FLIGHT MANUAL

USAF SERIES F-86K 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 (SF) 1-1 and 1-2. (The change dated 26 August 1960 replaced -1CU through -1CX.) See Basic Index, T.O. 0-1-1, and Weekly Index, T.O. 0-1-1A, for current status of Safety of Flight Supplements.

This publication is incomplete without Confidential Supplement T.O. 1F-86K-1A.

CHANGE NOTICE

LATEST CHANGED PAGES SUPERSEDE THE SAME PAGES OF PREVIOUS DATE

Insert changed pages into basic publication. Destroy superseded pages.

F-86K-1-00-62E

AIR FORCE, Cato Show Prtg. Co. 9/22/61 - 500 - REPRINT

30 JUNE 1958

CHANGED 30 DECEMBER 1960

Reproduction for nonmilitary use of the information or illustrations contained in this publication is not permitted without specific approval of the issuing service (BuAer or USAF). The policy for use of Classified Publications is established for the Air Force in AFR 205-1 and for the Navy in Navy Regulations, Article 1509.

LIST OF EFFECTIVE PAGES

INSERT LATEST CHANGED PAGES. DESTROY SUPERSEDED PAGES.

NOTE: The portion of the text affected by the changes is indicated by a vertical line in the outer margins of the page.

TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 336, CONSISTING OF THE FOLLOWING:

Page No.	Issue
*Title	30 Dec 60
*A	30 Dec 60
i thru ii	Original
iii	26 Aug 60
iv	Original
1-1	23 Oct 59
1-2 thru 1-4	Original
1-5	23 Oct 59
1-6 thru 1-8	Original
1-9	23 Oct 59
1-10	26 Aug 60
1-11 thru 1-21	Original
1-22	15 Apr 60
1-23	Original
1-24 thru 1-25	23 Oct 59
1-26 thru 1-29	Original
1-30	23 Oct 59
1-31	Original
1-32	26 Aug 60
1-33 thru 1-35	Original
1-36	23 Oct 59
*1-37	30 Dec 60
1-38 thru 1-40	Original
1-41	26 Aug 60
1-42 thru 1-53	Original
1-54	23 Oct 59
2-1	26 Aug 60
2-2	15 Apr 60
2-3 thru 2-5	23 Oct 59
2-6 thru 2-7	Original
2-8 thru 2-8A	26 Aug 60
2-8B Blank	26 Aug 60
2-9	23 Oct 59
2-10	15 Jan 59
2-11 thru 2-12	15 Apr 60
2-13	26 Aug 60
2-14 thru 2-17	Original
2-18 thru 2-20A	26 Aug 60
2-20B Blank	26 Aug 60
2-21	Original
2-22 thru 2-23	23 Oct 59
2-24	Original
2-25	15 Apr 60
2-26	26 Aug 60
2-27 thru 2-44 Deleted	26 Aug 60
*3-1	30 Dec 60
3-2 thru 3-3	26 Aug 60
3-4	Original
*3-4A thru 3-4B	30 Dec 60
*3-5 thru 3-7	30 Dec 60
3-8	23 Oct 59
3-9	Original
3-10	26 Aug 60
3-11	23 Oct 59
3-12	Original
*3-13 thru 3-16A	30 Dec 60
*3-16B Blank	30 Dec 60
3-17	26 Aug 60
3-18	23 Oct 59
*3-18A	30 Dec 60
*3-18B Blank	30 Dec 60
*3-19	30 Dec 60
3-20 thru 3-21	Original
*3-22 thru 3-23	30 Dec 60
3-24	23 Oct 59
3-25	Original
3-26	26 Aug 60
3-26A thru 3-26B	15 Apr 60
*3-27 thru 3-28	30 Dec 60
3-29	26 Aug 60
3-20 Blank	26 Aug 60
3-31 thru 3-46 Deleted	26 Aug 60
4-1	23 Oct 59
4-2 thru 4-8	Original
4-9	26 Aug 60
4-10 thru 4-12	15 Apr 60
4-12A thru 4-12B	23 Oct 59
4-13 thru 4-14	15 Apr 60
4-15 thru 4-16	Original
4-17	23 Oct 59
4-18 thru 4-18A	26 Aug 60
4-18B Blank	26 Aug 60
4-19	23 Oct 59
4-20	Original
4-21 thru 4-24B	23 Oct 59
4-24C	15 Apr 60
4-24D	23 Oct 59
4-25	23 Oct 59
4-26	16 Jan 59
4-27	23 Oct 59
4-28 thru 4-38	16 Jan 59
*5-1	30 Dec 60
5-2	Original
5-3	15 Apr 60
5-4 thru 5-5	23 Oct 59
5-6	Original
6-1 thru 6-6	Original
6-6A	26 Aug 60
6-6B Blank	26 Aug 60
6-7	26 Aug 60
6-8 thru 6-20	Original
7-1	Original
7-2 thru 7-3	15 Apr 60
7-4	23 Oct 59
7-5 thru 7-12	Original
*7-13 thru 7-14	30 Dec 60
9-1 thru 9-9	Original
9-10 thru 9-10B	23 Oct 59
9-11	23 Oct 59
9-12 thru 9-16	Original
A-1	Original
A-2 thru A-3	16 Jan 59
A-4 thru A-6A	26 Aug 60
A-6B	26 Aug 60
A-7 thru A-16	Original
A-17	16 Jan 59
A-18	Original
A-19	16 Jan 59
A-20	26 Aug 60
A-21 thru A-23	Original
A-24 thru A-25	16 Jan 59
A-26 thru A-29	Original
A-30 thru A-31	16 Jan 59
A-32 thru A-45	Original
A-46 thru A-47	23 Oct 59
A-48 thru A-50	Original
A-51	16 Jan 59
A-52 thru A-58	Original
A-59 thru A-63	16 Jan 59
A-64	23 Oct 59
A-65 thru A-74	Original
*X-1 thru X-9	30 Dec 60
*X-10 Blank	30 Dec 60

CURRENT FLIGHT CREW CHECK LIST

T.O. 1F-86K-(CL)1-1
DATED 30 DECEMBER 1960

*The asterisk indicates pages changed, added, or deleted by the current change.

ADDITIONAL COPIES OF THIS PUBLICATION MAY BE OBTAINED AS FOLLOWS:

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

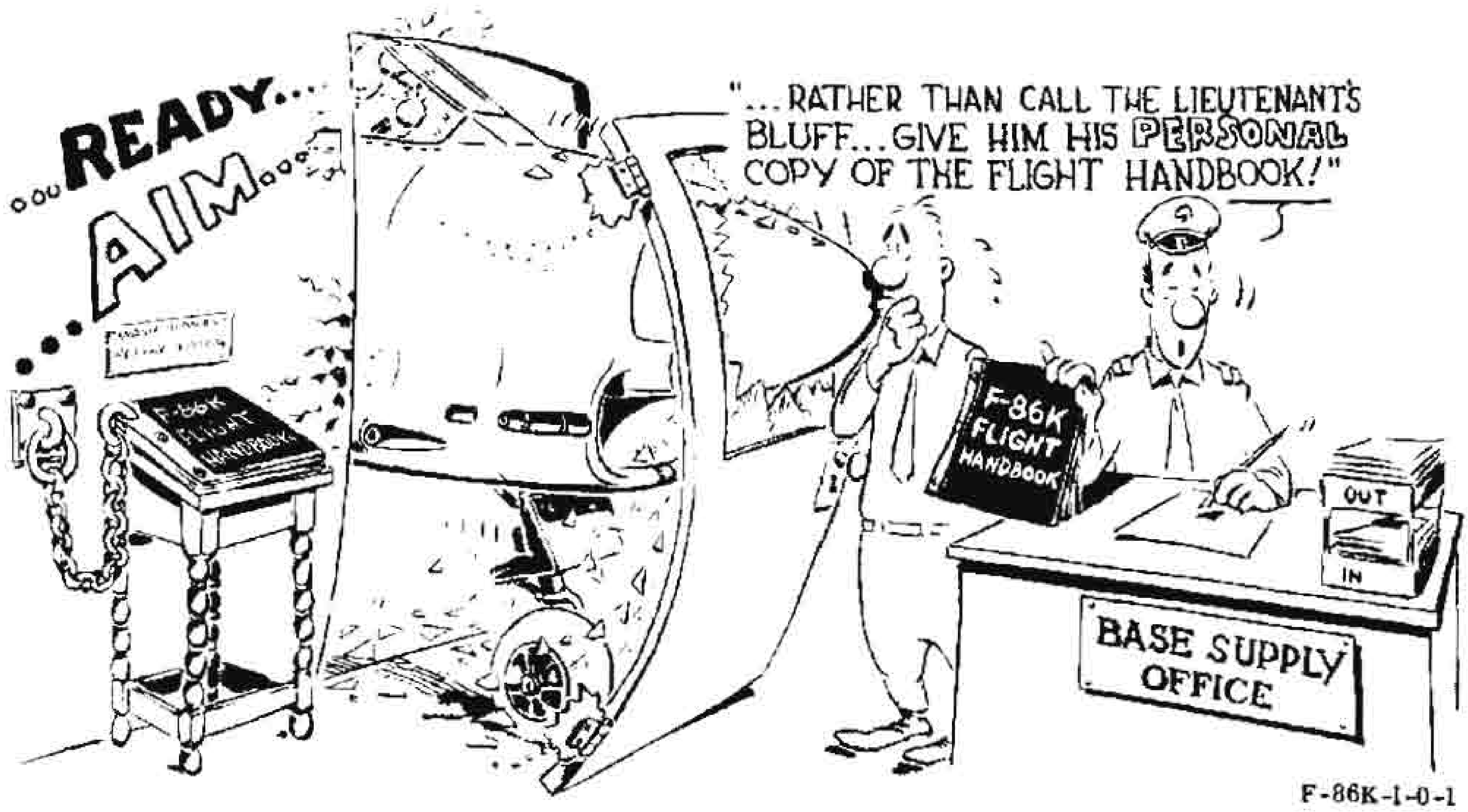
NAVY ACTIVITIES.—Use Publications and Forms Order Blank (NavAer 140) and submit in accordance with instruction thereon.

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

C-5
USAF

TABLE OF CONTENTS

F-86K-1-00-18B



The intent of Air Force Regulation 5-13, dated 11 August 1953, is to entitle each pilot to his own copy of the Flight Handbook.

SCOPE. This manual contains all the information necessary for safe and efficient operation of the F-86K Airplane. These instructions do not teach basic flight principles, but are designed to provide you with a general knowledge of the airplane, its flight characteristics, and specific normal and emergency operating procedures. Your flying experience is recognized, and elementary instructions have been avoided.

SOUND JUDGMENT. The instructions in this 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 require modification of the procedures contained herein.

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 both to read the book straight through when it is first received and thereafter to use it as a reference manual. The independence of these sections also makes it possible for the user to rearrange the book to satisfy his personal taste and requirements. The first three sections cover the minimum information required to safely get the airplane into the air and back down again. Before flying any new airplane, you must read and fully understand these three sections. 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 probably will be aware of most 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. These Flight Manuals are constantly maintained current through an extremely active revision program. Frequent conferences with operating personnel and constant review of UR's, accident reports, flight test reports, etc, ensure inclusion of the latest data in these manuals. In this regard, it is essential that you do your part! If you find anything you don't like about this book, let us know right away. We cannot correct errors whose existence is unknown to us.

TABS AND BINDERS. Flexible, loose-leaf tabs and binders 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 handbook as well as to keep it in good shape. These tabs and binders are secured through your local contracting officer.

HOW TO GET COPIES. If you want to be sure of getting your manuals on time, order them before you need them. Early ordering will ensure that enough copies are printed to cover your requirements. Technical Order 0-5-2 explains how to order Flight Manuals so that you automatically will get all changes, revisions, and Safety of Flight Supplements. Basically, all you have to do is order the required quantities in the Publication Requirements Table (T.O. 0-3-1). Talk to your Senior Materiel Staff Officer—it is his job to fulfill your Technical Order requests. Make sure to establish some system that will rapidly get the books and Safety of Flight Supplements to the 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 have 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 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 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. If you have ordered your Flight Manual on the Publication Requirements Table, you will automatically receive all supplements pertaining to your airplane. Technical Order 0-5-1 covers some additional information regarding these supplements.

Check Lists. The check lists previously included at the back of Sections II and III have been issued as a separate cardboard Technical Order. For the T.O. number and date of the check list applicable to this manual, refer to the "A" page under "Current Flight Check List." Procedures in this Flight Manual and its check list T.O. are identical with respect to arrangement of flight phases and step numbers. Order your cardboard check list T.O. as you would any Technical Order. The cardboard check list is designed for use with binders having plastic envelopes into which the cards are placed. These binders may be obtained through normal Air Force supply channels. Nomenclatures and stock numbers for the binders, with varying amounts of envelopes, are: Binder, USAF Flight Crew Check List, 15 envelopes—7510-766-4268; 25 envelopes, -4269; and 40 envelopes, -4270.

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

Operating procedures, conditions, etc, which are essential to emphasize.

MAINTENANCE TECHNICAL MANUAL. 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 -2 Series Systems Maintenance Technical Manual (T.O. 1F-86K-2 series) for your airplane.

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 Commander, Sacramento Air Materiel Area, McClellan AFB, McClellan, California, Attention: Weapons Engineering Division (SMNH).

F-86K-1-00-19A

Section I

DESCRIPTION

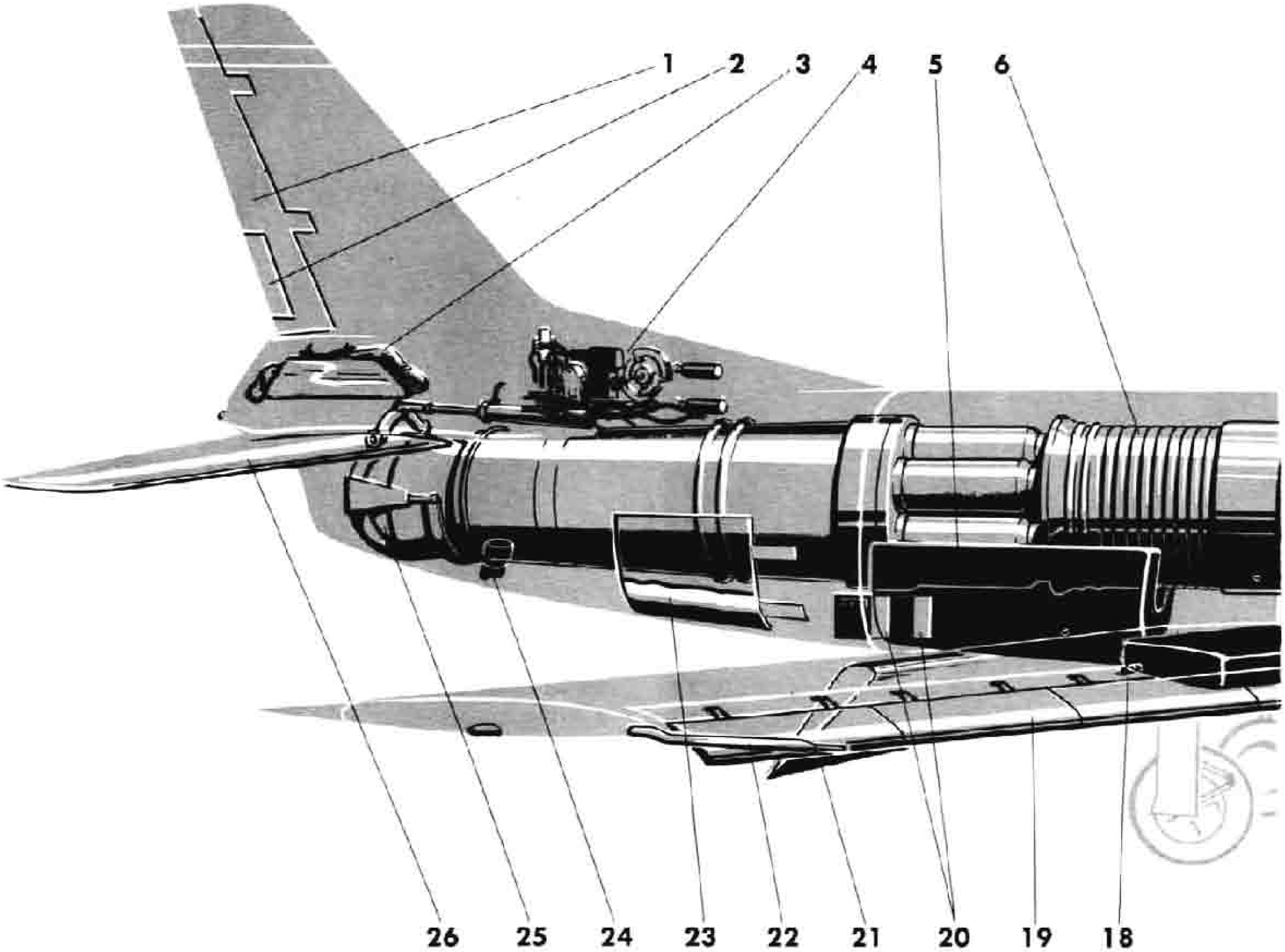
TABLE OF CONTENTS

AIRPLANE.

The North American F-86K is a single-place, all-weather fighter-interceptor, with fully retractable tricycle landing gear. It is armed with four 20 mm cannons and missiles (airplanes changed by T.O.) utilizing the MG-4 fire control system. The F-86K has the same basic recognition features as all F-86 Series Airplanes, including the swept-back wings and empennage, and a radome, very similar in appearance to a propeller spinner, on the nose, above the air intake duct. The airplane is powered by an axial-flow, turbojet engine incorporating an afterburner and electronic engine controls. Other noteworthy features include the leading edge wing slats and fuselage speed brakes to increase handling characteristics, a drag chute for additional braking on landings, and a unit which combines the horizontal stabilizer and elevators into one surface known as the controllable horizontal stabilizer. The airplane is designed as a high-altitude, high-performance, all-weather interceptor capable of searching out, intercepting, and destroying enemy aircraft by using the latest and most advanced type of electronic equipment to effectively fire the four rapid-fire 20 mm cannons. The fire control system locates and indicates to the pilot the proper course to follow to intercept his target. This system requires precision flying to fully utilize the electronic fire control system with a minimum of error; however, if evasive tactics are required, high-G maneuvers and abrupt turns within structural limitations of the airplane are permissible.

AIRPLANE GROUP DESIGNATIONS.

Group numbers are used to identify airplanes in accordance with production changes that affect the airplane and/or its equipment. Airplanes within a given group are usually identical with respect to production changes. The group numbers and Air Force serial numbers

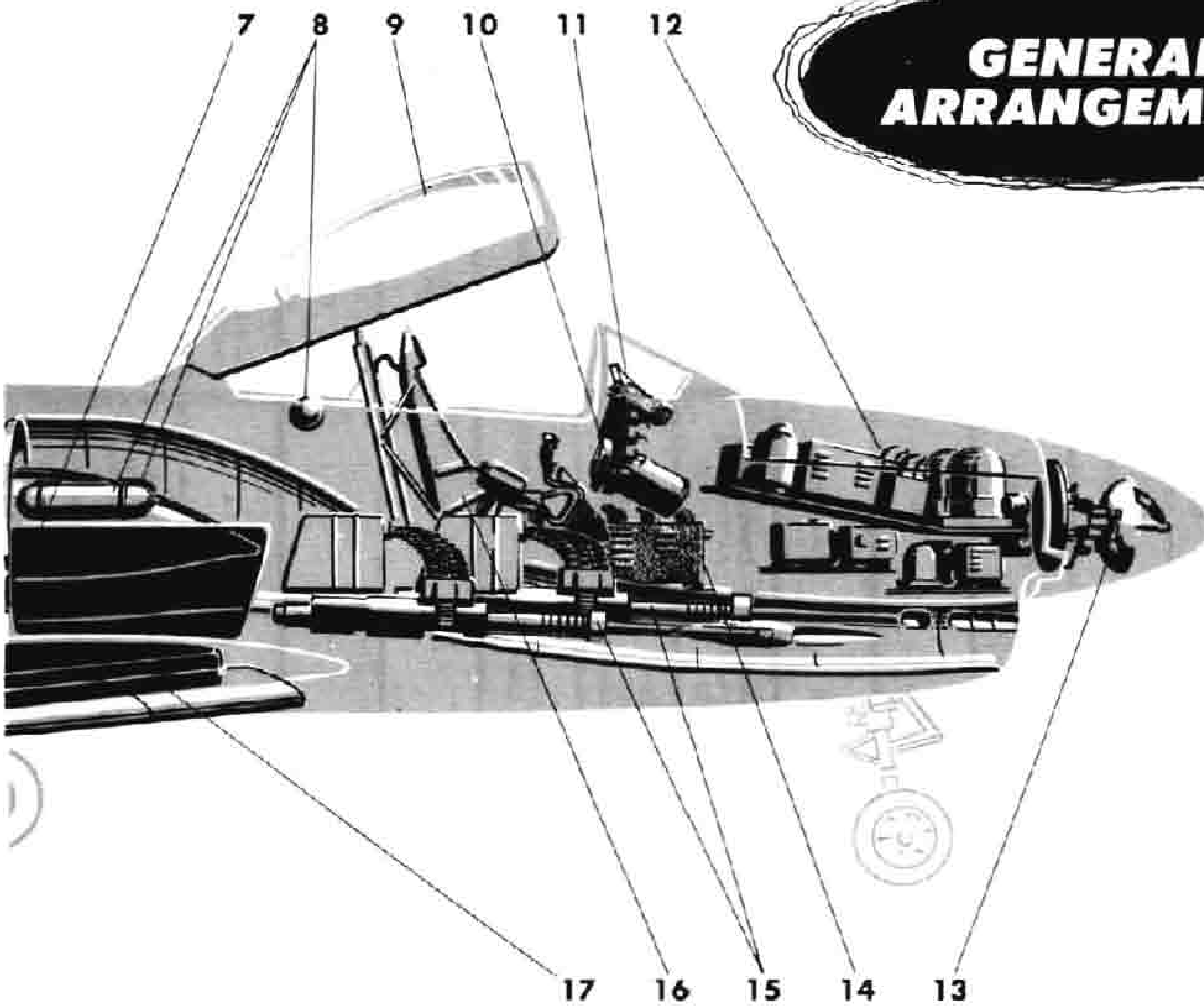


1. RUDDER
2. RUDDER TRIM TAB
3. DRAG CHUTE COMPARTMENT
4. VARIABLE-SLOPE FEEL FOR HORIZONTAL TAIL
5. AFT FUSELAGE FUEL TANK
6. J47-GE-17B JET ENGINE WITH AFTERBURNER
7. FORWARD FUSELAGE FUEL TANK
8. OXYGEN BOTTLES
9. ELECTRICALLY OPERATED HINGED CANOPY
10. RADARSCOPE
11. A-4 SIGHT
12. RADAR EQUIPMENT
13. RADAR ANTENNA

F-86K-1-00-20A

Figure 1-1

GENERAL ARRANGEMENT



14. ELECTRONIC ENGINE CONTROL AMPLIFIERS
15. 20 MM GUNS
16. EJECTION SEAT
17. WING FUEL TANK (TYPICAL BOTH SIDES)
18. EXTERNAL POWER RECEPTACLES
19. WING SLATS
20. BATTERIES
21. WING FLAP (TYPICAL BOTH SIDES)
22. PITOT TUBE (RIGHT-HAND WING ONLY)
23. SPEED BRAKE (BOTH SIDES)
24. FUEL VENT BAYONET (LEFT-HAND SIDE)
25. VARIABLE-AREA NOZZLE
26. CONTROLLABLE HORIZONTAL TAIL

F-86K-1-00-21

MAIN DIFFERENCES TABLE

ITEM	F86A	F86D	F86E	F-86F AND RF-86F	F86H	F-86K	F86L
ENGINE	J47-GE-7 OR -13	J47-GE-17, -17B, OR -33	J47-GE-13	J47-GE-27	J73-GE-3	J47-GE-17B	J47-GE-17B OR -33
ENGINE AIR INTAKE DUCT	IN NOSE	BELOW RADOME IN NOSE	IN NOSE	IN NOSE	IN NOSE	BELOW RADOME IN NOSE	BELOW RADOME IN NOSE
DRAG CHUTE	NO	IN EMPENNAGE ABOVE EXHAUST NOZZLE AND BELOW RUDDER	NO	NO	NO	IN EMPENNAGE ABOVE EXHAUST NOZZLE AND BELOW RUDDER	IN EMPENNAGE ABOVE EXHAUST NOZZLE AND BELOW RUDDER
CANOPY	SLIDING	CLAMSHELL	SLIDING	SLIDING	CLAMSHELL	CLAMSHELL	CLAMSHELL
HORIZONTAL TAIL ACTION	CONVENTIONAL	STABILIZER AND ELEVATOR COMBINED INTO ONE MOVABLE SURFACE	CONTROLLABLE STABILIZER AND ELEVATOR	CONTROLLABLE STABILIZER AND ELEVATOR	CONTROLLABLE STABILIZER AND ELEVATOR	STABILIZER AND ELEVATOR COMBINED INTO ONE MOVABLE SURFACE	STABILIZER AND ELEVATOR COMBINED INTO ONE MOVABLE SURFACE
SURFACE CONTROLS	CONVENTIONAL WITH HYDRAULIC BOOST	COMPLETELY HYDRAULIC IRREVERSIBLE CONTROL	COMPLETELY HYDRAULIC IRREVERSIBLE CONTROL	COMPLETELY HYDRAULIC IRREVERSIBLE CONTROL	COMPLETELY HYDRAULIC IRREVERSIBLE CONTROL	COMPLETELY HYDRAULIC IRREVERSIBLE CONTROL	COMPLETELY HYDRAULIC IRREVERSIBLE CONTROL
ENGINE CONTROLS	CONVENTIONAL (MECHANICAL LINKAGE)	ELECTRONIC	CONVENTIONAL (MECHANICAL LINKAGE)	CONVENTIONAL (MECHANICAL LINKAGE)	HYDROMECHANICAL	ELECTRONIC	ELECTRONIC
AUTOMATIC PILOT	NO	YES	NO	NO	NO	YES	YES
ARTIFICIAL FEEL	NO	YES	YES	YES	YES	YES	YES
SIGHT	A-1B, A-1CM, OR MARK 18	E-3 FIRE CONTROL E-4 FIRE CONTROL N-9-1 (STAND-BY)	A-1CM OR A-4	A-1CM OR A-4	A-4	MG-4 FIRE CONTROL (WITH A-4 SIGHT)	E-4 FIRE CONTROL NAFFARS (STAND-BY)
ARMAMENT	GUNS AND EXTERNALLY MOUNTED BOMBS, ROCKETS, OR CHEMICAL TANKS	ROCKETS MOUNTED IN RETRACTABLE PACKAGE	GUNS AND EXTERNALLY MOUNTED BOMBS, ROCKETS, OR CHEMICAL TANKS	MACHINE GUNS, BOMBS, ROCKETS, OR SPECIAL STORES* ------- K-17 OR K-22 CAMERAS†	MACHINE GUNS, BOMBS, ROCKETS, OR SPECIAL STORES	20 MM RAPID-FIRING GUNS	ROCKETS MOUNTED IN RETRACTABLE PACKAGE

* F-86F Airplanes † RF-86F Airplanes

F-86K-1-93-110

Figure 1-2

assigned to the F-86K Airplanes, for coding purposes, are listed as follows:

GROUP NUMBERS	AF SERIAL NUMBERS
Group 1 (F-86K-1)	AF54-1231 through -1350
Group 2	AF55-4811 through -4880
Group 3	AF55-4881 through -4936
Group 4	AF56-4116 through -4160

Group 1 airplanes are also designated as F-86K-1 Airplanes.

AIRPLANE DIMENSIONS.

The principal dimensions of the airplane are as follows:

Wing span .... 37.1 feet
Group 4 Airplanes .... 39.1 feet
(and those changed by T.O.)
Length .... 41.0 feet
Height (to top of fin) .... 15.0 feet

Note

The increased wing span on Group 4 airplanes and those changed by T.O., is the result of adding a 12-inch extension to each wing tip.

AIRPLANE GROSS WEIGHT.

The approximate take-off gross weight of the airplane, including pilot (230 pounds), full internal fuel tanks, and ammunition, is as follows:

Groups 1, 2, and 3 Airplanes—
No external load .... 18,400 pounds
With two 120-gallon drop tanks .... 20,200 pounds
With two 120-gallon drop tanks and two GAR-8 missiles .... 20,700 pounds
Group 4 Airplanes—
No external load .... 18,650 pounds
With two 120-gallon drop tanks .... 20,450 pounds
With two 120-gallon drop tanks and two GAR-8 missiles .... 20,950 pounds

Refer to "Weight Limitations," Section V, for additional information.

Note

The preceding gross weights are average weights. For the gross weights of a particular airplane, refer to the Weight and Balance Technical Manual, T.O. 1-1B-40, that is assigned to the particular airplane.

ARMAMENT.

The armament consists of four 20 mm, combination blowback and gas-operated guns. The guns are located on the forward sides of the fuselage, two on each side of the cockpit. Ammunition is carried in removable ammunition boxes located above each gun. Missiles may be carried on launchers attached to the underside of the wing on airplanes changed by T.O. 1F-86K-546.

ENGINE.

The Model J47-GE-17B turbojet engine (figure 1-3) has an electronic engine control system, an afterburner, and a variable-area jet nozzle. The rated sea-level static thrust of the engine is about 5425 pounds at Military Power and 7500 pounds at Maximum Power (with afterburner operating). During engine operation, air enters the intake duct below the nose of the airplane and is routed to an axial-flow compressor, where it is compressed progressively in 12 stages. The compressed air then flows to the combustion chambers, where atomized fuel is injected and combustion occurs. From the combustion chambers, the hot exhaust gases pass through a turbine and out the tail pipe in gradually expanding form to provide the high-velocity jet and reaction thrust. The turbine, which is rotated by the exhaust gases passing through it, is directly connected to, and drives, the compressor. When maximum performance for short periods is desired, the exhaust gas may be reheated by the injection of fuel into the tail pipe aft of the turbine. The burning of the injected fuel providing additional thrust is called afterburning. An electronically controlled, variable-area nozzle on the end of the tail pipe provides correct nozzle conditions for optimum performance with or without afterburner operating. The engine has a "hot streak" ignition system for afterburner ignition, a flame dome and flame holder mounting to give rigidity and strength to the tail pipe, and a ceramic-coated inner liner in the tail pipe to give better insulation of exhaust temperatures.

ELECTRONIC ENGINE CONTROL.

The airplane is equipped with an electronic engine control (figure 7-1), the main advantage of which is the extremely rapid response of the engine to changes in throttle setting. In addition, starting and operating techniques are considerably simplified. Flame-outs and compressor stalls due to excessively rapid throttle movement are prevented, as the controls always respond at the correct rate, regardless of how fast the throttle is moved. Control of the engine is tied in with the control of the variable-area nozzle, thereby automatically maintaining correct tail-pipe temperature. When the throttle is moved, an electronically amplified signal energizes the main and afterburner fuel control valves and the variable-area nozzle. If the electrical inverters do not function properly when external power is applied for an engine start, the electronic power control will be inoperative. Inverter failure warning lights should be checked and all applicable circuit breakers pushed in when external power has been applied before an engine start is attempted. After external power has been connected to the airplane, an automatic start may be made after the engine control lockup light is out. This will

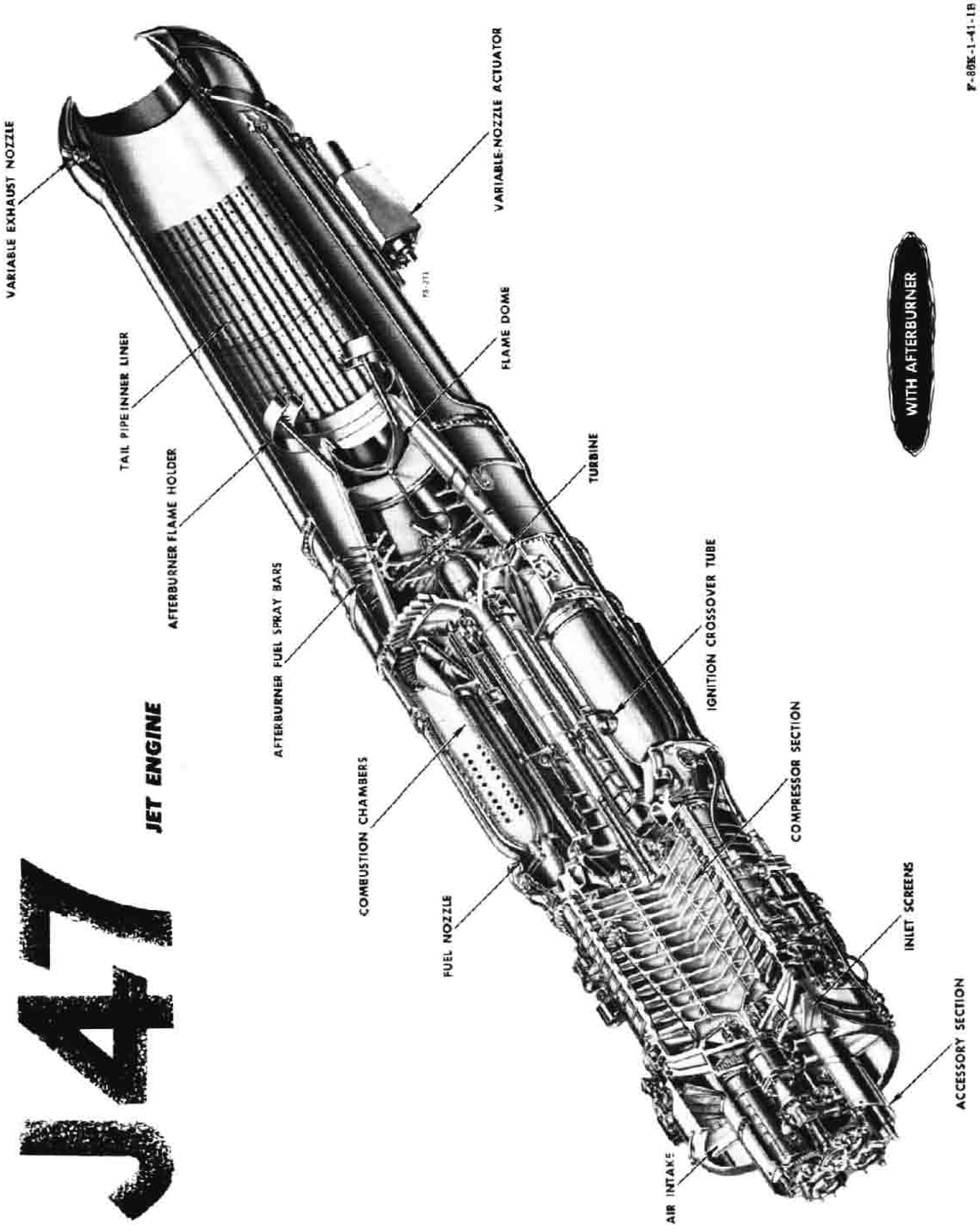

J47
JET ENGINE
WITH AFTERBURNER
F-86K-1-41-1B
VARIABLE EXHAUST NOZZLE
VARIABLE-NOZZLE ACTUATOR
TAIL PIPE INNER LINER
FLAME DOME
AFTERBURNER FLAME HOLDER
TURBINE
AFTERBURNER FUEL SPRAY BARS
IGNITION CROSSOVER TUBE
COMBUSTION CHAMBERS
COMPRESSOR SECTION
FUEL NOZZLE
INLET SCREENS
ACCESSORY SECTION
AIR INTAKE

Figure 1-3

ensure that the amplifiers are warmed up enough for proper electronic control during the automatic start. The starting circuit will not be energized if ac power is not available from the inverters. Refer to Section VII for further information on the electronic engine control and its characteristics.

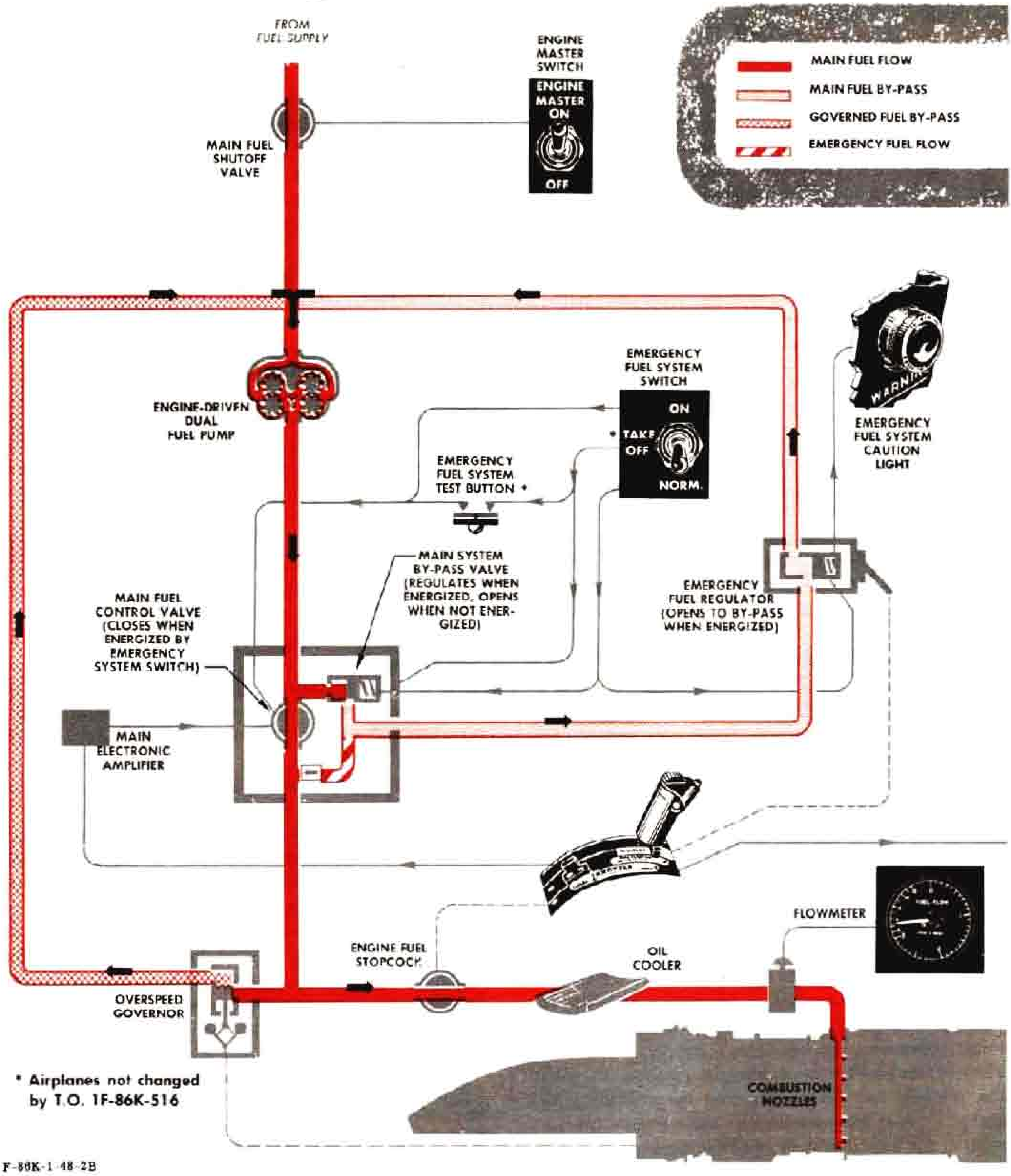
ENGINE FUEL CONTROL SYSTEM.

Engine fuel control is provided by a main fuel control valve and an emergency fuel regulator, controlled by a three-position emergency fuel system switch. (See figure 1-4.) On Group 3 and 4 airplanes and those changed by T.O., a two-position (NORM and ON) emergency fuel system switch is installed. The emergency fuel system has been changed to eliminate the chance of interaction between the main and emergency fuel control systems during take-off. It also eliminates confusion caused by two engine control systems being in use at the same time. This change *removes* the TAKE OFF position of the emergency fuel system switch and removes the emergency fuel system test button. A throttle-actuated, spring-loaded idle detent plunger and switch (replacing the 72-degree thrust selector switch) are added to the throttle quadrant to allow the pilot to abort a take-off if the electronic engine control locks up during the take-off roll. An engine-driven, dual fuel pump supplies fuel to the main fuel control valve, which meters the amount of fuel required by the engine. Excess fuel is bypassed through the open emergency fuel regulator back to the fuel pump inlet. Metered fuel from the control valve passes through a throttle-actuated engine fuel stopcock to the engine combustion chambers. The setting of the fuel control valves is determined electronically by throttle position, airspeed, exhaust temperature, engine rpm, altitude, and outside air temperature. The main fuel control valve automatically regulates fuel flow to the engine during starting; the correct fuel flow is provided for ignition and then for acceleration to the speed previously selected by the throttle. In case of failure of the electronically controlled main control valve, the throttle-controlled emergency fuel regulator takes over engine fuel control when the emergency fuel system switch is positioned at TAKE OFF or ON (at the ON position on airplanes with the two-position emergency fuel switch). The emergency regulator limits the amount of bypassed fuel in accordance with throttle setting, airspeed, and altitude. In normal operation, the emergency regulator is held in a full bypass position by an energized holdout solenoid. The solenoid may be de-energized by positioning the emergency fuel system switch to TAKE OFF or ON (ON position for airplanes with two-position emergency fuel switch), enabling the throttle to mechanically control the emergency regulator. On airplanes with the three-position emergency fuel system switch, with the switch at TAKE OFF (the emergency regulator holdout solenoid is de-energized, alerting the emergency regulator to a stand-by condition) during 100% rpm operation, a drop in fuel pressure causes the emergency regulator to take over control of fuel flow at a pressure slightly below normal (depending on outside air temperature). The emergency regulator, at a position determined by the throttle, forces fuel around the main control valve to the combustion chambers. When control by the emergency regulator is selected, a main system bypass valve is opened and the main fuel control valve is closed to enable the emergency regulator to control fuel flow. A throttle-actuated switch (72-degree switch incorporated in the thrust selector on airplanes with the three-position emergency fuel system switch, or the idle detent switch on airplanes incorporating the two-position emergency fuel system switch) also allows engine control to be converted to the emergency fuel system (with three-position emergency fuel system switch at TAKE OFF) if the engine controls lock up at Take-off Thrust on the main fuel system and it is desired to abort the take-off. The 72-degree switch (about ¾ throttle position) or idle detent switch is actuated by rapidly retarding the throttle to START IDLE. This switch, when actuated, electrically opens the main fuel system bypass valve and permits the emergency fuel system to assume engine control; however, it does not unlock the electronic engine controls. A complete loss of electrical power to the primary bus, or movement of the battery-starter and generator switches to OFF during engine operation also causes the holdout solenoid to be de-energized and the main system bypass valve to open. This allows the emergency fuel system to take over fuel control, regardless of the position of the emergency fuel system switch and without the emergency fuel system caution light coming on. The emergency regulator is set to deliver, normally, a slightly lower fuel pressure than the main fuel control valve. The emergency regulator does not provide automatic fuel control in starts, accelerations, and decelerations; therefore, with the engine operating below 85% rpm, any rapid throttle movement with the emergency regulator operating would supply too much fuel to the engine, causing flame-out, stall, or excess temperatures. A mechanical overspeed governor is installed downstream of the main control valve and emergency regulator. The governor bypasses excess fuel if the engine tends to overspeed. Refer to Section VII for additional information on the emergency fuel system.

Throttle.

The throttle quadrant (9, figure 1-6), on the left console, is labeled "CLOSED" and "OPEN." Immediately adjacent to the throttle, the markings are "START IDLE," "MILITARY," and "AFTERBURNER." There

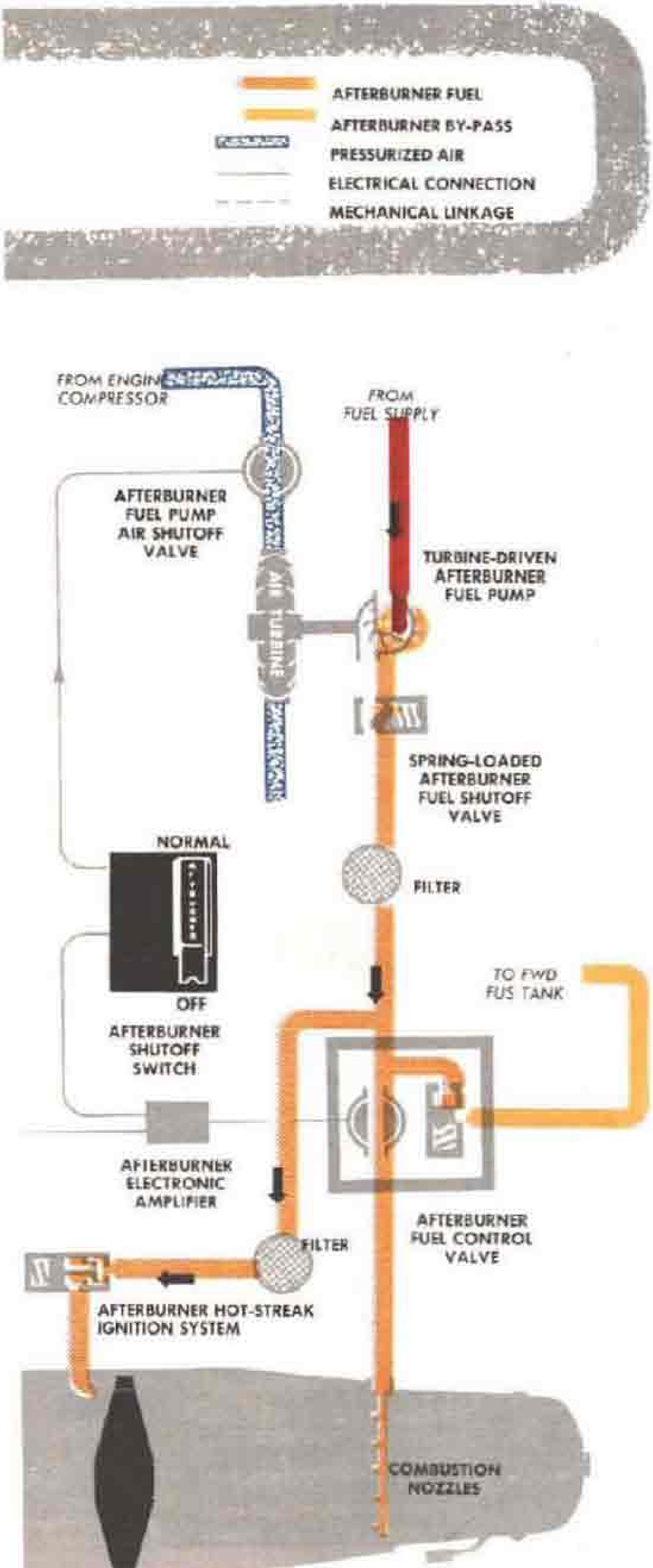
ENGINE FUEL CONTROL SYSTEM



* Airplanes not changed by T.O. 1F-86K-516

F-86K-1-48-2B

Figure 1-4



F-86K-1-48-1

are three stops on the quadrant: one at the CLOSED position, one at START IDLE to prevent shutting off the fuel supply inadvertently, and one at MILITARY. Outboard movement of the throttle, which is spring-loaded inboard, allows the stops to be bypassed. Throttle movement during engine starting has been simplified; the throttle is simply moved outboard and forward to the desired power setting when 6% rpm is obtained. With the engine master switch at ON, the initial outboard movement of the throttle actuates a microswitch that energizes the ignition system; subsequent movement of the throttle to START IDLE opens the engine fuel stopcock. Ignition is automatically cut off by a starter cutout relay when engine speed reaches about 23% rpm. Since the mixture in the combustion chambers will burn continuously after once being ignited, ignition is required only during the starting procedure. When the engine is running, movement of the throttle in the normal operating range changes engine rpm by electronically changing the setting of the main fuel control valve. The throttle setting (in conjunction with the temperature-limiting control circuitry) determines the position of the variable-area nozzle, which, in turn, maintains optimum exhaust temperatures. When the throttle is advanced above the MILITARY stop, compressor air is supplied for afterburner fuel pump turbine operation, and the afterburner fuel shutoff valve is opened. In the afterburner operating range, the afterburner fuel control valve is electronically controlled by movement of the throttle to obtain various afterburner power settings. Afterburning continues until the throttle is retarded below the AFTERBURNER range. The throttle grip (figure 1-9) contains a microphone button, a speed brake switch, and a target reject button for use with the MG-4 fire control system. Rotation of the grip provides manual ranging to supply range rate data.

