to provide the selected temperature. Cockpit emergency ventilation is obtained from the manually operated ram-air shutoff valve.

COCKPIT PRESSURIZATION.

Cockpit pressure is maintained at a selected schedule for various flight altitudes by two pressure regulators, which control the outflow of cockpit air. The cockpit is non-pressurized from sea level to 12,500 feet. Above this

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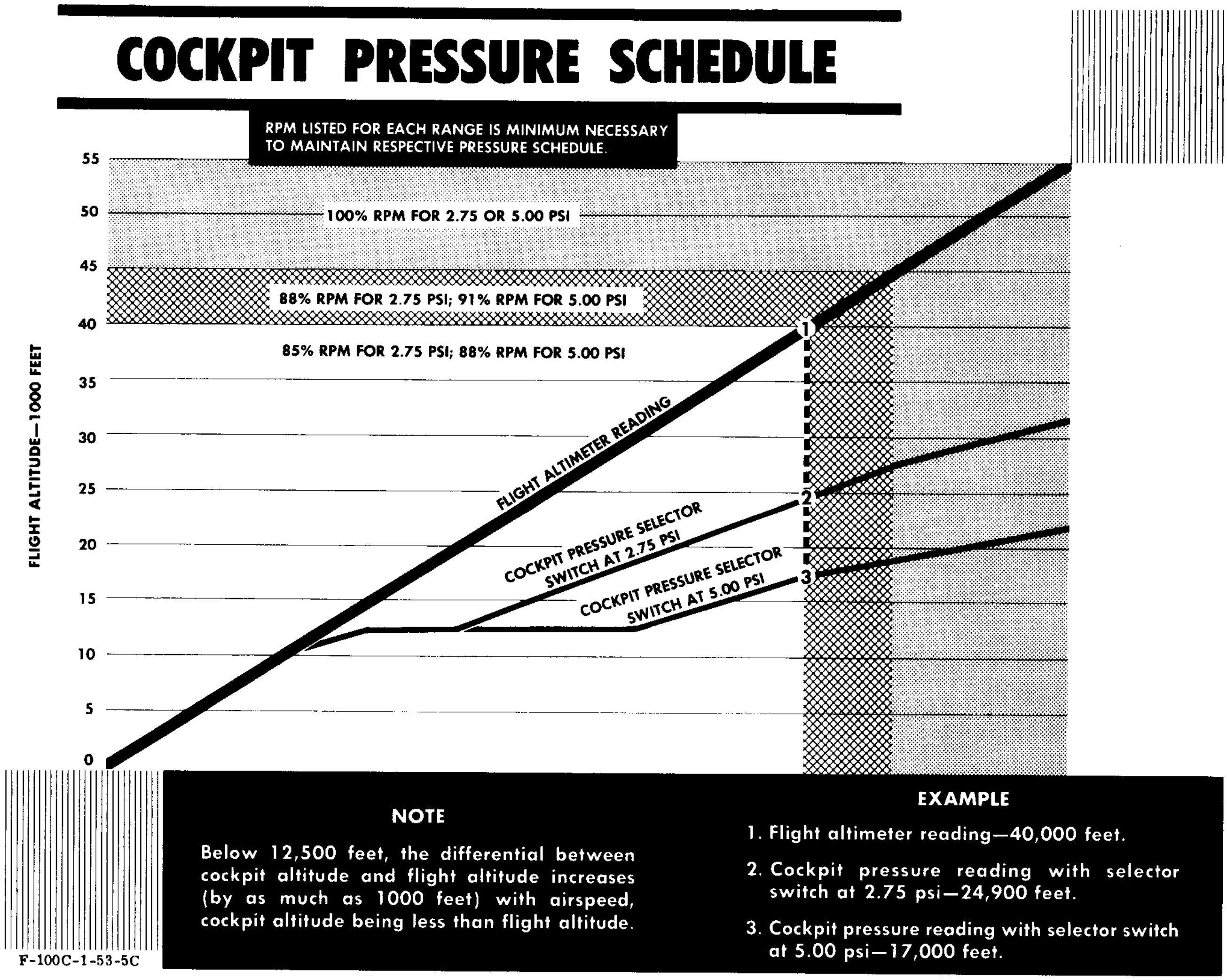


Figure 4-2

altitude, either of the two selected pressure schedules (2.75 psi or 5 psi) is maintained by the automatic pressure regulators. If the 2.75 psi schedule is selected, a cockpit pressure equal to that at 12,500 feet is maintained to a flight altitude of 21,200 feet, and a constant 2.75 psi pressure differential at all altitudes above. If the 5 psi schedule is selected, a cockpit pressure equal to that at 12,500 feet is maintained to about 31,000 feet, and a constant 5 psi pressure differential at all altitudes above. The comparison of flight altitude to cockpit altitude for the selected pressure schedule is shown in figure 4-2. An external pressurizing air source may be connected to provide for pressurization and cooling of the cockpit when the airplane is on the ground. A dump valve automatically relieves any excess pressure above 5.3 psi if the pressure regulators fail. (The dump valve can also be opened by the pilot, if necessary, to relieve cockpit pressure.)

NOTE The minimum engine rpm necessary to maintain cockpit pressurization is about 85%, depending on altitude and selected cockpit pressure schedule.

DEFROSTING, ANTI-ICING, AND RAIN REMOVAL SYSTEMS.

Heated air discharged from the engine compressor and then passed through the primary heat exchanger is used for all defrosting and anti-icing with the exception of the engine guide vanes. For defrosting the canopy and windshield, compressor air is directed onto their inner surfaces. Hot air from this source is also used to defrost the P-2 strike camera window. (On airplanes changed by T.O. this source has been disconnected.) Windshield anti-icing is accomplished by directing a layer of hot air over the outside of the windshield from an external outlet. Hot air sent into the pitot boom prevents ice formation on this unit. The windshield anti-ice system also can be used for removing rain from the windshield. The engine inlet guide vanes, however, are anti-iced by hot air taken directly from the engine compressor.

DEFROSTING AND ANTI-ICING SYSTEMS

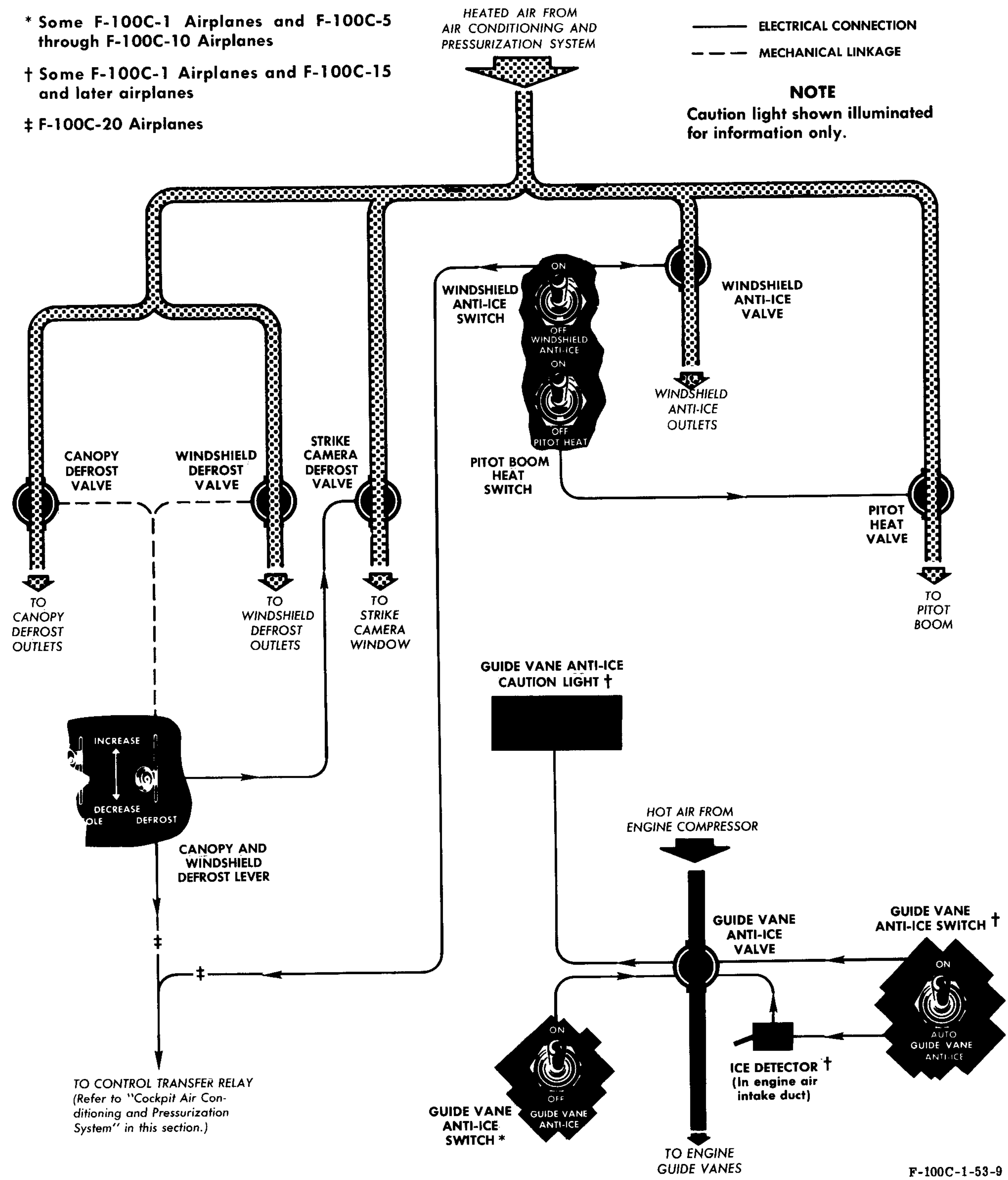
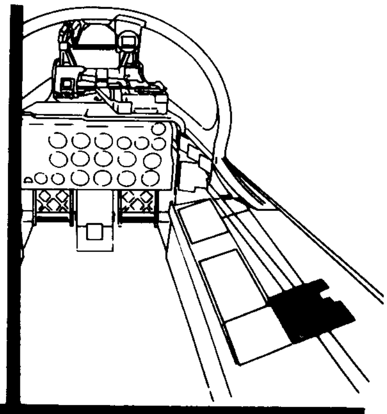
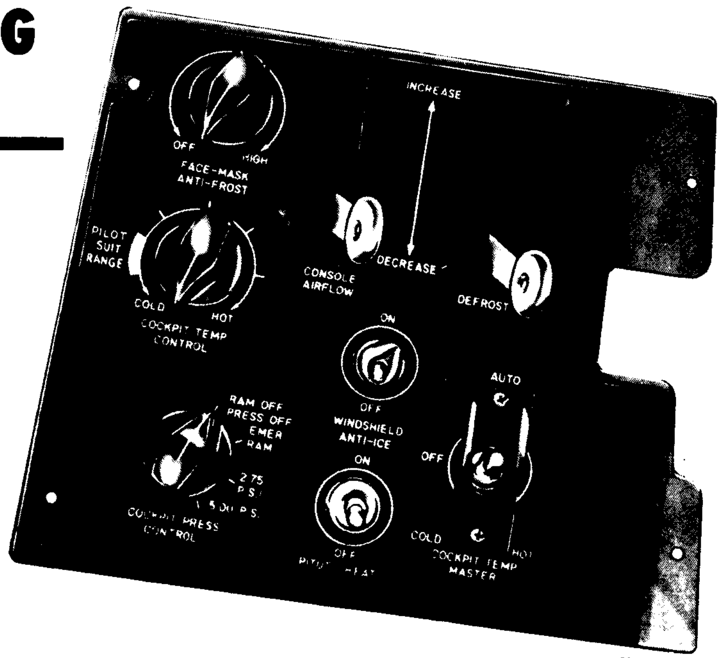


Figure 4-3

AIR CONDITIONING CONTROL PANEL





NOTE

"PILOT SUIT RANGE" marker added to air conditioning control panel on airplanes changed by T.O.

F-100C-1-53-7

Figure 4-4

AIR CONDITIONING, PRESSURIZATION, DEFROSTING, ANTI-ICING, AND RAIN REMOVAL SYSTEM CONTROLS.

Cockpit Pressure Selector Switch.

The desired cockpit temperature is selected by a primary-bus-powered switch. (See figure 4-4.) When the pressure selector switch is moved to either 2.75 P.S.I. or 5.00 P.S.I., the ram-air valve closes, the main system shutoff valve opens, the cockpit dump valve closes, and the pressure regulators maintain the selected pressure differential between cockpit and atmospheric pressure above 12,500 feet. (See figure 4-2.) When the selector switch is at the RAM OFF PRESS OFF position, the main system shutoff valve and the ram-air shutoff valve are closed and the dump valve is opened to depressurize the cockpit. When the selector switch is at EMER RAM, the main system shutoff valve closes, the cockpit dump valve opens, and the ram-air shutoff valve opens to admit ram air into the cockpit. The EMER RAM position is used in emergencies to eliminate smoke or fumes from the cockpit, or if the pressure or temperature systems do not function correctly.

NOTE When the cockpit pressure selector switch is at RAM OFF PRESS OFF or EMER RAM, cockpit temperature control is inoperative.

- To minimize danger to the pilot resulting from sudden decompression, the cockpit pressure selector switch should be set at 2.75 P.S.I. during combat.

Cockpit Temperature Master Switch.

Cockpit air temperature is controlled by primary bus power through a four-position switch. (See figure 4-4.) For automatic temperature control, the switch must be at AUTO and the cockpit temperature rheostat adjusted to obtain the desired temperature. When the switch is moved to HOT, the hot-air bypass valve is opened to supply hotter air to the cockpit. Moving the switch to COLD closes the bypass valve so that all incoming air is directed through the refrigeration turbine of the secondary heat exchanger. Cycle time from full hot to full cold for this valve is about 9 seconds. Thus, the desired temperature can be obtained by momentary positioning of the switch to HOT or COLD and then moving it to OFF. When the switch is OFF, the automatic temperature control system is inoperative and the hot-air bypass valve remains in the position it was in when the switch was set at OFF. Use of the canopy and windshield defrost lever is also an aid in regulating cockpit temperature.

Cockpit Temperature Rheostat.

The primary-bus-powered temperature rheostat (figure 4-4) may be rotated to any point between the COLD and HOT positions to maintain desired cockpit temperature only when the cockpit temperature master switch is in the AUTO position. The rheostat control is inoperative when the cockpit pressure selector is at the EMER RAM or RAM OFF PRESS OFF position. On some airplanes,* when the pilot's ventilated suit is being used, the rheostat should be positioned to PILOT SUIT RANGE position. Rotating the rheostat either direction within the marked range increases or decreases the temperature of the air entering the suit. (Refer to "Miscellaneous Equipment" in this section.)

Console Airflow Lever.

Console airflow is controlled by a lever (figure 4-4), which directs the flow of air to the outlets along the console and to the outlet behind the seat. Moving the lever forward toward INCREASE mechanically positions a diverter valve, so that more of the air supplied to the cockpit is directed through the console air outlets. Moving the lever back toward DECREASE directs more air through the outlet behind the seat, reducing cockpit air circulation, but still retaining the same airflow for pressurization. On some airplanes,* the console air lever controls the flow of air to the pilot's ventilated suit. The lever must be in full INCREASE in order to supply sufficient air to the suit.

Canopy and Windshield Defrost Lever.

Defrosting of the canopy and windshield is selected by a defrost lever. (See figure 4-4.) When the lever is moved forward to INCREASE, valves in the system are opened mechanically to distribute heated air to the inner surfaces of the camera compartment, canopy, and windshield. Defrost airflow is shut off when the lever is moved aft to DECREASE.

Windshield Exterior Air Switch.

Windshield anti-icing and rain removal is controlled by primary bus power through the exterior air switch. (See figure 4-4.) Moving the switch to ON opens the shutoff valve so that hot air is directed to the windshield outlets on the outside of the windshield.

NOTE Refer to "Ice and Rain" in Section IX for information on the effectiveness of the anti-icing and rain removal systems during various flight and weather conditions.

Engine Guide Vane Anti-icing Switch (Some F-100C-1 Airplanes, and F-100C-5 Through F-100C-10 Airplanes).

A two-position guide vane anti-icing switch is powered from the primary bus. (See figure 1-12.) With the switch at the ON position, two valves open and permit hot air from the engine compressor section to flow through those engine inlet guide vanes which have exposed frontal area. When the switch is at the OFF position, the valves shut off airflow to the guide vanes.

NOTE Engine guide vane anti-icing should be used only when icing conditions prevail, to prevent unnecessary bleeding of compressor discharge air.

Engine Guide Vane Anti-icing Switch (Some F-100C-1 Airplanes, and F-100C-15 and Later Airplanes).

Engine guide vane anti-icing is controlled by a two-position switch. (See figure 1-12.) When the switch is at AUTO, primary bus power arms the ice detector system, which automatically controls guide vane anti-icing. Whenever icing is encountered, the ice detector sends an impulse to the anti-icing valves which open and direct hot air from the engine compressor to deice the guide vanes and accessory nose strut. The valves remain open as long as impulses are being received from the ice detector unit, but close automatically one minute after the last impulse has been sent. The detector unit clears itself of ice in about 17 seconds after sending the impulse to the anti-icing valves, thus preparing itself to detect additional icing and send the ice presence impulse to the anti-icing valves before the one-minute closing cycle expires. The ON position of the switch disengages the automatic ice detector unit, but the hot-air valves remain open.

Pitot Boom Heat Switch.

Anti-icing of the pitot boom is controlled by a switch. (See figure 4-4.) When the switch is at ON, primary bus power to the pitot heat shutoff valve is interrupted, allowing the valve to open and direct hot air to the pitot boom. When the switch is at OFF, primary bus power holds the valve closed and shuts off the air. This fail-safe feature provides for pitot boom anti-icing if electrical power fails.

Face Mask Antifrost Rheostat.

Primary bus power for the antifrost elements of the pilot's face mask is controlled by a rheostat. (See figure 4-4.) The mask antifrost system is energized when the rheostat is rotated clockwise from the OFF position. Heat is increased with continued clockwise rotation of the rheostat.

***Airplanes changed by T.O.**

AIR CONDITIONING, PRESSURIZATION, DEFROSTING, ANTI-ICING, AND RAIN REMOVAL SYSTEM INDICATORS.

Cockpit Pressure Altitude Indicator.

The pressure altitude of the cockpit is shown by the cockpit pressure altitude indicator (31, figure 1-6; 29, figure 1-7), and is vented only to pressure within the cockpit.

Heat and Vent System Overheat Caution Light.

This placard-type light (figure 1-4) is primary-bus-powered to come on when the temperature of the compressor bleed air downstream of the primary heat exchanger exceeds 450°F and/or the temperature of air in the windshield anti-ice nozzle exceeds 345°F. Since the overheat caution light thermoswitch relay is controlled by ac power, the light will come on when the instrument inverter switch is at OFF or will come on briefly when the preflight check of the instrument inverter is made. The light coming on at this time shows that the relay and caution light are operating properly. The caution light can be tested by use of the indicator light test switch.

NOTE Operation in the null point at low engine speeds (below 84% rpm) does not harm the heat and vent system because compressor bleed temperatures and pressures are low.

- For further information on low-cooling airflow, reverse flow, and positive flow, refer to "Primary Heat Exchanger" in Section VII.

Engine Guide Vane Anti-ice Caution Light (Some F-100C-1 Airplanes, and F-100C-15 and Later Airplanes).

When the guide vane anti-ice system is on, primary bus power lights a placard-type guide vane anti-ice caution light. (See figure 1-4.) Bulb operation can be checked by means of the indicator light test switch.

NORMAL OPERATION OF AIR CONDITIONING, PRESSURIZATION, DEFROSTING, ANTI-ICING, AND RAIN REMOVAL SYSTEMS.

1. Turn cockpit pressure selector switch to desired pressure schedule.
2. Move cockpit temperature master switch to AUTO.
3. Move defrost lever toward INCREASE.

Warning Just before the first flight of the day, the defrosting and anti-icing systems should be operated at full ON for a few seconds to eliminate any moisture in the system.

- The defrost system should be operated for take-offs, landings, and throughout the flight at the highest possible heat consistent with pilot comfort, to preheat the canopy and windshield and to maintain the glass temperature above cockpit dew point.
- Fogging and frosting of the windshield can occur if the cockpit air temperature is lowered, the cockpit air distribution is changed, the cockpit airflow is reduced, or a rapid descent is made. Therefore, before selecting any of these changes, the defrost lever should be moved further toward INCREASE to ensure visibility.

4. Turn cockpit temperature rheostat toward HOT.

Warning The cockpit temperature should be maintained at the highest possible heat consistent with pilot comfort during take-off, in the landing pattern, and during a go-around, to prevent sudden fog or snow in the cockpit.

5. Position console airflow lever for desired air distribution.
6. Turn face mask antifrost rheostat to desired temperature.
7. Place pitot boom heat switch at ON.

Warning Under some icing conditions, particularly at high altitude, sufficient pitot boom heat may not be available. If boom becomes iced with the pitot heat on, increasing engine power setting and airspeed, and decreasing altitude, will assist in ice removal.

8. Move defrost lever toward INCREASE if any part of the windshield becomes fogged or frosted.
9. If cockpit air supply becomes fogged or contains snow, turn cockpit temperature rheostat toward HOT.
10. If snow, ice, or rain forms on *outer* surface of windshield, move windshield exterior air switch to ON.

Caution Avoid operation at low airspeed, high engine rpm, and high drag configuration, as it subjects the heat and vent system to excessive temperatures and pressures.

- To prevent possible breakage of windshield glass, the windshield anti-icing system should be turned on only when the following conditions prevail: ice on windshield in normal flight, rain during approach and landing, during letdowns at low rpm when ground conditions may offer icing or rain hazard, or for removing ice from windshield on the ground at engine speeds below 82% rpm. If the heat and vent overheat caution light comes on and stays on more than 30 seconds, the emergency procedures in this section should be followed.

- Minimum engine power necessary for windshield anti-icing and rain removal is 85% rpm.

NOTE When anti-icing or canopy defrosting systems are used on the ground, the overheat caution light may come on because of low cooling-air flow during ground operation. If the light comes on for this reason, minimize use of windshield anti-icing and canopy defrosting while on the ground.

- During take-off and initial climb, the heat and vent overheat caution light comes on between 170 and 340 knots IAS with only the cockpit air conditioning system on. This occurs because of transition from reverse flow to positive flow through the primary heat exchanger. After best rate-of-climb airspeed is established, the light should not stay on for more than 30 seconds. If the light remains on for more than 30 seconds, the emergency procedures in this section should be followed.

EMERGENCY OPERATION OF AIR CONDITIONING, PRESSURIZATION, DEFROSTING, ANTI-ICING, AND RAIN REMOVAL SYSTEMS.

Warning The symptoms of a cooling turbine bearing failure can be smoke entering the cockpit, a vibration, and a screeching noise. These symptoms are similar to an engine bearing failure; therefore, the engine instruments should be read to isolate the failure. (Refer to "Engine Oil System Failure" in Section III.)

Emergency Depressurization.

If sudden depressurization of the cockpit is necessary, proceed as follows:

1. Turn oxygen regulator diluter lever to 100% OXYGEN, and push emergency lever left or right from center position for positive pressure to mask.

2. Descend to 25,000 feet or below if circumstances permit.

3. Move cockpit pressure selector switch to either EMER RAM or RAM OFF PRESS OFF.

Caution The cockpit is decompressed rapidly when the cockpit pressure selector switch is moved to EMER RAM or RAM OFF PRESS OFF.

NOTE Anti-icing and defrosting systems are not turned off when pressure selector is at RAM OFF PRESS OFF or EMER RAM. These systems should be used, if required, to ensure visibility. The RAM OFF PRESS OFF position should not be used if cockpit contamination is suspected.

4. If no airflow or pressurization is necessary, move cockpit pressure selector switch to RAM OFF PRESS OFF.

Warning During this no-ventilation condition, use 100% oxygen to offset the effects of possible cockpit contamination.

Excessive Cockpit Temperature.

If the cockpit temperature control system does not function properly, and if the cockpit temperature is too high, proceed as follows:

1. Turn cockpit temperature rheostat to COLD.

2. Move cockpit temperature master switch to COLD if temperature remains high.

3. Move cockpit pressure selector switch to EMER RAM if temperature is still uncomfortably high. Check face mask for overheat.

Caution This can cause excessively high cockpit air temperature at low altitudes and high airspeed (especially at high outside air temperatures). Cockpit temperatures can be lowered by reducing airspeed and/or increasing altitude.

4. Descend to 25,000 feet or below if circumstances permit.

5. If cockpit heat remains too high:

   a. Retard throttle to maintain loiter airspeed.

   b. Jettison canopy if heat continues and if cockpit becomes hot enough to cause physical injury.

6. If cockpit heat cannot be reduced enough to continue safe flight, jettison external load and land as soon as possible.

System Overheated.

If the heat and vent system overheat caution light remains on for 30 seconds:

1. Turn cockpit temperature rheostat to COLD, and if light does not go out, move cockpit temperature master switch to COLD.
2. Turn off defrosting and anti-icing systems, if conditions permit.
3. If light remains on, increase airspeed and/or altitude. (This increases airflow and/or reduces the temperature of ram air to the heat exchangers.)
4. Reduce thrust to lower temperature of engine compressor bleed air.
5. If light remains on, descend to 25,000 feet, turn off cockpit air by moving pressure selector switch to EMER RAM, and land as soon as practical.

NOTE When the heat and vent system overheat caution light comes on during landing under icy, rainy, or frosty conditions, the applicable defrosting or anti-icing switches should not be turned off. The hazard of a completely iced or fogged windshield outweighs any damage resulting from system overheating.

ELECTRONIC EQUIPMENT COMPARTMENT COOLING SYSTEM.

The forward and aft electronic equipment compartments are automatically cooled by cockpit discharge air. Above 32,000 feet, additional cooling air from the engine air intake duct is automatically provided for cooling; this additional cooling air is automatically shut off at 27,000 feet during descent.

COMMUNICATION AND ASSOCIATED ELECTRONIC EQUIPMENT.

TABLE OF COMMUNICATION AND ASSOCIATED ELECTRONIC EQUIPMENT.

See figure 4-5.

UHF COMMAND RADIO—AN/ARC-34.

This radio, powered by the secondary bus, provides voice transmission and reception in the frequency range of 225.0 to 399.9 megacycles. A control panel (figure 4-5) permits selection of 20 preset channels, or operating frequencies can be selected manually without disturbing the preset channel frequencies. Two receivers are used in this equipment. The main receiver normally carries out all reception functions. The guard receiver is ground-tuned to a guard frequency, and may not be changed without removing the remote-control unit from the airplane. Whenever a new frequency is selected, an automatic tuning mechanism tunes the transmitter and receiver to the new frequency. This tuning cycle requires about 4 seconds.

Command Radio Controls.

Channel Selector Switch. The channel selector switch (figure 4-5) controls the selection of 20 preset frequencies by channel number. When the switch is rotated, channel numbers from 1 through 20 appear in the channel indicator window, above the selector. This window is masked when the sliding selector control is placed in any position other than PRESET.

Function Switch. Rotating the command radio function switch (figure 4-5) from OFF turns the command radio on. (A warm-up period of about one to two minutes is required.) When the switch is placed in the MAIN position, only the main receiver is audible in the headphones. In the BOTH position, the guard receiver and the main receiver are heard simultaneously. The ADF position is inoperative at present.

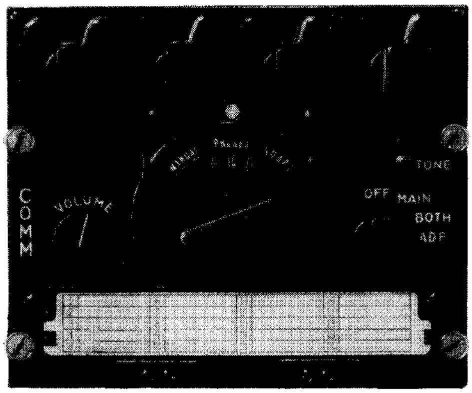
Tone Button. When the command radio is turned on, a continuous tone signal is transmitted by pressing the tone button (figure 4-5). This occurs on the frequency that is set on the transmitter, and it interrupts reception. A side tone is audible in the headphones while the button is depressed. This feature is useful in checking proper operation of the tuning mechanism during the preflight check, and for direction-finding operations in conjunction with other aircraft and ground stations.

Volume Control. The volume control (figure 4-5) regulates the sound level of the signal being heard in the headphones from both command receivers. Adequate control of volume is provided, but the volume may not be reduced below a fixed level.

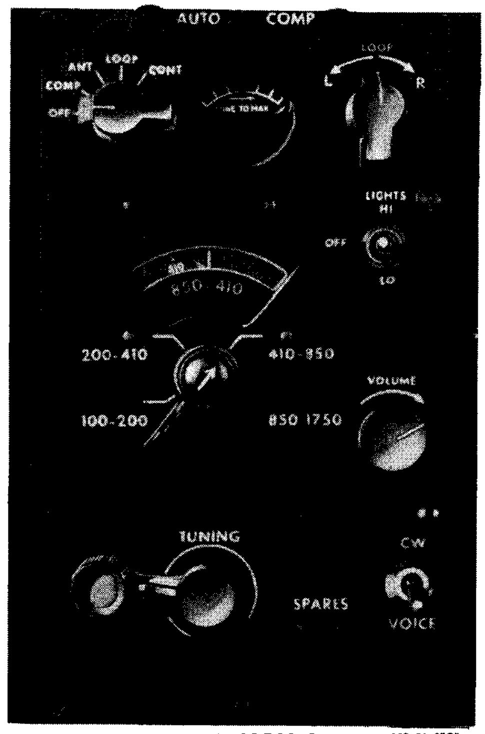
Manual-Preset-Guard Sliding Selector Control and Frequency Knobs.

The sliding selector control (figure 4-5) controls the method of command radio frequency selection. It is operated by sliding the control through a limited arc across the face of the panel. This control has three positions, MANUAL, PRESET, and GUARD, and is arranged so that when it is in any one position, the other two positions are masked by a semitransparent green glass. When the sliding selector control is placed in the MANUAL position, a mask is removed from in front of the four small windows across the top of the panel, revealing the numerals that make up an operating frequency. Beneath each window is a small frequency knob which, when rotated, changes the numeral and the frequency. This makes it

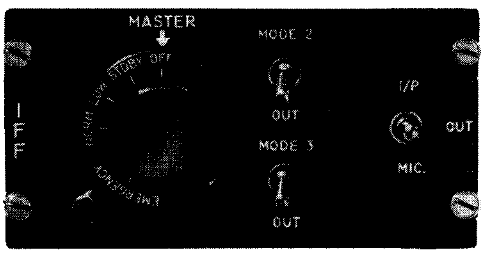
COMMUNICATION AND ASSOCIATED ELECTRONIC EQUIPMENT



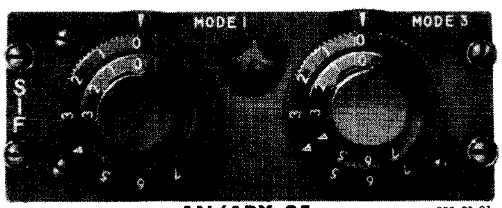
AN/ARC-34 223-30-20"I"



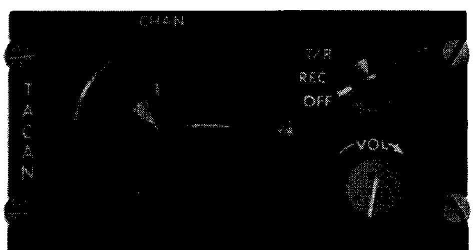
AN/ARN-6 192-30-3"O"



AN/APX-6A 223-30-20V



AN/APX-25 223-30-21



AN/ARN-21 255-51-108

TYPE	DESIGNATION (AN)	FUNCTION	RANGE	LOCATION
UHF COMMAND	ARC-34	TWO-WAY VOICE COMMUNICATION	LINE OF SIGHT	LEFT CONSOLE
RADIO COMPASS	ARN-6	RECEPTION OF VOICE AND CODE COMMUNICATION; POSITION FINDING; AND HOMING	20 TO 200 MILES, DEPENDING ON FREQUENCY USED AND TIME OF DAY	RIGHT CONSOLE
IDENTIFICATION EQUIPMENT	APX-6A APX-25*	AUTOMATIC TRANSMISSION OF IDENTIFICATION SIGNALS	LINE OF SIGHT	RIGHT CONSOLE
TACAN NAVIGATION TRANSCEIVER*	ARN-21	DISPLAYS AZIMUTH AND DISTANCE	LINE OF SIGHT UP TO 195 NAUTICAL MILES	RIGHT CONSOLE

* Some airplanes

F-100C-1-71-1C

Figure 4-5

possible to manually select 1750 frequencies within the range of 225.0 through 399.9 megacycles. The frequency range of 329.0 through 335.0 megacycles is reserved for glide-slope frequencies, and 243.0 megacycles is reserved for a guard frequency. While the sliding selector control is in the MANUAL position, the preset channels may be changed or checked without affecting the operation of the manually selected frequency. Sliding the control to PRESET masks the four small windows and deactivates the manually selected frequency. This activates the 20 preset channels controlled by the channel selector switch. Any time a frequency is changed, about 4 seconds is required for the tuning mechanism to complete the cycle. Placing the sliding selector control in the GUARD position automatically tunes the transmitter and main receiver to the guard frequency set up before the installation of the equipment.

Normal Operation of Command Radio.

1. Before take-off, check frequencies to be used against those listed on frequency card.
2. Check settings of buttons on frequency control drum with frequency card. (To do this, open door to which frequency card is attached. The channel number which corresponds to the preset frequency appears in a window at the left of the buttons. The frequency numbers of this channel are listed above the buttons.)
3. Check operation of transmitter and main receiver with sliding selector control in each position.
4. Check operation of guard receiver, using BOTH position of function switch.
5. For initial channel selection, select a channel other than the one to be used until warm-up is completed, or, after warm-up, switch to another channel and then back to the one desired. If the desired channel is selected before warm-up is completed, reduced performance due to mistuning may result.
6. Adjust volume as desired.
7. For manual selection of a frequency that is not included in the preset channels, move sliding selector control to MANUAL. The four windows across the top of panel should now be open. Use frequency knobs across top of panel to establish desired frequency. The numerals that appear in the windows indicate the operating frequency. (The function switch must be at MAIN or BOTH for this operation.)

NOTE Do not manually select a frequency of less than 225.0 mc. The transmitter will attempt to tune to this frequency, and after 90 seconds the transmitter will shut down. To restore transmission, turn function switch to OFF, wait 30 seconds, and then select a higher frequency.

8. To obtain transmission and reception of guard frequency only, move sliding selector control to GUARD.

NOTE No transmission should be made on emergency (distress) frequency channels except for emergency purposes. For test, demonstration, or drill purposes, the radio equipment should be operated in a shielded room to prevent transmission of messages that could be construed as actual emergency messages.

- This procedure places the equipment in condition to receive. Transmission on the same frequency is obtained by depressing the microphone button; however, if it is desired to change the transmitter frequency, the microphone button should be released before the frequency is changed. About 4 seconds should elapse before transmission begins on a new frequency.

9. Turn off receiver-transmitter by moving function switch to OFF.

Emergency Operation of Command Radio.

Channel Selection After Engine Shutdown or Engine Failure. If it is necessary to select another frequency channel, selection should be done as soon as possible after engine shutdown or engine failure, so that electrical power is available to complete selection.

Caution The channel selector system will hang up between channels when battery voltage is low.

Radio Not Operating. In the case of apparent failure of command radio, attempt operation in alternate positions of sliding selector control and/or alternate positions of function switch. Turn equipment off for several minutes; then turn function switch to type of operation desired. If the protective relay in the tuning mechanism was responsible, this action will restore operation.

RADIO MAGNETIC INDICATOR.*

The radio magnetic indicator (30, figure 1-7) is a dual-pointer instrument which receives heading information from the J-2 directional indicator system. This results in the operation of a rotating compass card, providing a magnetic heading displayed against a fixed reference marker at the 12 o'clock position on the dial. Signals from the AN/ARN-21* receiver and the AN/ARN-6 radio compass receiver are fed into the instrument to drive a set of pointers. These pointers give radio bearing information, which is read directly from the instrument as magnetic bearing to the station. The single-barred (No. 1) pointer is driven by the AN/ARN-6 radio

***Airplanes changed by T.O.**

compass receiver, and the double-barred (No. 2) pointer is driven by the AN/ARN-21 TACAN receiver.

NOTE The No. 2 pointer indication will not agree with the course window indication on the course indicator when flying from a beacon.

- When the TACAN system is not operating, the No. 2 pointer rotates freely.

RADIO COMPASS—AN/ARN-6.

The AN/ARN-6 radio compass is a navigational aid that controls the radio compass indicator. (See 29, figure 1-6.) It shows the direction of the transmitting station to which the receiver is tuned, relative to the heading of the airplane. On some airplanes,* the radio compass drives the No. 1 pointer on the radio magnetic indicator. Four separate frequency bands are provided: band one, 100 to 200 kilocycles; band two, 200 to 410 kilocycles; band three, 410 to 850 kilocycles; and band four, 850 to 1750 kilocycles. The controls (figure 4-5) permit receiver frequency selection, volume control, selection of automatic or manual loop direction finding, and range reception. The CONT position of the function switch is inoperative. A tuning meter indicates signal strength and accuracy of tuning. The radio compass sense antenna and loop are installed within the dorsal fairing. (See 15 and 16, figure 1-1.) The radio compass control panel is powered from the tertiary bus.

Operation of Radio Compass.

1. Turn five-position function switch from OFF to ANT.
2. Position panel light switch as desired.
3. Select frequency band.
4. Rotate tuning crank to select frequency and maximum obtainable meter needle deflection.
5. Adjust volume control as desired.
6. For range reception, position modulation switch at CW (continuous wave) or VOICE.
7. For homing:
   a. On airplanes which have a radio compass installed, set radio compass indicator card by turning VAR knob until actual airplane heading is at index marker.
   b. Position modulation switch at CW.
   c. Turn function switch to COMP (compass).
   d. Observe radio compass indicator pointer (or radio magnetic indicator No. 1 pointer†) for bearing to the station selected.
   e. To home on station selected, fly airplane to keep radio compass indicator pointer (or radio magnetic indicator No. 1 pointer†) at index marker (no-wind condition).
8. For aural-null direction finding:
   a. On airplanes which have a radio compass installed, set radio compass indicator card by turning VAR knob until actual airplane heading is at index marker.
   b. Position modulation switch at CW.
   c. Turn function switch to LOOP.
   d. Turn loop switch toward L or R until null is obtained in headset (or minimum obtainable deflection of meter needle).
   e. Observe radio compass indicator pointer (or radio magnetic indicator No. 1 pointer†) for bearing to or from station, depending upon null selected.

Caution Precipitation, static, or corona discharge can prevent satisfactory receiving. During these conditions, the best reception can be obtained with the function switch at LOOP.

TACAN—AN/ARN-21.†

The TACAN (Tactical Air Navigation) system is capable of giving bearing and slant distance to a surface beacon. The ARN-21 transmits an interrogation signal from the airplane to the ground surface station beacon, which receives the same signal and retransmits it back to the airplane. The equipment in the airplane accepts only the answer to its interrogation signal. By an electronic measurement of the elapsed time, the distance information is computed and shown on the distance indicator. This distance figure is given as slant distance in nautical miles from the airplane down to the surface beacon. The surface beacon also transmits a Morse code identification signal every 60 seconds. The AN/ARN-21 has a line-of-sight range of about 195 miles and a 40-degree limitation up from the surface beacon.

AN/ARN-21 Controls and Indicators.

Function Switch. When the function switch (figure 4-5) is at T/R, the AN/ARN-21 starts transmitting an interrogation signal to the surface beacon for distance information and also receives bearing information from the surface beacon. Moving the function switch to REC stops the transmitting of the interrogation signal and only bearing information is received from the surface beacon. The distance indicator is inoperative and a red bar drops across the figures when the function switch is moved to OFF and the AN/ARN-21 equipment is shut off.

*Airplanes changed by T.O.

†Airplanes Changed by T.O. 1F-100-734

Power for the switch is supplied by the secondary bus and single phase ac bus.

Channel Selector Switch. The channel selector switch (figure 4-5) permits selection of any of the 126 channels for air-to-ground transmissions. These channels cover 1025 mc to 1150 mc with a one mc separation. The switch consists of a large circular knob and a small handle. The circular knob selects frequencies in hundredths of megacycles and the handle selects tenths of megacycles; thus, any combination of channels up to 126 can be set up in the channel window. Power for the channel selector is from the single phase ac bus.

NOTE Allow about 12 seconds after channel selection for the bearing indicator and the distance indicator to correctly indicate the new information.

Volume Control Knob. The volume control knob (figure 4-5) adjusts the audio signal strength of the surface beacon identification tone. The knob should be rotated clockwise to increase the tone. Power for the volume control is from the single phase ac bus.

Bearing Indicator. The bearing indicator (radio magnetic indicator, 30, figure 1-7) indicates the relative bearing to the surface beacon from the airplane position. The double-barred (No. 2) pointer, provides radio bearing information which is read directly from the indicator as magnetic bearing to the beacon. The indicator operates when the function switch is at either REC or T/R. If the bearing signal is lost or interfered with, such as a steep bank which might place the antenna away from the surface beacon, a memory circuit in the receiver maintains the last bearing received for about 3 seconds. If the signal is still disrupted after the time limit, the bearing indicator pointer spins counterclockwise until the signal is picked up again. If the airplane is above the 40-degree angle limit, the bearing indicator pointer keeps spinning until the airplane is back within this limit. During a channel change or when the equipment is first turned on, the bearing pointer may falsely lock on momentarily to a bearing, but as the correct data is fed into the system, the pointer will swing to the correct bearing. Therefore, wait a few seconds after a lock-on before relying on the bearing indicated.

Distance Indicator. The distance (range) indicator (32, figure 1-7) shows in nautical miles the slant range from the airplane to the surface beacon by means of figures displayed in a small window in the center of the instrument. The indicator operates only when the function switch is at T/R. When the indicator is inoperative or when the channel is being changed, a red bar drops down and covers the figures. If the return signal from the surface beacon is lost because of interference or because the airplane is beyond the 195-mile range of the equipment, a memory circuit retains for about 10 seconds the last distance before the interruption; then the red bar drops across the figures. When the airplane is back within range, the distance indicator corrects itself and the red bar disappears automatically. The airplane receives bearing and distance indications except when it is above the 40-degree angle limitation from the surface beacon. Above this 40-degree limit, the airplane will receive distance information only. There will be a momentary false indication when the equipment is first turned on or when changing channels. However, wait a few seconds to ensure that the indication can be relied upon.

Course Indicator.

Signals from the TACAN navigation receiver are directed into the course indicator (33, figure 1-7) to operate the vertical needle for course guidance. It has a maximum deflection of about 10 degrees either side of the course centerline. A small background pointer provides course deviation information 45 degrees to the right or left of the course selected, both "to" and "from" the selected station. A "SET" knob on the lower left corner of the instrument is used to select a desired course, the magnetic value of which appears in a window at the top of the instrument. A window in the upper left corner of the instrument displays a "TO" or "FROM" indication, which signifies whether the selected course is inbound to the station tuned in or is the outbound reciprocal in relation to the airplane position. The indicator is provided with flag alarms which become visible at any time a received signal is unreliable, and when the equipment is shut off, either intentionally or because of electrical power failure. The horizontal needle and the marker beacon light of the indicator are inoperative on this installation.

Operation of AN/ARN-21 Radio (Homing).

To operate the AN/ARN-21 radio, proceed as follows:

1. Rotate channel selector switch to surface beacon channel desired.
2. Move function switch to either REC or T/R and allow about 2 minutes for warm-up, or until bearing indicator stops spinning.

NOTE A false lock-on may occur momentarily; however, the bearing needle will release and stabilize on the true bearing of the surface beacon.

3. To home on surface beacon:
   a. Turn airplane until J-2 directional indicator reads the same as the No. 2 pointer on the radio magnetic indicator.
   b. Rotate "SET" knob on course indicator to select desired course.

c. Read slant range on distance indicator.

NOTE If the function switch is at T/R, the distance indicator shows a reduction in mileage as the airplane approaches the surface beacon, and shows an increase in mileage as the airplane flies away from the beacon.

4. To turn equipment off, move function switch to OFF.

NOTE After the AN/ARN-21 is turned off, the No. 2 pointer rotates freely.

HEADSET ADAPTER.

The airplane is equipped with a high-impedance headset adapter to allow the use of the P-4 helmet. Whenever a low-impedance P-3 helmet is used, a headset adapter must be used. This adapter provides the impedance necessary to match the P-3 helmet with the airplane radio equipment. The radio lead from the P-3 helmet is plugged into the adapter, and the adapter is then plugged into the radio lead attached to the quick-disconnect fitting on the ejection seat. The adapter can be fastened to the parachute harness with an alligator clip.

RADAR IDENTIFICATION SYSTEM—AN/APX-6A.

The identification-friend-or-foe (IFF) system provides automatic coded replies for identification of the airplane by either surface or air-borne equipment. This automatic reply will identify a group of airplanes, and in addition, an individual airplane in a group can identify itself by a manually controlled coded reply. When a radar target shown on a challenger's equipment is identified by the reply, the target is considered to be a friendly airplane. The tertiary-bus-powered master switch (figure 4-5) has five positions. Selection of the STDBY position will warm up the system; however, challenges are not received. When NORM is selected, the IFF system operates throughout its maximum range. Selection of LOW reduces the distance range. The system responds only to challenges correctly coded for the mode of operation selected, except when the switch is at EMERGENCY; a coded reply is then automatically transmitted in response to any challenge. Selecting OFF turns off the system. When a radio request for individual airplane identification is received from ground control equipment, a coded reply can be transmitted in several ways. This reply can be transmitted by holding the alternate reply switch at I/P (identification of position) or by positioning the switch at MIC. and then pressing either the microphone button on the throttle or the tone button on the command radio control panel. (The command radio must be operating if the microphone button or the tone button is used.) The alternate reply is the same as the normal Mode 2 reply. Normal modes of operation are selected by positioning the two secondary-bus-powered mode switches and, for Mode 1 operation, the secondary-bus-powered alternate reply switch.

Operation of Radar Identification System—AN/APX-6A.

Caution Before take-off, check that IFF frequency counters have been set to proper frequency channels and that the transponder switch has been placed at NORM.

1. Turn IFF master switch to STDBY for a three-minute warm-up period.
2. Position IFF alternate reply switch at OUT.
3. Position IFF mode switches for desired operation as follows:

MODE NO. OF OPERATION	MODE SWITCH POSITION
1	OUT (all switches)
1 and 2	MODE 2 (Mode 3 and alternate reply at OUT)
1 and 3	MODE 3 (Mode 2 and alternate reply at OUT)
1, 2, and 3	MODE 2 and MODE 3 (alternate reply at OUT)

4. Turn IFF master switch to LOW or NORM.

NOTE The LOW position of the master switch (partial sensitivity) should not be used, except upon proper authorization.

5. To transmit a reply for individual airplane identification, hold alternate reply switch at I/P, or position switch at MIC, and then press either the microphone button or the tone control button. Return alternate reply switch to OUT after transmittal.
6. If in distress, press dial stop and, at the same time, rotate IFF master switch to EMERGENCY.
7. Rotate master switch to OFF to turn IFF system off.

RADAR IDENTIFICATION SYSTEM—AN/APX-25.

A complete AN/APX-25 radar identification system is installed on airplanes changed by T.O. 1F-100-755. Other airplanes have only wiring and space provisions for the installation of this system. The AN/APX-25 is formed when a coder and a control panel (figure 4-5) marked "SIF" (Selective Identification Feature) are added to the AN/APX-6A system. Through elaboration of the reply coding, the AN/APX-25 provides a more rapid and absolute identification of the airplane than the AN/APX-6A; however, with the exception of the reply coding, the operation is similar. When the AN/APX-25 system is installed, the SIF control panel is on the right console adjacent to the IFF control panel (figure 4-5) and is powered by the tertiary bus. The SIF control panel incorporates two code selector dials which are used in conjunction with the IFF control panel to provide control of the AN/APX-25 system. These dials, marked "MODE 1" and "MODE 3," are used to set in the reply code for the respective modes of operation which have been selected on the IFF control panel. The power (single-phase) inverter supplies 115-volt, 400-cycle power for the AN/APX-25 system.

Operation of Radar Identification System—AN/APX-25.

Caution Before take-off, check that IFF frequency counters have been set to proper frequency channels and that the transponder switch has been placed at MOD.

1. Turn IFF master switch to STDBY for a three-minute warm-up period.
2. Position IFF alternate reply switch at OUT.

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3. Position IFF mode switches for desired operation as follows:

MODE NO. OF OPERATION	MODE SWITCH POSITION
1	OUT (all switches)
1 and 2	MODE 2 (Mode 3 and alternate reply at OUT)
1 and 3	MODE 3 (Mode 2 and alternate reply at OUT)
1, 2, and 3	MODE 2 and MODE 3 (alternate reply at OUT)

4. Position SIF code selector dials for code to be used.

5. Turn IFF master switch to LOW or NORM for range desired.

NOTE The LOW position of the master switch (partial sensitivity) should not be used except upon proper authorization.

6. To transmit a reply for individual airplane identification, hold IFF alternate reply switch at I/P, or position switch at MIC. and then press either the microphone button or the tone control button. Return alternate reply switch to OUT after transmittal.

7. If in distress, press dial stop and, at the same time, rotate IFF master switch to EMERGENCY. A reply will be transmitted in response to a Mode 1 or Mode 3 challenge.

8. Rotate IFF master switch to OFF to turn off IFF and SIF systems.

LIGHTING EQUIPMENT.

EXTERIOR LIGHTING.

A position light is on each wing tip, and two are in the trailing edge of the fuel vent outlet fairing above the rudder. One recognition light is on top the dorsal fairing, behind the canopy; the other is on the lower surface of the fuselage, forward of the speed brake. The retractable landing-taxi lights are in the lower surface of the fuselage, aft of the nose wheel well. The lights extend for use as landing lights until the weight of the airplane is on the nose gear; then the lights extend farther to provide taxi lighting. All exterior lights are powered by the primary bus.

Position Light Switch.

Illumination of the position and recognition lights is controlled by a primary-bus-powered switch. (See figure 4-6.) When the switch is moved from the center (OFF) position to STEADY, the position and recognition lights

LIGHTING CONTROL PANEL

Figure 4-6

come on. When the switch is moved to FLASH, the position lights automatically flash at the rate of 40 cycles per minute; however, the recognition lights remain on steadily.

Position Light Dimmer Switch.

Brilliancy of the position and recognition lights is controlled by a primary-bus-powered switch. (See figure 4-6.) The switch has two positions, BRIGHT and DIM.

Landing-taxi Light Switch.

The retractable landing-taxi lights are controlled by a two-position primary-bus-powered switch. (See figure 1-24.) The lights are extended to the landing position and come on when the switch is positioned to ON. Upon touchdown, when the weight of the airplane is on the nose gear, the lights automatically extend farther to the taxi position, thus providing properly directed beams for taxiing. If a touch-and-go landing is made and the switch is left in the ON position, the lights return to the landing position as the weight of the airplane is removed from the nose gear. The lights go out and retract when the switch is positioned to OFF. Limit switches automatically cut off power to the light actuation motors when lights reach the fully retracted or one of the extended positions.

INTERIOR LIGHTING.

The instruments receive indirect illumination from individual lighting fixtures of either the ring or the post type. The stand-by compass, however, is illuminated by a bulb in the compass case. The position and identification markings of the controls and switches on the consoles and instrument panel are illuminated indirectly by light diffused within a plastic sheet from bulbs set into the panels. Direct lighting of the consoles and instrument panel is supplied by floodlights on the undersurface of the instrument panel shroud and above the consoles. (The indirect lights and floodlights furnish conventional red illumination.) A thunderstorm light on each side of the cockpit provides intense white light to reduce the blinding effect of lightning. A standard utility light fits into a socket above the right console for general cockpit illumination and may be removed from its socket to light areas of the cockpit not normally illuminated by other interior lights.

Console Light Rheostats.

The illumination and brilliance of the console indirect lights and floodlights are controlled by dual rheostats. (See figure 4-6.) Rotation of the oblong knob of the upper rheostat marked "INDIRECT" through OFF, DIM, and BRIGHT regulates the indirect lighting of the markings on the consoles and the instrument panel. The ring knob rheostat, marked "FLOOD," controls the console floodlights. Both the indirect lights and floodlights are powered by the primary bus.

Instrument Panel Light Rheostats.

Two primary-bus-powered rheostats, mounted together (figure 4-6), control the illumination and brilliance of the instrument panel lighting. One rheostat has an oblong knob, which is marked "INDIRECT." Rotating this knob through OFF, DIM, and BRIGHT controls the individual lights that provide indirect illumination for the instruments. When the knob is rotated from OFF to turn on the instrument indirect lights, the landing gear warning light circuit is also included so that the warning light (if it is illuminated) can be dimmed if the instrument lights are on. (When the instrument lights are OFF, the landing gear warning light can come on bright.) The indicator and warning lights may be dimmed when the instrument lights are on. The instrument panel floodlights are controlled by the other ring knob rheostat, marked "FLOOD."

Thunderstorm Light Rheostat.

The two white thunderstorm lights, which are powered by the tertiary bus, are controlled by a rheostat. (See figure 4-6.) For identification, the thunderstorm light rheostat has a hexagon-shaped knob, instead of the oblong-type knob used on the other lighting control rheostats.

Stand-by Compass Light Switch.

The light in the stand-by compass is controlled by a primary-bus-powered switch. (See figure 4-6.)

Cockpit Utility Light Control.

The primary-bus-powered cockpit utility light rheostat is attached to the side of the cockpit utility light. (See 7, figure 1-9.) The rheostat controls the lighting and brilliance of the utility light; however, pressing a push-button switch on the light housing provides full brilliance of the light, regardless of the rheostat setting. To change illumination from white to red, a detachable lens cover is supplied. A round knob on the side of the light also provides a means of obtaining the desired focus.

OXYGEN DURATION

- Black figures indicate diluter lever **NORMAL OXYGEN.**
- White figures indicate diluter lever **100% OXYGEN.**
- White figures in parentheses indicate diluter lever **100% OXYGEN,** emergency lever at **EMERGENCY,** and pressure suit used.
- Oxygen regulator pressure gage constant 70 psi.

HOURS

COCKPIT ALTITUDE—FEET	5 LITERS	4 LITERS	3 LITERS	2 LITERS	1 LITER	BELOW 1 LITER
35,000 AND ABOVE	31.4 31.4 (12.8)	25.2 25.2 (10.2)	18.9 18.9 (7.7)	12.6 12.6 (5.1)	6.3 6.3 (2.6)	EMERGENCY DESCEND TO ALTITUDE NOT REQUIRING OXYGEN
30,000	23.3 22.7 (12.8)	18.7 18.1 (10.2)	14.0 13.6 (7.7)	9.3 9.0 (5.1)	4.7 4.5 (2.6)	
25,000	22.0 17.5 (9.8)	17.6 14.0 (7.8)	13.2 10.5 (5.9)	8.8 7.0 (3.9)	4.4 3.5 (2.0)	
20,000	25.0 13.3 (7.6)	20.0 10.7 (6.1)	15.0 8.0 (4.6)	10.0 5.3 (3.0)	5.0 2.7 (1.5)	
15,000	30.2 10.7 (6.0)	24.2 8.6 (4.8)	18.1 6.4 (3.6)	12.1 4.3 (2.4)	6.0 2.2 (1.2)	
10,000	30.2 8.6 (4.8)	24.2 6.9 (3.8)	18.1 5.2 (2.9)	12.1 3.4 (1.9)	6.0 1.7 (1.0)	
5000	30.2 6.8 (3.9)	24.2 5.4 (3.1)	18.1 4.1 (2.3)	12.1 2.7 (1.6)	6.0 1.4 (0.8)	
0	30.2 5.5 (3.2)	24.2 4.4 (2.6)	18.1 3.3 (1.9)	12.1 2.2 (1.3)	6.0 1.1 (0.7)	

LIQUID QUANTITY

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Figure 4-7

OXYGEN SYSTEM.

The liquid-type oxygen system converts the oxygen from a liquid to a gas to make it suitable for breathing. The gaseous oxygen is supplied at normal temperature by a pressure-breathing, diluter-demand oxygen regulator. Liquid oxygen is stored in an insulated, "Thermos bottle" type container that is forward of the cockpit on the right side of the fuselage. The storage container has a volume of 5 liters (1.3 gallons); however, because of the boiling of the liquid oxygen and the shape of the container, it cannot be filled beyond 4.5 liters. Oxygen is delivered to the regulator at a pressure of about 70 psi. The system supplies breathing oxygen at a rate that depends on pilot demand, temperature, and altitude. The quantity of liquid oxygen contained in the system allows for a maximum of 24 hours of oxygen under the most desirable conditions. (Oxygen duration is shown in figure 4-7.) A full supply of liquid oxygen will completely boil off in about 5 days, when the airplane remains on the ground and no demands are made on the system.

The oxygen system is serviced through a single-point filler located behind an access door on the right side of the fuselage, below the cockpit. A build-up and vent valve, within the oxygen filler access door, controls oxygen pressure build-up in the system. The valve handle must be at VENT during system filling, and BLD. UP to pressurize the system for normal operation. (See figure 1-33 for oxygen specification.)

OXYGEN REGULATOR.

The automatic, pressure-breathing, diluter-demand oxygen regulator (figure 4-8) mixes air with oxygen. The ratio of air to oxygen varies according to the altitude and a quantity of the mixture is delivered each time the pilot inhales. At high altitudes, the regulator supplies positive pressure-breathing. The delivery pressure automatically changes with cockpit altitude. A pressure relief valve is on the outside of the regulator to relieve excess mask pressure.

NOTE Above 30,000 feet, a vibration or wheezing sound may sometimes be noticed in the mask. This noise is a normal characteristic of regulator operation and may be disregarded.

Diluter Lever.

The diluter lever (figure 4-8) should be at NORMAL OXYGEN for normal use, or at the 100% OXYGEN position for emergency oxygen use. In the NORMAL OXYGEN position, the regulator supplies a mixture of air and oxygen up to about 30,000 feet which is equivalent to normal breathing at sea level. Beyond 30,000 feet, 100 percent oxygen is supplied on either setting. These operating characteristics are related to the cockpit altitude only.

Emergency Lever.

The emergency lever (figure 4-8) should be in the center position at all times, unless an unscheduled pressure increase is desired. Moving the lever either way from its

OXYGEN REGULATOR CONTROL PANEL

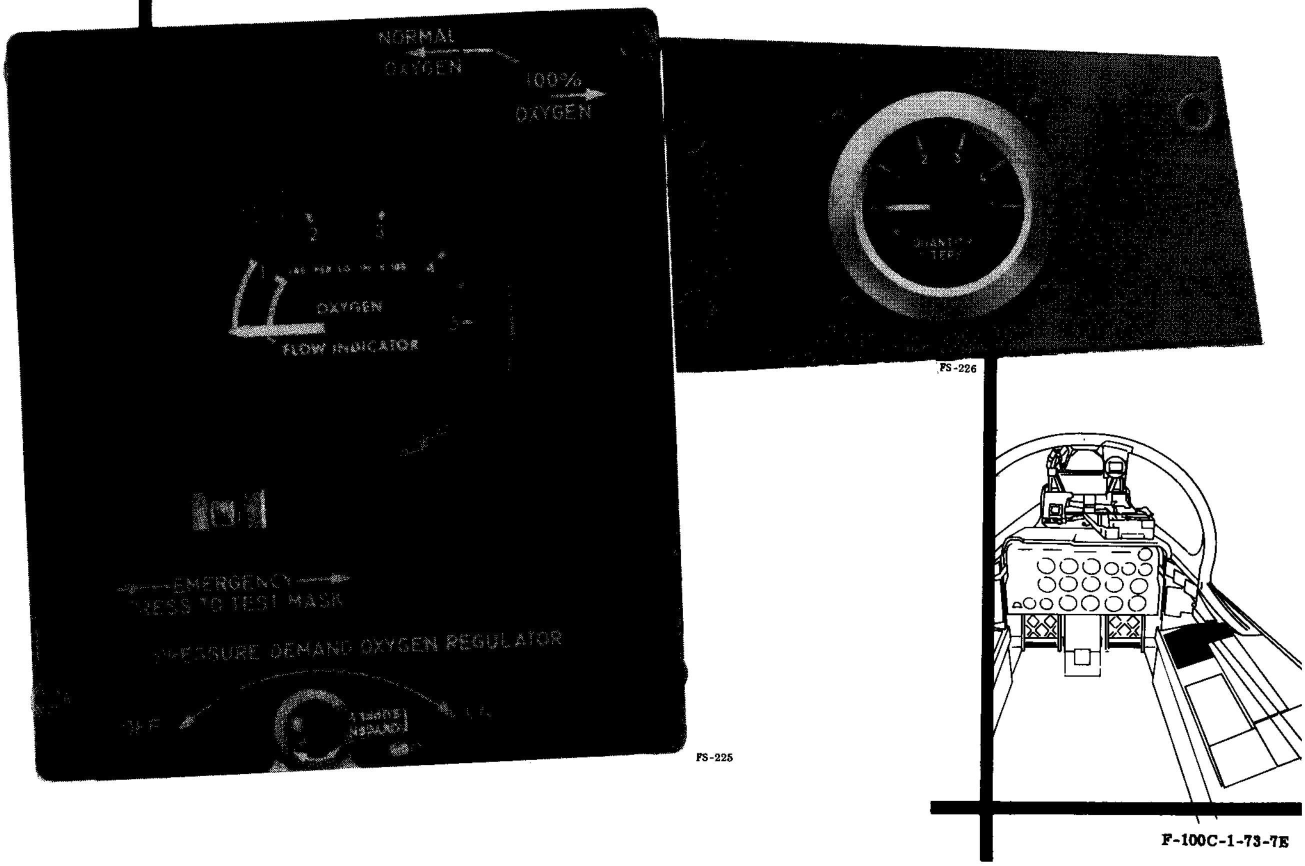

Figure 4-8

center position provides continuous positive pressure to the mask. When the toggle lever is in the center position, it may be pressed momentarily to supply positive pressure to test the mask for leaks.

Caution When positive pressures are required, it is mandatory that the oxygen mask be well fitted to the face. Unless special precautions are taken to prevent leakage, the continued use of positive pressure under these conditions results in rapid depletion of the oxygen supply. This condition could result in extremely cold oxygen flowing to the mask.

Supply Lever.

The supply lever (figure 4-8) is safety-wired to the ON position. It also has an OFF position.

Regulator Warning Light Switch.

The warning light switch (figure 4-8) has been deactivated.

Pressure Gage and Flow Indicator.

The pressure gage (figure 4-8) shows oxygen system pressure. The flow indicator has four small slots arranged in the lower half of the gage dial face. These slots show black and white alternately during the breathing cycle.

Liquid Oxygen Quantity Gage.

The liquid quantity gage (figure 4-8) shows the quantity of liquid oxygen in the storage tank, and is calibrated in liters from 0 to 5.

NOTE The liquid oxygen quantity gage should read between 4 and 4½ liters when the system is fully charged. It is impossible to charge the liquid oxygen converter to 5 liters. Use the oxygen duration graph (figure 4-7) to determine oxygen duration for indicated supply.

Oxygen Warning Light.

The oxygen warning light (8, figure 1-6) is inoperative.

OXYGEN SYSTEM PREFLIGHT CHECK.

Before take-off, the oxygen system should be checked as follows:

1. Check oxygen pressure gage at 55 to 130 psi; liquid quantity gage at 4 liters minimum.

NOTE For training and special-type flights only, the minimum quantity of oxygen may be 2½ liters, to avoid undue delay in turn-around time.

2. Check oxygen regulator with the diluter lever first at the NORMAL OXYGEN position and then at the 100% OXYGEN position as follows: Remove mask and blow gently into the end of the oxygen regulator hose as during normal exhalation. There should be resistance to blowing. Little or no resistance to blowing indicates a leak or faulty operation.

3. Fasten oxygen hose as shown in figure 4-9.

4. With regulator supply lever at ON, oxygen mask connected to regulator, and diluter lever in 100% OXYGEN position, breathe normally into mask and conduct following checks:

   a. Observe flow indicator for proper operation.

   b. Move emergency lever to right or left. A positive pressure should be supplied to the mask. Hold breath to determine if there is leakage around mask. Return emergency lever to center position. Positive pressure should cease.

Warning Do not leave the emergency lever at either positive pressure setting for more than 5 to 10 seconds unless the oxygen mask is attached, because the continuous flow of oxygen through the regulator will subject it to severe frosting conditions and possible permanent damage.

5. Return diluter lever to NORMAL OXYGEN.

NORMAL OPERATION OF OXYGEN SYSTEM.

1. Oxygen supply lever safetied ON.
2. Diluter lever at NORMAL OXYGEN.
3. Emergency lever at center (OFF) position.

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OXYGEN HOSE HOOKUP

MC-3A

1. Attach oxygen mask hose (male connector) to parachute harness chest strap by wrapping mask connector tie-down strap underneath and up behind chest strap harness twice, then snapping.

WARNING

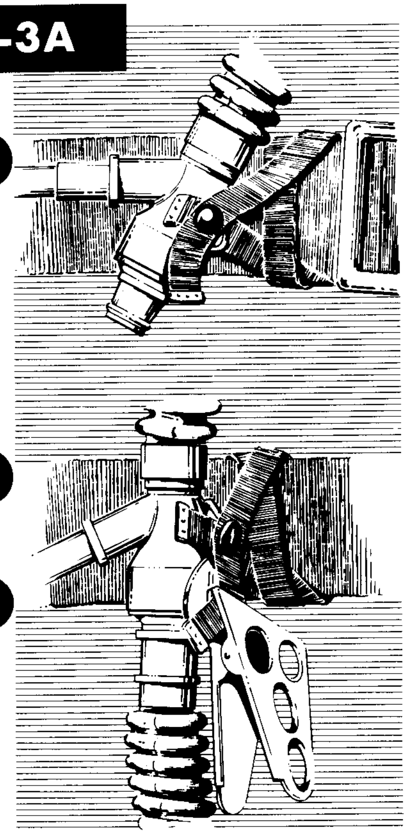
Failure to double-loop tie-down strap around chest strap may permit tie-down strap to slip into and open the chest strap snap during ejection.

2. Attach seat oxygen hose to oxygen mask hose. Listen for click and visually check (or feel) that sealing gasket is only half exposed.

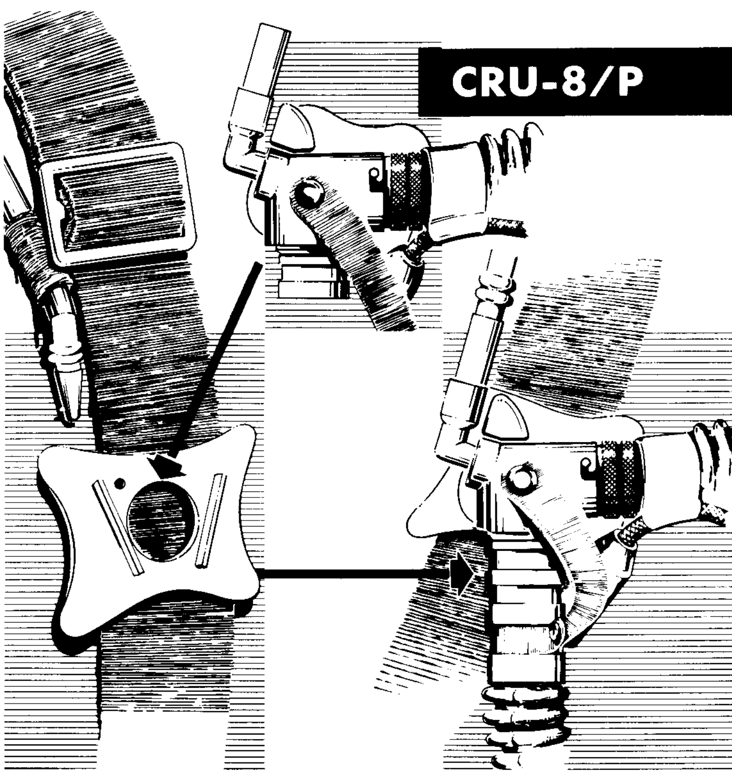
3. Fasten alligator clip as close to snap on tie-down strap as possible.

WARNING

Do not attach clip to harness as this may prevent quick separation from seat during ejection. The force required to pull clip from harness is more than from strap.



CRU-8/P



1. Insert connector into connector mounting plate attached to parachute harness. Check that connector is firmly attached and that lockpin is locked.

2. Insert male bayonet connector, on end of oxygen mask hose, into female receiving port of connector, and turn connector to lock its prongs into recesses in lip of receiving port.

3. Couple seat oxygen hose to lower port of connector.

4. Snap strap attached to seat oxygen hose onto connector.

WARNING

The seat hose should not have an alligator clip. If there is a clip, it should not be used, as possible interference may occur during ejection.

5. Attach bail-out bottle hose to swiveling port of connector by inserting male coupling of bail-out bottle hose and turning it clockwise against spring-loaded collar.

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Figure 4-9

EMERGENCY OPERATION OF OXYGEN SYSTEM.

If symptoms of hypoxia develop, or if smoke or fumes enter the cockpit, use one or more of the following procedures until satisfactory conditions are obtained:

1. Move diluter lever to 100% OXYGEN.
2. Push emergency lever right or left from center.
3. If oxygen regulator becomes inoperative, pull ball handle on H-2 emergency oxygen bail-out bottle (which contains a 6-minute oxygen supply).
4. Descend to a cockpit altitude below 10,000 feet as soon as possible.

NAVIGATION EQUIPMENT.

STAND-BY COMPASS.

Refer to "Instruments" in Section I.

RADIO COMPASS.

Refer to "Communication and Associated Electronic Equipment" in this section.

J-2 DIRECTIONAL INDICATOR (SLAVED).

The J-2 directional indicator (36, figures 1-6 and 1-7) indicate magnetic headings that are without northerly turning error, oscillation, or swinging. The directional indicator system consists of four principal units: a flux valve transmitter, a directional gyro control, an amplifier, and a repeater indicator. The indicator is basically a gyro-stabilized compass that is automatically kept on a true magnetic north heading with a flux valve transmitter within the left wing, inboard of the tip. The flux valve transmitter is the direction-sensing unit which senses the south-north flow of the earth's magnetic flux. The directional gyro control contains an electrically driven gyro, whose spin axis is not only tangent to the earth's surface but is also slaved to the earth's magnetic meridian. The system is operable when dc power from the primary bus and ac power are available (instrument inverter operating).

NOTE Should either the ac or dc supply fail, the directional indicator system is automatically disconnected from all electrical power.

For the first 3 or 4 minutes of operation, the gyro is on a fast slaving cycle and will precess rapidly; during this time, it should align with the magnetic heading. The gyro then begins a slow slaving cycle. The directional indicator is free from drift and requires no resetting in normal operation.

NOTE After the gyro reaches operating speed, the indicator should be checked against the stand-by compass to make sure the indicator does not show a 180-degree error in reading. The directional indicator is not operating properly if there is such error.

A knob at the lower left of the indicator ring is used to rotate the course index to a preselected heading. Indicator readings become incorrect if the airplane exceeds 82 degrees of climb, dive, or bank. If the airplane exceeds 82 degrees in these attitudes, the gyro will precess and indicate a change in heading of 180 degrees. Upon return to a level attitude, the indicated heading will be the correct heading of the airplane. In addition, heading errors known as gimbal errors may exist when the airplane is not in a level attitude. One typical error is 4 degrees (maximum) for a climb, dive, or bank of 30 degrees. An error of 19 degrees (maximum) will occur when the airplane is placed in a climb, dive, or bank of 60 degrees. When the airplane is returned to a level attitude, the indicated heading will be the correct heading of the airplane.

J-2 Directional Indicator Controls.

Directional Indicator Fast Slave Button. The fast slave button (2, figures 1-6 and 1-7) provides a means of rapidly synchronizing the gyro to the earth's magnetic field. Pressing the button interrupts primary bus power to the indicator. When the button is released, power is restored and the fast slaving cycle is initiated to permit faster gyro recovery to the magnetic heading.

NOTE To avoid damage to the slaving torque motor, the fast slave button should not be used too frequently. Allow 10 minutes between actuations, and hold button depressed no longer than 2 seconds.

Directional Indicator Slaving Cutout Switch. This two-position switch (3, figures 1-6 and 1-7) is used to discontinue the magnetic sensing of the directional indicator. It is designed to navigate in polar areas where the excessive dip of the earth's magnetic lines of force causes indications to become inaccurate. When the switch is moved to OUT position, the power supply to the slaving torque motor is shut off; however, the directional indicator may still be used temporarily as a turn indicator if conventional procedures for making gyro drift corrections are employed. The directional indicator functions normally when the switch is at IN.

NAVIGATIONAL COMPUTER.

The navigational computer (10, figure 1-9), mounted on a swivel arm above the right console, allows the pilot to solve simple problems of time, rate, distance, true airspeed, and density altitude. When not in use, the computer can be stowed under the canopy sill.

ARMAMENT EQUIPMENT.

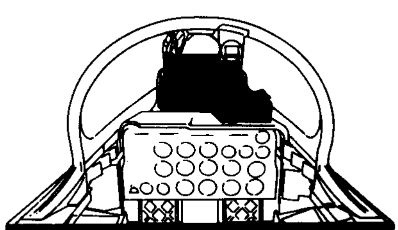
The basic armament installation consists of four 20 mm guns and provisions for carrying various external loads, including bombs, a special store, chemical tanks, and rocket launchers. Loads are carried on removable pylons fitted to the mounting stations under each wing. A gun-bomb-rocket sight is coupled with a radar ranging system.

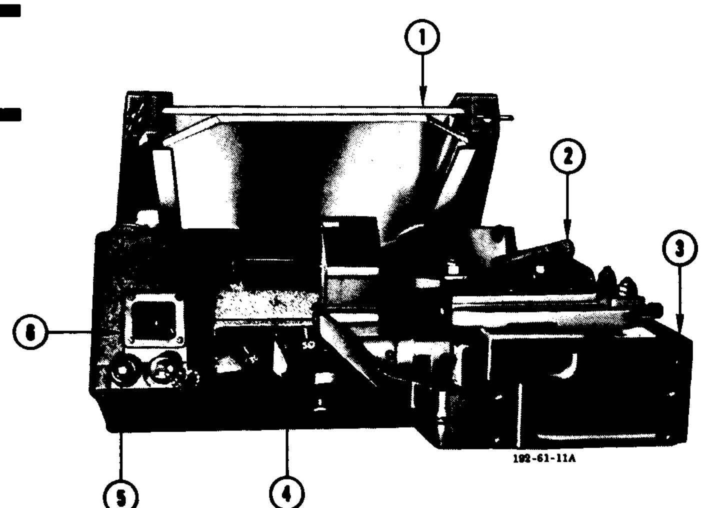
NOTE See figures 5-3 and 5-4 for approved external load configurations.

A-4 SIGHT.

The Type A-4 gyro computing sight (figure 4-10) automatically computes leads for gunnery, rocket firing, or bombing. The sight computation is entirely automatic, requiring only that the pilot keep the reticle center dot on the target and track the target smoothly. The sight reticle image has a center dot and an outer circle of ten diamond-shaped dots. The reticle image is projected on a reflector glass behind the windshield and compensates for the required lead for gun and rocket firing. A dual-filament bulb provides illumination for the reticle image projection. Range data for gunnery is supplied either by the AN/APG-30A radar or by a manual range control. The sighting system is calibrated to automatically compute leads for ranges between 600 and 6000 feet. On overland targets (6000 feet or less above the terrain), radar ranging is usually erratic because of ground return effects. Under such conditions, radar ranging distances may be reduced by use of the radar range sweep rheostat, or manual ranging may be employed. When the sight is used as an automatic bombsight, the line of sight is depressed approximately 10 degrees. This requires the approach to be made so that the flight path becomes tangent to the proper bomb release point, which is indicated by automatic extinction of the sight reticle image. Bombs can be released by the sight automatically (at the proper release point by an accelerometer mechanism within the sight) or manually; in either case, the bomb-rocket release button must be held depressed. The electrical power for the sight system (300-volt dc and 28-volt dc) is controlled by the gun safety switch. The sight can be operated as a fixed-reticle sight as long as dc power is available.

A-4 SIGHT





1. REFLECTOR GLASSES
2. SIGHT MECHANICAL CAGING LEVER
3. GUN SIGHT CAMERA
4. WING SPAN LEVER
5. RADAR LOCK-ON LIGHT
6. SIGHT RANGE DIAL

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Figure 4-10

Sight Ranging Radar.

The AN/APG-30A radar is powered by the tertiary bus and single-phase ac bus, and supplies range data to the A-4 sight. The radar system has a range of about 750 to 6000 feet and automatically locks on and tracks targets within this range. An indicator light on the A-4 sight shows when the radar has locked on a target. A manual range control supplements the radar set and should be used if radar ranging fails. Manual ranging should also be used for overland targets below 6000 feet, as radar ranging below that altitude is usually erratic because of ground return effects. The sight radar antenna is installed within the upper leading edge of the engine air intake duct fairing.

A-4 Sight Controls and Indicators.

Trigger Safety Switch. Refer to "Gunnery System Controls" in this section.

Sight Dimmer Rheostat. The sight dimmer rheostat (figure 4-16) adjusts the brilliance of the reticle image. When the sight is not in use, the rheostat should be turned to DIM to prevent damage to the reticle bulb in case of voltage surge. Turning the rheostat clockwise to BRIGHT increases reticle brilliance. On airplanes changed by T.O. 1F-100-707, the sight reticle on the sight reflector glass is dimmed before lock-on (independent of the reticle dim control), and at the time of lock-on, the sight reticle increases in brilliancy.

Sight Filament Selector Switch. Selection of either the primary or secondary filament in the dual-filament bulb is accomplished by the sight filament selector switch. (See figure 4-16.) The switch, normally set at PRIMARY, may be moved to SECONDARY if the primary filament in the bulb fails.

Sight Selector Unit. The sight selector unit (figure 4-16) has a sight function selector lever, a rocket depression angle selector lever, and a target speed switch. The sight selector unit requires secondary and tertiary bus power. The sight function selector lever, when set at GUN, BOMB, or ROCKET, adjusts the sight system for the desired operation. (However, when the radar reject button is pressed, the lever automatically returns to the GUN position if it was set at either BOMB or ROCKET.) The target speed switch, mounted on the sight selector unit, is used to control lead angle in accordance with speed ratio between the attacking airplane and its target. When a high-speed attack is being made on a slow target, the switch should be positioned to LO. The switch should be placed at HI when the target speed is approximately the same as that of the pursuing airplane. The TR position is used during a low-speed run on a low-speed training target. These relative speeds for the LO setting are: 600 knots TAS for the attacking airplane and 200 knots TAS for the target airplane. HI setting: 600 knots TAS for the attacking airplane and 500 knots TAS for the target airplane. TR setting: 300 knots TAS for the attacking airplane and 200 knots TAS for the target airplane. The rocket depression angle selector on the upper arc of the unit, has a scale calibrated in mils for sight reticle depression. There are no marked rocket settings. Movement of the rocket depression angle selector lever depresses the sight reticle image in increasing amounts through the full range of the mil scale according to the position selected. The proper selector lever setting for various rocket-firing conditions can be determined from the charts in figure 4-21. (Refer to "Angle-of-attack Relationship" in this section.) The data thus obtained should be set on the mil scale with variable index markers so provided. The index markers, numbered from 1 through 4, are for reference only and have no function in the sight system. When pulled out, a pull tab near the 50-mil mark on the inner rim of the selector unit face unlocks the index markers for adjustment.

Wingspan Lever. Setting the sight wingspan lever (figure 4-10) inserts target size data into the sight, varying the reticle diameter in proportion to the range information signals received from the manual ranging control or the radar. Graduated markings (from 30 to 120) on the scale represent the wingspan (in feet) of the target airplane. The wingspan adjustment lever should be the scale graduation that equals the anticipated size of the target.

Manual Ranging Control. The twist control in the throttle grip (figure 1-11) permits range data to be supplied manually to the sight system. It is used during gunnery when radar ranging becomes inoperative, or is erratic at altitudes below 6000 feet on overland targets because of ground effects. Manual radar ranging requires secondary and tertiary bus power. The manual range covers a 1500-foot segment of the entire radar range span and falls within the radar range span between the 1200- and 2700-foot marks. Ranges are shown on the sight range dial, and sight reticle diameter is determined by positioning of the manual range control. Clockwise rotation of the throttle grip reduces range (increases reticle diameter). Counterclockwise rotation increases range (decreases reticle diameter). The throttle grip is spring-loaded to the full counterclockwise position. This is the correct position for normal (automatic) operation of radar ranging.

Radar Reject Button. The radar reject button (figure 1-21) should be pressed momentarily to reject the range lock-on and shift the radar to another target. The radar can then lock on targets at ranges greater than the one rejected until the radar maximum sweep range is reached. Radar sweep then automatically recycles, starting to sweep again from minimum range. Pressing the radar reject button also automatically moves the sight function selector lever to GUN if the lever is at BOMB or ROCKET. The radar reject button requires power from the tertiary bus.

Radar Range Sweep Rheostat. This rheostat (figure 4-16) is used to decrease radar ranging distance and thus prevent the sight radar from locking on the ground or ground objects (when the airplane is making low-altitude attacks). Turning the rheostat toward MIN decreases radar sweep range; turning it toward MAX increases range. During normal operation at altitudes 6000 feet or more above the terrain, the rheostat should be at MAX. Power is supplied from the secondary and tertiary busses.

Sight Electrical Caging Button. Pressing the sight electrical caging button (figure 1-11) stabilizes the sight gyro reticle image by caging the sight gyros. When the button is released, the gyros uncage and become operable. To eliminate gyro deflection that results from maneuvering on the initial approach to the target, and to provide a stabilized reticle image, the sight should be caged electrically until the approach run has stabilized. Secondary and tertiary bus power is required for operation.

Sight Mechanical Caging Lever. Mechanical caging of the sight is done by a caging lever (figure 4-10) which should be at UNCAGE for normal automatic operation of the sight. The lever is for use during ground attacks if desired or in case the sight fails. It should be moved to CAGE to provide a fixed reticle. The size of the fixed reticle depends upon the setting of the wingspan lever. (When the lever is at 60, a 100-mil fixed reticle is produced when the sight is caged.)

Caution The sight should be mechanically caged during taxiing, take-off, and landing, to prevent damage to the sight.

Bomb-Target Wind Control. The bomb-target wind control (26, figures 1-6 and 1-7) adjusts the sight system for dive-bombing operations and is operative when the sight function selector lever is at BOMB and tertiary power is available. Turning the bomb-target wind control knob clockwise from the ROCKET GUN position depresses the sight reticle image to determine the proper approach to the target. If, during the attack, the path of the airplane is parallel to the wind or parallel to the direction of a moving target, the bomb-target wind control should be used to compensate the sight system accordingly. For attacking stationary targets, corrections for wind speed are made on either the "UPWIND" or "DOWNWIND" portion of the scale to correspond with known or estimated wind velocity. ("UPWIND" scale is used when attack is made into a head wind; "DOWNWIND," for attacks made with a tail wind.) If the wind direction is not parallel to the course of the attacking airplane, the amount of wind correction adjustment must be estimated. This correction approaches zero as the wind direction becomes 90 degrees to the airplane course. During attack on moving targets, additional corrections must be made to compensate for target velocity. For approaching targets, correction is "DOWNWIND"; for receding targets, correction is "UPWIND." No sight system correction is necessary when the target is moving at right angles to the path of attack; however, proper lead angle must be maintained. The ROCKET GUN position of the bomb-target wind control is inoperative.

Sight Range Dial. Target range in hundreds of feet is indicated by the range dial, visible through a window on the left side of the sight head. (See figure 4-10.) The dial is graduated in feet from 600 to 6000 and presents range distances as determined by either the manual range control or the radar ranging system. Secondary and tertiary bus power is necessary for operation.

Radar Lock-on Light. The radar lock-on light (figure 4-10) comes on when the radar ranging equipment has locked on the target. The lock-on light housing is rotated to control light intensity. Secondary and tertiary bus power is necessary for operation.

GUN CAMERA AND STRIKE CAMERA SYSTEMS.

The camera system includes a Type N-9 gun sight motion picture camera, and a P-2 strike camera. The gun camera, mounted on the sight, photographs the sight reticle and the target simultaneously during gun and rocket firing or during bombing. The strike camera in the lower surface of the fuselage records the impact or strike on ground targets whenever the bombs are dropped or the rockets are fired.

Gun Camera.

The Type N-9 gun sight aiming point camera (3, figure 4-10) on the sight records the sight reticle and target during gun firing. It is an electrically driven magazine-type, 16 mm motion picture camera. The film magazine contains 50 feet of film. During gun firing, pressing the trigger to the first detent starts camera operation. The camera continues to operate as long as the trigger is held, plus a preselected 0 to 3 seconds overrun. The camera shutter can be adjusted for various light conditions from the cockpit; however, shutter speed is preset on the ground. Thermostatically controlled camera and magazine heaters are provided.

Strike Camera.

The electrically driven Type P-2 strike camera is mounted on the underside of the fuselage, forward of the nose wheel well. (When the strike camera is not installed, the fuselage opening is closed by a cover plate.) The mount is adjustable and provides a range of settings from 40 degrees forward oblique to 145 degrees aft oblique. The camera lens door is actuated electrically by a camera door motor, which in turn is controlled automatically by strike camera operation. The window surface is defrosted by hot air from the engine compressor section which is automatically shut off during camera operation to prevent distortion of the picture. (On some airplanes, this routing of hot air has been disconnected by T.O.) A microswitch in the camera compartment prevents unnecessary defrosting of the compartment when the camera is not installed. A timer unit is provided to govern the start and running time of the camera.

Camera System Controls.

Trigger Safety Switch. Refer to "Gunnery System Controls" in this section.

Bomb Release Mode Selector Switch. Refer to "Bombing Equipment" in this section.

Bomb-Rocket Release Button. Refer to "Bombing Equipment" in this section.

Camera Shutter Selector Switch. Setting this secondary-bus-powered switch (4, figure 1-8; 5, figure 1-10; and figure 4-16) at BRIGHT, HAZY, or DULL adjusts the gun camera and the strike camera for lighting conditions. The OFF position disconnects power from the camera systems.

Strike Camera Timer. A camera timer (figure 4-16) to start and stop the strike camera, controls two adjustable time intervals. The first interval represents the time in seconds from release of bombs or rockets to initial camera operation. This interval is set before the bomb run with the large timer knob marked "START DELAY ADJUST." The second interval represents camera running time in seconds for a given pass, not including the 3-second overrun, and must be set by the ground crew with the small timer knob marked "PRESET RUN TIME." See figure 4-11 for the recommended time intervals for total numbers of passes to be made at various dive angles and release altitudes. (The conditions chosen are representative of typical combat conditions and requirements.)

Warning

Use these tables only for conditions known to be safe. For example, bomb release at 2000 feet above the target from a 30-degree dive at 650 knots TAS would require more than 2000 feet altitude for recovery, using a 6 G pull-up.

Operation of Strike Gun and Cameras.

When the trigger safety switch is at GUNS SIGHT CAMERA & RADAR and the trigger is squeezed to the second detent, gun firing and gun camera operation are initiated, provided the camera shutter selector switch is not at OFF. On airplanes changed by T.O. 1F-100-707, the camera is not affected by the trigger safety switch and will operate in conjunction with the gun sight when the trigger is squeezed to the second detent, provided the bomb release mode selector switch is in the RADAR & SIGHT position. If the gun sight camera is to be used to record the approach and tracking technique on an *expendable* target, the trigger is squeezed only to the first detent. To fire the guns, squeeze the trigger further to the second detent. To photograph the approach and tracking technique on a friendly or *nonexpendable* target, the trigger safety switch should be moved to SIGHT CAMERA & RADAR (CAMERA on airplanes changed by T.O. 1F-100-707), and the trigger should be squeezed to the first or second detent. To photograph a rocket or bomb run, the bomb-rocket release button is used. When the armament selector switch is at ROCKETS-FIRE, BOMB-SINGLE, BOMB-PAIRS, or BOMB-SALVO and the bomb-rocket release button is depressed, the gun sight and strike cameras operate. When the bomb-rocket release button is released, the gun sight camera stops but the strike camera delay timer continues to operate. After a preselected period of time, determined by the setting of the timer "START DELAY ADJ." knob, the timer starts the strike camera and simultaneously opens the strike camera door. The strike camera photographs the target for a preset period of time, determined by the setting of the timer "PRESET RUN TIME" knob. After timer power to the strike camera is removed, an overrun control allows the camera to continue operation for a period of 3 additional seconds. The camera shutter

STRIKE CAMERA SETTINGS

BASED ON RELEASE SPEEDS RANGING FROM 350 TO 650 KNOTS TAS

NUMBER OF PASSES	"PRESET RUN TIME" (CAMERA RUNNING TIME PER PASS-SECONDS)	DIVE ANGLE (DEGREES)	RELEASE ALTITUDE—FEET (ABOVE TARGET)	"START DELAY ADJUST" (CAMERA DELAY AFTER LOAD RELEASE)	
				2.75 ROCKETS (SECONDS)	BOMBS (SECONDS)
1	30 (MAX)	ANY	UNDER 20,000	0	0
2	17	ANY	UNDER 10,000	0	0
2	17	ANY	10,000 TO 20,000	–	10
3	10	30	UNDER 5000	0	0
3	10	30	5000 TO 10,000	4	7
3	10	30	10,000 TO 15,000	–	14
3	10	30	15,000 TO 20,000	–	20
3	10	50	UNDER 5000	0	0
3	10	50	5000 TO 10,000	0	5
3	10	50	10,000 TO 15,000	–	10
3	10	50	15,000 TO 20,000	–	16
3	10	70	UNDER 5000	0	0
3	10	70	5000 TO 10,000	0	4
3	10	70	10,000 TO 15,000	–	9
3	10	70	15,000 TO 20,000	–	14
4	7	30	UNDER 4000	0	0
4	7	30	4000 TO 7000	0	6
4	7	30	7000 TO 10,000	5	11
4	7	30	10,000 TO 13,000	–	15
4	7	30	13,000 TO 16,000	–	18
4	7	30	16,000 TO 20,000	–	22
4	7	50	UNDER 4000	0	0
4	7	50	4000 TO 7000	0	4
4	7	50	7000 TO 10,000	0	8
4	7	50	10,000 TO 13,000	–	11
4	7	50	13,000 TO 16,000	–	14
4	7	50	16,000 TO 20,000	–	18
4	7	70	UNDER 4000	0	0
4	7	70	4000 TO 7000	0	0
4	7	70	7000 TO 10,000	0	6
4	7	70	10,000 TO 13,000	–	9
4	7	70	13,000 TO 16,000	–	12
4	7	70	16,000 TO 20,000	–	15

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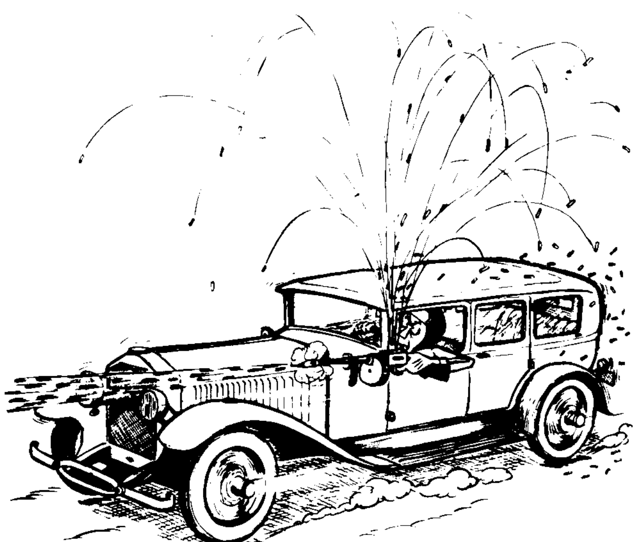
Figure 4-11

selector should be set for the prevailing visibility conditions.

NOTE For extreme low-temperature operation, the camera heaters should be on for a minimum warm-up period of ½ hour. Before electrical power is available to the camera heaters, the camera shutter selector switch must be at BRIGHT, HAZY, or DULL.

GUNNERY SYSTEM.

Four Type M-39 20 mm guns are mounted in the lower forward section of the fuselage. The guns are gas-operated and use electrically fired ammunition. Rate of fire is about 1500 rounds per minute. Normal ammunition load is 257 rounds per gun. All guns are manually



CAUTION

As "cook-offs" may occur if more than 200 rounds are fired without allowing sufficient cooling time, the capacity of each ammunition box is temporarily restricted to 200 rounds.

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charged on the ground. Ammunition is belt-fed to the guns from two compartments behind the cockpit. Expended ammunition links are retained to prevent impact damage to fuselage and tail surfaces. The expended cases, however, are ejected overboard (through tubes having outlets in the fuselage bottom) with sufficient velocity to clear the airplane. The gun, ammunition, and expended link compartments have a purging system for removing explosive gases created during gun firing. The purging system uses air from the engine air intake duct and is actuated automatically during gun firing.

Caution When the guns are fired on the ground, all gun, ammunition, and expended link compartments must be open, as there is insufficient airflow to adequately purge the compartments.

The sight is coupled with a radar ranging set, and a gun camera photographs the sight reticle. The effective range of various gunnery system components is shown in figure 4-13.

Gunnery System Controls.

Trigger Safety Switch (Airplanes Not Changed by T.O.). Electrical power (ac and dc) for operation of sight camera, sight, radar ranging equipment, and guns is selectively controlled by secondary bus power through a guarded trigger safety switch. (See 10, figure 1-6; and figure 4-12.) When the switch is at SIGHT CAMERA & RADAR, power is supplied to the sight and radar equipment and is also available to permit the sight camera to operate when the trigger is pressed. When the switch is at the GUNS SIGHT CAMERA & RADAR position, the sight and radar are energized and power is provided to actuate the camera, the guns, and the gun purging system when the trigger is pressed. Power to these units is disconnected when the switch is at the OFF position.

Trigger Safety Switch (Airplanes Changed by T.O 1F-100-707). Electrical power (ac and dc) for the operation of the gun camera, guns, and, under some conditions, the radar ranging system is controlled by secondary bus power through a guarded trigger safety switch. (See 9, figure 1-7; and figure 4-12.) When the switch is in the GUNS CAMERA position, power is provided to actuate the gun sight camera, guns, and gun purging system when the trigger is squeezed. With the switch at MISSILES CAMERA, power is supplied to change the radar ranging system from stand-by condition to a ready condition, and power is supplied to the gun sight camera when the trigger is squeezed. Power through this switch for a ready condition of the radar system and power to the guns is disconnected when the switch is in the CAMERA position, but power is continually supplied to the gun sight camera which can then be operated by squeezing the trigger.

Trigger. The gun-firing and camera circuits are energized when the trigger (figure 1-21) on the control stick is depressed. The trigger has two detent positions. With the trigger safety switch at SIGHT CAMERA & RADAR, either trigger position energizes the camera. With the trigger safety switch at GUNS SIGHT CAMERA & RADAR, the first

TRIGGER SAFETY SWITCH

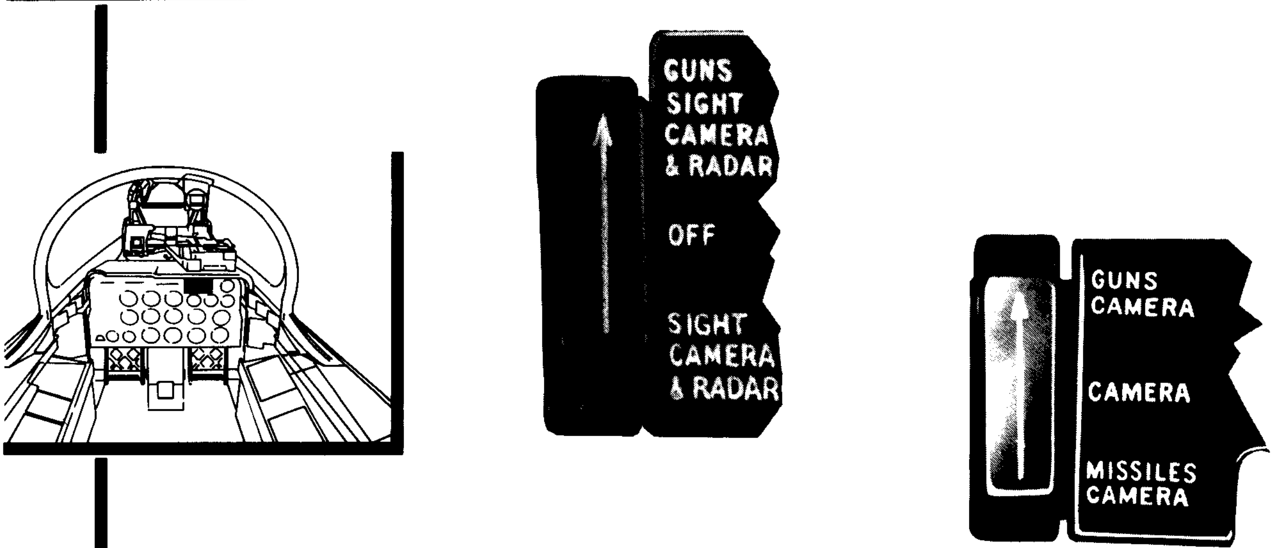


Figure 4-12

pressed position of the trigger energizes the camera circuits and energizes the purge door selector valve so that utility hydraulic system pressure opens the purge door for gun bay purging. Then at the second (fully depressed) trigger position, camera operation continues and high-voltage ac power is supplied from the gun-firing transformers to detonate the cartridges. As the second trigger position is released, the guns stop firing and a time-delay unit in the purging system circuit keeps the purging system functioning for 5 seconds after the first trigger detent is released. On airplanes changed by T.O. 1F-100-707, either trigger detent position energizes the gun sight camera when the trigger safety switch is at GUNS CAMERA. The first detent position of the trigger energizes the gun sight camera and the gun purge doors selector valve. Then, at the second (fully squeezed) trigger position, gun sight camera operation continues and the guns fire. When the trigger safety switch is at CAMERA or MISSILES CAMERA, either trigger detent position energizes the gun camera and the strike camera.

NOTE If the purge door fails to open, thereby prohibiting the flow of air to the compartments requiring ventilation, a microswitch prevents the gun-firing circuit from being energized.

Ground Fire Switch. The ground fire switch (figure 4-16) is for gun harmonization purposes only. It bypasses the nose gear ground safety switch and allows guns and missiles to be fired on the ground. This switch is channel-guarded with a safety pin fastened through holes in the guard. The switch is powered by the secondary bus and is spring-loaded to SAFE. When held at ON, the switch overrides the nose gear safety switch and the purge door circuits.

NOTE This switch should not be used in flight, because a gun gas explosion in the gun bay can result.

Firing Guns (Radar Ranging).

To fire guns using A-4 sight with radar ranging, proceed as follows:

1. Position trigger safety switch at SIGHT CAMERA & RADAR. (On some airplanes,* position trigger safety switch at CAMERA and bomb release mode selector switch at RADAR & SIGHT.) Allow a 5- to 15-minute warm-up period (depending on outside air temperature) for sight and radar.

2. Set sight filament switch to PRIMARY. If primary filament is inoperative, move switch to SECONDARY.

3. Adjust sight dimmer rheostat for desired image brilliance.

***Airplanes changed by T.O. 1F-100-707**

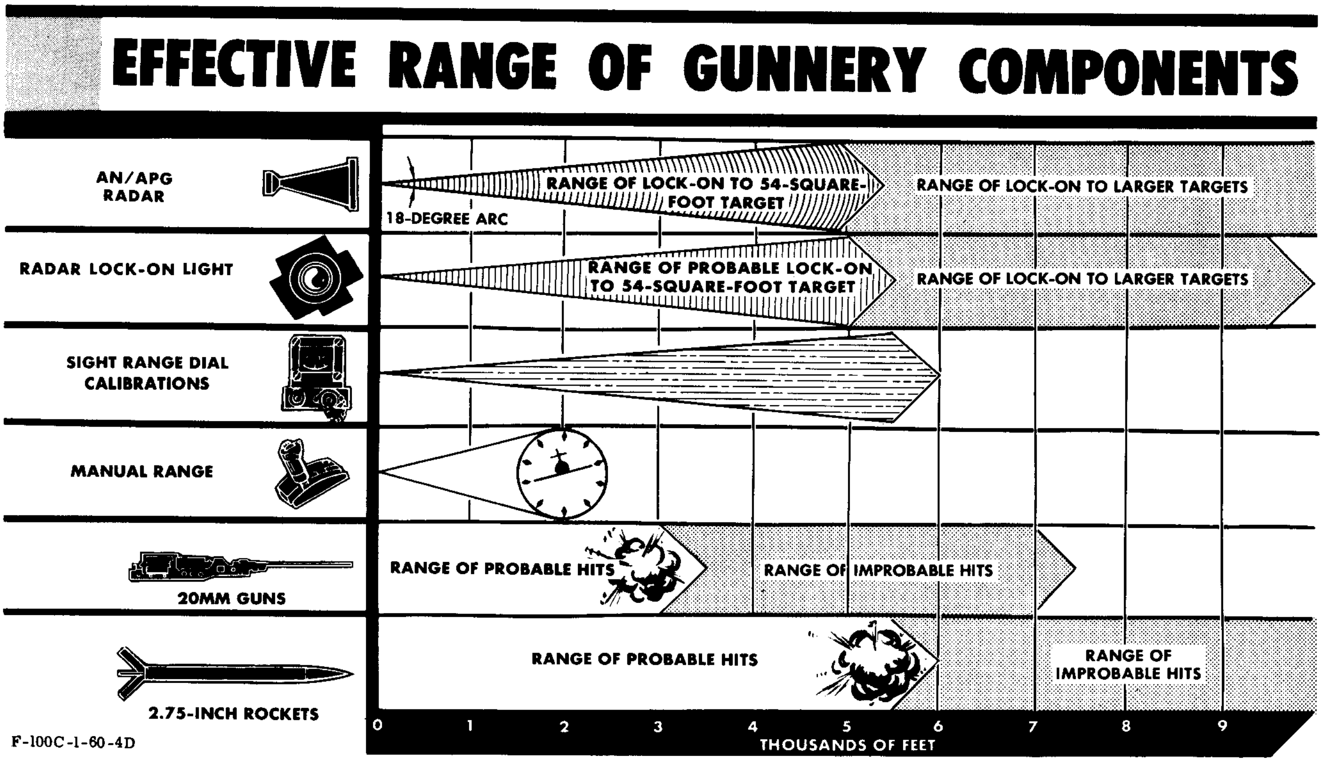


Figure 4-13

4. Sight selector unit: set sight function selector lever at GUN, and target speed switch at TR, HI, or LO, depending on speed of attacking airplane and speed of target.