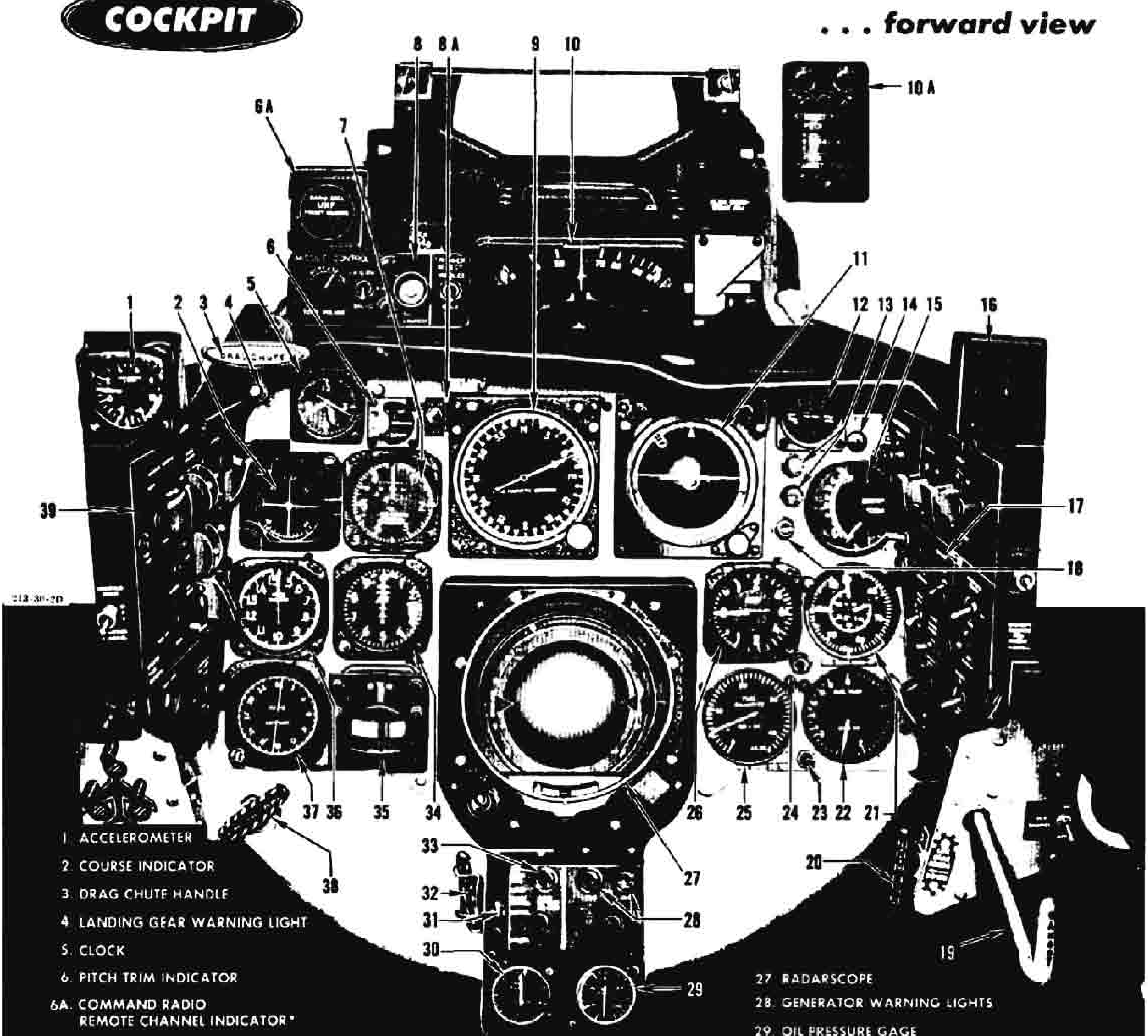
Engine Master Switch.

An engine master switch is located on the engine control panel (figure 1-8) on the left instrument subpanel. Turning the master switch to the ON position opens the main fuel shutoff valve, starts the fuel booster pumps, and completes circuits to the throttle-actuated microswitch, which provides ignition during starting. The circuit to the air start switch is also energized. The engine master switch is powered from the primary bus.

Emergency Fuel System Switch (Three-position).

A means of selecting the proper fuel control for the engine is provided by a switch on the engine control panel. (See figure 1-8.) The switch has three positions, ON, TAKE OFF, and NORM, and is powered by the primary

COCKPIT . . . forward view



1. ACCELEROMETER
2. COURSE INDICATOR
3. DRAG CHUTE HANDLE
4. LANDING GEAR WARNING LIGHT
5. CLOCK
6. PITCH TRIM INDICATOR

6A. COMMAND RADIO REMOTE CHANNEL INDICATOR*

7. AIRSPEED INDICATOR (AIRSPEED-MACHMETER)*
8. MISSILE CONTROL PANEL*

8A. TACAN-ILS CHANGE-OVER SWITCH*

9. DIRECTIONAL INDICATOR (SLAVED)
10. A-4 SIGHT HEAD

10A. MISSILE RELEASE INDICATOR*

11. ATTITUDE INDICATOR
12. VARIABLE-NOZZLE INDICATOR
13. FIRE-WARNING LIGHTS
14. DIRECTIONAL INDICATOR FAST SLAVE SWITCH
15. EXHAUST TEMPERATURE GAGE
16. STAND-BY COMPASS
17. RIGHT INSTRUMENT SUBPANEL
18. FIRE-WARNING LIGHT TEST SWITCH
19. CANOPY LOCK HANDLE
20. LANDING GEAR EMERGENCY HANDLE
21. TACHOMETER
22. FUEL FLOW INDICATOR
23. FUEL QUANTITY GAGE TEST SWITCH
24. ENGINE CONTROL LOCKUP LIGHT
25. FUEL QUANTITY GAGE
26. VERTICAL VELOCITY INDICATOR
27. RADARSCOPE
28. GENERATOR WARNING LIGHTS
29. OIL PRESSURE GAGE
30. HYDRAULIC PRESSURE GAGE
31. HYDRAULIC PRESSURE GAGE SELECTOR SWITCH
32. DROP TANK EMER JETTISON HANDLE
33. FLIGHT CONTROL ALTERNATE SYSTEM INDICATOR LIGHT
34. ALTIMETER
35. TURN-AND-SLIP INDICATOR
36. MACHMETER (RADIO COMPASS INDICATOR)*
37. RADIO COMPASS INDICATOR (DISTANCE INDICATOR)*
38. FLIGHT CONTROL EMERGENCY HANDLE
39. LEFT INSTRUMENT SUBPANEL (ENGINE CONTROL PANEL)

* Some airplanes. (Refer to applicable text.)

F-86K-1-00-27H

Figure 1-5

bus. The TAKE OFF position is used only during take-off and initial climb to safe altitude. When the switch is at TAKE OFF at 100% rpm, fuel flow to the engine is electronically controlled by the main fuel control valve, with the emergency regulator serving as a stand-by. With the switch in this position, the emergency fuel system caution light comes on as a warning that rapid throttle movements should not be made; otherwise, a compressor stall or flame-out may result. If the main fuel system pressure drops while the switch is at TAKE OFF, the emergency fuel regulator automatically takes over fuel control. However, if the main fuel control valve again becomes operative, it will serve as the primary control and the emergency fuel regulator will return to stand-by.

CAUTION

If it becomes necessary to reduce power when switch is at TAKE OFF, the throttle should be retarded to START IDLE and the emergency fuel system switch should be returned to NORM without hesitating in TAKE OFF position before the throttle is readvanced, to avoid undesirable power surges, possible compressor stall, or over-temperature condition.

When the emergency fuel system switch is at NORM, the main control valve controls fuel flow without the emergency regulator serving as a stand-by. The switch should normally be in this position for all flight conditions except take-off and initial climb. When the switch is moved to ON, the emergency regulator takes over fuel control, the main system by-pass valve is opened, and the main fuel control valve is closed. If loss of electrical power to the primary bus occurs, or if the battery-starter and generator switches are moved to OFF during engine operation, the emergency fuel system will take over fuel control without illuminating the emergency fuel system indicator light, regardless of the position of the emergency fuel system switch.

Emergency Fuel System Switch (Two-position).

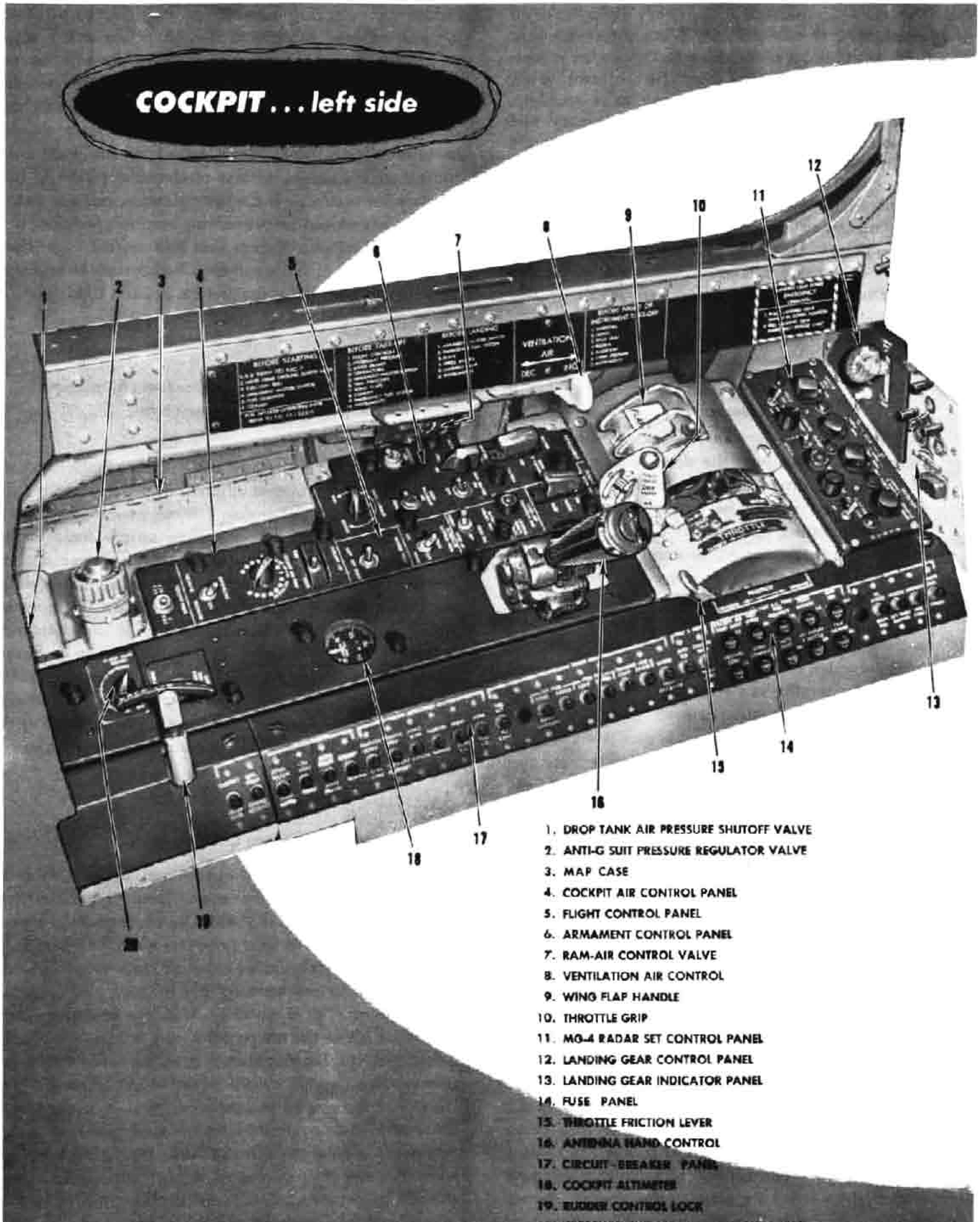
A means of selecting the proper engine fuel control is provided by a switch (figure 1-8) on the engine control panel. The switch has two positions, ON and NORM, and is powered by the primary bus. With the switch in the ON position, engine control is provided by the emergency fuel system, and the emergency fuel system caution light comes on. This light is a warning that rapid throttle movements should not be made when engine rpm is below 85%; otherwise, a compressor stall or flame-out may result. The switch should be set at the NORM position for take-off and all normal operations. If automatic lockup occurs during take-off and it is desired to abort the take-off, the throttle is moved to the START IDLE position with enough force to depress the idle detent switch. This actuates the idle detent switch and immediately switches control from the main fuel system to the emergency fuel system. The emergency fuel system should be selected only when actual failure of the main fuel control system occurs. If loss of electrical power to the primary bus occurs or if the battery-starter and generator switches are moved to OFF during engine operation, the emergency fuel system takes over fuel control, regardless of the position of the emergency fuel system switch and without the emergency fuel system caution light coming on.

Emergency Fuel System Test Button (Airplanes With Three-position Emergency Fuel System Switch).

Operation of the emergency fuel system may be checked by means of a test button adjacent to the emergency fuel system switch on the engine control panel. (See figure 1-8.) The emergency fuel system switch must be at TAKE OFF and the throttle at MILITARY power during the test. When the test button is depressed, completing the circuit from the primary bus, the main fuel control system is shut off by electrical closing of the main fuel control valve. A decrease in engine rpm to a lower stabilized value (figure 2-4) indicates that the emergency fuel regulator has taken over fuel control. When the test button is released, the main fuel control valve is allowed to regain fuel control, and the emergency fuel regulator is again at stand-by.

Emergency Fuel System Caution Light.

An amber emergency fuel system caution light, labeled "WARNING" is on the engine control panel. (See figure 1-8.) On airplanes with the three-position emergency fuel switch, the light comes on when the emergency fuel system switch is moved to ON or TAKE OFF. Illumination of the light is a warning that the emergency regulator is in control or in stand-by. With the emergency fuel system switch in the ON position, any accelerations from below-85%-rpm engine speeds must be made very cautiously. The throttle should never be readvanced when the switch is in TAKE OFF position because of the possibility of exhaust overtemperature. On airplanes with the two-position emergency fuel switch, the light comes on when the switch is moved to the ON position or when the idle detent switch is actuated during a lockup condition. Throttle movements should be made cautiously, if rpm is below 85% when the light is on. The light is powered from the primary bus.



1. DROP TANK AIR PRESSURE SHUTOFF VALVE
2. ANTI-G SUIT PRESSURE REGULATOR VALVE
3. MAP CASE
4. COCKPIT AIR CONTROL PANEL
5. FLIGHT CONTROL PANEL
6. ARMAMENT CONTROL PANEL
7. RAM-AIR CONTROL VALVE
8. VENTILATION AIR CONTROL
9. WING FLAP HANDLE
10. THROTTLE GRIP
11. MG-4 RADAR SET CONTROL PANEL
12. LANDING GEAR CONTROL PANEL
13. LANDING GEAR INDICATOR PANEL
14. FUSE PANEL
15. THROTTLE FRICTION LEVER
16. ANTENNA HAND CONTROL
17. CIRCUIT-BREAKER PANEL
18. COCKPIT ALTIMETER
19. RUDDER CONTROL LOCK
20. PRESSURE-SUIT MASK HEATER RHEOSTAT

Figure 1-6

. . . right side

1. CANOPY SWITCH
2. CANOPY UNSAFE WARNING LIGHT
3. FLOOD AND CONSOLE LIGHT CONTROL PANEL
4. WINDSHIELD AND CANOPY DEFROST LEVER
5. RADIO COMPASS CONTROL PANEL
6. UHF RADIO CONTROL PANEL
7. IFF CONTROL PANEL
8. GENERATOR INDICATOR SELECTOR SWITCH
9. LOADMETERS FOR GENERATORS
10. THUNDERSTORM LIGHT RHEOSTAT
11. AUTOMATIC PILOT POWER SWITCH
12. VOLTMETER
13. FUSE PANEL
14. LIGHTING CONTROL PANEL
15. RADARSCOPE PRESENTATION INTENSITY CONTROL PANEL
16. CIRCUIT-BREAKER PANEL
17. AUTOMATIC PILOT FLIGHT CONTROLLER
18. OXYGEN REGULATOR
19. YAW DAMPER SWITCH

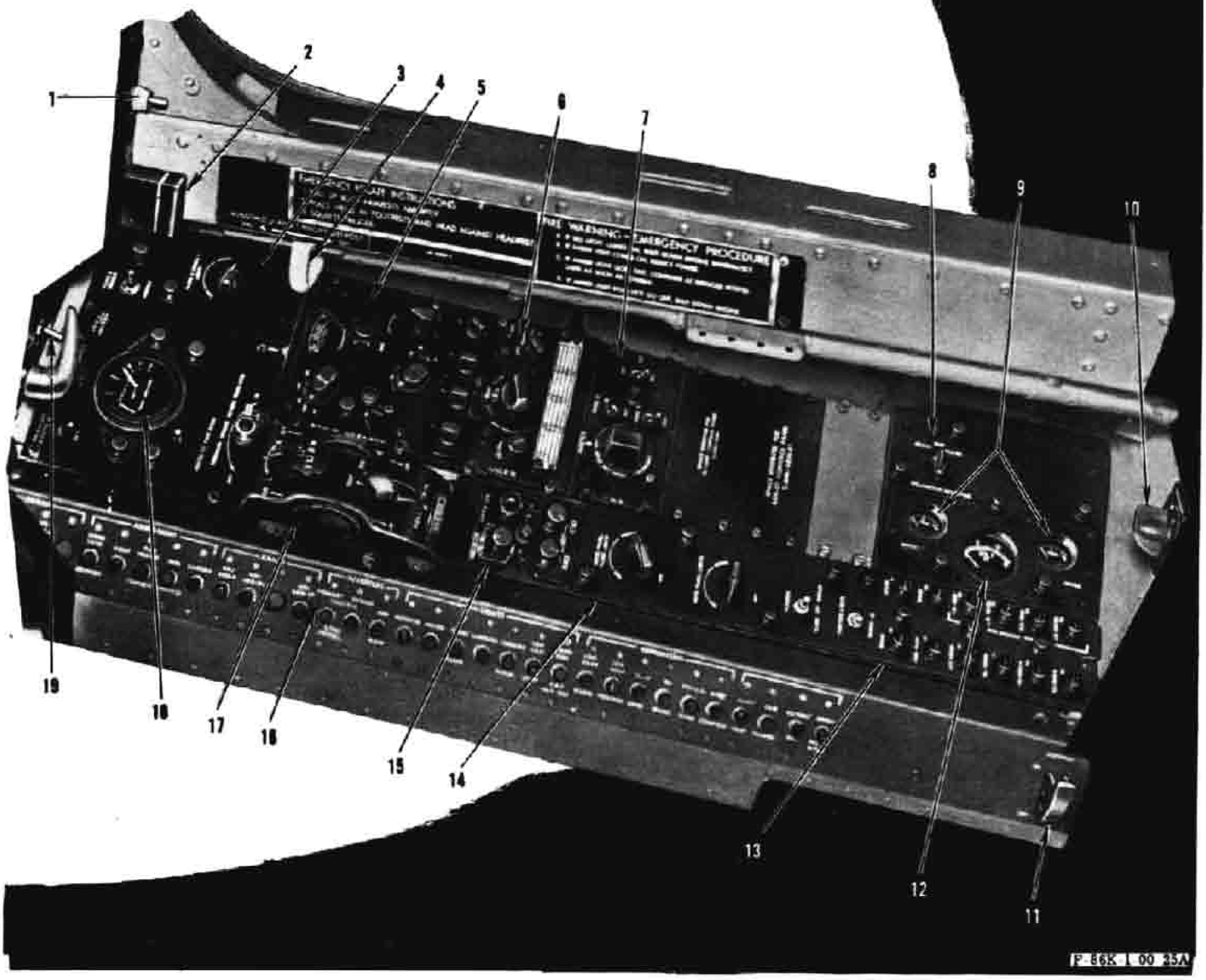
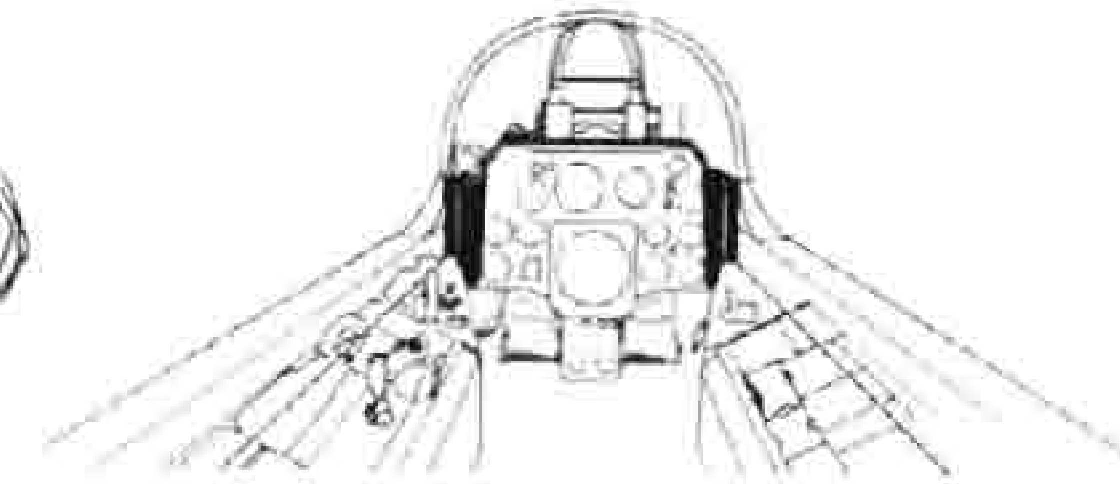


Figure 1-7

INSTRUMENT SUBPANELS



LEFT (ENGINE CONTROL)

RIGHT

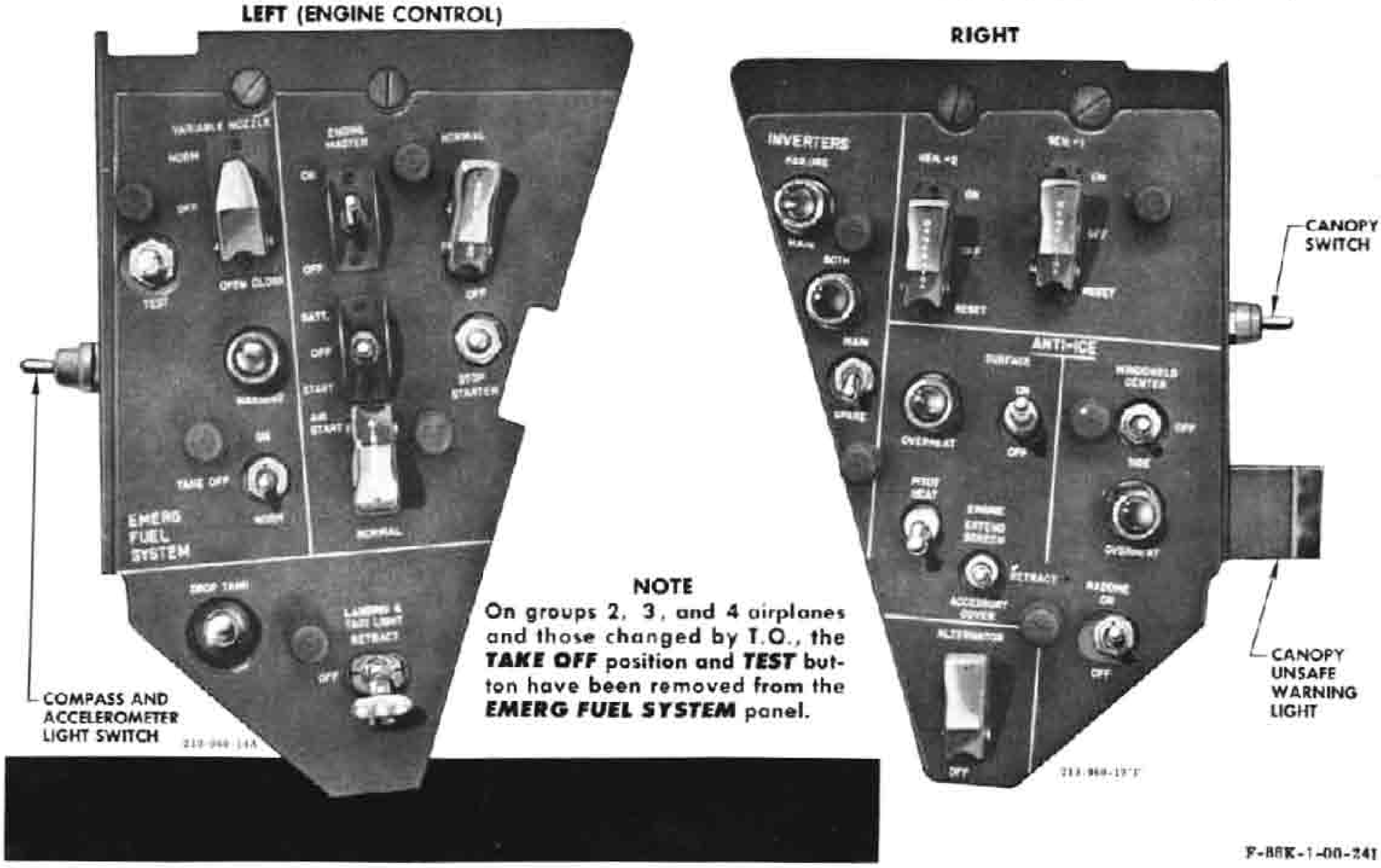


Figure 1-8

ELECTRONIC ENGINE CONTROL AUTOMATIC LOCKUP SYSTEM (AIRPLANES WITH THREE-POSITION EMERGENCY FUEL SYSTEM SWITCH).

An engine control automatic lockup system is installed in this airplane to provide protection against possible loss of thrust should the electronic engine control lose ac power. The lockup system is used in conjunction with the electronic engine control and permits full engine control to be maintained until an ac power supply failure is actually encountered. Whenever the ac power supply to the electronic engine control falls below about 92 volts, the main and afterburner fuel control valves and the variable exhaust nozzle are automatically locked in their existing positions. This locked power setting is then maintained until about 15 seconds after the ac power supply rises above about 98 volts. The lockup is then automatically removed, and the electronic engine control resumes operation. The 15-second interval following inverter change-over is required so that the electronic engine control components can be rewarmed after a main inverter failure. If the ac power supply is not re-established above about 98 volts, the electric engine controls will stay in automatic lockup. Engine control is recovered by converting to operation on the emergency fuel system. Power settings should not be changed when engine controls are in lockup, since engine overtemperature or surging may result when lockup is removed. During an engine start, the automatic lockup system is made ineffective when the battery-starter switch is momentarily positioned at START. *After the engine is operating, positioning the emergency fuel system switch to* ON *then back to* NORM *without hesitating at* TAKE OFF *makes the automatic lockup system operable.* It will then remain operable during all normal operation. If automatic lockup occurs during take-off roll, with the emergency fuel system switch at TAKE OFF, the take-off can be aborted by rapidly retarding the throttle to START IDLE. (The throttle is retarded rapidly to prevent engine overspeed, because back pressure on the turbine wheel is decreased as afterburner operation ceases.) This action actuates the 72-degree switch in the thrust selector, which transfers engine operation to the emergency fuel system. For taxiing after take-off is aborted, before the throttle is readvanced, positioning the emergency fuel system switch to ON will eliminate any power surges that may occur when the throttle is readvanced. A lockup caution light, labeled "ENG. CONT. LOCK-UP," is provided to indicate when engine controls are in lockup. Refer to Section VII for added information on characteristics of the automatic lockup system.

ELECTRONIC ENGINE CONTROL AUTOMATIC LOCKUP SYSTEM (AIRPLANES WITH TWO-POSITION EMERGENCY FUEL SYSTEM SWITCH).

When ac power to the electronic engine control drops below 92 volts, the main and afterburner fuel control valves and the variable exhaust nozzle are automatically locked in position. This locked power setting is then maintained until about 15 seconds after the ac power rises above about 98 volts. The lockup is then automatically removed, and the electronic engine control resumes operation. The 15-second interval following inverter change-over (automatic or manual) is required so that the electronic engine control parts can be rewarmed after a main inverter failure. If the ac power is not re-established above about 98 volts, the engine controls will stay in automatic lockup. With the installation of the two-position emergency fuel switch, the automatic lockup system is capable of locking engine controls during an automatic start. (Refer to "Automatic Start" in Section II.) After the engine is operating, the automatic lockup system remains operable during normal operation with the emergency fuel system in the NORM position. If automatic lockup occurs during the take-off roll with the emergency fuel switch at NORM, the take-off can be aborted by rapidly retarding the throttle to START IDLE. The throttle is retarded rapidly to prevent engine overspeed because back pressure on the turbine wheel is decreased as afterburner operation ceases. This throttle action actuates the idle detent switch, which transfers engine operation to the emergency fuel system during a lockup condition only.

Note

Moving the emergency fuel switch to ON or actuating the idle detent switch when the engine controls are locked up does not unlock the exhaust nozzle. It must be controlled by the variable-nozzle switch.

The emergency fuel system remains in control until the engine control lockup light goes out and until the emergency fuel switch is cycled to ON and returned to NORM. For taxiing after a take-off is aborted and before the throttle is readvanced, the emergency fuel system switch should be positioned to ON. If it is desired, the take-off can be continued in the lockup condition. After a safe altitude is reached, (if engine controls do not unlock automatically, or if engine controls do not unlock within 30 seconds after manually selecting the secondary inverter) the emergency fuel system should be manually selected by moving the emergency fuel switch to ON, and a landing should be made using the emergency fuel system for engine operation.

Engine Control Lockup Caution Light.

An amber engine control caution light on the instrument panel (24, figure 1-5), labeled "ENG. CONT. LOCK-UP," is provided in the cockpit to indicate when the electronic engine controls are in lockup. The light is powered by the primary bus. Whenever ac power loss

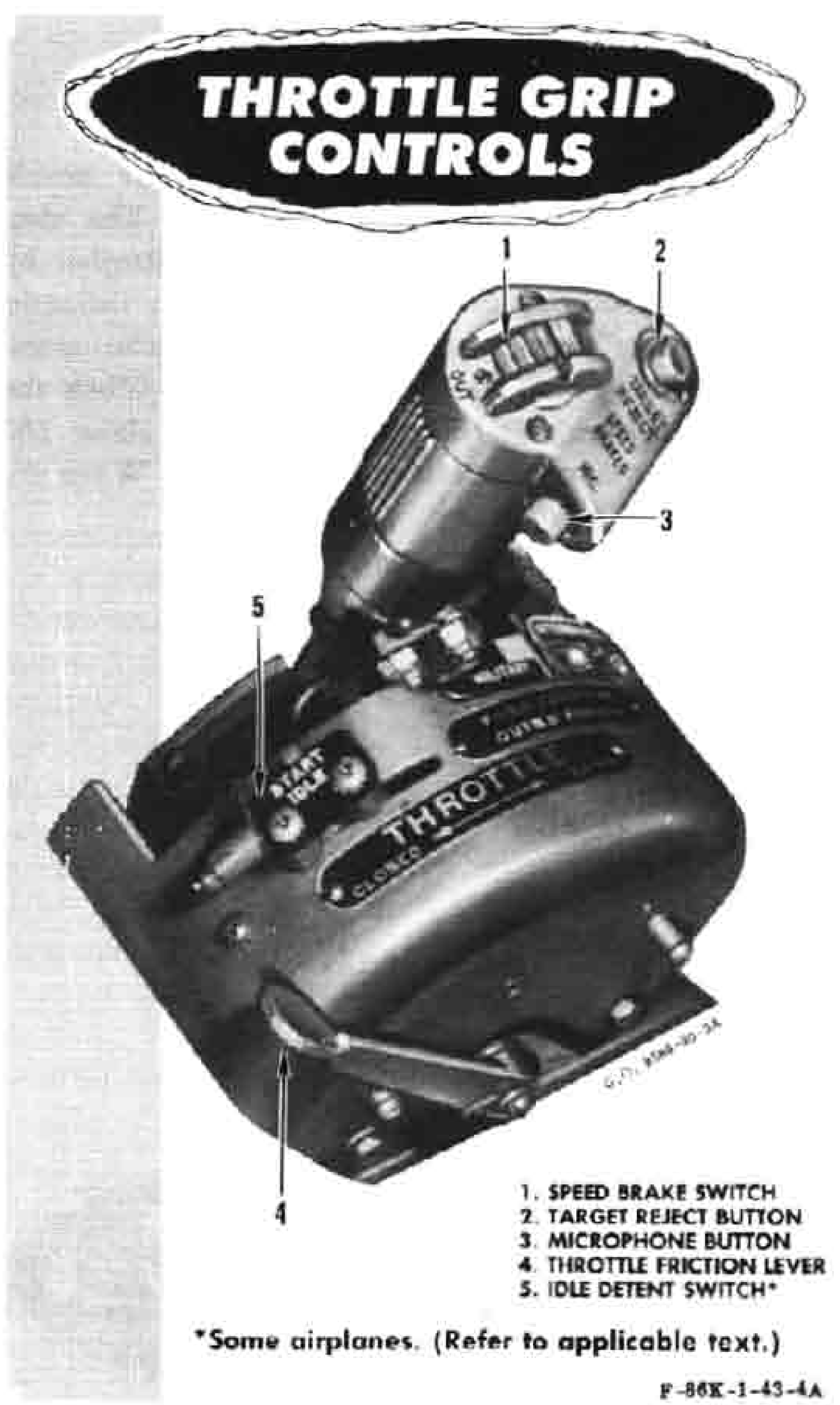


Figure 1-9

occurs, causing the electronic engine controls to be locked in position, this light comes on. This light remains on until ac power is restored and the electronic engine controls have been automatically released from automatic lockup. Consequently, during operation of the main fuel control system, this light serves as a warning that power settings should not be changed as long as the light remains on. If it is necessary to operate on the emergency fuel system, illumination of the light will not be affected. The light will remain on as long as ac power is not available. Switching the emergency fuel system switch from the ON position to the NORM position must not be attempted while the lockup caution light is on. For example, if lockup occurs when operating at Military Thrust and throttle reductions are made after transferring to the emergency fuel system, and then the emergency fuel switch is moved back to NORM, the sudden surge of fuel fed through the locked-open main fuel control valve will cause a dangerous overtemperature condition.

VARIABLE-AREA NOZZLE.

Two clamshell-type doors form the variable nozzle (figure 1-10) at the end of the tail pipe. The electrically actuated nozzle is electronically controlled by throttle position and exhaust temperature to maintain correct exhaust temperature for optimum performance. The nozzle may also be manually actuated. When the variable-area nozzle is full-open, its area is about 160 percent of the nozzle area at Military Thrust. When the nozzle is fully closed, its area is 95 percent of the Military Thrust nozzle area. Under automatic control, the nozzle gradually closes to follow the throttle-scheduled positions from about ¾ position (shown on the variable-nozzle indicator) at idle power to about ¼ position at Military Thrust. On a throttle burst, the nozzle locks at the lower power position until the engine rpm reaches from 2% to 7% of the higher power rpm. The nozzle then rapidly closes to scheduled position. This scheduled nozzle position, at steady-state operation, causes the exhaust temperature to exceed 685°C, and the nozzle will then be driven open from the scheduled position to the position necessary to maintain 685°C by the exhaust temperature control circuitry. During normal afterburner operation, the nozzle position is determined primarily by exhaust temperature; that is, the nozzle is moved to whatever position is necessary to maintain 685°C. If, in an effort to maintain the correct exhaust temperature, the nozzle is driven full-open and the exhaust temperature still tends to exceed 685°C, the electronic engine control will automatically decrease afterburner fuel flow to prevent excessive exhaust temperatures. The afterburner fuel flow is also cut back in case the nozzle jams at a position which would normally result in overtemperature operation, or if the nozzle is manually jogged closed during afterburner operation, the afterburner fuel flow will be automatically decreased as nozzle area is decreased.

Figure 1-10

WARNING

It is recommended that the variable-nozzle switch be left in the NORM (automatic) position during the landing approach and ground run. If the nozzle has been jogged open, sufficient thrust will not be available for a go-around unless the nozzle is jogged closed or the switch is returned to the NORM position.

Note

With the variable-nozzle switch in the NORM position, the nozzle is automatically controlled to give optimum engine performance. Opening the nozzle has a negligible effect on the landing ground roll, because the thrust loss is a very small percentage of the total available braking force during a landing. The total available braking force is about 4000 pounds, and idle thrust is reduced only 100 pounds by opening the nozzle.

Variable-nozzle Switch.

For automatic operation of the variable nozzle through the electronic engine control, a variable-nozzle switch on the engine control panel (figure 1-8) is placed in the guarded NORM position. When the switch is turned OFF, automatic control is cut off and, if the switch is left at OFF during normal operation, engine control will be limited, allowing the possibility of engine overspeed and/or overtemperature operation. If the automatic controls fail or are to be overridden, the nozzle may be actuated by movement of the switch from OFF to either of the spring-loaded positions, OPEN or CLOSE. The nozzle moves more slowly when actuated by the switch than when automatically controlled. However, when the switch is at NORM, ac power must be available for automatic operation of the variable nozzle. The switch is powered from the primary bus.

Variable-nozzle Position Indicator.

A position indicator (12, figure 1-5) for the variable nozzle is located on the main instrument panel. The indicator dial is calibrated in quarters from minimum to maximum nozzle area. Power for operation of the position indicator is supplied from the primary bus. During starts, with the variable-nozzle switch in the normal position, the indicator should show about ¾ position (with the new-type thrust selector) or ½ position (with the old-type thrust selector).

IGNITION SYSTEM.

The ignition system, providing ignition through four spark plugs, functions only during normal ground starts and windmilling air starts. For normal ground starts, with the engine master switch ON and the battery-starter switch moved to the START position momentarily, the initial outboard movement of the throttle (to pass the START IDLE stop) actuates a microswitch that supplies dc power to the ignition vibrator units. This dc power is converted by the ignition unit into high-voltage alternating current and is fed to the spark plugs in the No. 3 and No. 7 burners. After ignition occurs and the engine has accelerated to about 23% rpm, the ignition system is de-energized by the automatic starter drop-out relay. During windmilling air starts, the main ignition system is energized through the AIR START (up) position of the air-start switch and the throttle microswitch as in normal ground starts. After an air start, it is necessary to return the air-start switch to NORMAL (down) to de-energize the main ignition system. Afterburner ignition is done by a "hot streak" ignition system. (See figure 1-4.) Fuel is bled from the inlet side of the afterburner fuel control valve through the "hot streak" ignition valve, which permits a metered amount of fuel to flow through the turbine wheel. The metered fuel is ignited aft of the turbine wheel by hot gases or spontaneous combustion and streaks down to ignite fuel discharged from the afterburner fuel spray bars. The "hot streak" ignition system is automatically cut off after a short time interval and will be recharged automatically only when the throttle is retarded below AFTERBURNER range.

Engine Master Switch.

Refer to "Engine Fuel Control System" in this section.

Air-start Switch.

To provide ignition for restarting the engine in flight, a two-position switch (figure 1-8) is installed on the left instrument subpanel. (See figure 1-11.) The throttle also must be moved outboard to complete the ignition circuit. At the same time, an inverter for the fuel flowmeter is energized and all electrical equipment powered by the secondary bus, monitored bus No. 1, monitored bus No. 2, monitored bus No. 3, and the ac bus is automatically turned off to temporarily decrease the load on the battery. The air-start switch is powered from the primary bus. (See figure 1-14.) When the air-start switch is returned to the NORMAL (down) position, after the start is completed and the generators are again operating, the ignition shuts off and the electrical equipment returns to normal operation. If the emergency fuel system switch is returned to NORM before the engine control lockup light goes out, abnormal engine operation can occur, since the engine fuel control valve is still in a locked-up condition.

CAUTION

Continuous operation of the air-start ignition circuit is limited to a maximum of 3 minutes per start. Longer periods of use will damage the ignition vibrator units.

STARTER SYSTEM.

A combination starter-generator functions as a starter until engine speed reaches about 23% rpm when it is automatically disconnected. At rpms above idle it functions as a generator. The starter can be energized only when an external power source is connected to the airplane, as the airplane batteries are automatically disconnected from the electrical system during ground starts. Starter operation is entirely automatic after the battery-starter switch is momentarily moved to the START position. Should the engine fail to start, the starter is de-energized if the "STOP STARTER" button is depressed.

Note

An external power source capable of 28 volts, 1200 amperes surge, and a continuous operating current of 500 amperes must be connected to both dc external power receptacles for starting.

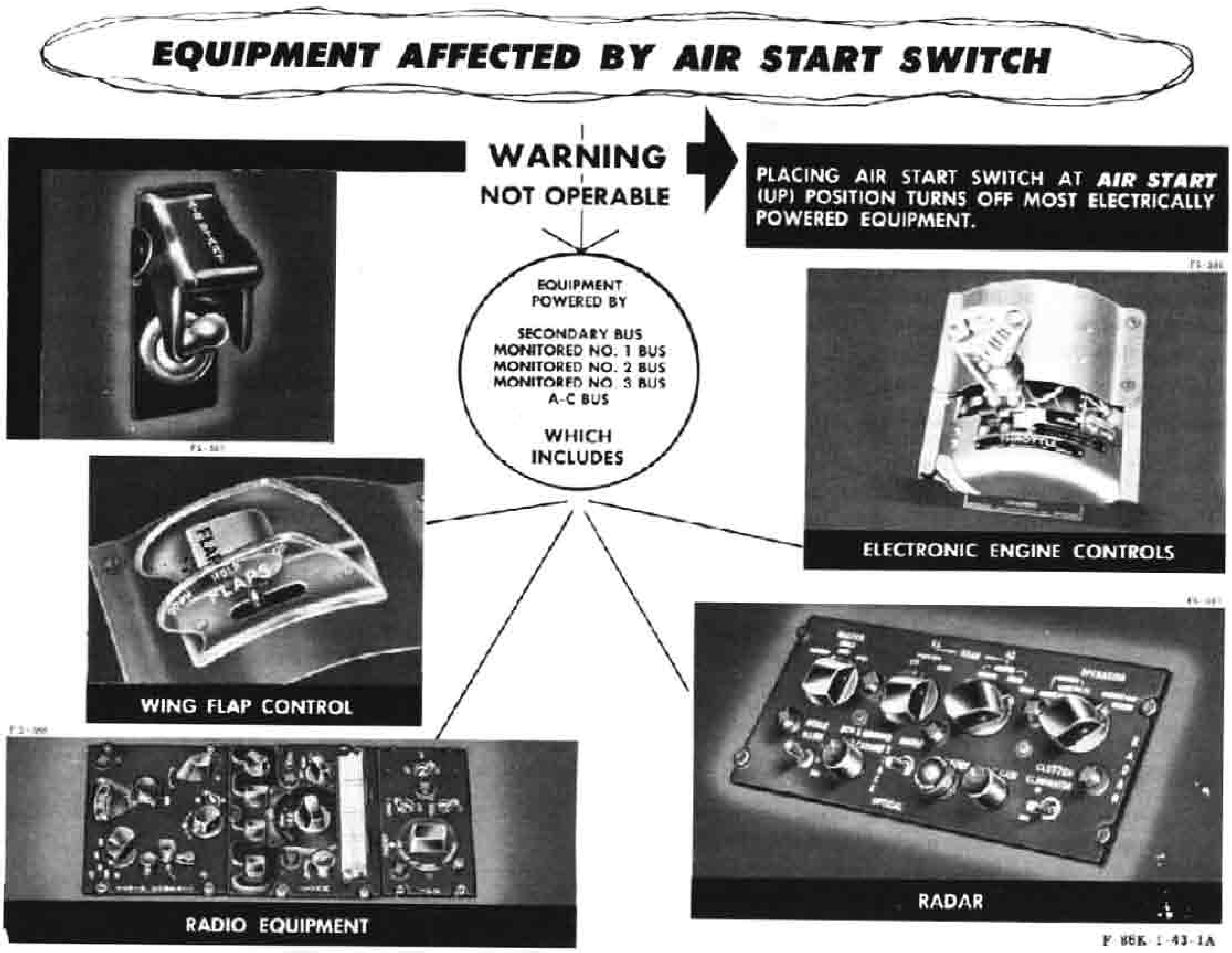


Figure 1-11

Battery-Starter Switch.

A guarded battery-starter switch on the engine control panel (figure 1-8) has two maintained positions, BATT. and OFF, and a spring-loaded START position for ground use only. When the switch is moved momentarily to START, power from the primary bus is supplied to the starter-generator when an external power source is connected. The starter-generator and ignition are automatically disconnected from the circuit at about 23% rpm. The engine automatically accelerates to the speed previously selected with the throttle. The switch returns to OFF from the START position and should be turned to BATT. for all normal operation. With the battery-starter switch at BATT., battery power is supplied to the primary bus. When the battery-starter switch is OFF, battery power is supplied only to the battery bus. (See figure 1-14.)

Stop-starter Button.

A stop-starter button, on the left instrument subpanel (figure 1-8), is for use in the event of a false start. When the button is depressed, current to the starter-generator and to the ignition system is cut off. Since the starter-generator is automatically disconnected from the circuit during engine starts, it is unnecessary to use the stop-starter button except in case of a false start.

ENGINE AIR INLET.