5. Move sight mechanical caging lever to UNCAGE.

6. Set camera shutter selector switch as required.

7. Reposition trigger safety switch to GUNS SIGHT CAMERA & RADAR (GUNS CAMERA*).

8. Set wingspan lever to size of target airplane. (This provides a sight reticle of a size corresponding to the expected target, and allows manual ranging to be set up in a minimum of time, should radar ranging fail.)

9. Press electrical caging button to stabilize reticle image and begin tracking. Hold caging button depressed and continue to track ahead of target with a lead estimated to be that for which the sight will compensate upon release of the caging button.

NOTE If more than one target is within range along the airplane flight path, make sure the radar is tracking the desired target. As the range is decreased, the reticle should grow larger. Check the range dial against the estimated range of the target. If the radar has locked on an undesired target, reject it by pressing the radar reject button on the stick grip.

10. Release electrical caging button as soon as radar lock-on light comes on, showing radar lock-on. As caging button is released, reticle image drifts down and then back to the target.

11. Continue to track target smoothly, without slipping or skidding, for about one second after releasing caging button.

12. Begin firing as soon as target is within firing range (as indicated by the sight range dial).

Caution If it is necessary to nose the airplane down immediately after firing the guns at speeds above Mach 1, do not maintain the same heading at which the guns were fired. Instead, turn to one side or the other, and when possible, pull up slightly. This will prevent the airplane from intercepting its own projectiles.

Firing Guns (Manual Ranging).

To fire the guns if radar ranging fails (as indicated by radar lock-on light going out or other improper range indications) or at any other time, it is necessary or desirable to employ manual ranging:

1. Check wingspan lever for correct target span setting.

2. Rotate throttle grip clockwise until reticle image circle is reduced to minimum diameter.

3. Press electrical caging button to stabilize reticle image and begin tracking. (Track ahead of target with

***Airplanes changed by T.O. 1F-100-707**

a lead estimated to be that for which the sight will compensate upon release of the caging button.)

4. Rotate throttle grip as necessary to maintain size of reticle image same as span of target.

5. Release caging button and make necessary changes to correct aim. (The reticle should now be completely on target.)

6. Continue to track target smoothly, without slipping or skidding, for about one second after releasing caging button.

7. Begin firing as soon as target is within firing range (as indicated by the sight range dial).

Caution If it is necessary to nose the airplane down immediately after firing the guns at speeds above Mach 1, do not maintain the same heading at which the guns were fired. Instead, turn to one side or the other, and when possible, pull up slightly. This will prevent the airplane from intercepting its own projectiles.

BOMBING EQUIPMENT.

The bombing equipment includes removable (non-jettisonable) pylons with ejector-type bomb racks. Attachment of the pylons is made at two or more of the six stations under the wings. Manual and electrical controls are incorporated to operate the equipment. The A-4 sight is used as a bombsight, and during dive bombing can be used as an automatic bomb release system. To release bombs automatically in low-altitude bombing, the MA-1A or MA-2 low-altitude bombing systems (LABS) are used. In addition, wiring provisions for the M-1 automatic release system have been made to use in toss bombing. The equipment also provides controls for a special store carried under the left wing, at the intermediate station.

NOTE For approved external loads, see figures 5-3 and 5-4.

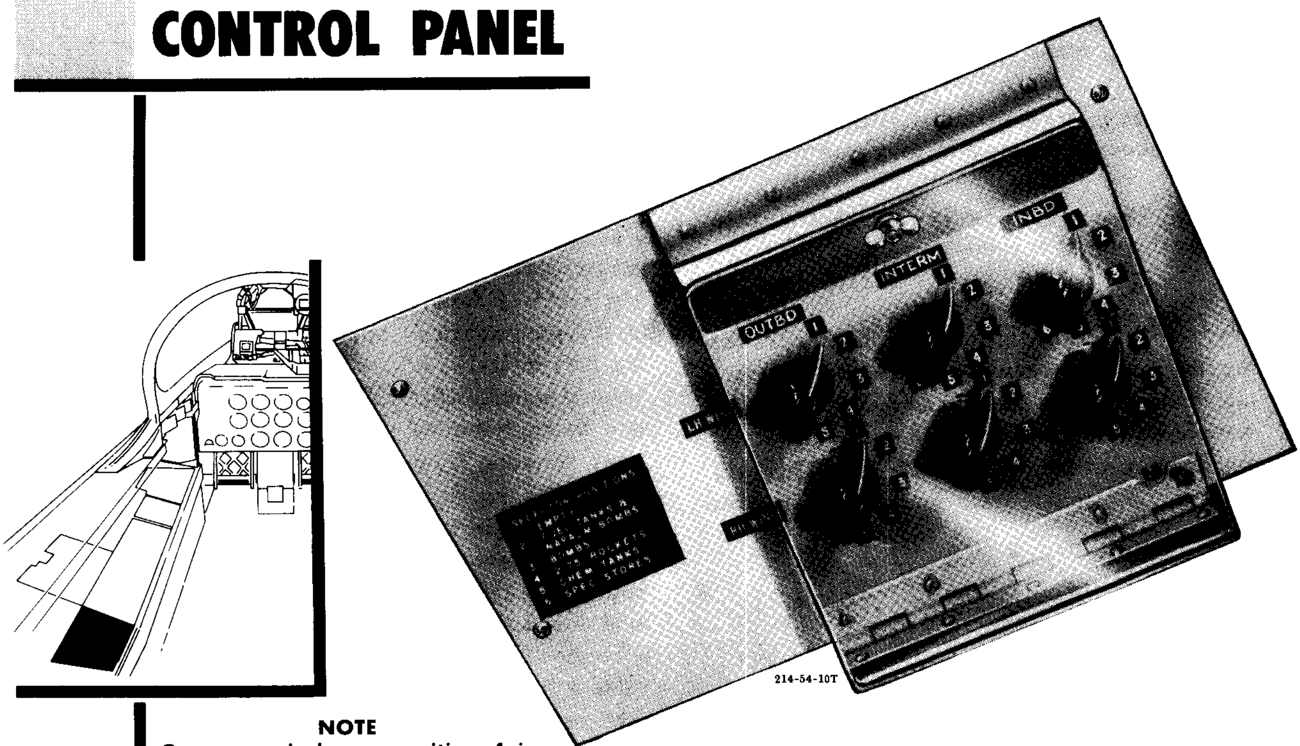
(Deleted)

Ejector-type Bomb Pylon.

The ejector pylon differs from the conventional bomb rack in its method of releasing the load. The load is either force-ejected from the rack, or released and free-falls. Two electrically ignited cartridges jettison the load. Two separate and complete igniter circuits are provided; a normal and an emergency circuit, each terminating in igniter contacts in different cartridge receptacles. If the first cartridge fails to fire, the second cartridge is fired by the jettison circuit or auxiliary release circuit. When the first cartridge is fired by either igniter circuit, the other is simultaneously fired by heat and pressure generated by explosion of the first cartridge. The expanding gases, resulting from detonation of the cartridges, opens both bomb hooks and blasts the load from the pylon. When drop tanks, rocket pods, napalm or chemical tanks, or other loads which are not readily separable from the airplane on release are carried, a valve within the rack is held closed and the full force of the exploding cartridges is applied to the load. When bombs are carried, a bypass valve is held open and allows most of the ejection pressure to dump overboard. By this means, bombs are dropped in a manner closely approximating a "free-fall" trajectory. This trajectory angle is anticipated by the sight system for greater scoring accuracy. A manual release permits jettison and "free-fall" of loads which do not require force ejection. The pylons cannot be jettisoned from the wings. On airplanes changed by T.O. 1F-100-623, the armament circuit wiring has been changed to prevent the inadvertent jettisoning of "hung" stores after the release circuit has been actuated, but the cartridge has failed to fire.

(Figure 4-14 deleted)

PYLON LOADING CONTROL PANEL



NOTE

On some airplanes, position 4 is marked "***5.00 ROCKETS***." On other airplanes, position 4 is marked "***CHEM TANKS***" and position 5 is marked "***2.75 ROCKETS***."

F-100C-1-63-1D

Figure 4-15

Warning When the ejector cartridges are being installed in the pylon, all dc and ac electrical power must be off to prevent accidental explosion of the cartridge and serious injury to ground personnel.

Bombing Equipment Controls and Indicator.

Pylon Loading Selector Switches. These rotary switches (figure 4-15), powered by secondary bus power, ensure that the correct circuitry has been established to the particular loads being carried. They also ensure that the desired action takes place when loads are being controlled through the armament control panel. During preflight, the pilot should check that the switches are set at the correct position for the individual load on each pylon for the immediate mission contemplated. All switches are collectively safetied by a single, hinged, plastic cover which should be locked closed during flight.

NOTE The EMPTY position refers to an empty station, not to empty drop tanks.

Warning Do not change setting of pylon loading selector switches, because the loads may release when the selectors are reset. If selector setting does not correspond to the load on the respective wing station, maintainance personnel must make a check of applicable electrical circuit before selector switches are repositioned.

- On F-100C-25 Airplanes, the 1 (EMPTY) position of the pylon loading selector switches energizes the release circuits to the respective wing stations. If a selector switch is inadvertently placed at 1, when a load is at its respective station, the load will be released when the weight of the airplane is off the nose gear. Therefore, to prevent unintentional release of loads, make sure that the selector switch settings are not at 1 but at the corresponding station positions carrying the loads.

Armament Selector Switch. This rotary-type selector (figure 4-16) is powered by the secondary bus. Its position determines the action that follows when the bomb-rocket release button is pressed. Regardless of the release method used, all external loads leave the airplane in various fixed sequences as shown in figure 4-17. When the armament selector switch is at BOMB-SINGLE, a single bomb drops (except the outboard bombs which drop together) each time the bomb-rocket release button is pressed. With the armament selector switch at BOMB-PAIRS, symmetrical pairs of bombs drop each time the bomb-rocket release button is pressed. When the BOMB-SALVO position is selected and the bomb-rocket release button is pressed, all bombs drop simultaneously; however, loads other than bombs remain on the airplane. When bombs are released by means of the armament selector and bomb-rocket release button, the special store is released, armed or unarmed, depending on the switch settings of the special store control panel. Bombs can be salvoed armed or safe, depending on the position of the bomb-arming switch. When the armament selector switch is at NAPALM REL & TANKS JETT—OUTBD JETT, INTERM JETT, or INBD JETT, the selected pair of drop tanks is jettisoned when the bomb-rocket release button is pressed. The 200-gallon drop tanks (and 450-gallon drop tanks, carried at the intermediate stations only) are jettisoned by electrically fired ejector cartridges within the pylons. The 275-gallon drop tanks, carried at the intermediate stations only, are jettisoned, and the 275-gallon drop tanks are solenoid-released and free-fall from the airplane. When the selector is at JETTISON ALL (selector switch must be lifted and rotated to obtain this position) and the bomb-rocket release button is pressed, all external loads force-jettison safe. External loads requiring force ejection are jettisoned at ½-second delay between symmetrical pairs to reduce recoil loads on wing structure. When the armament selector switch is at OFF, the circuits are de-energized and the bomb-rocket release button is inoperative. Refer to "Rocket System Controls," "Bombing Equipment Controls and Indicator," and "Chemical Tank System" in this section for details of armament selector positions applicable to these systems.

Bomb Arming Switch. Bombs are armed by means of secondary bus power through the bomb arming switch. (See figure 4-16.) With the switch at TAIL ONLY, bombs are armed for delayed detonation. For bombs to explode instantly upon impact, the switch must be at NOSE & TAIL. The bombs are released unarmed if the switch is at SAFE. Bomb arming is not effective except when the armament selector switch is at BOMB-SINGLE, BOMB-PAIRS, BOMB-SALVO or NAPALM REL & TANKS JETT, and the external load emergency jettison handle is in the normal stowed position.

Bomb-Rocket Release Button. The drop tank, napalm, bomb, rocket-firing, and chemical tank discharge circuits are energized (after the armament selector switch is correctly positioned) by secondary bus power when the bomb-rocket release button is pressed. If desired, all external loads can be released (safe) by pressing the bomb-rocket release button when the armament selector switch is at JETTISON ALL. The gun and strike camera circuits are energized when the bomb-rocket release button is pressed if the armament selector switch is at BOMB-SINGLE, BOMB-PAIRS, BOMB-SALVO, or ROCKETS-FIRE. The bomb-rocket release button must be held down when bombs are being released automatically by means of the automatic bombing systems.

Warning

Before pressing the bomb-rocket release button, make sure the armament selector switch is positioned correctly for the desired release condition. Failure to check the selector switch position could cause accidental bomb or rocket release or failure of desired store to release.

- If loads do not release properly when a normal release method is used, the loads must be jettisoned to prevent an unintentional release after leaving the target area.

Bomb Release Signal Selector Switch (Airplanes Not Changed by T.O. 1F-100-707). A selector switch (figure 4-16) permits selection of either MANUAL, A4, LABS, or M1 bomb positions. When the selector switch is at MANUAL, bomb release occurs when the bomb-rocket release button on the control stick is pressed. When the bomb release signal selector switch is at the A4 position and the bomb-rocket release button is held down, the mechanism within the A-4 sight automatically releases the bomb when the path of the airplane during bomb run becomes tangent to the bomb trajectory. With the switch at the LABS position, the bomb is released at an automatically computed point on the LABS bomb run. With the switch at the M1 position, bombs are released at an automatically computed point on the M-1 bomb run. The switch is powered by secondary bus.

NOTE When LABS system is not being used, release signal selector switch should be set at MANUAL to prolong the life of both gyros.

- After the bomb release signal selector switch is set at LABS, there should be a 2-minute delay to allow gyros to come up to speed before the LABS start switch is turned on.

Bomb Release Mode Selector Switch (Airplanes Changed by T.O. 1F-100-707). This switch (figure 4-16) is used to select the mode of bombing release desired, and controls the operation of the radar ranging system and the A-4 sight, by means of the secondary bus

ARMAMENT CONTROL PANEL

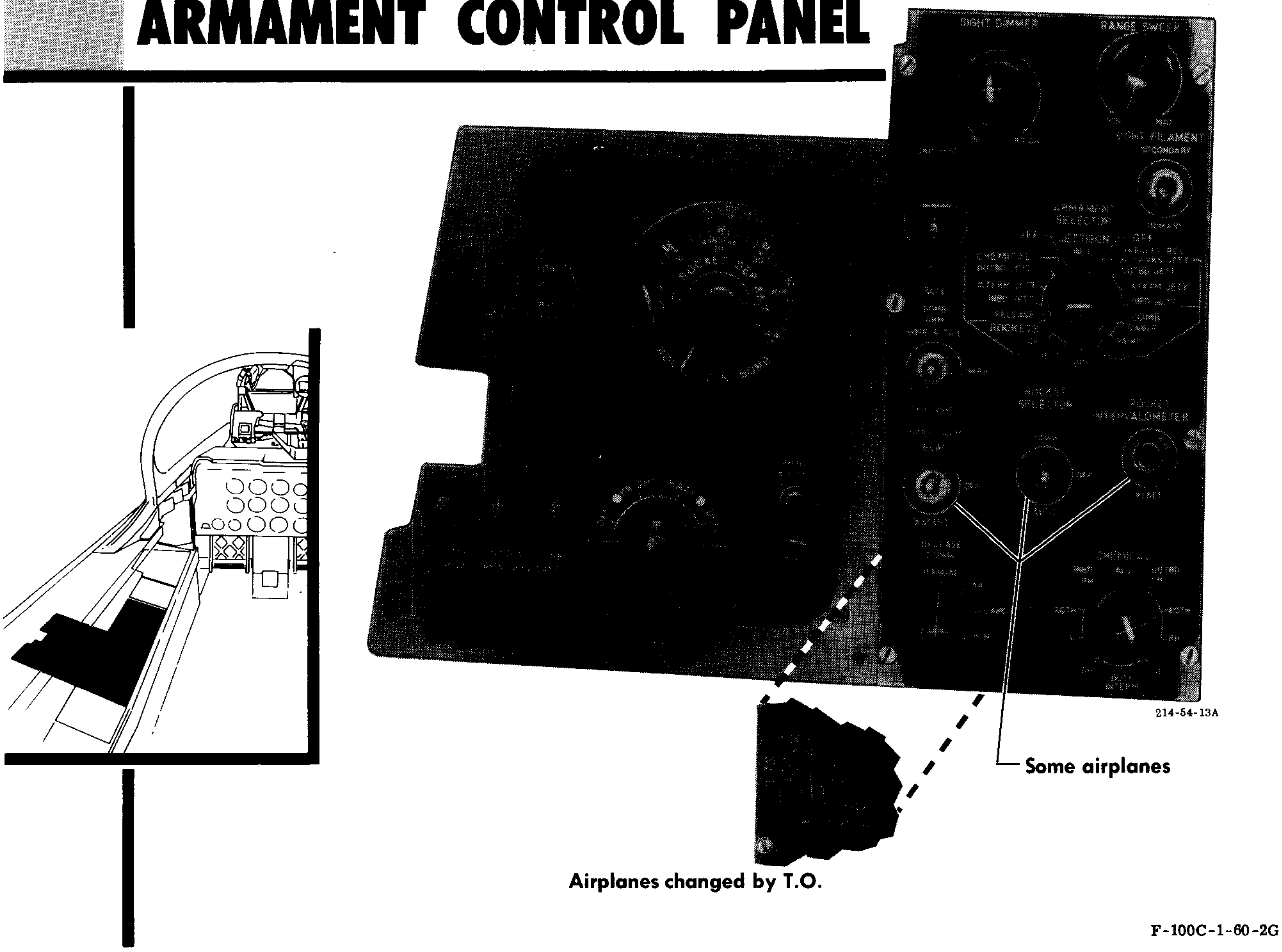


Figure 4-16

power. When the switch is at RADAR & SIGHT, power is supplied to the radar ranging system and to the sight. When the selector knob is at MANUAL, bombs are released by the bomb-rocket release button. If the selector knob is at DIVE, and the bomb-rocket release button is held down, bomb release is automatically accomplished by the sight when the path of the airplane becomes tangent to the bomb trajectory during the bomb run. When the selector knob is at TOSS, bombs are released at an automatically computed point on the M-1 bomb run. With the selector at LABS, bombs are released at an automatically computed point on the bomb run. With the selector at LABS ALT, bombs are released at an automatically computed alternate point on the bomb run. Power to all units of the fire control system is disconnected when the switch is at OFF.

External Load Auxiliary Release Buttons. The three external load auxiliary release buttons (figures 4-16 and 4-18) provide separate release circuits to fire the second cartridge in the external load mounting pylons. These buttons, which are powered by the primary bus, should be used if loads are not released by the other electrical release circuits. Pressing the OUTBD, INTERM, or INBD button releases the pair of external loads at the respective stations. When loads are released by means of these buttons, the pilot determines the sequence in which pairs of loads are released. Loads released by means of the external load auxiliary release buttons are released armed or safe (depending on the position of the bomb arming switch) and are either forcibly ejected or gravity-released as required.

Warning

Do not press more than one auxiliary release button at a time. Combined recoil of ejector cartridges for stores that require the full force of the ejector cartridge produces stresses that can damage the wing structure. This does not include general-purpose bombs, since they do not require the full force of the ejector cartridge for release.

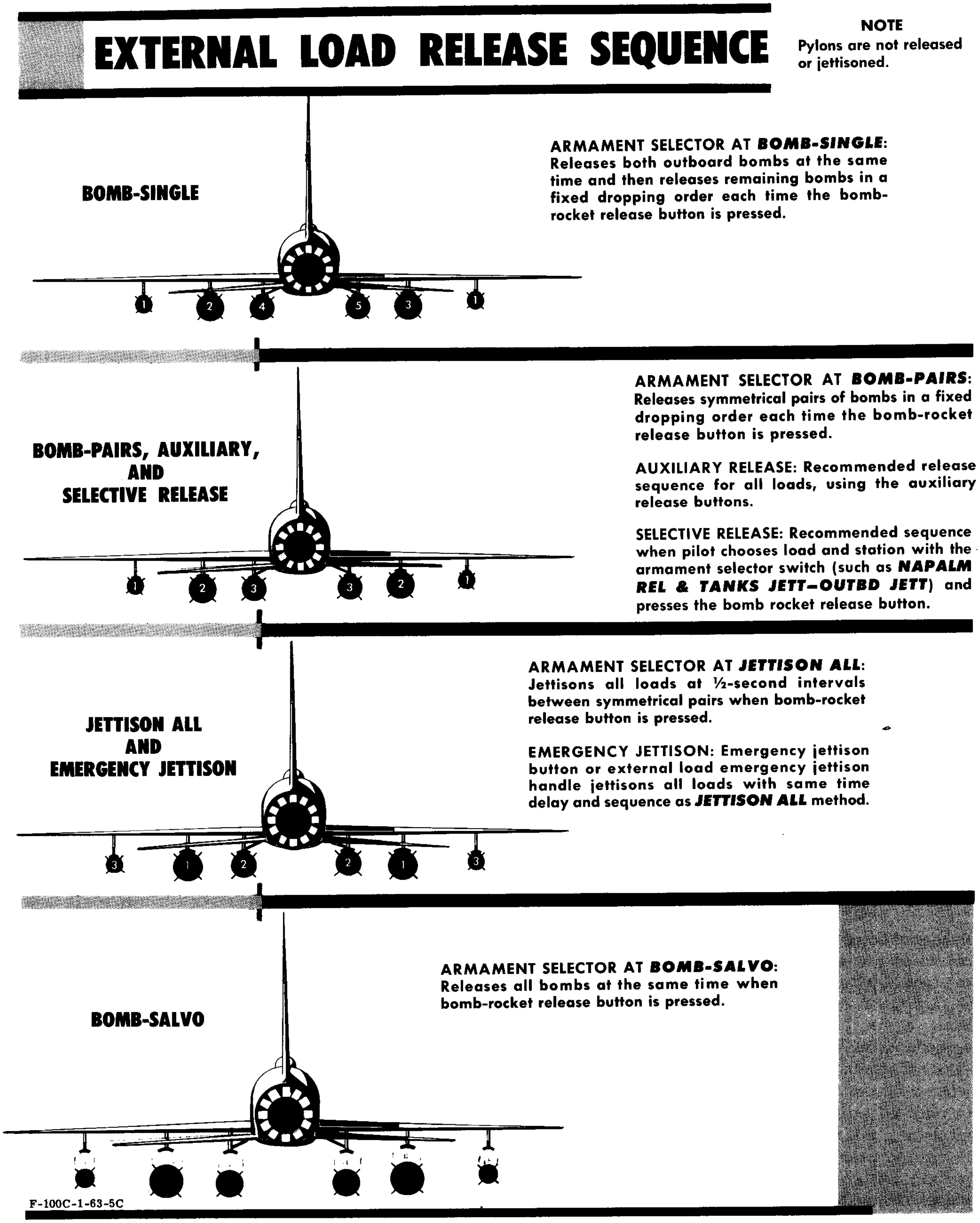
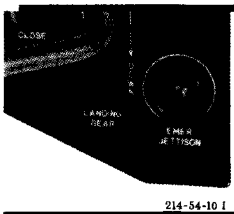
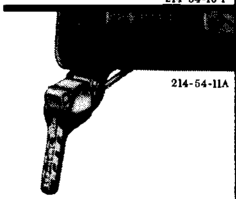
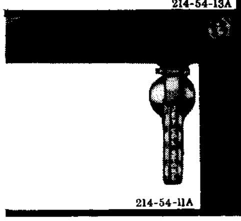

EXTERNAL LOAD RELEASE SEQUENCE
NOTE
Pylons are not released or jettisoned.
BOMB-SINGLE
ARMAMENT SELECTOR AT **BOMB-SINGLE**: Releases both outboard bombs at the same time and then releases remaining bombs in a fixed dropping order each time the bomb-rocket release button is pressed.
1 2 4 5 3 1
BOMB-PAIRS, AUXILIARY, AND SELECTIVE RELEASE
ARMAMENT SELECTOR AT **BOMB-PAIRS**: Releases symmetrical pairs of bombs in a fixed dropping order each time the bomb-rocket release button is pressed.
AUXILIARY RELEASE: Recommended release sequence for all loads, using the auxiliary release buttons.
SELECTIVE RELEASE: Recommended sequence when pilot chooses load and station with the armament selector switch (such as ***NAPALM REL & TANKS JETT—OUTBD JETT***) and presses the bomb rocket release button.
1 2 3 3 2 1
JETTISON ALL AND EMERGENCY JETTISON
ARMAMENT SELECTOR AT ***JETTISON ALL***: Jettisons all loads at ½-second intervals between symmetrical pairs when bomb-rocket release button is pressed.
EMERGENCY JETTISON: Emergency jettison button or external load emergency jettison handle jettisons all loads with same time delay and sequence as ***JETTISON ALL*** method.
3 1 2 2 1 3
BOMB-SALVO
ARMAMENT SELECTOR AT **BOMB-SALVO**: Releases all bombs at the same time when bomb-rocket release button is pressed.
F-100C-1-63-5C

Figure 4-17

EXTERNAL LOAD EMERGENCY JETTISON

	METHOD OF RELEASE	STORE ARMING	TYPE OF DROP
	EXTERNAL LOAD EMERGENCY JETTISON BUTTON	SAFE (SPECIAL STORE SELECTIVE)	ELECTRICALLY fires ejector cartridges (and actuates the 275-gallon drop tank release solenoids) to drop all external loads.
	EXTERNAL LOAD EMERGENCY JETTISON HANDLE	SAFE	MECHANICALLY releases all bombs (except special store) and 275-gallon drop tanks when electrical power is not available. (Same as external load emergency jettison button if electrical power is available.)
	EXTERNAL LOAD AUXILIARY RELEASE BUTTON	SELECTIVE	ELECTRICALLY fires ejector cartridges and actuates the release solenoids as required to drop external loads from respective stations.
	SPECIAL STORE EMERGENCY JETTISON HANDLE	SELECTIVE	MECHANICALLY jettisons special store only.

F-100C-1-63-7

Figure 4-18

The external load auxiliary release button circuits are safetied through the nose gear switch and are not operative when the weight of the airplane is on the nose gear.

External Load Emergency Jettison Button. All external loads are jettisoned by pressing the external load emergency jettison button. (See figures 1-24 and 4-18.) Regardless of the position of the bomb arming switch, all loads jettison safe except the special store. The release sequence is shown in figure 4-17. (See figures 4-17 and 4-18.) On some airplanes,* the external load emergency jettison button must be held down for about 2 seconds, or until all external loads have jettisoned. On all other airplanes,† this button need only be pressed momentarily to jettison external loads. The external load emergency jettison button is powered by the primary bus. On airplanes changed by T.O. 1F-100-623, armament circuit wiring has been changed to prevent the inadvertent jettisoning of "hung" stores after the release circuit has been actuated, but the cartridge has failed to fire.

Caution External loads cannot be jettisoned electrically when the airplane is on the ground except on late airplanes‡ and those changed by T.O. 1F-100-564.

- The special store is jettisoned armed or unarmed, depending on the switch settings of the in-flight control tester panel.

External Load Emergency Jettison Handle. If electrical jettison fails or electrical power is not available, the external load emergency jettison handle (33, figure 1-6; 31, figure 1-7; and figure 4-18) can be used to

***F-100C-1 through F-100C-20 Airplanes and F-100C-25 Airplanes AF54-1970 through -2024**
†F-100C-25 Airplane AF54-2025 and all later airplanes
‡F-100C-25 Airplane AF54-1999 and all later airplanes

mechanically release all bombs (except the special store) and/or 275-gallon drop tanks. (All other loads must be forcibly ejected for clean separation.) On airplanes changed by T.O. 1F-100-677, this manual jettison system also closes the electrical circuits normally used by the external load emergency jettison button; therefore, when electrical power is available, the external load emergency jettison handle jettisons loads in the same manner as the external load emergency jettison button.

Caution If electrical power is available, the special store is jettisoned armed or safe, depending on the switch setting of the special store control panel.

- External loads cannot be electrically jettisoned when the airplane is on the ground, except on late airplanes* and those changed by T.O. 1F-100-564.

The emergency jettison handle must be pulled to its full extension of about 10 inches and held extended for a minimum of 2 seconds. Bomb- and rocket-arming circuits are interrupted automatically when the emergency jettison handle is pulled, and bombs and rockets are jettisoned unarmed, regardless of the position of the bomb- and rocket-arming switches.

(Deleted)

A-4 Sight Bomb Release Indicator. During the bomb run, the proper bomb release point (point at which the path of the airplane becomes tangent to bomb trajectory) is indicated by an automatic dim out of the reticle image circle and dot. This indication occurs whether the bomb release system is set for automatic (A-4 or LABS) release or, on F-100C-25 Airplanes and airplanes changed by T.O., the manual (MANUAL) release method.

Bomb Release—A-4 Sight.

To release bombs using the A-4 sight, proceed as follows:

Caution To prevent bombs from striking the airplane, do not release bombs while negative G is being applied to the airplane.

1. Check that power inverter warning light is out.
2. Position trigger safety switch at SIGHT CAMERA & RADAR. On airplanes changed by T.O. 1F-100-707, turn bomb release mode selector switch to RADAR & SIGHT. Allow a 5- to 15-minute warm-up period (depending on outside air temperature) for the sight. Check sight mechanical caging lever at CAGE.
3. Check that sight filament selector switch is at PRIMARY. If primary filament is inoperative, set switch to SECONDARY.
4. Adjust sight dimmer rheostat to desired reticle image brilliancy.
5. Move sight mechanical caging lever to UNCAGE.
6. Turn armament selector switch to BOMB-SINGLE, BOMB-PAIRS, or BOMB-SALVO.
7. Turn sight function selector lever to BOMB.
8. Turn bomb release signal or mode slector switch to A4 (or DIVE) or MANUAL.
9. After sighting target and before starting approach, set bomb arming switch at NOSE & TAIL or TAIL ONLY.
10. Set strike camera delay timer to desired delay.
11. Set camera shutter selector switch as desired.
12. Adjust bomb-target wind control to known or estimated target wind velocity.
13. Make approach to target that will give desired dive angle during bombing run.
14. Press sight electrical caging button to stabilize reticle image before pushing over into dive.
15. Place reticle image dot on target.
16. After establishing dive, keep dot on target and release electrical caging button. If selector switch is at A4 or DIVE, press bomb-rocket release button at this time. (On A4 or DIVE release, bomb release occurs automatically at correct release point as indicated by the disappearance of the reticle circle and dot.)
17. Track smoothly, keeping dot on target.
18. If release is manual, press bomb-rocket release button at proper release point. On F-100C-25 Airplanes and airplanes changed by T.O., press bomb-rocket release button when sight aiming circle and dot go out.

NOTE The first release impulse from the bomb-rocket release button with the armament selector switch at BOMB-SINGLE drops both outboard bombs simultaneously; however, only one bomb drops at each subsequent release.

Warning If loads do not release properly when a normal release method is used, the loads must be jettisoned to prevent an unintentional release after leaving the target area.

The order of bomb release is shown in figure 4-17.

*F-100C-25 Airplane AF54-1999 and all later airplanes

Bomb and External Load Emergency Jettison.

To externally jettison loads (safe), use one or more of the following methods:

1. Position armament selector switch to JETTISON ALL and hold bomb-rocket release button pressed for 2 seconds.

Caution Failure of electrical power does not allow rockets, chemical or napalm tanks, or 200-gallon drop tanks to be released from the airplane by any method.

2. Hold external load emergency jettison button pressed for 2 seconds. With electrical power available, all external loads are jettisoned safe (except the special store), regardless of position of armament selector. Battery switch must be ON and on early airplanes,* the weight of the airplane must be off nose gear. (On all later airplanes, however, bombs can be jettisoned when weight of the airplane is on the nose gear.)

Caution By this release method, the special store is jettisoned armed or safe, depending on the switch settings of the in-flight store control tester panel.

3. To jettison only the bomb load and retain drop tanks, position armament selector switch to BOMB-SALVO (arming switch at SAFE) and press bomb-rocket release button.

4. To jettison only chemical tanks, position armament selector switch to CHEMICAL—OUTBD JETT, CHEMICAL—INTERM JETT, and CHEMICAL—INBD JETT, and press bomb-rocket release button at each setting.

5. To jettison only drop tanks or napalm tanks, position armament selector switch to NAPALM REL & TANKS JETT—INBD JETT—INTERM JETT, and—OUTBD JETT, and depress bomb-rocket release button at each setting.

6. Press (one at a time.) the external store auxiliary release buttons to drop (armed or safe, depending on position of bomb arming switch) symmetrical pairs of loads from the inboard, intermediate, or outboard pylon stations.

Warning Do not press more than one auxiliary release button at a time. Combined recoil of ejector cartridges for stores that require the full force of the ejector cartridge produces stresses that can damage the wing structure. This does not include general-purpose bombs, since they do not require the full force of the ejector cartridge for release.

7. To mechanically drop external loads, pull external load emergency jettison handle straight out to its fully extended position (10 inches). This will release all loads which do not require force ejection. On airplanes changed by T.O. 1F-100-677, loads which require force ejection will also be jettisoned if electrical power is available.

Caution Failure of electrical power does not allow rockets, chemical or napalm tanks, or 200-gallon drop tanks to be jettisoned from the airplane by any method.

- If electrical power is available, the special store is jettisoned armed or safe, depending on the switch settings of the in-flight control tester panel.

M-1 BOMBING SYSTEM.

Wiring and space provisions have been made for the M-1 bombing system. This bombing system is a computing system used in conjunction with the normal bombing system and the A-4 (sight reticle caged) to provide automatic bomb release during toss bombing operations. The system is controlled by the secondary bus and powered by the single-phase ac bus. The M-1 control panel is used to supply target and ballistics information to the computer. (See figure 4-19.)

M-1 Bombing System Controls and Indicator.

Target Pressure Selector. This selector (figure 4-19) is powered by the secondary bus. It has positions from 21 to 31 (in. Hg) and is used to set into the system, the barometric pressure prevailing over the target.

Gross Weight Selector. The gross weight selector (figure 4-19) is powered by the secondary bus. It has positions from 12 to 60 (1000 pounds) and is used to set into the system airplane gross weight over the target.

Ballistics Selector. This selector (figure 4-19) is powered by the secondary bus. It has positions 0 to 10 (ballistics index numbers) and is used to set necessary ballistics information into the system.

Wind Selector. This selector (figure 4-19) is powered by the secondary bus. It is used to set into the system, the wind prevailing over the target. The selector dial has positions 0 to 80 (knots) for both ("HD") and tail ("TL") winds.

Selector Switch. The selector switch (figure 4-19) is powered by the secondary bus. It has positions T (toss bomb), R (radar), S (stand-by), D (direct), and OFF. It is used to set the type of bomb function into the system.

*F-100C-1 through F-100C-20 Airplanes and F-100C-25 Airplanes AF54-1970 through -1998

M-1 BOMBING SYSTEM CONTROL PANEL

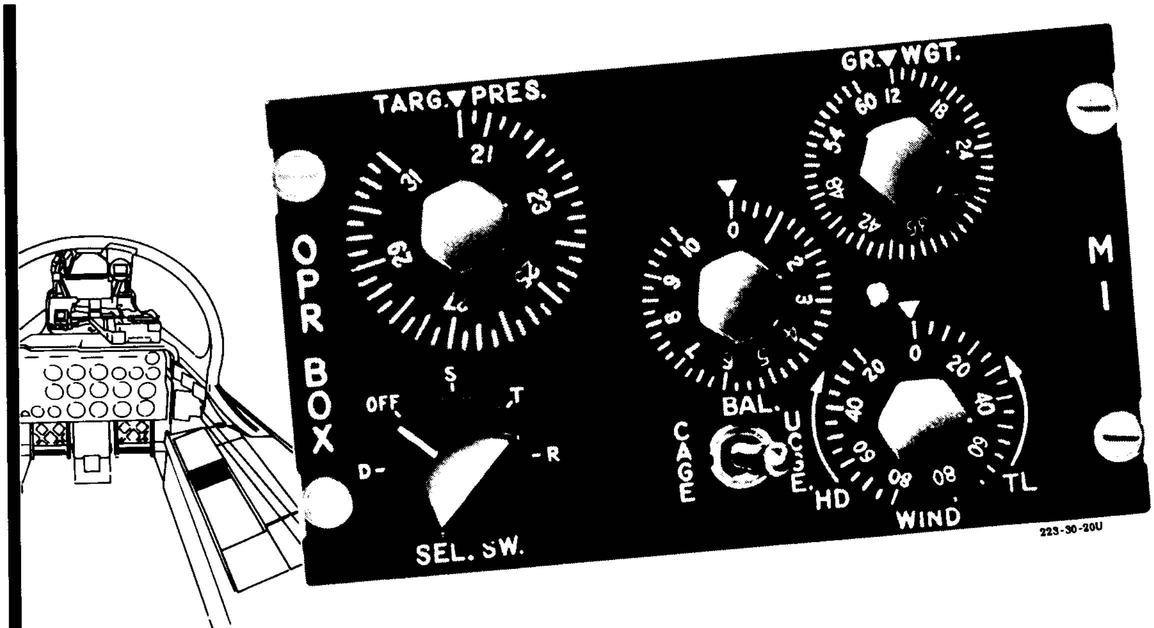


Figure 4-19

Cage-Uncage Switch. This switch (figure 4-19), powered by the secondary bus, is used to cage or uncage the M-1 gyro.

M-1 Indicator Light. A secondary-bus-powered indicator light (5, figures 1-6 and 1-7) shows bomb release and certain timing functions of the M-1 bombing system.

Operation of M-1 Bombing System.

1. At established altitude, level airplane and put caged sight reticle on horizon.
2. Place cage-uncage switch at UNCAGE.
3. Place wind control to value of wind over target.
4. Set gross weight selector to value of airplane gross weight.
5. Dive at target keeping wings level.
6. At any time after M-1 indicator light comes on, press bomb-rocket release button.
7. Start immediate pull-up to predetermined G value while holding bomb-rocket release button depressed.
8. Hold pull-up until bomb releases (as shown by M-1 indicator light going out).
9. When M-1 indicator light goes out, release bomb-rocket release button and complete escape maneuver.

NOTE The M-1 bombing system recycles for further operations when the bomb-rocket release button is released.

- When not in use, the cage-uncage switch should be at CAGE; the selector switch should be OFF.

LOW-ALTITUDE BOMBING SYSTEMS (LABS).

MA-1A* and MA-2† Low-altitude Bombing Systems.

These low-altitude bombing systems are electromechanical systems used with the A-4 sight to provide proper bomb aiming and bomb release for toss-bombing operations. The sight is maintained electrically caged for these types of bomb release.

MA-1A and MA-2 Low-altitude Bombing Systems Controls and Indicators.

Bomb Release Signal Selector Switch. Refer to "Bombing Equipment Controls and Indicator."

***F-100C-1 through F-100C-15 Airplanes and F-100C-20 Airplanes AF54-1860 through -1914**
†F-100C-20 Airplanes AF54-1915 and all later airplanes

Bomb Release Mode Selector Switch. Refer to "Bombing Equipment Controls and Indicator" in this section.

Accelerometer.* This unit provides pitch acceleration data to the system, and is energized by secondary bus power when the bomb button is pressed if the LABS bomb switch is in ALT (or the bomb release mode selector switch is at LABS ALT on airplanes changed by T.O.). If the LABS bomb switch is in NORM (or the bomb release mode selector switch is at LABS on airplanes changed by T.O.), it is energized only when the timing cycle is completed or when the LABS GYRO switch is at UNCAGE and the bomb button pressed.

LABS Start Switch (Airplanes Not Changed by T.O. 1F-100-707). Moving this switch (39, figure 1-6) from OFF to ON uncages and powers the vertical gyro, partially uncages the yaw-roll gyro, energizes the circuits to the dive-and-roll indicator, supplies secondary bus power so that the reticle circle comes on again in the A-4 sight, and energizes the intervalometer motor. (Intervalometer timing action is not controlled by the LABS start switch.) The LABS start switch should be at OFF when LABS equipment is not in use.

LABS Bomb Switch (Airplanes Not Changed by T.O. 1F-100-707). This switch (39, figure 1-6) has two positions, NORM and ALT. It is used to determine delivery angle during bomb release. With the switch at NORM, the normal angle which is preset in the vertical gyro, is placed in the circuit. With the switch at ALT, the alternate delivery angle which is preset in the vertical gyro is placed in the circuit. This switch is powered by the secondary bus.

LABS Yaw-Roll Gyro Switch. Caging of the LABS yaw-roll gyro is electrically controlled by secondary bus power through a two-position switch. This switch (39, figure 1-6) should be at CAGE when LABS equipment is being started or when LABS equipment is not in use. When the switch is at UNCAGE, the gyro is uncaged and the dive-and-roll indicator shows airplane attitude and acceleration forces.

NOTE LABS equipment should have a 2-minute warm-up period after the trigger safety switch is turned ON and before the yaw-roll gyro switch is set at UNCAGE.

LABS Dive-and-roll Indicator. The LABS dive-and-roll indicator (18, figure 1-6) is a dual-movement, zero-centered unit. The vertical pointer indicates airplane roll attitude when the vertical gyro is uncaged and the yaw-roll gyro is electrically caged. It indicates yaw-roll attitude when the yaw-roll gyro is completely uncaged. The horizontal pointer shows airplane pitch attitude when the vertical gyro is uncaged and the yaw-roll gyro is electrically caged. It indicates "G's" when the yaw-roll gyro is completely uncaged. The dive-and-roll indicator is operable when the release signal selector switch is at LABS and the LABS start switch is at ON (or the bomb release mode selector switch is at LABS on airplanes changed by T.O.). When the LABS start switch or the bomb release mode selector switch is at OFF, both indicator pointers should rest at zero.

LABS Timer. The LABS timer is in the radar bay and is preset by ground personnel before a LABS mission. On airplanes changed by T.O., the LABS timer (20, figure 1-9) is on the right console. The LABS timer is used to sequence the operation of certain timing units in the system. This control is a round dial and is calibrated to measure time lapses from 2 to 30 seconds in increments of 0.2 second. To turn the dial from one setting to another, the dial knob should be pulled upward from the lock detents. The LABS timer is powered by the tertiary bus.

Operation of MA-1A and MA-2 Low-altitude Bombing Systems.

This information will be supplied when available.

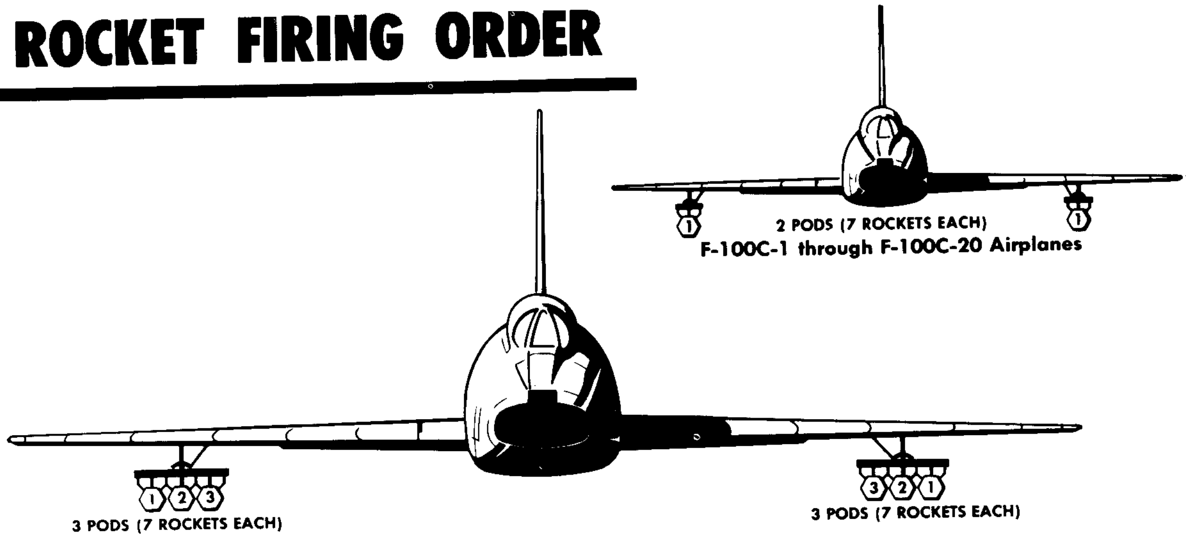
ROCKET SYSTEM.

The airplane can carry 2.75-inch FAA (folding-fin aircraft) rockets. Two rocket launchers are carried on some airplanes,† and six rocket launchers are carried on other airplanes.‡ With the two-rocket launcher configuration (total—14 rockets), one rocket launcher is suspended from a pylon at each outboard station. With the six-rocket launcher configuration (total—42 rockets), three rocket launchers are hung from a pylon at each outboard station. The A-4 sight is used to aim the rockets, and controls are provided for normal firing or electrical emergency jettison. The gun sight camera and strike camera operate automatically when rockets are fired.

NOTE For approved external loads, see figures 5-3 and 5-4.

***F-100C-20 Airplanes AF54-1915 and all later airplanes**
†F-100C-1 through F-100C-20 Airplanes
‡F-100C-1 Airplanes AF53-1721 through -1726, and F-100C-25 Airplanes

ROCKET FIRING ORDER



NOTE

A symmetrical pair consists of one pod from identical stations under each wing.

AUTO

Fires all rockets armed, as long as bomb-rocket release button is held depressed, at 1/10 second between symmetrical pairs of pods. (Ripple fire sequence.)

PAIRS

Fires all rockets armed, one symmetrical pair of pods, each time bomb-rocket release button is depressed.

AUXILIARY RELEASE

Jettisons pods and adapters when the outboard auxiliary release button is pressed.

JETTISON ALL or ROCKETS JETT

All adapters and pods jettison unarmed simultaneously when bomb-rocket release button is depressed and armament selector switch is at ***JETTISON ALL*** or ***ROCKETS JETT***. Adapters and pods also jettison when the external load emergency jettison button is pressed or the external load emergency jettison handle is pulled.

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Figure 4-20

Rocket Intervalometer.*

During automatic firing of rockets, rocket-firing order between launchers is controlled by a rocket intervalometer. The intervalometer is in the electronics compartment and is powered by the secondary bus. When the armament selector switch is at ROCKETS-FIRE and the rocket selector switch is at PAIRS, the total content of one symmetrical pair of launchers (one pod from each identical station under each wing) is fired each time the bomb-rocket release button is pressed. The intervalometers automatically maintain the correct firing order and delay between launchers and between individual rockets. (See figure 4-20 for rocket firing order.) When the armament selector switch is at ROCKETS-FIRE and the rocket selector switch is at AUTO, the intervalometers fire all rockets in symmetrical pairs of launchers as long as the bomb-rocket release button is held down.

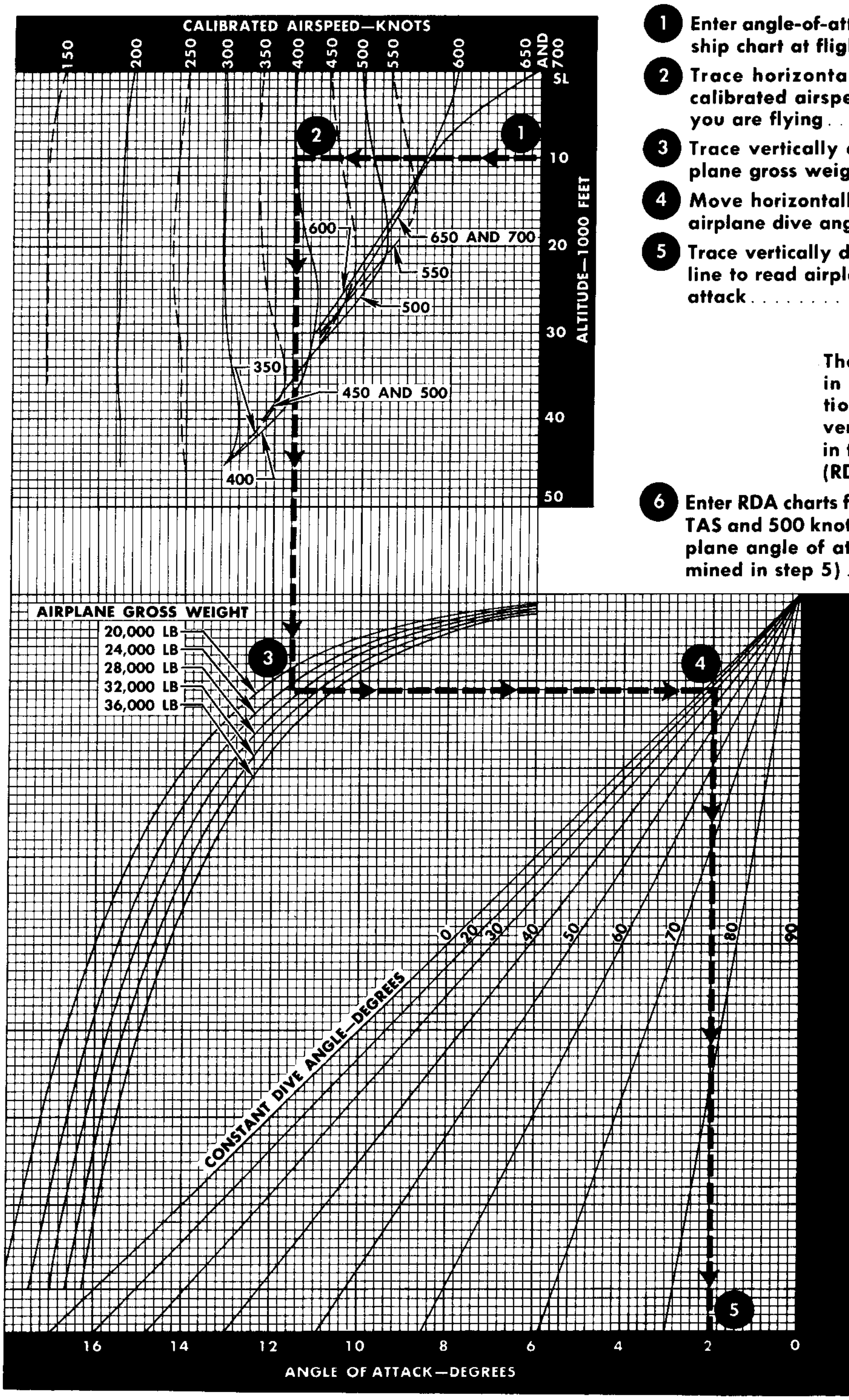
NOTE When six launchers are being carried and any launcher fails to fire, the rocket intervalometer reset button should be used in an attempt to refire the remaining rockets. If this fails, rocket launchers should be jettisoned in a safe area.

Rocket System Controls.

Bomb-Rocket Release Button. Refer to "Bombing Equipment Controls and Indicator" in this section.

***F-100C-1 through F-100C-15 Airplanes not changed by T.O.**

ANGLE-OF-ATTACK RELATIONSHIP AND ROCKET



EXAMPLE

1. Enter angle-of-attack relationship chart at flight altitude . . . . . 10,000 feet
2. Trace horizontally to left to calibrated airspeed at which you are flying . . . . . 400 knots CAS
3. Trace vertically down to airplane gross weight . . . . . 26,000 pounds
4. Move horizontally to right to airplane dive angle . . . . . 30 degrees
5. Trace vertically down to base line to read airplane angle of attack . . . . . 2 degrees

NOTE

The calibrated airspeed used in the angle-of-attack relationship chart must be converted to true airspeed for use in the rocket depression angle (RDA) selector setting charts.

6. Enter RDA charts for 400 knots TAS and 500 knots TAS at airplane angle of attack (determined in step 5) . . . . . 2 degrees

NOTE

Use of two RDA charts is required in order to interpolate for an intermediate airspeed.

7. Trace horizontally to right to dive angle line for the slant range to be used . . . . . 30 degree dive angle and 1800 feet slant range
8. Trace vertically down to base line to read RDA setting for 400 knots TAS and 500 knots TAS . . 28 mils and 26 mils
9. By interpolation, the RDA setting for a true airspeed of 450 knots will be . . . . . 27 mils

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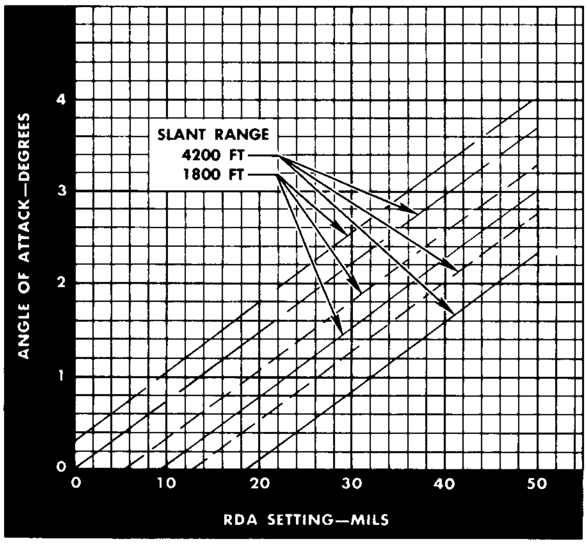
Figure 4-21

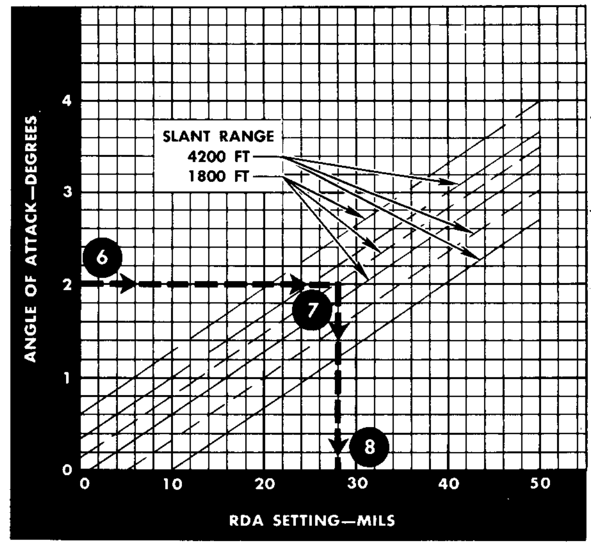
DEPRESSION ANGLE SELECTOR SETTING

MA-3 ROCKET LAUNCHERS ONLY

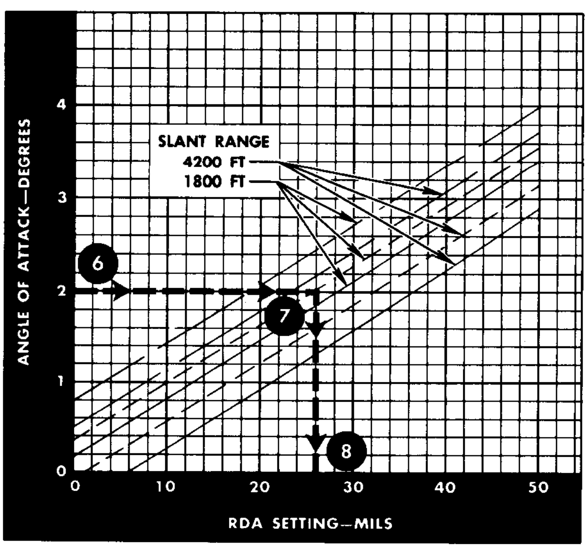
300 KNOTS TAS



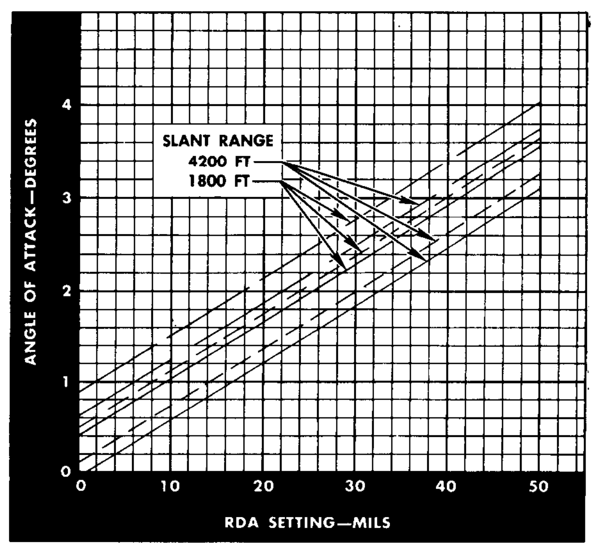
400 KNOTS TAS



500 KNOTS TAS



600 KNOTS TAS



———— 0° DIVE ANGLE
— — — — 30° DIVE ANGLE
—— —— —— 60° DIVE ANGLE

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Armament Selector Switch. This multiple-position switch (figure 4-16) in addition to being used with other armament systems, is used to select the rocket function desired. It is powered by the secondary bus. With the armament selector switch at ROCKET-FIRE (and the rocket selector switch properly positioned), the rockets can be fired by pressing the bomb-rocket release button. When the armament selector switch is at ROCKET JETT, all launchers and adapters force-jettison when the bomb-rocket release button is pressed. For other functions of the armament selector switch, refer to "Bombing Equipment Controls and Indicator" and "Chemical Tank System," in this section.

Rocket Arming Switch.* This switch, on the armament control panel (figure 4-16), is inoperative and should always be left at the OFF position.

Rocket Selector Switch.* The rocket selector switch (figure 4-16) provides a choice between PAIRS or AUTO when firing 2.75-inch rockets in the six-pod configuration. It is powered by the secondary bus. With the armament selector switch at ROCKETS-FIRE and the rocket selector switch at PAIRS, the total content of one symmetrical pair of pods is ripple-fired each time the bomb-rocket release button is pressed. The AUTO position allows ripple-fire to be accomplished with a 1/10-second delay between symmetrical pairs of pods and a 1/100-second delay between pairs of rockets within the pods. Rockets continue to fire in this manner until all rounds are expended. The pilot may interrupt rocket firing between pairs of pods at any time by releasing the bomb-rocket release button. For firing order of rocket pods, see figure 4-20.

Rocket Intervalometer Reset Button.* The invervalometer reset button (figure 4-16) is powered by the secondary bus. When the button is pressed, it resets the rocket intervalometer. In addition to reindexing the rocket-firing circuits, the intervalometer reset button may also be used to reset circuits for further attempts to fire any misfired rockets. (During landing, the intervalometer is automatically reindexed to the starting position as the nose gear touches down.)

External Load Emergency Jettison Button. Refer to "Bombing Equipment Controls and Indicator" in this section.

External Load Emergency Jettison Handle. Refer to "Bombing Equipment Controls and Indicator" in this section.

External Load Auxiliary Release Buttons. Refer to "Bombing Equipment Controls and Indicator" in this section.

Bomb Release Mode Selector Switch. Refer to "Bombing Equipment Controls and Indicator" in this section.

Sight Selector Unit. Refer to "A-4 Sight Controls and Indicator in this section.

Trigger Safety Switch. Refer to "Gunnery System Controls" in this section.

Angle-of-Attack Relationship.

Airplane angle of attack for varying flight conditions can be determined from the angle-of-attack chart in figure 4-21. In addition, rocket depression angle selector lever settings for varying rocket-firing conditions can be determined from the rocket depression angle selector setting chart in figure 4-21. A sample problem is provided for use of the charts.

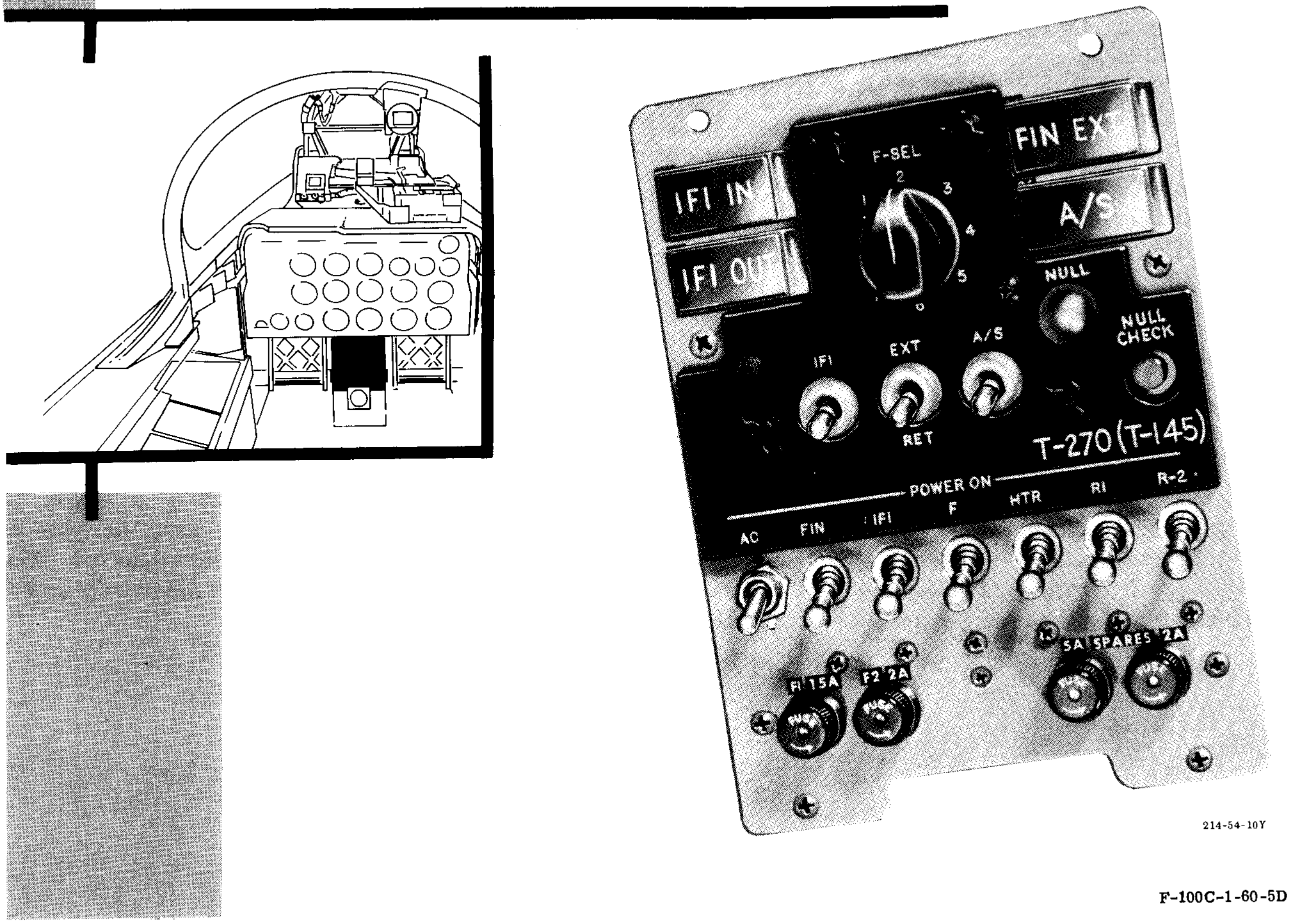
Firing Rockets.

For rocket firing, sight and armament controls should be set as follows:

1. Check that power inverter warning light is out.
2. Check that pylon loading switches are set at proper positions (before flight).
3. Turn trigger safety switch to SIGHT CAMERA & RADAR. On airplanes changed by T.O. 1F-100-707, turn bomb release mode selector switch to RADAR & SIGHT. Allow 5- to 15-minute warm-up period (depending on outside air temperature) for sight. Check sight mechanical caging lever at CAGE.
4. Turn sight function selector lever to ROCKET.
5. Turn armament selector switch to ROCKETS-FIRE.
6. Position rocket-selector switch* at PAIRS or AUTO.
7. Set rocket depression angle selector lever for mil angle of rockets to be fired.
8. Check that sight filament switch is at PRIMARY. If primary filaments are inoperative, set switch to SECONDARY.
9. Adjust sight dimmer rheostat to obtain desired reticle image brilliancy.

***The following airplanes not changed by T.O. 1F-100C-538: F-100C-1 Airplanes AF53-1709 through -1720, -1727 through -1778, AF54-1740 through -1769, and F-100C-5 and F-100C-10 Airplanes**

IN-FLIGHT CONTROL TESTER PANEL



F-100C-1-60-5D

Figure 4-21A

10. Move sight mechanical caging lever to UNCAGE.
11. Set strike camera delay timer to desired delay.
12. Make approach to target that will give desired dive angle during firing.
13. Before pushing over into the dive, press sight electrical caging button to stabilize reticle image.
14. Put reticle image dot on target.
15. After establishing dive, keep dot on target and release electrical caging button.
16. Track smoothly, without skidding or slipping, keeping dot on target for approximately 3 seconds; then press bomb-rocket release button to fire rockets.

Rocket Emergency Jettison.

The rocket emergency jettison system provides for jettison of rocket launchers (complete with adapters) singly or collectively. Use one or more of the following procedures:

1. Move armament selector switch to ROCKETS-JETT and press bomb-rocket release button.
2. Press external load auxiliary release button marked "OUTBD."

NOTE To jettison rocket launchers with other external loads, refer to "External Load Emergency Jettison Button" and "External Load Emergency Jettison Handle" in this section.

Caution Failure of electrical power prevents jettisoning of rocket launchers by any method.

SPECIAL STORE.

A special store can be carried under the left wing, at the intermediate station. A T-270 (T-145) in-flight control tester panel (figure 4-21A), located below the instrument panel, contains the various switches and indicator lights necessary for normal control and operation of the special store. For mechanically jettisoning the special store, a special store emergency jettison handle is located below the instrument panel. The special store also can be jettisoned electrically by means of the external load emergency jettison button.

NOTE For information on operation of the in-flight control tester in various bombing modes, refer to Aircrew Weapon Delivery Manuals, T.O.'s 1F-100C-25, -26, -27, and -28.

Special Store Controls and Indicators.

F-Sel Switch. This switch (figure 4-21A), labeled "F-SEL," is primary bus powered and has positions 1 through 7.

A/S Switch. This primary-bus-powered switch (figure 4-21A) controls the safing switch solenoid. The switch, labeled "A/S," is spring-loaded to the OFF (neutral) position. When it is moved momentarily down, an amber "A/S" light comes on, if the safing switch is closed (armed). To change the safing switch from the closed (armed) or open (safe) position, the switch must be moved momentarily down.

IFI Control and IFI Power Switches. These switches (figure 4-21A) are powered by the primary bus. When the "IFI" circuit-breaker power switch is at POWER ON, power is applied to the "IFI" control switch, which readies the special store for arming. If the store is not ready for arming, the green "OUT" light comes on. If the story is ready for arming, the amber "IN" light comes on. Moving the "IFI" control switch momentarily down changes the store from either prevailing condition to the other ("OUT" to "IN" or "IN" to "OUT").

Fin Control and FIN Power Switches. These switches (figure 4-21A) are powered by the primary bus. The fin control switch controls special store fin position if the "FIN" circuit-breaker power switch is at POWER ON. When the fin control switch is at EXT, the store fins extend; then the amber "EXT" light comes on. When the fin control switch is at RET, the fins retract and the amber "EXT" light goes out.

Heater Power Switch. This circuit-breaker switch (figure 4-21A), labeled "HTR," applies primary bus power to the special store when placed to POWER ON.

F Switch. This circuit-breaker switch (figure 4-21A) applies primary bus power to the special store components (both directly and through the "F-SEL" switch) when placed at POWER ON.

AC Power Switch. When the ac power switch (figure 4-21A), labeled "AC," is maintained at POWER ON position, 115-volt, 400-cycle ac power is supplied to the special store.

Null Check Switch. This switch is inoperative.

Special Store Emergency Jettison Handle. The special store emergency jettison handle (28, figure 1-6; 27, figure 1-7), is used to mechanically jettison only the special store. Pulling the handle jettisons the special store armed or safe, depending on switch settings on the in-flight control tester panel.

External Load Emergency Button. (Refer to "Bombing Equipment Controls and Indicator" in this section.)

Null Light. This light (figure 4-21A), labeled "NULL," can be used for checking the special store. It is powered by the primary bus through the ac power switch.

Special Store Indicator Light. A placard-type special store indicator light (4, figures 1-6 and 1-7) is powered by the primary bus. ("T/0" appears when the light comes on.) The indicator light test circuit provides an operational test of the indicator light.

CHEMICAL TANK SYSTEMS.

A chemical tank may be carried on any wing pylon station. The release of chemicals from the tanks is selective, and the tanks can be dropped selectively or jettisoned by the bomb release and jettison systems.

NOTE For approved external loads, see figures 5-3 and 5-4.

Armament Selector Switch.

In addition to its function of selecting drop tanks, bombs, or rockets, the armament selector switch (figure 4-16) is used to set up the chemical tank discharge and jettison circuits. (Refer to "Bombing Equipment Controls and Indicator" and "Rocket System Controls," in this section.) When the armament selector switch is at CHEMICAL-RELEASE, the contents of chemical tanks selected by the chemical tank selector are discharged when the bomb-rocket release button is pressed. If the armament selector is at CHEMICAL—OUTBD JETT, CHEMICAL—INTERM JETT, or CHEMICAL—INBD JETT, the selected pair of chemical tanks are jettisoned when the bomb-rocket release button is pressed.

Chemical Tank Selector Switch.

The chemical tank selector switch (figure 4-16) regulates selection of tank to be discharged, by means of power from the secondary bus. Provided the armament selector switch is at the CHEMICAL RELEASE position, setting the chemical tank selector at one of its 10 positions (OUTBD LH, OUTBD RH, OUTBD BOTH, INTERM LH, INTERM RH, INTERM BOTH, INBD LH, INBD RH, INBD BOTH, and ALL) and pressing the bomb-rocket release button on the stick grip discharges the selected tanks. The selected tanks empty completely once the discharge circuit has been energized.

Caution Failure of electrical power prevents release of tank contents and jettison of tanks by any method.

Bomb-Rocket Release Button.

Refer to "Bombing Equipment Controls and Indicator" in this section.

External Load Emergency Jettison Button.

Refer to "Bombing Equipment Controls and Indicator" in this section.

External Load Emergency Jettison Handle.

Refer to "Bombing Equipment Controls and Indicator" in this section.

External Load Auxiliary Release Buttons.

Refer to "Bombing Equipment Controls and Indicator" in this section.

PRESSURE REFUELING SYSTEM.

The pressure refueling system permits all internal fuel tanks to be filled on the ground by single-point refueling and in flight by probe-and-drogue refueling. On airplanes changed by T.O., two 450-gallon drop tanks can be refueled by using the pressure refueling system in flight or on the ground, except as stated in "Single-point Refueling" in this section. The pressure refueling system is shown in figure 4-22.

SINGLE-POINT AND AIR REFUELING

AIRPLANES NOT CHANGED BY T.O.

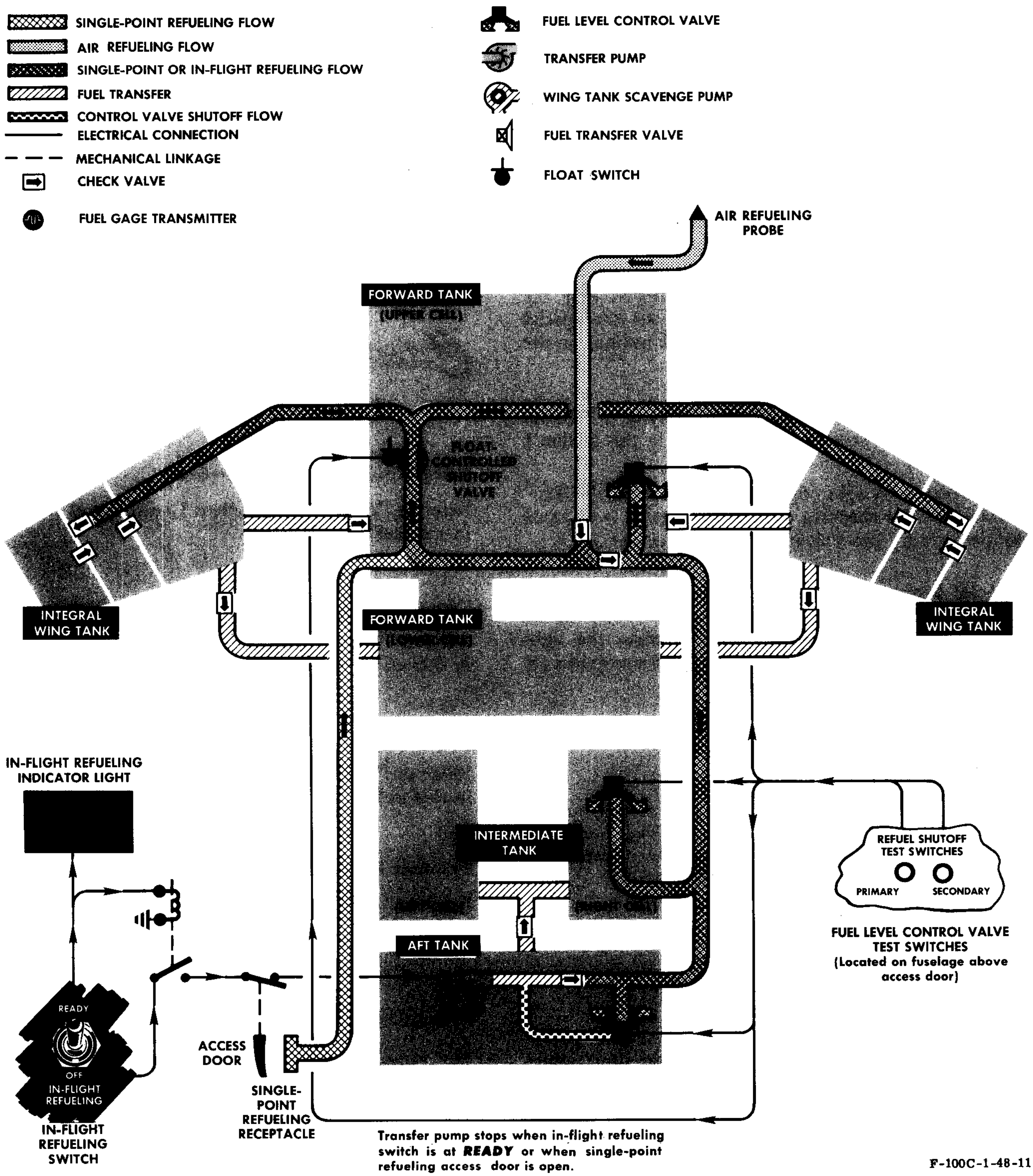


Figure 4-22

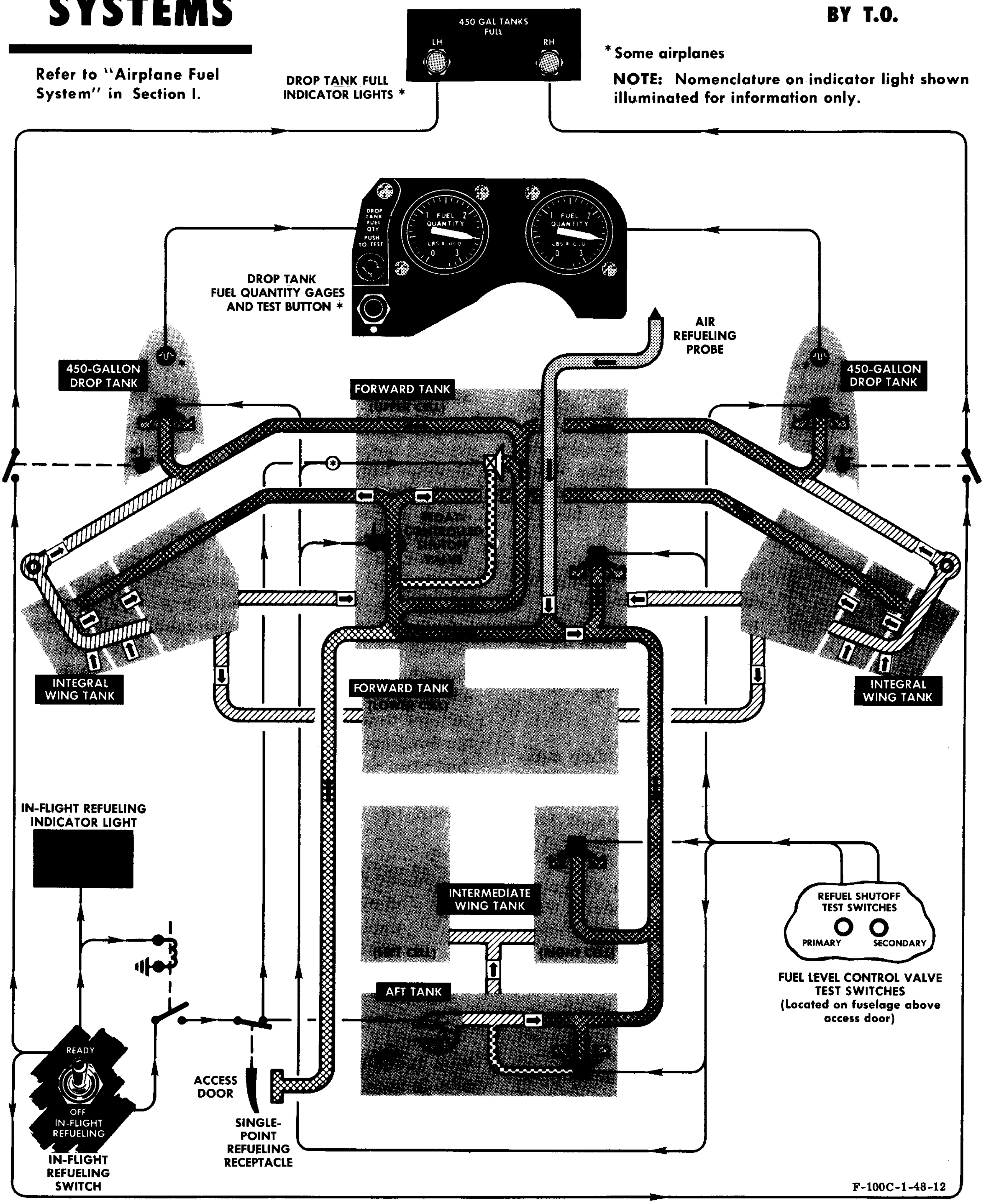
SYSTEMS

Refer to "Airplane Fuel System" in Section I.

AIRPLANES CHANGED BY T.O.

* Some airplanes

NOTE: Nomenclature on indicator light shown illuminated for information only.



GROUND REFUELING.

Single-point Refueling.

The internal fuel tanks are normally filled through the single-point refueling system. The single-point refueling receptacle is behind an access door on the left side of the fuselage, just below the wing trailing edge. (See figure 1-33.)

Caution Loss of the access door during flight can cause a critical fuel shortage by preventing operation of the aft fuel transfer pump. On airplanes changed by T.O. 1F-100C-548, loss of the door will also prevent use of fuel normally available from the 450-gallon drop tanks and the wing scavenge pumps.

All internal fuel tanks can be filled in about 4 minutes by using the pressure refueling system. Drop tanks, including the 450-gallon tanks, should be refueled through the individual drop tank fillers; however, the two 450-gallon drop tanks can be refueled by using the pressure refueling system if the engine is running. When these drop tanks are included in the single-point refueling operation, the complete system will fill in about 11 minutes.

Warning Do not refuel 450-gallon drop tanks using single-point refueling unless the engine is running, because the internal fuel system will be overfilled and the fuel will spill from the vent outlet on the vertical stabilizer, causing a fire or an explosion hazard.

The internal fuel tanks and the 450-gallon drop tanks can be topped off by using single-point refueling, whether the engine is running or not. However, during filling and topping off, the 450-gallon drop tank filler caps should be loosened by raising the lever on the caps.

NOTE When an airplane equipped with 450-gallon drop tanks is being refueled, the internal tanks are full when a sudden decrease in the single-point refueling flow rate is noted. This is caused by the slower filling rate of the 450-gallon drop tanks.

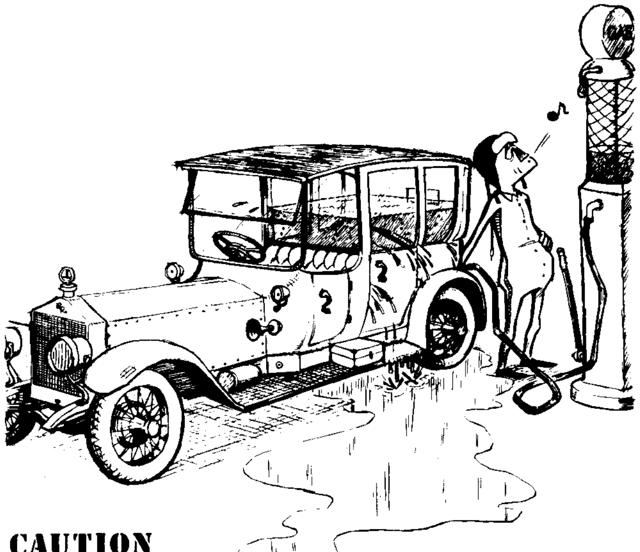
Starting with an empty airplane and using single-point refueling, about 100 gallons of fuel will be transferred to the 450-gallon drop tanks during the refueling process. This will occur if the engine is not running. If the 450-gallon drop tanks are attached after the internal tanks have been refueled and the airplane is allowed to stand, there will be about 130 gallons in each drop tank after a time lapse of 16 hours. If the airplane has been refueled with the 450-gallon drop tanks attached and allowed to stand over the same period of time, there will be about 230 gallons in each drop tank. When the mission requires that the airplane be flown with empty 450-gallon drop tanks, the tanks should be attached to the airplane just before take-off. If this cannot be done, the excess fuel in the 450-gallon drop tanks can be transferred to the forward fuselage tank immediately after the engine has been started. (The transfer rate of fuel from the drop tanks to the fuselage tank is about 25 gallons per minute per tank.) Tank-mounted fuel level control valves automatically shut off fuel to each fuselage tank and to the 450-gallon drop tanks when the tanks become full. The automatic shutoff operation of the fuel level control valves must be tested during the first few seconds of refueling. Failure of a valve to shut off fuel flow could allow refueling pressure to rupture fuel tanks and damage the airplane structure. (Refer to "Fuel Level Control Valve Test Buttons" in this section.)

Single-point Refueling Controls and Indicators.

Single-point Refueling Door Switch. This two-position tertiary-bus-powered (primary-bus-powered on airplanes changed by T.O. 1F-100C-548) switch (figure 4-22) controls electrical power to the aft transfer pump during single-point refueling. When the access door is opened, the aft transfer pump cannot transfer fuel to the forward tank, and the aft tank is refueled through the transfer line. On airplanes changed by T.O. 1F-100C-548, opening the door also controls the sequence of tank refueling by closing the transfer control valve. Closing this valve prevents fuel from entering the forward tank through this valve to ensure that the wing tanks and 450-gallon drop tanks will be completely filled before the forward tank is full. This sequence must occur, because the float-controlled shutoff valve will stop the refueling flow when the forward tank is full. At the completion of single-point refueling, the door must be closed to allow normal fuel system operation.

Caution Loss of the access door during flight can cause a critical fuel shortage by preventing operation of the aft fuel transfer pump. On airplanes changed by T.O. 1F-100C-548, loss of the door will also prevent use of fuel normally available from the 450-gallon drop tanks and the wing scavenge pumps.

Fuel Level Control Valve Test Buttons. Two push buttons (figure 4-22), on the left side of the fuselage above the single-point refueling receptacle access door, must be used to test the closing of the fuel level control valves. When either button is held down, the respective solenoid (primary or secondary) in each control valve is energized by power from the primary bus and closes the valve. Within the first seconds of the single-point refueling operation, these valves should be tested for closing. It is necessary to test the operation of the control valves in the first seconds of the refueling operation because some tanks fill early. When a tank is filled, an



CAUTION

It is necessary to check the control valve operation at the beginning of the refueling operation, because failure of a valve to close could cause refueling pressure to rupture the fuel tanks and damage the airplane structure.

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individual check of the primary and secondary operation of the valve cannot be made. Satisfactory valve operation is indicated by the shutoff of the fuel flow accompanied by the stopping of vibration and the stiffening of the refueling hose, which occurs when fuel flow through the nozzle stops. A more positive indication of fuel shutoff can be obtained by observing the counter on the ground refueling equipment. If fuel flow continues when either or both of the test switches are pressed, refueling operations must be stopped immediately to prevent possible damage, and the cause must be determined and corrected.

Drop Tanks Full Indicator Lights (Airplanes Changed by T.O.). Refer to "Air Refueling" in this section.

AIR REFUELING.

Air refueling permits all internal fuel tanks to be filled from a tanker airplane. On airplanes changed by T.O., two 450-gallon drop tanks can be carried at the intermediate wing stations and can also be serviced by means of air refueling. The refueling equipment consists of a probe and drogue, with the probe attached to the receiver airplane and the drogue trailed from the tanker airplane. The 12½-foot probe mast and probe (figure 4-18) is detachable. On airplanes changed by T.O., the probe has been changed to a 5-degree-down attitude to improve air refueling contacts. Some probe masts have been changed by T.O. to extend the probe to about 15 feet, which will assist the pilot in the hookup. Also, on airplanes changed by T.O., there is a light (figure 4-23) that shines forward to light the probe and the tanker drogue for night refueling. The probe is connected by a fuel line to the pressure refueling system. (See figure 4-22.) Fuel flow automatically shuts off as the tanks become full. A switch is provided in the cockpit to turn off the fuel transfer pump in the aft fuselage tank. If this is not accomplished, aft tank transfer pump pressure, through a sensing line from the pump to the aft tank fuel level control valve, will close the fuel level control valve, preventing filling of the aft tanks. Before air refueling, this switch must be placed in the READY position, and the in-flight refueling ready indicator light should be checked to be on. Hookup to the tanker is made by flying the probe into the drogue trailed by the tanker. After making contact, the pilot of the receiver airplane decreases the distance between his plane and the tanker until hose length has been shortened by about 10 feet. This action automatically starts fuel flow through the hose to the receiver airplane. During the refueling operation, the receiver airplane may remain in any location between this rearward limiting position and a position about 20 feet forward. The time required to take maximum fuel aboard is about 11 minutes for airplanes changed by T.O. and equipped with 450-gallon drop tanks. On airplanes not changed by T.O., the time required to take maximum fuel aboard is about 3 minutes. When the refueling operation is completed, the receiver airplane reduces power and falls astern of the tanker so that the hose unwinds to its limit and automatically shuts off fuel flow. When the tanker hose has unwound to its limiting stop, the probe pulls from the drogue. Contact may be broken by the receiver airplane at any time during refueling operations by reducing power and dropping aft.

Caution Disconnect probe from drogue when fuel quantity gages read full. If contact is continued after tanks are full, cycling of the float-controlled shutoff valve may rupture the valve diaphragm and allow fuel from the drop tanks to be lost overboard through the vent system.

Air Refueling Controls and Indicators.

In-flight Refueling Switch. This two-position switch (figures 1-12 and 4-22) is powered by the tertiary bus (secondary bus on airplanes changed by T.O. 1F-100C-548). It controls electrical power to the aft transfer pump during air refueling. When this switch is at READY, the aft transfer pump will not operate. This will permit refueling flow to the aft tank through the line normally used for fuel transfer. On airplanes changed by T.O. 1F-100C-548, the READY position also controls the sequence of tank refueling by closing the control valve.

Closing this valve prevents fuel from entering the forward tank through this valve to ensure that the wing tanks and 450-gallon drop tanks will be completely filled before the forward tank is full. This sequence must occur because the float-controlled shutoff valve will stop the refueling flow when the forward tank is full. At the completion of air refueling, the in-flight refueling switch must be positioned at OFF to allow normal fuel system operation.

Caution Failure to return the in-flight refueling switch to OFF after refueling is completed can cause a critical fuel shortage by preventing operation of the aft fuel transfer pump. On airplanes changed by T.O. 1F-100C-548, failure to return the switch to OFF will also prevent use of fuel normally available from the 450-gallon drop tanks and the wing scavenge pumps.

In-flight Refueling Ready Indicator Light. When the air refueling switch is set at READY to shut off the aft fuel transfer pump, a placard-type indicator light (figure 1-4) comes on. The indicator light is powered by secondary bus, and bulbs in the light can be tested by means of the indicator light test switch.

450-gallon Drop Tanks Full Indicator Lights (Airplanes Changed by T.O. 1F-100C-539). Two press-to-test indicator lights (38, figure 1-6; 29, figure 1-9; figure 4-22) show when the 450-gallon drop tanks are full. Both lights are powered by the primary bus. An indicator light float switch, in each of the 450-gallon drop tanks, is connected to one of the two indicator lights. These float switches close when the drop tanks are full, causing the indicator lights to come on, provided the air refueling switch is at READY. The lights will go out when the refueling switch is returned to OFF, at the completion of the refueling operation. To test the indicator lights, the indicator light test switch must be held at TEST BRIGHT or TEST DIM and the indicator light press-to-test cover pressed in.

450-gallon Drop Tanks Fuel Quantity Gages (Airplanes Changed by T.O.). Provisions have been made to gage the fuel in each of the two 450-gallon drop tanks. Two gages (figure 4-22) are installed on a removable panel that attaches to the instrument panel shroud above the drag chute handle. Each gage shows the amount of fuel in its respective drop tank. This indicating system is independent of the normal internal fuel quantity indicating system. The 450-gallon drop tank fuel quantity indicating system is of the capacitor-type and is electrically powered (ac) by the three-phase instrument bus. The system automatically compensates for the contraction or expansion of fuel due to temperature changes. When the drop tanks are jettisoned, the fuel gage needles rotate to the left momentarily and then stop automatically just below zero. A fuel quantity gage test button for the two gages is in the lower left corner of the fuel gage panel. Its operation is the same as that described in "Fuel Quantity Gage Test Button" in Section I. Lighting of the drop tank fuel gages is controlled by a two-position switch on the right side of the lighting control panel.

Refueling Probe Light Switch (Airplanes Changed by T.O. 1F-100-713). The refueling probe light switch (figure 4-6) controls secondary bus power to the refueling probe light. (See figure 4-23.)

Air Refueling Procedure (Without 450-gallon Drop Tanks).

Success of the air refueling operation depends upon pilot proficiency, atmospheric conditions (visibility, turbulence, etc), stability of the tanker and drogue, gross weight of the tanker, and loading of the receiver airplane. Receiver-tanker compatibility is extremely sensitive to all of these variables. However, it has been demonstrated that operations at night pose no additional difficulties. Air refueling from a KC-97, KB-50, or KB-50J should be made at the airspeeds and altitudes shown in figure 4-24. When the hose is fully extended from the tanker, a yellow light will come on in the tanker hose-reel pod. This indicates to the receiver airplane that the hookup should be started. Tests show that the optimum technique for hookup is for the receiver airplane to accelerate into the contact from a point about 10 to 12 feet directly aft of the drogue. When the receiver airplane is stabilized so that the probe is at this position, the drogue is out of the turbulence area around the inlet duct and there is enough space to build up an optimum closure rate of 4 to 5 knots. Higher closure rates are likely to cause the hose to whip, possibly damaging the probe, drogue, or receiver airplane. Slower closure rates may not allow a proper connection for fuel transfer. Also, closing very slowly on the drogue and chasing it through its oscillations reduces the possibility of a successful hookup. The speed and attitude of the receiver airplane should be stabilized so that position is maintained without any large longitudinal or directional control movements. When the airplane is stabilized, a straight forward acceleration gives the best probability of successful hookup.

NOTE The lower right corner of the curved part of the windshield can be used as a guide to proper position. When the drogue is framed in this corner and the probe is the recommended distance back of the drogue, the airplane is in the best prehookup position.

- The in-flight refueling switch should be at READY before contact, to ensure refueling of the internal wing tanks. (The switch must be moved to OFF when refueling is completed.)

AIR REFUELING PROBE

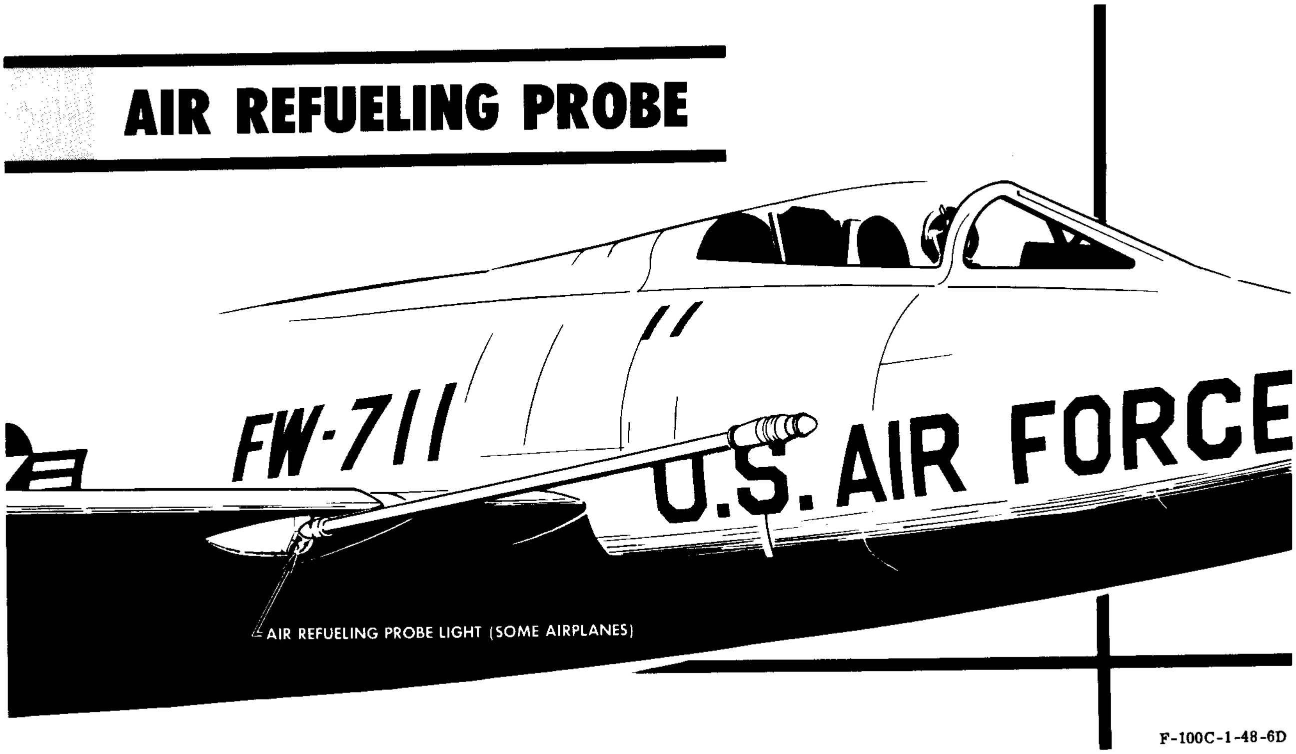


Figure 4-23

If the receiver airplane is too far aft of the drogue, the drogue tends to "suck in" in the area of the intake duct and then go out again as the duct passes the drogue. This causes an oscillation in the hose and drogue, making hookup difficult. A slight airplane vibration or buffet occurs during closing; however, as the airplane nears the correct position, the vibration and buffet disappear. After hookup, the receiver airplane must be flown forward until about 10 feet of hose has rewound on the reel in the tanker to start fuel flow. Control of the airplane after hookup is not difficult. The receiver airplane takes on the extra drag of the drogue; therefore, the left rudder must be held in to maintain proper position. This rudder pressure can be trimmed out, but since the time for refueling is short (about 4 minutes or less, depending on the amount of fuel taken aboard), holding rudder does not become tiresome. Relatively large control movements are needed to obtain good airplane response at the necessarily low airspeed during the refueling operation. It is much easier to hold refueling position than make the contact, since contact requires an exact position. When refueling is completed, breakaway is made by slowly dropping aft of the tanker until the hose has reeled out to its full length. As the hose reel hits the stops, fuel flow is automatically cut off, and as the receiver airplane continues to drop back, the probe is pulled from the drogue. In breaking contact, an attempt should be made to back out of the engagement as straight aft as possible, because the drogue whips back and forth over its trail position very rapidly after the probe and drogue disconnect.

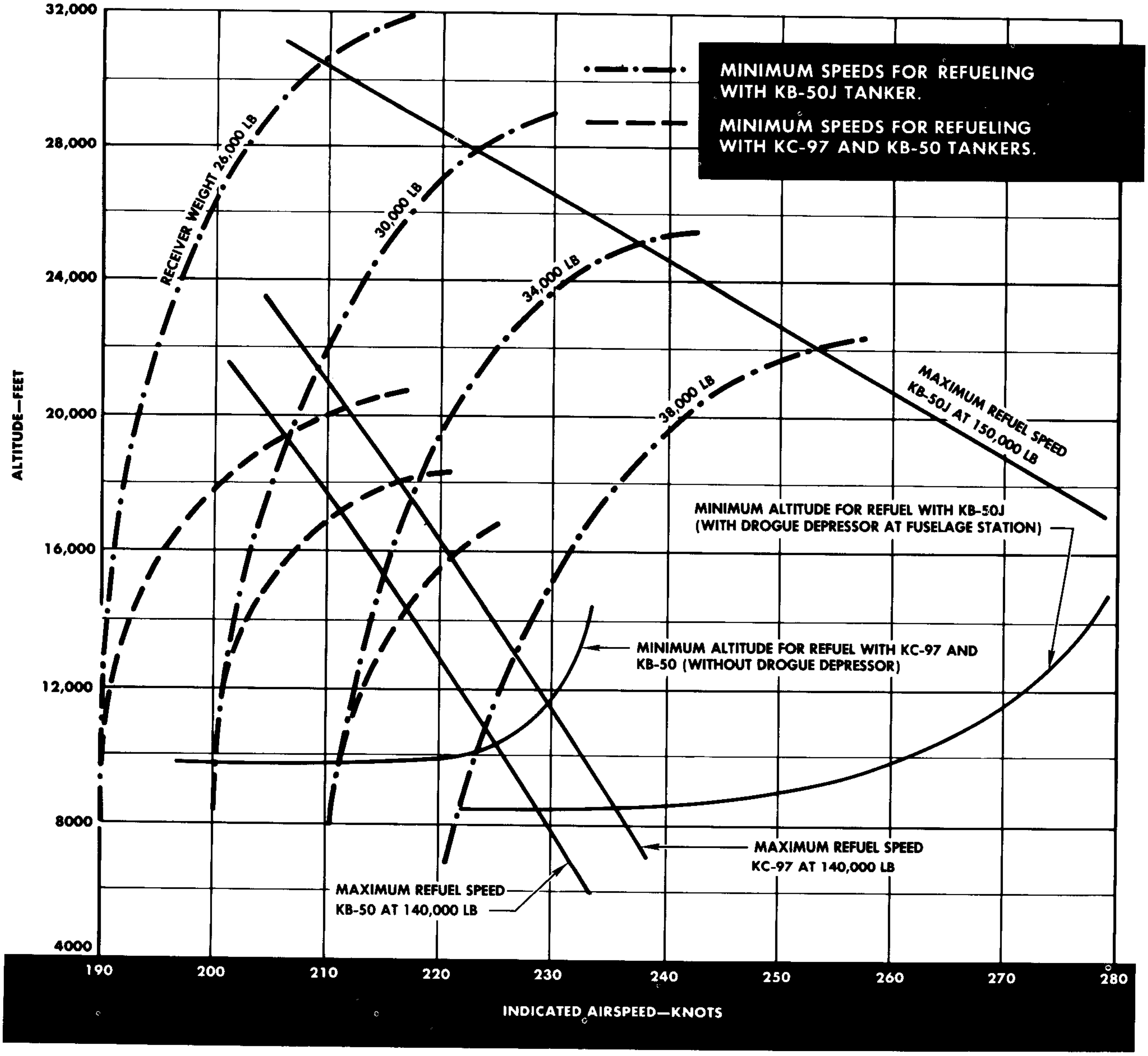
Caution If breakaway is made when the receiver airplane is to the right of the normal trail position of the drogue, the drogue may damage the canopy when it whips off the probe.

Air Refueling Procedure (450-gallon Drop Tanks*).

When carrying 450-gallon drop tanks, the air refueling procedures are basically the same as those used for a clean airplane, except allowance is made for the additional gross weight of the receiver airplane as a result of the additional fuel load from the 450-gallon drop tanks. This additional weight adds a control problem at the low airspeed of the tanker airplane. Also, at 18,000 feet or above, Military Thrust may not be sufficient to hold the receiver airplane in position after the gross weight of the receiver airplane has been increased to more than 31,000 pounds. An additional problem is presented when the tanker increases airspeed to a range of 220 and 230 knots IAS (by decreasing altitude) before a hookup is accomplished, causing the drogue at the fuselage station to ride high and making a hookup difficult. Refuelings at heavy gross weight (over 33,000 pounds) can be made with

***Airplanes changed by T.O.**

AIR REFUELING CAPABILITIES (WITH KC-97, KB-50, AND KB-50J TANKERS)



NOTE

Tanker performance is shown for an average expected weight at the time of refueling. An increase (or decrease) in tanker weight of 40,000 pounds will reduce (or increase) the maximum refuel speed by approximately 15 knots IAS.

Minimum receiver speeds are shown for normal conditions.

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Figure 4-24

consistency at 16,000 feet and 210 knots IAS. Military Thrust is not sufficient to hold the receiver airplane in the fuselage drogue position at this heavy gross weight; therefore, because less power is required to hold position on the wing tip drogues, the wing tip drogues should be contacted first, in preference to the fuselage drogue position.

NOTE Contacts on the wing tip drogues present less trouble than contacts at the fuselage drogue position, because there is less of the receiver airplane exposed to turbulence created by the tanker.

When the fuselage drogue is contacted, the tanker should increase its airspeed to between 220 and 225 knots IAS by starting a descent of 200 to 400 feet per minute. This aids the receiver airplane in holding position at heavy gross weight. Because the compatibility region with the KC-97 and the KB-50 Airplanes is restricted, the speeds and altitudes shown in figure 4-24 should be used. A normal refueling procedure should be performed as follows:

1. Drop tank fuel selector switch at OFF. This switch should be turned to OFF during air refueling of the 450-gallon drop tanks; otherwise, refueling time will be increased, since the combined air-refueling pressure and transfer pressure (caused by the tank selector being open) will cause a back pressure in the tank.

1A. Flying at 16,000 feet and 210 knots IAS.

2. Air refueling switch at READY, before contact.
3. Contact wing tip drogues, if available, in preference to the fuselage drogue. When all three drogues are to be used, wing tip receivers should hook up first.
4. Immediately after hookup, the tanker should begin a descent of 200 to 400 feet per minute and increase airspeed to between 220 to 225 knots IAS.
5. In case of inadvertent breakaway, wing tip drogue receivers should be able to recontact without difficulty. If the fuselage drogue receiver is unable to recontact, he should move to a wing tip drogue when one becomes available.
6. In-flight refueling switch OFF after refueling is completed.