Engine inlet air is routed from the air inlet opening, at the nose of the airplane under the radome, to the engine by a duct designed to provide maximum airflow to the engine under all flight conditions. Foreign objects entering the duct during take-off or landing are prevented from entering the engine by a retractable engine inlet screen. Position of this screen is manually controlled by movement of an inlet switch to the desired position, provided the surface anti-ice switch is OFF. (Refer to "Anti-icing Systems," in Section IV.) A glide-slope antenna is located on the leading edge of the lower part of the air inlet opening.

Engine Inlet Switch.

The movable engine inlet screen, which protects the engine from foreign objects, is controlled by a three-position switch on the right instrument subpanel. (See figure 1-8.) The switch is normally at EXTEND SCREEN on the ground and during take-off and landing, so that the screen covers the inlet. To maintain maximum air-flow and to prevent icing of the screen, the switch is moved to RETRACT in flight to retract the screens. The third position, ACCESSORY COVER, provides for anti-icing the accessory cover and retracting the screens. (Refer to "Anti-icing and Defrosting Systems," Section IV.) The engine inlet switch receives power from the primary bus, but is operable only when the surface anti-ice switch is in the OFF position.

ENGINE INDICATORS.

Exhaust Temperature Gage.

An exhaust temperature gage, calibrated in 25-degree increments from 0°C to 1000°C (15, figure 1-5), mounted on the instrument panel, provides a visual indication of engine operating condition, so that accurate power settings can be obtained. The gage, being a self-generated electrical unit, does not require power from the electrical system of the airplane for operation. For exhaust temperature gage limitation markings, see figure 5-1.

Tachometer.

The tachometer, which is calibrated from 0% to 110% rpm (20, figure 1-5), and mounted on the main instrument panel, indicates engine speed in percentage of maximum rated rpm (7950). This indicator, used in conjunction with the exhaust temperature gage, enables engine power to be accurately set without exceeding engine limitations. The tachometer is not powered from the electrical system of the airplane. It is supplied by the tachometer generator, which generates a voltage proportional to engine speed. For tachometer markings, see figure 5-1.

Fuel Flowmeter.

A fuel flowmeter, calibrated from 0 to 12,000 pounds per hour fuel flow (21, figure 1-5), is on the lower right side of the instrument panel and gives the rate of fuel flow in pounds per hour. The indicator dial has the 0 to 3000 pounds per hour sector expanded, thus enabling more accurate readings within this range. The fuel flowmeter does not indicate rate of afterburner fuel flow. The flowmeter is powered from the ac bus; however, in case normal ac power is not available (when the air-start switch is actuated), a special inverter, powered by the primary bus, supplies ac power only for the flowmeter.

Oil Pressure Gage.

The oil pressure gage on the instrument panel is calibrated from 0 to 100 psi (28, figure 1-5), and indicates the pressure of oil within the engine. The gage is an electrical instrument powered from the ac bus of the airplane. For oil pressure gage limitation markings, see figure 5-1.

AFTERBURNER SYSTEM.

For Maximum Thrust, fuel discharged from the spray bars aft of the turbine wheel is burned in the tail pipe. In this manner, the engine exhaust gas is reheated and provides additional thrust. Fuel to the afterburner spray bars is controlled by an afterburner fuel control valve. (See figure 1-4.) Throttle position, altitude, airspeed, engine rpm, and exhaust temperature electronically determine the afterburner fuel control valve setting. An afterburner fuel pump, driven by engine compressor air, supplies fuel to the afterburner fuel control valve. The afterburner fuel pump is tank-mounted and will discharge enough fuel for afterburning operation without utilizing the booster pumps. Bypass fuel from the tank-mounted unit is routed back to the forward fuselage tank.

CAUTION

- If afterburner blowout occurs with less than 1300 pounds of fuel remaining, do not attempt further afterburner operation unless dictated by emergency or combat conditions.
- This precaution does not constitute an operating limitation, but rather a measure for protection of the afterburner turbine-driven pump in case of aft fuselage tank transfer pump failure.

Afterburning can be obtained by advancing the throttle above the MILITARY stop to the AFTERBURNER range. This action causes the afterburner air shutoff valve to be opened. This allows passage of compressor air to drive the afterburner fuel pump turbine. The fuel pressure of the pump output then opens the afterburner fuel shutoff valve and allows flow to the afterburner fuel control valve. As afterburner fuel flow is increased, the variable nozzle is automatically opened to prevent excessive exhaust temperatures. When the variable nozzle is fully open, afterburner fuel flow is limited by the fuel control valve position as required to prevent excessive exhaust temperatures, regardless of throttle position. The afterburner is shut off when the throttle is retarded below the AFTERBURNER range. The afterburner fuel control valve incorporates a mechanical stop to prevent the fuel flow from exceeding the desired maximum limit. A ceramic-coated inner liner is installed in the tail pipe to prevent high temperatures from damaging the tail pipe and aft fuselage. The inner liner, made of corrugated metal sprayed with heat-resistant ceramic compound, fits around the inner circumference of the tail pipe. The tail pipe should be checked for the inner liner installation before flight. There is no altitude restriction for afterburner operation. Refer to Section VII for additional information on the afterburner system.

Note

Extensive use of afterburner materially reduces flight range and operational time because of high fuel consumption.

AFTERBURNER EMERGENCY SHUTOFF SWITCH.

A guarded switch (figure 1-8), on the left engine subpanel and powered from the battery bus, provides an emergency means of cutting off afterburner operation. The switch has two positions: NORMAL and OFF. For afterburner operation, the switch must be in the NORMAL position. Movement of the switch to the OFF position will close the air shutoff valve to the air-turbine-driven afterburner fuel pump, thus shutting off the afterburner fuel pump operation.

OIL SYSTEM.

Lubrication of the various gears and bearings of the engine is done through a pressure-type oil system and a scavenge-pump return. The oil both lubricates and cools and the system is completely automatic, requiring no control action by the pilot. Oil is routed to the different sections of the engine and is then returned through a scavenge pump to the oil supply tank. If the oil has been heated above the preset temperature of the oil temperature control valve, it is automatically routed through the oil cooler before being returned to the oil supply tank. The oil system uses 3 US gallons of oil in a 4½ US gallon tank (1½-gallon expansion space). The tank is located high on the right side of the fuselage, aft and above the trailing edge of the wing. Inverted operation is limited, because the scavenge pumps are unable to return oil from the sumps to the oil supply tank. (See figure 1-26 for oil specification.)

FUEL SYSTEM.

Four fuel tanks are installed in the airplane: two in the fuselage, and one in each wing outer panel. (See figure 1-12.) Fuel is supplied to the engine from the forward fuselage tank by electric booster pumps. The afterburner turbine-driven fuel pump is tank-mounted with its own integral boost pump unit and provides enough afterburner fuel without utilizing the other booster pumps for afterburner operation. The forward fuselage tank consists of two cells. The lower one, in the wing center section, receives fuel by gravity feed from the upper cell and from the outer wing tanks. Fuel is transferred from the aft fuselage tank to the forward fuselage tank (lower cell) under pressure by an electric transfer pump that operates automatically when the fuel quantity in the forward tank drops below a preset value. Fuel transfer is made when about 30 gallons have been consumed from the forward fuselage tank. If drop tanks are carried, aft fuselage tank fuel transfer is made after all the drop tank fuel is consumed. The transfer pump is powered by monitored bus No. 2 and automatically operates at a higher speed during afterburner operation. In addition, fuel flow to the engine is obtainable from the forward fuselage tank and from the aft fuselage tank by suction flow in case the electric booster pumps fail. There are individual filler points for each tank. When the airplane is refueled by means of the individual filler points, the forward fuselage tank must be filled first in order to utilize full fuel capacity; if the wing tanks or the aft fuselage tank is filled first, fuel from these tanks will drain into the forward fuselage tank lower cell while the forward fuselage tank is being serviced. In addition, a single-point refueling-nozzle-receptacle-and-line system is provided. The nozzle receptacle is in the left side of the fuselage, adjacent to the aft fuselage fuel tank. Single-point refueling time is about 3 minutes. The refueling equipment should be capable of delivering fuel at the rate of about 200 gpm with a refueling nozzle pressure of 40 to 60 psi (50 psi is recommended for maximum filling). If a nozzle pressure of less than 40 psi is used, incomplete filling of the system will result; and a nozzle pressure greater than 60 psi may be detrimental to the equipment. The refueling flow is automatically shut off when the airplane system is full. (See figure 1-26 for fuel specification.) Refer to Section VII for additional information on this system.

DROP TANKS.

The main fuel supply can be augmented by installation of a 120-gallon (US) external drop tank under each wing. Four types of drop tanks can be carried. Types I and II tanks are of knockdown construction and are designed so that final assembly can be accomplished in the field by maintenance personnel. Types III and IV

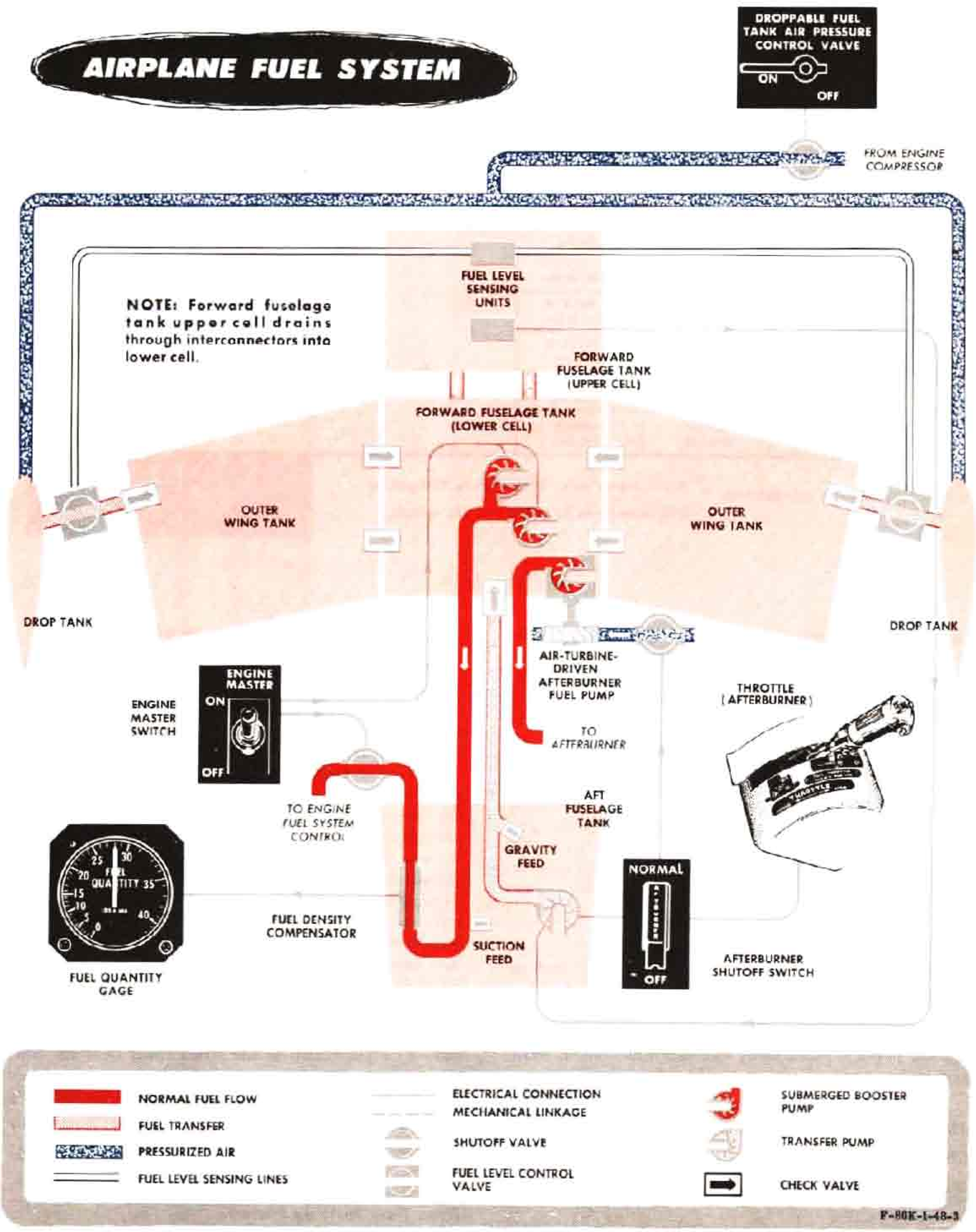
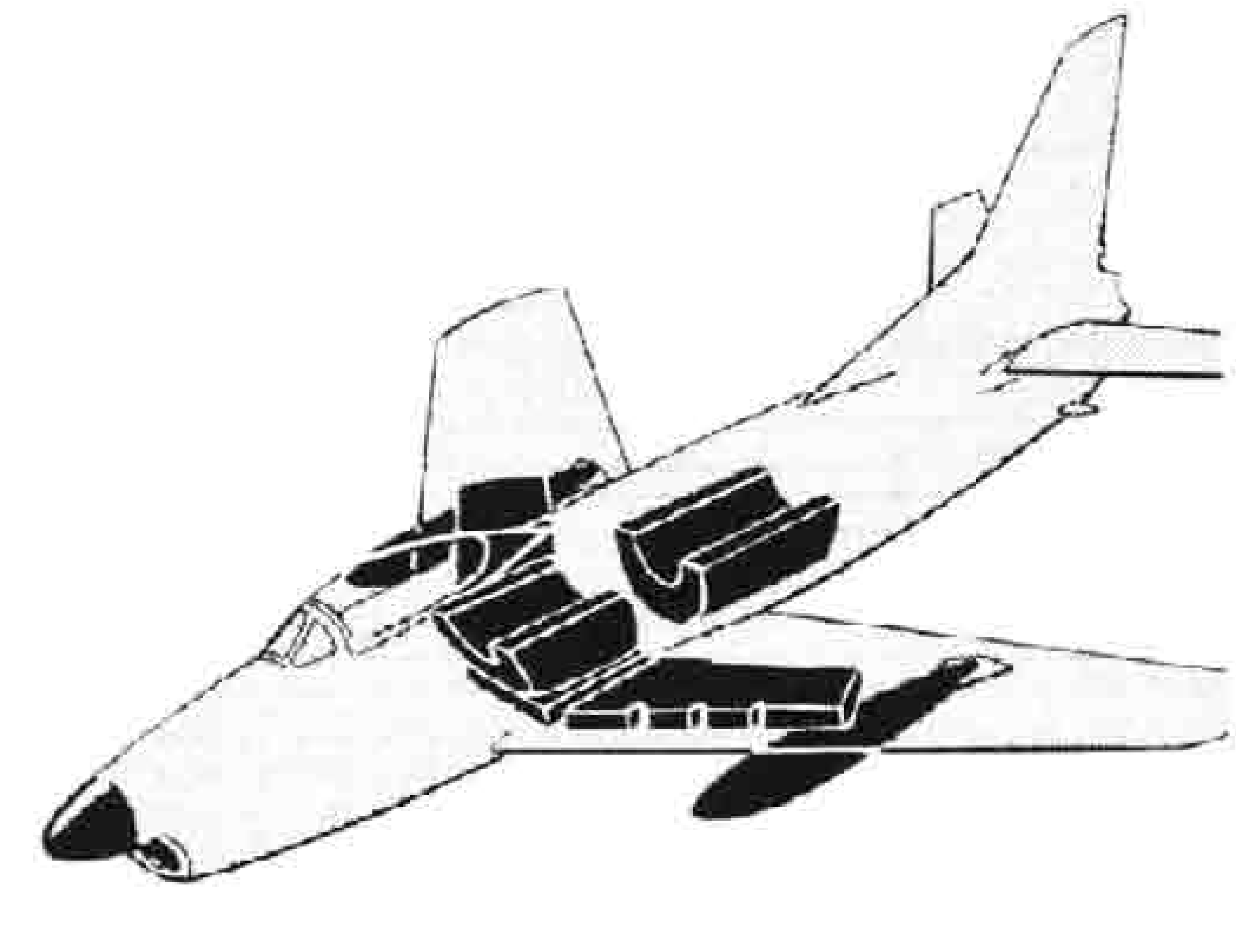

AIRPLANE FUEL SYSTEM
DROPPABLE FUEL TANK AIR PRESSURE CONTROL VALVE
ON
OFF
FROM ENGINE COMPRESSOR
FUEL LEVEL SENSING UNITS
NOTE: Forward fuselage tank upper cell drains through interconnectors into lower cell.
FORWARD FUSELAGE TANK (UPPER CELL)
FORWARD FUSELAGE TANK (LOWER CELL)
OUTER WING TANK
OUTER WING TANK
DROP TANK
DROP TANK
AIR-TURBINE-DRIVEN AFTERBURNER FUEL PUMP
TO AFTERBURNER
ENGINE MASTER SWITCH
ENGINE MASTER
ON
OFF
THROTTLE (AFTERBURNER)
TO ENGINE FUEL SYSTEM CONTROL
AFT FUSELAGE TANK
GRAVITY FEED
FUEL QUANTITY
NORMAL
OFF
FUEL DENSITY COMPENSATOR
SUCTION FEED
AFTERBURNER SHUTOFF SWITCH
FUEL QUANTITY GAGE
NORMAL FUEL FLOW
FUEL TRANSFER
PRESSURIZED AIR
FUEL LEVEL SENSING LINES
ELECTRICAL CONNECTION
MECHANICAL LINKAGE
SHUTOFF VALVE
FUEL LEVEL CONTROL VALVE
SUBMERGED BOOSTER PUMP
TRANSFER PUMP
CHECK VALVE
F-86K-1-48-3

Figure 1-12

FUEL QUANTITY DATA

POUNDS OR US GALLONS



NOTE

Multiply US gallons by 6.5 to obtain pounds (standard day only).

TANKS	USABLE FUEL IN LEVEL FLIGHT (TOTAL)	FULLY SERVICED (TOTAL)
FORWARD FUSELAGE TANK	1495 LB 230 GAL	1504.75 LB 231.5 GAL
AFT FUSELAGE TANK	1495 LB 230 GAL	1501.5 LB 231.0 GAL
LEFT WING TANK	487.5 LB 75 GAL	490.75 LB 75.5 GAL
RIGHT WING TANK	487.5 LB 75 GAL	490.75 LB 75.5 GAL
DROP TANKS (TWO)	1560 LB 240 GAL	1560 LB 240 GAL

F-86K-1-93-26B

TOTAL USABLE FUEL
- Without drop tanks 3965 pounds, 610 gallons.
- With drop tanks 5525 pounds, 850 gallons.

Figure 1-13

tanks are completely assembled for installation. Only Types II and IV tanks have identifying markings stenciled on the inboard side of the tank nose section because of the tank restrictions. The identification mark is visible from the cockpit. Fuel in the drop tanks can be transferred into the main wing outer tanks by directing engine compressor air to the drop tanks. Transfer of fuel is possible when fuel quantity in the forward fuselage tank drops about 5 gallons. (Refer to Section V for airspeed and G-limitations applicable to drop tanks.) On airplanes changed by T.O. 1F-86-590, provisions are incorporated for installing maintenance safety pins to prevent inadvertent release of the drop tanks during maintenance.

FUEL BOOSTER PUMPS.

Two constant-speed booster pumps, a forward and an aft pump, are in the lower cell of the forward fuselage tank. These pumps supply fuel to the engine when the engine master switch is positioned at ON. The forward booster pump is powered by monitored bus No. 2, while the aft booster pump is powered by the primary bus.

FUEL SYSTEM CONTROLS AND INDICATORS.

Throttle.

Refer to "Engine Fuel Control System," this section.

Engine Master Switch.

Refer to "Engine Fuel Control System," this section.

Drop Tank Air Pressure Shutoff Valve.

A drop tank air pressure shutoff valve (1, figure 1-6) is aft of the left console. When the valve is turned ON, both drop tanks are pressurized by engine compressor air, which has been cooled in the heat exchanger. Drop tank pressurization is almost immediate after engine start is made and engine rpm is increased above idle. The valve must be ON whenever fuel is to be transferred from the drop tanks. Since no drop tank fuel quantity gage is provided, fuel transfer from the drop tanks during operation at high-altitude cruise is indicated by a constant aircraft fuel quantity gage reading during the transfer. Because of a change in fuel tank sequencing, the fuel quantity gage will indicate almost full during the transfer. During afterburner operation (high fuel consumption rate), fuel transfer from the drop tanks may be insufficient to maintain a constant reading on the fuel quantity gage. In this case, fuel transfer is indicated by a relatively low rate of fuel quantity reduction. The valve should be positioned at ON at all times in flight when drop tanks are installed, to prevent possible drop tank collapse during rapid descents. Uneven feeding from the drop tanks does not affect the flying qualities of the airplane.

Drop Tank Jettison Button.

Tanks can be jettisoned by depression of the drop tank jettison button on the left engine control panel. (See figure 1-8.) Power for jettisoning the tanks is supplied by the battery bus.

WARNING

To prevent accidental explosion of drop tanks while on ground, they must not be installed, removed, or given an operational drop test (either manually or electrically) unless the airplane and drop tanks are electrostatically grounded.

Drop Tank Emergency Jettison Handle.

A manual drop tank emergency jettison handle (31, figure 1-5), below and to the left of the radarscope, provides a means of jettisoning the drop tanks if the electrical (battery) system fails. When the handle is pulled to full extension, about 3 inches, the emergency jettison system releases the drop tanks; when the handle is released, it returns to its normal position.

Fuel Quantity Gage.

A fuel quantity gage (24, figure 1-5) is on the lower right side of the instrument panel and indicates total actual pounds of internal fuel regardless of temperature or type of fuel. The fuel quantity gage is powered from the ac bus of the airplane. No fuel quantity gage is provided for the drop tanks.

Fuel Quantity Gage Test Switch.

A push-button switch (22, figure 1-5) on the instrument panel is provided to test the fuel quantity indicating system for proper operation. Depressing the test switch should cause the indicator needle to rotate counterclockwise. Upon release of the test button, the needle should return to its former position. Failure of the needle to respond indicates a faulty indicating system. The switch is powered by the ac bus.

ELECTRICAL POWER SUPPLY SYSTEM.

Electrical energy in this airplane is supplied through a 28-volt, direct-current system powered by two 400-ampere, engine-driven generators. (See figure 1-14.) One of the two generators is a combination starter-generator unit, acting as a starter up to about 23% rpm, and thereafter acting as a generator. Two 24-volt, 24-ampere-hour storage batteries serve as a stand-by to supply current to the essential units in case failure of both generators occurs. All ac operated equipment (except radar) is powered by a main inverter (single-phase). Power for the radar equipment is supplied by a secondary inverter (single-phase) and a single-phase engine-driven alternator. The secondary inverter supplies the radar with a regulated frequency, but will be disconnected from the radar and will assume the ac load of the airplane if the main inverter fails and the inverter switch on the right instrument subpanel is manually positioned at SPARE. The alternator supplies the radar with an unregulated frequency. Loss of the unregulated frequency will cause all ac and dc power to the radar to function improperly. Three-phase power is provided for the automatic pilot, vertical gyro, yaw damper, and directional indicator by four power converters which are normally powered by the main inverter.

ELECTRICALLY OPERATED EQUIPMENT.

See figure 1-14.

CAUTION

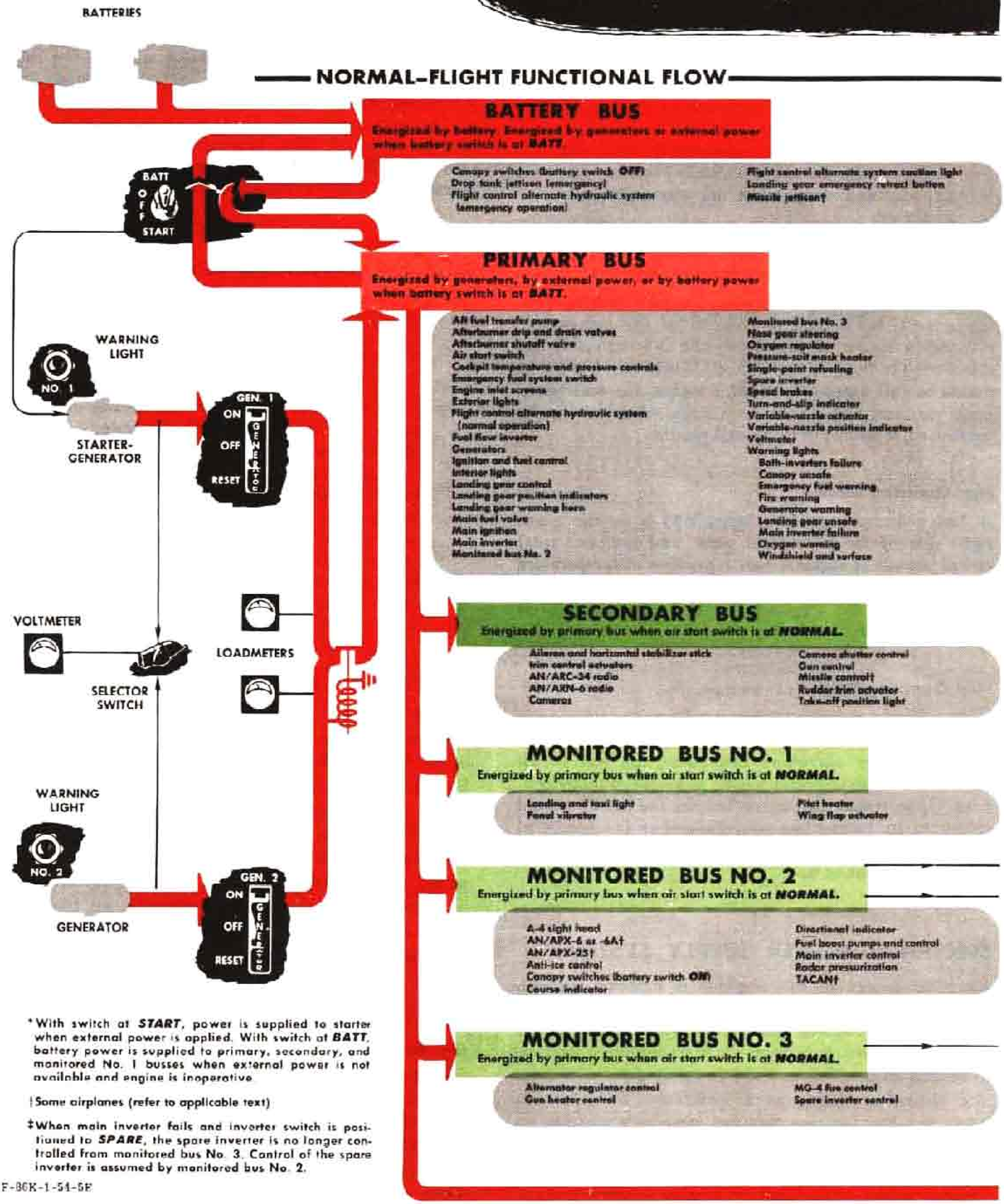
If the electrical equipment (including radar equipment) is to be ground-operated, such operation should not exceed 30 minutes unless a special cooling supply is attached to the in-flight cooling system or unless the fuselage access panels, covering the electrical equipment, are removed. Heat generated in the electrical compartments will cause a serious reduction in life or immediate failure of equipment if adequate ventilation is not provided.

DC ELECTRICAL POWER DISTRIBUTION.

The dc electrical power necessary for operation of the electrical units in the airplane is distributed by a group of six busses: a battery bus, a primary bus, a secondary bus, and monitored busses No. 1, 2, and 3. The battery bus is "hot" at all times, so that essential equipment, powered from the battery bus, is operable regardless of the position of the battery-starter switch. When external power is supplied through the oval (right) receptacle or when both generators are operating, all busses are energized through the primary bus. If one generator fails, monitored bus No. 3 is disconnected from the system. If both generators fail, monitored busses No. 2 and 3 are disconnected, and, with the battery-starter switch at BATT., the remaining busses are powered by the battery. The rectangular (left) receptacle is used only to supply external power to the starter during ground starts. During an air start with the air-start switch in AIR START (up), the secondary bus, the ac bus, and monitored busses No. 1, 2, and 3 are automatically disconnected to conserve battery power. The fuel flowmeter remains energized during an air start by an auxiliary inverter which is turned on when the air-start switch is energized.

ELECTRICAL POWER

NORMAL-FLIGHT FUNCTIONAL FLOW



*With switch at ***START***, power is supplied to starter when external power is applied. With switch at ***BATT***, battery power is supplied to primary, secondary, and monitored No. 1 busses when external power is not available and engine is inoperative.

†Some airplanes (refer to applicable text)

‡When main inverter fails and inverter switch is positioned to ***SPARE***, the spare inverter is no longer controlled from monitored bus No. 3. Control of the spare inverter is assumed by monitored bus No. 2.

F-86K-1-54-5E

Figure 1-14

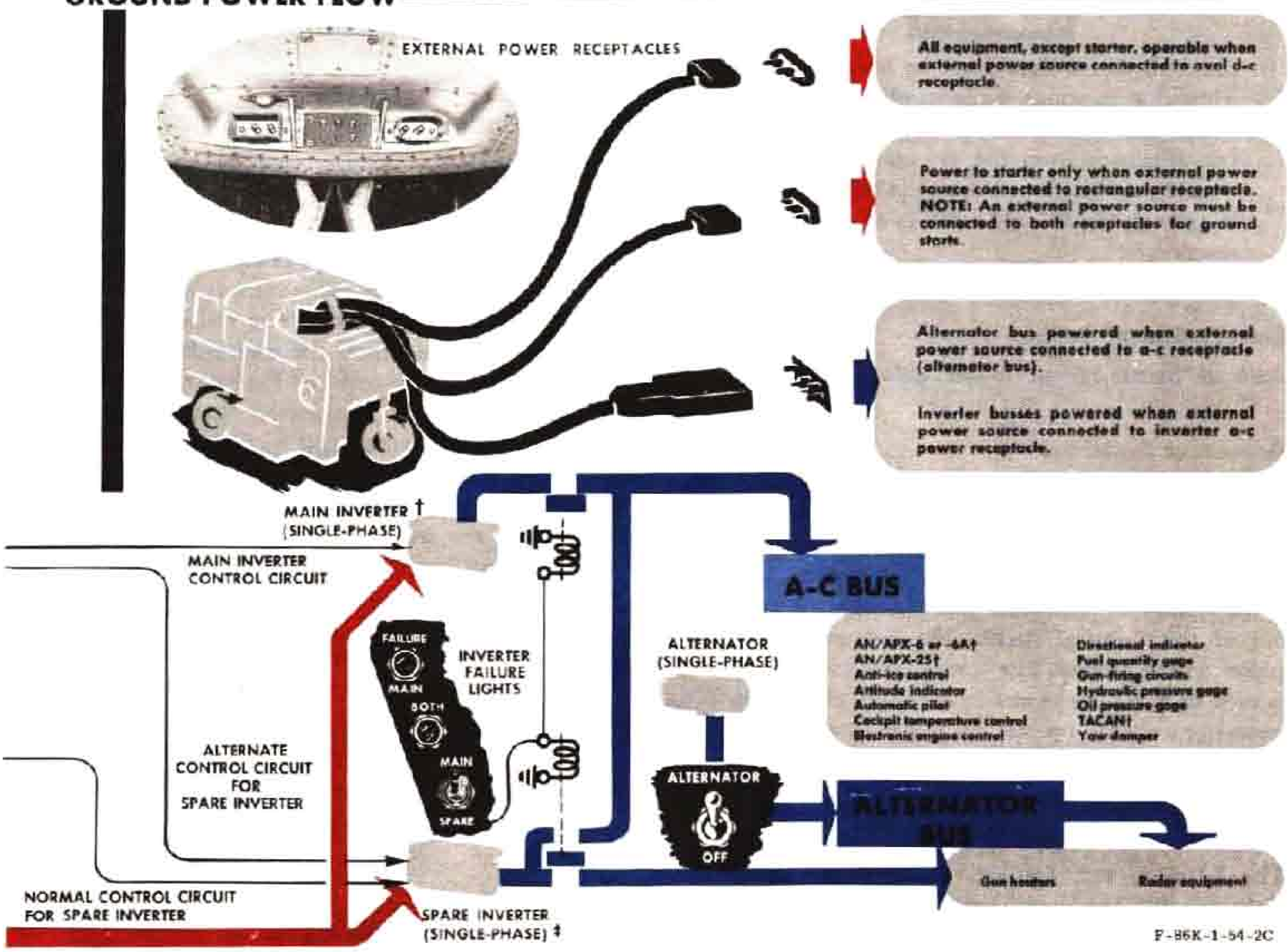
DISTRIBUTION

FLIGHT EMERGENCIES

COLORED BUSSES OPERATIVE

EMERGENCY CONDITIONS	AIR START SWITCH AT *AIR START* (UP)	BOTH GENERATORS INOPERATIVE	ONE GENERATOR INOPERATIVE	BOTH INVERTERS INOPERATIVE	MAIN INVERTER INOPERATIVE
	BATTERY BUS	BATTERY BUS	BATTERY BUS	BATTERY BUS	BATTERY BUS
	PRIMARY BUS	PRIMARY BUS	PRIMARY BUS	PRIMARY BUS	PRIMARY BUS
	SECONDARY BUS	SECONDARY BUS	SECONDARY BUS	SECONDARY BUS	SECONDARY BUS
	MONITORED BUS NO. 1	MONITORED BUS NO. 1	MONITORED BUS NO. 1	MONITORED BUS NO. 1	MONITORED BUS NO. 1
	MONITORED BUS NO. 2	MONITORED BUS NO. 2	MONITORED BUS NO. 2	MONITORED BUS NO. 2	MONITORED BUS NO. 2
	MONITORED BUS NO. 3	MONITORED BUS NO. 3	MONITORED BUS NO. 3	MONITORED BUS NO. 3	MONITORED BUS NO. 3
	A-C BUS	A-C BUS	A-C BUS	A-C BUS	A-C BUS

GROUND POWER FLOW



F-86K-1-54-2C

External Power Receptacles.

Two dc external power receptacles (figure 1-14) are on the bottom of the fuselage at the wing trailing edge to permit forward movement of the airplane to disconnect the external power source. All equipment is operable when external power is connected to both receptacles. The right dc receptacle is oval and the left is rectangular. All equipment except the starter is operable when external power is connected to the oval (right) receptacle; power supplied through the rectangular (left) receptacle is transmitted only to the starter. *An external power source must be connected to both receptacles for ground starts.*

Circuit Breakers.

Most of the dc electrical circuits are protected by push-pull circuit breakers mounted on panels (16, figure 1-6; 16, figure 1-7) on each side of the cockpit.

CAUTION

Circuit breakers should not be pulled or reset without a thorough understanding of all the effects and results. Use of the circuit breakers can eliminate from the system some related warning system, interlocking circuit, or canceling signal, which could result in an undesirable reaction.

Battery-Starter Switch.

Refer to "Starter System" in this section.

Generator Switches.

Two generator switches on the right instrument subpanel (figure 1-8) are guarded in the ON position and have two other positions: OFF and RESET. If the generator voltage becomes excessive (over 31 volts), an overvoltage relay automatically cuts the affected generator out of the electrical circuit. The voltage regulator is preset on the ground. The spring-loaded RESET position is used to bring the generator back into the circuit. The generator switches operate on power from the primary bus.

Voltmeter.

The voltmeter (12, figure 1-7) is mounted aft on the right console. This instrument provides a visual indication of the electrical potential produced by either generator or available at the primary bus. Above 37% rpm, the voltmeter should indicate about 28 volts.

Voltmeter Indicator Selector Switch.

A voltmeter indicator selector switch (8, figure 1-7) is aft on the right console. This switch may be moved to GEN. #1, GEN. #2, or BUS to produce voltage readings from either generator or from the primary bus.

Loadmeters.

Two loadmeters (9, figure 1-7) are aft on the right console. These instruments indicate percent of maximum amperage (−0.1 to +1.25) for the corresponding generators. Under normal conditions, both loadmeters should indicate about the same value (about +0.6).

Generator Warning Lights.

Two red generator warning lights (27, figure 1-5), one for each generator, are installed on the small subpanel mounted below the main instrument panel. Illumination of either warning light indicates that the respective generator has failed or has been disconnected because of overvoltage. Both lights are powered by the primary bus and come on during air starts.

AC ELECTRICAL POWER DISTRIBUTION.

AC electrical power (figure 1-14) is distributed to the ac electrical equipment throughout the airplane by two busses: the ac bus and the alternator bus. Power to all ac-operated equipment except radar is supplied through the ac bus by the single-phase main inverter. The radar equipment derives its power from the single-phase secondary inverter and from the engine-driven alternator. Both inverters are powered by the primary bus. Control of the main inverter is powered from monitored bus No. 2; the main inverter will be cut out if power from monitored bus No. 2 is not available. Likewise, control of the secondary inverter is powered from monitored bus No. 3; the secondary inverter will not operate if monitored bus No. 3 fails. If the main inverter fails during flight with only one generator operating (monitored bus No. 3 and secondary inverter inoperative), the control of the secondary inverter will automatically be transferred from monitored bus No. 3 to monitored bus No. 2. When the change-over is completed, the secondary inverter will automatically take over the main inverter load. The alternator bus powers only the radar and supplies it with unregulated frequency.

Alternator.

For unregulated-frequency ac power for the radar, an 8-kilovolt-ampere, 115-volt, single-phase alternator is provided. The alternator is engine-driven and connected directly to the radar. The radar itself incorporates a means of preventing damage by overvoltage supply from the alternator. The alternator bus is supplied power on the ground by a separate ac external power receptacle. The external power supply cannot be paralleled with the engine-driven alternator supply.

Alternator External Power Receptacle.

An ac external power receptacle (figure 1-14) is located between the two dc external power receptacles, on the bottom of the fuselage at the wing trailing edge. The ac receptacle may be used to furnish power, between 380 and 770 cycles per second, for ground operation of the radar.

Inverter External Power Receptacle.

The center electrical receptacle (figure 1-14), on the bottom of the fuselage, allows inverter power to be supplied by an external power source for ground purposes only. The center receptacle has been modified so that external power for the radar and electronic equipment can be supplied simultaneously. The inverters are disconnected when the external power source is connected and the engine master switch is OFF, allowing for extended ground operation providing alert power for those units requiring ac power. If the engine master switch is ON, the external power source is automatically disconnected. To prevent damage to the plug connection when disconnecting, the engine master switch should be turned ON before removing the plug.

Inverter Selector Switch.

The inverter selector switch, on the right instrument subpanel (figure 1-8), is used for manually selecting the main or spare inverter as power sources for the ac-operated equipment. The switch (powered by monitored bus No. 2) has two fixed positions: MAIN, which is for all normal operation; and SPARE, for a secondary inverter power source in case of main inverter failure. Normally, the main inverter supplies power for all ac-operated equipment except radar, which is supplied by the secondary inverter and alternator. If the main inverter fails, the inverter selector switch must be placed at SPARE, causing the secondary inverter to drop its power supply to the radar equipment and making it available to the other ac-operated equipment.

Alternator Switch.

A guarded, two-position switch for control of the alternator is provided at the bottom of the right instrument subpanel. (See figure 1-8.) When the switch is in the ALTERNATOR position, the alternator bus is provided with ac voltage from the engine-driven alternator or from an external power source. When an external source is supplying power to the alternator bus, it alone supplies the power until disconnected. The switch is powered by monitored bus No. 3 and should be at ALTERNATOR at all times unless an alternator failure is indicated by loss of radarscope picture.

Inverter Failure Warning Lights.

Failure of the main inverter is indicated by steady illumination of an amber warning light on the right instrument subpanel. (See figure 1-8.) Steady illumination of a red warning light, adjacent to the main inverter warning light, indicates failure of both inverters. Both of the inverter failure warning lights receive their power from the primary bus. Refer to Section VII for further information on inverter failure warning lights and their characteristics.

Note

The electronic engine controls (main fuel control valve, afterburner fuel control valve, and the exhaust nozzle control) will automatically lock up when ac power fails.

AC Fuses.

Most of the ac circuits are protected by fuses which are replaceable in flight. The fuses are grouped together on panels (13, figure 1-6; 13, figure 1-7) on each side of the cockpit. One group is on the panel next to the throttle; the other group is aft on the right console.

UTILITY HYDRAULIC POWER SUPPLY SYSTEM.

The utility hydraulic power supply system is a closed-center, constant-pressure type system incorporating an engine-driven, variable-output pump. (See figure 1-15.) This system is completely independent of the flight control hydraulic systems. A pressure-storage accumulator is provided for nose gear emergency extension. This system supplies power for operation of the landing gear, speed brakes, nose wheel steering, and wheel brakes. (See figure 1-26 for hydraulic fluid specification.)

UTILITY HYDRAULIC SYSTEM INDICATORS.

Hydraulic Pressure Gage and Pressure Gage Selector Switch.

A pressure gage (29, figure 1-5) is on the small subpanel directly beneath the main instrument panel, with a pressure gage selector switch (30, figure 1-5) adjacent

UTILITY HYDRAULIC SYSTEM

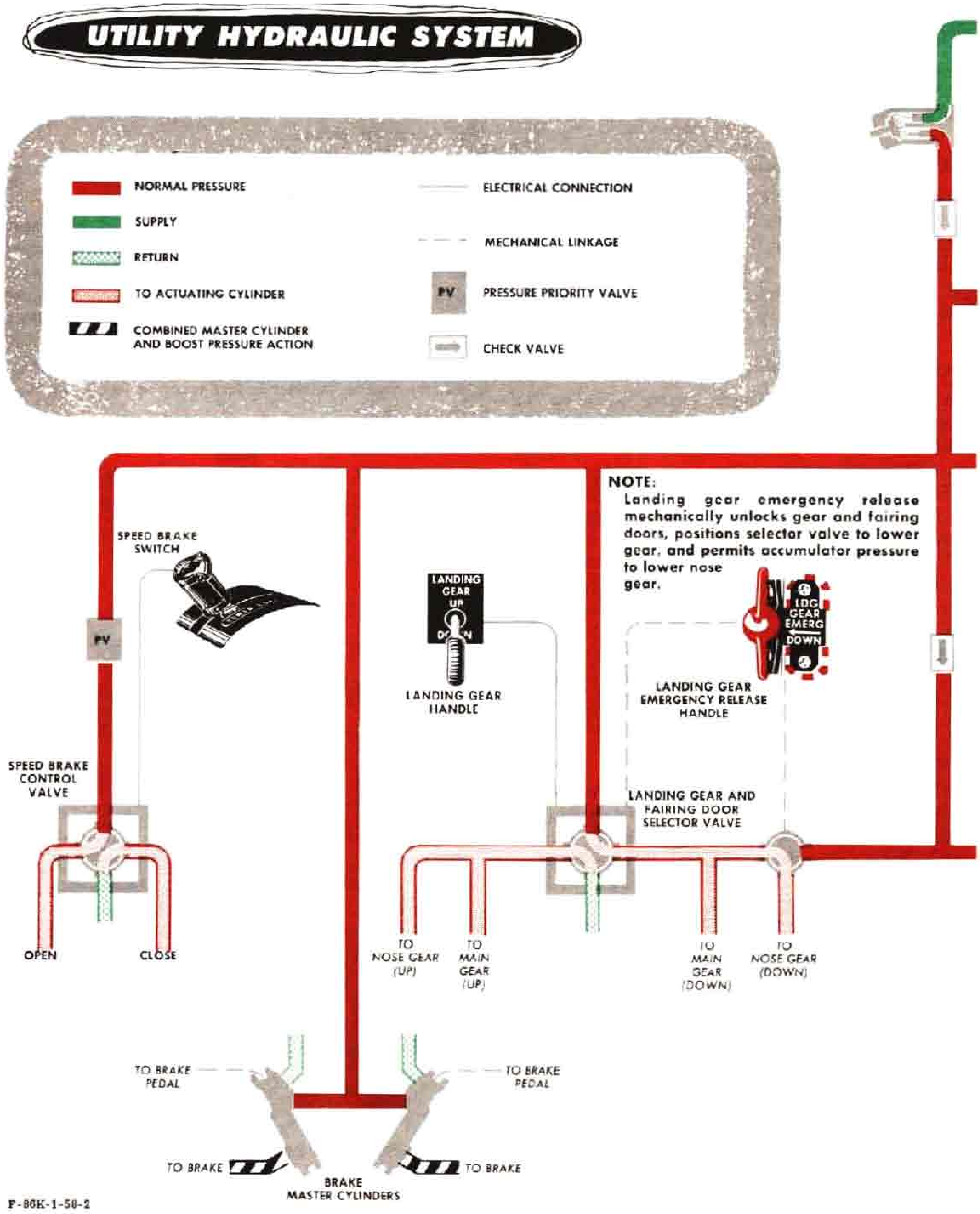
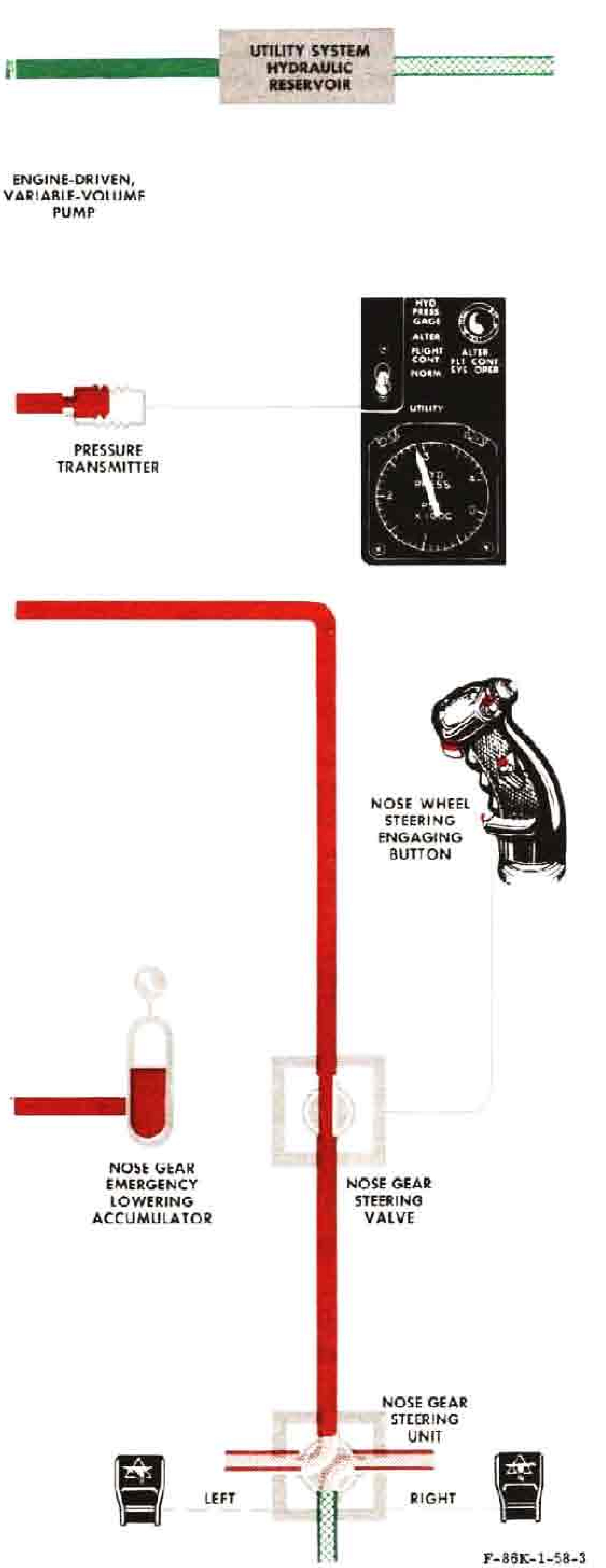


Figure 1-15



F-86K-1-58-3

to it. The switch is positioned to either UTILITY, NORMAL, or ALTER to obtain pressure gage readings for the respective systems. As the pressure gage is ac powered, it is operable, along with the pressure gage selector switch, when power is supplied by the ac bus. (Refer to figure 5-1 for the gage markings.)