The KB-5J allows a much wider range of speeds and altitude. However, for optimum results, the widest practicable margins above the indicated minimum speeds shown on figure 4-24 should be used, particularly with very heavy or asymmetrical configurations. If any difficulty is encountered, a moderate rate of descent (200 to 400 feet per minute) is recommended.

MISCELLANEOUS EQUIPMENT.

ANTI-G SUIT SYSTEM.

Air pressure for the anti-G suit is supplied by engine compressor air through the cockpit air conditioning and pressurization system. This air is routed through a pressure-regulating valve to the suit attachment fitting. The line from the regulating valve to the attachment fitting passes through the quick-disconnect fitting on the front of the seat so that the line severs automatically upon ejection.

Anti-G Suit Pressure-regulating Valve.

The pressure-regulating valve (21, figure 1-8) regulates air pressure to the suit and permits automatic inflation of the suit only when positive G is encountered. The valve operates automatically and begins to function at about 1.75 G whether the cap has been rotated to the HI (clockwise) or the LO (counterclockwise) detent. When the valve is at LO, one psi air pressure is exerted in the suit for each additional 1 G increase; with the valve positioned at HI, 1.5 psi is delivered per G increase. Pressing the button on top of the valve checks valve operation, and also allows the suit to be inflated when desired. The suit can be used in this manner to lessen fatigue during prolonged flights.

VENTILATED SUIT PROVISIONS.*

The ventilated suit provides air circulation around the pilot's body and is normally worn under an antiexposure suit as a means of perspiration elimination. Air for the ventilated suit is taken from the console air duct of the cockpit air conditioning and pressurization system and directed through a hose leading to the personal-lead quick-disconnect on the front of the ejection seat. A short section of hose, attached to the suit, is connected to the hose from the personal-lead quick-disconnect. A manually operated flow control valve in this hose permits adjustment of the airflow into the suit. The console air lever must be at full INCREASE to supply air to the ventilated suit. The temperature of the air to the suit is controlled by the cockpit temperature rheostat.

Ventilated Suit Flow Control Valve.

The ventilated suit flow control valve is used to control the flow of air to the suit. The flow control valve is manually operated, and is where the suit hose section joins the hose from the personal-lead quick-disconnect at the ejection seat. This valve should always be closed before the two hoses are connected, to prevent sudden temperature changes.

Console Airflow Lever.

Refer to "Air Conditioning, Pressurization, Defrosting, Anti-icing, and Rain Removal Systems Controls" in this section.

***Airplanes changed by T.O.**

Cockpit Temperature Rheostat.

Refer to "Air Conditioning, Pressurization, Defrosting, Anti-icing, and Rain Removal Systems Controls" in this section.

Operation of Ventilated Suit System.

After the engine is started, and *before* connecting the suit, check out system as follows:

1. Move console airflow lever to full INCREASE.
2. Move cockpit temperature master switch to AUTO.
3. Rotate cockpit pressure selector switch to 2.75 P.S.I. or 5 P.S.I.
4. Feel for airflow from hose coming from personal-lead quick-disconnect of seat by opening flow control valve.
5. Check for increased and decreased airflow when flow control valve is turned from open to closed.
6. Rotate cockpit temperature rheostat from HOT to COLD, and notice that there is a change in temperature of air coming from the hose. Then rotate rheostat so that it is in the center of the "PILOTS SUIT RANGE" marking.
7. Close flow control valve and connect suit hose to hose from personal-lead quick-disconnect of each seat.
8. Slowly open flow control valve for desired airflow into suit.
9. Adjust cockpit temperature rheostat for desired temperature in ventilated suit.

NOTE Always adjust temperature rheostat in small increments to prevent sudden temperature changes in suit.

RELIEF CONTAINER.

A relief container (figures 1-6 and 1-7) is stowed in a compartment beneath the center pedestal.

PILOT'S PROTECTIVE HOOD.

A white canvas protective hood which slides along metal runners, attached to the inside of the cockpit canopy, can be installed. When not in use, this hood should be kept stored in its special container.

DATA CASE.

The data case is on the inner surface of the forward electronics compartment hood and is accessible on the ground when the hood is open.

MAP CASE.

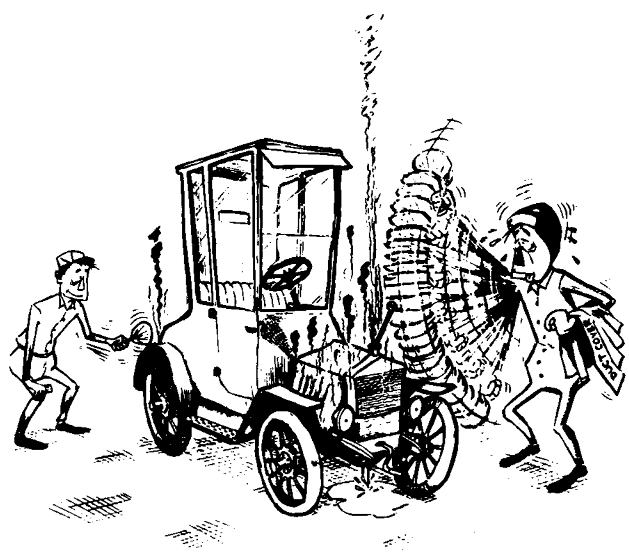
The map case (15, figure 1-9) is on the right console.

CHECK LISTS (SOME AIRPLANES).

The take-off check list (13, figure 1-9) is on the right canopy frame, and the landing check list (7, figure 1-8) is on the left.

PROTECTIVE COVERS.

Removable covers include wing and horizontal stabilizer covers, air refueling boom cover, wing walkaway cover mats, a cockpit canopy cover, a cover for the forward section of the fuselage, an air intake duct plug, and a tail-pipe cover. In addition, an automatic pullaway-type pitot boom cover is provided.



CAUTION

The air intake duct plug and tail-pipe cover should not be installed until the engine has cooled, to prevent formation of excessive moisture.

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REAR-VIEW MIRROR.

An adjustable rear-view mirror (figure 1-27) is attached to the canopy bow.

MOORING EQUIPMENT.

A plugged threaded hole, into which a mooring eye may be screwed for securing the airplane to the ground, is in the lower surface of each wing and in the lower surface of the fuselage, at the nose and tail. Four mooring eyes and a canvas container are included as tie-down equipment. Three jack pads are also supplied with the kit. All mooring-eye threaded holes and jack pad attachment points are identified by suitable markings on the outside of the wing and fuselage skins.

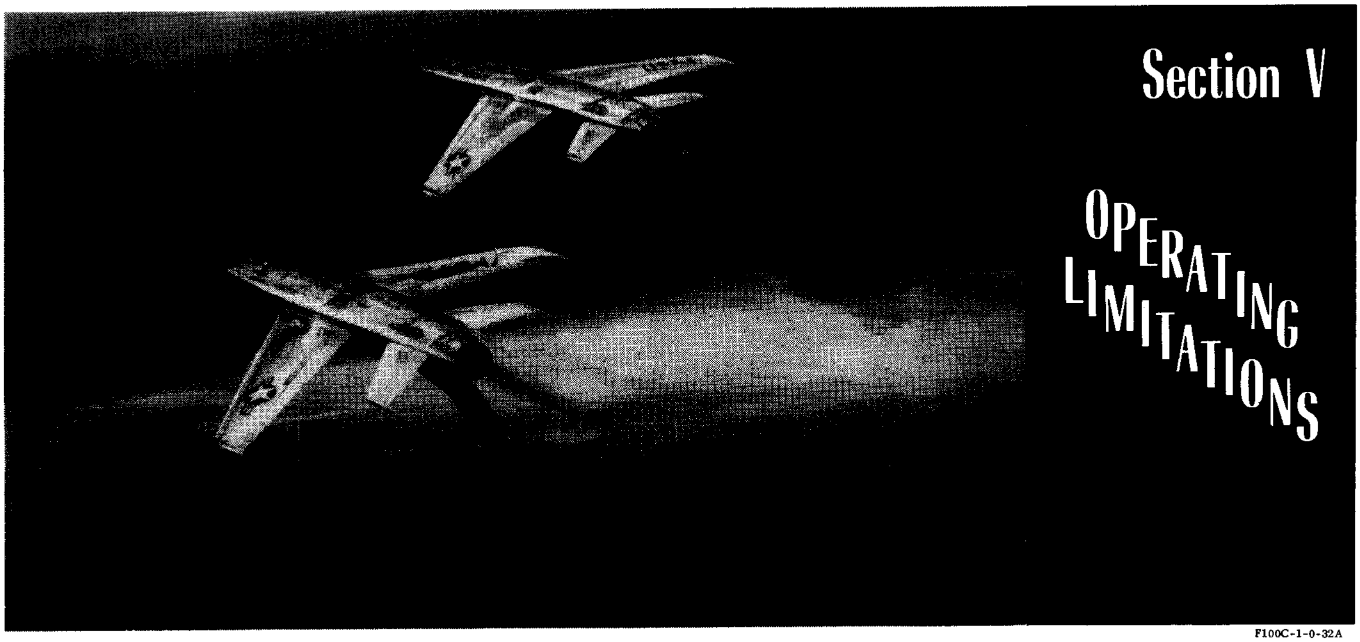

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TABLE OF CONTENTS

INSTRUMENT MARKINGS.

Careful attention must be given to the instrument markings (figure 5-1), because the limitations shown on these instruments and noted in the captions are not necessarily repeated in the text of this or any other section.

ENGINE LIMITATIONS.

All normal engine limitations are based on JP-4 fuel and are shown in figure 5-1.

THRUST DEFINITIONS AND TIME LIMITS.

Maximum Thrust.

Maximum Thrust is defined as the thrust obtained at full afterburner and is limited to 5 minutes continuous operation on the ground and 15 minutes continuous operation in flight.

NOTE The time limits for operation at Maximum Thrust apply to the full range of afterburner operation.

Military Thrust.

Military Thrust is defined as the thrust obtained at full throttle without afterburner and is limited to 15 minutes continuous operation on the ground and 30 minutes continuous operation in flight.

NOTE When operating requirements dictate, Military Thrust may be used for periods of time longer than 30 minutes; however, engine life will be shortened.

Maximum Continuous Thrust.

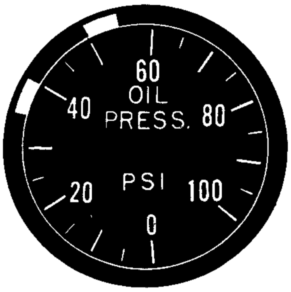
Maximum Continuous Thrust is defined as the thrust obtained at about 3% engine rpm below Military Thrust rpm. There is no time limit for operation at this thrust.

NOTE Refer to "Maximum Continuous Thrust Operation" in Section VII for additional information.

ENGINE OVERSPEED.

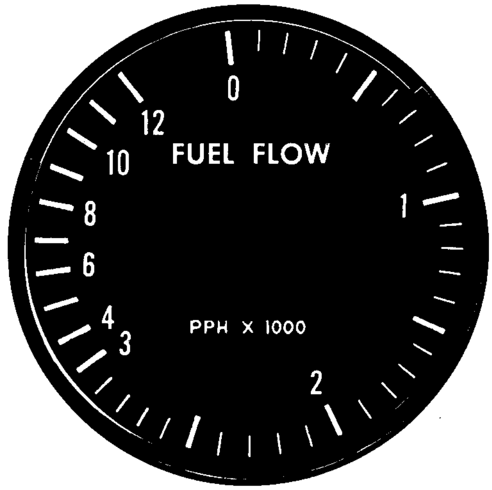
The maximum allowable engine speed is 102% rpm. If this speed is exceeded while the airplane is on the ground, the engine must be shut down. If this speed is exceeded in flight, if possible, use minimum power to sustain flight

INSTRUMENT MARKINGS BASED ON JP-4 FUEL



OIL PRESSURE GAGE

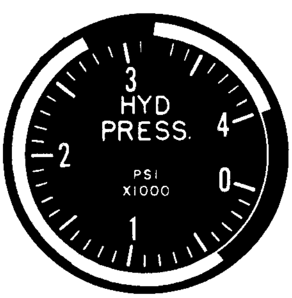
35 psi	MINIMUM
35-40 psi	CAUTION
40-50 psi	NORMAL
50-55 psi	CAUTION
55 psi	MAXIMUM



FUEL FLOW INDICATOR

650 lb/hr	Minimum
650-9000 lb/hr	Continuous

HYDRAULIC PRESSURE GAGE



	NO. 1 FLIGHT CONTROL SYSTEM	NO. 2 FLIGHT CONTROL SYSTEM	UTILITY SYSTEM
	Permissible with rapid control surface movement.		Permissible with high flow demands on system.
450-2800 psi	Shows malfunction with control surface static.		Shows malfunction with no flow demands on system.
2800-3200 psi	Normal		
3200 psi	Maximum (may be exceeded only when emergency hydraulic pump is in operation).	Maximum	
3200-4000 psi	Maximum when emergency hydraulic pump is in operation and control surfaces static.	Shows malfunction of engine-driven hydraulic pump pressure regulator.	

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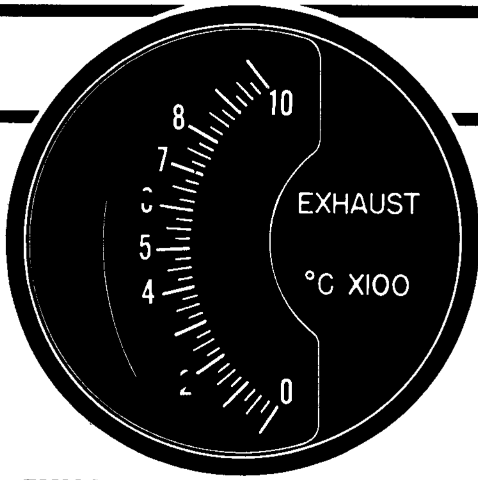
Figure 5-1 (Sheet 1 of 3)

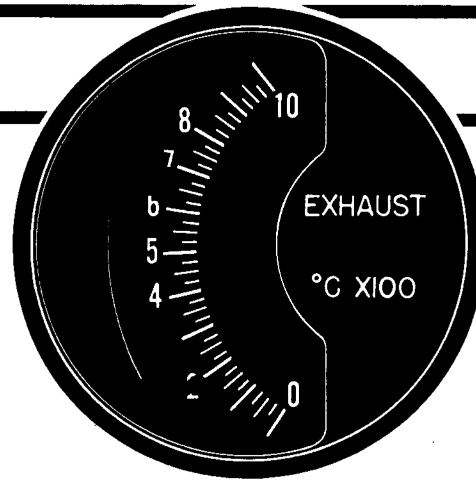


EXHAUST TEMPERATURE GAGE
(J57-39 ENGINE)

NOTE

- Maximum allowable stabilized exhaust temperature at engine idle rpm is 340°C.
- Minimum exhaust temperature for take-off is 475°C.
- Maximum Continuous Thrust is the thrust obtained at approximately 3% engine rpm below Military Thrust rpm.

	200°C	Minimum
	260°C to 590°C	Continuous NOTE Below 30,000 feet, maximum is 560°C.
	610°C	Maximum on the ground (limited to 15 min at Military Thrust and 5 min at Afterburner Thrust). Maximum below 30,000 feet at Military Thrust (30 min), or at Afterburner Thrust (15 min). NOTE • Maximum for Military Thrust (30 min) or Afterburner Thrust (15 min) above 30,000 feet is 640°C. • Maximum during start is 620°C.
	660°C	Maximum during acceleration and 2 minutes thereafter.



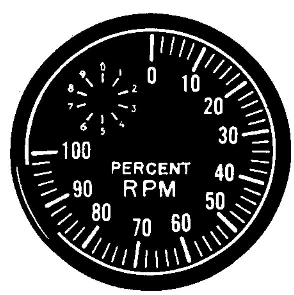
EXHAUST TEMPERATURE GAGE
(J57-21 AND -21 A ENGINE)

NOTE

- Maximum allowable stabilized exhaust temperature at engine idle rpm is 340°C.
- Minimum exhaust temperature for take-off is 540°C.
- Maximum Continuous Thrust is the thrust obtained at approximately 3% engine rpm below Military Thrust rpm.

	200°C	Minimum
	260°C to 610°C	Continuous NOTE Below 30,000 feet, maximum is 580°C.
	630°C	Maximum during start. Maximum at Military Thrust on ground (15 min) and during flight below 30,000 feet (30 min). NOTE • Maximum at Military Thrust during flight above 30,000 feet (30 min) is 660°C. • Maximum in afterburner on ground (5 min) and during flight below 30,000 feet (15 min) is 640°C. • Maximum in afterburner during flight above 30,000 feet (15 min) is 670°C.
	680°C	Maximum during acceleration and 2 minutes thereafter.

	85%-98%	Normal operating range
	102%	Maximum overspeed



TACHOMETER

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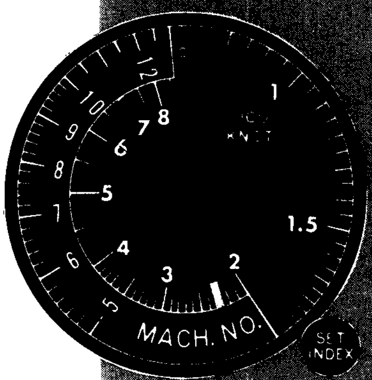
Figure 5-1 (Sheet 2 of 3)

INSTRUMENT MARKINGS



AIRSPEED AND MACH NUMBER INDICATOR

700 knots IAS maximum allowable airspeed with no external load.

NOTE

- The black and red pointer must not be used as a limiting speed reference, since it will show airspeeds greater than the 700 knots IAS limit.
- For airspeed limits with external loads, refer to "External Loading Configuration Limitations" in this section.

230 knots IAS maximum gear extension.

ACCELEROMETER

7.33 G Maximum clean (Combat Condition)

4.0 G Maximum with average external load

—2.0 G Maximum with external loads

—3.0 G Maximum clean (combat condition)

NOTE

For specific limits for all external loading configurations, refer to "External Loading Configuration Limitations" in this section.

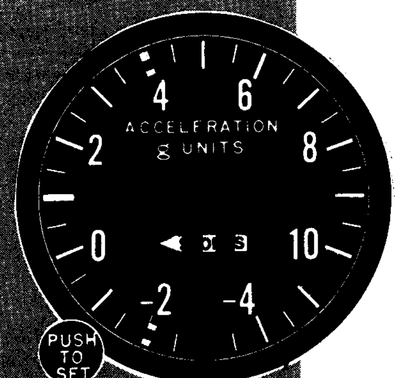


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Figure 5-1 (Sheet 3 of 3)

and land as soon as possible. In either case, the engine must be inspected for damage.

NOTE The amount and duration of any engine overspeed must be entered in the Form 781, so that the prescribed engine inspection can be performed.

EXHAUST TEMPERATURE LIMITS.

Exhaust temperature gage markings are shown in figure 5-1.

NOTE The amount and duration of any engine overtemperature must be entered in the Form 781, so that the prescribed engine inspection can be performed.

ENGINE PRESSURE RATIO AND DIFFERENTIAL PRESSURE GAGE TAKE-OFF LIMITS.

The permissible ranges of engine pressure ratio and differential pressure gage readings for Military Thrust and Maximum Thrust checks prior to take-off are shown in figure 5-2. The permissible ranges for the engine pressure ratio gage are based on proper initial setting of the gage take-off index marker for the prevailing outside air temperature. The permissible ranges for the differential pressure gage are based on proper initial setting of the gage free air temperature scale with respect to the outside air pressure scale.

AIRSPEED LIMITATIONS.

MAXIMUM ALLOWABLE AIRSPEEDS.

Refer to "External Loading Configuration Limitations" in this section.

LANDING GEAR LOWERING SPEED.

Limit airspeed for landing gear operation is 230 knots IAS. Flight with the gear extended at speeds greater than 230 knots IAS is likely to cause damage to gear doors or gear operating mechanism.

LANDING LIGHT EXTENSION SPEED.

The landing lights should not be extended at speeds above 250 knots IAS. If the lights are extended at speeds greater than 250 knots IAS, damage to the units is likely to result.

CANOPY OPERATING SPEED.

The canopy is not designed to be opened in flight, as any partial opening of the canopy could cause air loads to tear it off the airplane. During taxiing, however, the canopy may be opened safety at speeds below 50 knots IAS.

DRAG CHUTE OPERATING SPEED.

The drag chute should be deployed only after touchdown with the nose wheels on the runway, and only at speeds below about 180 knots IAS. If the drag chute is deployed above 180 knots IAS, either the chute will be damaged or structural damage will occur if the chute tears away from the airplane.

Caution To prevent slowing airplane to below landing speed, the drag chute must not be deployed before touchdown.

PROHIBITED MANEUVERS.

The airplane is restricted from performing the following maneuvers:

1. Spins. (Refer to "Spins" in Section VI.)
2. Snap rolls or snap maneuvers.
3. When no external load is installed, or when only NAA Type III 275-gallon drop tanks are installed, full aileron deflection rolls exceeding 360 degrees and aileron deflections of more than about two-thirds on continuous rolls.

NOTE Under conditions of high roll rate, reduce aileron angle early to avoid exceeding 360 degrees.

4. With external loads, other than only NAA Type III 275-gallon drop tanks, roll rates exceeding 120 degrees per second, which is equivalent to about one-half aileron deflection at cruise speed.
5. Flying near stall speed in accelerated flight when inboard pylons, or asymmetrical loads are installed. (Refer to "Flight With External Loads" in Section VI.)

ACCELERATION LIMITATIONS.

NOTE Refer to "External Loading Configuration Limitations" in this section for load factor limits for the airplane with no external load and for the airplane in all approved external loading configurations.

NEGATIVE-G FLIGHT LIMITS.

Oil System Limits.

Under sustained zero-G or negative-G flight conditions, complete loss of engine oil pressure may occur.

ENGINE PRESSURE RATIO AND DIFFERENTIAL PRESSURE GAGE TAKE-OFF LIMITS

PRESSURE RATIO GAGE

TYPE OF CHECK	ALLOWABLE PRESSURE RATIO GAGE SETTING	REMARKS
MILITARY THRUST CHECK (Made during preflight engine check)	Within arc of the take-off index marker. (Marker set according to outside air temperature.)	Tolerance shown is for stabilized rpm, but does not require stabilization of exhaust temperature.
MAXIMUM THRUST CHECK (Made at start of take-off roll)	Within arc of the take-off index marker, after the marker has been readjusted so that the lower edge lines up with the indicator reading obtained at Military Thrust check.	Because brakes will not hold the airplane during Maximum Thrust operation, this check must be made during the initial part of the take-off roll.

NOTE

During the take-off roll and at lift-off, gage reading may rise as much as 0.15 in. Hg above the reading observed during Maximum Thrust check. This rise is acceptable.

DIFFERENTIAL PRESSURE GAGE

TYPE OF CHECK	ALLOWABLE DIFFERENTIAL PRESSURE (ΔP) GAGE READING	REMARKS
MILITARY THRUST CHECK (Made during preflight engine check)	Within +3, −1 in. Hg of index marker. (Marker set according to ambient temperature and barometric pressure.)	Tolerance shown is for stabilized rpm, but does not require stabilization of exhaust temperature.
MAXIMUM THRUST CHECK (Made at start of take-off roll)	J57-7 and -39 ENGINES Within +2.5, −1.5 in. Hg of gage reading observed during foregoing Military Thrust check. J57-21 ENGINE Within 0 to +4 in. Hg of the gage reading observed during foregoing Military Thrust check.	Because brakes will not hold the airplane during Maximum Thrust operation, this check must be made during the initial part of the take-off roll.

NOTE

During the take-off roll and at lift-off, gage reading may rise as much as 6 in. Hg above the reading observed during Maximum Thrust check. This rise is acceptable.

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Figure 5-2

Therefore, do not maintain zero or negative G for more than 15 seconds.

Fuel System Limitations.

Based on the capacity of the inverted-flight tank and on required engine fuel flows, the time limits for negative-G flight before flame-out can be expected are as follows:

ALTITUDE (FEET)	MILITARY THRUST TIME LIMIT (SECONDS)	AFTERBURNER THRUST TIME LIMIT (SECONDS)
5,000	6	1.5
10,000	7	1.5
20,000	8	1.5
30,000	9	2.0
40,000	12	3.0
45,000	15	4.0
Above 45,000	Negative-G flight may result in flame-out, because suction feed cannot be ensured.	

EXTERNAL LOADING CONFIGURATION LIMITATIONS.

The external loading capabilities of this airplane, coupled with the variety of individual stores which may be carried, makes it impractical to list individually each external loading configuration the airplane may safely carry. A practical method of listing approved external loading configurations must first permit determination of what particular types of stores can be carried and operated (released, fired, discharged, etc) and at which loading stations these stores can be carried. Figure 5-3 shows this information in the form of station loading capabilities and pylon requirements. Note that general categories of stores are listed and that specific stores are listed for each category.

NOTE Part numbers for the pylon designations given in figure 5-3 are as follows:

PYLON DESIGNATION	PART NUMBER
I	192-63026-6 and -2
III	192-63051-1 and -2
IV	192-63076-1 and -2
Mod IV	217-48520-1 and -2 or 217-48577-1 and -2
V	192-63151

Once it has been determined which stores can be carried and at what stations, the next step is to determine the loading combinations in which these stores can be carried. All approved external loading configurations are presented in figure 5-4 in the form of three graphs for symmetrical configurations and one table for asymmetrical configurations. For whatever configuration it is desired to fly, a check of the applicable graph or table in figure 5-4 will show if such a configuration is permissible. The graphs and tables are based on the structural integrity of the airplane for the weight and arrangement of the stores installed, on adequate aerodynamic stability for the configuration, and on the ability of the airplane to operate the stores.

Warning All of the permissible loading configurations assume that the clean airplane take-off center of gravity falls within the range of 30-32% MAC. If the clean airplane CG is outside this range, because of improper ballasting or unauthorized modification, the airplane CG can move beyond the limits when external loads are installed.

NOTE All factors which can affect the acceptability of the loading configurations and limitations for this airplane, such as structural, aerodynamic and CG limitations, and controllability requirements, have been considered. In addition, the many combinations of approved loading configurations presented satisfy the largest practical percentage of operational and training requirements.

The three graphs which cover symmetrical configurations, make use of horizontal lines with two or more boxes of store listings attached to each line under the various loading stations. The lines and boxes are used to indicate the limiting combination of stores which can be carried.

NOTE The graphs for symmetrical loadings show only the right-hand wing stations. However, the loading conditions shown for the right-hand stations also apply to the left-hand stations. For example, the two-store symmetrical loading graph lists the 750-pound bomb at the right inboard station; consequently, the 750-pound bomb must also be considered as listed at the left inboard station.

The principle of the graphs makes it imperative that, to determine if a given configuration is permissible, it must be checked in a specific sequence, beginning with the inboard station and proceeding through intermediate to outboard. In addition, when a graph is entered on a certain horizontal line, *only* the stores listed in the boxes attached to that particular line can be considered. If the desired loading configuration cannot be established on one horizontal line, check the other lines individually until it is determined that the loading configuration can or cannot be carried. Since there are only a few approved

STATION LOADING CAPABILITIES AND PYLON REQUIREMENTS

NOTE

- Items listed in station columns are pylon requirements. Where no pylon requirement is given, store cannot be carried.
- Type II 450-gallon drop tank is equivalent to Class II (restricted).

STORE		STATION WHERE STORE CAN BE CARRIED AND PYLON REQUIREMENTS		
		INBOARD (WING STA 55)	INTERMEDIATE (WING STA 106 OR 108-3/8)	OUTBOARD (WING STA 155)
1000 LB BOMBS	M-65A-1*		III	
750 LB BOMBS	M-117	I	III	III
	M-38E-1 (T-28) Fragmentation cluster		III	III
	M-129 (T58E3 Leaflet)		III	III
	MC-1 Toxic	I	III	III
500 LB BOMBS	M-64*	I	III	III
DROP TANKS	Type II 450 gal †		Modified IV†	
	NAA Type III 275 gal‡		Integral Pylon	
	200 gal USAF Type IV (Modified for F-100)	I	III	III
ROCKETS	MA-3 Launcher			III
SPECIAL STORES	MK-7 or M-21 Practice		V and only at LH station	
CHEMICAL TANKS	Approved types not available	I	III	III
MISCELLANEOUS	Napalm bomb (M116A2 750 lb)		III	III

* Use conical fin. Do not use M-34 or M-44 demolition bombs in place of M-65A-1 or M-64 bombs.

† Airplanes changed by T.O. 1F-100C-539 or 1F-100C-548.

‡Type II 275-gallon tanks not approved.

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Figure 5-3

asymmetrical configurations, they can be read directly from the asymmetrical configuration chart. Any asymmetrical configuration not shown on the chart cannot be flown.

NOTE Stores are generally listed by category in the loading charts. If a specific store is to be carried, it must also be listed in the breakdown for that category, as shown in figure 5-3.

G-limit tables also accompany each graph and table. Information on use of these G-limit tables is presented in a later paragraph, "Acceleration Limitations." The following paragraphs present sample problems which show how to determine whether a desired loading configuration is acceptable.

HOW TO DETERMINE APPROVED LOADING CONFIGURATIONS.

The following sequence of steps is necessary to determine whether any combination of stores can be carried on this airplane.

a. Check figure 5-3 to determine whether all desired stores can be carried and at what stations they can be carried. If all desired stores can be carried and will result in a symmetrical loading configuration, proceed to step b.

NOTE If the desired stores result in an asymmetrical loading configuration, simply check the asymmetrical loading table in figure 5-4 to determine whether the stores can be carried and at what stations.

- It is desirable, although not mandatory, that the heaviest stores be placed at the most inboard stations, graduating to the lightest stores at the outboard stations.

b. Select the loading graph corresponding to the total number of stores to be carried.

c. Starting with the heaviest stores desired, select the most inboard station at which these stores can be carried.

d. From the remaining stores, select the next heaviest pair and place it at the most inboard station remaining at which it can be carried.

e. Check the remaining stores against the approved loadings for the remaining stations.

f. After placing the desired stores at the appropriate stations, check to see that all stores lie in the boxes attached to a common horizontal line.

NOTE If all of the desired stores cannot be accounted for by following this procedure, then the combination of stores cannot be carried.

ACCELERATION LIMITATIONS.

The load factor limits shown in figure 5-1 are for the airplane with no external load and for the average external loading configuration. The operating flight limits diagram (figure 5-7) graphically shows combat condition G-limits for the airplane with no external load.

Warning Airplanes not changed by T.O. 1F-100-686 and having more than 300 hours total flying time are restricted to two-thirds of all G-limits. This restriction is imposed because of the possibility that the ribs in the wing tip assemblies may crack under extreme G-loads.

No External Load or Empty Pylons.

Load factor limits for the airplane with no external load or with empty pylons are as follows:

TAKE-OFF CONDITION (Internal fuel exceeds 5400 lb)		COMBAT CONDITION (Internal fuel less than 5400 lb)	
Straight pull-outs	6.0 G	Straight pull-outs	7.33 G
Straight push-downs	−2.0 G	Straight push-downs	−3.0 G
Rolling pull-outs	4.0 G	Rolling pull-outs	4.8 G
Rolling push-downs	0 G	Rolling push-downs	0 G

With External Loads.

G-limits for straight pull-outs and push-downs when external loads are carried are presented in the G-limit tables accompanying the loading graphs and table in figure 5-4. The G-limit tables are based on the total number of stores installed and the structural integrity of each individual store and mounting. To determine the G-limit for straight pull-outs and push-downs when the airplane is carrying certain stores, first select the G-limit table in figure 5-4 accompanying the loading graph for the total number of stores carried. Determine the G-limit for each store carried. The lowest limit so determined is the over-all limit for the configuration, as long as the low-limit store is carried. As stores are released, the G-limits for the resulting loading configuration must be obtained from the loading graph for the remaining number of stores. For example, assume take-off were made with a six-store configuration. The initial G-limits would be obtained from the six-store symmetrical configuration graph. After the first symmetrical pair of stores was released, the configuration G-limits would be those determined from the four-store symmetrical loading configuration graph. After the second pair of symmetrical stores was released, the configuration G-limits would be those determined from the two-store symmetrical loading con-

PERMISSIBLE LOADING

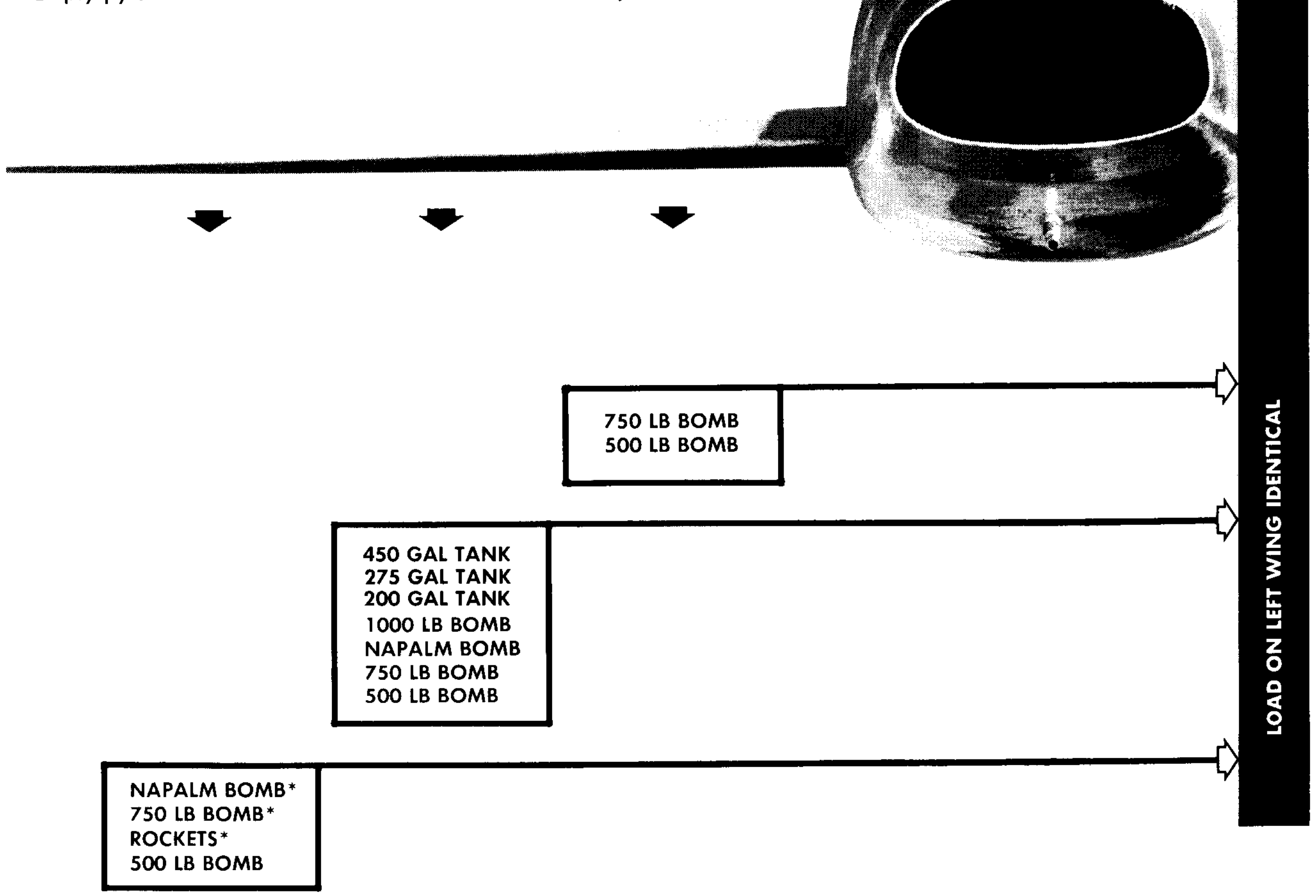
2 STORE SYMMETRICAL LOADING CONFIGURATIONS

CAUTION

If 450-gallon drop tanks are installed, they must be full or empty for take-off. If these tanks are partially full, fuel sloshing may cause the CG to exceed the take-off limit. When fully serviced 450-gallon tanks are carried, do not select fuel from these tanks until initial climb speed is established.

NOTE

- Take-off permissible with or without fuel in the 275-gallon and 200-gallon drop tanks.
- Empty pylons to accommodate other authorized loads may be carried, if desired.



G-LIMITS (STRAIGHT PULL-OUTS AND PUSH-DOWNS)	6.0 G and −2.0 G	5.0 G and −2.0 G	4.0 G and −2.0 G
NOTE Maximum allowable G-limit for a given configuration is the lowest limit listed for the individual stores carried in that particular configuration only.	TYPE III 275 GAL TANK (EMPTY) 1000 LB BOMB NAPALM BOMB 750 LB BOMB 500 LB BOMB	TYPE III 275 GAL TANK (WITH FUEL)	TYPE IV 200 GAL TANK (WITH OR WITHOUT FUEL) TYPE II 450 GAL TANK (WITH OR WITHOUT FUEL) ROCKETS

* Ammunition must not be fired if these stores are to be retained for landing.

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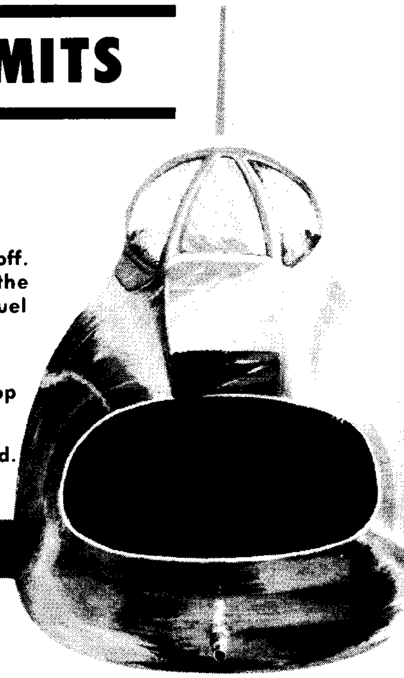
Figure 5-4 (Sheet 1 of 4)

CONFIGURATIONS AND G-LIMITS

4 STORE SYMMETRICAL LOADING CONFIGURATIONS



CAUTION

If 450-gallon drop tanks are installed, they must be full or empty for take-off. If these tanks are partially full, fuel sloshing may cause the CG to exceed the take-off limit. When fully serviced 450-gallon tanks are carried, do not select fuel from these tanks until initial climb speed is established.

NOTE

- Take-off permissible with or without fuel in the 275-gallon and 200-gallon drop tanks.
- Empty pylons to accommodate other authorized loads may be carried, if desired.

LOAD ON LEFT WING IDENTICAL

Outboard station	Intermediate station	Inboard station
	450 GAL TANK 275 GAL TANK 200 GAL TANK 1000 LB BOMB NAPALM BOMB 750 LB BOMB 500 LB BOMB	750 LB BOMB 500 LB BOMB
NAPALM BOMB 750 LB BOMB ROCKETS 500 LB BOMB		750 LB BOMB 500 LB BOMB

G-LIMITS (STRAIGHT PULL-OUTS AND PUSH-DOWNS)

NOTE
Maximum allowable G-limit for a given configuration is the lowest limit listed for the individual stores carried in that particular configuration only.

6.0 G and −2.0 G	5.0 G and −2.0 G	4.0 G and −2.0 G
TYPE III 275 GAL TANK (EMPTY) 1000 LB BOMB NAPALM BOMB 750 LB BOMB 500 LB BOMB	TYPE III 275 GAL TANK (WITH FUEL)	TYPE IV 200 GAL TANK (WITH OR WITHOUT FUEL) TYPE II 450 GAL TANK (WITH OR WITHOUT FUEL) ROCKETS

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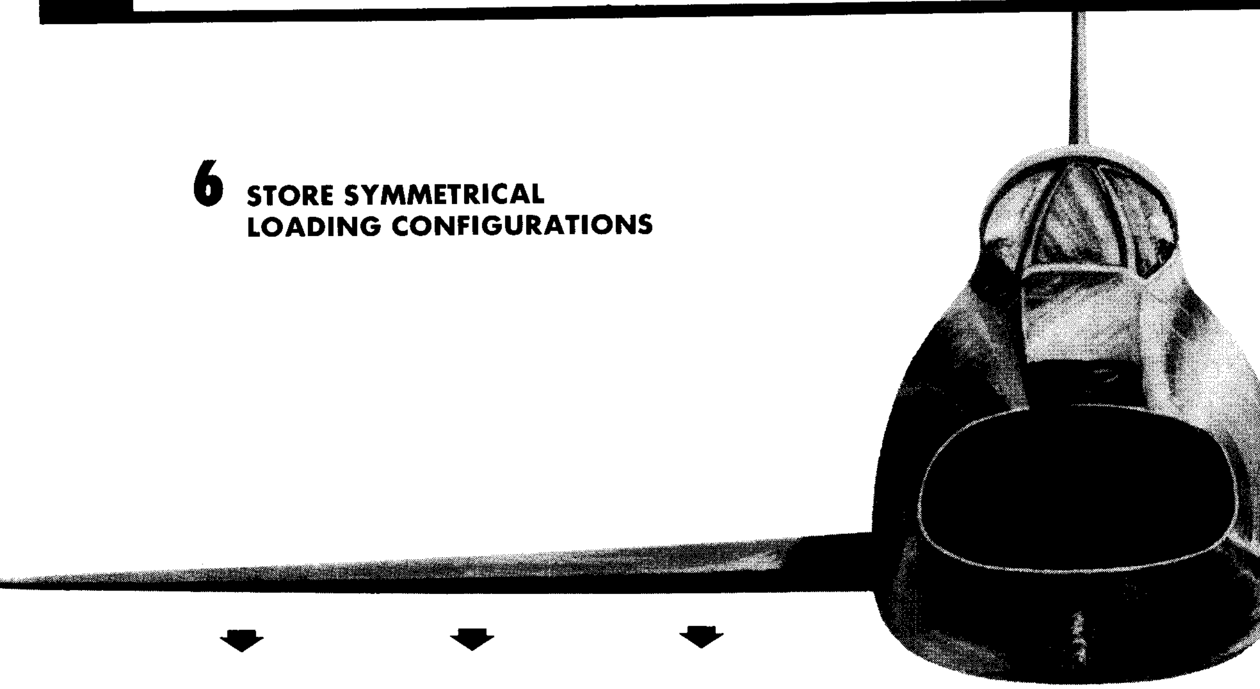
Figure 5-4 (Sheet 2 of 4)

PERMISSIBLE LOADING CONFIGURATIONS

6 STORE SYMMETRICAL LOADING CONFIGURATIONS



NAPALM BOMB 750 LB BOMB ROCKETS 500 LB BOMB	1000 LB BOMB NAPALM BOMB 750 LB BOMB 500 LB BOMB	750 LB BOMB 500 LB BOMB

LOAD ON LEFT WING IDENTICAL

G-LIMITS (STRAIGHT PULL-OUTS AND PUSH-DOWNS)

NOTE
Maximum allowable G-limit for a given configuration is the lowest limit listed for the individual stores carried in that particular configuration only.

6.0 G and −2.0 G	4.0 G and −2.0 G
1000 LB BOMB NAPALM BOMB 750 LB BOMB 500 LB BOMB	ROCKETS

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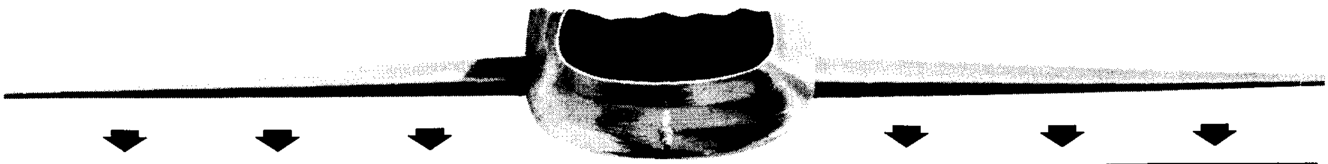
Figure 5-4 (Sheet 3 of 4)

AND G-LIMITS

ASYMMETRICAL LOADING CONFIGURATIONS

NOTE

- Take-off with fewer stores installed (with or without pylons for the omitted stores) is permissible, provided the configuration is one which would normally result from correct sequencing of drop tank fuel and release of stores. Proper sequencing of drop tank fuel is outboard, inboard, then intermediate, except as noted (†).
- Take-off is permissible with or without fuel in the drop tanks, with the following exception: The tank carried at the inboard station must be fully serviced if full tanks are carried at either the intermediate or outboard stations.
- Where a configuration lists more than one store in one or more station blocks, any store in any of these station blocks may be selected.



	275 GAL TANK				NO LOAD SPECIAL STORE 275 GAL TANK 1000 LB OR LIGHTER BOMB*	
	275 GAL TANK	200 GAL TANK			NO LOAD† SPECIAL STORE 275 GAL TANK 1000 LB OR LIGHTER BOMB*	200 GAL TANK‡
	NO LOAD 1000 LB OR LIGHTER BOMB*				NO LOAD SPECIAL STORE 275 GAL TANK 1000 LB OR LIGHTER BOMB*	
					NO LOAD SPECIAL STORE 275 GAL TANK 1000 LB OR LIGHTER BOMB*	
	275 GAL TANK					ROCKETS
						ROCKETS
ROCKETS						
	NO LOAD 1000 LB OR LIGHTER BOMB*					ROCKETS
	275 GAL TANK				NO LOAD 1000 LB OR LIGHTER BOMB*	
	275 GAL TANK			200 GAL TANK		

G-LIMITS (STRAIGHT PULL-OUTS AND PUSH-DOWNS)	7.0 G and −3.0 G	6.0 G and −2.0 G	5.0 G and −2.0 G	4.0 G and −2.0 G
NOTE Maximum allowable G-limit for a given configuration is the lowest limit listed for the individual stores carried in that particular configuration only.	SPECIAL STORE **NOTE** **LIMITS ARE 6.0 G and −2.0 G when internal fuel is more than 5400 pounds.**	TYPE III 275 GAL TANK (EMPTY)	TYPE III 275 GAL TANK (WITH FUEL) 1000 LB OR LIGHTER BOMB	TYPE IV 200 GAL TANK (WITH OR WITHOUT FUEL) ROCKETS

* Does not include napalm bomb.

† If no load is carried at left intermediate station, drop tank fuel should be sequenced inboard, outboard, then intermediate.

‡ If load is carried at left intermediate station and this tank fails to feed, this tank must be dropped before any fuel is used from inboard 200-gallon tank.

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Figure 5-4 (Sheet 4 of 4)

figuration graph. In all cases, the configuration G-limits would be those for the low-limit store installed at the time. When asymmetrical loading configurations are carried, G-limits must be obtained from the asymmetrical loading configurations table, even for configuration changes due to release of stores. Positive G-limits for rolling pull-outs are two-thirds of the limits for straight pull-outs. Negative G-limit for rolling push-downs is 0 G.

MAXIMUM ALLOWABLE AIRSPEEDS.

No External Load or Empty Pylons.

The maximum allowable airspeed for the airplane with no external load or empty pylons is 700 knots IAS. The limit shown in figure 5-1 is for the airplane with no external load.

With External Loads.

Four major factors affect the maximum airspeed which the airplane may attain when carrying external loads. They are the aerodynamic stability of the airplane with various external loading configurations installed, the structural integrity of the individual stores carried, the structural integrity of the mounting, and the flutter characteristics of the configuration. Any one, or combination, of these factors may determine the maximum allowable airspeed. The maximum allowable airspeeds for the airplane when carrying external loads are presented in figure 5-5, and are based on the most limiting combination of factors. If more than one type of store is carried at the same time, the maximum allowable airspeed is the most limiting airspeed shown in figure 5-5 for the individual stores carried. For example, if bombs and NAA Type III 275-gallon drop tanks with fuel are carried, the maximum allowable airspeed is 500 knots IAS. If the bomb Mach limit (Mach .90 below 10,000 feet, Mach .95 between 10,000 and 25,000 feet, and Mach 1.0 above 25,000 feet) is lower than 500 knots IAS, it must be observed.

NOTE For this configuration, if the drop tanks contain fuel and internal fuel is less than 4000 pounds, the maximum allowable airspeed is 450 knots IAS. This is denoted in the qualifying notes of figure 5-5. Again, if the stated bomb Mach limit is lower than 450 knots IAS, it must be observed.

Assuming the same configuration as previously outlined, when the drop tanks are emptied or released, the maximum allowable airspeed becomes 600 knots IAS or the stated bomb Mach limit, if lower.

USE OF LOADING AND LIMITATIONS CHARTS.

The use of the loading and airspeed and G-limits charts is explained in the following sample problems.

Sample Problem No. 1.

Assume that it is desired to carry a four-store symmetrical configuration which consists of two MA-3 rocket launchers and two of the heaviest possible bombs.

1. From figure 5-3, it is determined that MA-3 rocket launchers can be carried at only the outboard stations. Also, it is determined that 750-pound or 500-pound bombs can be carried at the inboard stations, and 1000-pound, 750-pound, or 500-pound bombs at the intermediate stations.

NOTE Although figure 5-3 indicates the bombs at the intermediate stations, the four-store configuration graph in figure 5-4 prohibits carrying any stores at the intermediate stations when outboard stores are carried.

2. Using the four-store symmetrical loading configuration graph in figure 5-4, proceed along the upper horizontal line, beginning with the inboard station. It can be seen that 750-pound bombs are the heaviest listed at the inboard station, but rockets are not listed under the intermediate station. Using the lower horizontal line, it can be seen that 750-pound bombs are the heaviest listed under the inboard station, and rockets are listed under the outboard station.
3. Therefore, the acceptable symmetrical configuration for two MA-3 rocket launchers and two of the heaviest possible bombs consists of a 750-pound bomb at each inboard station and an MA-3 rocket launcher at each outboard station.
4. Using the G-limits associated with the four-store configuration graph, it will be seen that the 750-pound bombs are in the 6.0 G column and rockets in the 4.0 G column. Therefore, the configuration limit is 4.0 G and −2.0 G.
5. Airspeed limits obtained from figure 5-5 show the following limits:

   Bombs—600 knots IAS, or Mach .90 below 10,000 feet, Mach .95 between 10,000 and 25,000 feet, and Mach 1.0 above 25,000 feet.

   Rockets—600 knots IAS. (It is recommended that Mach .80 below 20,000 feet or Mach .90 above 20,000 feet not be exceeded, to prevent failure of launcher nose fairings and decreased cruise range.) Therefore, the airspeed limit is 600 knots IAS, or Mach .90 below 10,000 feet, Mach .95 between 10,000 and 25,000 feet, and Mach 1.0 above 25,000 feet. (It is recommended that Mach .80 below 20,000 feet and Mach .90 above 20,000 feet not be exceeded, to prevent failure of launcher nose fairings and decreased cruise range.)

Warning As indicated in figure 5-4 under "MANEUVER," do not use more than 3/4 rudder deflection at speeds in excess of Mach .80 when stores are carried at the inboard stations.