Utility Hydraulic System Fluid Quantity Gage.

The amount of fluid in the utility hydraulic system reservoir is indicated by the fluid quantity gage (figure 1-26) in the top of the fuselage, behind the canopy. The gage should be checked for a full (in the green) indication before flight. If the tank cap is to be removed, bleed off the air pressure first.

FLIGHT CONTROL SYSTEM.

Four features are incorporated in control surface action. First, the horizontal stabilizer and elevators are combined into a single surface known as the controllable horizontal tail, which is operated for longitudinal control through stick movement. The horizontal stabilizer control incorporates a variable-slope feel, longitudinal control system. This feature is designed to minimize sensitivity and overcontrol by increasing the stick force gradient during high-speed flight conditions. For increased longitudinal control at low-speed flight conditions, stick forces and travel are reduced to provide a more positive control response and at the same time be more desirable for the pilot. Two single-acting bungees are installed: one for pull forces and one for push forces. When one bungee (either the push or pull) is actuated, the other bungee is idle. The horizontal tail has a control valve that allows quick response characteristics when surface movement is started and stopped. The ratio of the stick throw (movement) and stabilizer displacement is varied by a mechanical linkage in the follow-up system. *The trimmed position of the horizontal tail determines the stick force rate by varying the mechanical advantage of the stick to the artificial feel bungees.* For example, during straight-and-level flight and with the airplane trimmed for cruising speed, the stick-movement-to-stabilizer ratio is approximately equal (for a given amount of stick movement, the stabilizer moves approximately the same). When trimmed for high-speed flight condition (airplane trimmed nose-down), the stick must be moved farther than for normal cruise trimmed position to get a small amount of surface deflection. The reverse is true for slow-speed flight (airplane trimmed nose-up), as the stabilizer deflection will be larger for a small stick movement. (See figure 1-16.)

Second, the ailerons and horizontal tail are completely hydraulically operated. The conventional rudder system is installed. Movement of the control stick positions only the hydraulic control valves that direct pressure to the respective surface actuating cylinders. Third, to provide normal stick feel to the pilot at all times, an artificial feel system (spring-loaded bungees and a bobweight) is built into the control system. Fourth, no control surface trim tabs are required on the ailerons or horizontal tail; trim is effected by positioning the stick for the desired flight attitude and then operating the trim switch to remove the stick loads. The control system of the ailerons and horizontal tail holds the surfaces in the selected position regardless of loads and prevents these loads from being transmitted back to the control stick. This hydraulic irreversible control system makes it possible for the pilot to overcome a tremendous amount of aerodynamic force through the control stick with relatively small effort on his part. The one-piece horizontal tail affords more positive action with less control surface movement, eliminating or reducing many of the undesirable effects of compressibility, such as loss of control effectiveness at high Mach numbers.

YAW DAMPER.

A yaw damper is installed to increase the directional stability of the airplane. The yaw damper senses rate of directional changes and electrically varies rudder position to dampen out the change. It should be on during the search and attach phase of the mission, to provide the necessary directional stability and at any time that yawing oscillation becomes pronounced.

FLIGHT CONTROL ARTIFICIAL-FEEL SYSTEM.

Because no feel of air loads can be transmitted through the flight control hydraulic system, no conventional stick feel is present. Therefore, in order to supply the usual stick feel under all flight conditions, an artificial-feel system is installed. (See figure 1-16.) Normal stick forces resulting from G are provided through a bobweight, while stick forces resulting from control surface air loads are simulated through spring bungees. The normal and alternate trim switches control the position of the bungees so that control stick no-load position is changed and desired trim is obtained.

FLIGHT CONTROLS AND INDICATOR.

Control Stick.

The control stick grip (figure 1-17) has an aileron and horizontal tail normal trim switch, a camera and gun firing trigger (which also fires the missiles on airplanes changed by T.O.), a nose wheel steering engaging button, a microphone button, and an automatic pilot release switch.

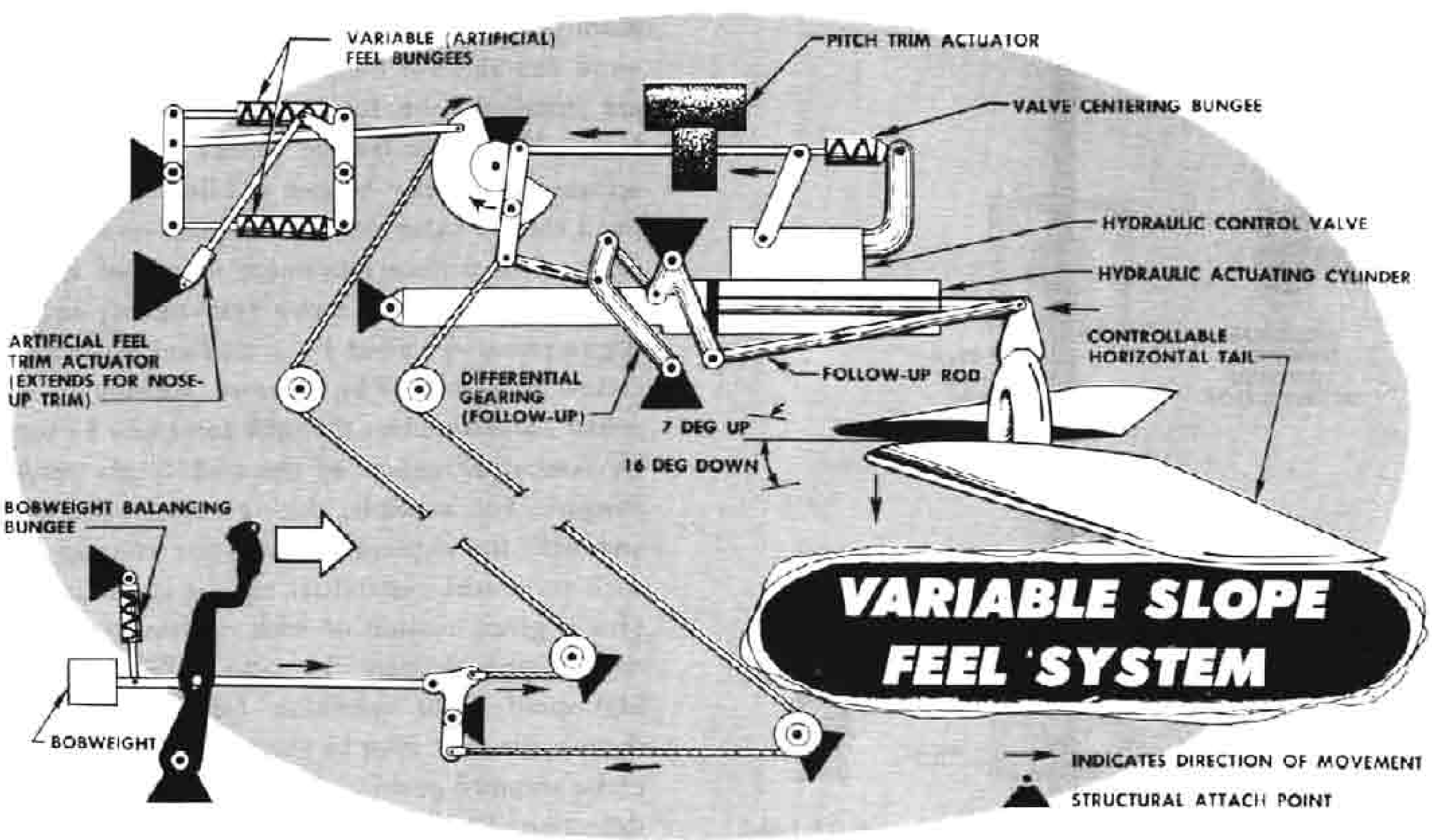


Figure 1-16

Figure 1-17

Rudder Pedals.

The angle of the rudder pedals is adjustable on the ground. The pedals can also be individually adjusted fore and aft by means of adjustment levers outboard of each pedal. When the lever is held out with the foot, the pedal can be moved to one of five neutral positions. The pedal position will lock as selected when the lever is released.

Control Lock.

The control surfaces are locked against external loads at all times because of the irreversible hydraulic system. The rudder lock handle (18, figure 1-6) is aft on the left console. When the handle is pulled up, a mechanical lock is set to engage when the rudder pedals are neutralized. To unlock the rudder, the lock handle is pivoted to release an incorporated catch, then pushed down.

CAUTION

Do not twist the rudder lock handle, as this could cause the locking system to function incorrectly.

Normal Trim Switch.

Normal trim of the horizontal tail or of the ailerons is provided through a five-position switch on top of control stick grip. (See figure 1-17.) This switch is powered by the secondary bus and is spring-loaded to the center position. Trim is effected by positioning the stick for the desired flight attitude and then operating the normal trim switch to remove the stick loads. Holding the normal trim switch to either side causes the corresponding wing to be trimmed down. Holding the normal trim switch forward trims the nose down, while holding it aft trims the nose up. When the switch is released, it automatically returns to the center (off) position and trim action stops.

WARNING

- The normal trim switch is subject to sticking in any or all of the actuated positions, resulting in application of extreme trim. If this condition occurs during preflight check and the switch does not return automatically to the center OFF position, enter this fact in the DD Form 781 with a red cross and do not fly the airplane.
- If the normal trim switch sticks in any actuated position during flight, the switch must be returned manually to the center (off) position after the desired amount of trim is obtained.

Alternate Longitudinal Trim Switch.

A four-position switch, on the flight control panel (figure 1-18) on the left console, provides an alternate trim circuit for the horizontal tail. This switch accomplishes longitudinal trim at the same speed as the normal trim switch. The alternate longitudinal trim switch must be kept at NORM. if the normal trim switch (on the stick grip) is to be used for trimming. Moving the alternate longitudinal trim switch to OFF disconnects both the alternate and the normal trim circuits for the stabilizer, and prevents operation of the stabilizer automatic trim by the autopilot. Holding the switch at NOSE UP or NOSE DN overrides any malfunction of the normal trim switch and trims the airplane accordingly. The switch is powered by the secondary bus and is spring-loaded from NOSE UP or NOSE DN to OFF.

Alternate Lateral Trim Switch.

A four-position switch, on the flight control panel (figure 1-18), provides an alternate means of lateral trim. Trim by this switch is done at the same speed as by the normal trim switch. Ordinarily, this switch is kept at NORMAL, which allows use of the normal trim switch on the control stick. Placing the switch at OFF disconnects both normal and alternate aileron trim circuits; holding the switch at either LEFT or RIGHT overrides any malfunction of the normal trim switch and will trim the corresponding wing down. The switch is powered by the secondary bus and is spring-loaded from LEFT or RIGHT to OFF.

Rudder Trim Switch.

Rudder trim is electrically controlled through a spring-loaded switch on the flight control panel. (See figure 1-18.) The switch is held to LEFT or RIGHT for corresponding rudder trim and is spring-loaded to the OFF position. The switch should be in the OFF position at all times after desired rudder trim is obtained. The rudder trim switch receives its power from the secondary bus.

Yaw Damper Switch.

A two-position switch (19, figure 1-7), located on the vertical panel forward of the right console and powered by the monitored bus No. 2, controls the yaw damper. Placing the switch in the ON position puts the yaw damper into operation, provided the automatic pilot is not engaged.

Note

To fully utilize the advantages of the yaw damper, it is recommended that the damper be turned on during climb-out and turned off during the before-landing check.

Take-off (Trim) Position Indicator Light.

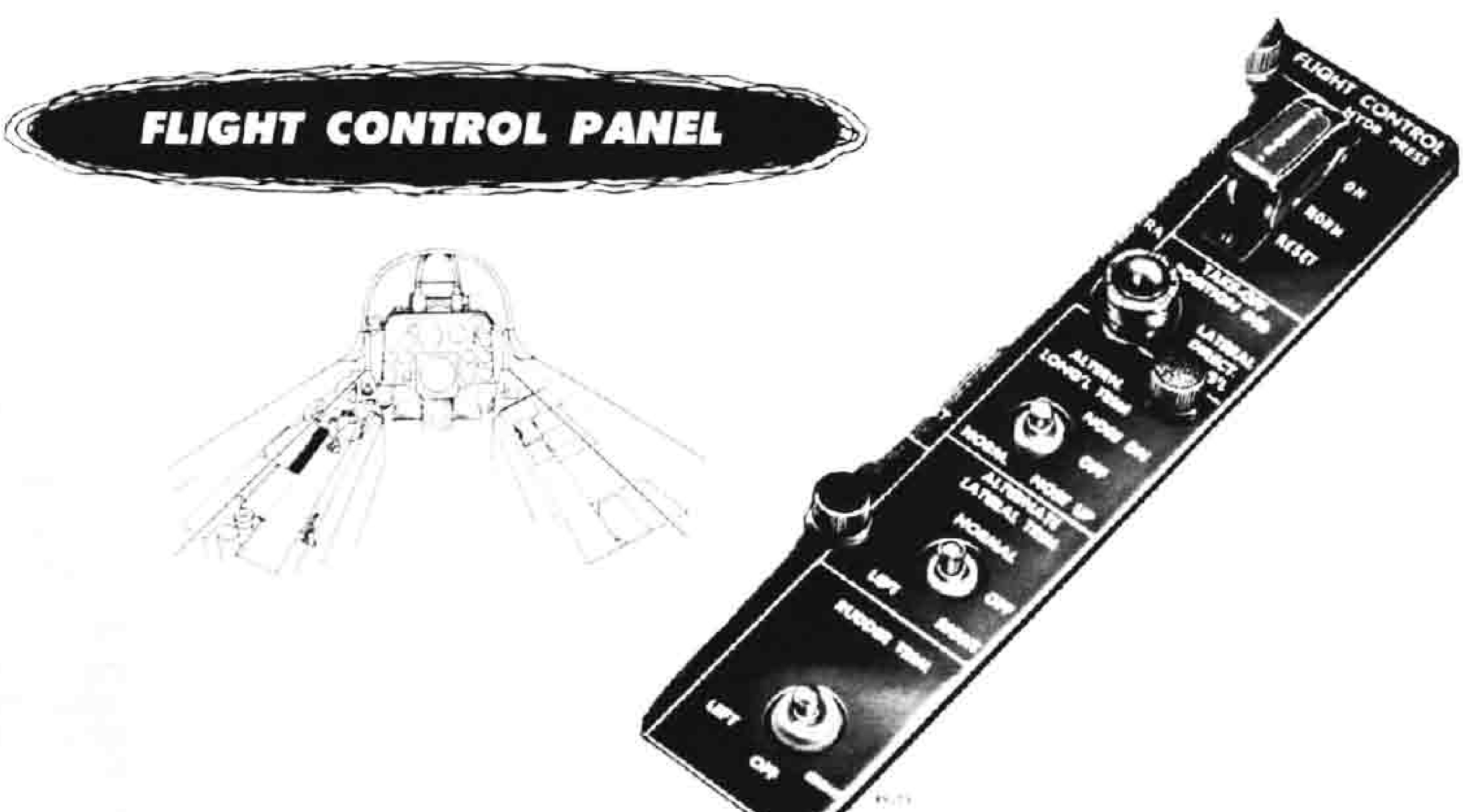
An amber light, on the flight control panel (figure 1-18), indicates the take-off trim position for the ailerons, horizontal tail, and rudder. The light is powered by the secondary bus; it comes on whenever any one of these surfaces is trimmed to the take-off position and goes out when the trim switch is released; it comes on again when the next surface is trimmed for take-off, etc. Aileron and rudder take-off trim positions are neutral; the horizontal tail take-off trim position is set for an airplane nose-up condition.

Note

- The take-off trim position indicator light does not come on when surfaces are being trimmed with the automatic pilot master switch ON.
- The take-off trim setting of the horizontal stabilizer is identified by a white triangle painted on the left side of the 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 is obtained.

FLIGHT CONTROL HYDRAULIC SYSTEMS.

A constant-pressure hydraulic system supplies power for operation of the ailerons and the horizontal tail. (See



F-86K-1-52-3A

Figure 1-18

figure 1-19.) An alternate constant-pressure hydraulic system is provided in case the normal system fails. Change-over from the normal to the alternate system is usually automatic when normal system pressure fails. A manual method of change-over, however, is provided by a control handle in the cockpit. A flight control switch tests the alternate system by simulating a failure of the normal system. When normal system pressure falls below 650 psi, two pressure switches close (one of which serves as stand-by for the other), energizing two solenoid-operated shutoff valves. One valve shuts off the pressure supply in the normal system; the other opens to allow operation of the alternate system. However, if the alternate system pressure is also below 650 psi, a second pair of pressure switches in the alternate system lines will remain open; the circuits to the solenoid-operated valves will not be completed, and the valves will remain in the positions to utilize normal system pressure. Therefore, automatic transfer to the alternate system is prevented if alternate pressure is below a usable amount. (See figure 1-26 for fluid specification.) Refer to Section VII for additional information on these systems.

Flight Control Normal Hydraulic System.

The system is pressurized by a variable-volume, engine-driven pump which receives fluid from the normal system reservoir and compensator. The pump is supplemented by an accumulator for instantaneous high rates of demand. The accumulator air pressure gage (figure 1-26), behind the same access door as the engine oil filler point, should be checked before flight for 600 to 650 psi air precharge when hydraulic pressure is depleted. The pressure is applied to three hydraulically operated dual actuating cylinders: one for the horizontal tail and one for each aileron. Each actuating cylinder is, in effect, two independent actuating cylinders and contains one normal and one alternate control valve. The normal and the alternate control valves on the actuating cylinder operate entirely independently of each other; malfunction or loss of fluid in one valve or cylinder does not affect operation of the other in any way. The amount of fluid in the system can be determined by the fluid quantity indicator pin which protrudes from the compensator. The pin can be seen after removal of the access door just forward of the flight control normal hydraulic system filling point. *The pin should protrude a minimum of 1/4 inch to a maximum of 1 1/4 inches and should be checked before flight.* This flight control system is irreversible, in that movement of the control stick, which is mechanically linked to the control valves, directs system pressure through the valves to the actuating cylinders, moving the corresponding control surface. Thus, air loads on the control surfaces are not transmitted to the control stick. The ailerons are designed to hold against air loads up to the structural design limits of the airplane, and the horizontal tail is designed to withstand air loads exceeding these limits.

Flight Control Alternate Hydraulic System.

The system (figure 1-19) is pressurized by an electric-motor-driven pump, which receives fluid from an alternate reservoir and compensator. When the alternate system is operating, pressure is supplied through separate hydraulic lines to a hydraulic control valve on each of the three actuating cylinders. Two pressure-storage accumulators are included in the system. The pump is automatically turned on by two pressure switches (one of which serves as a stand-by for the other) whenever the alternate system accumulator pressure drops below 2700 psi. The operation of the alternate system is identical to that of the normal system. Whenever the alternate system shutoff valve opens, an indicator light comes on in the cockpit, indicating operation of the alternate system. Rapid control stick movement causes system pressure to drop considerably below the normal 3000 psi. The amount of fluid in the alternate system can be determined by checking the alternate compensator shaft extension length. The compensator is forward of the alternate system accumulators on the front spar and is visible when the access panel at the right wing root lower fairing is removed. *The shaft should extend a minimum of 1/4 inch to a maximum of 1 1/4 inches.*

Flight Control Switch.

A three-position flight control switch, on the flight control panel (figure 1-18) aft of the throttle, provides selective changing from the normal to the alternate flight control hydraulic system for test purposes. The three positions are ON, guarded NORM, and spring-loaded RESET. With the switch in the NORM position (with engine running), the normal system supplies pressure to the flight controls, and the alternate system will cut in automatically should the normal system fail. With the switch in the ON position, two solenoid valves are energized, shutting off normal system pressure and supplying alternate system pressure to the flight controls. If alternate system pressure is below 650 psi, however, the alternate system valve will not be energized even though the switch is at ON. To return control to the normal system, the switch must be moved to the spring-loaded RESET position momentarily before it is returned to NORM. With the switch at RESET, the normal system shutoff valve is opened and the alternate system valve is closed. However, when the switch is returned from RESET to NORM, if normal system pressure is below 650 psi, the valves will automatically transfer again and the alternate system will return to operation. If the switch is positioned at NORM without first being moved to RESET, the alternate system will continue to operate.

FLIGHT CONTROL HYDRAULIC SYSTEM

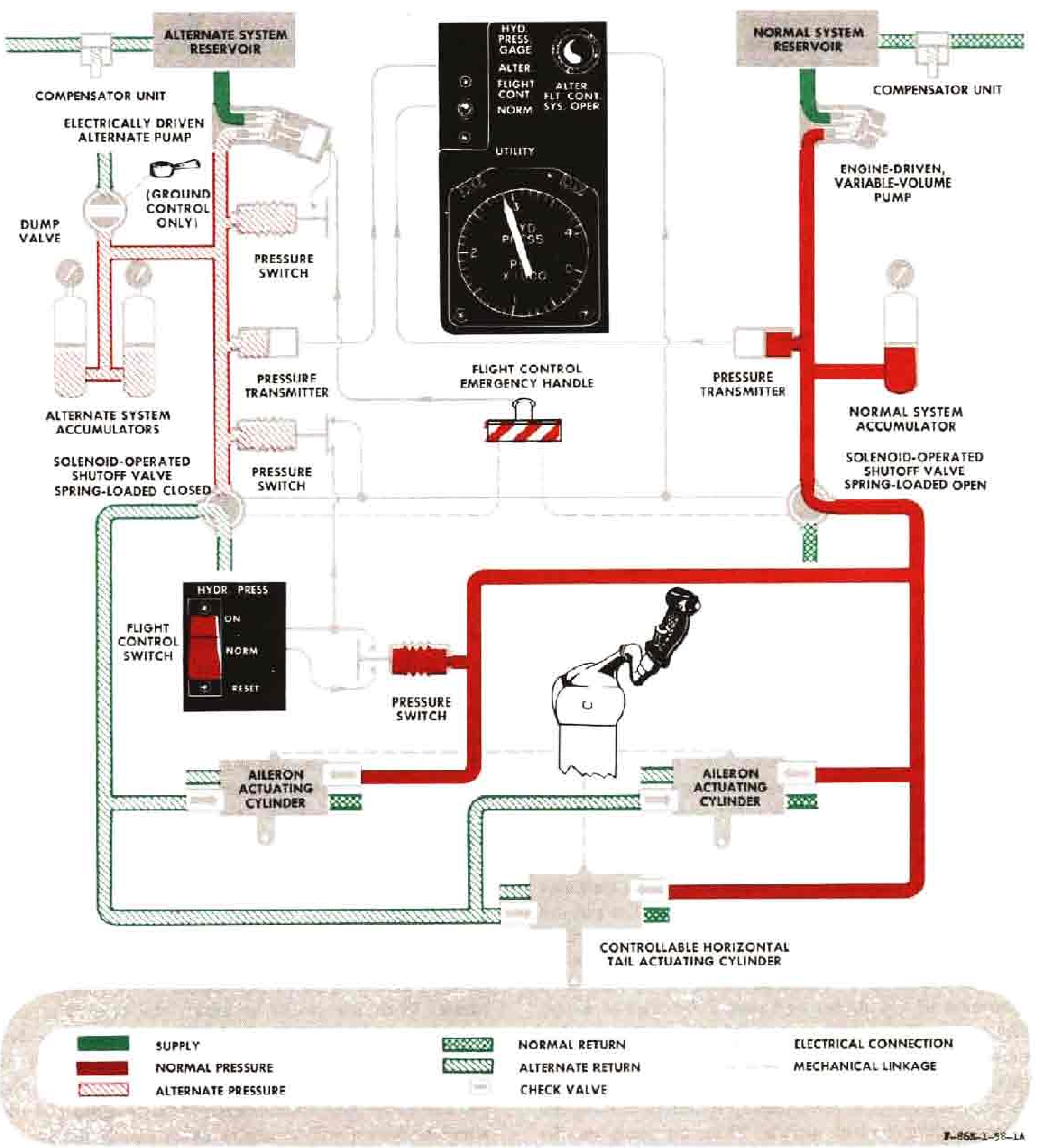


Figure 1-19

Regardless of switch position, the normal system will not operate if the engine is not running. The alternate system may be checked, however, without the engine running, by use of an external electrical power source; to check transfer of operation of the normal system to the alternate system, the engine must be running. The switch is normally powered by the primary bus; however, if the primary bus fails, the switch will automatically be powered by the battery bus.

Flight Control Emergency Handle.

For manual change-over of operation from the normal to the alternate flight control hydraulic system, a flight control emergency handle (37, figure 1-5) is located below and to the left of the main instrument panel. When the handle is pulled rapidly aft about 2½ inches, the alternate pump is turned on and the solenoid-operated valves in the normal and alternate flight control hydraulic systems are manually actuated, shutting off normal system flow and supplying alternate system pressure to the flight controls. The valves will remain in this position, regardless of normal or alternate system pressure, as long as the handle remains out. When the flight control emergency handle is pulled out, power is supplied from the battery bus to the alternate system pump, which operates continuously as long as the handle remains extended. This results in pressure indications ranging as high as 4000 psi, which is above the maximum marked on the hydraulic pressure gage. This is also the pressure at which the alternate system relief valve automatically functions. No damage to the hydraulic system is likely to result, but such high pressures should be reported at the conclusion of flight. A detent is provided on the handle shaft for locking the handle in the emergency position. To release handle from emergency position, push handle down and forward. When the emergency handle is returned to the normal position, the alternate system will continue to operate until the flight control switch is momentarily positioned to RESET and then placed at NORM.

CAUTION

The flight control alternate hydraulic system pump operates continuously as long as the manual emergency change-over handle is actuated. Decreased pump life may result from excessive periods of operation; also, drain on the battery in case of generator failure would appreciably shorten battery life. In addition, manual change-over to the alternate system may prevent return to the normal system if the change-over valve sticks. This would necessitate the duration of the flight to be performed on the alternate system. Therefore, do not actuate the manual emergency change-over handle in flight, except when the normal system fails and automatic (electrical) change-over to the alternate system does not occur, or just before entering the landing pattern when flying on the alternate system after normal system failure.

Hydraulic System Pressure Gage and Pressure Gage Selector Switch.

Refer to "Utility Hydraulic Power Supply System" in this section.

Flight Control Alternate System Indicator Light.

An amber light (32, figure 1-5), below the instrument panel, comes on whenever the flight control alternate hydraulic system is operating. Electrical power for this light is from the battery bus.

Flight Control Alternate System Accumulator Air Pressure Gages.

Two accumulator air pressure gages (figure 1-26) and the fluid and air filler valves are behind an access door in the right wing root lower fairing. The gages should be checked before flight for a precharge air pressure of 600 to 650 psi with the alternate system hydraulic pressure depleted. The pressure is depleted by opening a dump valve in the same recess as the accumulator air pressure gages. Opening the dump valve allows pressure to be routed to return.

WING SLATS.

Wing slats (19, figure 1-1) extend from fuselage to wing tip along the leading edge of each wing panel. Aerodynamic forces acting upon the slats cause them to open and close automatically, depending upon the airspeed and attitude of the airplane. When they open, the slats move forward along a curved track, forming a slot in the wing leading edge. This automatic extension of slats smooths the airflow over the upper surface of the wing and allows the wing to go to higher angles of attack before stalling, resulting in lower stalling speeds. At higher speed, in unaccelerated flight, the slats automatically close to provide minimum drag for maximum performance in flight. On Group 4 and airplanes changed by T.O., an improved wing leading edge and slat assembly has been installed. The new slat is known as the "6-3 slatted wing leading edge." The new slatted leading edge can be identified by a sharper leading edge and a thinner slat section. The purpose of the 6-3 leading edge is to give better high-altitude performance as well as good low-speed handling characteristics.

WING FLAP SYSTEM.

Electrically operated, slotted-type wing flaps (21, figure 1-1) extend from the aileron to the fuselage on each wing panel. Each flap is operated by an individual electrical actuator through an individual electric circuit. The actuators are mechanically interconnected by a flexible shaft to synchronize the flap travel. Each actuator is capable of driving the opposite flap through the synchronizing shaft along with the flap to which it is attached. Therefore, in case of a power failure to one actuator, flap positioning (at a reduced speed) is still obtainable. The actuators are of the screw-jack type, and are mechanically irreversible, thus preventing air loads from moving the flaps. No emergency system is provided, as there is enough protection in the normal system through the mechanical interconnection, the individual electric motors, and the individual electric circuits.

WING FLAP HANDLE.

The wing flap handle (8, figure 1-6), outboard of the throttle, moves on a quadrant marked "UP," "HOLD," and "DOWN." The wing flap handle receives its power from the monitored bus No. 1. To position the flaps full up or down, the flap handle is moved to the corresponding position and left there. (Power is automatically removed from the actuators when the flaps reach the extreme position.) If "sink" occurs during flap retraction immediately after take-off (at high gross weights), the flap handle can be temporarily positioned to HOLD to maintain an intermediate flap position. However, after complete flap retraction is made, the handle should remain at UP. Refer to Section VII for additional information on this system.

SPEED BRAKE SYSTEM.

Hydraulically operated speed brakes are on each side of the fuselage, below the dorsal fin. Each of the two brakes consists of a hinged panel which, when open, extends down and forward into the air stream. The speed brakes will open or close in about 2 seconds. A slight nose-up pitch will be noticed when speed brakes are opened and, correspondingly, a slight nose-down pitch will be evident when the brakes are closed. Speed brakes can be positioned as desired.

WARNING

Before operating speed brakes on the ground, be sure aft fuselage area around speed brakes is clear, as brakes operate rapidly and forcefully and could injure any personnel near the brakes.

Note

If utility hydraulic system pressure is momentarily reduced below about 1500 psi, a pressure priority valve will cut out the part of the system supplying the speed brakes.

SPEED BRAKE SWITCH.

A serrated toggle switch, on top of the throttle grip (figure 1-9), controls the speed brake hydraulic control valve. The switch is powered by the primary bus and has three fixed positions: IN, OUT, and a neutral position, which is indicated by a white mark on the switch guide. The brakes can be stopped in any position by movement of the switch to neutral. After the brakes have been opened or closed, the switch is normally returned to neutral (center position).

Note

- Since the speed brake hydraulic lines are routed near the engine, it is important that the speed brake switch be kept in the neutral position to cut off pump pressure to the lines and minimize fire hazard in case of a damaged line.
- If the speed brakes do not open when the control switch is positioned to OUT, return switch to the neutral position. The switch should not be cycled to IN and OUT, as additional fluid will be lost with each cycle if the malfunction is caused by a broken line.

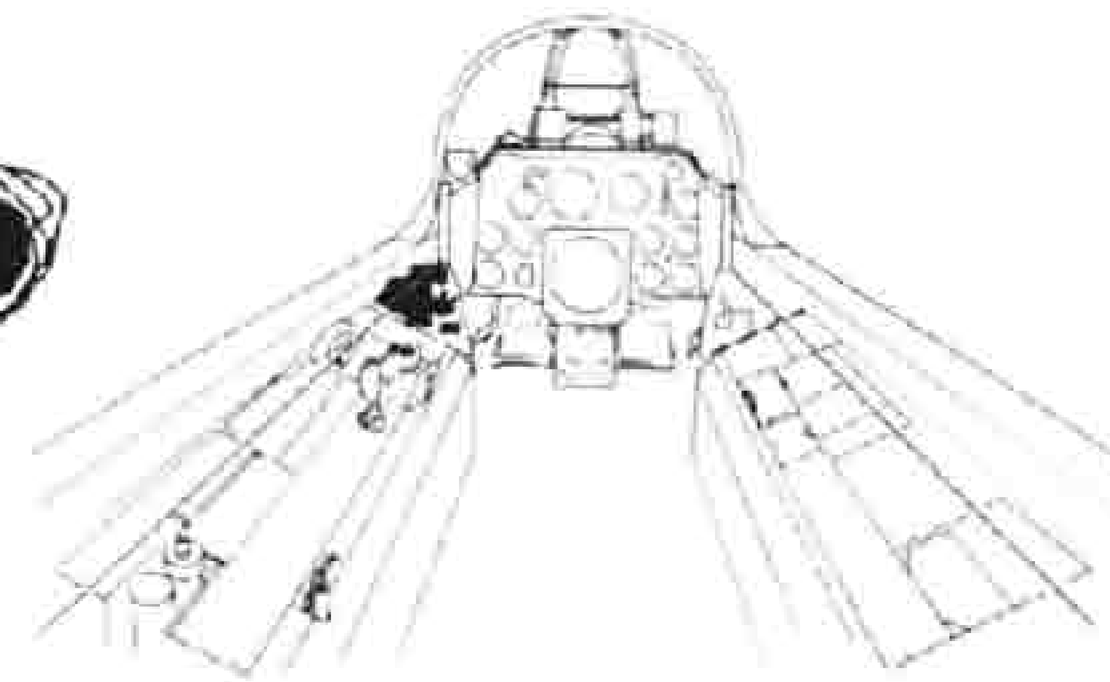
LANDING GEAR SYSTEM.

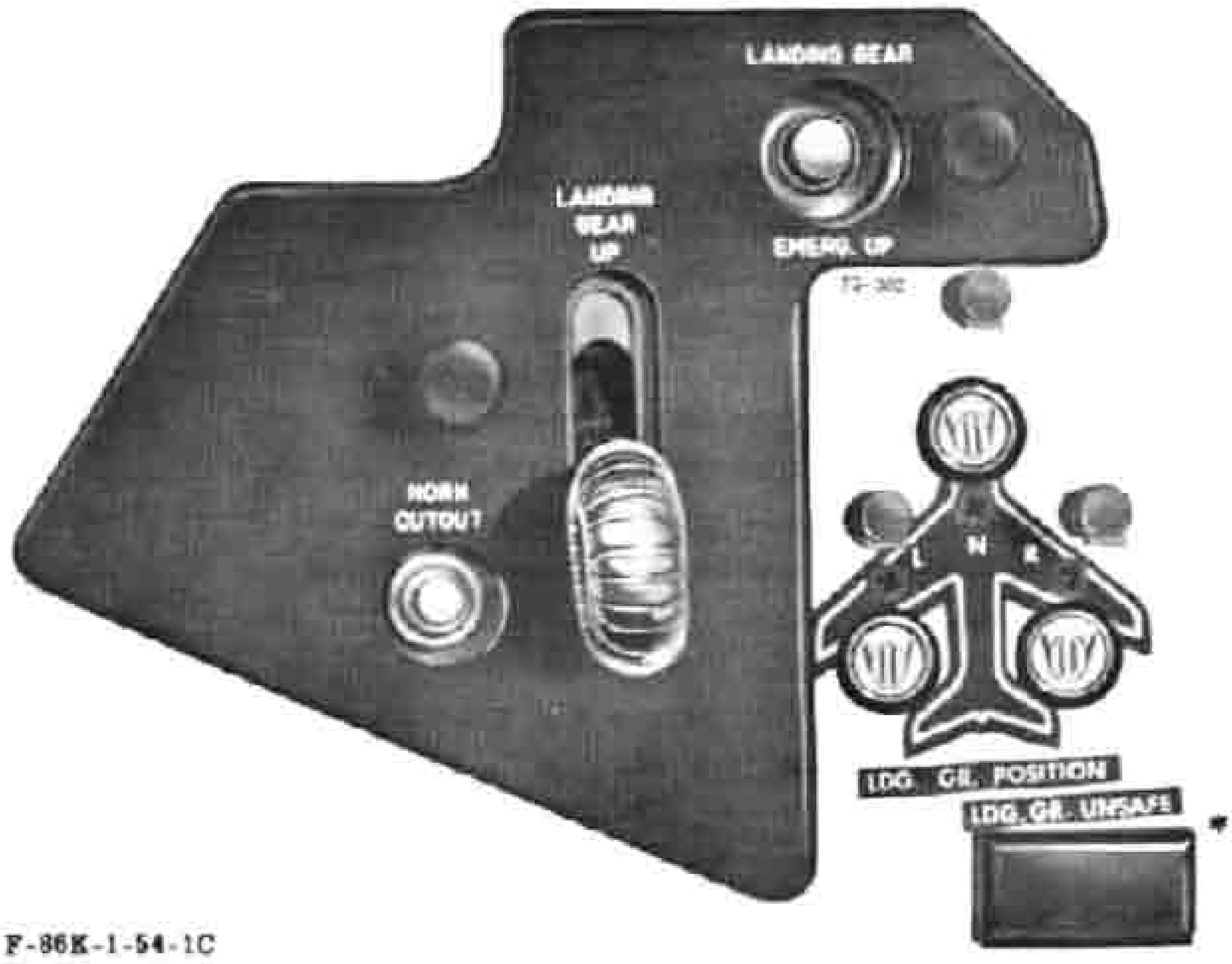
The landing gear and wheel fairing doors are hydraulically actuated and electrically (dc power) controlled and sequenced. An accumulator supplies pressure for emergency lowering of the nose gear. The accumulator air pressure may be checked by operating the nose gear accumulator dump valve in the nose wheel well. The air pressure should be 1200 ($\pm$50) psi with the hydraulic pressure exhausted. The steerable nose gear retracts aft into the fuselage, pivoting to lie parallel with the bottom of the airplane. The main gear retracts inboard into the wing panels and fuselage. Hydraulic brakes are provided on the main wheels.

LANDING GEAR HANDLE.

A handle, on the landing gear control panel (figure 1-20) above and forward of the left console, electrically

LANDING GEAR CONTROL PANEL





F-86K-1-54-1C

NOTE

***Landing gear unsafe warning light is located on left side of instrument panel shroud on F-86K Airplane AF54-1251 and all subsequent airplanes. (Also those changed by T.O.)**

An additional warning light is located in the gear handle of all airplanes.

Figure 1-20

controls the landing gear and the gear-door selector valves. The gear handle has two positions, UP and DOWN. It receives its power from the primary bus. When the gear is down and locked and the weight of the airplane is on the gear, a ground safety switch prevents gear retraction if the gear handle is inadvertently moved to UP. The fairing doors are not controlled by this switch and will follow their normal sequence, opening when the gear handle is moved to UP.

CAUTION

Although the ground safety switch will not allow the gear to retract even though the gear handle is moved to UP while the weight of the airplane is on the gear, subsequent taxiing on rough ground might allow enough strut extension to open the safety switch and allow the gear to retract.

LANDING GEAR EMERGENCY RETRACT BUTTON.

A guarded emergency-retract switch is above the gear handle on the landing gear control panel. (See figure 1-20.) When the gear handle is at UP and the emergency-retract button is depressed and held, the ground safety switch is bypassed and the gear can be retracted on the ground.

CAUTION

Do not use landing gear emergency-retract button in flight to raise gear, as damage to gear doors and the gear lowering mechanism may result.

WARNING

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

LANDING GEAR EMERGENCY-RELEASE HANDLE.

Should failure of the utility hydraulic system or electrical system occur, the gear may be lowered by use of the landing gear emergency-release handle. When the landing gear emergency-release handle (19, figure 1-5), below the instrument panel on the right, is pulled, with a force of about 65 pounds, to full extension (about 14 inches), all fairing doors and the main gear uplocks are mechanically unlocked, gear and door hydraulic selector valves are positioned to lower the gear, and a special nose gear accumulator provides pressure to extend the nose gear. The main gear falls by gravity to the down-and-locked position. Once the gear has been lowered by the emergency-release handle, the nose gear cannot be retracted until the nose gear emergency-lowering control valve is manually reset while the airplane is on the ground. The red control valve-reset shaft is pushed out during emergency nose gear lowering and protrudes from the right side of the fuselage just above the nose gear door. Pushing this reset rod in until it is again flush with the fuselage skin molding resets the nose gear emergency release system. The emergency-release handle must be pulled to full extension to ensure release of all uplocks and proper positioning of hydraulic selector valves. The handle should be held in the fully extended position until landing gear indicators show a safe landing gear position.

CAUTION

To prevent damage to the surrounding equipment, maintain a grip on the handle until it retracts to the stowed position.

LANDING GEAR DOOR GROUND CONTROL SWITCH.

A guarded switch is provided in the recess for the pilot's retractable step on the left forward side of the fuselage, to open the landing gear wheel well doors for ground maintenance. The switch has two positions, OPEN and CLOSE, and is powered by the primary bus. The switch should be checked before flight to ensure that it has been placed in the CLOSE position. The only safe method for opening the landing gear doors for ground maintenance is by operation of this switch. Any other method of opening the doors for maintenance is unsafe, with one exception. If, after the switch has been moved to OPEN, the doors will not open because of lack of hydraulic pressure, then, with the switch still at OPEN, the landing gear emergency-release handle can be pulled to open the doors. If the emergency release is used to open the doors, the nose gear emergency-lowering valve must be reset before the next flight.

LANDING GEAR SYSTEM INDICATORS.

Three landing gear position indicators (figure 1-20) are on the landing gear control panel to provide a visual indication of the condition of the gear and fairing doors. An unsafe gear warning light is in the landing gear control handle. On early airplanes* an additional gear unsafe warning light is located on the landing gear control panel. On later airplanes† and those changed by T.O., an additional gear unsafe warning light (4, figure 1-5) is on the upper left side of the instrument panel shroud. Each indicator shows red crosshatching if the related gear is in an unlocked condition, the word "UP" if the gear is up and locked, or a miniature wheel if the gear is down and locked. Red crosshatching will also appear if the electrical system is inoperative. The warning light comes on any time the landing gear or the door position does not correspond with the position of the gear handle, or when the throttle is retarded below minimum cruising rpm and gear is not down and locked. A warning horn in the cockpit sounds when the gear is in any position other than down and locked if the throttle is at less than cruising power. A warning horn cutout button (figure 1-20), beside the gear handle, is provided to silence the horn. Advancing the throttle silences the horn and resets the horn circuit. Both the unsafe warning light and the warning horn operate either in the air or on the ground whenever power is available. Power for the landing gear position indicators, unsafe warning light, and warning horn is received from the primary bus. The landing gear unsafe warning light is automatically dimmed when the instrument panel lights are turned on.

NOSE WHEEL STEERING SYSTEM.

Utility hydraulic system pressure is supplied to the nose wheel steering unit through a shutoff valve actuated by a push-button switch on the control stick grip. (See figure 1-17.) The nose wheel may be turned about 27 degrees either side of center by pressure on the corresponding rudder pedal while the steering system is engaged. The nose wheel steering unit acts as a shimmy damper when not being used for steering.

NOSE WHEEL STEERING RELEASE PIN.

A nose wheel steering release pin, on the left side of the nose gear assembly just above the wheel (figure 1-21) is disengaged to disconnect the nose wheel steering unit from the nose wheel for towing the airplane. It is held disengaged by inserting a tow-pin wedge in the release pin.

CAUTION

It is important to check before flight to make sure that the safety cap is on and tight; this will ensure that the release pin is engaged and that nose gear will retract properly.

***F-86K Airplanes AF54-1231 through -1250**
†F-86K Airplane AF54-1251 and all later airplanes

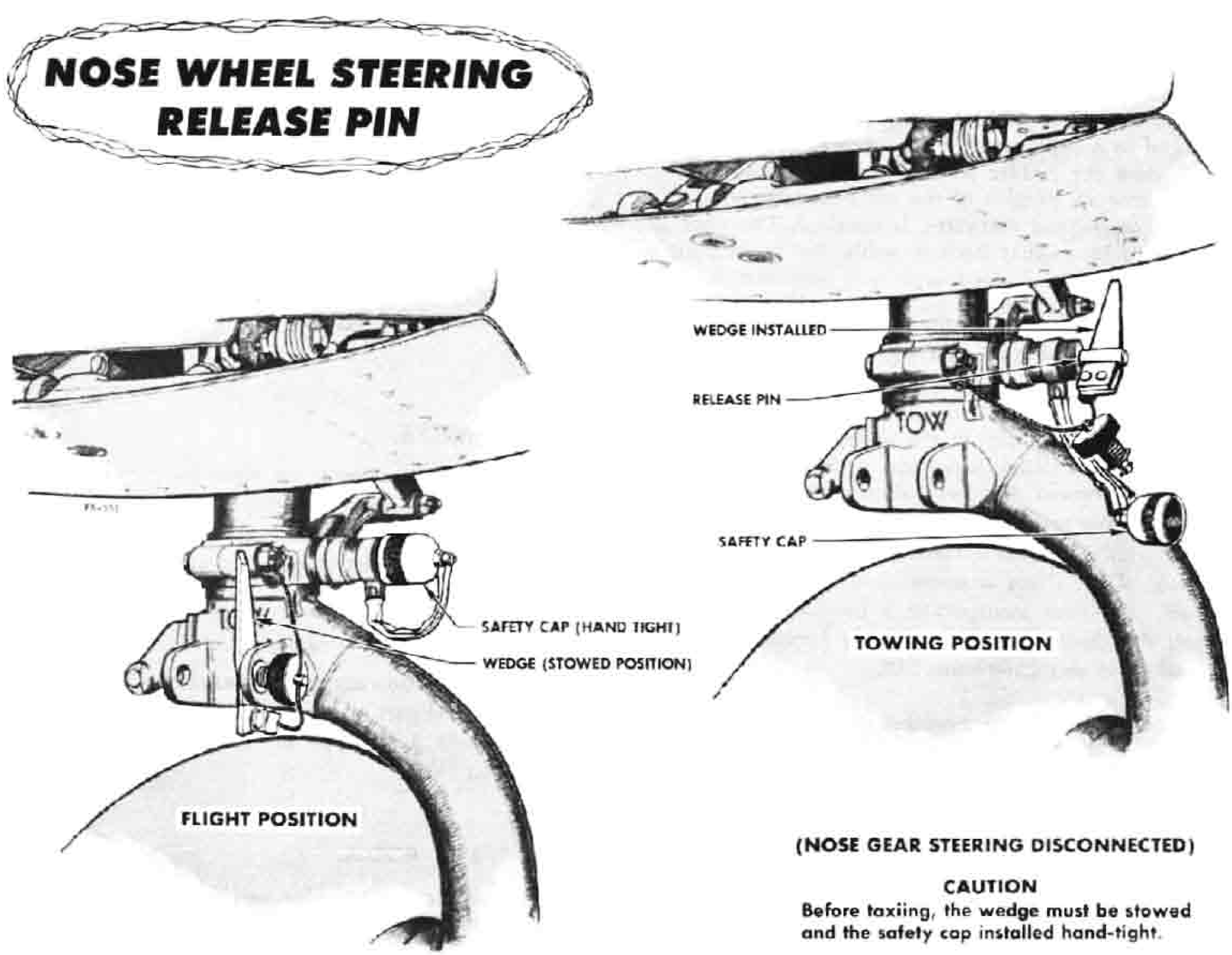


Figure 1-21

NOSE WHEEL STEERING ENGAGING BUTTON.