AIRSPEED AND MANEUVER LIMITATIONS
..... WHEN CARRYING EXTERNAL STORES

AIRSPEED	MANEUVER
600 KNOTS IAS WHEN CARRYING: a. BOMBS—DOES NOT INCLUDE NAPALM Do not exceed Mach .90 below 10,000 feet, Mach .95 between 10,000 and 25,000 feet, or Mach 1.0 above 25,000 feet. b. SPECIAL STORES Do not exceed Mach .95 below 30,000 feet. c. ONE, TWO, OR THREE EMPTY TANKS NAA Type III 275 gal Type IV 200 gal at other than inboard station d. ROCKETS	Rolling G-limits: Pull-outs—2/3 of those for straight pull-outs. Push-downs—0 G.
NOTE When MA-3 rocket launchers are installed and contain rockets, it is recommended that Mach .8 below 20,000 feet or Mach .9 above 20,000 feet not be exceeded. If these speeds are exceeded, launcher nose fairings will fail, which results in decreased cruise range but is not hazardous.	Maximum rate of roll is 120 degrees per second (equivalent to approximately 1/2 aileron deflection at cruise speed).
500 KNOTS IAS WHEN CARRYING: a. TANKS WITH FUEL NAA Type III 275 gal b. FOUR EMPTY TANK CONFIGURATION c. THREE EMPTY TANKS AND SPECIAL STORE d. EMPTY TANKS Type IV 200 gal at inboard station Type II 450 gal e. NAPALM BOMBS Do not exceed Mach .95 below 25,000 feet or Mach 1.0 above 25,000 feet.	No abrupt rudder maneuvers.
450 KNOTS IAS WHEN CARRYING: a. TANKS WITH FUEL Type IV 200 gal **375 KNOTS IAS WHEN CARRYING:** a. TANKS WITH FUEL Type II 450 gal	When stores are carried at the inboard stations, do not use more than 3/4 rudder deflection at speeds in excess of Mach .80.

NOTE

- If external tanks contain fuel and internal fuel is less than 4000 pounds, do not exceed 450 knots IAS for NAA Type III 275-gallon tanks and 340 knots IAS for Type II 450-gallon tanks.
- Do not exceed Mach .95 with Type II or IV tanks.

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Figure 5-5

EXTERNAL LOAD RELEASE LIMITS

STORE	RELEASE LIMITS
BOMBS (Includes Napalms)	Any airspeed and between 0 G and 4 G.
DROP TANKS	Full drop tanks .... Any airspeed in level flight (1 G). Partially full drop tanks .... Not recommended for drop, because partially full drop tanks may tumble and strike the airplane when released. **NOTE** If the risk involved in retaining partially full tanks is considered greater than that due to possible collision of the tanks and the airplane, the tanks should be jettisoned as near 350 knots IAS as possible and in level unaccelerated flight. Empty drop tanks .... Any airspeed above 200 knots IAS in level flight (1 G).
SPECIAL STORES	Any airspeed and above 0 G.
ROCKET LAUNCHERS	Any airspeed between 200 knots IAS and Mach .85 in level flight (1 G).

NOTE

- Any airspeed limitation which is more restrictive than those shown above prevails for normal release of stores.
- In extreme emergencies which require jettisoning of all external loads, such as spins, jettison all loads. This action should be taken even if the recommended release condition cannot be attained or if release of load is not recommended.

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Figure 5-6

6. Either the 750-pound bombs or rockets may be expended first (as indicated in the two-store symmetrical loading configuration graph in figure 5-4). If the rockets are expended first, the G-limits for the 750-pound bombs, as determined from the two-store configuration graph, are 6.0 G and −2.0 G. The airspeed limits, as determined from figure 5-5, are 600 knots IAS, or Mach .90 below 10,000 feet, Mach .95 between 10,000 and 25,000 feet, and Mach 1.0 above 25,000 feet. In addition, do not use more than ¾ rudder deflection at speeds in excess of Mach .80.
7. If the 750-pound bombs are released first, the G-limits for the MA-3 rocket launchers, as determined from the two-store configuration graph, are 4.0 G and −2.0 G. The airspeed limit, as determined from figure 5-5, is 600 knots IAS. (It is recommended that Mach .80 below 20,000 feet and Mach .90 above 20,000 feet not be exceeded, to prevent failure of launcher nose fairings and decreased cruise range.)
8. When all external stores have been released, the clean airplane airspeed and G-limits apply.

Sample Problem No. 2.

Assume that it is desired to carry a six-store symmetrical configuration, consisting of the heaviest possible bombs.

1. From figure 5-3, it is determined that 750-pound and 500-pound bombs can be carried at the inboard stations; 1000-pound, 750-pound, and 500-pound bombs can be carried at the intermediate stations; and 1000-pound, 750-pound, and 500-pound bombs can be carried at the outboard stations.
2. Using the six-store symmetrical loading configuration graph in figure 5-3, proceed along the horizontal line, beginning at the inboard station. It is determined that 750-pound bombs are the heaviest which can be carried at the inboard stations, 1000-pound bombs are the heaviest which can be carried at the intermediate stations, and 750-pound bombs the heaviest which can be carried outboard.

OPERATING FLIGHT LIMITS

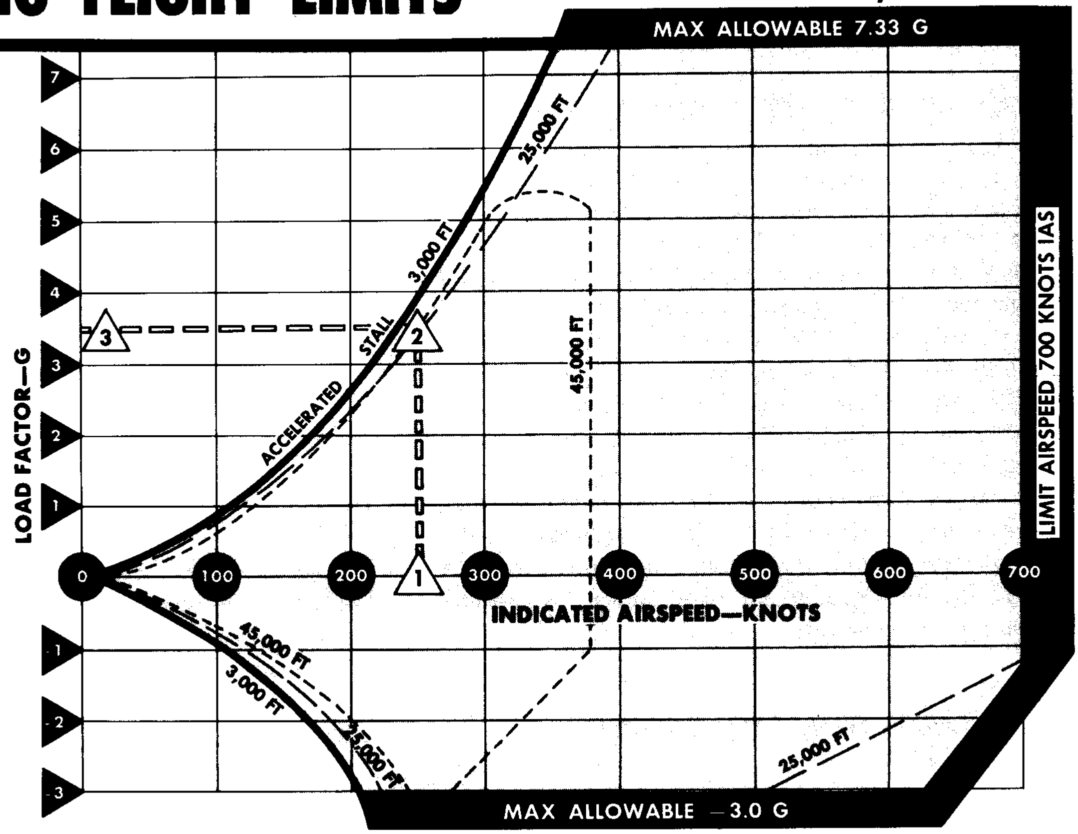
NO EXTERNAL LOAD
GROSS WEIGHT-24,000 LB.

HOW TO USE CHART

1 Select your indicated airspeed—250 knots IAS.

2 Trace vertically to your flight altitude—25,000 feet.

3 Move horizontally to the left and find the maximum G you can pull before stalling—3.5 G.



NOTE
Accelerated stall speeds increase with an increase in gross weight.

F-100C-1-93-10E

Figure 5-7

3. Therefore, the acceptable symmetrical configuration, which includes six of the heaviest possible bombs, consists of a 750-pound bomb at each inboard station, a 1000-pound bomb at each intermediate station, and a 750-pound bomb at each outboard station.
4. Using the G-limits associated with the six-store graph in figure 5-4, it will be seen that all bombs are listed in the 6.0 G column. Therefore, the configuration G-limit is 6.0 G and −2.0 G.
5. Airspeed limits obtained from figure 5-5 are 600 knots IAS, or Mach .90 below 10,000 feet, Mach .95 between 10,000 and 25,000 feet, and Mach 1.0 above 25,000 feet.

Warning As indicated in figure 5-5 under "MANEUVER," do not use more than ¾ rudder deflection at speeds in excess of Mach .80 when stores are carried at the inboard stations.

6. A check of the four-store symmetrical loading configuration graph in figure 5-4 shows that either the 750-pound bombs at the outboard stations or the 1000-pound bombs at the intermediate stations must be released before the inboard stores. When the outboard 750-pound or intermediate 1000-pound bombs are released, a check of the four-store graph shows the configuration G-limits remain 6.0 G and −2.0 G. A check of figure 5-5 indicates the airspeed and rudder deflection limits also are not changed.
7. Either of the remaining two pairs of bombs may be released first, as indicated in the two-store graph of figure 5-4. The G-limits, as determined from the two-store graph, remain 6.0 G and −2.0 G. A check of figure 5-5 shows the airspeed limits remain the same, except that if the inboard bombs are released before the other remaining pair of bombs, the ¾ rudder deflection limit does not apply.
8. When the last pair of bombs is released, the clean airplane airspeed and G-limits apply.

EXTERNAL LOAD RELEASE LIMITS.

Limitations which must be observed when releasing external loads are shown in figure 5-6.

CENTER-OF-GRAVITY LIMITATIONS.

Since there is no in-flight control of CG position (other than normal expenditure of ammunition, release of external loads, and consumption of external fuel), the major factors affecting CG position must be checked before flight; for example, the installation of guns and ammunition. If any guns or ammunition are removed from the airplane before flight, the ammunition boxes must be ballasted with an equivalent weight to maintain the CG within limits. (Refer to Weight and Balance Data Technical Manual, T.O. 1-1B-40.) To maintain favorable CG conditions when carrying external loads, fuel from the drop tanks must be used in the sequence described under "Drop Tank Fuel Sequencing Limitations" in this section. Also, external armament must be released in the sequence described under "Armament Equipment" in Section IV.

DROP TANK FUEL SEQUENCING LIMITATIONS.

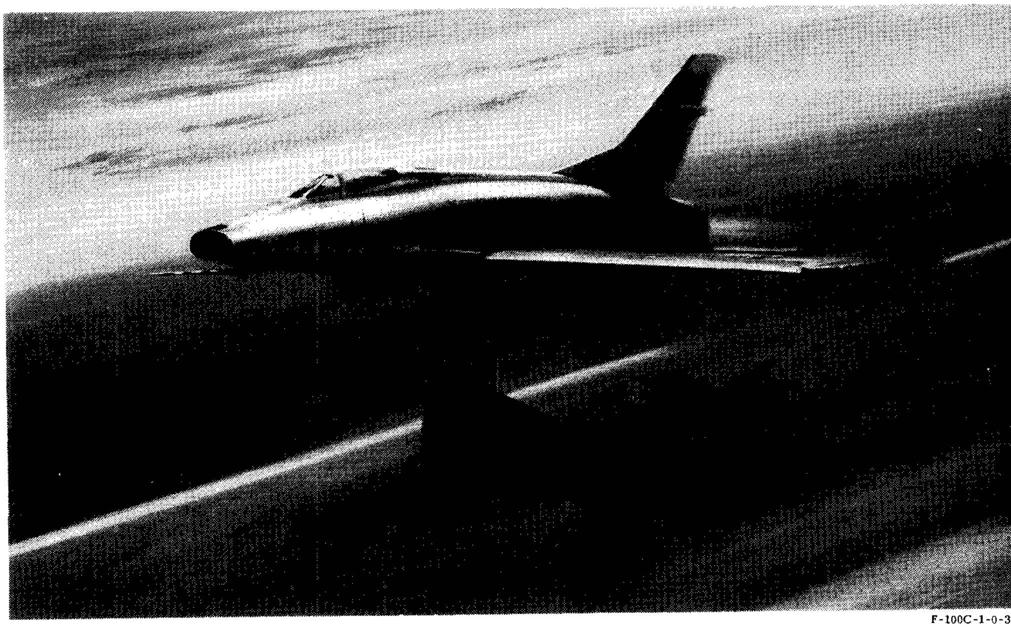
In order to maintain the airplane CG within limits and to ensure adequate lateral control, the drop tank fuel sequencing instructions given in the loading graphs and tables of figure 5-4 must be observed. Unless otherwise noted in these graphs and table, drop tank fuel should be selected at engine start, to ensure maximum use of drop tank fuel in case the tanks must be jettisoned.

Caution The graphs in figure 5-4 instruct that 450-gallon drop tanks must be full or empty for take-off. If any internal system fuel has drained into *empty* 450-gallon tanks, this fuel must be burned out before take-off. (Fuel transfers from these tanks at the rate of about 25 gallons per minute, and the drop-tank-empty indicator light will indicate when they are empty.)

WEIGHT LIMITATIONS.

The design of the airplane precludes the possibility of overloading as long as only approved external loading configurations are flown. (See figure 5-4 for approved external loading configurations.)

NOTE There is no maximum landing weight; consequently, it is not necessary to burn out fuel before landing.



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Section VI
FLIGHT CHARACTERISTICS

TABLE OF CONTENTS

INTRODUCTION.

The airplane handles satisfactorily throughout its speed range. It has no pitch-up or snap tendency in any flight condition. The airplane provides a stable platform for gunnery and bombing in the various modes.

MACH NUMBER.

Mach number provides a convenient speed index of flight characteristics and eliminates the need of remembering a long series of indicated airspeeds for various altitudes. A given flight characteristic appears at the same Mach number at any altitude and varies only in intensity. The lower the altitude, the higher the indicated airspeed for a given Mach number. This higher indicated airspeed is an indication of the greater pressure force that air exerts at lower altitudes; as a result, you notice that, although a specific handling quality occurs at the same Mach number at all altitudes, the effect on the airplane and on the controls is more pronounced at the low altitudes. Figure 6-1 shows the relationship of altitude, indicated airspeed, and Mach numbers. For conversions from indicated to true airspeeds for a standard atmosphere for the range of altitudes and Mach numbers in which you fly, refer to Appendix I.

NOTE Airspeed and Mach number indicator and altimeter readings are affected by position error (because of compressibility effects) which is greatest between .96 and 1.02 Mach number.

MINIMUM CONTROL SPEEDS AND STALLS.

Airplanes with highly swept wings do not, in general, have a clearly defined stall. Instead, an airspeed is reached where mild stick force lightening and mild buffet occur, the flight characteristics begin to deteriorate, rate of descent increases, and the airplane requires an excessive amount of control effort by the pilot to maintain level flight. This is due to the wing tips stalling out, resulting in a forward movement of the center of pressure. The speed at which control requirements

MACH NUMBER CHART

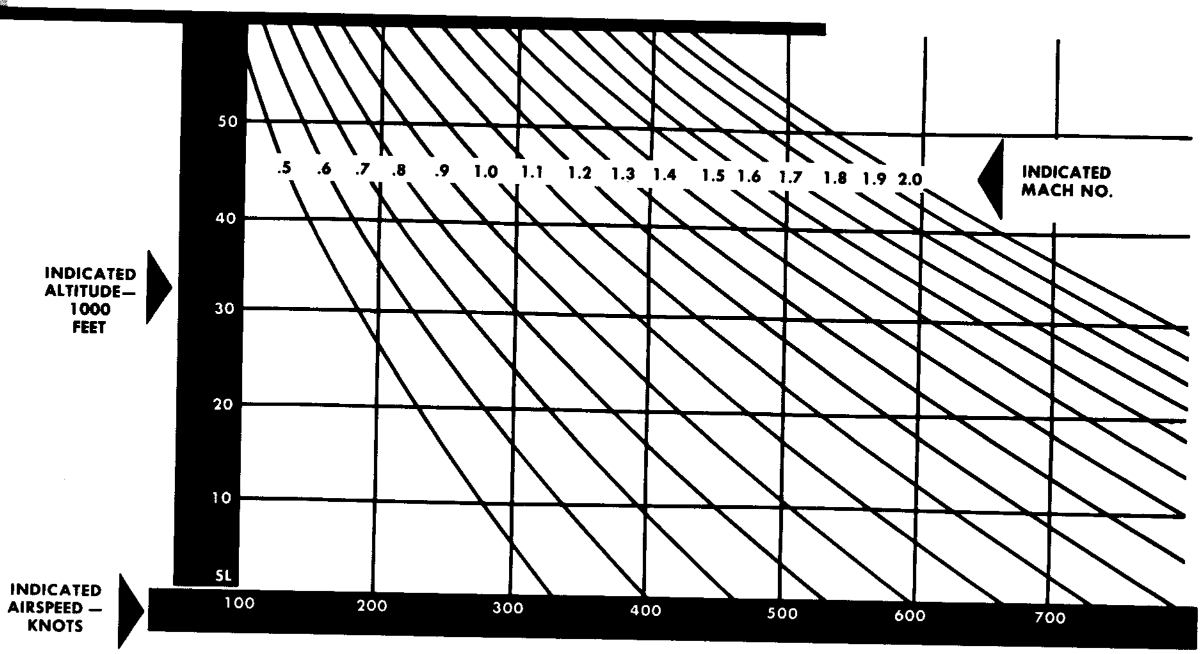

Figure 6-1

become excessive has been defined as minimum control speed. At an airplane gross weight of 25,000 pounds, power-off minimum control speed with gear down in unaccelerated flight is 137 knots IAS. As airspeed is further reduced, there occurs a yawing and rolling tendency coupled with an increase in buffet intensity. These roll-off tendencies require progressively more control action until, at stall, full back stick is required and the rate of descent becomes extremely high. The fact that buffet will occur well above stall, coupled with a roll-off tendency, might prematurely imply a stall condition. At an airplane gross weight of 25,000 pounds, power-off stall speed with gear down in unaccelerated flight is 131 knots IAS. Minimum control speeds and stall speeds are shown in figure 6-2.

STALLS WITH GEAR DOWN.

Because control movement is necessarily excessive in order to control the airplane at stall speeds and because of the increased rate of descent associated with stall, you should not touch down at speeds below the recommended minimum for a particular gross weight.

Caution Because of the extremely powerful longitudinal response, excessive use of the stabilizer can rotate the airplane to extreme attitudes, thereby increasing the drag, rate of descent, and altitude required to recover.

Extending the speed brake at low airspeeds causes a slight nose-down trim change.

STALLS WITH GEAR UP.

Stall characteristics of the airplane with gear up generally are the same as with gear down. Yawing and rolling tendencies occur at speeds comparable to those for gear down at the same gross weights.

ACCELERATED STALLS.

An accelerated stall can occur at high speed when pulling into a tight turn and increasing G through the buffet region to the stall point. A low-speed accelerated stall is preceded by a very mild amount of general airplane buffet and by a mild tendency of the airplane to roll-off and yaw. Recovery can most easily be made by releasing back pressure on the stick and, if necessary, increasing power and diving to accelerate out of the stalling speed range.

Warning To avoid entering inadvertent spins out of accelerated maneuvers, you should

MINIMUM CONTROL SPEEDS AND STALL SPEEDS ...KNOTS IAS

GEAR UP OR GEAR DOWN
BASED ON FLIGHT TEST

NOTE: Stall speeds are shown in parentheses.

	GROSS WEIGHT - LB	ANGLE OF BANK—DEG 0 / LOAD FACTOR—G 1.0	30 / 1.2	45 / 1.4	60 / 2.0
POWER OFF	22,500	131 (125)	139 (133)	152 (146)	177 (171)
POWER OFF	25,000	137 (131)	146 (140)	160 (154)	188 (182)
POWER OFF	30,000	149 (142)	159 (153)	174 (167)	205 (198)
POWER OFF	35,000	159 (154)	170 (166)	187 (179)	221 (212)
POWER ON (MILITARY THRUST)	22,500	124 (117)	132 (124)	145 (138)	169 (165)
POWER ON (MILITARY THRUST)	25,000	130 (123)	140 (132)	153 (146)	179 (176)
POWER ON (MILITARY THRUST)	30,000	143 (135)	153 (145)	167 (161)	196 (193)
POWER ON (MILITARY THRUST)	35,000	155 (146)	165 (158)	180 (173)	212 (208)

NOTE: For recommended final approach and touchdown speeds, refer to "Landing Distances" in Appendix 1.

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Figure 6-2

develop an awareness of the accelerated stall characteristics of the airplane and utilize turning performance of the airplane to a point short of these stalls.

If an accelerated stall is encountered, the airplane will ordinarily roll "over the top," although with some external loading configurations it may roll "under." When the roll occurs, do not fight it with opposite aileron; keep ailerons neutral, apply forward stick, and maintain directional control with rudder. If this procedure is followed, the airplane will have no tendency to spin out of a turn from an accelerated stall.

Warning If airspeed is near stall in either accelerated or unaccelerated flight, do not use ailerons, because this can induce a spin.

STALL RECOVERY.

Stall recovery is made by releasing back pressure on the stick and increasing power to regain flying speed.

Caution If landing gear is down, do not exceed gear-down limit airspeed, as excessive air loads may result in structural damage.

PRACTICE STALLS.

Flight at low airspeeds to determine airplane characteristics should be limited to familiarization and test flights. In order to fly below minimum control speed, excessive control movement is necessary to maintain control of the airplane and it would be extremely easy to cross-control. This condition, if aggravated, could result in a spin.

SPINS.

Warning

Intentional spins in this airplane are prohibited.

The airplane has been spin-tested in the clean configuration, with landing gear down and speed brake extended, with 275-gallon drop tanks installed, and with bomb pylons installed. Tests in these varying configurations have been conducted at medium and high altitudes. The tests reveal that the airplane will not spin in the direction of applied aileron. The aileron is a much more powerful yaw device near the stall than is the rudder and this yaw is opposite in direction to the applied aileron (adverse yaw). With ailerons held at neutral, the airplane will not enter a true spin. With stick full aft and full rudder in the direction of the intended spin, *but with ailerons neutral,* the nose of the airplane pitches up and over slightly and then drops through a 60- to 70-degree nose-down attitude while maintaining a slow rotation rate. The airplane maintains this attitude while yawing slowly in the direction of the deflected rudder. Any time back pressure on the stick is released, the airplane flies right out. If moderate amounts of opposite aileron are added at spin entry, the airplane reacts the same as with ailerons neutral for the first half turn, then yaws up to an attitude of about 20 to 30 degrees nose-down and half-heartedly spins, with the nose oscillating between this attitude and about 60 degrees nose-down. Any time neutral aileron is resumed, the nose falls back to 60-70 degrees below the horizon.

As a spin is entered, the nose of the airplane pitches up and over in the direction of the spin, then drops to 50-60 degrees below the horizon at the end of one-half turn. Yaw then builds up rapidly, as does rotation rate, and the nose swings back up until it is at least level with the horizon at the end of one turn. In high-altitude spins, the nose definitely is 10 to 20 degrees above the horizon at this point. You may have the impression that the spin is going flat. The nose then drops back down to an attitude of about 30 to 40 degrees below the horizon at the end of 1½ turns, then starts to swing back up again. At the end of the second turn, the nose is slightly below the horizon; at 2½ turns, it is about 20 degrees below the horizon; and, from then on, it is fairly stable at about 20 degrees below the horizon. Rotation rate builds up so that the airplane completes the third turn at the rate of one turn in 4 seconds.

Rate of descent after the spin has stabilized is between 1500 and 2000 feet per turn. From entry altitude to recovery in straight-and-level flight, a three-turn, ailerons-against spin usually requires between 14,000 and 16,000 feet. *One-turn spins require about 10,000 feet for recovery to straight-and-level flight.* Because of this minimum clearance necessary for recovery, eject if a spin is entered below 10,000 feet above the terrain or if recovery from a spin entered at a higher altitude is not imminent at 10,000 feet.

With minor exceptions, spins in any combination of the following conditions demonstrate the same characteristics as spins in a clean configuration: out of accelerated turns, with landing gear down, with speed brake extended, or with 275-gallon drop tanks installed. Spins in other than clean configuration at high altitude (above 45,000 feet) appear flatter, with the nose of the airplane higher at the end of the first turn.

It is possible to put the airplane into a violent spin by holding full or almost full ailerons against the spin for several turns and then popping the stick forward while still holding ailerons against the spin.

Mild, rapid engine compressor stalls are often encountered in spins in this airplane, accompanied by a drop from the normal engine idle rpm. However, in no case did flame-out occur during the tests.

If a yawing turn is attempted near the stall, opposite aileron to hold the wings level will very likely start a spin. Large aileron deflections at the top of Immelmanns should be avoided where speed is low. It is interesting to note that this airplane can successfully cross the top of a loop at very low airspeeds *as long as aileron is not used.* Therefore, if airspeed should become lower than expected at the top of an Immelmann, the maneuver should be continued as a loop until sufficient airspeed is attained to use ailerons to roll out.

If a spin is inadvertently entered, some confusion may exist as to what is happening. Generally, fighting a stalled condition causes a spin entry, and the tendency may be to continue fighting, not realizing that a spin is developing. Fighting the stall will only aggravate the spin. Only a small amount of opposite aileron is necessary to cause a spin, so, unless the direction of the spin is definitely known, release all controls. If this is done in time, the spin will stop by itself. If the spin continues, make sure of the spin direction; then apply recovery controls. Proper recovery controls are full opposite rudder, full ailerons with the spin, and full aft stick. *Forces on the pilot during a spin may make it necessary to use both hands on the stick to obtain full recovery controls.* Experience has shown that once you are in a spin and have applied correct recovery controls, it is of no value to return to pro-spin controls and then go back to recovery controls. Recovery controls should be held until rotation stops (observing, of course, the minimum safe altitude for recovery, i.e., 10,000 feet above the terrain). Flight test data shows that the yaw rate begins to drop as soon as recovery controls are applied, even though this may not always be apparent.

The maximum number of turns required to halt spin rotation in the test program was two turns after recovery controls were applied. However, under some aggravated spin conditions, several additional turns may be necessary for recovery.

Figure 6-3 graphically illustrates spin characteristics from a clean configuration entry at 35,000 feet.

SPINS VS SPIRALS.

Spins differ from spirals in rotation rate and pitch oscillations. Spirals exhibit slower, steadier rotation rates and no pitch oscillation. In a spin, you will observe the airspeed drop below 100 knots IAS, while in a spiral, the airspeed remains above stall speed and increases as the spiral progresses.

SPIN RECOVERY.

If a spin is inadvertently entered, regardless of configuration, proceed as follows:

1. Retard throttle to IDLE, to prevent severe engine compressor stall.
2. Release all controls and determine spin direction.
3. Apply full opposite rudder, *full* ailerons *with* the spin and full aft stick.

Caution Jettison external loads, if installed.

- If landing gear is extended when spin is entered, retract gear immediately to prevent structural damage if gear-down limit airspeed is exceeded during recovery.

4. If speed brake is extended, move speed brake switch IN.
5. When rotation stops, the airplane will be in a stall attitude; therefore, use the prescribed stall recovery technique.

Warning Do not hold recovery controls after rotation stops; otherwise, the airplane will enter a spin in the opposite direction.

- If a spin is entered at less than 10,000 feet above the terrain or if recovery from a spin entered at a higher altitude has not been completed by the time you pass through 10,000 feet above the terrain, eject. There will not be enough terrain clearance if recovery is not completed by 10,000 feet.

TYPICAL SPIN CHARACTERISTICS

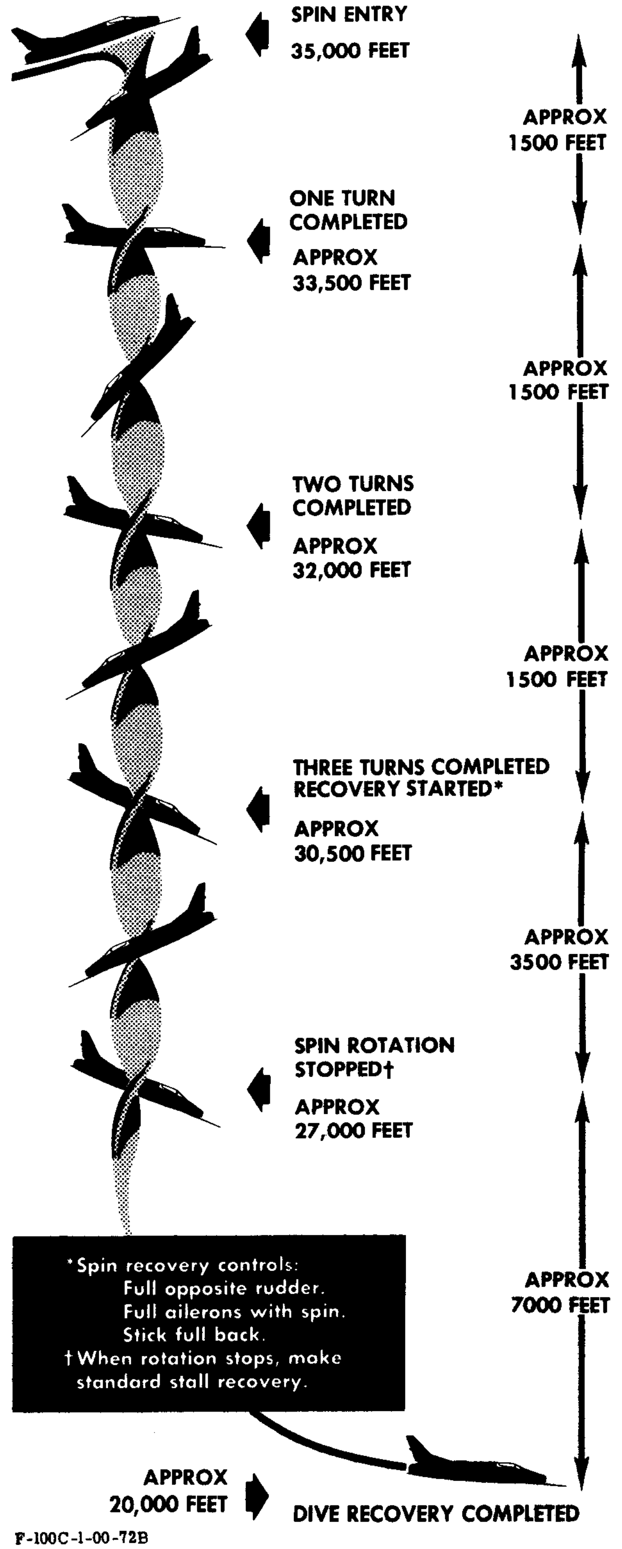
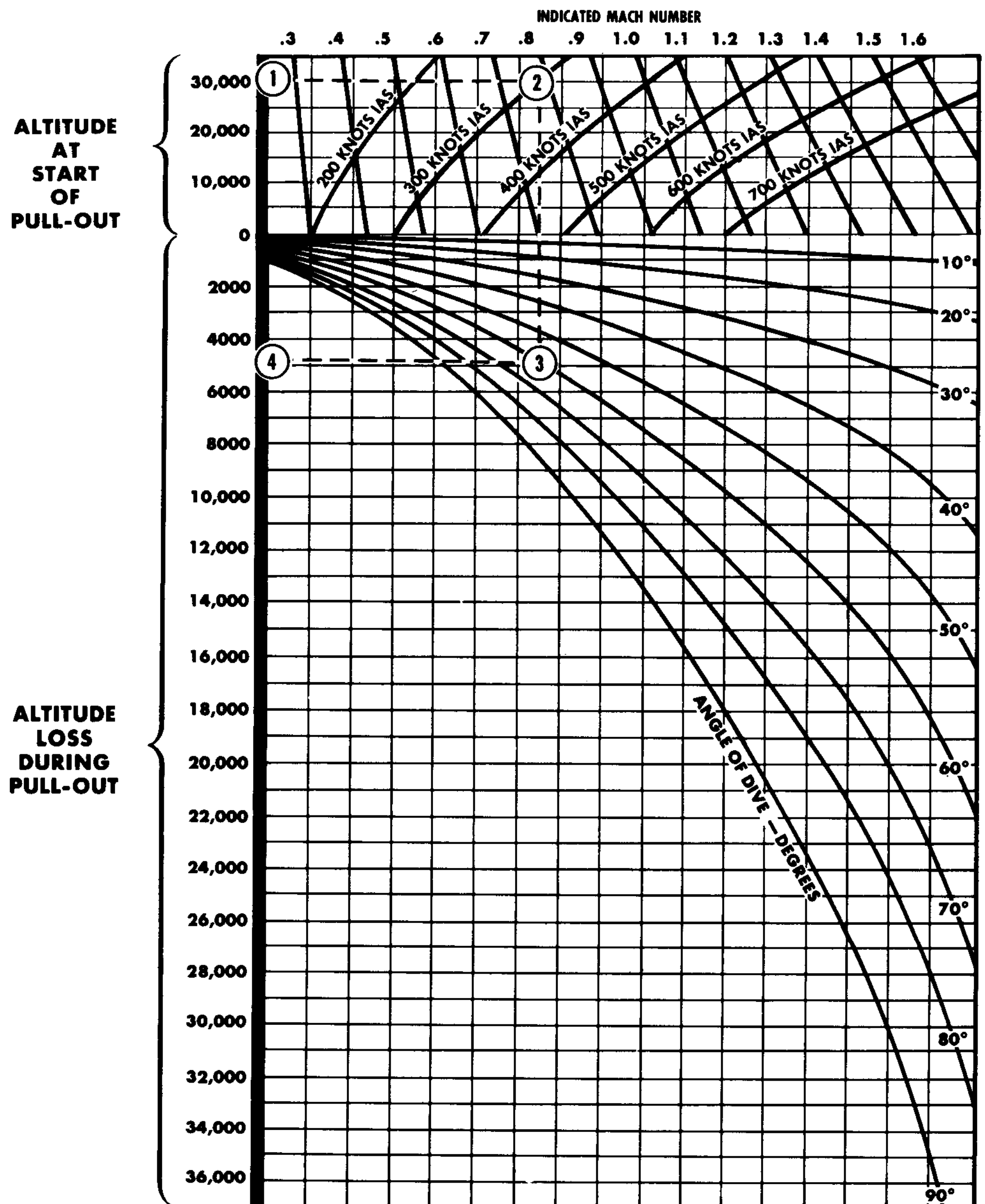


Figure 6-3

ALTITUDE LOSS IN DIVE RECOVERY

CONSTANT **4G** PULL-OUT



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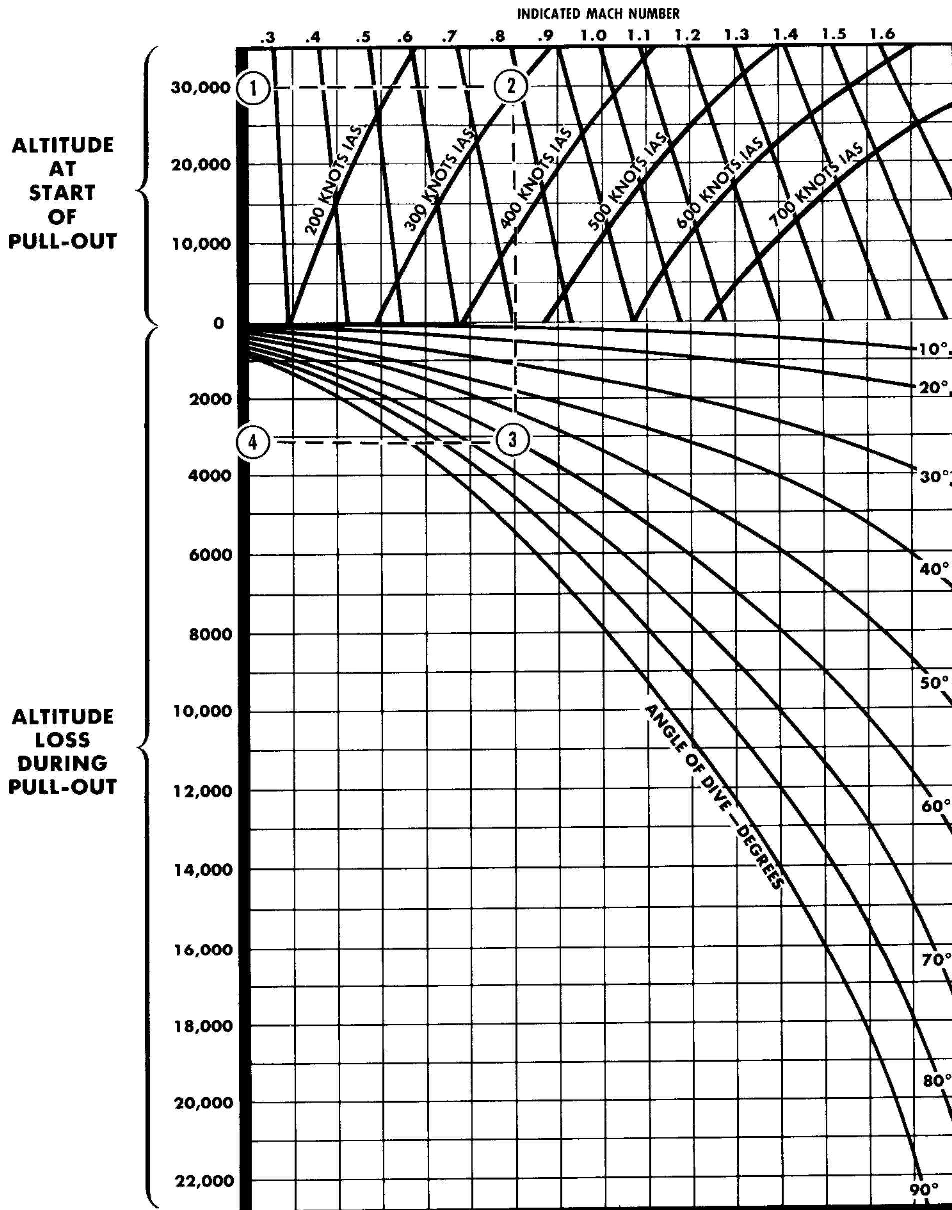
HOW TO USE CHART

NOTE
Altitude loss may be computed by use of either indicated air-speed or Mach number.

Figure 6-4

CONSTANT 6G PULL-OUT



Select appropriate chart, depending on acceleration (4 G or 6 G) to be held in pull-out; then—

1. Enter chart at altitude line nearest actual altitude at start of pull-out (for example, 30,000 feet).
2. Move horizontally along altitude line to the indicated airspeed at which pull-out is started (300 knots IAS).
3. Move vertically down to point on curve of dive angle (60°).
4. Move horizontally to left to altitude scale to read altitude lost during pull-out (constant 4 G pull-out 4900 feet; constant 6 G pull-out 3200 feet).

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FLIGHT CONTROL EFFECTIVENESS.

CONTROLLABLE HORIZONTAL TAIL.

The one-unit controllable horizontal tail provides good over-all maneuvering characteristics at both subsonic and supersonic speeds. The use of this type control permits operation at all flight conditions with rapid airplane response. The increased response over conventional elevator-type controls should be most noticeable at low altitudes and high speeds; therefore, you should use caution when flying at those conditions in order to avoid excessive G that results from overcontrolling. The airplane can be inadvertently rotated to extreme pitch angles at low airspeeds, because of the relatively large amount of horizontal stabilizer control available.

Warning Because the resulting acceleration can cause you to pull back on the stick and induce a stall and possibly a spin, use caution when lighting the afterburner at low airspeeds or when maneuvering under high G-loads.

Airplane response is sluggish at low speeds, and large stabilizer movements are required for airplane reaction. As a result, overcontrolling at these speeds can make demands on the flight control hydraulic systems that are close to the design limits. When an instantaneous demand is higher than available hydraulic system flow, the control stick "stiffens" momentarily. (Refer to "Landing" in Section II for recommended landing techniques.) The artificial-feel system gives stick forces proportional to stick deflection. Since the stick deflection required for maneuvering the airplane varies with both altitude and Mach number, the maneuvering forces also vary with altitude and Mach number. A stick force reversal is encountered at transonic speeds.

AILERON CONTROL.

Because the ailerons are mounted farther inboard than conventional aileron installations, the loss in rate of roll due to the wing twisting under high air loads is minimized. Very high rates of roll can be obtained; therefore, use ailerons cautiously until thoroughly familiar with their effectiveness. Yaw due to aileron deflection is noticeable in this airplane. Adverse yaw (yaw in the direction opposite to aileron application) occurs at subsonic speeds, and small increments of favorable yaw (yaw in the direction of aileron application) occur in the transonic and supersonic speed ranges. Therefore, when coordinated turns are made at subsonic speeds, the standard practice of applying small amounts of rudder in the same direction as the turn should be followed; whereas in the transonic and supersonic speed ranges, it may be necessary to hold small amounts of opposite rudder for coordinated maneuvers.

Warning If airspeed is near stall in either accelerated or unaccelerated flight, do not use ailerons, because this can induce a spin.

RUDDER CONTROL.

The rudder gives effective directional control at all normal flight speeds. Because of the high dihedral effect (roll due to yaw) common to swept-wing designs, the rudder is very effective in picking up a low wing at low airspeeds. Sufficient rudder is available throughout the flight range for all normal purposes. Abrupt maximum rudder deflections at subsonic speeds should be avoided because of high rudder effectiveness. Sudden application of full rudder at speeds near .8 Mach number when no external loads are installed results in large yaw angles. Resulting high side forces are imposed on the pilot's body, leading to pilot-induced pitching and rolling oscillations. These rolling and pitching oscillations can be avoided by releasing or returning all controls to neutral.

SPEED BRAKE.

The speed brake is very effective and creates a considerable amount of drag with little objectionable buffeting. It may be used at any time to slow the airplane, with small trim changes required. When the speed brake is full out at low speeds, it creates a mild buffet, which could give a false impression that the airplane is nearing stall. Speed brake extension at supersonic speeds may cause the airplane to yaw slightly because of some asymmetry in shock wave formation on the speed brake.

NOTE Although the speed brake may be used at any speed, a relief valve in the hydraulic line allows the speed brake to retract when aerodynamic loads become excessive. The speed where air loads will cause the speed brake to start to retract varies from about 500 knots IAS at 10,000 feet to about 580 knots IAS at 30,000 feet.

SLAT OPERATION.

Wing leading edge slats are installed to improve airplane stability at high angles of attack, to decrease airplane drag in maneuvering flight, and to delay the onset of buffet. The slats are designed to operate at both high and low Mach numbers. Slat operation is automatic and depends on airspeed and angle of attack of the airplane. The slats normally are open at low speeds, and fully closed for climb, cruise, and high-speed flight. To delay the onset of buffet and to increase the lift available, the slats open at high Mach numbers when nearing the airplane ceiling or when pulling moderate G. Opening of the slats at high Mach numbers is normal and beneficial to over-all performance.

LEVEL-FLIGHT CHARACTERISTICS.

LOW SPEED.

Recommended speeds for take-off, approach and landing phases of flight are given on the take-off distances and landing distances charts in Appendix I ("Take-off Distances" and "Landing Distances"). Handling characteristics at low speeds are influenced by the basic drag and angle-of-attack variations. As a result, essentially two speed ranges exist: one, speeds above touchdown speed; and two, speeds from touchdown to stall.

Above Touchdown Speed.

Above the touchdown speed, flight characteristics are conventional, with normal control effectiveness and airplane response. The high wing loading for this airplane requires high engine thrust settings for flight in this speed range.

Below Touchdown Speed.

At speeds below touchdown, airplane behavior is greatly influenced by the angle of attack required. Longitudinally, the airplane can be flown down to the minimum speeds using about one-half to three-fourths stabilizer travel. Since the available stabilizer control has been provided primarily for high Mach number maneuverability, more than adequate control is available at low speed. Thus, it is possible to fly the airplane to angles of attack well above the normal touchdown angle. In this nose-high attitude, however, airplane response is slow; drag is high, with resulting high rates of descent; or to maintain constant altitude, very high engine thrust is required. The high dihedral effect associated with high angles of attack (roll due to yaw) requires that sideslip be kept at a minimum to avoid any roll-off tendency. If sideslip is allowed to progress at speeds close to stall, ailerons alone cannot overcome the resulting roll due to sideslip. However, zero sideslip can easily be maintained with the rudder at speeds down to and including stall. It is also doubly important to consider the rate of descent variation with speed during the landing approach. At speeds below the recommended minimum touchdown speed, the rate of descent for a given power setting increases rapidly as the speed is reduced. In view of the higher rates of descent and inability of the airplane to flare at these low speeds, the airplane should not be flown below the recommended minimum speeds, except at altitude during familiarization and test flights. In addition, touchdown at airspeeds under the recommended minimum would require such a high angle of attack that the tail skid would contact the runway before the main gear.

NOTE Approach and touchdown speeds, which vary with gross weight, are shown on the landing distances charts of Appendix I.

CRUISE SPEEDS.

At moderate speeds, the airplane handling characteristics and control effectiveness are excellent. A large amount of power is available for rapid airplane accelerations.

HIGH SPEEDS.

An outstanding feature of the airplane is its ability to attain very high speeds and Mach numbers. Little or no lateral or directional trim changes are encountered, and control is effective and positive. A longitudinal trim change due to compressibility effects is encountered between .85 and .95 Mach number. This is evidenced by a mild stick force gradient reversal as speed is increased through this speed range. The stick force required to maneuver in this speed range is normal, in that pull forces are required to increase G and push forces are required to decrease G. Because of the excellent aileron effectiveness at high speeds, large aileron movements should not be attempted until you are thoroughly familiar with the response. No wing drop is encountered in the transonic Mach number range.

MANEUVERING-FLIGHT CHARACTERISTICS.

MANEUVERABILITY.

The stick forces required in maneuvering flight are reasonable and generally at a comfortable level. Airplane operation at high altitudes and high Mach numbers requires somewhat higher stick forces than at the lower altitudes.

Supersonic Speeds.

The stick forces required for maneuvering flight at supersonic speeds are higher for small accelerations (2 to 3 G) than at subsonic speeds. When rolling pull-outs are performed at high supersonic speeds, sudden reduction in G coupled with large changes in aileron deflection may produce moderately high yaw angles. Therefore, the proper technique for recovery from a rolling pull-out at supersonic speeds is to neutralize the ailerons while holding constant G, and, after the roll has stopped, acceleration force may be reduced to 1 G flight condition.

Subsonic Speeds.

At speeds in the vicinity of .8 Mach number at low altitude, stick forces required to reach accelerations of 4 G or more are low. Caution should be exercised when performing a rolling pull-out maneuver in this speed, altitude, and G-range; abrupt use of the horizontal stabilizer should be avoided, because of the relatively light stick force required to increase G.

Caution Abrupt use of the horizontal stabilizer during a rolling pull-out in the region of .8 Mach number can cause you to pull excessive G.

DIVES.

In high Mach number dives and maneuvers, stability and control characteristics are very good. The stick forces remain at a comfortable level, and no adverse airplane or control characteristics exist. To obtain the maximum dive Mach numbers, you should use a shallow dive angle at high altitudes in order to gain the utmost speed from the engine thrust available, then push over into successively steeper dive angles, holding as closely to a zero-G condition as practicable. Caution must be taken to keep fuel flow and oil pressure within limits.

DIVE RECOVERY.

Stabilizer stick forces for recovery are reasonable and well within pilot capabilities. Because of the ease of control, you should be careful not to develop excessive G by overcontrolling.

Altitude Loss in Dive Recovery.

The altitude lost during dive recovery is determined by four interdependent factors: (1) angle of dive, (2) altitude at start of pull-out, (3) airspeed at start of pull-out, and (4) the G maintained during pull-out. Because these factors must be considered collectively in estimating altitude required for recovery from any dive, their relationship is best presented in chart form as shown in figure 6-4. Note that one of the charts is based on a 4-G pull-out, the other on a 6-G pull-out. Compare the altitude lost during recovery from a 4-G pull-out with that lost during recovery from a 6-G pull-out; also compare the effects of variations in the other three factors. Remember that a value obtained from either chart is the altitude lost during recovery—not the altitude at which recovery is completed. Therefore, in planning maneuvers that involve dives, consider first the altitude of the terrain and then use the charts to determine the altitude at which recovery must be started for pull-out with adequate terrain clearance. In using the charts, you should allow for the fact that, without considerable experience in this airplane, you cannot determine exactly what your dive angle and speed are going to be at the start of pull-out. If you come out of a split "S" or other high-speed maneuver in a near-vertical dive, speed builds up rapidly. Consequently, until you know the airplane well, use the chart at the highest speed and dive angle you might expect to reach after completing your maneuvers. Maneuvers should be planned so that if they terminate in a near-vertical dive, the airplane may be pulled on through to a shallower dive angle before speed becomes excessive.

NOTE It is a good idea to memorize a few specific conditions from the dive recovery charts, so that you may have a basis for judgments on pull-outs.

ROLLS.

The aileron system is designed to produce adequate roll rate at maximum dive speed; therefore, roll rate can be expected to be quite high at lower speeds when full aileron deflection is used. Because of several aerodynamic effects, rolling is accompanied by a tendency to yaw. Through a gyroscopic effect known as inertial coupling, any yaw that does develop is accompanied by pitching. The tendency to yaw is opposed by the vertical stabilizer. As long as established roll limits are observed, the airplane exhibits only minor yawing tendencies. Refer to "Prohibited Maneuvers" in Section V for roll limits. High roll rates are available with considerably less than full aileron deflection under most operational flight conditions, and inertial coupling will not be encountered as long as roll rates are kept at a level that is comfortable to the pilot. If inertial coupling is encountered during high-rate rolls, smoothly reduce aileron deflection until the roll rate is normal and the pitching motions cease.

ANGLE OF ATTACK.

Airplane angle of attack is a function of airspeed, dive angle, altitude, gross weight, and load factor. It varies inversely with change in airspeed and dive angle, and directly with change in altitude, gross weight, and load factor. The effect of angle of attack must be considered in rocket firing and bombing missions. For additional information, refer to "Angle-of-attack Relationship" in Section IV.

SHOCK-INDUCED BUFFET.

Airplane buffet is encountered at transonic speeds at high altitude. This buffet is induced by a spanwise shock wave which occurs on the wing at these flight conditions. Turbulent separation occurs behind the shock, and it is this separation of the airflow that produces the shock-induced buffet. Since this condition can occur in 1 G flight, it has been popularly called "1 G buffet" to differentiate it from stall buffet. However, shock-induced buffet can occur in maneuvering flight where the wing shock appears before the stall buffet is reached. Buffet is mild as the buffet region is entered and usually appears in the form of slight stick shake. It grows in intensity to a general airplane buffet as the region is penetrated. The regions in which buffet is encountered are shown graphically in figure 6-5. It should be noted that the airplane will not encounter shock-induced buffet in the cruise condition. Buffet is encountered only mildly at very high altitude when climbing on recommended climb schedule.

FLIGHT WITHOUT CANOPY.

If canopy is jettisoned in flight or released inadvertently, flight characteristics are not affected. Wind noise in the cockpit will be high, and the wind blast may cause your eyes to water even with your helmet visor down. Leaning forward in the cockpit will reduce these discomforting conditions. Approach and touchdown speeds remain unchanged.

FLIGHT WITH EXTERNAL LOADS.

NORMAL LOADING CONFIGURATIONS.

NOTE Normal loading configurations are approved configurations, including those resulting from proper sequencing of drop tank fuel and release of external loads.

In general, both longitudinal and directional stability are slightly decreased in the various combinations of normal symmetrical and asymmetrical external loading configurations. The amount of decrease varies with the shape and weight of the loads and their locations on the wing. The cleaner the load, the less its effect on the flight characteristics of the airplane. For example, the 275-gallon drop tanks have a negligible effect on the handling characteristics of the airplane. The heavier the loads carried, the more sluggishly the airplane handles. The stabilizing forces on the vertical and horizontal stabilizers are unchanged, but increased inertia makes return to trim following a disturbance slower and increases overshoot tendencies. Location of the loads on the wing affects longitudinal airflow characteristics and directional stability, in addition to changing the center of gravity. When 275-gallon drop tanks are installed at the intermediate stations, and 750-pound bombs at the inboard stations,

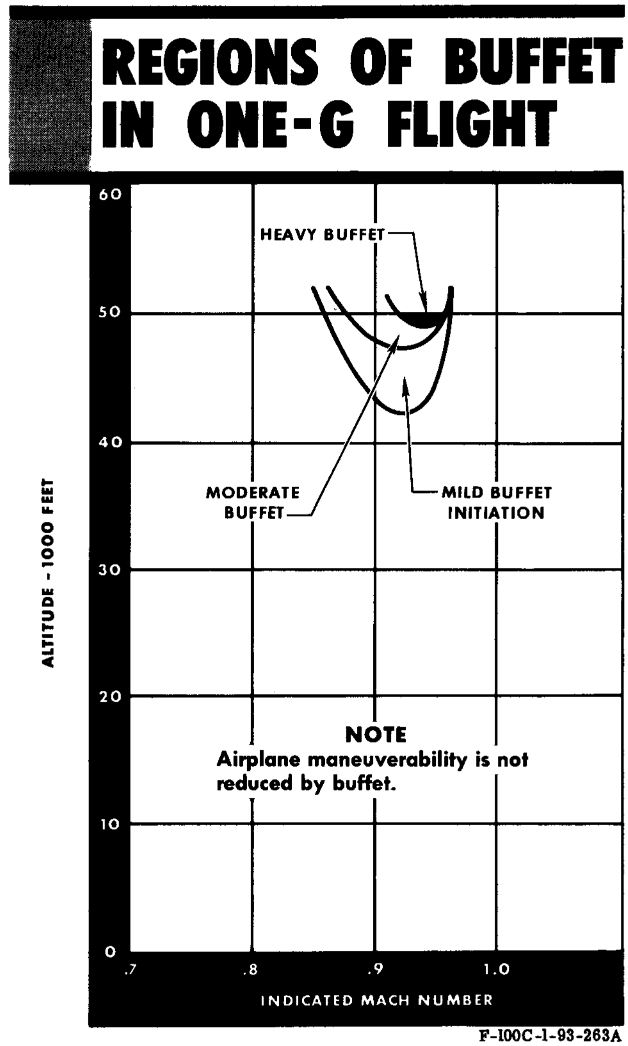

Figure 6-5

directional stability is somewhat decreased because of the inboard pylons, and the yaw damper should be used to reduce the lateral-directional oscillations which may occur at high speeds.

NOTE During take-off and landing, the dampers should not be engaged.

Loads mounted at the inboard stations, although they move the center of gravity forward, decrease directional stability of the airplane because they are forward of the center of gravity, thus detracting from the stabilizing effects of the vertical stabilizer. The cleaner and smaller the load at this station, the less this effect and the less the change in airflow over the horizontal stabilizer.

NOTE Deterioration of flying qualities due to external stores and pylons is greatest when the stores or pylons are at the inboard stations. Therefore, if operational conditions permit, do not carry pylons at the inboard stations.

Normal Asymmetrical Loading Configurations.

The installation of asymmetrical loading configurations has certain deteriorating effects on flight characteristics beyond those encountered with symmetrical loading configurations. The following paragraphs present information on normal asymmetrical loading configurations. The most extreme normal asymmetrical loading configuration is that of only the MK-7 special store installed at the left intermediate station. The following procedures and information pertain generally to this extreme configuration. For less extreme normal asymmetrical loading configurations, the deviation from normal techniques and flight characteristics is proportionately less.

Taxiing. In general, ground handling is influenced by the asymmetrical weight distribution betwen the left and right wings and requires more-than-usual nose wheel steering during taxiing.

Take-off. At start of take-off roll, maintain heading by use of nose wheel steering up to at least 135 knots IAS. Upon release of nose wheel steering, simultaneously apply right rudder to prevent airplane from skidding. (This is particularly necessary in gusty wind conditions.)

NOTE As airspeed increases, the amount of right rudder deflection required decreases proportionately.

At 155 knots IAS, raise nose wheel slowly off runway. More right rudder will be needed as the nose is raised. The attitude should be established so that the airplane will lift off the runway at about 170 knots IAS. Be prepared to correct for a possible yawing tendency as the airplane becomes air-borne. Do not pull the airplane off. If you do, the tendency of the airplane to yaw to the left and then roll to the left will be increased.

NOTE If the airplane is allowed to yaw at lift-off, a moderate left-wing roll is encountered. This can be corrected by use of the rudder and aileron.

- A small amount of aileron trim is desirable, but optional, for take-off. If it is used, set left aileron so that its trailing edge is about 3/4 inch below the wing trailing edge.

Instrument take-off with asymmetrical loading configurations is not recommended. Directional control during take-off and initial climb is critical. If such a take-off must be made, the airplane should be trimmed out after take-off before entering the overcast.

Cruise Flight. With asymmetrical loading configurations, any change of airspeed causes the airplane to yaw. This must be trimmed out.

Speed Brake Operation. When the special store is installed at the left intermediate station and when a drop tank or pylon is installed at the right inboard station, a right yawing moment is experienced when the speed brake is extended. To minimize the effect of the yaw condition, open the speed brake in small increments and apply left rudder as necessary to maintain heading. The magnitude of the yaw is proportional to airspeed.

Afterburner Operation. When the afterburner is ignited in flight with an asymmetrical load, a nose-down pitching moment is encountered because the axis of thrust is above the center of gravity of the airplane. (Center of gravity is lowered vertically with the addition of heavy external loads.) This trim change due to thrust can easily be corrected. When the afterburner is shut down, a nose-up moment is encountered. A slight directional disturbance may also be encountered with use of the afterburner.

Holding or Loitering. Holding or loitering with asymmetrical loads above 30,000 feet is not practical because of power requirements. If holding or loitering is required, it should be accomplished at or below 30,000 feet and at about 275 knots IAS.

High-speed Flight. With asymmetrical loads, the airplane encounters store buffet at about Mach .85 to .90. This increases in intensity up to the limiting Mach number. At Mach .93, wing roll is encountered but is controllable with ailerons. The airplane encounters a change in directional trim as airspeed is increased.

Maneuvering Flight. Asymmetrical loading configurations will present lateral-directional control problems in maneuvering flight near limit load factor or stall speed. The weight of the asymmetrical load produces a rolling moment which increases in direct proportion to airplane load factor. Thus, the aileron required to balance this rolling moment increases with increasing G. At high load factor or near stall speed, the aileron effectiveness deteriorates, and greater aileron deflections are required to overcome the wing-heavy condition caused by the asymmetric loading. In a rolling maneuver where G is pulled, it is possible to reach a condition of speed and G where full aileron control will not overcome the rolling moment caused by the asymmetric load. If this occurs, lateral control can be regained only by relaxing back stick pressure and reducing angle of attack or G.

A directional control problem is also produced by the yawing moment due to store drag and the yawing moment induced by the aileron deflections required to hold up the heavy wing. These yawing moments tend to be additive as airplane load factor is increased or speed reduced, resulting in an increased tendency for the airplane to yaw toward the wing with the higher store drag. The net effect of these yawing moments may be favorable (into the turn) or adverse (out of the turn), depending on the direction of the turn and the amount of aileron required to balance the asymmetrical load in the accelerated maneuver.

Warning When asymmetrical loading configurations are flown, avoid maneuvering near limit load factor or stall speed. If it is necessary to fly near stall speed, use extra care in keeping the maneuver coordinated (ball centered). If the airplane does stall, the yawing moments caused by the asymmetrical load and the aileron required to balance the load may tend to induce a spin.

Landing. When normal asymmetrical loading configurations are installed, sufficient rudder and aileron effectiveness is available to use the approach and touchdown speeds presented in Appendix I for the airplane gross weight involved.

NOTE Lowering the landing gear causes yaw. When performing an instrument approach, this yaw should be trimmed out before turning on final approach. Use of the speed brake is not recommended on final during an instrument approach, because of the yaw produced when the speed brake is extended.

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LONGITUDINAL CONTROL PROBLEMS...

WITH ABNORMAL ASYMMETRICAL LOADING CONFIGURATIONS

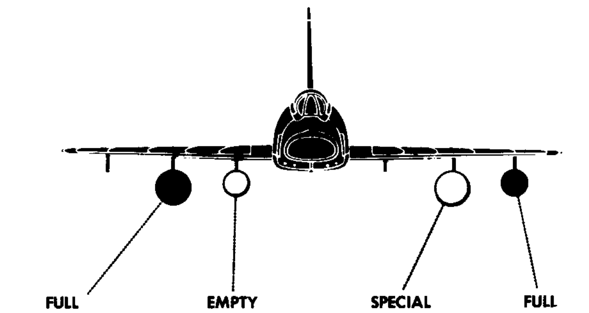
CONFIGURATION	RECOMMENDED ACTION
	**If, contrary to existing instructions, the inboard 200-gallon tank is emptied first and retained, burn fuel from the outboard 200-gallon tank to return the CG to a satisfactory position. If the outboard tank fails to feed and cannot be jettisoned, dropping the inboard tank or the special store or retaining ammunition will provide improved longitudinal handling characteristics. If a full outboard tank must be retained, do not burn fuel from the 275-gallon tank as a lateral control problem will result. If a 275-gallon tank is carried in place of the special store, empty both 275-gallon tanks. Dropping these tanks will provide a further improvement in handling characteristics.**

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Figure 6-6

ABNORMAL LOADING CONFIGURATIONS.

NOTE Abnormal loading configurations are defined as those which develop from approved loadings as a result of system failures or pilot error, or both (such as failure of a drop tank to feed and failure of that tank to jettison, or improper sequencing of drop tank fuel).

Abnormal Symmetrical Loading Configurations.

NOTE No forward CG limits problem will occur as a result of abnormal symmetrical loading configurations.

Certain abnormal symmetrical loading configurations will cause the airplane center of gravity to exceed aerodynamic limits, thus producing longitudinal stability and control problems. The airplane will exceed the aft stability limits if ammunition is fired and the stores are retained for the following configurations only:

a. Rockets or bombs heavier than 500 pounds at the outboard stations only.

b. Rockets or bombs at the outboard stations and bombs at the intermediate stations.

Longitudinal control becomes sensitive in these configurations, particularly in the speed region of Mach .75 to .85 at low altitude. The resulting overcontrol problems will demand greatly increased pilot attention at time of these flight conditions; however, the airplane can be flown safely and a safe landing can be made at the approach and touchdown speeds presented in Appendix I.

Abnormal Asymmetrical Loading Configurations.

Certain abnormal asymmetrical loading configurations will present longitudinal stability and control problems as well as lateral control problems. These problems are discussed in the following paragraphs.

Longitudinal Stability and Control Problems. The configuration shown in figure 6-6 will result in an airplane center of gravity aft of the aft stability limit. The unsatisfactory CG condition results from an asymmetrical four store loading with a store at an outboard station wherein (contrary to existing instructions) the inboard 200-gallon drop tank was emptied first and retained. The recommended action listed will provide improved longitudinal handling characteristics either through a CG shift or by an increase in airplane stability due to dropping stores. If the recommended action is not taken, the airplane CG will remain behind the aft stability limit. This will result in longitudinal control sensitivity, particularly in the speed region of Mach .75 to .85 at low altitude. The resulting overcontrol problems will demand

LATERAL CONTROL PROBLEMS . . . WITH ABNORMAL ASYMMETRICAL LOADING CONFIGURATIONS

CONFIGURATION (Assumes stores on one wing only with or without empty tanks or pylons on other wing)	RECOMMENDED INCREASE IN LANDING DISTANCES CHART APPROACH SPEED—KNOTS IAS*
ONE FULL 450-GALLON TANK AT INTERMEDIATE STATION†	0
ONE FULL 200-GALLON TANK OUTBOARD PLUS ONE FULL 275-GALLON TANK INTERMEDIATE	7

* No additional increment for experience level should be added to the approach speeds for abnormal asymmetrical loading configurations when the flat, straight-in approach is used.

† No increase in approach or touchdown speed is required for any permissible single store loading at either the inboard or outboard wing stations, or for any store lighter than a full 450-gallon tank at the intermediate station.

WARNING

No more than 10 knots should be lost from the approach speed in accomplishing the flare and touchdown, to ensure lateral control speed.

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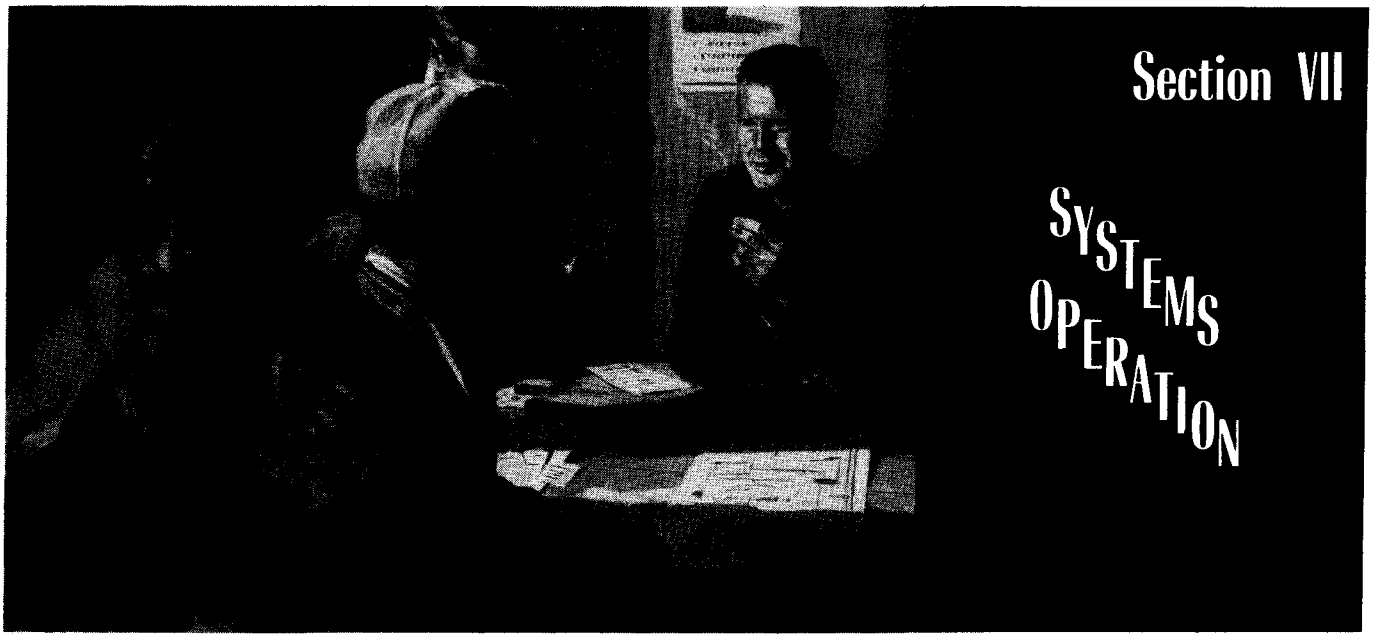
Figure 6-7

greatly increased pilot attention at time of these flight conditions; however, the airplane can be flown safely and a safe landing can be made.

Lateral Control Problems. Certain abnormal asymmetrical loading configurations will present lateral control problems at low speeds where the ailerons are least effective. For some of these configurations, full aileron deflection will not overcome the rolling moment caused by the stores at the touchdown speeds presented in Appendix I; however, an increase in touchdown speed will provide adequate lateral control for landing. Figure 6-7 lists some of the most critical abnormal asymmetrical loading configurations and shows the recommended increases in Appendix I approach speeds required to provide adequate lateral control through touchdown when following the approach and touchdown procedures recommended in paragraphs a. and b. It is, of course, impractical to list each possible abnormal asymmetrical loading configuration which requires increased landing speed; other abnormal configurations will present lateral control problems in direct proportion to the lateral imbalance in weight.

a. Since maneuvering the airplane in the landing pattern increases the speed required for adequate lateral control of asymmetrical loading configurations, a very flat, straight-in approach should be made for landing with abnormal asymmetrical loading configurations. The approach should be sufficiently flat that very little flare will be required to accomplish a smooth touchdown. Because of the flatness of this approach, approach power must be carried closer to the point of intended touchdown. No more than 10 knots should be lost from the approach speed in accomplishing the touchdown. No attempt should be made to hold the airplane off the runway once the end of the runway has been passed.

b. It should be emphasized that any substantial increase in touchdown speed over that recommended in Appendix I will require extreme care in planning the landing and in handling the airplane during the landing to ensure that a safe stop can be made within the available runway length, and to avoid porpoising at touchdown. It is recommended that before attempting a landing in an extreme asymmetrical loading configuration, the pilot should familiarize himself with the airplane handling characteristics at the planned approach speed while at a safe altitude.



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THRUST-RPM RELATIONSHIP.

The J57 engine has a split ("two-spool"), 16-stage, axial-flow compressor. The compressor section consists of a nine-stage, low-speed, low-pressure rotor unit and a seven-stage, high-speed, high-pressure rotor unit. Both rotor assemblies are mechanically independent and, therefore, do not rotate at the same rpm. The tachometer, however, shows the rpm of the high-pressure compressor rotor only. A tachometer reading of 100% rpm for the J57 engine, unlike that for other jet engines, is not intended to show proper thrust output. In fact, on these engines, 100% rpm is considerably above the rpm at which rated thrust is obtained. During the factory calibration run of the engine, high-pressure rotor rpm for Military Rated Thrust is determined for an outside temperature of 60°F, and this speed is stamped on the engine fire wall speed data plate. This original trim speed varies from engine to engine from 93.5 to 96.5% rpm. However, as engine operating time increases, some loss of performance results, and the engine speed may be increased progressively above the original trim speed by adjustments (retrimming) to restore Military Rated Thrust. It is apparent, then, that each engine must be treated individually with respect to the rpm at which Military Thrust is obtained. Because of the maximum speed variations between engines, the large variation between engine speed and thrust (1% change in rpm changes thrust about 5%), and the inherent inaccuracies of tachometers, the engine is trimmed and power-checked according to turbine discharge pressure, which does not vary as much with thrust as does rpm. Early airplanes* have an engine differential pressure (ΔP) gage which shows the difference between turbine discharge pressure

F-100C-1 through F-100C-15 Airplanes and F-100C-20 Airplanes AF54-1860 through -1914 and pitot pressure. Later airplanes have an engine pressure ratio gage which indicates the ratio of turbine discharge pressure to pitot pressure. As these pressure differentials are a function of engine power output, either gage gives a more accurate indication of take-off power than the tachometer or exhaust temperature gage. The desired pressure ratio gage reading at Military Thrust depends upon outside air temperature; therefore, the gage must be adjusted just before take-off, to compensate for temperature. (Refer to "Engine Pressure Ratio Gage" in Section I.) When the preflight engine check is made, the engine is unstabilized. During this transient period, thrust may be higher than the stabilized rated thrust. The pressure ratio gage pointer will also indicate thrust "overshoot" by exceeding the position of the index marker on the gage. This engine thrust "overshoot" is acceptable for take-off if the pointer falls within the allowable limits.

MAXIMUM CONTINUOUS THRUST OPERATION.

Some pilots have misinterpreted the maximum continuous exhaust temperature limits as the maximum continuous engine thrust operation limits. This procedure will often result in using thrust that is above the continuous rating. The maximum continuous exhaust temperature limit was not intended to be used as a means of setting up continuous thrust, but only as a cross check.

Operation at Maximum Continuous Thrust requires a reduced thrust setting of about 3% rpm below that noted for Military Thrust. After selecting the Maximum Continuous Thrust setting, using the tachometer, cross check with the exhaust temperature gage to be sure it remains within limits of 580°C below 30,000 feet and 610°C above 30,000 feet.

For review, Maximum Continuous Thrust is first a *thrust reduction* of about 3% rpm below the indicated Military Thrust and secondly, observance of exhaust temperature limits. Disregarding this method of setting up the Maximum Continuous Thrust will shorten the service life of the engine and cause unnecessary fuel consumption.

AIR TEMPERATURE VS THRUST.

Air density, and therefore engine performance, of all air-breathing jet engines is affected by inlet air pressure and temperature. When inlet air density is increased by either a lower air temperature or a higher ram pressure, the engine, at a constant rpm, "pumps" an increased quantity of fuel and air (by weight), resulting in an increase in thrust.

OIL PRESSURE.

When oil pressure is normal (between 40 and 50 psi), adequate oil flow for lubrication and for cooling is indicated. When oil pressure falls below or fluctuates to below 40 psi, oil flow may not be adequate for cooling, and bearing temperatures can rise. High bearing temperatures can lead to relatively rapid bearing failures. For this reason, power must be reduced when low oil pressures are noted. Power reduction reduces bearing loads, particularly in thrust bearings; reduces internal friction in the bearing when rpm is reduced; and reduces heat transfer into the bearing from the engine. Power reduction thus will permit normal bearing operation for a longer time under adverse conditions compared with high power operation. After a complete loss of lubricating oil, it is possible that the engine may continue to run for 10 to 30 minutes, provided maximum engine power is not used, and provided the throttle was retarded upon the *first indication* of oil pressure difficulty. Bearing failure caused by oil starvation is generally characterized by a slight vibration which rapidly increases and very quickly results in an engine seizure. In some types of turbojet engines, high oil pressures indicate oil system potential failures. However, this is not likely in the case of the J57 engine. If oil pressure fluctuates above 50 psi at any power setting or exceeds 50 psi at high power settings and does not return to the normal range, a malfunction of the oil system or of the oil pressure gaging system is indicated and should be corrected before future flights. A temporary rise in oil pressure to a maximum of 55 psi is tolerable and will not harm the engine, provided there is no substantial oil pressure fluctuation, and provided the stabilized pressure returns to the normal range.

COMPRESSOR BLEED SYSTEM.

During acceleration and deceleration of engine speed, one or more stages of the compressor may reach the stalling point during some flight conditions. Engine operation becomes unstable when the stall occurs, with surging flow and fluctuating compressor discharge pressures. The stall condition is partially relieved by bleeding part of the low-pressure compressor discharge air overboard at low engine speeds. Two ducts carry the bleed air from the discharge area of the low-speed compressor to exhaust ports on the fuselage skin. Operation of the compressor bleed system is completely automatic, and no manual override is provided. Opening and closing of the bleed valves are automatically controlled by a governor that senses engine inlet temperature and pressure, and the speed of the low-pressure compressor rotor. (The system does not use electrical controls.) Two slide

***F-100C-20 Airplane AF54-1915 and all later airplanes**

valves in the governor port air from the high-pressure compressor to the bleed valve actuators. The actuators open or close the butterfly-type bleed valves, exhausting the low-pressure bleed air overboard. The governor control is factory adjusted to open and close the bleed valves according to a low-pressure compressor speed and engine inlet temperature-pressure schedule.

NOTE The J57-21 and -21A engines have one compressor bleed valve instead of the two used on the -7 and -39 engines.

COMPRESSOR STALL.

An undesirable but inherent characteristic of most air compressors, including those of the axial-flow multistage turbojet design, is that airflow instability may occur as a result of adverse compressor inlet or exit conditions. This characteristic is more pronounced in high-performance compressors of the type used in the J57 engine. This unstable condition has been referred to as

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surge, pulsation, chugging, "choo-choo," or explosions, but is usually described as compressor stall in a turbojet engine because it results from separation of airflow from the surfaces of the compressor blades just as separation of airflow from a wing surface results in an airplane stall. Compressor stalls may vary in severity, and may occur momentarily or be cyclic. J57 engine compressor stalls may occur during certain adverse operating conditions, or because of an engine accessory malfunction. Compressor stalls in this airplane are usually the result of improper and abnormal operation, and any compressor stall must be recorded on Form 781 because of possible engine case damage or malfunction of the engine fuel control unit. A discussion of compressor stalls sometimes encountered as a result of adverse conditions during normal operation follows:

a. Low airspeed maneuvering may induce stalls because of distortion of intake duct airflow. However, stalls will not usually occur under these conditions unless throttle movement is also used. During spins, continuous mild stalls will probably be encountered with a steady increase in exhaust temperature because of severe engine airflow distortion.

b. During high-altitude, low-airspeed flight conditions, the engine compressor is operating closer to the stall region because low-density air has a greater tendency to separate from the compressor blades. Consequently, engine acceleration stalls may be induced at high altitude with low airspeeds. The engine is expected to be stall-free above .8 Mach number at high altitude.

c. On the ground, very mild acceleration stalls will usually be experienced just above idle (60 to 65 percent rpm) with the -21 series engines. This type of stall is considered acceptable, provided the engine accelerates through the stall zone and to Military Thrust within acceptable time limits.

d. During high-altitude air starts (above 30,000 feet) using the normal fuel control system, mild compressor stalls may occur as the engine accelerates to idle. If persistent stalls occur, they can be eliminated by descending to increase airspeed.

e. Erratic throttle movements can induce compressor stalls. An example of this is when the throttle is retarded and then advanced while the engine is still decelerating.

f. The emergency fuel control system does not provide automatic fuel scheduling to meet engine acceleration requirements. Consequently, compressor stalls may be experienced whenever rapid throttle movements are made using the emergency fuel system.

Provided the stall condition was not induced by adverse operating conditions or erratic throttle movement, a severe stall or a series of severe stalls is usually the result of one of the following malfunctions:

a. Excessive fuel scheduling by the fuel control unit can cause stalls during engine acceleration.

b. Unsatisfactory operation of the intercompressor bleed valve may result in stalls during engine acceleration or deceleration or steady-state fixed-throttle stalls.

c. Failure of the fuel control to reduce engine rpm with colder inlet air temperatures or engine operation at thrust settings above rated thrust can cause steady-state fixed-throttle stalls. Generally, this type of stall occurs only at high altitude.

d. If the exhaust nozzle is slow acting or will not open, an extremely violent compressor stall will occur when afterburner is selected.

Experience has shown that engine compressor stalls have not resulted in any engine or airplane damage, provided corrective action is taken by the pilot to eliminate the continuous type of compressor stalls. The following procedure is recommended for recovering from severe compressor stalls:

1. Correct any unusual attitude of the airplane.
2. Retard throttle; then slowly advance throttle to the desired thrust setting.
3. If stall persists, reduce altitude and increase airspeed.
4. If stall occurs upon afterburner selection, shut down afterburner immediately.

Exhaust temperature should be monitored during compressor stalls and any overtemperature condition recorded in Form 781. An engine surge, unlike that associated with a compressor stall, may occur during low-altitude high-speed flight. This is usually the result of the normal automatic operation of the burner pressure limiter in the engine fuel control unit. The limiter automatically reduces fuel flow, when required, to prevent burner pressure from exceeding the maximum safe value. This surge is not harmful and can be eliminated by a slight reduction of the airspeed or rpm. Under extreme cold weather conditions, limiter action can occur just after take-off and before initial climb. At outside air temperatures of 60°F and above, the limiter operates at about .8 to .85 Mach number at sea level.

FLAME-OUT.

Flame-out can result from rapid throttle movement and is most commonly encountered at extremely high altitudes. Acceleration flame-out, like compressor stall, occurs when more fuel is injected into the combustion chambers than the engine can use for acceleration at the existing rpm. But, unlike the compressor stall condition, this mixture is so excessively rich that it cannot burn, so the flame goes out. Flame-out, which can also occur during rapid engine deceleration, will result whenever the amount of fuel injected into the combustion chambers is reduced to a level insufficient to sustain combustion at the existing rpm. Acceleration and deceleration flame-outs are not usually encountered during operation on the normal fuel system. However, they are possible when the emergency fuel system is being used. Acceleration flame-out can be avoided by accelerating engine rpm at a slower rate. Flame-outs can also occur, on either the normal or emergency fuel system, under certain flight conditions due to fuel booster, fuel transfer, or fuel scavenger pump failure. Flame-outs are indicated by loss in thrust, drop in exhaust temperature and rpm, and airplane deceleration. When flame-out occurs, an engine air start is necessary. (Refer to "Engine Air Start" in Section III.)

Caution Above 47,000 feet, afterburner blowout may occur with the J57-21 engine because of an overrich fuel schedule. (Normal engine operation is not affected.) If blowout occurs, the afterburner should be shut down. Improvements in afterburner fuel metering and an improved flame holder incorporated in late J57-21A engines provide satisfactory afterburner operation to the service ceiling of the airplane.

NEGATIVE-G FLAME-OUT.

The inverted-flight tank in the right cell of the intermediate tank traps about 1.6 gallons of fuel to permit limited negative-G operation. If the limitations of the fuel system are exceeded by negative-G, fuel starvation leading to possible flame-out can occur in a relatively short time. There are two conditions that can cause engine flame-out during negative-G operation. In the first of these, flame-out can occur when the fuel supply of the inverted-flight tank is exhausted. Fuel is then not available until positive-G flight is resumed. The second negative-G condition that can cause flame-out occurs any time the suction-feed capabilities of the engine are exceeded. Negative-G operation uncovers the inlets of the tank-mounted fuel booster pumps so that fuel is supplied to the engine from the inverted-flight tank by suction feed. Depending on fuel condition, suction feed cannot sustain engine operation long enough to empty the inverted-flight tank (because of cavitation of the engine-driven fuel pump) above 45,000 feet at Maximum Thrust or at Military Thrust. Thus, negative-G operation is *time-limited* (by the capacity of the inverted-flight tank) and *altitude-limited* (by the suction-feed limitations of the engine).

NOTE The time limits of negative-G operation at Military and Maximum Thrust, based on the capacity of the inverted-flight tank and the required fuel flows, are given in Section V.

The suction-feed characteristics depend on fuel temperature, fuel pressure, pump performance, etc. These factors, in turn, are influenced by flight duration, speed, and outside air temperature. The altitude limits on suction-feed operation are based on a fuel temperature of 110°F. If fuel temperature is lower, suction feed might be sustained to higher altitudes.

NOTE There are no inverted-flight fuel system restrictions as long as positive-G is maintained.

AFTERBURNER IGNITION.

The engine afterburner ignition system is designed to favor ignition of the afterburner during its predominant mode of use, which is after several minutes or more of nonuse. When the afterburner has not been used for a few minutes, the fuel in the afterburner fuel manifold is heated and some of this fuel will be evaporated. When the afterburner is selected at this time, some delay occurs in afterburner fuel manifold pressure build-up, in fuel flow from the nozzles, and in the action of the afterburner igniter (which is dependent on fuel manifold pressure build-up). During this delay (which is actually but a few tenths of a second), the nozzle has had sufficient time to open almost completely when ignition occurs. This produces a "soft" light-up. When the afterburner is selected within one minute of previous use, a relatively small amount of fuel has evaporated from the afterburner fuel manifold. Accordingly, afterburner fuel manifold pressure and fuel flow out of the nozzles occurs almost immediately after selection of the afterburner, and the afterburner igniter also receives its signal to inject "hot-streak" fuel almost immediately after selection of afterburner. Because of inertia of its moving parts, the afterburner nozzle always requires about the same time to move from closed to open. Therefore, it is possible for the nozzle to be closed or only partially open when afterburner selection is made within one minute of previous use. This can result in a "hard" afterburner light-up. Hard light-ups will not always occur when afterburner is selected within one minute of previous use because of differences among the many components involved, but the probability of such hard light-ups is always present. Most pilots prefer to avoid hard light-ups.

TURBINE NOISE DURING SHUTDOWN.

The light scraping or squealing noise, sometimes heard during engine shutdown, results from interference between engine rotating and stationary parts having dissimilar cooling rates. The scraping is undesirable and may damage parts. To minimize the possibility of engine damage, it is necessary for the engine to be run at reduced power (idle) for about 5 minutes before shutdown after any high-power operation (either ground or flight).

NOTE Approach, landing, and taxi time may be considered as reduced power operating time.

If, despite this precaution, heavy scraping still occurs on shutdown, no attempt to restart the engine should be made until the turbine temperature has dropped sufficiently to provide adequate clearance between the affected parts, since a starting attempt might result in destruction of the starter. If a start must be made when interference is suspected, tachometer readings and a listening check should be made to determine that the engine begins to turn as soon as air is supplied to the starter. If the engine does not begin turning at starter engagement, the starter and ignition stop-button must be pressed immediately.

SMOKE FROM TAIL PIPE DURING SHUTDOWN.

During engine shutdown, oil or fuel fumes may be noticed coming from the tail pipe or inlet duct, depending on ground wind conditions. These fumes indicate the presence of fuel or oil in the hot section of the engine. Boiling fuel, indicated by the appearance of white vapor, will not damage the engine but is a hazard to personnel, since the vapor may ignite with explosive violence if allowed to accumulate within the engine or fuselage. Therefore, all personnel should keep clear of the tail pipe for at least 3 minutes after engine shutdown and at all times when fuel vapor or smoke comes from the tail pipe. The appearance of black smoke from the tail pipe, after shutdown, indicates burning oil or fuel which will damage the engine. Vapor or smoke should be eliminated by motoring the engine as follows:

1. Check throttle OFF.
2. Have external air and dc electrical power sources plugged in.

NOTE If external electrical power is not available, turn battery switch ON to energize primary bus.

3. Turn engine master switch ON.
4. Press starter and ignition button. (Listen to check that engine begins to turn as soon as starter is engaged, or note tachometer rpm rise.)
5. Allow engine to crank until all evidence of fire has disappeared; then press starter and ignition stop-button and turn engine master and battery switches off.
6. If fire does not go out when engine is cranking, press stop-button, turn switches off, and leave airplane immediately.

FUEL SYSTEM MANAGEMENT.

FUEL SEQUENCING.

Sequencing of internal fuel is entirely automatic. Drop tank fuel is selected by the pilot by means of the drop tank fuel selector switch which controls the shutoff valves to pressurize the drop tanks. To maintain the most favorable CG conditions when drop tanks are carried, the fuel from the drop tanks must be used in the sequence shown in figure 5-4. Some fuel may be transferred from nonselected drop tanks because of any one or combination of the following circumstances which could pressurize the nonselected drop tanks:

a. Climbing from a low altitude to a high altitude.

b. Pausing at a full station when rotating the drop tank fuel selector switch to the next desired position. Fuel will be used from the nonselected drop tanks until the pressure within these tanks has been dissipated.

c. Ram air entering the dive vent port on the drop tanks. (This is considered negligible.)

Pressurizing of the drop tanks can also be caused by certain mechanical or electrical failures or malfunctions.

a. Loss of tertiary bus power, by any means, will de-energize all the drop tank shutoff valves. The valves open and all drop tanks are pressurized, causing simultaneous feeding from all drop tanks.

b. Failure of a drop tank shutoff valve causes this drop tank to also feed when other drop tanks are selected.

c. If the stop in the drop tank fuel selector switch has been removed, lost, or indexed wrong, the selector switch can be moved past the inboard tank position. This opens all of the drop tank shutoff valves, pressurizing all the drop tanks.

DROP TANK FUEL.

To maintain the most favorable CG conditions and adequate lateral control when drop tanks are installed, the fuel from the drop tanks must be used in the sequence described under "Drop Tank Fuel Sequencing Limitations" in Section V.

FUEL TRANSFER.

Fuel is transferred to the forward fuselage tank from all other internal fuel tanks and the drop tanks. Internal fuel is transferred by means of gravity flow, by electrically driven transfer pumps in the aft and intermediate tanks, and by scavenge pumps in the integral wing tanks. Normal transfer of fuel is in this order: drop tanks (if carried), aft tank, intermediate tank, and finally the wing tanks. Transfer of fuel is automatically controlled by float-operated fuel transfer control valves mounted at different levels in the forward tank. The transfer pumps run continuously, but fuel is not transferred until the fuel transfer control valves open as the fuel level drops below each one. For example, when the forward tank fuel level drops about 35 pounds from full, the drop tank fuel starts transferring. At about 165 pounds from full, the aft tank fuel starts transferring. When the fuel level in the forward tank is about 975 pounds from full, the intermediate tank transfers its fuel. After the intermediate tank is empty, fuel flows by gravity from the wing tanks until the forward tank has only about 1400 pounds of fuel remaining. At this time, the wing tank scavenge pumps are started by float switches to complete the transfer of the wing tank fuel not transferred by gravity. During all of the transfer operations, if the fuel transfer rate exceeds the consumption rate, the transfer of fuel stops when the fuel level raises the floats in the fuel transfer control valve. On the other hand, if fuel transfer rate is slower than the consumption rate, the transfer pump transfers fuel until the transferring tank is empty.

FUEL QUANTITY GAGES.

The two fuel quantity indicating systems show the total internal fuel quantity and the amount of fuel in the forward fuselage tank which is directly available to the engine. Normally, the fuel transfer rate to the forward tank exceeds the fuel flow rate to the engine, resulting in a nearly full forward fuel tank, provided the total fuel exceeds the forward tank capacity. The exception to this is during afterburner operation at low altitudes, or in case of a fuel system component malfunction. After extended afterburner operation at low altitudes when the forward fuel tank gage has shown a decrease, an increase in the forward tank quantity should occur when engine requirements are reduced. However, if a fuel system component malfunction has occurred, the forward fuel tank gage indication may not rise. The comparative gage readings of the forward fuel tank gage and the total internal fuel quantity gage may, if correctly interpreted, indicate failure of fuel system components when deviation from normal readings is observed. Familiarization with fuel gage readings for normal missions (that is, for average power settings, altitudes, and properly functioning equipment) will give greater flexibility and utility to the airplane, because the limitations of the fuel system are then reduced to the amount of fuel remaining in the forward fuel tank. When the two fuel quantity gages have the same reading, it is an indication that all remaining fuel has transferred to the forward tank, and the forward tank reading indicates the total fuel remaining. Therefore, if all fuel remaining is in the forward tank, the only fuel quantity limitation is that set by the practical minimum landing fuel reserves which may be established by the using organization.

HEAT EXCHANGER COOLING AIRFLOW CIRCUITS.

PRIMARY HEAT EXCHANGER.

Cooling air for the primary heat exchanger is normally obtained from the engine air inlet duct. It passes through the primary heat exchanger and is then ducted overboard. (See figure 7-1.) The amount of cooling airflow available depends on the pressure differential between the engine inlet duct and the overboard discharge. The greater the pressure differential, the greater the available cooling airflow. During normal level flight, the pressure in the inlet duct is higher than the pressure at the overboard discharge, and the cooling air from the duct goes through the primary heat exchanger and out the overboard discharge. This is known as positive flow. During ground operation and some flight conditions, the pressure in the engine air inlet duct is less than the pressure at the overboard discharge. This causes a reverse (negative) airflow through the primary heat exchanger. Whenever these pressures are equal, this is called null flow and no air flows through the primary heat exchanger. This can occur momentarily during flight.

SECONDARY HEAT EXCHANGER.

Cooling air for the secondary heat exchanger is not dependent upon the pressure differential between the engine air inlet duct and that outside the duct. Therefore, positive flow is not required for operation. (See figure 7-1.) Air for this heat exchanger is drawn from the intake duct by a fan within the heat exchanger and exhausted back into the duct. This fan is driven by a refrigeration turbine. Air from the engine compressor, after passing through the primary and secondary heat exchangers, drives this turbine before going to its respective system. (See figure 4-1.)

FLIGHT CONTROL SYSTEM EMERGENCY HYDRAULIC PUMP.

The ram-air turbine-driven emergency hydraulic pump supplies pressure to the No. 1 flight control hydraulic system in case of engine or system No. 1 engine-driven pump failure. The emergency pump is designed to maintain adequate system pressure with a "frozen" or windmilling engine at altitudes from sea level to the service ceiling of the airplane. The turbine and the emergency pump (which is mounted on the turbine hub) are in the upper part of the fuselage, behind the cockpit. When the emergency pump is selected, utility hydraulic system pressure opens the ram-air inlet doors in the engine air intake duct below the turbine, and the ram-air exhaust door in the upper fuselage fairing above the turbine. Ram air from the intake duct rotates the turbine and is exhausted overboard. (See figure 7-1.) Rotation of the turbine drives the emergency pump, which builds up and maintains pressure in the No. 1 flight control hydraulic system. A governor is used to control the speed of the turbine so that the speed of the pump remains within design limits. When the pump is selected, and the turbine is suddenly exposed to high-velocity ram air, the

INTAKE DUCT AIRFLOW CHARACTERISTICS

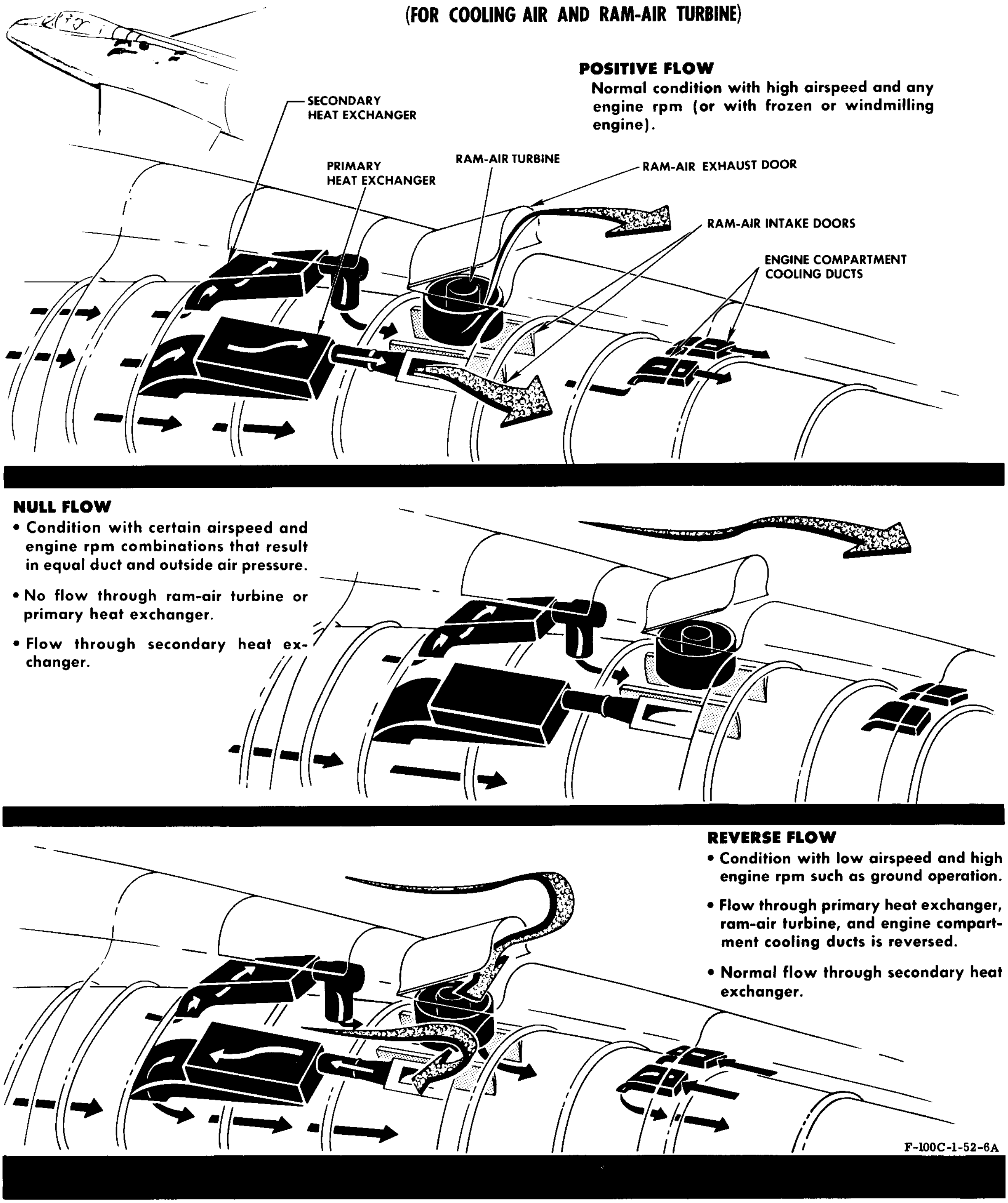

Figure 7-1

governor automatically increases the pitch of the turbine blades to decrease turbine rpm, thus preventing the turbine and pump from overspeeding. As the speed of the incoming ram air stabilizes, the rpm of the turbine decreases and the pitch of the turbine blades is decreased. This lower pitch setting causes an increase in turbine rpm to maintain the proper pump output. The changes in turbine blade pitch continue as long as the system is engaged, to compensate for variations in ram-air flow. When the airplane is flown at low airspeeds using high engine rpm, airflow through the turbine may reach a null (no airflow), or completely reverse direction. (As airflow approaches the null point, hydraulic power from the emergency pump is proportionally lowered until a zero output is reached at the null point.) On F-100C-1 Airplanes, turbine damage can result when the airflow through the turbine is reversed. This reverse airflow turns the turbine backwards and positions the turbine blades in various unbalanced pitch angles. This can result in destruction of the turbine. On F-100C-5 and later airplanes, the turbine is not damaged by reverse airflow. During reverse flow conditions pump output is not available. If the ram-air turbine-driven emergency pump is used when the engine is operating, it is necessary to vary the throttle setting to avoid a reduction of pump output. The ram-air turbine-driven pump is an emergency system which does not provide normal maneuvering capability, but is considered adequate for a proficient pilot, flying under near-normal conditions of visibility and turbulence, with adequate runways, to permit a well-planned approach. Under other circumstances, the pilot's judgment must prevail.

Caution If an increase in engine speed is anticipated on F-100C-1 Airplanes (such as would occur during a go-around), the emergency pump must be shut down to prevent turbine damage.

CIRCUIT-BREAKER USE.

A circuit breaker is designed to protect the operating units within a particular electrical circuit from damage due to overloads or short circuits, and is capable of automatically breaking the circuit under specified conditions of current flow. The length of time a circuit is subjected to an overload before the breaker trips to open the circuit depends on the amount of overload, and the rate (fast or slow) of overload build-up. The circuit breakers used on this airplane are the trip-free type. After being tripped by an overload in the circuit, the trip-free circuit breaker cannot be reset immediately. Because of its internal construction, this type of circuit breaker, when tripped, needs a cooling period before it can be reset. For example, a small, normally curved metal bar or disk in the breaker is straightened by the heat of the increased current drain of an overload. As the bar straightens, spring-loaded contacts are released and the circuit is broken. Pressing the button on the circuit breaker in an attempt to reset the circuit is ineffective until the metal bar cools enough to return to its normal position and lock the contacts closed. The practice of using circuit breakers as a switch should be avoided. Circuit breakers should not be pulled in flight, as this could easily result in creating a more dangerous condition than already exists. Many of the systems are hydraulically operated and electrically actuated. Interruption of the electrical sequence could cause complete system malfunction. Also, there is always the danger of pulling the wrong circuit breaker, causing failure of another system. Resetting circuit breakers can be entirely safe, provided circuit-breaker operation and the individual circuit involved are thoroughly understood. It is necessary to analyze the condition which caused the breaker to trip. If a circuit breaker cannot be reset and the circuit is one of major systems, prepare to land as soon as possible.

WHEEL BRAKE OPERATION.

To reduce accidents and maintenance difficulties that are caused by brake failure, it is important that the wheel brakes be used properly. Frequently, pilots will try to stop the airplane as quickly as possible, regardless of runway length. They also use the brakes consistently for speeding up turns and, drag the brakes while taxiing. Brakes should not be used to their maximum potential to make all landing rolls as short as possible. The landing roll distance should be used to take advantage of aerodynamic braking and the brakes should be used as seldom and as lightly as possible. Consideration should be given to the antiskid system installed on some airplanes. Although the antiskid system will give consistently shorter landing distances on dry runways, it should not be used to its maximum potential to purposely make all landing rolls as short as possible. To minimize wheel brake wear, the following precautions should be observed as much as practicable:

a. Immediately after touchdown or if there is considerable lift on the wings, use extreme care to prevent skidding the tires and causing flat spots when applying brakes on airplanes without antiskid, or when the antiskid switch is OFF. A heavy brake pressure can result in locking the wheel more easily if brakes are applied immediately after touchdown than if the same pressure is applied after the full weight of the airplane is on the wheels. A wheel once locked in this manner, immediately after touchdown, will not become unlocked until brake pressure has been greatly reduced. Proper braking action cannot be expected until the tires are carrying heavy loads.

NOTE Brakes can merely stop the wheel from turning, but stopping the airplane is dependent on the friction of the tires on the runway. There are two reasons for the loss of braking effectiveness with skidding. First, the immediate action is to scuff the rubber, tearing off little pieces which act almost like rollers under the tire. Second, the heat generated starts to melt the rubber and the molten rubber acts as a lubricant. If one wheel is locked during application of brakes, there is a tendency for the airplane to turn away from that wheel and further application of brake pressure will offer no corrective action. Since friction goes down when the wheel begins to skid, it is apparent that a wheel, once locked, will never free itself until brake pressure is less than the turning moment.

b. The antiskid system, on some airplanes, is intended to prevent skids at high speed under light wheel loads. Therefore, the brakes may be applied immediately after touchdown if the antiskid switch is ON, but this should be done only when definitely necessary. The antiskid system will function to prevent tire skidding if it is operating properly; however, it is not designed to perform as a completely automatic braking system. Continuous braking from the point of touchdown will result in excessive tire and brake wear and extreme heating of the brakes.

c. If maximum braking is required after touchdown, the lift should be decreased as much as possible by dropping the nose before applying the brakes.

d. For short landing rolls, a single smooth application of the brakes with constantly increasing pedal pressure is most desirable. On airplanes without the wheel brake antiskid or with antiskid system OFF, brakes should be applied intermittently and hard, but not hard enough to lock the wheels. Apply brakes for about 2 or 3 seconds, allowing a one-second release interval between applications. If too much pedal force is used during landing roll, the antiskid system can be felt cycling, indicating maximum braking action. If this cycling occurs, part of the brake pedal force should be relaxed.

NOTE Brake pedal force should be applied smoothly and steadily. An abrupt, full stroke application may fail to produce braking action. If this occurs, a slight relaxing of pedal force to give less than full pedal deflection will restore normal braking action. If utility hydraulic system pressure should fail, power braking is provided by an electrically powered emergency brake pressure pump, which is acuated by brake pedal pressure.

e. After the brakes have been used excessively for an emergency stop, and are in a heated condition, the airplane should *not* be taxied into a crowded parking area. Peak temperatures occur in the wheel and brake assembly from 5 to 15 minutes after a maximum braking operation. If maximum braking has been used, notify ground personnel to cool the wheel and tire assemblies immediately. (Refer to "Wheel Brake Fire" in Section III.)

SONIC BOOM.

When the airplane is flown at supersonic speeds, it can cause a phenomenon known as sonic boom. This can result from level- or diving-flight speeds that are great enough to build up a compressibility or shock wave. The collision of this shock wave with the ground or any object in the air will be accompanied by sufficient impact pressure to be startling or even dangerous. Sonic booms have been known to break windows or rip fabric from the wings of light aircraft. The destructive force of these waves is usually more concentrated straight ahead or in a line-of-flight direction. But, like all sound waves, they radiate in all directions from their source, and thus are likely to cover a wide area and possibly be deflected by temperature changes or unusual atmospheric conditions. The intensity of the boom depends upon the size and speed of the airplane creating it, as well as the distance of the airplane from the observer. Usually, the explosion sound is very loud at distances up to one mile.

Section VIII CREW DUTIES

Not applicable to this airplane.