An engaging button, on the control stick grip (figure 1-17), is depressed to operate the nose wheel steering system. In order to engage the nose wheel steering unit, the switch must be depressed and the rudder pedals aligned in the direction the nose wheel is turned. When the nose wheel and the rudder pedals are coordinated in this manner, the nose wheel steering unit will remain engaged as long as the switch is depressed. The nose wheel steering engaging button is powered by the primary bus and is operable only when the airplane is on the ground.

BRAKE SYSTEM.

The hydraulic brake system is of the segmented rotor-disk type, incorporating boost-type brake master cylinders. The braking units, on each main landing gear wheel, consist of rotor and stator plate assemblies. Braking effect is obtained by metered hydraulic pressure pushing the stationary stator plates against the rotor plates. Multiple plates are used to increase braking efficiency, aid in heat dissipation, and prevent brake seizure due to disk warpage resulting from high temperatures. The brakes are operated by toe action on the rudder pedals. Brake pressure is supplied from the brake master cylinder supplemented by power boost from the utility hydraulic system. However, if no pressure is available from the utility hydraulic system, the brakes function through conventional action of the brake master cylinders when sufficient toe pressure is applied to the rudder pedals. Excessive use of the brakes can cause them to overheat and, in turn, cause detrimental effects upon the tires. If the heat is great enough, it can cause the tires to weaken and subsequently blow out. Best braking results are obtained by applying the brakes below 100 knots IAS, intermittently and hard, but not hard enough to stop wheel rotation.

Note

This airplane is not equipped with parking brakes.

DRAG CHUTE SYSTEM.

A drag chute (3, figure 1-1) is provided to reduce landing distances. The 16-foot, ring-slot type drag chute, packaged in a deployment bag, is stowed in a compartment below the rudder and above the exhaust nozzle. The extreme aft portion of the tail cone is squared off, and a door, hinged vertically, is installed. The door is held closed by a roller latch assembly that is controlled from the cockpit. A door latch safe indicator is provided for visual and touch inspection. A riser joins the chute to a release mechanism, enclosed in the tail-cone assembly. On some airplanes* mechanical linking of the riser assembly to the release mechanism is not accomplished until the initial movement of the drag chute handle is made to deploy the drag chute. With this method of installation, accidental opening of the drag chute compartment door will allow the complete drag chute assembly to jettison without affecting the airplane flight attitude. Normal operation (deployment) and jettisoning of the chute is manually controlled from the cockpit. The riser incorporates a breakaway fitting to permit the chute to be automatically jettisoned if it is opened above about 160 knots IAS.

CAUTION

The drag chute is for operation only after touchdown has been made and at speeds of 150 knots IAS or below.

DRAG CHUTE HANDLE.

The drag chute handle (3, figure 1-5) is in a bracket directly above the upper left corner of the instrument panel. Pulling the drag chute handle straight aft, without turning it, to the first stop position (about 2 inches) releases the compartment door, allowing the pilot chute to be deployed, which, in turn, opens the drag chute. For controlled jettisoning of the chute after deployment, the handle must be rotated 90 degrees counterclockwise, and pulled full-aft (about 3 more inches). This releases the locking assembly and allows the chute to be jettisoned.

CAUTION

To prevent the drag chute from being jettisoned inadvertently when it is deployed, the drag chute handle should be actuated with a smooth, steady pull. Abrupt handle movement with excessive force may cause overrun of the operating linkage and jettisoning of the drag chute. (Do not use handle as handhold when entering or leaving the cockpit.)

DRAG CHUTE DOOR LATCH SAFE INDICATOR.

The latch indicator is directly below the drag chute compartment door and to the left of the door latch. The indicator is a square pin that protrudes from a hole adjacent to the latch to indicate that the latch is securely locked. The indicator pin must extend at least 1⅜ inches (as determined by a latch indicator gage, riveted alongside the indicator pin), and must be checked for a safe indication before flight. If the indicator does not protrude at least as far as the indicator gage, the latch is insecure.

INSTRUMENTS.

Most of the instruments are electrically operated by power from the electrical system. (See figure 1-14.) The tachometer and exhaust temperature gage are self-generated electrical instruments and are not powered by the electrical system.

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, which extends from the right wing tip. Boom anti-icing protection is afforded by electrical heating elements. (Refer to "Anti-icing and Defrosting Systems," in Section IV.)

AIRSPEED INDICATOR.

The airspeed indicator (7, figure 1-5) is essentially a conventional airspeed indicator with the addition of a maximum allowable airspeed pointer which indicates maximum airspeed for the airplane when it is equipped with drop tanks. The fluorescent pointer registers indicated airspeed. The striped pointer is used as a limit only when drop tanks are carried. This pointer is preset for the limit Mach number of the airplane with drop tanks, and it moves to show the airspeed corresponding to the limit Mach number or limit airspeed, whichever is less, during flight at 15,000 feet or below. Clockwise movement of the striped pointer will stop at the limiting airspeed at low altitude.

***F-86K Airplane AF54-1276 and all later airplanes**

MACHMETER.

A Machmeter (35, figure 1-5) is provided for use in conjunction with the airspeed indicator. The Machmeter indicates the speed of the airplane in relation to the speed of sound.

AIRSPEED AND MACH NUMBER INDICATOR.*

This combination instrument (figure 5-1) replaces the individual airspeed and Machmeter indicators and incorporates the following features: A conventional needle hand is used to indicate airspeed through a range of 80 to 850 knots. A knurled knob, at the lower right corner of the instrument ring, sets the landing speed index marker to the recommended landing speed for various configurations. (The landing speed index marker moves along the right perimeter of the dial.) The adjustment of this landing speed index can be made within a range of 110 to 200 knots IAS. In the left half of the instrument dial is a movable Mach scale (with a range from Mach .5 to Mach 2.2) that rotates with altitude changes to show the Mach number that is equivalent to 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. A movable red and black limiting hand automatically indicates, in terms of IAS, the maximum allowable equivalent airspeed (EAS) of the airplane in a clean configuration.

Note

Equivalent airspeed (EAS) is calibrated airspeed (CAS) corrected for errors induced by compressibility. Calibrated airspeed is indicated airspeed (IAS) corrected for installation error.

As altitude is increased, changes in outside air density cause the limiting hand to move to a higher IAS reading. If, for example, the limiting hand is set for 610 knots EAS at sea level, then at 20,000 feet, the hand will move to about 654 knots IAS. In effect, this movable limiting hand replaces the fixed red limitation mark used on previous airspeed indicators which deprives the airplane of additional allowable speed at altitude.

ALTIMETER.

Some airplanes have standard type altimeters, while other airplanes are equipped with a modified altimeter which, in addition to the standard 1000- and 100-foot pointers, incorporates a new 10,000-foot pointer (notched disk with an extension pointer), which serves a second function as a warning indicator. The warning indicator is a striped section which appears through the notched disk at altitudes below 16,000 feet. This altimeter offers improved readability and gives visual warning when an altitude of less than 16,000 feet is entered.

ACCELEROMETER.

An accelerometer (1, figure 1-5), installed at the bottom of the left windshield bow, indicates G (positive and negative). Reference to this instrument provides an indication of structural loads. In addition to the conventional indicating pointer, there are two recording pointers (one for positive 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, thus giving a record of maximum G-load 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. Illumination of the accelerometer is controlled by a switch on the aft edge of the left instrument subpanel, and power is supplied by the primary bus.

Figure 1-22

*F-86K Airplane AF54-1326 and all later airplanes

STAND-BY COMPASS.

A conventional magnetic compass (16, figure 1-5), mounted on the windshield bow to the right of the instrument panel, is furnished for navigation in the event of instrument or electrical system failure. Illumination of the stand-by compass is controlled by a switch, on the aft edge of the left instrument subpanel, and power is supplied by the primary bus.

DIRECTIONAL INDICATOR.

Refer to "Navigation Equipment," in Section IV.

ATTITUDE INDICATOR.

The Type B-1A attitude indicator (11, figure 1-5), on the instrument panel, indicates the attitude of the airplane in relation to the horizon. The indicator gyro is electrically driven and receives its power from the ac electrical bus. Erection of the indicator gyro requires about 2½ minutes after application of power and can be observed by disappearance of the "OFF" power-failure flag visible through the cover glass of the indicator. The "OFF" flag will appear in case of a complete ac or dc power failure. However, a slight reduction in ac or dc power, or failure of certain electrical components within the system, *will not* cause the "OFF" flag to appear, even though the system is not functioning properly.

WARNING

The "OFF" power-failure flag should not be relied upon as the sole means of determining malfunction of the attitude indicator. As an additional check, reference should be made to the turn-and-slip and directional indicators.

The instrument is operative through 360 degrees of roll, 82 degrees of climb, and 82 degrees of dive, and is not likely to tumble even during extreme maneuvers. However, should the gyro tumble, it will erect in about 2½ minutes if the circuit breaker labeled "VERTICAL GYRO," on the right console circuit-breaker panel, is momentarily pulled out and then pushed back in. If the circuit breaker is not used, the gyro will require about 15 minutes to erect. 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 the conventional indicator. In turns of 40 degrees or more per minute, a compensating mechanism in the instrument limits turn error to 2 degrees.

WARNING

A slight pitch error in the indication of the Type B-1A attitude indicator results from accelerations or decelerations. It appears as a slight climb indication after a forward acceleration and as a slight dive indication after deceleration when the airplane is flying straight and level. This error is most noticeable at the time the airplane breaks ground during the take-off run. At this time a climb indication error of about 1½ bar widths is normally noticed; however, the exact amount of bar-width error depends upon the acceleration and elapsed time of each individual take-off. The erection system automatically removes the error after the acceleration ceases.

The indicator does not have a manual caging handle. When electrical power is turned off, a snubber automatically grips the gimbal and keeps it from tumbling. When power is turned on, the snubber is released after a 15-second time delay. As the level-flight angle of attack of the airplane varies with different loadings and speeds, a pitch trim knob is provided on the indicator for the pilot to center the horizon bar after the airplane has been trimmed for level flight.

TURN-AND-SLIP INDICATOR.

The conventional turn-and-slip indicator (34, figure 1-5), on the instrument panel, is electrically driven by power from the primary bus. The instrument is calibrated so that a standard needle-width turn is equivalent to a 360-degree turn accomplished in 4 minutes (1½-degree-per-second rate of turn). Because of the excessive tilt required in the present installation of the turn-and-slip indicator, the instrument erroneously indicates a turn in the opposite direction during all entries into turns. The error increases with increased rate of roll. The turn needle indicates correctly only when there is no roll movement. When the attitude indicator is inoperative and the turn-and-slip indicator is being used as a primary flight instrument, the following instructions should be followed:

1. Avoid excessive rate of roll.
2. Maintain a constant angle of bank in a turn; the indicator then shows the correct rate and direction of turn.

EMERGENCY EQUIPMENT.

ENGINE FIRE-WARNING SYSTEM.

Two fire detector systems detect and indicate fire in the forward section of the engine compartment and an overtemperature condition or fire in the aft section. A stainless-steel fire wall divides the engine compartment immediately aft of the compressor. Therefore, the forward section includes the compressor and the accessory section and each main landing gear wheel well*; the aft section, the combustion chambers and tail pipe. Each system consists of fire detector units mounted throughout the engine compartments and a warning light mounted in the cockpit. The warning lights (13, figure 1-5) are on the right side of the main instrument panel. Illumination of the red warning light, marked "FWD," indicates fire in the forward section of the engine compartment or in the wheel wells. Illumination of the amber warning light, marked "AFT," shows an excessive overtemperature condition or fire in the aft engine section. Operation of the warning system and lights can be checked by means of the system test switch next to the lights. When the switch is moved from NORM to the spring-loaded TEST position, the entire fire-warning circuit is energized and both warning lights should come on. The lights are powered by the primary bus and are of the push-to-test type, permitting check of bulb illumination independent of system operation.

CANOPY.

The electrically actuated clamshell-type canopy (9, figure 1-1) opens and closes by rotating about a hinge point at the rear. The airplane may be taxied at speeds up to 50 knots IAS with the canopy in any position from fully closed to fully open. The canopy is closed by an electrically powered actuator and is locked by manually operated latches on the canopy rails. When the landing gear leaves the ground, a hook at the canopy hinge point automatically disengages, releasing the canopy from the actuator. The canopy is then secured by the mechanical latches in readiness for emergency jettison. When the landing gear again touches the ground, the hook engages, and, when the mechanical latches are released, the canopy may be opened by the actuator. Emergency jettisoning of the canopy during flight is accomplished when either the right or left ejection seat armrest is raised to full-up position, which fires the canopy initiator and its gas charge fires the canopy ejector. The ejection seat armrests being interconnected, raising either armrest raises the opposite armrest. Actuation of the ejection seat catapult firing mechanism is not dependent upon canopy jettisoning or operation, as there is no seat catapult firing mechanism safety pin to be pulled by the canopy as it leaves the airplane. Thus, if canopy fails to leave the airplane, the ejection seat may be ejected through the canopy as a last resort. However, either armrest must be raised to the full-up position before the trigger can be squeezed and ejection through the canopy is possible.

GROUND AND MAINTENANCE SAFETY PINS.

The canopy jettison system is safetied by inserting a ground safety pin (figure 1-23) through a block on the front of the seat and across the trigger in the right seat armrest. This pin will prevent raising the seat armrest and inadvertently firing the canopy. This ground safety pin is to be removed before flight and replaced immediately after flight. When the safety pin is removed, the canopy and seat catapults are armed.

WARNING

The canopy ejector initiator may be safetied during ground maintenance by a safety pin. This maintenance safety pin should not be inserted in the initiator for normal ground operations, but if installed, must be removed before flight.

CANOPY SEAL.

An inflatable canopy seal seals the canopy in the closed position. Pressure for inflation of the seal is provided by the engine compressor and is automatically controlled by a pressure regulator when the engine is operating. The seal is automatically inflated whenever the canopy is fully latched and is deflated whenever the canopy is unlatched.

CANOPY OPERATING BUTTONS (EXTERNAL).

The canopy is operated externally through two electrical spring-loaded push buttons on the left side of the fuselage, about 2 feet below and in line with the windshield. One button is marked "OPEN"; the other, "CLOSE." These operating buttons receive their power from monitored bus No. 2 when it is energized. If this bus is not energized, the battery bus supplies these buttons with power.

EXTERNAL CANOPY EMERGENCY RELEASE HANDLE.

An external canopy emergency release handle (figure 3-6) can be reached through an access door on the left side of the fuselage, about 3½ feet below the canopy frame and slightly forward of the windshield bow line. When the door is opened, the canopy hook is electrically released. Pulling the external emergency release handle unlocks the canopy latches so that the canopy can be lifted. If electrical power is not available, the canopy hook may be disengaged by a handle beneath a small access door directly behind the canopy in the top of the fuselage. See figure 3-6.

***F-86K Airplane AF54-1276 and all subsequent airplanes and those changed by T.O. 1F-86K-508**

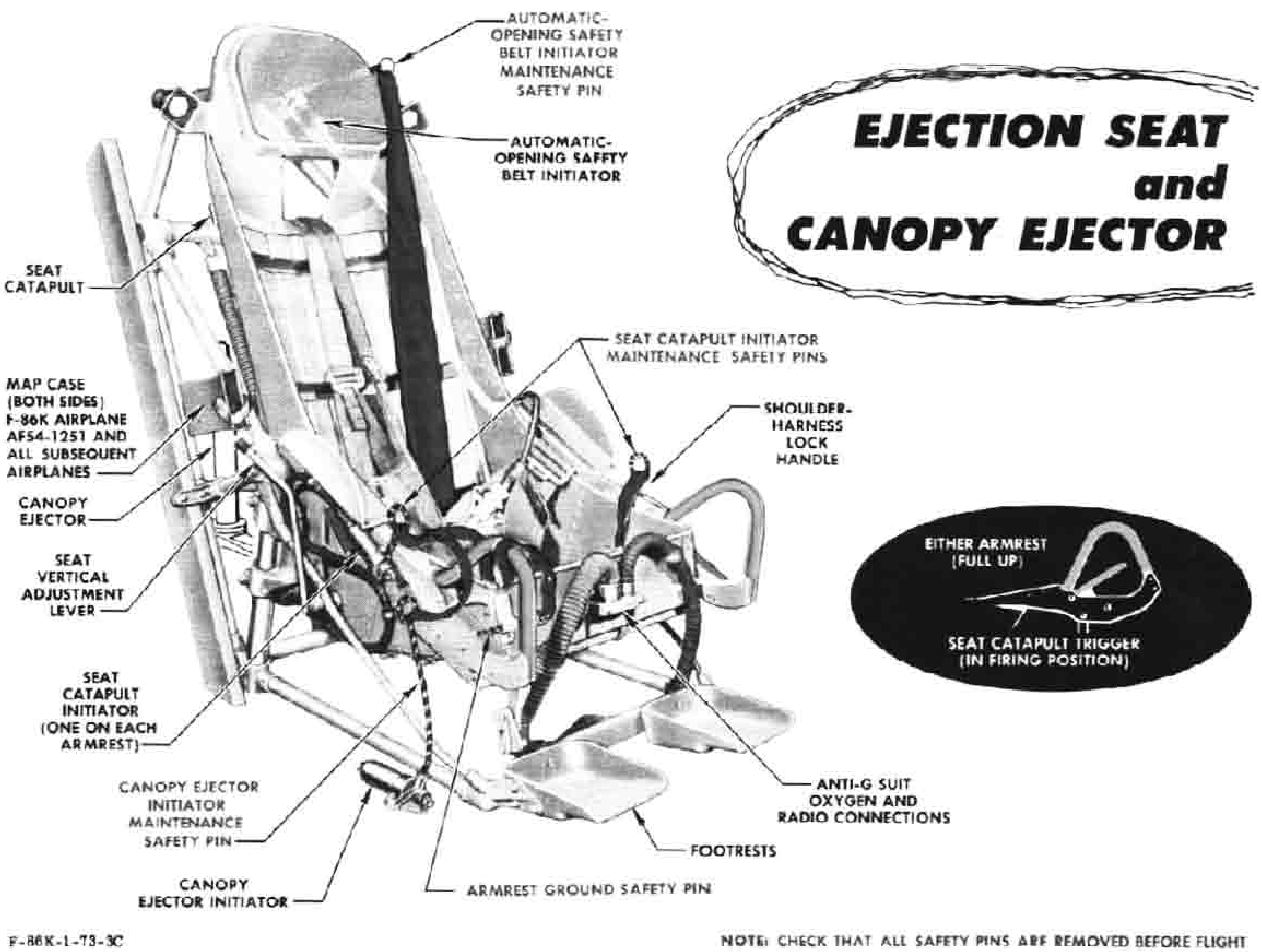


Figure 1-23

CANOPY SWITCH.

From within the cockpit, the canopy is controlled by a three-position toggle switch on the aft edge of the right instrument subpanel. (See figure 1-8.) To operate the canopy, the switch must be held at either of the spring-loaded positions, OPEN or CLOSE. When the canopy has fully opened or closed, power to the canopy actuator is automatically cut off. When the switch is released, it returns to the center (off) position and the canopy remains in the selected position. The canopy switch is powered by monitored bus No. 2 when this bus is energized, and from the battery bus when monitored bus No. 2 is not energized. The circuit to the switch is opened whenever the canopy latches are in the locked position.

Note

Operation of either external button overrides the selection of the cockpit switch.

CANOPY LOCK HANDLE.

The canopy, when closed, is locked or unlocked by means of a push-pull type canopy lock handle (18, figure 1-5), extending through the vertical panel forward of the right console. When the handle is pushed full forward, the latches are engaged and the canopy is locked. The latches are in the locked position when the yellow stripe on the latches is visible through the rig pin holes on the inboard face of the canopy frame. When the canopy is fully locked, the canopy switch circuit is opened and the canopy unsafe warning light goes out. Pulling the handle aft unlocks the latches and activates the canopy switch circuit, and the canopy unsafe warning light comes on.

Note

During flight if it is desired to release the canopy without arming the ejection seat, the canopy may be released by manual unlocking and allowing the air stream to carry it away.

CANOPY EMERGENCY RELEASE (SEAT ARMREST).

The latches are released and the canopy ejector is fired when either armrest on the ejection seat (figure 1-23) is pulled full-up in preparation for seat ejection.

CANOPY UNSAFE WARNING LIGHT.

A canopy unsafe warning light (figure 1-8) is mounted on the aft edge of the right instrument subpanel. The light is powered by the primary bus and will come on and remain lighted as long as the canopy latches are unlocked. The light goes out when the latches are locked. A yellow stripe is painted on the forward canopy latches so that a visual check may be made to ensure, when the canopy unsafe warning light is out, that the canopy latches are in the fully locked position. This additional visual check can be made by leaning forward and looking, right or left, through the forward latch rig pin hole. If the yellow stripe is not readily visible, repeat locking procedure until yellow stripe is apparent, to ensure that latches are fully locked.

EJECTION SEAT.

An ejection seat (figure 1-23) is provided which will catapult the seat clear of the tail surfaces, thus making ejection possible at any speed. A catapult (explosive cartridge with telescoping tubes) aft of the seat supplies the propelling force to eject seat and pilot from the cockpit. A gas initiator system is used to fire the seat catapult. The seat may be adjusted up and forward, but the footrests remain in a fixed position. If added height in seat is needed, use a solid filler block, if the frontal height does not exceed 5 inches. When a C-2A raft is carried, *a filler block may be used in the modified zipper compartment on the bottom of the pack provided the frontal height of the entire pack does not exceed 5 inches.* The armrests are hinged to actuate the ejection sequence. When the seat is ejected, the anti-G suit, oxygen hose, and microphone and headset connections automatically disconnect at a single fitting attached to the seat between the footrests.

WARNING

- When airplane is equipped with a one-man life raft or survival kit, the A-5 seat cushion, or any similar sponge rubber cushion should not be used. 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. The chance of injury during a crash landing is also increased.
- No cushion, life raft pack, or survival kit should be used that has a frontal height greater than 5 inches; otherwise, there may be interference between control stick and kit when seat is raised to its top position.

GROUND AND MAINTENANCE SAFETY PIN.

The seat ejection system is safetied by inserting a ground safety pin (figure 1-23) through a guide on the front of the seat and across the trigger in the right seat armrest. This pin locks the seat armrests in their stowed positions, thus preventing accidental firing of the canopy and positioning of the ejection seat firing triggers. The ground safety pin is to be removed before flight and replaced immediately after flight. When the safety pin is removed, the canopy and seat catapults are armed.

WARNING

The seat catapult initiators may be safetied during ground maintenance by initiator safety pins. These safety pins should not be inserted in the initiators for normal ground operations, but if installed, must be removed before flight.

SEAT ARMRESTS.

The ejection seat armrests (figure 1-23) are hinged to actuate the ejection sequence. The left armrest is interconnected to the right armrest so that lifting either armrest simultaneously raises the opposite armrest. A seat catapult trigger is provided on each armrest. Lifting either the right or the left armrest to the full-up position raises the opposite armrest, mechanically unlocks the canopy, fires the canopy ejector, locks the shoulder harness, and raises both triggers into firing position. Should the canopy ejector fail to fire when the armrests are raised, the air stream will carry the canopy away.

SEAT CATAPULT TRIGGERS.

A seat catapult trigger (figure 1-23) is beneath the handgrip at the forward end of each armrest of the ejection seat; the triggers are recessed in the armrests and thus protected by guards when the armrests are in the normal stowed position. As the armrests are interconnected, pulling either armrest to its full-up position also raises the opposite armrest to its full-up position, which raises both triggers out of their guards to within reach of the fingers, fires the canopy from the airplane, and locks the shoulder harness. With armrests raised, squeezing either trigger will fire the seat catapult. Actuation of the ejection seat catapult firing mechanism is not dependent upon canopy jettisoning for operation. Thus, if during emergency bail-out procedures the canopy fails to leave the airplane when the armrests are raised, as a last resort the seat can be ejected through the canopy when either trigger is squeezed. However, either armrest must be raised before the trigger can be squeezed and ejection through the canopy is possible.

SEAT VERTICAL ADJUSTMENT LEVER.

Vertical seat adjustment is done mechanically by operation of the seat vertical adjustment lever on the right side of the ejection seat. (See figure 1-23.) Pulling the lever forward and up releases the seat for adjustment. A handle on the left bow of the windshield helps relieve weight of the pilot on the seat during adjustment. The seat adjusts up and forward. The footrests are stationary and may be used to assist in adjusting the seat.

CAUTION

After making air-borne or ground adjustment, be sure seat is locked in position, to prevent accidental firing of canopy caused by negative G forcing the unlocked seat to its top position hard enough to move the armrests upward.

SHOULDER HARNESS LOCK HANDLE.

The shoulder harness lock handle, on the left armrest of the ejection seat (figure 1-23), is conventionally operated for manually locking and unlocking the shoulder harness. In addition, the shoulder harness inertia reel will automatically lock under 2 to 3 G deceleration in a forward direction, as in a crash landing. It is recommended that the shoulder harness be manually locked during maneuvers and flight in rough air, or as a safety precaution in event of a forced landing. The shoulder harness is automatically locked before seat ejection when the left armrest on the seat is in the full-up position.

CAUTION

Before a forced landing, all switches not readily accessible with the shoulder harness locked should be "cut" before harness lock handle is moved to the locked position.

If the harness is locked while the pilot is leaning forward, the harness will retract into successively locked positions as he moves back against the seat. To unlock the harness, the pilot must be able to lean back enough to relieve the tension on the lock. Therefore, if the harness is locked while the pilot is leaning back hard against the seat, he may not be able to unlock the harness without first loosening the harness. After automatic locking of the harness, it will remain locked until the lock handle is moved to the locked position and then back to the unlocked position while tension on the shoulder harness cable is released.

Note

The shoulder harness inertia reel is locked and unlocked when the handle is moved fore and aft. Forward is locked, and aft is unlocked.

SAFETY BELT.

The airplane is equipped with a B-18 manual-opening type safety belt, or an MA-1, MA-3 or MA-4, or an MA-5 or MA-6 automatic-opening type safety belt.

Automatic-opening Safety Belt.

The primary purpose of the automatic belt is to raise the maximum and lower the minimum altitudes at which escape may be successfully accomplished with the ejection seat. 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. Consequently, use of the automatic belt and automatic parachute would lower the altitude required for safe ejection. Until you have become thoroughly familiar with the automatic belt and have been convinced that the automatic belt has been designed to save your life, you may have a tendency to distrust the automatic feature and feel that you can only be sure of its operation by manually operating it. However, the automatic belt has been thoroughly tested and is completely reliable. *Under no circumstances should the automatic belt be manually opened before ejection, regardless of altitude.* No matter how fast your reactions are, you cannot beat the automatic operation.

Before the use of automatic belts, instructions were issued that when ejection was necessary at less than 2000 feet above the terrain the conventional safety belt should be opened manually before ejection. However, manual release of automatic belts is not only undesirable but dangerous. The escape operation using the automatic feature is not only faster, since the belt automatically opens 2 seconds after ejection, but it also protects the pilot from severe injury at high speeds. (If the airplane is equipped with an M-12 automatic belt initiator, the belt opens 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 accidentally. The high opening shock of the parachute could cause serious or fatal injuries. So remember, *the automatic operation can't be beaten.*

MA-1, MA-3, and MA-4 Automatic Safety Belts. The Type MA-1, MA-3, or MA-4 automatic safety belt is a cartridge-operated device designed for use with the same webbing and fittings as used with the standard B-18 (manual) safety belt, but differs in the center section or release portion of the belt. Release of the MA-1, MA-3 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-4 (or M-12) initiator on the back of the seat. The initiator supplies approximately 1500 psi pressure through a high-pressure hose which actuates a piston inside the belt, retracting the latch tongue and releasing the link. 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. This is a feature of the design so that the pilot will not neglect to tie the automatic parachute into the system. 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 parachute, if above 14,000 feet.

Figure 1-24 shows the automatic belts closed with shoulder harness attached, automatically opened, and manually opened.

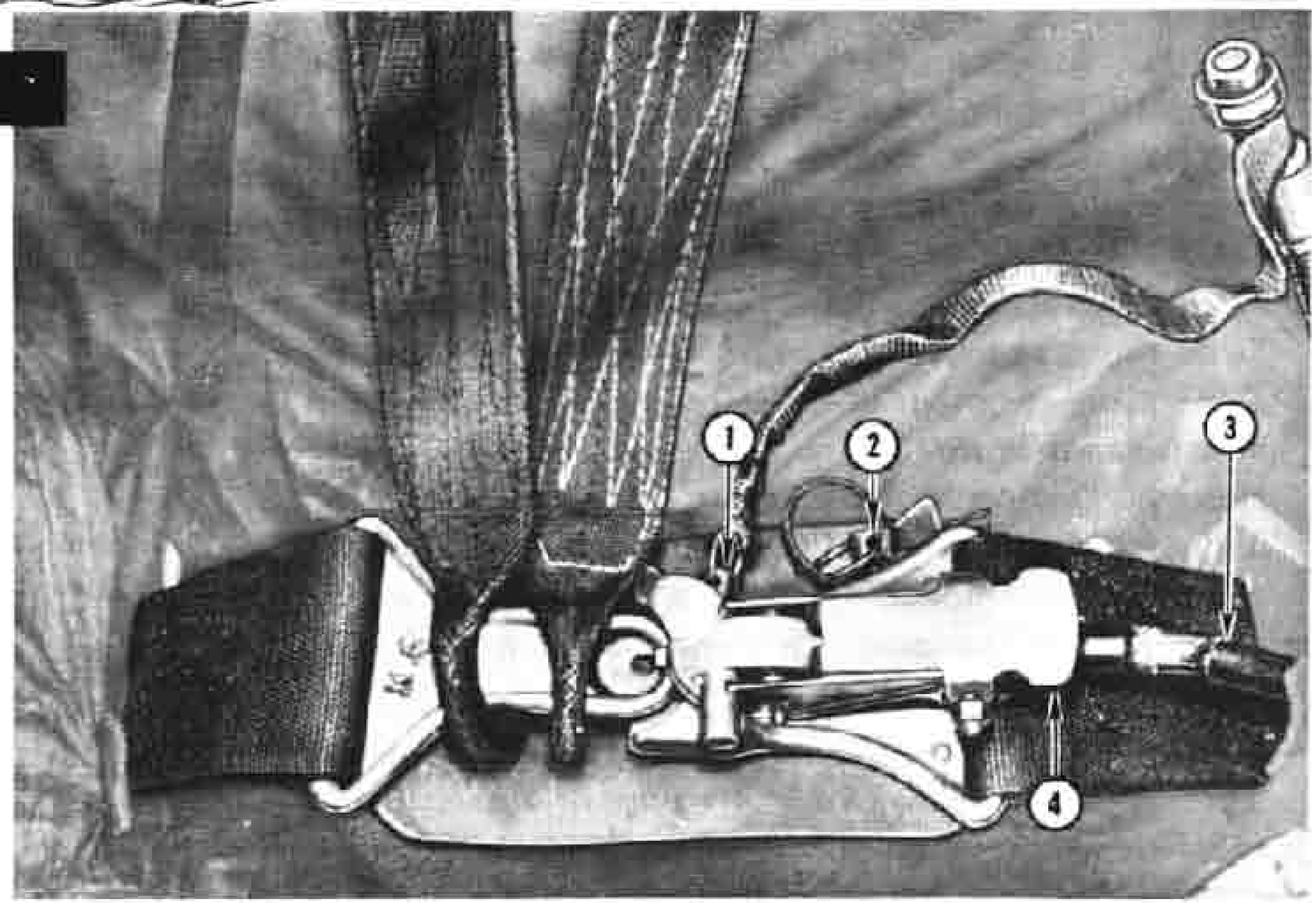
MA-5 and MA-6 Automatic Safety Belts. The MA-5 and MA-6 automatic safety belts are similar in design and function to the MA-1, MA-3, and MA-4 belts. However, the MA-5 and MA-6 belts have a swivel link. When the belt is fully locked, the swivel is attached on one end to the manual release lever and on the other end to the automatic release. The swivel link is detached from the automatic release by actuation of the automatic release initiator. In addition, the MA-5 and MA-6 belts are designed to retain a ring-type anchor for actuating the automatic parachute, in place of a key. 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 or MA-6 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 1-24 shows the MA-5 and MA-6 belts closed with the 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 the parachute, if above 14,000 feet.)

MA-1 AUTOMATIC-OPENING SAFETY BELT

LOCKED



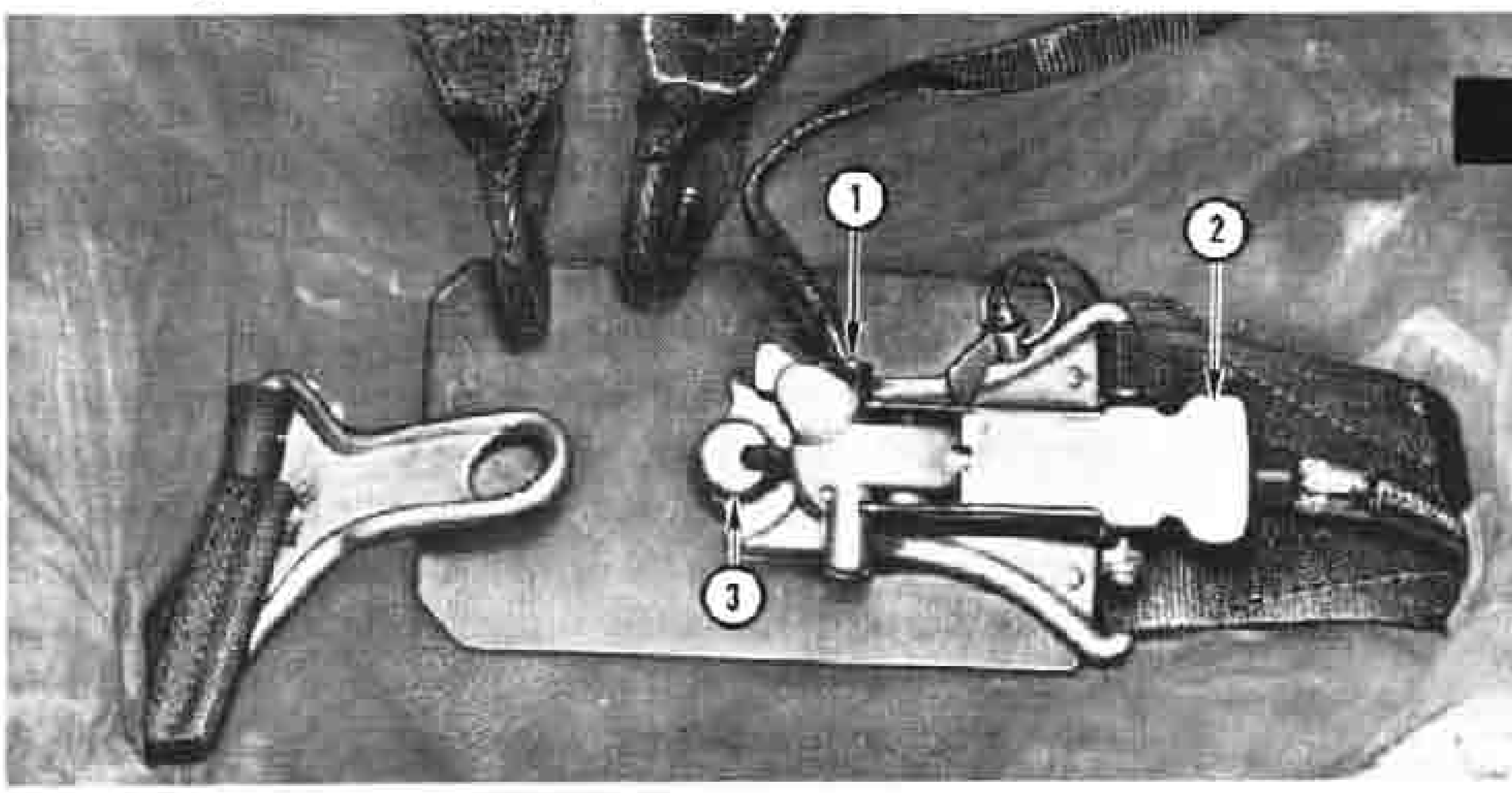
1. Belt locking key (attached to automatic parachute arming lanyard) inserted in belt locking mechanism.

   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.

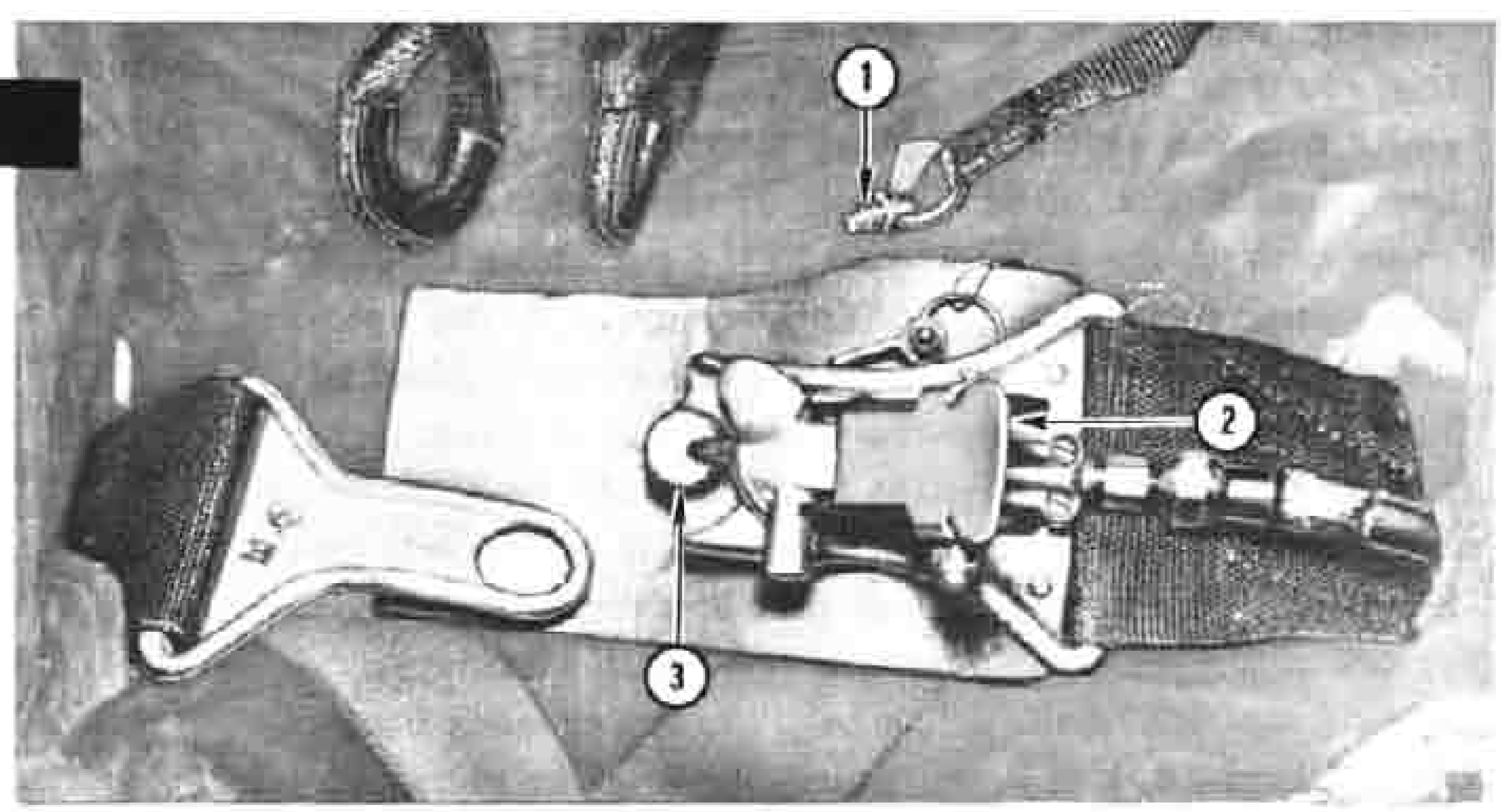
2. Belt locking key (attached to belt). Used to close belt only when automatic parachute is *not* worn.
3. Initiator hose.
4. Manual release lever closed (shown with NAA type handle extension).



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.

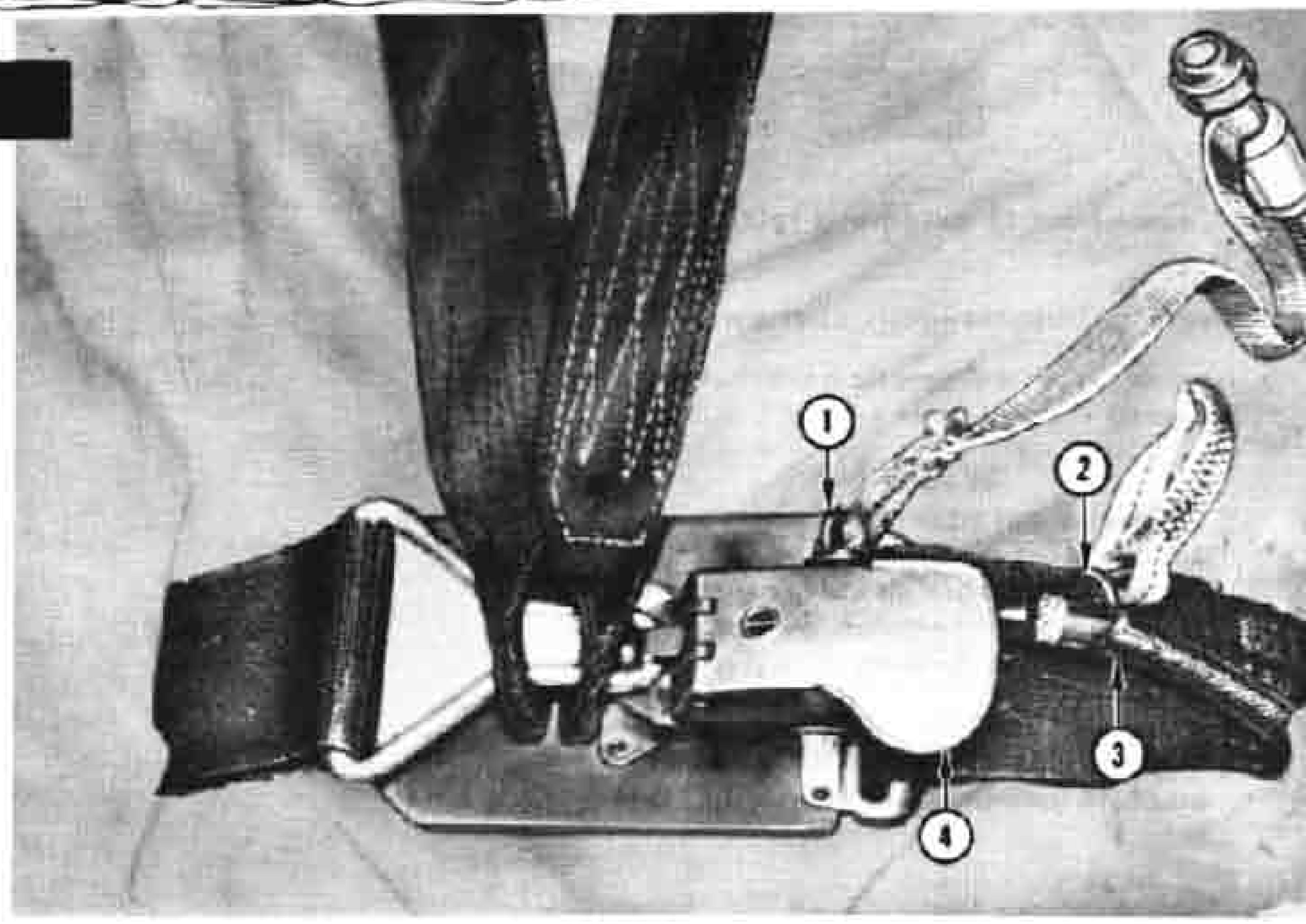
   NOTE

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

F-86K-1-73-15A

Figure 1-24 (Sheet 1 of 3)

MA-3 AND -4 AUTOMATIC-OPENING SAFETY BELTS



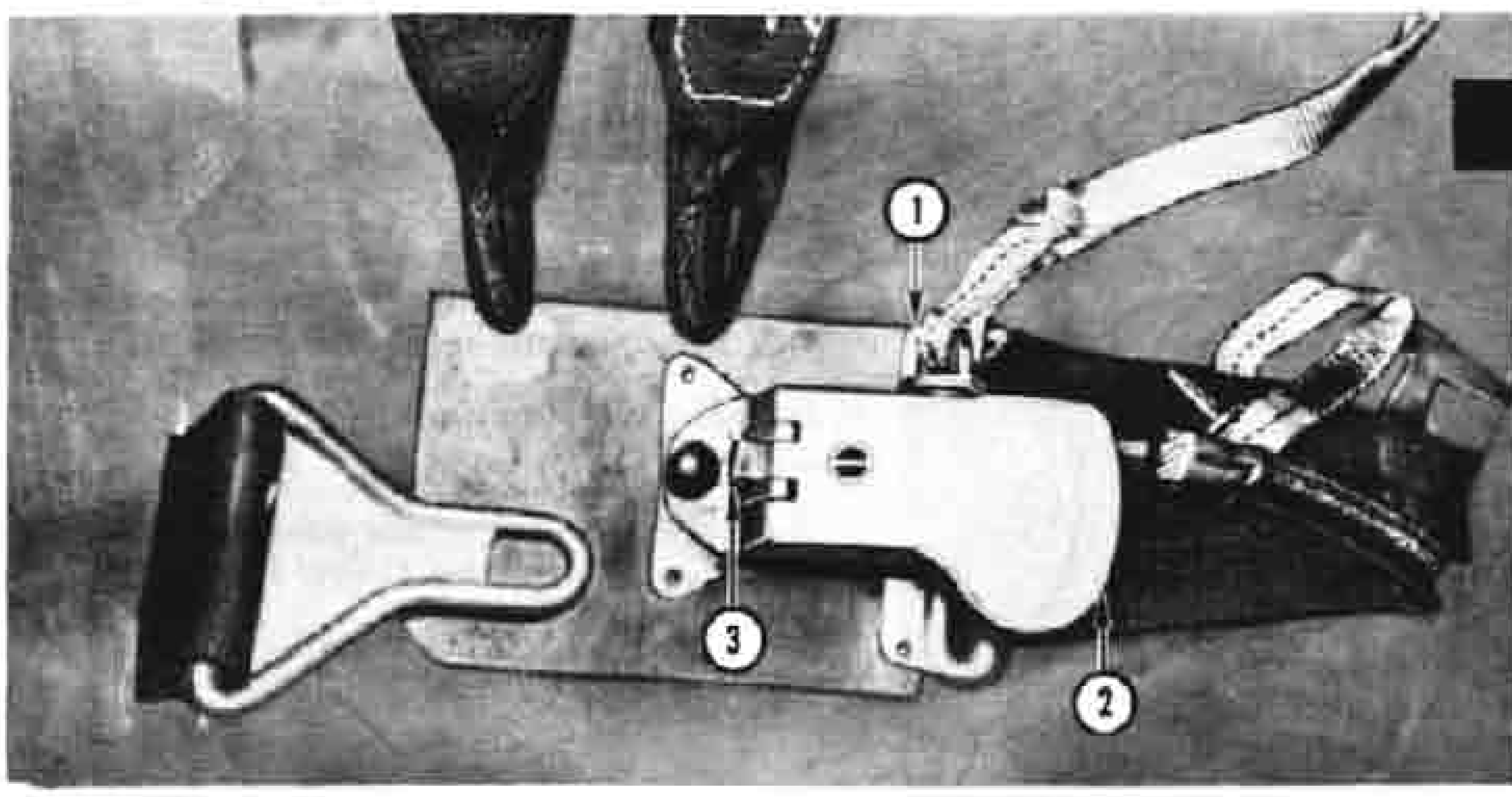
LOCKED

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 key is inserted properly 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.

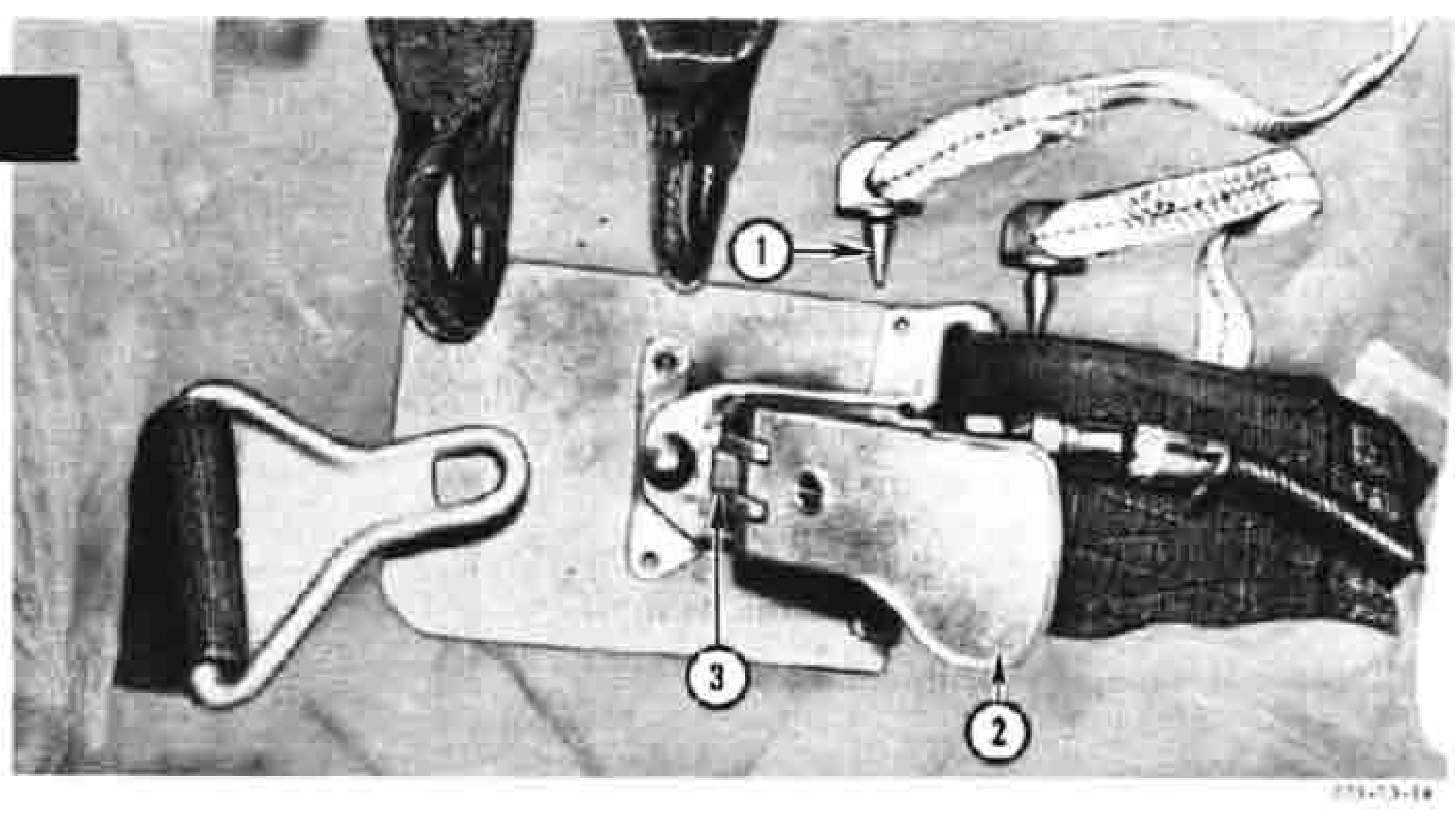
   WARNING

   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.

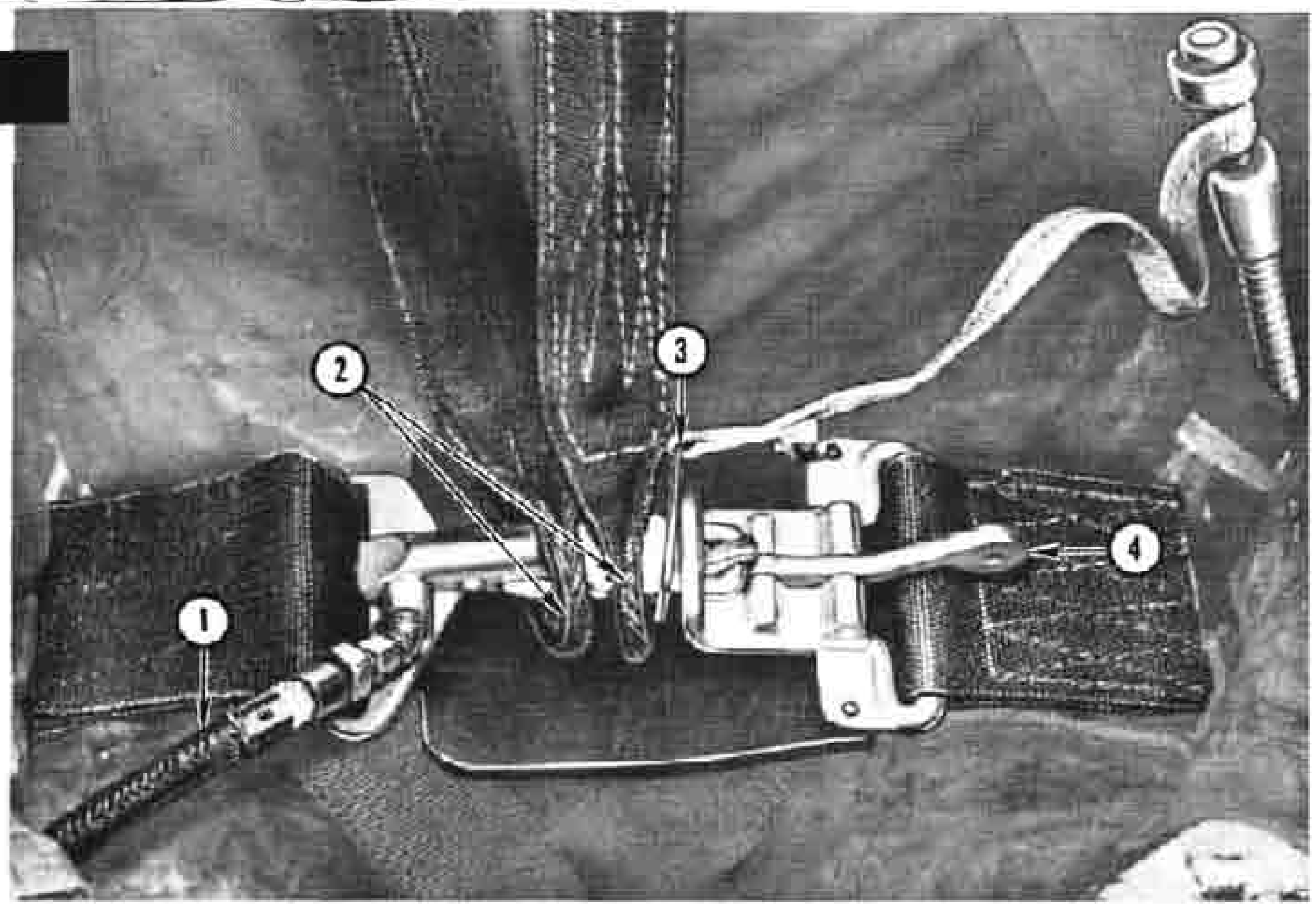


F-86K-1-73-14A

Figure 1-24 (Sheet 2 of 3)

MA-5 AND -6 AUTOMATIC-OPENING SAFETY BELTS

LOCKED

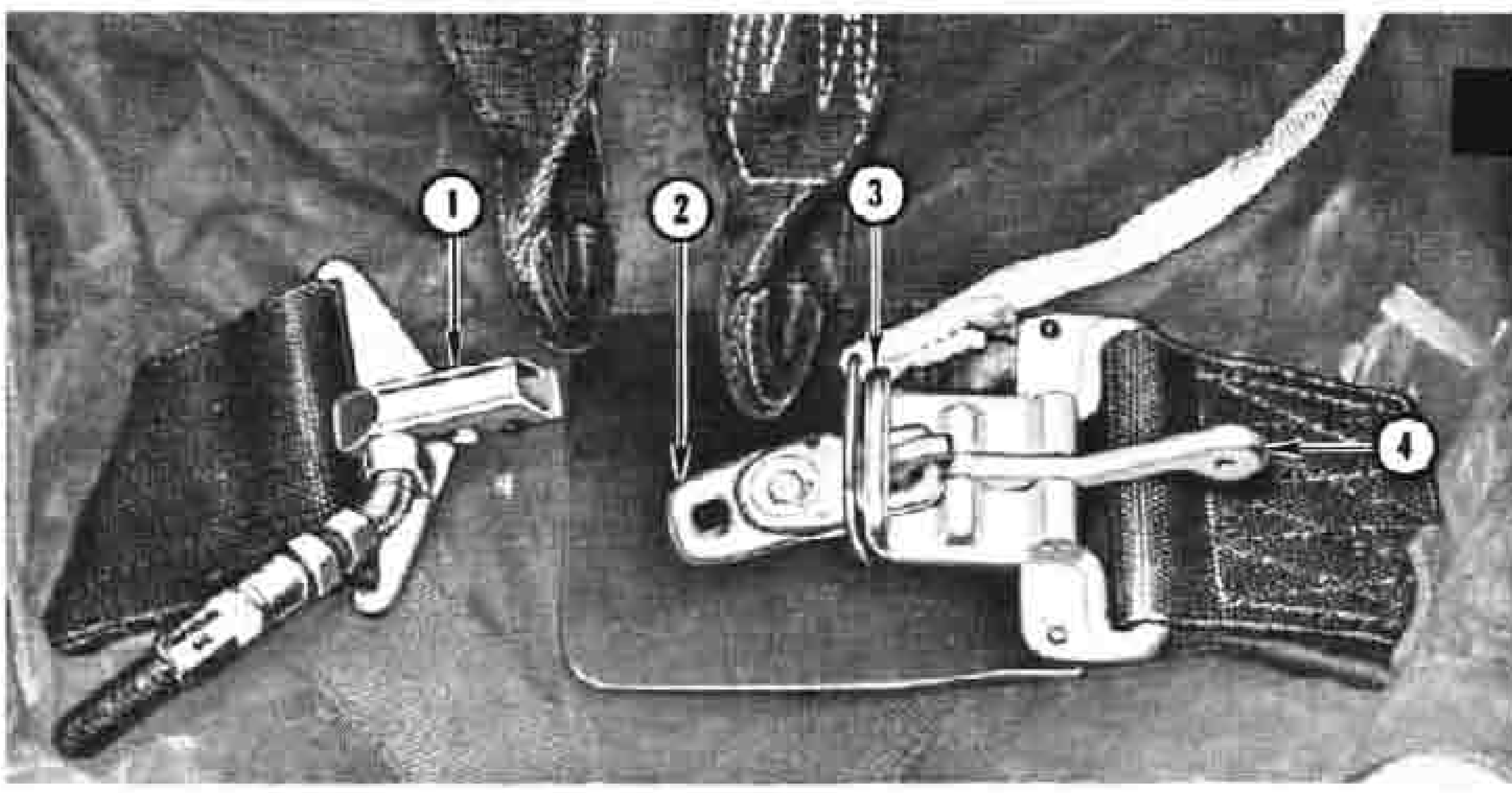


1. Initiator hose to automatic release mechanism.
2. Shoulder harness loops over swivel link.
3. Anchor (from automatic parachute arming lanyard) slipped over swivel link.

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

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

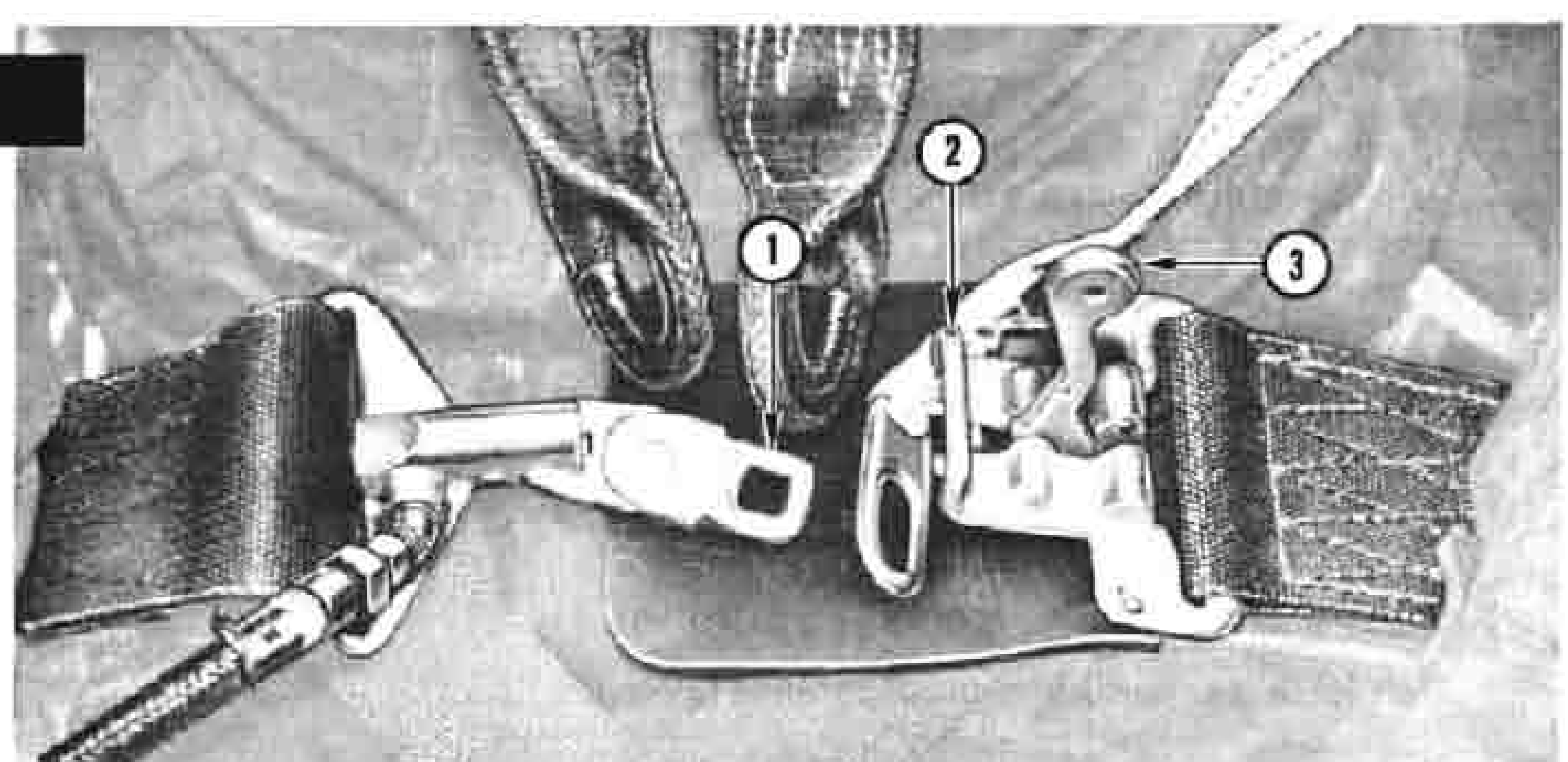
WARNING

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

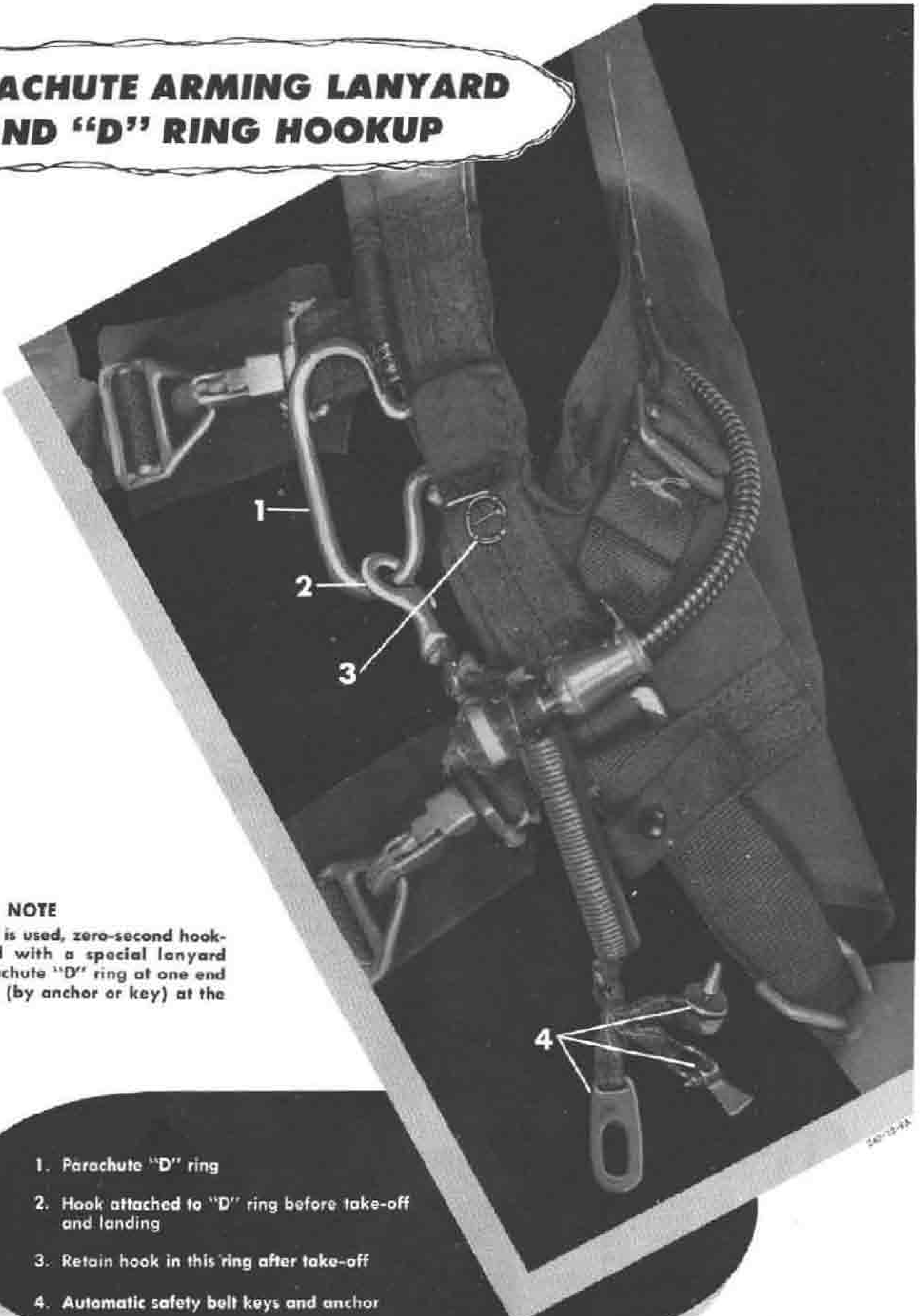
Manual release lever can be used to unlock belt at any time, even if automatic-opening sequence has been initiated.



F-86K-1-73-13

Figure 1-24 (Sheet 3 of 3)

PARACHUTE ARMING LANYARD AND "D" RING HOOKUP



NOTE

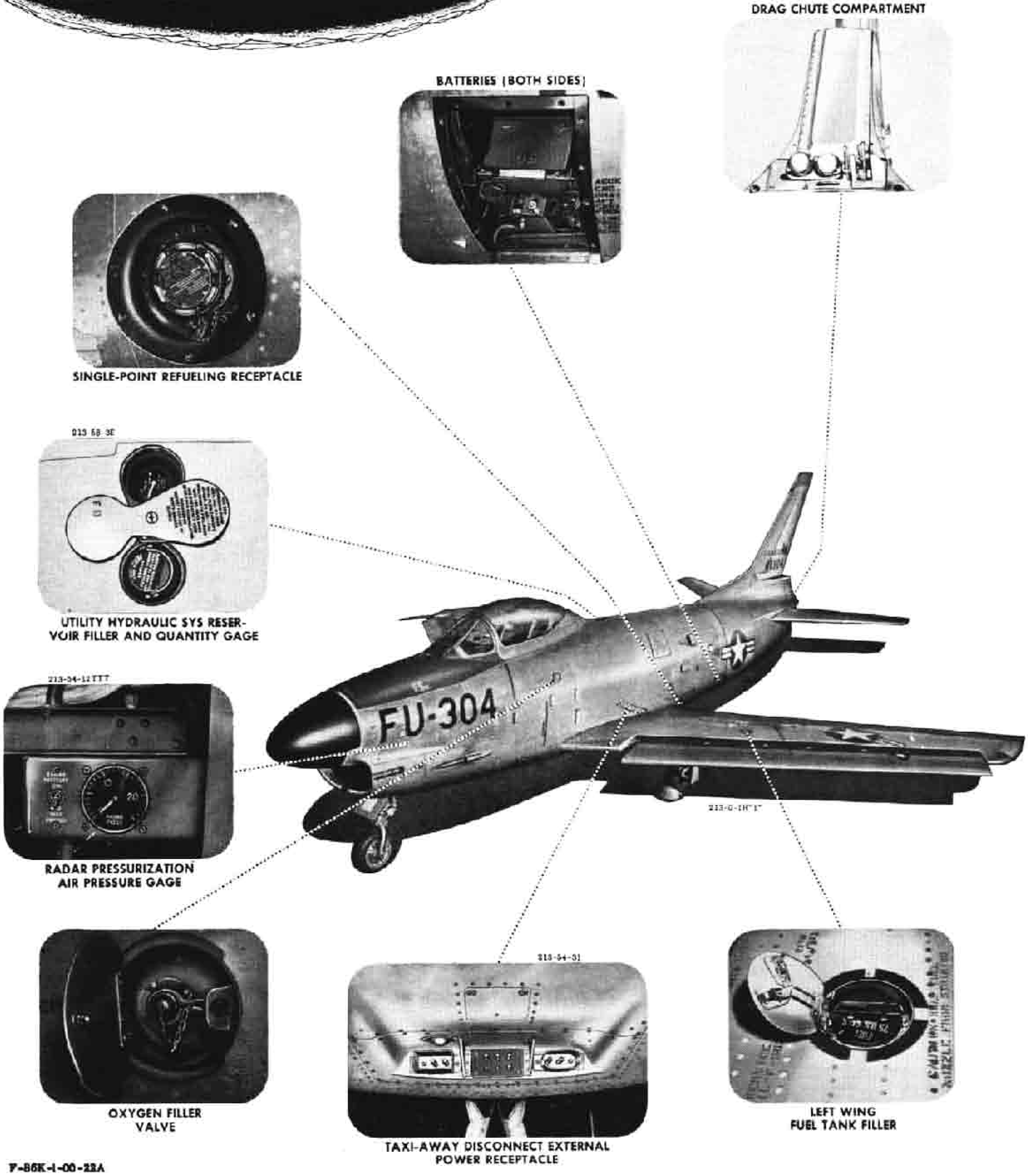
If manual parachute is used, zero-second hookup is accomplished with a special lanyard which hooks to parachute "D" ring at one end and attaches to belt (by anchor or key) at the other end.

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

F-86K-1-73-17/

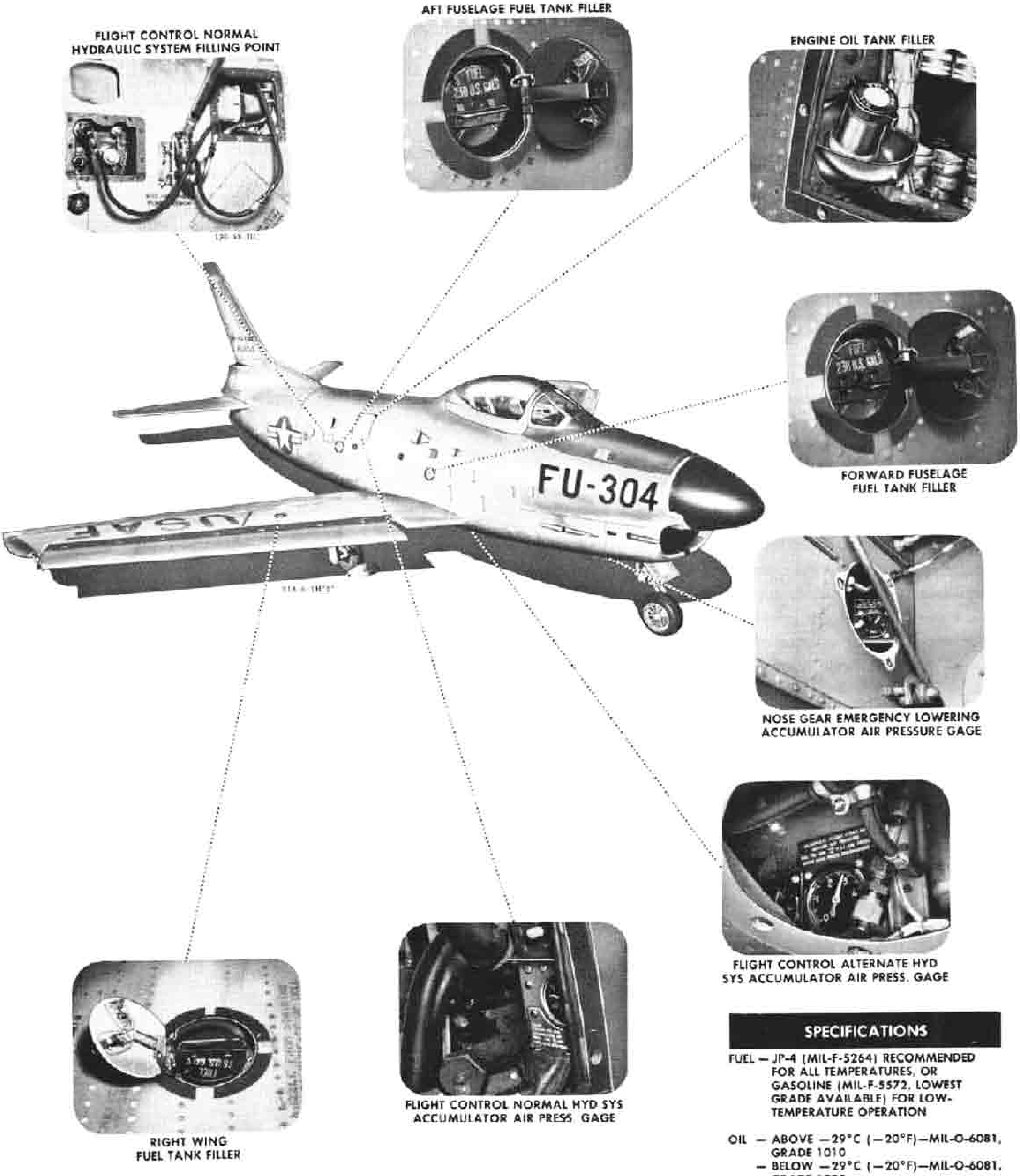
Figure 1-25

SERVICING DIAGRAM



F-86K-1-00-22A

Figure 1-26



SPECIFICATIONS

FUEL — JP-4 (MIL-F-5264) RECOMMENDED FOR ALL TEMPERATURES, OR GASOLINE (MIL-F-5572, LOWEST GRADE AVAILABLE) FOR LOW-TEMPERATURE OPERATION

OIL — ABOVE −29°C (−20°F)—MIL-O-6081, GRADE 1010
— BELOW −29°C (−20°F)—MIL-O-6081, GRADE 1005

HYDRAULIC FLUID—MIL-O-5606

OXYGEN—BB-O-925

F 86K-1-00-23B

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 1-25.)

Note

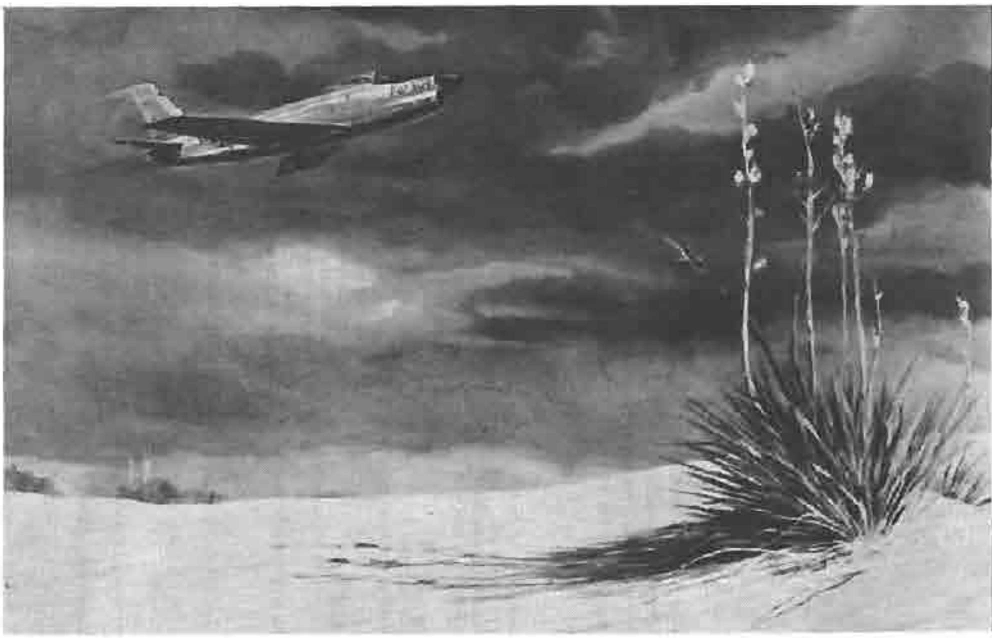
The "D" ring hook and lanyard may be installed on the parachute before the one-second safety belt initiator is installed on the airplane. This will temporarily provide a 2-0 system, with higher minimum safe ejection altitudes.

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 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 1-25 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 minimum safe ejection altitudes for various combinations of ejection equipment. Figure 3-5 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 be injured from deceleration effects. The lower chart of figure 3-5 shows the minimum altitude for a successful ejection with different combinations of automatic safety belt and automatic parachute timing sequence.

AUXILIARY EQUIPMENT.

The following auxiliary equipment is described in Section IV:

- Cockpit Air Conditioning and Pressurization System
- Radar Pressurization
- Anti-icing and Defrosting Systems
- Communication and Associated Electronic Equipment
- Lighting Equipment
- Oxygen System
- Automatic Pilot
- Navigation Equipment
- Armament System
- Missile System
- Fire Control System
- Miscellaneous Equipment



Section II

NORMAL PROCEDURES

TABLE OF CONTENTS

PREPARATION FOR FLIGHT.

FLIGHT RESTRICTIONS.

Refer to Section V for detailed airplane and engine operating limitations.

FLIGHT PLANNING.

The performance data in Appendix I is provided to determine fuel consumption and correct airspeed, power setting, and altitude necessary to complete the proposed mission.

TAKE-OFF AND LANDING DATA CARDS.

Refer to Appendix I for information necessary to fill out the take-off and landing data cards contained in T.O. 1F-86K-(CL)1-1, 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 the following:

1. Weight and balance—Check.
   Check take-off and anticipated landing gross weight and balance. Check Form 365F for weight and balance clearance. If no gun or ammunition is installed, check for proper ballast installation.

CHECK LISTS.

Refer to page iii for additional information on this subject. AFR 62-2 requires each flight crew member to refer directly to the check list during ground and flight operation except during taxi, take-off, landing, or critical emergencies. For these exceptions, the check list will be reviewed before the operation or afterward for clean-up.

ENTRANCE.

After the canopy is opened by using the external switch on the left side of the fuselage, the cockpit can be entered from either side of the airplane. A tubular metal ladder hooks over the cockpit ledge for normal entry

EXTERIOR INSPECTION

Check all surfaces for cracks, distortion, loose rivets, and signs of damage; check for signs of hydraulic fluid, fuel, and oil leaks; check all access doors and panels and fuel filler cap secured; check tires for general condition, slippage, and proper inflation; and check position of gear doors, gear strut extension, and condition of the wheels.

Accumulator gage pressures (given on placards next to gage) are for 70°F. Pressures will be higher on hot days.

Starting at nose of airplane, make following checks:

*You may rely on your crew chief to check these items, 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

- Landing gear ground control switch **CLOSED**
- Gun ports clear
- Radar access door secure (under fairing)
- Access panels secure (left side)
- Radome for condition and security
- Intake duct clear, except nose screen installed
- Landing light retracted
- Tow pin safety cap on hand-tight, wedge secure
- Oleo extension (4-5/16 inch at scissors)
- Nose gear steering unit for condition and security
- Nose gear tire for inflation, condition, and slippage
- Nose wheel chock removed
- Nose gear door switch and uplock
- Nose gear ground safety lock removed
- Nose gear emergency extension accumulator air pressure (1200 (±50) psi) *
- Nose gear emergency selector valve reset *
- Access panels secure (right side)

2. WING CENTER SECTION AND RIGHT WHEEL WELL

- Alternate flight control accumulator air pressure (600 (+50, −0)
- Alternate flight control compensator pin extension (1/4 inch to 1-1/4 inch)
- Brake pins for wear (1/8 inch minimum length) *
- Tire for inflation, condition, and slippage
- Brake disk for clearance
- Oleo extension (4-7/8 inch at scissors)
- Hydraulic leaks
- Gear uplock and door switch for condition
- Engine access door for security

3. TOP CENTER FUSELAGE

- Forward fuselage fuel tank cap secured, cover latched
- Utility hydraulic system quantity (in green), filler cap for security. (Caution—do not remove cap.)
- Normal flight control accumulator air pressure (600 (+50, −0) psi)
- Oil quantity (tank cap and dip stick secure)
- Circuit breakers in (inside engine access door)
- Normal flight control compensator pin extension (1/4 inch to 1-1/4 inch)
- Access panels secure

4. RIGHT WING

- Wing fuel tank cap secure, cover latched
- Wing slats for freedom of movement
- Drop tank sway brace secure (if installed)
- Drop tank maintenance safety pin removed.
- Pitot cover removed
- Position light for damage
- Aileron and wing flap for damage
- Right drop tank fuel quantity, cap secure
- Wing skin condition

5. RIGHT AFT FUSELAGE

- Aft fuselage fuel tank cap secure, cover latched
- Battery connected *
- Speed brake for damage and hydraulic leaks
- Access panels secure

6. EMPENNAGE

- Control surfaces for any visual obstruction to movement
- Drag chute door secure, fly latched and indicator pin extended as far as indicator
- Position lights for damage
- Tail pipe and inner liner for cracks, distortion, and clearance
- Variable-nozzle, afterburner ring, and turbine wheel for condition

7. LEFT AFT FUSELAGE

- Fuel bayonet drain clear
- Speed brake for damage and hydraulic leaks
- Battery connected *
- Single-point refueling access panel secure
- Access panels secure

8. LEFT WHEEL WELL

- Brake pins for wear (1/8 inch minimum length)
- Tire for inflation, condition, and slippage
- Brake disk for clearance
- Oleo extension (4-7/8 inch at scissors)
- Hydraulic leaks
- Gear uplock and door switch for condition
- Engine access door for security

9. LEFT WING

- Wing flap and aileron for damage
- Left drop tank fuel quantity, cap secure
- Position light for damage
- Wing slats for freedom of movement
- Drop tank sway brace secure (if installed)
- Drop tank maintenance safety pin removed.
- Wing fuel tank cap secure, cover latched
- Wing skin condition

F-86K-1-00-63C

Figure 2-1

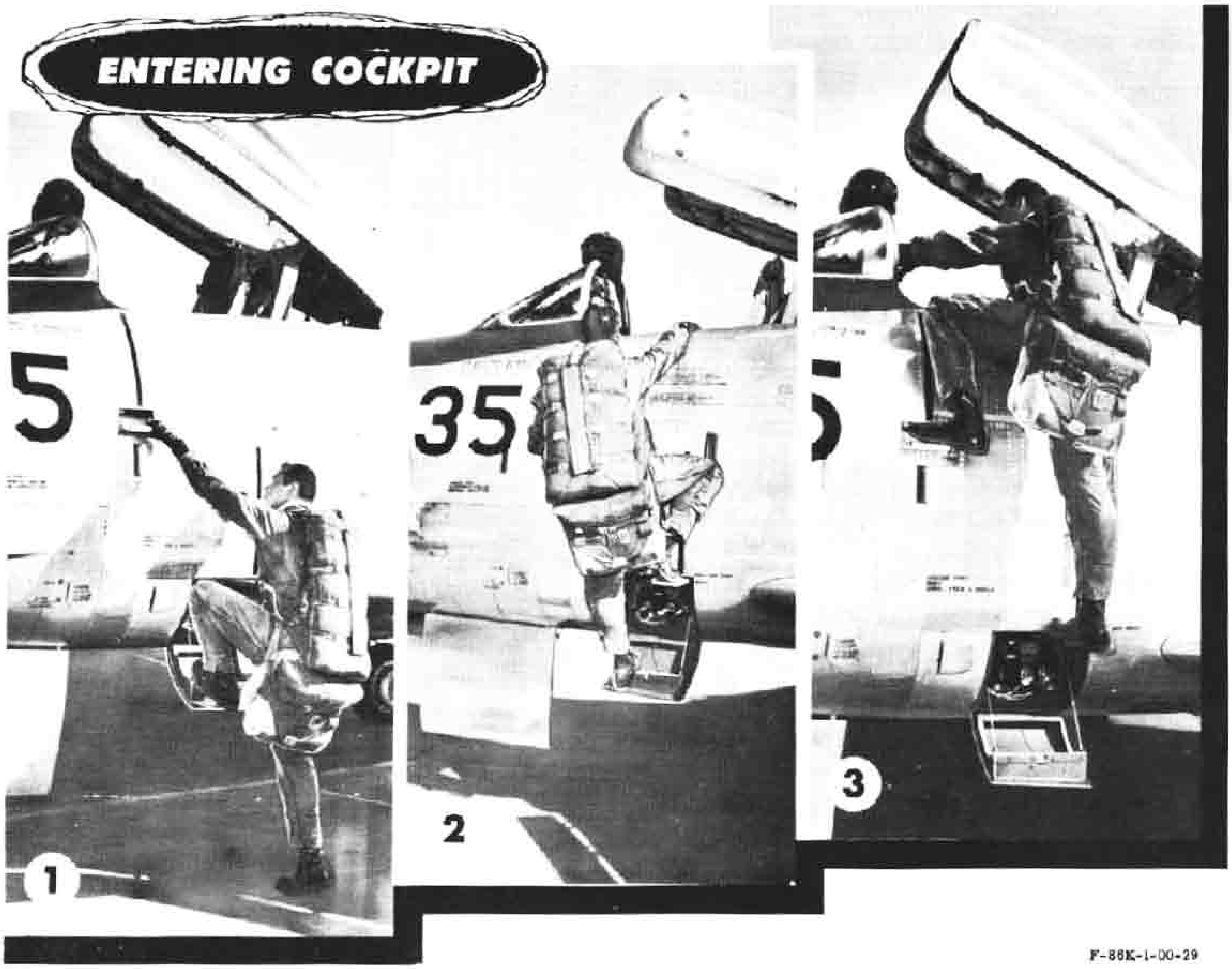


Figure 2-2

into the cockpit. If a ladder is not available, cockpit entry is gained from the left side of the airplane by a telescoping step (released by a push latch) and two combination handhold and kick-in steps. (See figure 2-2.)

Note

After pilot entry, the ground crew manually stows the telescoping step.

PREFLIGHT CHECK.

BEFORE EXTERIOR INSPECTION.

1. DD Form 781—Check.

Check DD Form 781 for engineering status, and make sure airplane has been serviced with required amounts of fuel, oil, hydraulic fluid, oxygen, and a drag chute for the mission. For servicing points, see figure 1-26.

2. Personal gear—Check.

Make sure that personal equipment, parachute harness, anti-G suit, oxygen mask, helmet, and survival equipment is in good condition.

EXTERIOR INSPECTION.

Perform exterior inspection as outlined in figure 2-1.

CANOPY AND EJECTION SEAT CHECK.

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

1. Handgrips and triggers—Check.
   Check that seat handgrips are full down and latched.
2. Safety pin—Check.
   Check that ground safety pin is installed in right seat armrest across trigger. Check that maintenance safety pin of canopy ejector initiator on right side of cockpit, below the right console, has been removed. Check that maintenance safety pins of the seat catapult initiators, on the outboard side of the seat under each armrest, have been removed. Check that maintenance safety pin has been removed from automatic-opening safety belt initiator, on aft upper left corner of the seat tubular frame.

CAUTION

- 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.
- After safety pins have been removed, the seat and canopy ejection systems are fully armed.

3. Shoulder-harness strap—Check.
   Make sure shoulder-harness straps are over upper horizontal tube of seat supporting structure behind seat.
4. Seat quick-disconnects—Check.
   Check that seat quick-disconnects for oxygen, radio, electrical, and anti-G suit personal leads are properly mated.
5. Tubing and hose fitting—Check.
   Check tubing and hose fittings from initiators to canopy remover and seat ejection catapult.
6. Canopy external emergency release handle—Check.
   Check that canopy external emergency release handle is properly stowed and access door closed.
7. Canopy ejector lead seal—Check.
   Check that lead seal on canopy ejector is not broken.

INTERIOR CHECK (ALL FLIGHTS).

After entering the cockpit, make the following safety checks before making the left-to-right cockpit check.

Note

A pilot's check list is located above the left console.

1. Safety belt (shoulder harness and lanyard to safety belt), and zero-second parachute hook—Secured (inertia-reel handle unlocked).

CAUTION

Make sure automatic-opening safety belt is properly fastened, and if the automatic parachute is worn, that the chute arming lanyard is properly attached to the safety belt latching mechanism, and that zero-second parachute hook is attached to the "D" ring 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 problems 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.

2. Seat—Adjust.

CAUTION

After adjusting seat, check that adjustment lever is locked. If seat is not locked, G-loads in flight may cause it to move, possibly causing armrests to raise and jettison canopy.

3. All personal equipment leads—Attach and check.
   Attach radio lead, electrical, oxygen hose, and anti-G suit hose to personal equipment; check that bail-out oxygen bottle is connected.
4. Rudder pedals—Adjust.
5. Armament master switch—OFF.
6. Ground fire switch—SAFE.
7. Throttle and friction—Closed and adjust.
8. Speed brake switch—Center (off) position.
9. Engine master switch—OFF.
10. Battery-starter switch—OFF.
11. Circuit breakers—IN.
12. External electrical power source—Plugged in.
    Make sure that power source is capable of 28-volt,

1200-ampere surge, and a continuous current of 500 amperes. Connect to both dc receptacles and the ac receptacles for starting and ground operation of radar equipment.

Note

External power units suitable for use on this airplane are the A3, A4, C22, C26, and V-1 (if they have been maintained to produce their rated output). However, the A4 and V-1 require a separate source for supplying ac power to the airplane.

After completing the aforementioned safety checks, make a left-to-right check around the cockpit on the following items:

13. Interior and exterior lighting—Check as required.
14. Drop-tank air pressure shutoff valve—Check.
    Drop-tank air pressure shutoff valve ON if tanks are installed; OFF if tanks are not installed.
15. Anti-G suit pressure regulating valve—As desired.
16. Map case—Check.
    Flight Manual, Radio Facility Charts, Pilot's Handbooks—Jet, and other necessary publications and charts available for intended mission.
17. Pressure suit face mask heater rheostat—OFF.
18. Rudder control lock handle—Check.
    Rudder control lock handle unlocked (push down).

CAUTION

Do not twist lock handle, as this could cause damage or cause a malfunction of the locking system.

19. Cockpit pressure selector switch—5 PSI (2.75 psi for combat).
20. Cockpit air temperature control switch—Automatic (forward position).
21. Cockpit temperature rheostat—As desired.
22. Cockpit air switch—PRESS.
23. Manual ram-air valve—CLOSED.
    Make sure that lever is fully locked closed.
24. Alternate trim switches—Check.
    Check for operation and check that switches return to OFF (center); then return to NORMAL.
25. Normal trim system—Check.
    Check rudder trim tab movement visually and return switch to OFF position. Using normal trim switch (on stick grip), check horizontal tail and ailerons for normal operation. As the ailerons or horizontal tail artificial-feel spring bungees are repositioned, the control stick moves, resulting in corresponding movement of the ailerons or horizontal tail.

WARNING

The normal trim switch is subject to sticking in an actuated position, resulting in application of extreme trim. Therefore, operate normal trim switch in all four trim positions and check that it automatically returns to OFF (center) position when released. If switch sticks in any of the actuated positions, enter this fact with a red cross in Form 781 and do not fly airplane.

26. Landing gear handle—DOWN.
    Depress horn cutout button to check warning light in gear handle and unsafe warning light on the upper left corner of the instrument panel.
27. Landing gear indicators—Check.
28. Flight control switch—NORM.

Note

Only the flight control alternate hydraulic system operates until after the engine has been started and the flight control switch momentarily placed at RESET and released to NORMAL.