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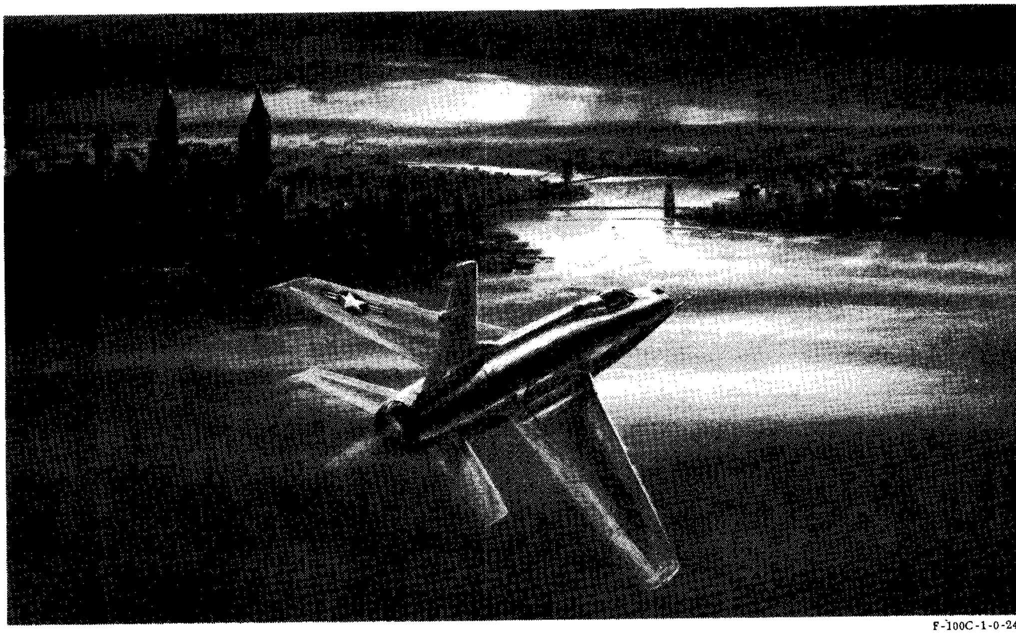


Section IX

All-Weather Operation

F-100C-1-0-24

TABLE OF CONTENTS

The procedures set forth in this section differ from, or are in addition to, the normal operating procedures in Section II. Particular emphasis should be placed upon the recommendations shown in the instrument flight procedures of this section, because these steps and procedures are the minimum requirements whenever you are operating IFR.

INSTRUMENT FLIGHT PROCEDURES

This airplane has all the basic flight instruments and radio-navigation equipment necessary to conduct IFR flights as well as the UHF command radio required to control the flight. This airplane can be flown at speeds in excess of Mach 1 on instruments, and, though it is not ordinarily practical because of the high fuel consumption, it can be flown at such speeds in cases of military or tactical necessity. The characteristic of the airplane in any asymmetric external load configuration presents somewhat of a problem during instrument flight. The use of the yaw damper will improve this characteristic. Refer to "Flight With External Loads" in Section VI for recommended flight procedures with an asymmetrical configuration.

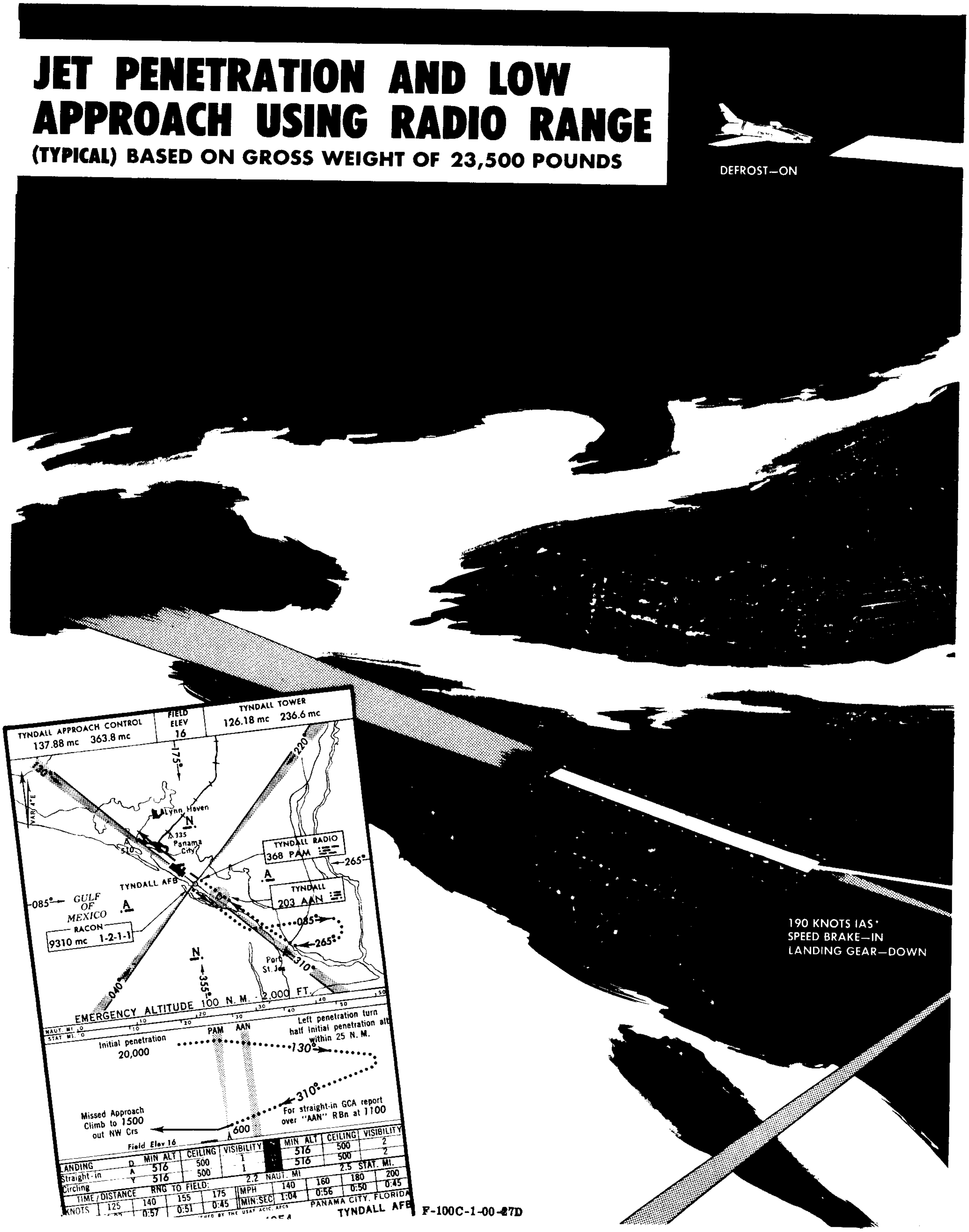
Warning Instrument flight in event of failure or suspected unreliability of the attitude indicator should be considered an emergency situation. All available alternatives should be considered before attempting partial panel techniques for weather penetration.

BEFORE INSTRUMENT TAKE-OFF.

1. Line up visually with centerline of runway.
2. Directional indicator—Rotate course index until runway heading is aligned with top of dial.
3. Attitude indicator—Adjust reference airplane by aligning it with the 90-degree indices on the instrument.

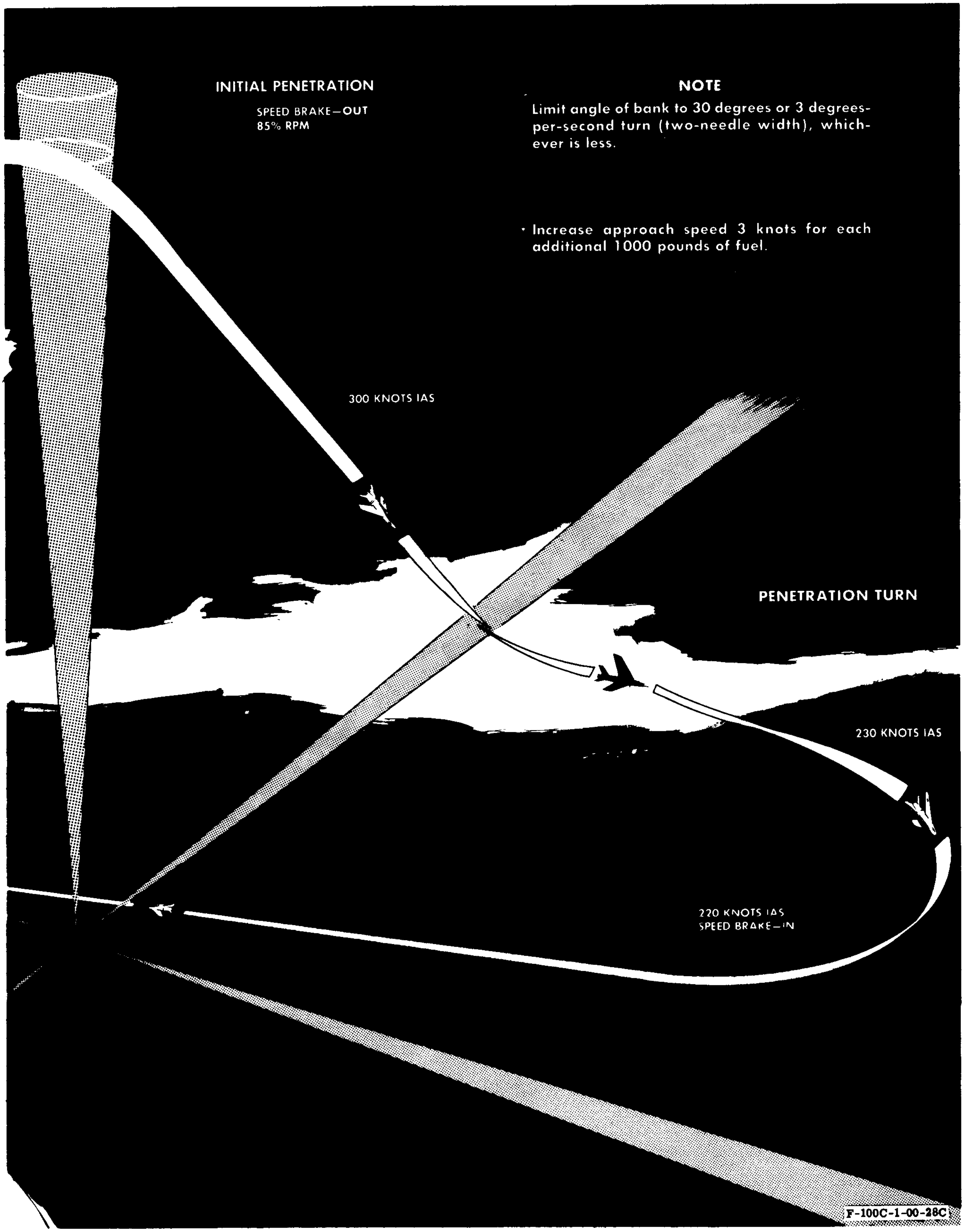
JET PENETRATION AND LOW APPROACH USING RADIO RANGE

(TYPICAL) BASED ON GROSS WEIGHT OF 23,500 POUNDS



F-100C-1-00-87D

Figure 9-1


INITIAL PENETRATION
SPEED BRAKE—OUT
85% RPM
NOTE
Limit angle of bank to 30 degrees or 3 degrees-per-second turn (two-needle width), whichever is less.
Increase approach speed 3 knots for each additional 1000 pounds of fuel.
300 KNOTS IAS
PENETRATION TURN
230 KNOTS IAS
220 KNOTS IAS
SPEED BRAKE—IN
F-100C-1-00-28C

JET PENETRATION AND LOW APPROACH USING ADF (TYPICAL)

BASED ON GROSS WEIGHT OF 23,500 POUNDS

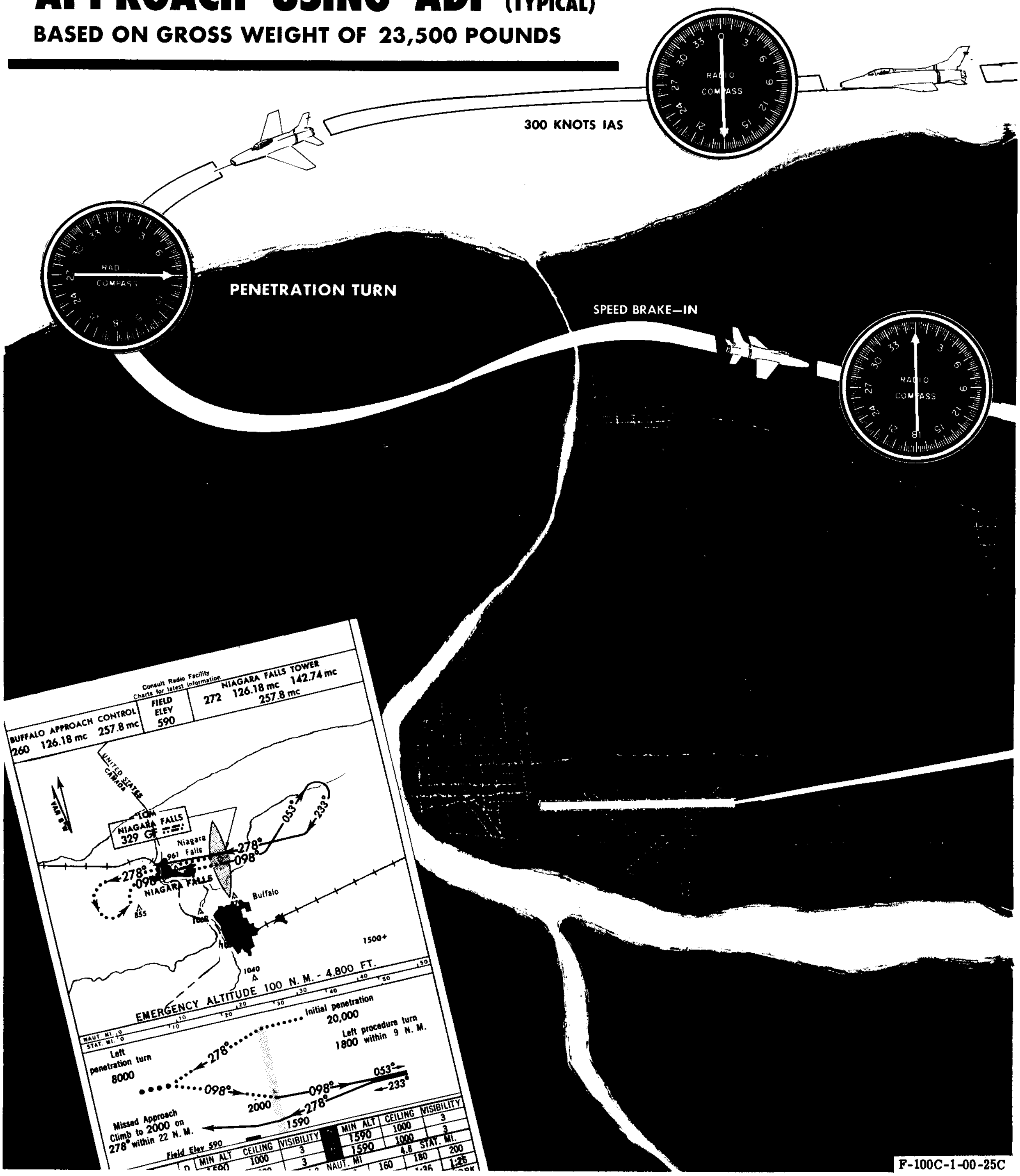
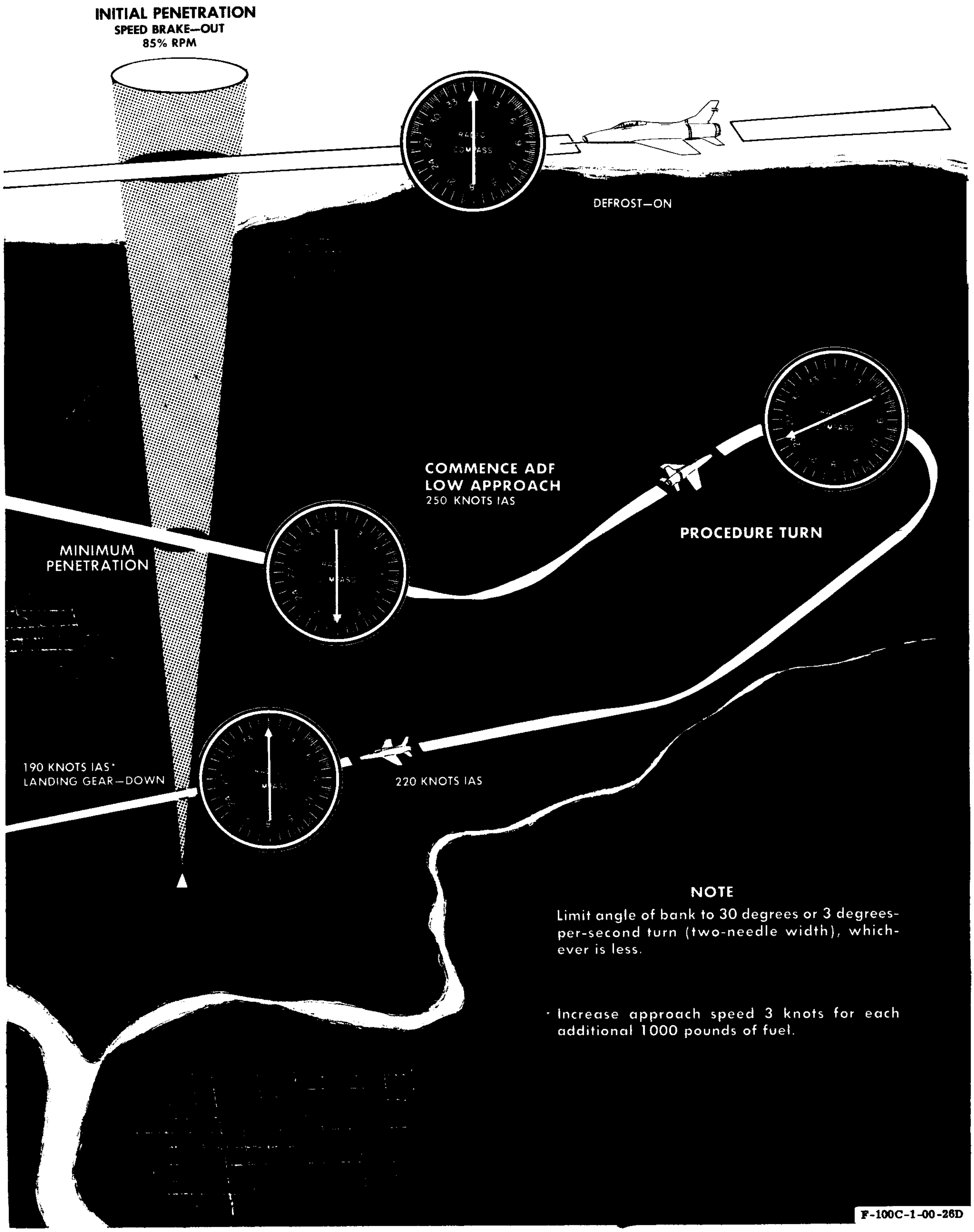


Figure 9-2


INITIAL PENETRATION
SPEED BRAKE—OUT
85% RPM
DEFROST—ON
COMMENCE ADF
LOW APPROACH
250 KNOTS IAS
PROCEDURE TURN
MINIMUM
PENETRATION
190 KNOTS IAS*
LANDING GEAR—DOWN
220 KNOTS IAS
NOTE
Limit angle of bank to 30 degrees or 3 degrees-per-second turn (two-needle width), whichever is less.
* Increase approach speed 3 knots for each additional 1000 pounds of fuel.
F-100C-1-00-26D

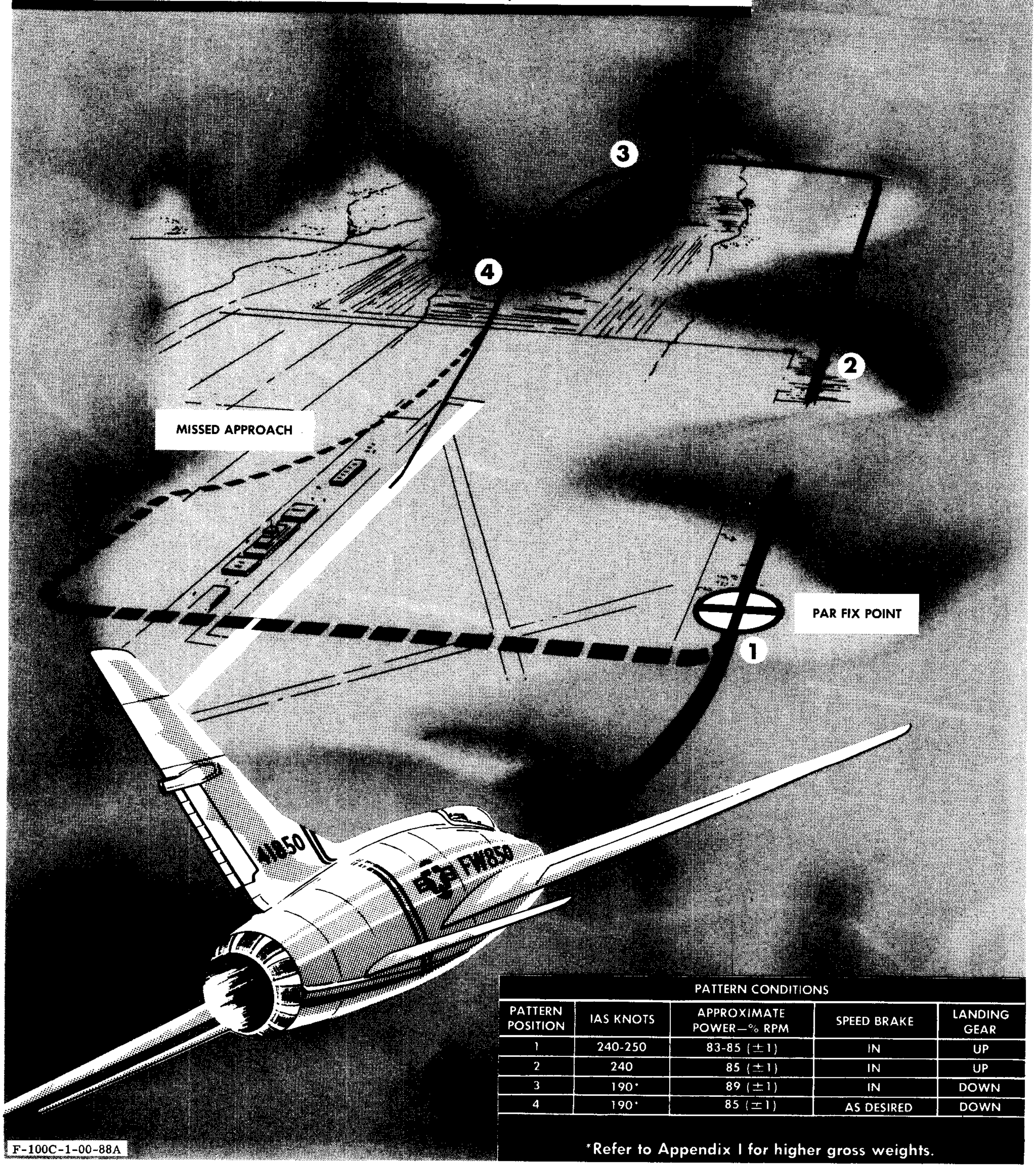
TYPICAL

PRECISION APPROACH RADAR

BASED ON GROSS WEIGHT OF 23,500 POUNDS

NOTE

All turns are standard rate but not exceeding 30 degrees angle of bank.



PATTERN CONDITIONS				
PATTERN POSITION	IAS KNOTS	APPROXIMATE POWER—% RPM	SPEED BRAKE	LANDING GEAR
1	240-250	83-85 (±1)	IN	UP
2	240	85 (±1)	IN	UP
3	190*	89 (±1)	IN	DOWN
4	190*	85 (±1)	AS DESIRED	DOWN

*Refer to Appendix I for higher gross weights.

Figure 9-3

4. Windshield anti-ice switch—ON if ice has accumulated on windshield or if forward visibility is restricted by rain. (Refer to "Ice and Rain" in this section.)

Caution To prevent windshield glass breakage, use anti-ice system only to the degree required to ensure visibility.

5. Canopy and windshield defrost lever—INCREASE, as needed.
6. Engine guide vane anti-ice switch—ON (AUTO*) if within icing temperature range.
7. Hold brakes and advance throttle to full MILITARY.
8. Check instruments and recheck all flight instruments.

INSTRUMENT TAKE-OFF.

1. Release brakes and move throttle to AFTERBURNER.
2. Maintain zero net runway heading error with nose wheel steering. Use whatever outside reference is available and the directional indicator for heading reference.
3. Initiate nose-wheel lift-off at normal VFR nose-wheel lift-off speed.
4. Rotate airplane to, and maintain, a pitch attitude of 12 degrees as indicated by the attitude indicator.
5. After take-off, maintain heading and attitude.

NOTE There are inherent lags in the altimeter and vertical velocity indicating systems.

6. Maintain pitch attitude and heading until a rate of climb schedule is established.

INSTRUMENT CLIMB.

1. If desired, retard throttle to Military Thrust after reaching desired climb schedule.

NOTE Continuous climbs using afterburner should be avoided whenever possible because of the difficulty of detecting small pitch changes on the attitude indicator at steep climb angles. During afterburner, the range of the vertical velocity indicator is exceeded.

2. Do not turn or bank airplane until 250 knots IAS is reached.
3. Limit angle of bank to 30 degrees.

INSTRUMENT CRUISING FLIGHT.

Use normal techniques and procedures for instrument cruising flight.

RADIO-NAVIGATION EQUIPMENT.

The AN/ARN-6 radio compass and the AN/ARN-21* TACAN are provided for en route radio navigation. Because the radio compass is highly susceptible to precipitation and electrical static, its reliability at high altitudes is considerably reduced by thin overcasts, haze, dust, and thunderstorm activity. Therefore, automatic operation of the radio compass should not be relied upon during flight under these weather conditions. When flying through areas of interference-type weather, the TACAN should be used in preference to the radio compass, because of clearer reception and a more stable directional indication of the visual features of the system.

HOLDING OR LOITERING ON INSTRUMENTS.

Ease of handling and minimum fuel consumption are the prime factors to be considered while loitering or while in a holding pattern. A speed of 250 knots IAS above 15,000 feet gives the best fuel consumption and handling ease, while holding or loitering. If external load configuration is such that difficulty in handling arises, increase airspeed for handling ease. Because of the requirement for a 180-degree turn approximately every two minutes, the power for holding is slightly greater than for loitering.

NOTE Holding above 30,000 feet with asymmetrically mounted drop tanks is not practical because of thrust requirements. Increase holding speed to 275 knots IAS for all altitudes below 30,000 feet while flying this configuration.

INSTRUMENT LETDOWNS.

On IFR cross-country flights, the letdown procedures at the destinations should be checked and fuel allowances made as part of preflight planning.

NOTE Because rain impairs forward visibility during approach, turn on windshield anti-icing and rain removal system for landing.

Descents on instruments can be made without difficulty at any speed, though you should be careful not to get into too steep a descent.

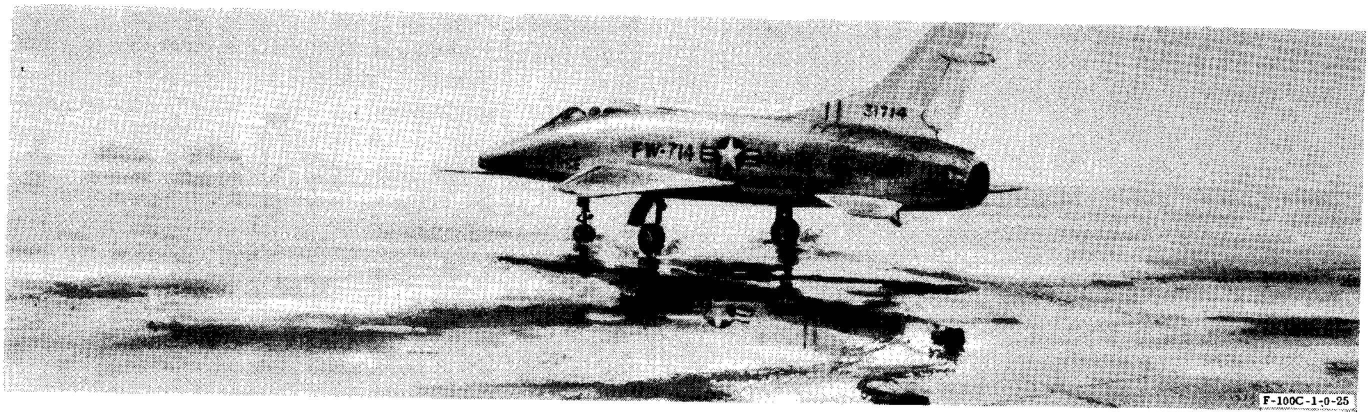
Jet Penetrations and Low Approaches.

Jet penetrations provide a high-speed and high-rate-of-descent letdown from altitudes to a point where a VFR approach or an instrument approach (such as PAR, TACAN,* low-frequency range, or ADF) can be made. (See figures 9-1, 9-2, and 9-3 for typical penetrations and approaches.)

Missed Approach.

Refer to "Go-around" in Section II for missed-approach procedure.

***Some airplanes**



ICE AND RAIN

Although this airplane does not have a wing and tail surface anti-icing system, flights under icing conditions may be made, provided a speed of Mach .85 to Mach .90 (depending on outside air conditions) is maintained. Use caution at slower speeds and, in case ice forms on the airplane, increase airspeed, change altitude, or leave the icing region. Engine guide vane anti-icing and pitot boom heat should be turned on before entering an area where icing conditions prevail. The windshield anti-ice outlets are capable of anti-icing the windshield and removing rain of moderate intensity. However, under certain conditions in the rain, visibility will be affected. If mist or light rain is encountered, visibility will not be affected. In moderate rain, use of the windshield anti-icing system will improve vision. The windshield will be streaked, but reasonable visibility will be retained. In heavy rain, visibility will be completely obscured except for a small area next to the outlets of the anti-icing system. The anti-icing and rain removal system should be turned on only to the degree required to ensure visibility under the following circumstances:

1. Ice accumulation on the windshield in normal flight.
2. In rain during normal approach and landing.
3. During letdown when it is known or suspected that icing or rain may prevail at low altitudes or on the ground.
4. Removal of ice or rain when the airplane is on the ground.
5. During take-off into anticipated icing conditions or when forward visibility is restricted because of rain.
6. When approaching a thunderstorm.

The cockpit temperature should be set as cold as practical for operation of the airplane in conditions where it is necessary to use the windshield anti-icing or rain removal system.

NOTE If the heat and vent caution light comes on, or if the cockpit pressure selector switch is in the OFF position, the windshield anti-icing and rain removal system should not be operated unless a clear windshield is absolutely necessary.

Icing of the engine air inlet area is always possible during operation in weather with temperatures at or near the freezing point. An engine surge with a loss of thrust (no mechanical difficulties present) can indicate engine icing. A major rise in exhaust temperature will normally not be experienced with engine icing on this type of engine.

Caution If engine icing occurs, the throttle should be retarded immediately to about 85% rpm until the engine stabilizes, and an effort should be made to leave the icing area. Low airspeed and high engine rpm are most conducive to engine icing.

During take-off into fog or low clouds, when temperatures are at, or near freezing, the engine could be subject to icing. The airplane should be accelerated to 275 knots IAS as rapidly as possible. Avoid atmospheric icing conditions whenever feasible. The most proficient weather service cannot always predict accurately just when or where icing may be encountered. However, many areas of probable icing conditions can be avoided by careful flight planning, using available weather information. The following are conditions under which engine icing can occur without wing icing when the temperature is between −10°C (14°F) and 5°C (41°F), if fog is present, or if the dew point is within 4°C (7°F) of the outside temperature. If the outside air temperature is in the range of 0°C (32°F) to 5°C (41°F), the speed of the airplane should be maintained at 275 knots IAS or above to prevent inlet duct icing. If engine icing conditions are encountered at freezing atmospheric temperatures, immediate action should be taken as follows:

1. Change altitude rapidly, or vary course to avoid cloud formations.
2. Establish 275 knots IAS to minimize rate of ice build-up.

3. Maintain a close watch of exhaust temperature, and reduce engine rpm as necessary to prevent excessive exhaust temperature.

Another serious form of engine icing that should be avoided, if possible, results from ice entering the engine. Flight tests have proved that engine flame-outs can occur because of heavy ice accumulating around the inlet duct, dislodging, and entering the engine. Flame-outs due to this condition can occur within 4 to 5 minutes after entering an area of severe icing conditions. To reduce this hazard, avoid flight conditions that are conducive to the rapid accumulation of ice. Flame-out from this type of weather hazard is recognized by a pronounced compressor stall, followed by a drop in rpm and temperature. When a flame-out has occurred from ice entering the engine and an air start has been successful, maintain the lowest rpm permissible to make a safe landing. After landing, make a notation in the Form 781 to request an engine damage inspection.

Warning

Heavy ice accumulations can cause wing slats to function incorrectly and/or stall speeds to be greatly increased; therefore, extreme caution must be used when landing under such conditions, and increased approach speed may be necessary.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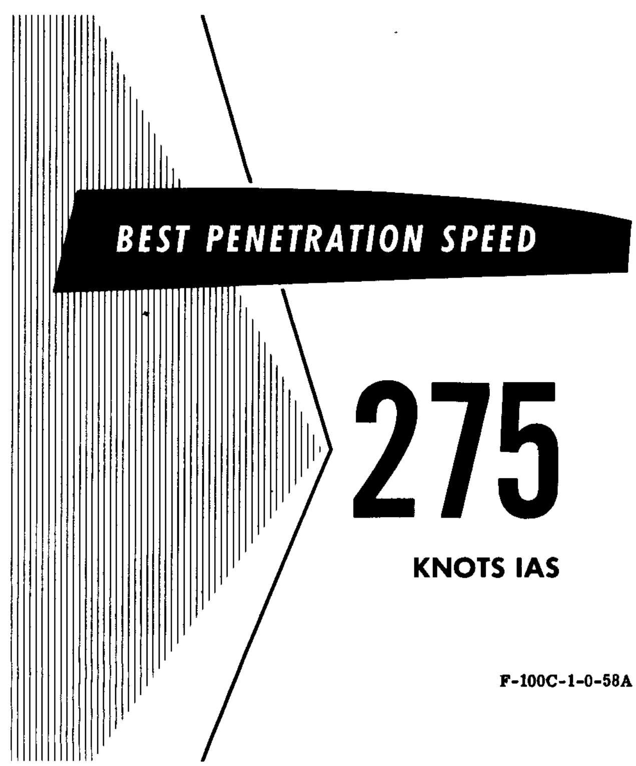
TURBULENCE AND THUNDERSTORMS

Before entering an area of turbulence and thunderstorms, throttle and pitch attitude required for the desired penetration airspeed should be established, for they are the keys to proper flight technique in turbulent air. Throttle setting and pitch attitude, if maintained throughout the storm, must result in constant airspeed, regardless of any false readings of the airspeed indicator.



F-100C-1-0-58A

ENGINE SURGE AND FLAME-OUT CAUSED BY ADVERSE WEATHER CONDITIONS.

The following factors, singly or in combination, can cause engine flame-out:

a. Penetration of cumulus build-ups with associated high liquid content.

b. Engine icing of either nose accessory section cover or inlet guide vanes.

c. Turbulence associated with penetration can result in excessive nose-up angles of attack, causing marginal engine performance.

d. Above 40,000 feet, the surge margin of the engine is reduced and there is poor air distribution across the face of the compressor.

Caution Flying in turbulence or hail may increase inlet duct distortion. At higher altitudes, this distortion can result in engine surge and possible flame-out. However, normal air starts may be accomplished, as outlined in Section III.

Areas of turbulent air, hailstorms, or thunderstorms should be avoided whenever possible, because of the increased danger of engine flame-out. If these areas cannot be avoided, the engine guide vane anti-icing system switch should be turned to ON before weather penetration. The exhaust temperature gage *and engine pressure ratio or engine differential pressure gages* should be monitored continuously during weather penetration. *Exhaust temperature indication alone may come too late to enable the pilot to take timely corrective action.* The engine guide vane anti-icing system prevents the formation of ice and is not a deicer. Whenever possible, icing conditions should be anticipated in advance and the engine guide vane anti-icing system should be activated to warm up the engine air inlet. If ice has already begun to build up before the engine guide vane anti-icing system switch should be turned to ON, reduce the throttle setting to minimize the danger of internal engine damage until all ice has broken off and been ingested by the engine. When the presence of ice is no longer evident, check the engine at idle, and then advance the throttle to any desired setting.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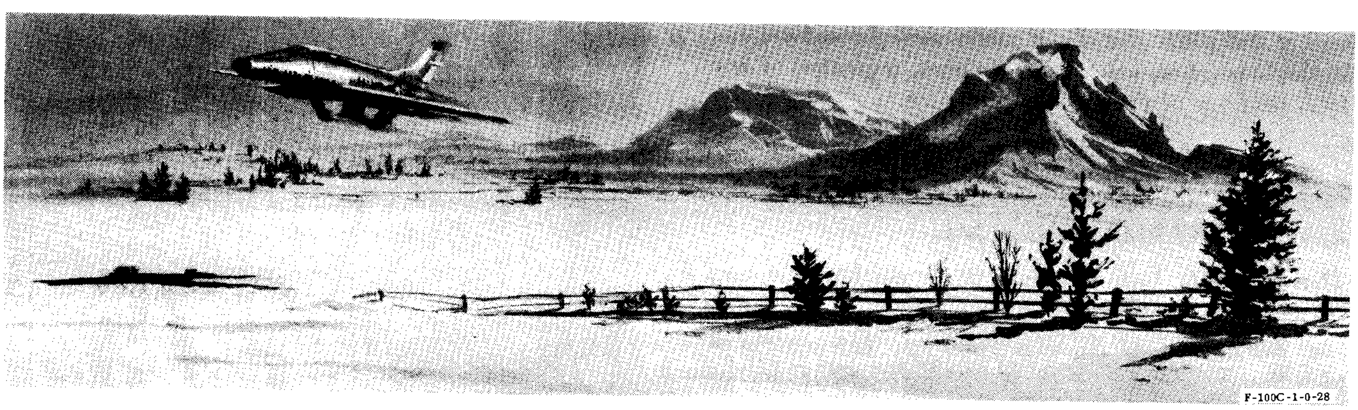
NIGHT FLYING

There are no specific techniques for flying this airplane at night that differ from those for day flight.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COLD-WEATHER PROCEDURES

Cold-weather procedures differ from normal procedures mainly in that additional precautions are required during ground operation. Flight operations are identical for the most part, and over-all problems are considerably reduced with jet engines because of the lack of oil dilution requirements and other difficulties associated with reciprocating engines. Icing conditions are not covered here, but are covered under "Ice and Rain." Because

*Some airplanes

cold-weather procedure is concerned primarily with extremely low-temperature operation, the procedures set forth are additions or exceptions to the normal operating procedures in Section II.

BEFORE ENTERING AIRPLANE.

1. Check that all surfaces, ducts, struts, drains, and vents are free of snow and ice.

Warning Remove all snow and ice from the wings, fuselage, and tail before flight. Depending on the weight and distribution of the snow and ice, take-off distances and climb-out performance can be adversely affected. The roughness, pattern, and location of the snow and ice can affect stall speeds and handling characteristics to a dangerous degree. In-flight structural damage also may result, because of the vibrations induced by unbalanced loads of accumulated ice and snow.

2. Make sure airplane has been carefully inspected for fuel and hydraulic leaks caused by contraction of fittings or by shrinkage of packings.
3. Inspect area behind airplane to make sure water or snow will not be blown onto personnel or equipment during start.

ON ENTERING AIRPLANE.

1. Make sure canopy can be fully closed.
2. Check engine guide vane anti-ice switch at ON (AUTO*).

STARTING ENGINE.

JP-4 fuel has good starting characteristics for low-temperature starts and permits normal starting procedures.

WARM-UP AND GROUND CHECK.

Use *firmly anchored* wheel chocks for engine run-ups.

NOTE Without chocks, the airplane may skid forward while in Military Thrust on a wet surface or while in afterburner on a dry surface.

1. If there has been heavy rain, turn on cockpit heat and canopy and windshield defrosting system immediately after engine starts.
2. Cycle flight controls four to six times. Check hydraulic pressure and control reaction.

Caution Make sure all instruments have warmed up sufficiently to ensure normal operation. An operational check of all flight instruments should be made while taxiing. Check gyro operated instruments for sluggishness or incorrect operation.

TAXIING.

1. Avoid taxiing in deep snow, as taxiing and steering are extremely difficult and the brakes may freeze.
2. Increase interval between airplanes while taxiing at subfreezing temperatures, to ensure safe stopping distance and to prevent icing of airplane surfaces by melted snow and ice in the jet blast of a preceding airplane.
3. Minimize taxi time to reduce amount of ice fog generated by the engine.

BEFORE TAKE-OFF.

1. Make normal full-power engine check; however, if field conditions make this impossible, final checks must be made during first part of take-off roll.
2. Turn pitot boom heat switch ON just before moving into take-off position.

AFTER TAKE-OFF.

NOTE Under extreme cold-weather conditions, thrust surge or slight loss of rpm may occur just after take-off and before initial climb. (Refer to "Engine Fuel Control System" in Section I.)

1. After take-off from a wet, snow-covered, or slush-covered field, operate landing gear through several complete cycles to prevent gear from freezing in retracted position. (Expect considerably slower operation of landing gear in cold weather due to stiffening of all lubricants.) Also, cycle wing slats by varying airspeed or applying G, to preclude their freezing in one position.
2. Cross-check flight instruments continuously, as they may become unreliable during cold-weather operation.

*Some airplanes

DURING FLIGHT.

Use cockpit heat, canopy and windshield defrosting, and anti-icing and rain removal systems as required. (Refer to "Defrosting, Anti-icing, and Rain Removal Systems" in Section IV.)

DESCENT.

The windshield and canopy defrosting system should be operated throughout the flight at the highest possible heat, consistent with pilot comfort, to preheat the canopy and windshield and maintain the glass temperature above the cockpit dew point in case circumstances require a rapid descent from altitude.

BEFORE LEAVING AIRPLANE.

1. Have main gear wheels chocked; then release brakes.
2. Leave canopy partly open to allow circulation within cockpit, to prevent canopy cracking from differential contraction, and to decrease windshield and canopy frosting.
3. Whenever possible, leave airplane parked with full fuel tanks. Every effort should be made during servicing to prevent moisture from entering the fuel system.
4. Make sure battery is removed when airplane is parked outside at temperatures below −29°C (−20°F) for more than 4 hours.
5. Check that proper protective covers are installed on the airplane.

HOT-WEATHER AND DESERT PROCEDURES

In general, hot-weather and desert procedures differ from normal procedures mainly in that additional precautions must be taken to protect the airplane from damage caused by high temperatures and dust. Particular care should be taken to prevent the entrance of sand into the various airplane components and systems (engine, fuel system, pitot-static system, etc). All filters should be checked more frequently than under normal conditions. Units having plastic and rubber parts should be protected as much as possible from windblown sand and excessive temperatures. Tires should be checked frequently for signs of blistering, etc.

BEFORE ENTERING AIRPLANE.

1. Check exposed portions of the shock strut pistons for dust and sand, and have them cleaned if necessary.
2. Check inflation of shock struts and tires which may have become overinflated because of temperature increases.
3. Examine tires carefully for blistering or cord separations, and be sure all protective covers are removed if used.
4. Check intake duct for accumulations of dust or sand.
5. Make sure crew chief has had the filters cleaned, and that the airplane has been thoroughly inspected for fuel or hydraulic leaks caused by the swelling of packings or expanded fittings.
6. Inspect area behind airplane to make sure sand or dust will not be blown onto personnel or equipment during starting operations.

ON ENTERING AIRPLANE.

1. Check the cockpit for excessive accumulations of dust or sand.
2. Check instruments and controls for moisture from high humidity, and ground-heat them if necessary to dry them.

3. Cockpit temperature rheostat—COLD.
4. Console air lever—INCREASE.
5. Cockpit temperature master selector switch—AUTO.
6. Complete as much of preflight cockpit check as possible before starting, to avoid prolonged ground running.

BEFORE TAKE-OFF.

As much as possible, limit use of brakes for taxiing, because ground cooling is reduced when outside air temperatures are high.

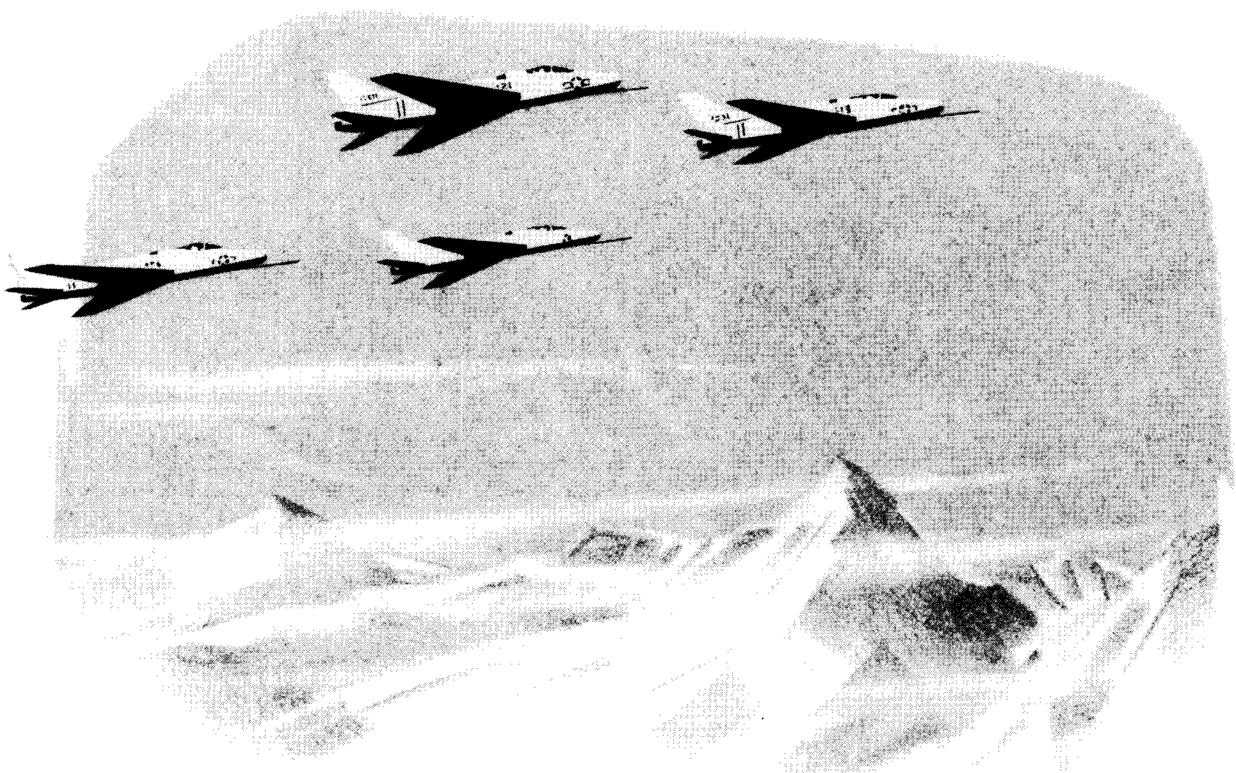
NOTE Excessively high outside air temperatures increase take-off distances. (Refer to take-off distance charts in Appendix I.)

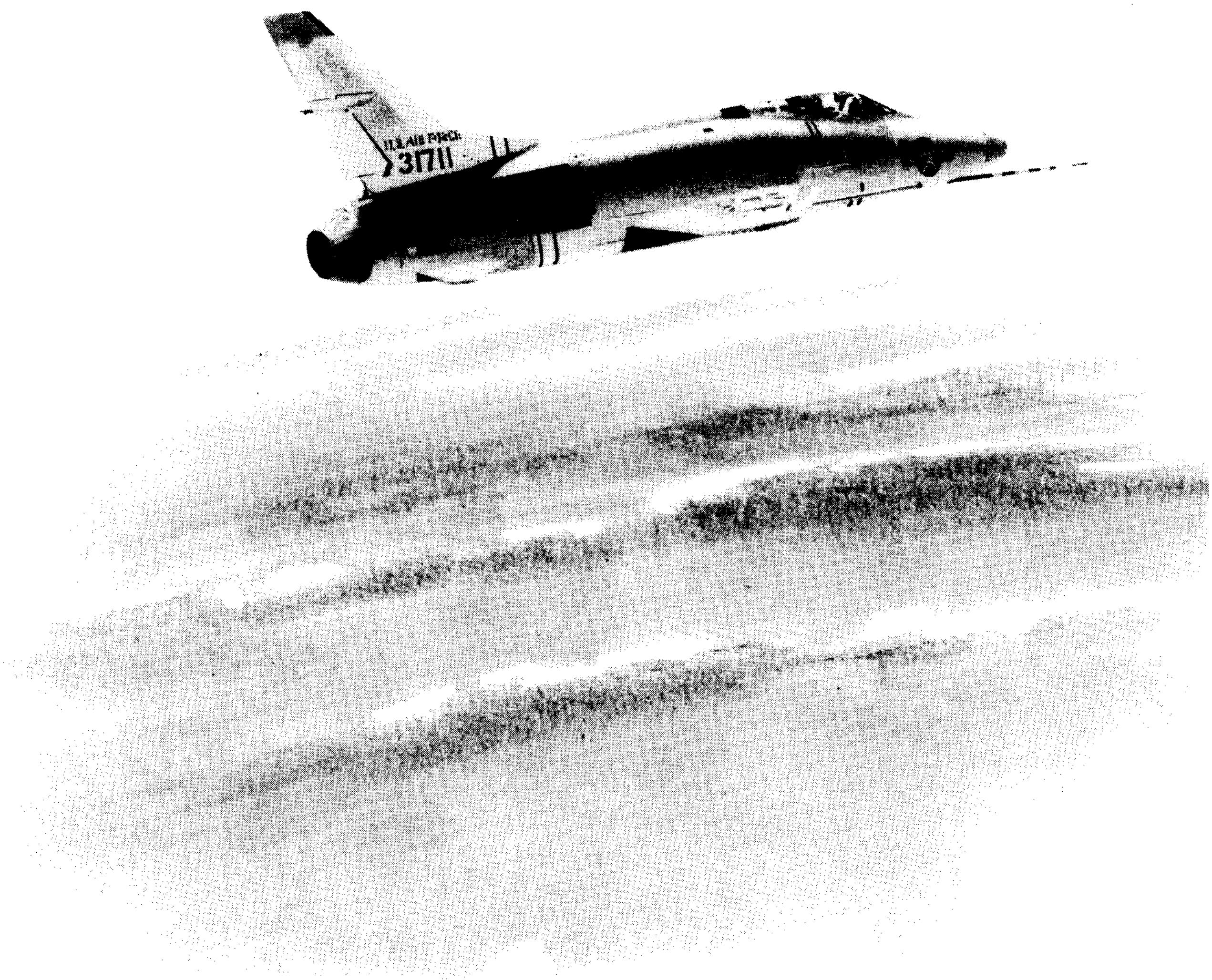
TAKE-OFF.

Caution It is imperative that take-off be made at recommended speeds. When outside air temperature is high, do not lift from runway too soon, because more than the usual take-off run will be required to obtain recommended take-off speed.

BEFORE LEAVING AIRPLANE.

1. Make sure that protective covers are installed immediately on the pitot boom, canopy, and the intake and exhaust ducts.
2. Before covering, the canopy should be opened slightly to permit air circulation within the cockpit.

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