29. Ventilation air control—As desired.
30. Sight reticle dimmer rheostat—As desired.
31. Sight filament selector switch—PRIM.
32. Gun heater switch—As desired.
33. Wing flap handle—UP.
34. Radar master switch—OFF.
35. Flight control emergency handle—Fully in.
36. Afterburner shutoff switch—NORMAL.
37. Variable-nozzle switch—NORM.
38. Air start switch—NORMAL (guard cover down).
39. Emergency fuel system switch—NORM.
40. Landing and taxi light switch—Center (off) position.
41. Stand-by compass and accelerator light switch—As desired.
42. Drag chute handle—Stowed (full in).
43. Clock—Check and set.
44. Altimeter—Set to field elevation.

45. Accelerometer—Reset.
46. Airspeed and Mach number indicator—Check and set.
    Set airspeed and Mach number indicator landing speed index.
47. Fuel quantity—Check.
48. Fuel quantity gage test switch—Check.
49. Hydraulic pressure gage selector switch—ALTERNATE.
50. Generator switches—ON.
51. Inverter selector switch—SPARE.
52. Surface anti-ice switch—OFF.
53. Windshield and radome anti-ice switches—OFF.
54. Pitot heat switch—ON, then OFF.
    Check operation with crew chief.

WARNING

Warm-up time for the pitot heater is about one minute at 32°F. Allow sufficient heating time if taking off into freezing rain or other visible moisture with surface temperature at or near freezing.

55. Alternator switch—ON.
56. Engine screen switch—EXTEND SCREEN.
57. Yaw damper switch—OFF.
58. Landing gear emergency release handle—Fully in.
59. Oxygen system—Check.
    Oxygen regulator supply lever safetied on and pressure at 400 PSI; diluter lever NORMAL OXYGEN, and emergency lever at center position. Check oxygen system operation. (Refer to "Oxygen System Preflight Check" in Section IV.)

WARNING

If the airplane is to be operated on the ground under possible conditions of carbon monoxide contamination, such as taxiing directly behind another operating jet airplane or during operation with tail into the wind, use 100% oxygen.

60. Navigation and communication equipment—Check; then turn OFF.
    Check tower, approach control, GCI, GCA, and CAA radio frequencies. Set omni radio to first station en route.
61. Automatic pilot system—Check.
    Place autopilot engaging switch on. Set autopilot roll trim wheel to neutral position by rotating wheel as required to streamline ailerons.

CAUTION

Failure to take this precaution could cause the airplane to suddenly roll to an extreme of 10 degrees when the autopilot is first turned on.

62. Windshield and canopy defrost lever—DEC.
63. Voltmeter indicator selector switch—BUS.
64. Operation of A-4 sight—Check.
    (Refer to preflight check procedure for fire control system in Section IV.)
65. Warning, caution, and indicator lights—Check.
66. Stick grip—Check secure.
    Check stick grip for firmness of attachment.
67. Flashlight—Check.
    Check that an operating flashlight is included in the personal gear (night flights).

BEFORE STARTING ENGINE.

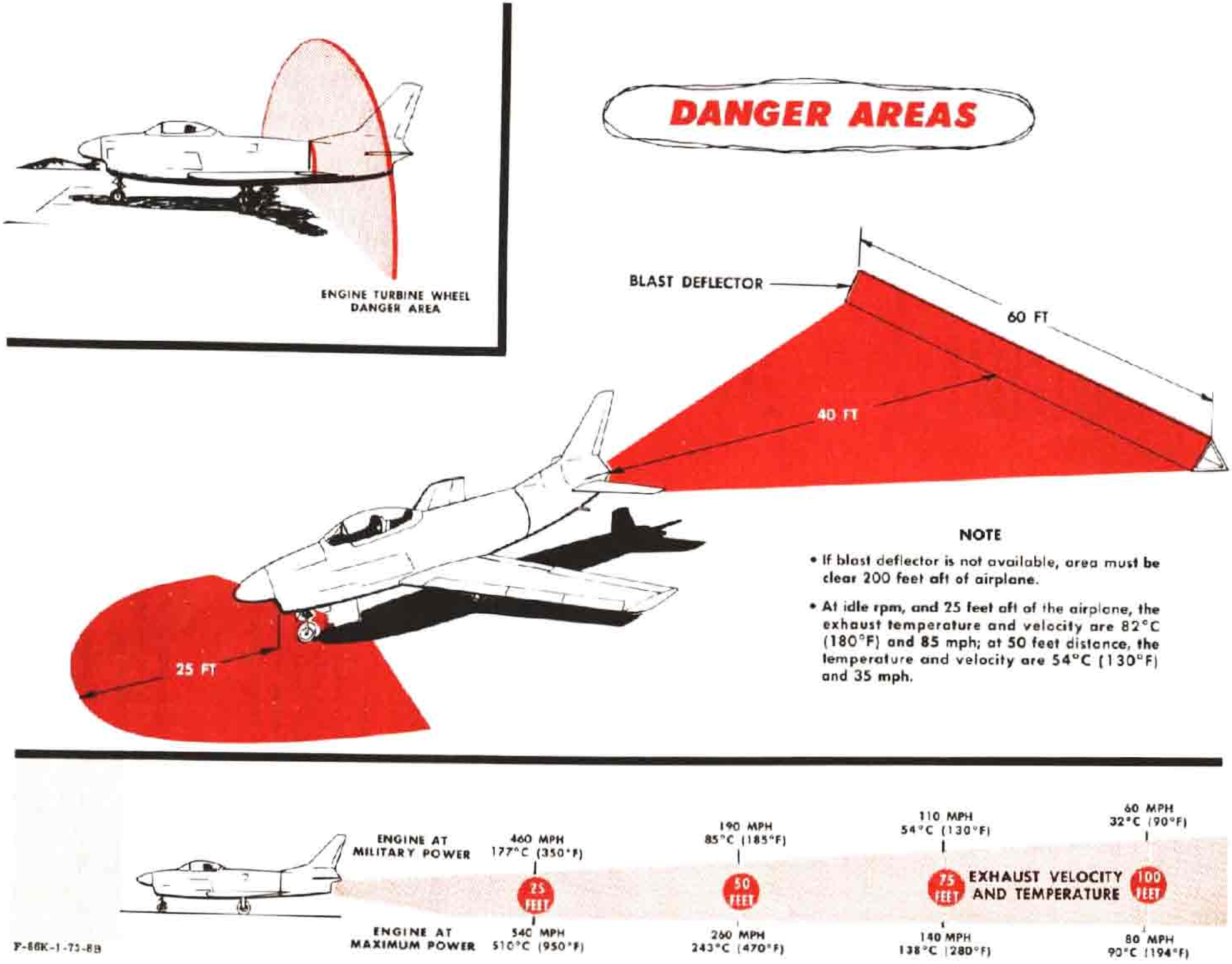
CAUTION

- Before starting engine, make sure nose intake duct screen is installed, to prevent engine damage caused by foreign objects being sucked into the engine. Hold toe brakes on or make sure that main wheels are securely chocked and that danger areas fore and aft of airplane are clear of personnel, airplanes, and vehicles. (See figure 2-3.)
- Before every engine start, the tail pipe should be visually checked to ensure that there are no puddles of fuel. If fuel puddles are allowed to remain in the tail pipe during starting, fire may occur in the fuselage rear section.

WARNING

- Danger aft of the airplane is created by high exhaust temperatures and blast from the tail pipe. This danger is greatly increased during afterburner operation.
- Suction at the intake duct is sufficient to kill or severely injure personnel drawn into, or pulled suddenly against the duct.

The disintegration area of the engine is indicated by a red warning stripe around the fuselage. This area



NOTE

- If blast deflector is not available, area must be clear 200 feet aft of airplane.
- At idle rpm, and 25 feet aft of the airplane, the exhaust temperature and velocity are 82°C (180°F) and 85 mph; at 50 feet distance, the temperature and velocity are 54°C (130°F) and 35 mph.

Figure 2-3

should be clear of personnel. 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 wind or at right angles to it. When operating within the jet blast of another airplane, maintain a minimum distance of 80 feet, to prevent damage to the canopy. When jet blast is from afterburner operation, maintain a minimum distance of 150 feet.

STARTING ENGINE.

AUTOMATIC START.

Note

- The automatic start procedure will normally be used for all operational and training missions.
- The spare inverter will be used during starting to reduce ground operational check-out time. This will provide a check of the spare inverter and simplify the automatic lockup check procedure.

Start the engine as follows:

Note

See figure 5-1 for exhaust temperature limits.

1. Recheck throttle—CLOSED.
2. Inverter circuit breakers in, inverter caution light out—Check.

   The starting circuit will be held open if inverter power is not available.
3. Variable-nozzle switch—NORM.

   Check through operating range; set at ¾ position; then back to NORM.

Note

When the variable-nozzle switch is held in the OPEN or CLOSE position until the nozzle is either full open or full closed and then released, the indicating needle will experience a spring-back because of design characteristics of the instrument.

4. Engine master switch—ON.

4A. Engine control lockup light—OUT.
Check that lockup light is out to ensure that electronic fuel control has warmed up.

4B. Emergency fuel system switch—ON.
Check for 10°C to 100°C drop on exhaust temperature gage.

4C. Emergency fuel system switch—NORMAL.
Check for 10°C to 100°C rise on exhaust temperature gage.

CAUTION

If no fluctuation of the exhaust temperature gage is noted during steps 4B and 4B, the temperature-sensing circuit is not functioning properly. Therefore, do not attempt a start. This check confirms proper functioning of the start circuit portion of the main fuel amplifier. However, it is still essential to monitor the fuel flowmeter very closely to ensure that the start temperatures will remain within limits.

5. Battery-starter switch—Hold momentarily at START position; then return switch to BATT.

CAUTION

- On airplanes equipped with the two-position emergency fuel switch, if the engine control lockup caution light comes on as the starter is energized, continue the automatic start by advancing the throttle to START IDLE at 6% rpm as usual, because lockup protection is now provided during automatic starting.
- On these airplanes, if the lockup caution light comes on at any time during an automatic start and does not go out within about 30 seconds, retard the throttle to CLOSED and investigate prior to another start attempt.
- The high current required for starting will burn out the starter in a matter of seconds if the engine doesn't "turn over" as soon as the starter is energized. If there are no audible indications of engine rotation, or if there is no response on the tachometer within a few seconds, depress stop-starter button immediately.

6. 5% rpm—Check for minimum of 18 volts.

6A. Oil pressure—Check.
If there is no visible indication of oil pressure, shut down engine and investigate.

7. 6% rpm—Advance the throttle rapidly to START IDLE.
The fuel flow will rise to about 900 to 1000 pounds per hour and stabilize at about 600 pounds per hour. Exhaust temperature will rise and stabilize at about 600°C.

WARNING

If ignition does not occur within 15 seconds, close throttle and depress stop-starter button. Wait 3 minutes, to allow drainage of fuel accumulation from combustion chamber and tail pipe, before attempting restart.

Note

During automatic starts, the fuel flow indication in the cockpit precedes the exhaust gas temperature indication by about 3 seconds. For this reason, the fuel flow indication will give a more rapid indication of the engine start than will the exhaust temperature. Using the fuel flow gage as a primary instrument and observing the exhaust temperature will allow a start to be aborted before an overtemperature condition can take place.

8. 12% rpm—Exhaust temperature should decline slightly.
   The fuel flow will remain steady.
9. 14% rpm—Fuel flow and exhaust temperature start to rise.
   Observe that fuel flow starts to rise to about 950 pounds per hour, and exhaust temperature starts to rise and will peak at about 815°C (maximum of 850°C).
10. 14% to 40% rpm—Fuel flow continues to rise slowly to about 1500 pounds per hour and exhaust temperature remains at about 815°C (with a possible momentary or maximum peak of 850°C).

CAUTION

The rise of 815°C should occur before 18% rpm is reached; if it does not, chop throttle to CLOSED immediately and investigate before flight.

11. 40% rpm—Check (fuel flow between 800 and 1300 pounds per hour, exhaust temperature between 400°C and 600°C).
    Observe that fuel flow and exhaust temperature decline to lower readings of between 800 and 1300 pounds per hour and between 400°C and 600°C exhaust temperature. (Refer to "Automatic Start Characteristics," Section VII. Complete knowledge of these characteristics is very important if engine overtemperature operation during starting is to be prevented in the event of an electronic engine control malfunction.) Idle rpm should be about 40% on the main fuel system.

WARNING

- If cockpit indications depart from these normal trends (and continue to rise), retard throttle to CLOSED, press stop-starter button, and investigate. Failure to accomplish a satisfactory automatic start shows a control system malfunction, and the airplane should not be flown until an investigation is made to isolate and replace the faulty component. The inability to accomplish an automatic start does not necessarily mean that the faulty component is used only during the starting cycle, nor does it mean a "hot start" need occur.
- During engine starts up to idle rpm (within 2 minutes), exhaust temperatures of 950°C or above for 2 seconds or more constitute overtemperature operation, and require engine removal.
- For all engine operations (except starting), exhaust temperatures of 690°C to 750°C for 40 seconds or more, temperatures of 750°C to 800°C for 10 seconds or more, and temperatures above 800°C for 2 seconds or more constitute overtemperature operation.
- The duration and degree of all overtemperature must be entered in the Form 781.

Note

On throttle bursts from about 90% rpm to Military Thrust, the exhaust temperature encountered during the transient condition may be higher than that experienced during throttle bursts from lower thrust settings. However, it should be noted that existing exhaust gas temperature limits are not exceeded.

WARNING

- The starter is limited to three consecutive starts of one-minute duration per start, with a 3-minute cooling period between starts. If more than three starts are required, allow starter to cool 30 minutes before using again.
- If engine speed does not reach 25% rpm in one minute, shut down and investigate the cause. Excessive operation below 25% engine rpm can cause extensive damage to starter and engine.
- If the starter should become de-energized before the engine reaches about 20% rpm, shut down engine immediately. No attempt to accelerate the engine should be made.

Note

It is unnecessary to use the stop-starter button to disengage the starter after starts, since the starter relay is designed to cut out automatically at about 25% rpm.

12. Oil pressure—Check (12 psi minimum).
    If there is no sign of oil pressure within 30 seconds, shut down engine and investigate.
13. Engine instruments—Check for desired readings.
14. External power—Disconnect.
15. Generator caution lights out—Check.

START ON EMERGENCY FUEL SYSTEM.

When it is necessary to use the emergency fuel system for engine start, observe same cautions and warnings as during an automatic start. Start the engine as follows:

1. Recheck throttle—CLOSED.
2. Inverter circuit breakers in and inverter caution light off—Check.
3. Variable-nozzle switch—NORM.
   Check through operating range; set at ¾ position, then back to NORM.
4. Engine master switch—ON.
5. Emergency fuel system switch—ON.

CAUTION

If the generator voltmeter reading drops below 15 volts during the start, immediately abort the start by pressing the stop-starter button; otherwise, the relays in the starter-controller and generator circuits may be damaged. If the voltmeter reading does drop below 15 volts during the start, external power unit output is inadequate. Therefore, have the external power unit replaced by a suitable unit before a subsequent start attempt.

6. Battery-starter switch—Hold momentarily at START; then return to BATT.
7. 5% rpm—Check for minimum of 18 volts.
8. 6% rpm—Advance throttle about halfway to START IDLE.
9. As fuel flow rises—Observe ignition.
   Regulate throttle to maintain 400 to 500 pounds per hour fuel flow until ignition occurs, as shown by a rise in exhaust temperature.
10. When ignition occurs—Move throttle to START IDLE without exceeding 750°C.
    Use both hands to regulate throttle to maintain 700°C to 750°C exhaust temperature.

CAUTION

- Do not make excessively cool starts; try to maintain recommended temperatures. Cold starts prolong the starting period, put excessive loads on the starter-generator unit, and give poor airflow through the combustion chambers at low rpm.
- When a hot start occurs, shut down engine immediately. If smoking or fire persists, engage starter with throttle closed for about 20 to 30 seconds, to clear engine of excess fuel.

11. Engine instruments—Check for desired readings.
12. External power—Disconnected.

CAUTION

After start is made, check that engine control lockup caution light is out, showing that electronic engine control amplifiers are warmed up enough to permit operation on main fuel system.

13. Emergency fuel system switch—NORM.
    Engine should stabilize at about 40% rpm.

CAUTION

If the engine operates abnormally with the emergency fuel system switch at NORM, return the switch to ON and check for correct position of the power switches and circuit breakers.

GROUND OPERATION.

No engine warm-up is necessary. As soon as the engine stabilizes at idling speed with normal gage readings, the throttle may be opened to full power. Idle rpm should be about 40% on the main fuel system, but will vary slightly with the setting of each individual airplane.

CAUTION

During any engine operation at idle rpm, check that the engine control lockup caution light and the emergency fuel system caution light are not on before throttle advancement. If the caution lights are on, cautiously advance the throttle to an rpm slightly above idle and wait for the engine control lockup caution lights to go out. Then move the emergency fuel system switch to ON and back to NORMAL to return the engine control to the main fuel control system.

Note

Be sure wheels are firmly chocked and hold toe brakes also. This airplane is not equipped with parking brakes.

GENERATOR LOADMETER DIFFERENTIAL CHECK.

1. Generators—Check at 55% rpm.

   Check that loadmeter differentials do not vary more than 10 percent from each other and that voltmeter shows about 28 volts (generators do not generate below about 37% rpm). The loadmeter reading should be about 0.6; if the indication is above this, the system should be checked before flight.

AUTOMATIC LOCKUP SYSTEM CHECK.

Before the first flight of the day, the operational check of inverter change-over and electronic engine control automatic lockup system may be made, using the following procedures:

1. Exhaust nozzle full open—Check.

   With variable-nozzle switch, "jog" exhaust nozzle full open. Leave switch at OFF.
2. Throttle—Advance to 55% rpm.
3. Inverter selector switch—MAIN.

   Lockup caution light should come on.

Note

Placing the inverter selector switch at MAIN de-energizes the spare inverter and transfers operation to the main inverter.

4. Throttle—START IDLE.
5. Variable-nozzle switch—NORM.

   Note that rpm and variable-nozzle position remain constant, indicating engine controls are in lockup condition.
6. Note time for recovery of engine controls—Check.

   With throttle at START IDLE, the lockup caution light should go out approximately 10 to 25 seconds after the inverter caution light goes out. When the lockup caution light goes out, an abrupt reduction in rpm (about 40%) and the automatic closing of the variable-nozzle to one-half position (about three-quarter position on some airplanes) takes place. Engine control is restored by the automatic lockup system when the primary inverter again supplies power to the electronic engine controls.

Note

The exhaust nozzle should close from full open to one-half position (or three-quarter position on some airplanes) within 3 seconds after lockup caution light goes out.

7. Radar master switch—STBY.

   The radar should be on at least 2 minutes prior to taxi.

FLIGHT CONTROL HYDRAULIC SYSTEM CHECK.

The following checks of the flight control and utility hydraulic systems are necessary to ensure proper operation of the systems:

Note

The flight control alternate hydraulic system becomes operative automatically when external power is applied. It remains engaged until the flight control normal hydraulic system is manually selected after the engine is started.

1. Throttle—START IDLE.
2. Hydraulic pressure gage selector switch—NORMAL.
3. Flight control switch—RESET.

   Engage flight control normal hydraulic system by holding flight control switch at RESET momentarily. Check that alternate system caution light is out.

CAUTION

When checking control surface movement on both normal and alternate systems, check rate of travel of control stick by rapid, full-travel movements of the stick. If rate is slower than normal, as determined by experience, have ground personnel check systems to determine malfunction. (Refer to "Hydraulic System," Section VII.)

4. Flight control normal hydraulic system—Check.
   a. Flight control switch—NORMAL.
   b. Control stick—Move.

      Visually check for proper surface movement.
   c. Pressure—After 5 seconds, 2850 to 3200 psi (control stick not in motion).
5. Flight control alternate hydraulic system—Check.
   a. Flight control switch—ON.
   b. Alternate system caution light—ON.
   c. Hydraulic pressure gage selector switch—ALTER.
   d. Control stick—Move and check for pressure drop.

      Visually check for proper control surface movement.
   e. Pressure—2550 to 3200 psi (control stick not in motion).

Note

The alternate system pressure should slowly fluctuate between the maximum limits of 2550 and 3200 psi because of the designed leakage in the flight control actuators causing the alternate system hydraulic pump to cycle on and off.

   f. Flight control switch—RESET.

      Momentarily hold flight control switch at RESET and then release. Check that alternate system caution light is out.

6. Flight control system manual emergency (override) system—Check.

a. Flight control switch—Hold at RESET.

b. Flight control emergency handle—Pull to full extension (about 2½ inches).
Holding the flight control switch at the RESET position opens the electrical circuit to the flight control system transfer valves. This ensures that the normal system transfer valve is held in the closed position and that the alternate system transfer valve is held in the open position by the mechanical flight control manual emergency control only. The alternate caution light should not be on.

Note

With the flight control emergency override handle pulled out, the gage pressure should not change when the flight control switch is positioned at RESET or released to NORMAL.

c. Control stick—Move and check for pressure drop.
Visually check for proper control surface movement while holding switch at RESET.

d. Flight control switch—NORM.

e. Alternate system caution light—ON (indicating electrical circuit complete).

f. Pressure—3050 to 4000 psi.
Pressure should remain constant (except for momentary surges) at a value between the maximum limits of 3050 and 4000 psi (control stick not in motion).

7. Flight control emergency handle—IN.

8. Pressure—2550 to 3200 psi (control stick not in motion).

Note

Because of the tolerances of the alternate system relief valves and the pressure indicating system, the pressure may exceed the pressure gage redline limit (3200 psi) and may even reach 4000 psi when the manual emergency handle is actuated. These pressures are considered normal for this phase of alternate hydraulic system operation.

9. Automatic return to flight control normal system—Check.

a. Control stick—Move rapidly.

b. Alternate system caution light out—Check.
Check that light goes out, indicating that normal system is again in control.

c. Hydraulic pressure gage selector switch—NORM.

d. Pressure—2850 to 3200 psi (control stick not in motion).

UTILITY HYDRAULIC SYSTEM CHECK.

1. Hydraulic pressure gage selector switch—UTILITY.
Check pressure indicator on gage.
2. Speed brakes—Check.
Operate speed brakes through one complete cycle. Close speed brakes and return switch to neutral position. Have ground crew check for proper operation.

WARNING

Before operating speed brakes, be sure fuselage rear section around speed brakes is clear, as brakes operate rapidly and forcefully and could injure any personnel near the brakes.

3. Pressure—Approximately 3000 psi.
4. Hydraulic pressure gage selector switch—NORMAL.
Switch should be maintained at NORMAL except when pressure checks of other hydraulic systems are made or when another system is being monitored because of a suspected or known malfunction.

TRIMMED FOR TAKE-OFF INDICATOR LIGHT CHECK.

1. Take-off trim—Check.
Horizontal tail, ailerons, and rudder trimmed individually until take-off caution light comes on.

Note

Under any load configuration, trimming to the light ensures a more comfortable feel for lifting the nose off during take-off and for holding the nose down during the transition phase of retracting gear and flaps after take-off.

WING FLAP CHECK.

1. Wing flap handle—Down.

BEFORE TAXIING.

1. Communication and navigation equipment—ON.
2. Anti-icing switches—ON (as required).

Note

With the surface anti-icing system on, the engine anti-icing is in operation and the intake screens are automatically retracted.

3. Pitot heat switch—ON (as required).
4. Safety belt and shoulder harness—Secured; inertia reel handle UNLOCKED.
5. Ground safety pin—Remove.

WARNING

After the ground safety pin has been removed, the seat and canopy ejection systems are fully armed.

6. Main wheel chocks—Removed.
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 resetting altimeter during flight.

WARNING

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

8. IFF master switch—STBY.

TAXIING.

Observe the following rules for taxiing:

WARNING

Maintain a minimum distance of 80 feet from the exhaust blast of any other airplane that is operating at Military Thrust, to prevent damage to canopy. When the blast is from afterburner operation, the minimum distance should be 150 feet.

1. Taxi at lowest practical rpm.

   Once the airplane is moving, it can be taxied with the throttle in the START IDLE position (about 40% rpm) on a hard surface. This setting provides enough cooling air for the generators.

2. Nose wheel steering—Engage.

   Maintain directional control through steerable nose wheel by use of rudder pedals; hold steering button depressed to obtain nose wheel steering action. The nose wheel and rudder pedal position must be coordinated before the steering mechanism can engage if the nose wheel is not centered.

CAUTION

If the turn must be made tighter than the nose wheel steering permits, disengage the nose wheel steering and continue the turn using the brakes only.

3. Taxi time—Minimize.

   Airplane range is considerably decreased by high fuel consumption during taxiing. Fuel consumption during taxi is about 3 gallons per minute (20 pounds per minute) with engine at 40% rpm.

4. Oxygen regulator diluter lever—As required.

   If airplane is to be operated on the ground under possible conditions of carbon monoxide contamination, such as taxiing directly behind another jet airplane or during operation with tail into the wind, use oxygen with diluter lever at 100% OXYGEN.

5. Flight indicators—Check.

   Perform operational check of all flight (gyro) indicators during taxiing.

BEFORE TAKE-OFF.

PREFLIGHT AIRPLANE CHECK.

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

1. Intake duct nose screen—Remove.

WARNING

The intake duct nose screen must be removed before the preflight engine check and with the engine at idle rpm. Ground personnel removing the screen must not wear articles of loose clothing or carry equipment likely to be drawn into the intake duct.

2. 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.

3. Canopy—Closed and locked.

   Check canopy locking handle in full forward position, canopy unsafe warning light out, and canopy latches visually (yellow stripe visible through rig pin hole).

CAUTION

When the canopy is being closed, the canopy switch should be held at CLOSED until the canopy actuator automatically cuts off. If the switch is released before the actuator cuts off, the hook at the canopy hinge point may not disengage when becoming air-borne. Emergency canopy ejection is still possible if the hook fails to disengage, but structural damage to the fuselage may result.

4. Automatic pilot engaging switch—OFF.
5. Oxygen regulator diluter lever—NORMAL OXYGEN.

   If contamination is suspected, use 100% OXYGEN.

EMERGENCY FUEL REGULATOR CHECK

SUMMER OPERATION
+40 F TO +100 F

OUTSIDE AIR TEMP °F	% RPM	EXHAUST TEMP °C
100	96.0	685 (+5, −15)
90	94.0	685 (+5, −15)
80	92.5	680 (+10, −15)
70	91.5	665 (±15)
60	91.0	655 (±15)
50	90.5	645 (±15)
40	90.0	635 (±15)

WINTER OPERATION
0 F TO +60 F

OUTSIDE AIR TEMP °F	% RPM	EXHAUST TEMP °C
60	96.0	685 (+5, −15)
50	94.0	685 (+5, −15)
40	92.5	680 (+10, −15)
30	91.5	665 (±15)
20	91.0	655 (±15)
10	90.5	645 (±15)
0	90.0	635 (±15)

EXTREME WINTER OPERATION
−60 F TO +20 F

OUTSIDE AIR TEMP °F	% RPM	EXHAUST TEMP °C
20	96.0	685 (+5, −15)
10	94.0	685 (+5, −15)
0	92.5	680 (+10, −15)
−10	91.5	665 (±15)
−20	91.0	655 (±15)
−30	90.5	645 (±15)
−40	90.0	635 (±15)
−50	89.5	620 (±15)
−60	89.0	610 (±15)

ALLOWABLE VARIATIONS 1. RPM ±2%

Select correct table for emergency fuel schedule setting temperature range. The exhaust temperature and rpm should read, within the allowable variations, as shown. If reading is other than given in table, the scheduled emergency fuel system performance will not be realized, and a check of the emergency fuel regulator is desirable.

F-86K-1-93-28B

Figure 2-4

6. Take-off position.

   Make sure airplane is lined up on runway, and nose wheel is centered. Hold airplane with brakes.

PREFLIGHT ENGINE CHECK.

Perform preflight engine check as follows:

CAUTION

The engine screens should not be cycled if foreign objects are believed to be present. Instead, the airplane should be returned and the preflight inspection for foreign objects repeated.

1. Engine screen—RETRACT; then EXTEND.

   With engine at idle rpm, operate engine screens through one cycle; then leave engine screen switch at EXTEND SCREEN.

Note

This check allows any foreign matter caught on the edge of the engine screens to be dumped into the engine while the airplane is on the ground, before flight safety is involved. It requires about 10 seconds to cycle the screens.

2. Three-position emergency fuel control system switch—Check.

   a. Throttle—Advance rapidly from START IDLE to MILITARY stop.

      Allow engine to stabilize. Normal stabilized exhaust temperature should be 685°C (+5°C, −10°C) at 100% rpm.

   b. Engine instruments—Check for desired readings.

CAUTION

When operating within the jet blast of another airplane, maintain a minimum distance of 80 feet to prevent damage to the canopy. When jet blast is from afterburner operation, maintain a minimum distance of 150 feet.

c. Emergency fuel switch—TAKE OFF.

CAUTION

- When moving emergency fuel system switch to TAKE OFF, be prepared to retard throttle immediately to minimize engine overspeed in case of maladjustment or malfunction of emergency fuel regulator.
- When it becomes necessary to reduce power, retard throttle to START IDLE and move emergency fuel system switch to ON for about 2 seconds; then, without hesitating at TAKE OFF, return switch to NORM before readvancing throttle. This action is necessary to avoid undesirable power surges, possible compressor stall, or overtemperature conditions.

Note

Placing the emergency fuel system switch at TAKE OFF when the throttle is above three-fourths open position places the emergency fuel system in stand-by condition. When the throttle is below three-fourths open position, the engine is operating on the emergency fuel system. (Refer to "Automatic Lockup System Characteristics," Section VII.)

d. Variable-nozzle switch—NORM.

e. Emergency fuel system test button—Press.
Stabilized rpm and exhaust temperature should be in accordance with chart in figure 2-4.

f. Emergency fuel system test button—Release.
If recovery is slow or if rpm fails to recover to 100%, move emergency fuel switch to NORM. Retard throttle as necessary to assist rpm recovery. [Refer to "Nonrecovery Characteristic Following an Emergency Fuel System Test (Three-position Switch)" Section VII.]

g. Throttle—Advance steadily and rapidly past MILITARY stop to full forward position.
It is not necessary to stabilize at Military Thrust before advancing throttle into afterburner range.

3. Two-position emergency fuel control system switch—Check.

a. Throttle—Advance rapidly from START IDLE to MILITARY stop.
Allow engine to stabilize. Normal stabilized exhaust temperature should be 685°C (+5°C, −10°C) at 100% rpm (+0%, −2% rpm).

b. Engine instruments—Check for desired readings.

CAUTION

When operating within the jet blast of another airplane, maintain a minimum distance of 80 feet to prevent damage to the canopy. When jet blast is from afterburner operation, maintain a minimum of 150 feet distance.

c. Emergency fuel switch—ON.
Exhaust temperature and rpm should be in accordance with chart in figure 2-4.

CAUTION

When moving the emergency fuel system switch to ON, be prepared to retard the throttle immediately to minimize the engine overspeed in case of maladjustment or malfunction of the emergency fuel regulator.

d. Throttle—Retard to 85% rpm.

CAUTION

The throttle should be retarded to approximately 85% rpm before switching back to the NORMAL position because an overtemperature could result from the drop-off in rpm which would occur if the throttle were left in the MILITARY position. If an overtemperature condition does occur, the duration and degree of the overtemperature must be entered in DD Form 781 and the appropriate correction maintenance must be accomplished.

e. Emergency fuel switch—NORMAL.

CAUTION

Engine rpm may drop momentarily to about 70% rpm. Do not return switch to ON during this rpm drop unless throttle is first retarded to START IDLE, because overtemperature or compressor stall could occur.

f. Throttle—Advance steadily and rapidly past MILITARY stop to full forward position.

It is not necessary to stabilize at Military Thrust before advancing throttle into afterburner range.

4. Afterburner ignition—Check.

Observe that afterburner ignition occurs within 5 seconds, shown by a definite increase in thrust and an increase in variable-nozzle area. Exhaust temperature should not exceed afterburner ignition temperature limits. Normal stabilized temperature should be 685°C (+5°C, −10°C). Engine speed should stabilize between 98% and 100% rpm.

CAUTION

- On airplanes equipped with the three-position emergency fuel switch, move switch to NORM before retarding throttle from AFTERBURNER. This will prevent engine overspeed.
- Engine shutdown is required if the exhaust temperature limit of any afterburner light-up on the ground is exceeded. Temperature and duration must be entered in DD Form 781.
- Should the engine overspeed exceed 104% rpm, either with or without an overtemperature condition, shut down engine as this necessitates turbine wheel replacement. For overspeeds in excess of 108% rpm, the engine must be removed for overhaul.

5. Afterburner fuel control valve—Check.

After engine stabilizes, retard throttle slowly and carefully about one half the afterburner range. Note that exhaust nozzle area decreases and exhaust temperature stays constant. Readvance throttle.

CAUTION

If exhaust nozzle area does not decrease as throttle is retarded, the afterburner fuel control valve is not operating properly. Shut down afterburner operation by retarding throttle to MILITARY position or below. Electronic engine controls should be checked before throttle is readvanced to afterburner range.

6. Engine instruments—Check.

Check engine instruments for proper readings.

TAKE-OFF.

NORMAL TAKE-OFF.

Note

Refer to take-off distance charts in Appendix I for take-off distances and speeds. Make sure chart referred to is for applicable airplane, because Group 1, 2, and 3 airplanes use a different chart than Group 4 airplanes.

Before the take-off roll is started, check that the exhaust temperature and variable-nozzle positions are stabilized. Monitor these instruments closely during take-off with Maximum Thrust to detect accidental nozzle closure. Engine failure can occur in a relatively short time if nozzle closure occurs during afterburner operation. The normal take-off procedure produces results as shown in the take-off charts. During the early phase of the take-off, after the wheel brakes are released, maintain directional control with the nose wheel steering. Do not use the wheel brakes to maintain directional control during take-off as the use of the brakes slows the airplane and lengthens the take-off run. The rudder control becomes effective at approxiately 60 knots IAS. At about 10 knots below take-off speed, pull the stick back firmly to rotate the airplane nose to take-off attitude. If the take-off is being made on rough terrain, it is advisable to lift the nose wheel slightly as soon as possible to minimize the shock loads to the nose gear assembly. Hold the nose wheel just off the runway until the nose wheel lift-off speeds are attained, and then rotate the nose to the take-off attitude. During the take-off run, maintain a nose-high attitude. As the airplane leaves the ground, it assumes a more normal attitude as the airspeed increases and the wing flaps are raised.

WARNING

After an aborted take-off, regardless of the reason, the airplane must be taxied back to the parking area, the engine shut down, and the brakes allowed to cool enough so that they can be touched by hand before further flight. Do not park the airplane in a crowded parking area because of the danger of fire and explosion from overheated brakes.

Note

The three-position emergency fuel switch should be in the TAKE OFF position for take-off. The two-position emergency fuel switch should be in the NORM position for all normal operation.

MINIMUM-RUN TAKE-OFF.

A minimum-run take-off is a maximum-performance maneuver, with the airplane lifting off near the stalling speed, and should be attempted only when using afterburner. It is closely related to slow flying with the airplane in a high angle-of-attack attitude. Therefore, you should be familiar with the characteristics of this maneuver to be able to maintain the necessary safe margin above the stall. The same trim settings should be used as for a normal take-off, and the initial take-off run is the same. As the take-off run progresses, the stick should be pulled back firmly at about 5 knots IAS below nose wheel lift-off speed. As the nose wheel lifts off, a steady rotation of the airplane to take-off attitude occurs with airplane lift-off occurring about 5 knots IAS below normal take-off speeds. As the airplane lifts off, reduce the back pressure enough to maintain minimum airspeed build-up and maximum climb angle to effect the shortest air run that will clear all obstacles. The landing gear should not be retracted until the airplane accelerates to the normal take-off speeds, i.e., at least 5 knots faster than minimum-run take-off speeds. After all obstacles are cleared, retrim the airplane and accelerate to best climb speed.

WARNING

When the airplane is very close to stall speed, retracting the gear may cause a nose-up pitch sufficient to cause a stall. Waiting until normal take-off speeds are reached or exceeded eliminates this hazard.

CROSS-WIND TAKE-OFF.

Note

Refer to cross-wind take-off and landing chart in Appendix I for effect of varying cross winds.

During a cross-wind take-off, use the same procedures as for normal take-offs. However, a higher nose wheel lift-off speed is recommended to improve airplane controllability. Be prepared to apply rudder pressure after nose wheel lift-off to keep the take-off roll straight down the runway until air-borne. After breaking ground, be prepared to counteract the airplane drift.

AFTER TAKE-OFF—CLIMB.

When the airplane is definitely air-borne, do the following:

Note

Binding and/or jerky control operation can be caused by malfunction of either the flight control system or the autopilot system. It is possible for the autopilot system to become partially engaged with the flight controller switch at OFF. Therefore, to eliminate the possibility of autopilot system malfunction when abnormal control operation occurs, place the autopilot master switch at OFF.

1. Landing gear handle—UP.
   Check gear position indicator lights.
2. Wing flap handle—UP.
   Wing flaps up above 155 IAS. Normally, no "sink" occurs because of the rapid acceleration of the airplane. However, if "sink" does occur (at high gross weight), the flap control can be temporarily set to HOLD to maintain intermediate flap position. After flaps are fully retracted, leave wing flap handle at UP.

CAUTION

- Do not retract the landing gear while yawing or slipping, as damage to the gear doors may result.
- Raise the landing gear and flaps below limit airspeeds; otherwise, excessive air loads may damage the gear doors or flap operating mechanism and prevent later operation.
- The wing flaps must be fully retracted to avoid failure of the flap actuating mechanism that may occur if the flaps are not supported against the up-stop (fully retracted) during accelerated maneuvers at high speed.

3. Landing and taxi light—RETRACT.

CAUTION

When the landing light is used for take-off, it should be retracted before the landing light airspeed limit is reached, to prevent damage by heavy air loads to the operating mechanism.

4. Engine screen switch—RETRACT.
5. Trim longitudinally—As required.

Note

Slats close at about 180 to 200 knots IAS. On Group 4 airplanes, the slats close at about 240 knots IAS when no external load is carried;

when drop tanks are carried, the slats close at about 265 knots IAS.

6. Altitude—Hold constant and increase airspeed.
   Start climb about 20 knots IAS before reaching best climb speed for that particular altitude to stabilize on desired climb schedule as quickly as possible. Maintain best climb speed for minimum time to altitude. Refer to Appendix I for further information.

7. Emergency fuel switch (three-position)—NORM.
   When a safe altitude is reached, position emergency fuel switch (three-position) at NORM. The switch should be at NORM for all normal operations except take-off and initial climb.

Note

- If loss of engine power occurs when emergency fuel system switch is positioned at NORM, move switch to ON. If rpm decreases below 90%, shut off afterburner to prevent engine damage due to overheating the tail pipe.
- If engine speed is inadvertently allowed to drop below 85% rpm before the emergency fuel system switch is moved back to ON, the throttle should first be retarded to START IDLE before the switch is placed ON.
- Any time ambient air temperature causes the emergency fuel regulator setting to approach that of the main fuel system, and the emergency fuel system switch is at TAKE OFF, it is possible for the emergency fuel system to take over engine control and result in engine overspeed. Engine overspeeding during climb after take-off with emergency fuel system switch at TAKE OFF indicates the emergency fuel system has taken over engine control. When such an engine overspeed exists, an apparent loss of engine power will result when emergency fuel system switch is positioned at NORM. For further information, refer to "Emergency Fuel System Overriding Main Fuel System (Three-position Switch)," Section VII.

8. Zero-second parachute hook—Detach from parachute "D" ring and attach to stowage ring.
   Parachute hook should be stowed after reaching 2000 feet above the terrain.

WARNING

The lanyard must be disconnected whenever the airplane is operated outside the operational area so that the safety delay provided by the parachute timer-aneroid will not be overridden.

9. Armament master and radar master switches—Desired position and STBY.
   Maintain wing-level flight during 4½-minute warm-up period.

10. Yaw damper switch—ON.

11. Throttle—Retard to shut down afterburner.
    To provide a minimum safe altitude for taking corrective action in case of power loss, do not shut off afterburner until a minimum altitude of at least 1000 feet above the terrain is obtained. When added thrust is no longer needed, shut off afterburner by retarding throttle past MILITARY stop to desired setting.

Note

A momentary surge up to 101% rpm is often experienced when coming out of afterburner operating range. These momentary surges are not harmful to the engine.

12. Oxygen diluter level—NORMAL OXYGEN.
    If 100% oxygen was used for take-off, return diluter to NORMAL OXYGEN, unless carbon monoxide contamination is suspected. If such is the case, continue use of 100 percent oxygen as long as considered necessary.

WARNING

Oxygen diluter lever must be returned to NORMAL OXYGEN as soon as possible, because use of 100% oxygen will so deplete the oxygen supply as to be hazardous.

13. Reset altimeter when climbing through 23,500 feet—29.92 in. Hg or as required.

14. IFF—Checked.
    If positive operation of the normal mode of IFF has not been established during departure with an air traffic control facility, a check should be made with such a facility as soon after take-off as flight conditions will permit. This check must be made before entering a radar advisory area. If the IFF is inoperative, consult the appropriate navigation publication.

CLIMB.

Military Thrust is recommended for climb under maximum-range conditions when minimum time to altitude is not important. For minimum time to altitude, such as in a point interception mission, Maximum Thrust is required. 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.

CAUTION

If an in-flight seat adjustment is made, check that the seat vertical adjustment lever is locked and seat is locked in position. If seat is not locked, G-loads may cause it to move and possibly cause armrests to raise and jettison the canopy.

CRUISE.

For cruise data, refer to Appendix I.

AFTERBURNER OPERATION DURING FLIGHT.

Note

- The afterburner should be used only when Maximum Thrust is essential and should be turned off when this need has passed, because of the greatly increased fuel consumption.
- In steady-state operation, if exhaust temperature climbs over 685°C (+5°C, −10°C), or if nozzle operation becomes erratic, a malfunction of the engine control or thermocouples is indicated. Reduce power and land as soon as possible. Do not go into or return to afterburner after such a condition has existed.

CAUTION

- If afterburner blowout occurs with less than 1300 pounds of fuel remaining, do not attempt further afterburner operation unless dictated by emergency or combat conditions. This precaution does not constitute an operating limitation, but rather a measure to reduce the possibility of afterburner fuel pump overspeed if the fuselage rear tank transfer pump fails.
- No attempt is to be made to ignite the afterburner whenever engine is operating on the emergency fuel system.

Follow this procedure for afterburner operation while in flight:

1. Variable-nozzle switch—AUTO.
2. Throttle—Full forward position.
   From any intermediate power setting, advance throttle steadily and rapidly past MILITARY stop to full forward position. Afterburner ignition is possible by movement to the afterburner range from any throttle position. Ignition is indicated by an increase in thrust and variable-nozzle area.

CAUTION

To prevent engine damage due to overheating the tail pipe, do not operate continuously in afterburner with engine rpm below 90%.

Note

- There is no time limit for afterburner operation; however, extended or excessive use of the afterburner (Maximum Thrust) will rapidly decrease the fuel supply and seriously impair the range capabilities of the mission.
- Ten seconds may be required to effect afterburner light-up in flight. The time required for afterburner light-up will normally increase as altitude is increased.

3. Afterburner—OFF.
   When added thrust is no longer needed, shut off afterburner by retarding throttle past MILITARY stop to desired setting.

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. Rates of descent as high as 55,000 feet per minute can be obtained with this airplane. For a typical descent, refer to descent charts in Appendix I.

Note

The windshield and canopy defrost system provides enough heating of the transparent surfaces to effectively eliminate the formation of frost or fog during descent.

1. IFF—Checked.
   This check should be performed within one hour before the estimated time of landing.

1A. Reset altimeter when descending through flight level 240—Altimeter setting at point of descent.

BEFORE LANDING.

During approach to the field, make the following checks:

1. Ground fire switch—SAFE.
2. Armament master switch—OFF.
3. Radar master power switch—STBY.
4. Gun sight—Mechanically cage.

CAUTION

To prevent landing shock loads from damaging the fire control system gyro, wait until landing has been made and taxiing is completed before turning radar off.

4A. Circuit breakers—Check.

5. Fuel quantity—Check.
6. Hydraulic pressure—Check.
7. Safety belt, shoulder harness, and zero-second parachute hook—Secured.
   Parachute hook must be attached to "D" ring prior to descending below 2000 feet above the terrain.
8. Shoulder-harness inertia reel handle—Unlocked.
9. Yaw damper switch—OFF.
10. Windshield anti-icing switch—As desired.
    If vision is impaired by rain during landing approach, select either CENTER or SIDE, as desired.

    Note

    - Enough anti-icing airflow is available over windshield to improve visibility effectively if a minimum of 75% engine rpm is maintained. If rain is still encountered as power is reduced for landing, vision through windshield side panels may be necessary. Turn anti-icing switch OFF after touchdown, if windshield caution light has not come on. If light comes on, leave switch on; reduced engine power on the ground or selecting manual ram air will allow gradual cooling of windshield, and prevent cracking of the glass by sudden temperature changes.
    - Illumination of the light shows that the design limit of the air supply in the system has been reached, but does not necessarily mean that the windshield has reached the same temperature. In addition to reducing engine power to lower anti-ice air temperature, selecting manual ram air will reduce the amount of air to be cooled in the heat exchanger, thus reducing the temperature.
    - It is recommended that manual ram air be used in conjunction with anti-ice system only during taxiing, take-off or landing, as unsatisfactory cockpit temperatures could result if windshield anti-icing is used extensively during flight.
11. Speed brake switch—OUT.
    Return switch to neutral when brakes extend fully.
12. Landing gear handle—DOWN.
    Lower gear below 185 knots IAS and check position indicators.
13. Pattern—Fly at 160 to 185 knots IAS, using power for level flight.
14. Wing flap handle—DOWN.
15. Check instruments—In desired range.
16. Final approach—Fly at 140 knots IAS.
    Use this as minimum flare speed.
17. Throttle—Retard to START IDLE at touchdown.
    Do not chop throttle earlier because of high rate of descent with power off. Touch main wheels first, wings level, tail well down; lower nose wheel slowly and deploy drag chute to shorten landing roll and minimize brake wear. The drag chute is for use after touchdown at speeds of 150 knots IAS and below.

While following the procedure outlined in figure 2-5 for making a normal approach and landing, observe the following precautions.

CAUTION

- Do not lower the landing gear in accelerated turns or pull-ups, because the G encountered may damage the landing gear operating mechanism. Also, if the gear is lowered above the gear-down limit airspeed of 185 knots IAS, the air loads may damage the landing gear doors or fairings.
- To prevent possible damage to the gear doors, the landing gear should not be extended or retracted while the airplane is in a slipping or yawing attitude.

In addition to improving deceleration and shortening ground roll, extending the speed brakes permits the use of higher engine rpm during a normal approach. This is a definite advantage if a go-around is required.

Note

The speed brakes are made inoperative automatically if the utility hydraulic system pressure falls below 1500 psi.

Flying the landing pattern at 160 to 185 knots IAS, using power for level flight, results in about the same amount of thrust as that produced at much lower rpm in airplanes with fixed nozzles. Rapid increases in thrust are possible only above about 75% rpm, Military Thrust being reached in 3.5 seconds from this setting. Therefore, to ensure adequate acceleration, use full flaps, speed brakes, and high engine rpm on the approach, if required.

LANDING.

NORMAL LANDING.

The procedure set forth produces the results shown in the landing charts in Appendix I. Refer to the proper chart for the applicable group of airplanes. While following the procedure outlined in figure 2-5 for completing a normal landing, observe the following precautions:

Note

The full length of the runway should be used during the landing roll, so that the brakes can be used as little and as lightly as possible for stopping.

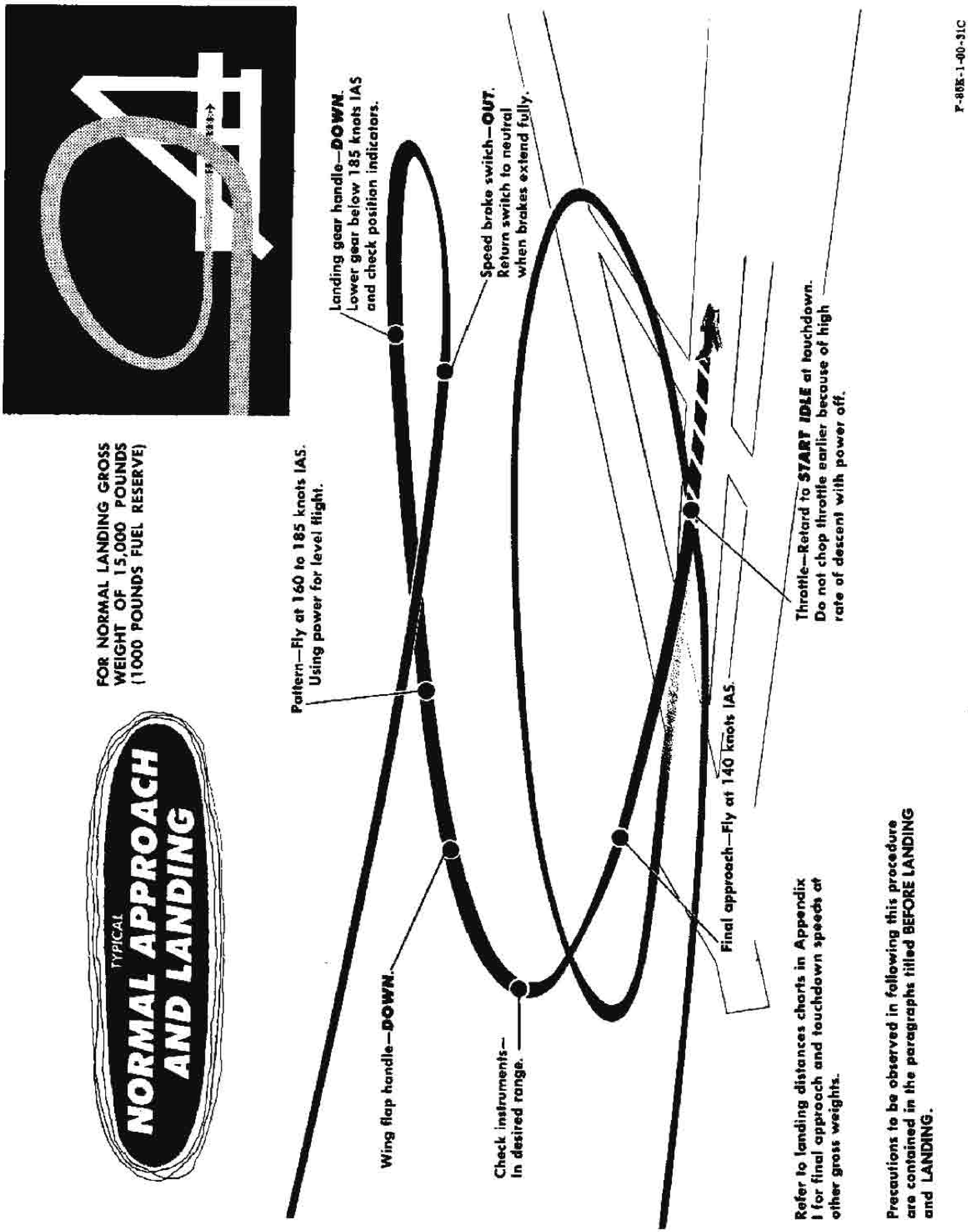

TYPICAL
NORMAL APPROACH AND LANDING
FOR NORMAL LANDING GROSS WEIGHT OF 15,000 POUNDS (1000 POUNDS FUEL RESERVE)
Landing gear handle—DOWN. Lower gear below 185 knots IAS and check position indicators.
Speed brake switch—OUT. Return switch to neutral when brakes extend fully.
Pattern—Fly at 160 to 185 knots IAS. Using power for level flight.
Wing flap handle—DOWN.
Check instruments—In desired range.
Final approach—Fly at 140 knots IAS.
Throttle—Retard to START IDLE at touchdown. Do not chop throttle earlier because of high rate of descent with power off.
Refer to landing distances charts in Appendix I for final approach and touchdown speeds at other gross weights.
Precautions to be observed in following this procedure are contained in the paragraphs titled BEFORE LANDING and LANDING.
F-86K-1-00-31C

Figure 2-5

Speed brakes may be used optionally in the traffic pattern, although the recommended approach procedure is to have the speed brakes open to allow carrying a higher power setting in case of a go-around. To avoid high rate of sink, a power setting of 75% to 85% rpm is necessary to hold the rate of descent, on final approach, to less than 1500 feet per minute at the recommended final approach speed.

WARNING

The variable-nozzle should be left at AUTO during the landing approach and ground run. If the nozzle has been "jogged" open, enough thrust will not be available for a go-around unless the nozzle is "jogged" closed or the switch is returned to AUTO.

Note

With the variable-nozzle switch at AUTO, the nozzle is automatically controlled to give the most favorable engine performance. Opening the nozzle has a negligible effect on the landing ground roll, because the thrust loss is a very small percentage of the total available braking force during a landing. The total available braking force is about 4000 pounds, and idle thrust is reduced only 100 pounds by opening the nozzle.

Do not attempt a full-stall landing, since the angle of attack at the stall is so high that the tail will drag the ground. Maintain directional control during the landing roll by use of rudder and differential braking.

CROSS-WIND LANDING.

Cross-wind landings may be easily performed in this airplane by using the normal landing procedures. However, while using normal approach speeds, crab or lower the wing into the wind to keep the airplane lined up with the runway. The normal approach speed is used for flare-out; if crabbed or wing low, align the airplane with the runway just before touchdown. After touchdown, lower the nose wheel smoothly to the runway as soon as practical and deploy the drag chute if necessary.

CAUTION

- The drag chute should not be deployed in 90-degree cross winds exceeding 20 knots or in 45-degree cross winds exceeding 30 knots, because of weathercocking tendencies of the airplane with the chute deployed.
- However, in an emergency, the drag chute may be deployed during strong cross winds to provide fast deceleration. The drag chute should be deployed immediately after the nose wheel touches in order to obtain maximum deceleration effects. Then jettison the chute as soon as practical if excessive yaw develops. Be prepared to use brakes, rudder, and/or nose wheel steering to maintain directional control. Use enough aileron to prevent the cross wind from lifting the wing but not so much that the wing will start down.
- If possible, be sure that drag chute will clear the following airplanes if it becomes necessary to jettison the chute to maintain a straight landing roll.
- Refer to cross-wind landing and take-off chart in Appendix I for effect of varying cross winds.

MINIMUM-RUN LANDING.

To make a minimum-run or short-field landing with this airplane, you should be thoroughly familiar with the slow speed flight and stall characteristics of the airplane. In planning the approach, hold 160 knots IAS in turn onto the final approach, and then reduce the power to maintain 120 to 130 knots IAS on the final approach. Control the final approach airspeed with the throttle, flaps, and speed brakes and plan to touch down as near the end of the runway as possible. Immediately after touchdown, deploy the drag chute and, as soon as the chute opens, lower the nose smoothly and quickly to the runway to permit brake application. Begin maximum braking when the speed falls below 100 knots IAS being careful not to slide the tires. Use the brakes intermittently and hard (apply the brakes for about 2 to 3 seconds; allow one second release intervals between applications).

Note

Although the drag chute is not designed for in-flight use, it does not adversely affect the airplane flight characteristics if it is advertently opened just before touchdown and the proper flare-out has been initiated.

CAUTION

- Braking is permissible above 100 knots IAS; however, caution should be used to prevent the wheels from sliding, because brake action is extremely difficult to feel above this speed.
- Excessive use of the brakes can cause them to overheat, causing damaging effects on the tires. If the heat is great enough, it can cause the tires to weaken and later blow out. If the brakes are used excessively during taxiing, landings, or aborted take-offs, for any rea-

son, the airplane must be taxied back to the line, the engine must be shut down, and the brakes must be allowed to cool enough to touch by hand before starting another flight. Do not park the airplane in a crowded parking area because of the danger of fire or explosion from overheated brakes.

- The drag chute should be jettisoned before taxiing downwind in winds exceeding 15 knots, because of the possibility of the chute collapsing and risers burning by contact on hot areas of the exhaust nozzle.

HEAVY-WEIGHT LANDING.

The same technique for normal landing applies for the heavy-weight landing (near maximum take-off gross weight), except for necessary increases in power settings. As gross weight increases, approach and touchdown speed should be increased accordingly. For example, if the take-off is made with full internal fuel, full 120-gallon drop tanks, and full rocket load, and a landing has to be made before any excess fuel and the rocket load can be expended, the landing weight is about 19,500 pounds. With this landing weight, the recommended final approach and flare speed is 160 knots IAS, to provide adequate flare characteristics. A stall landing should be avoided, if at all possible, in an attempt to keep the G to a minimum at point of touchdown.

Note

- If necessary, the drag chute may be deployed to provide maximum deceleration after touchdown.
- If a heavy-weight landing is made, the airplane should be checked for signs of overstress before the next flight.

SLIPPERY-RUNWAY LANDING.

When landing on a slippery runway (wet or icy), use the normal landing pattern and procedures. However, the condition of the runway (degree of slipperiness) must be determined by ground personnel and the pilot advised accordingly so that the proper technique can be used. On rough ice or a wet rough surface, upon touchdown, deploy the drag chute, and lower the nose immediately and apply heavy intermittent braking as necessary. On smooth ice or a wet smooth surface, deploy drag chute and maintain a nose-high attitude after touchdown with full flaps to provide aerodynamic braking. Care must be taken not to become air-borne again at the higher speeds. As the speed is reduced and after the nose wheel touches, attempt to obtain braking with wheel brakes. As the braking coefficient is greatly reduced on slippery runways (especially on the first portion of the landing roll), the landing roll is increased. In each case, use of the drag chute is imperative to give maximum deceleration. Careful braking action is necessary to prevent locking of the wheel brakes which cause skidding and loss of directional control. Braking should be intermittent to retain directional control as nosewheel steering under these conditions is relatively ineffective. Rudder should be used also for directional control, and it will be effective down to about 60 knots IAS. Make every effort to remain on the runway in case a barrier engagement becomes necessary. When taxiing, care must be taken as directional control on a slippery runway is difficult. Refer to landing distance chart in Appendix I for approach and touchdown speeds and landing distances.

TOUCH-AND-GO LANDING.

When a touch-and-go landing is made, perform a normal approach and landing, except do not use the drag chute. Lower the nose wheel onto the runway as soon as possible after touchdown and simultaneously close the speed brakes and advance the throttle to Maximum Thrust.

Note

- Do not perform a touch-and-go landing with less than 1000 pounds of fuel.
- Do not use Maximum Thrust if fuel level is below 1300 pounds.

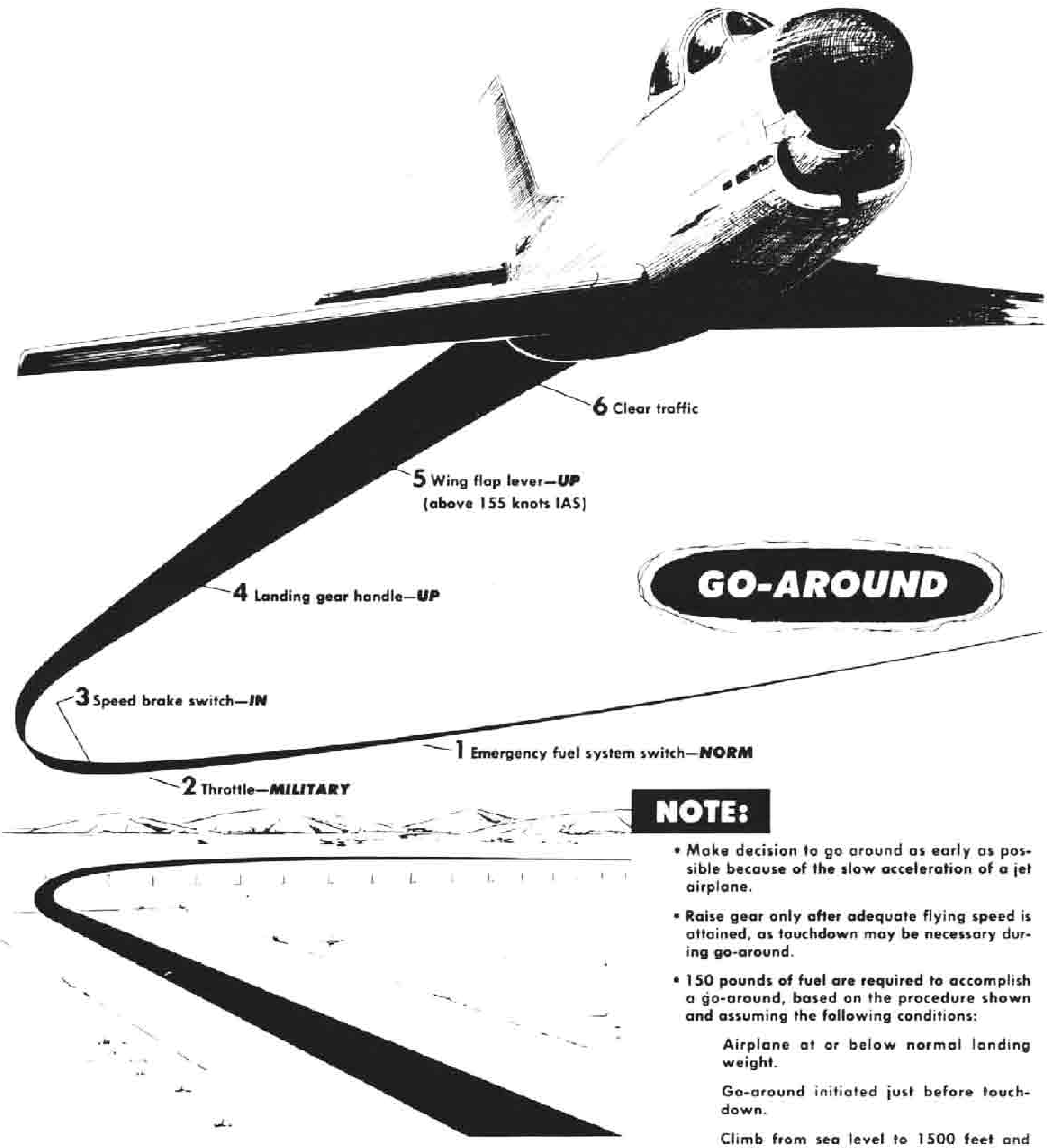
Complete a normal take-off, observing the recommended nose wheel lift-off speeds. Retract landing gear and wing flaps as in a normal take-off. Where a series of touch-and-go landings are to be made, the normal before landing check must be accomplished for the initial landing. After the final touch-and-go landing, if flight is to be continued, the normal after take-off climb must be made.

GO-AROUND.

While following the procedure outlined in figure 2-7 for making a go-around from an aborted landing approach, observe the following precautions:

WARNING

- Make decisions to go-around as early as possible. The low-altitude acceleration characteristics of a jet-propelled airplane are definitely inferior to those of a propeller-driven airplane.
- During a go-around, if the engine does not respond to throttle advancement on the first attempt, as shown by engine instruments, retard throttle to START IDLE (if rpm drops below 85%), position emergency fuel system switch to ON, and cautiously readvance throttle.
- If the main fuel system has failed during flight, the emergency fuel system switch



NOTE:

- Make decision to go around as early as possible because of the slow acceleration of a jet airplane.
- Raise gear only after adequate flying speed is attained, as touchdown may be necessary during go-around.
- 150 pounds of fuel are required to accomplish a go-around, based on the procedure shown and assuming the following conditions:

  Airplane at or below normal landing weight.

  Go-around initiated just before touchdown.

  Climb from sea level to 1500 feet and traffic pattern of 10 ground miles flown.
- The possibility of fuel gage error or inability to use all fuel aboard should be considered in determining minimum fuel quantity gage reading for a go-around.

F-86K-1-00-30B

Figure 2-6

should be ON, and if the variable nozzle is inoperative, the variable-nozzle switch should be OFF (nozzle closed). Under these conditions, the acceleration characteristics of the airplane are extremely poor. Also, advancement of the throttle must be done with caution to prevent flame-out or dangerous overtemperature.

Afterburning should not be used if the emergency regulator is controlling fuel flow, since the emergency regulator does not have the safety features of the main fuel control valve.

CAUTION

To prevent damage from air loads, the landing lights should be retracted before the light-down limit airspeed is reached.

AFTER LANDING.

After completion of the landing roll:

1. Engine screen switch—EXTEND SCREEN.
   Engine screens should be extended after completion of landing roll and before turning off runway.
2. Windshield and canopy defrost lever—DEC.
3. Speed brake switch—Center (OFF) position.
4. Nose wheel steering—Engage.
   Engage nose wheel steering when slow taxiing becomes necessary.
5. Drag chute handle—Jettison (on taxiway)

CAUTION

- To obtain the best drag chute service life, it is recommended that the drag chute be jettisoned, at the lowest possible taxi speed, immediately after taxiing off the runway onto the taxiway and while the drag chute is still inflated.
- 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 the drag chute deployed to prevent it from dragging on the ground or touching the hot exhaust nozzle area.
- Do not make sharp turns during taxiing with the drag chute deployed to prevent the chute from collapsing and damaging the chute and the chute compartment.

6. Speed brake switch—IN.
7. Wing flap handle—UP.
8. Anti-ice and pitot heat switches—OFF.
9. IFF and ILS switches—OFF.
10. Trim—Set at take-off position.

ENGINE SHUTDOWN.

This shutdown procedure permits engine stabilization at the lowest temperature, which minimizes the possibility of shroud ring rub. If required by emergency conditions, the engine may be shut down immediately.

1. Wheel brakes—ON.
2. Throttle—65% to 70% rpm.
   The engine should be operated at 65% to 70% rpm for about 2 minutes.

Note

When operating under local command procedures for checking coast down time of engine rotor with a locked open nozzle, the temperature should be stabilized at the lowest level consistent with the locked nozzle setting before shutdown.

3. Throttle—CLOSED.
   Close throttle sharply.

Note

When ac power stops during engine shutdown as rpm decreases, the ac powered fuel flow, oil pressure and hydraulic pressure gages may deceptively change indications. Therefore, during this period, no reliance should be placed upon these indications.

4. Engine master switch—OFF.
   Turn master switch OFF below 10% rpm, and wait a few seconds before turning battery-starter switch OFF.
5. Battery-starter switch—OFF.
6. All electrical switches—OFF.
   Turn all switches OFF except generator and alternator.

WARNING

Keep clear of tail pipe and do not move airplane into hangar for at least 15 minutes after shutdown, because of the possibility of accumulated fuel vapors exploding.

7. Control stick—Cycle.
   With engine rpm at zero, cycle control stick full fore and aft until it "freezes" to dump flight control normal hydraulic system pressure. This helps prevent damage to "O" rings in the normal system accumulator.
8. Flight control emergency handle—OUT (aft).
9. Control stick—Cycle
   Move control stick as rapidly as possible full fore and aft through two complete cycles to dump flight control alternate hydraulic system pressure. This helps prevent damage to "O" rings in the alternate system accumulators.

10. Flight control emergency handle—IN (forward).
    Push flight control emergency handle full in immediately after control stick cycling is completed. If handle is not pushed in immediately after stick cycling is completed, alternate system pressure builds up again.

BEFORE LEAVING AIRPLANE.

Make the following checks before leaving the airplane:

1. Armrests full down and latched—Check.
2. Ejection seat ground safety pin—Install in right armrest (across the trigger).
3. Drop tank air pressure shutoff valve—OFF.
4. Rudder—Lock.

CAUTION

If wearing an automatic-opening, aneroid-type parachute that has a key attached to the aneroid arming lanyard, make sure key does not foul when leaving cockpit, to prevent chute from being opened accidentally.

5. Main wheels—Chocked.
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 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 take-offs, long and fast landings, and long taxi runs at high speeds, etc.

CONDENSED CHECK LIST.

Your normal condensed check list is now contained in T.O. 1F-86K-(CL)1-1.

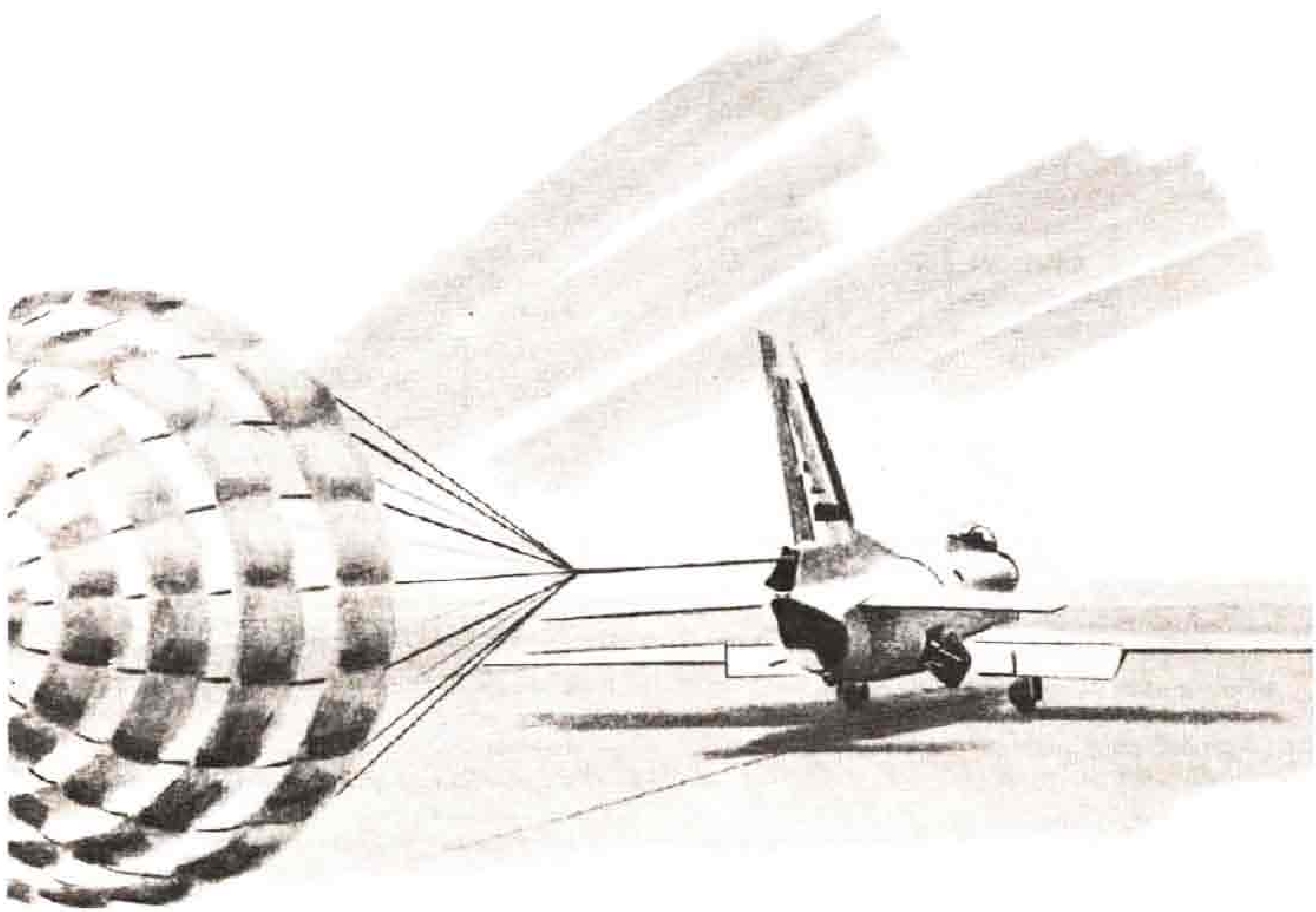


TABLE OF CONTENTS.

ENGINE FAILURE.

Complete engine failures are rare on this airplane. However, engine flame-outs and malfunctions of various types do occur from time to time. These usually result from improper fuel scheduling caused by a malfunction of the integrated electronic engine control or of one of its components, or by incorrect techniques during critical flight conditions. (Refer to "Main Fuel Control System Failure.") When time and altitude permit, air starts can usually be accomplished if engine failure is due to malfunction of the main fuel control system. Failure of the main fuel control system is often indicated by the engine instruments. Air starts should never be attempted if engine failure can be attributed to some obvious mechanical failure within the engine proper.

ENGINE OVERSPEED DURING TAKE-OFF.

On airplanes with the three-position emergency fuel switch installed, any time ambient air temperature causes the emergency fuel regulator setting to approach that of the main fuel system, it is possible for the emergency fuel system to take over engine control and result in engine overspeed during the climb after take-off. This overspeed is gradual and is a result of the emergency fuel system overriding the main fuel system, when the emergency fuel system switch is in the TAKE OFF position. If the emergency fuel system switch is positioned at NORM with the overspeed condition present, what appears to be a complete power loss will occur. (Refer to Section VII for further information.) If engine overspeed stabilizes at about 102% rpm, the climb may be continued without any power change being made. As altitude is increased, the engine speed will return to 100% rpm. However, before the emergency fuel system switch is positioned to NORM, the engine must be allowed to remain stabilized at 100% rpm for about 15 seconds. If engine overspeed tends to exceed 104% rpm during climb after take-off, while operating in afterburner range with the emergency fuel system switch at TAKE OFF, perform the following:

1. For airplanes equipped with the three-position emergency fuel system switch:
   a. Emergency fuel system switch—NORM.

b. Throttle—Retard immediately and rapidly to below MILITARY stop.

Note

When emergency fuel system switch is positioned to NORM, a loss in power results. For this reason, the throttle must be retarded from the AFTERBURNER range.

c. Throttle—Readvance to desired setting.
Engine will respond on main fuel system.

Note

This condition does not occur on airplanes incorporating the two-position emergency fuel switch, as the switch is in NORM position for take-off.

ENGINE FAILURE DURING TAKE-OFF RUN (NO RUNWAY OVERRUN BARRIER.)

WARNING

Do not attempt to use the landing gear emergency up button. 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.

Note

For procedure when using a runway equipped with runway overrun barrier, refer to "Engaging Runway Overrun Barrier" in this section.

If the engine fails, or if a take-off is aborted before the airplane leaves the ground and insufficient runway remains for a normal stop, accomplish as much of the following as time permits:

1. For airplanes equipped with three-position emergency fuel switch.

a. Drag chute handle—Pull.

CAUTION

Use care after deploying drag chute in cross winds of 45 to 90 degrees because of weathercocking tendencies of airplane with chute deployed. Be ready to use brakes, rudder, and or nose wheel steering to maintain directional control.

b. Throttle—CLOSED.

c. Brakes—Apply as necessary.

WARNING

- The heat generated in the brake during an aborted takeoff continues to build up during taxiing operation back to the line. This heat is transmitted to the wheel and into the tire itself. This heat in the tire melts the rubber and weakens the cords until the casing blows out.
- After an aborted take-off, for any reason, the airplane must be taxied back to the line. Shut down engine. Make sure brake assembly is cool enough to touch by hand before further flight.

CAUTION

Do not retract gear if runway overrun barrier is present.

d. Drop tank jettison button—Depress (or emergency jettison handle—Pull) if drop tanks are installed.

e. (Deleted)

f. Seat armrests—Raise.
Raise armrest to jettison canopy, and lock shoulder harness before coming to a complete stop.

WARNING

If armrests have not been raised and if spilled fuel is in the vicinity of the airplane, use the mechanical or electrical means to remove the canopy, if time permits. If these systems fail, the canopy jettison mechanism may be used; however, a fire may result from a hot powder spark when the canopy catapult is actuated.

g. Engine master and battery-starter switches—OFF.

CAUTION

Turn engine master switch OFF while battery-starter switch is at BATTERY, so that power will still be available to close fuel shutoff valve.

h. Generator switches—OFF (if time permits).

2. For airplanes equipped with two-position emergency fuel system switch.

   a. Emergency fuel system switch—ON (if engine rpm is above 85%).

   If engine power loss is indicated by rpm or exhaust temperature drop but rpm has not fallen below 85%, move emergency fuel system switch to ON.

   WARNING

   If engine rpm has fallen below 85%, abort take-off. There would not be enough time to retard throttle to START IDLE, switch emergency fuel system switch to ON, and then readvance throttle.

   b. Drop tank jettison button—Depress (or emergency jettison handle—Pull) if drop tanks are installed.

   Note

   If engine does not immediately recover sufficient power to continue take-off when emergency fuel system switch is moved to ON, proceed to step c.

   c. Drag chute handle—Pull.

   CAUTION

   Use care after deploying drag chute in cross winds of 45 to 90 degrees because of weathercocking tendencies of airplane with chute deployed. Be ready to use brakes, rudder, and/or nose wheel steering to maintain directional control.

   d. Throttle—CLOSED.

   e. Brakes—Apply as necessary.

   WARNING

   - The heat generated in the brake during an aborted take-off continues to build up during taxiing operation back to take-off position. This heat is transmitted to the wheel and into the tire itself. This heat in the tire melts the rubber and weakens the cords until the casing blows out.
   - After an aborted take-off, for any reason, the airplane must be taxiied back to the line. Shut down engine. Make sure brake assembly is cool enough to touch by hand before further flight.

   f. (Deleted)

   g. Seat armrests—Raise.

   Raise armrest to jettison canopy, and lock shoulder harness before coming to a complete stop.

   WARNING

   If armrests have not been raised and if spilled fuel is in the vicinity of the airplane, use mechanical or electrical means to remove the canopy, if time permits. If these systems fail, the canopy jettison mechanism may be used; however, a fire may result from a hot powder spark when the canopy catapult is actuated.

   h. Engine master and battery-starter switches—OFF.

   CAUTION

   Turn engine master switch OFF while battery-starter switch is at BATTERY, so that power will still be available to close fuel shutoff valve.

i. Generator switches—OFF (if time permits).

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

If engine failure occurs on take-off after airplane is air-borne, prepare for an emergency landing, accomplishing as much of the following as time permits:

1. For airplanes equipped with three-position emergency fuel system switch.

   a. Throttle—CLOSED.

   b. Drop tank jettison button—Depress (if drop tanks are installed).

   c. Canopy handle—Unlock.
   Manually unlocking the canopy allows the air-stream to carry the canopy away from the fuse-lage.

   Note

   Pull helmet visor down before unlocking canopy.

   WARNING

   If canopy has not been released and if spilled fuel is in the vicinity of the airplane, use the mechanical or electrical means to remove the canopy, if time permits. If these systems fail, the canopy jettison mechanism may be used; however, a fire may result from a hot powder spark when the canopy catapult is actuated.

   d. Landing gear handle—DOWN.

   e. Wing flap handle—DOWN.

   f. Engine master, generator, and battery-starter switches—OFF.

   Note

   Turn engine master switch OFF while battery-starter switch is still at BATTERY, so that power will still be available to close fuel shutoff valve.

   g. Shoulder harness lock handle—LOCKED.

   h. Land straight ahead.
   Change course only enough to miss obstacles.

   i. Drag chute handle—Pull (after touchdown).

   Note

   If drag chute is deployed at speeds above about 160 knots IAS, it will automatically jettison.

2. For airplanes equipped with the two-position emergency fuel system switch.

   a. Emergency fuel system switch—ON (if engine rpm is above 85%).
   If engine power loss is indicated by rpm or exhaust temperature drop but rpm has not fallen below 85%, move emergency fuel system switch to ON.

   WARNING

   If engine rpm has fallen below 85%, there would not be enough time to retard throttle to START IDLE, switch emergency fuel system switch to ON, and then readvance throttle. Therefore, proceed to steps b. through h.

   b. Drop tank jettison button—Depress (or emergency jettison handle—Pull) if drop tanks are installed.

   Note

   If engine does not immediately recover sufficient power to sustain flight when the emergency fuel system switch is moved to ON, proceed to step c.

   c. Throttle—CLOSED.

   d. Canopy handle—Unlock.
   Manually unlocking the canopy allows the air-stream to carry the canopy away from the fuse-lage.

   Note

   Pull helmet visor down before unlocking canopy.

   WARNING

   If canopy has not been released and if spilled fuel is in vicinity of airplane, use mechanical or electrical means to remove canopy, if time permits. If these systems fail, the canopy jettison system may be used; however, a fire may result from a hot powder spark when the canopy catapult is actuated.

   e. Landing gear handle—DOWN.

   f. Wing flap handle—DOWN.

   g. Engine master, generator, and battery-starter switches—OFF.

   Note

   Turn engine master switch OFF while battery-starter switch is still at BATTERY, so that power will still be available to close fuel shutoff valve.

   h. Shoulder harness lock handle—LOCKED.

   i. Land straight ahead.
   Change course only enough to miss obstacles.

j. Drag chute handle—Pull (after touchdown).

Note

If drag chute is deployed at speeds above about 160 knots IAS, it will automatically jettison.

ENGINE FAILURE DURING FLIGHT.

If engine failure occurs during flight, follow this procedure.

Note

Before closing the throttle, check fuel flow (600 psi minimum) and exhaust temperature indication. If engine has not flamed out, do not close throttle.

1. Attempt air start immediately (if mechanical malfunction is not apparent).

   Refer to "Engine Air Start" in this section.

Note

The actuation of the air start switch automatically shuts off electrical equipment not essential when making an air start. However, after the air start is made, turn off any electrical equipment not required.

If engine does not start before airspeed decreases to about 185 knots IAS, establish glide at 185 knots IAS (200 knots on Group 4 airplanes and those changed by T.O.), with landing gear and wing flaps up and speed brakes closed for maximum glide distance. (See figure 3-2.)

2. Repeat air start procedure, if necessary.

If engine failure necessitates a forced landing, maximum gliding distance can be obtained by establishing a glide of 185 knots IAS (200 knots on Group 4 airplanes and those changed by T.O.), with landing gear and wing flaps up and speed brakes closed. Unless the engine is damaged, it will windmill at enough speed to operate all hydraulic controls, including the flight control normal hydraulic system. However, engine windmilling will be inadequate to provide generator power at any normal gliding speed. Operation of the landing gear, wing flaps, and speed brakes will be considerably slower than normal. Because electrical power is being derived only from the battery, such power will be available for about 25 to 28 minutes with all unnecessary electrical equipment turned off, unless a failure of the flight control normal hydraulic system accompanies the engine failure. If this is the case, electrical power will be available for about 20 minutes only, and alternate system hydraulic accumulator pressure should be conserved by minimum movement of the control surfaces. Operation from localities with low prevailing outside temperature causes more rapid loss of battery power. (See figure 1-14 for list of equipment powered by battery when battery-starter switch is at BATTERY and both generators are inoperative.)

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 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 cimb 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 light buffet until the speed drops to 120 knots IAS or the rate of climb approaches zero; then eject. If the decision is to continue attempting air starts, the climb should be terminated prior to 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 prior to 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: terrain where external loads will fall (populated areas, friendly or enemy territory, etc); type of stores to be jettisoned (full or empty drop tanks, etc); controllability of the airplane if one or more stores fails 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 the factors mentioned and conditions existing at the time of the emergency.

ENGINE AIR START.

Although engine starts during flight (figure 3-1) are more readily obtainable below 40,000 feet, the air start should be attempted as soon as possible after flame-out. During the restart, if ignition does not occur within 20 seconds after throttle is opened, slowly retard throttle to CLOSED and then readvance throttle until a higher fuel flow is reached. Repeat this procedure until ignition occurs or until one minute has elapsed, as a 5-second fuel accumulation drainage period should be allowed after each one-minute restart attempt. On some altitude restarts, the engine may be on the verge of compressor stall with throttle at START IDLE, and any attempt to advance the throttle will cause a complete stall. If this occurs, retard the throttle below initial position and then readvance it slowly, keeping exhaust temperature well within limits. If, after several attempts have been made, ignition does not occur before airplane has descended to an altitude of 10,000 feet above the ground and a forced landing is to be made, return air start switch to NORMAL (down) to re-establish radio communication and operation of landing gear, landing light, and flaps for landing. Refer to "Forced Landing (Windmilling or Frozen

Engine)" for a forced landing, or to "Ejection," if engine failure necessitates ejection.

LOW-ALTITUDE AIR START.

The altitude and/or airspeed at time of flame-out, plus pilot proficiency and experience, will dictate whether a low-altitude air start, ejection, or forced landing will be performed. The low-altitude air start procedure should be accomplished immediately after the flame-out, even to the extent of overspeeding or overheating the engine. If flame-out occurs with sufficient airspeed available (300 knots IAS or more), the airplane should be pulled up (zoom-up) to exchange airspeed for altitude while the low-altitude air start procedure is being initiated. The following air start procedure is to be used if flame-out occurs at 5000 feet or less above the terrain.

1. Throttle—Retard to mid-quadrant range.
2. Air start switch—AIR START (up).
3. Emergency fuel switch—ON.
4. Throttle—Advance to desired thrust position.

If restart does not occur immediately, as evidenced by an increase in exhaust gas temperature and engine rpm, prepare for an ejection or forced landing.

MAXIMUM GLIDE.

For maximum glide distance, the optimum gliding speed is 185 knots IAS (200 knots IAS on Group 4 airplanes and those changed by T.O.) with gear and flaps up, 160 knots IAS with gear down, and 140 knots IAS with gear and flaps down. These speeds apply with speed brakes closed and no external load. (See figure 3-2.)

EJECTION VS FORCED LANDING.

Normally, ejection is the best course of action with a windmilling or frozen engine, or failure of both 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 predetermined 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, before ejection, if possible, the pilot should 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. Before a decision is made to attempt a flame-out landing, the following basic conditions should exist.

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

b. Flame-out landings should only be attempted 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, the pilot should 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 only be attempted 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 (WINDMILLING OR FROZEN ENGINE).

If engine failure during flight necessitates a forced landing, a maximum gliding distance can be obtained by establishing a glide of 185 knots IAS (200 knots IAS on Group 4 airplanes and those changed by T.O.), with landing gear and wing flaps up, speed brakes closed.

Note

Braking action is difficult to feel between normal recommended touchdown airspeed of 120 knots IAS and when decelerating to 100 knots

ENGINE AIR START PROCEDURE

1 Throttle—**CLOSED**

To prevent flooding the engine with fuel.

2 Emergency fuel system switch—**ON**

The electronic engine control is inoperative with air start switch in ***AIR START*** (up).

3 Variable nozzle switch—**CLOSE**

To aid in making an easier air start.

4 Air start switch—***AIR START*** (up)

To reduce electrical load, providing maximum battery life.

WARNING

When air start switch is on ***AIR START*** (up) position, equipment powered by these busses is inoperative:

SECONDARY BUS
MONITORED NO. 1 BUS
MONITORED NO. 2 BUS
MONITORED NO. 3 BUS
A-C BUS
WHICH INCLUDES
RADAR EQUIPMENT
RADIO EQUIPMENT
WING FLAP CONTROL
ELECTRONIC ENGINE CONTROLS

CAUTION

With air start switch at ***AIR START*** (up), do not move the battery-starter switch out of ***BATTERY***, as a complete loss of fuel pump and ignition power could result.

Hold airplane as level as possible for at least 5 seconds to drain any fuel that may have accumulated in the engine. Attempt air start as soon as possible. However, starts are more readily obtainable below 40,000 feet.

5 Airplane—Hold level

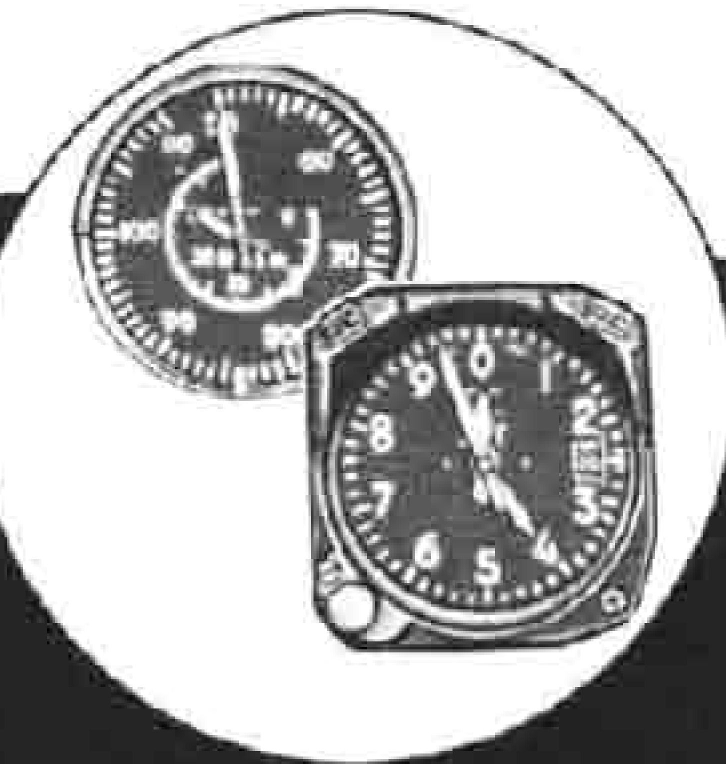
F-86K-1-73-6C

IAS. Maximum braking technique should be used immediately after touchdown by rapid on-off applications on brake pedals (about one second on, one second off), this pressure being applied very lightly at higher indicated airspeeds, with heavier pressure being applied as the airplane decelerates under 100 knots IAS. With the utility hydraulic system pressure low or inoperative, brake boost pressures drop with continued brake application. Braking action is still possible, but pedal pressures are extremely high.

The procedure outlined in figure 3-3 is recommended for a forced landing.

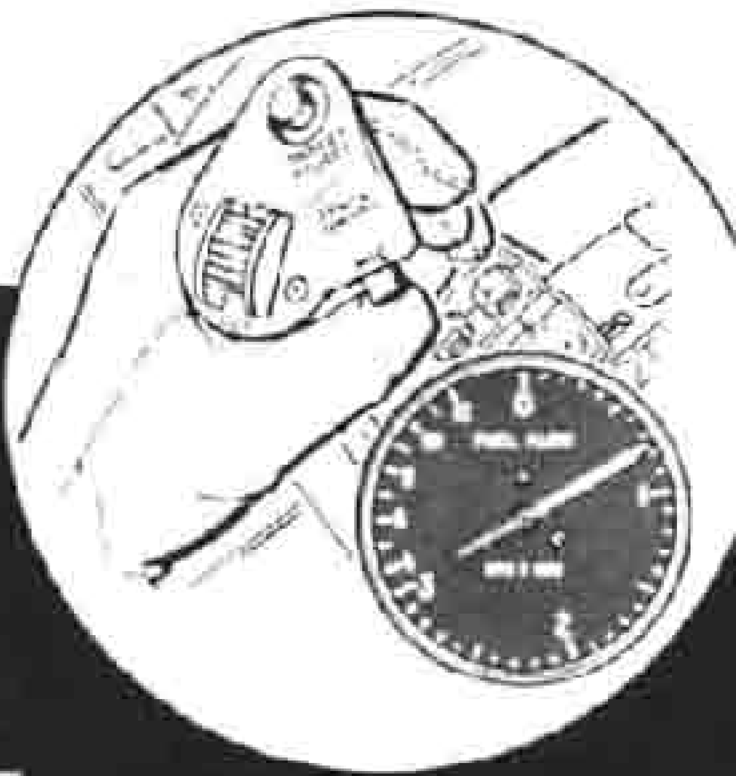
SIMULATED FORCED LANDING.

The normal concept of retarding the throttle to idle to practice flame-out forced landings does not apply to jet airplanes. With the throttle at START IDLE, the engine produces about 400 pounds of thrust, whereas a flame-out and windmilling engine creates drag. Thus, with the engine at idle power, the rate of descent would be less



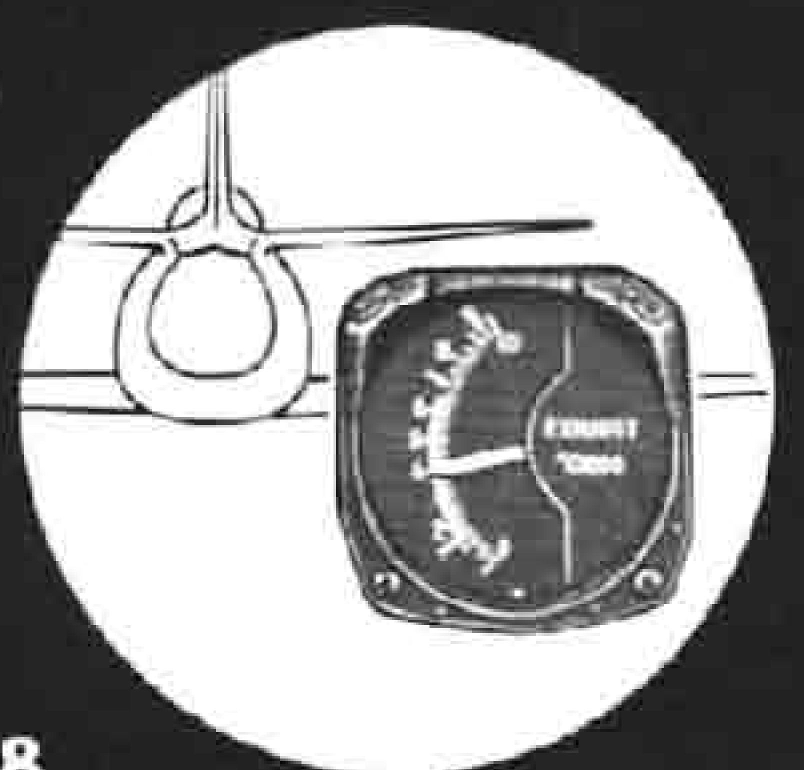
6

Engine speed—20% to 40% rpm, engine windmilling.
Restart at 40,000 feet or below.



7

Throttle—Adjust.
Fuel flow of 250 pounds per hour (at high altitudes) to 750 pounds per hour (at low altitude).

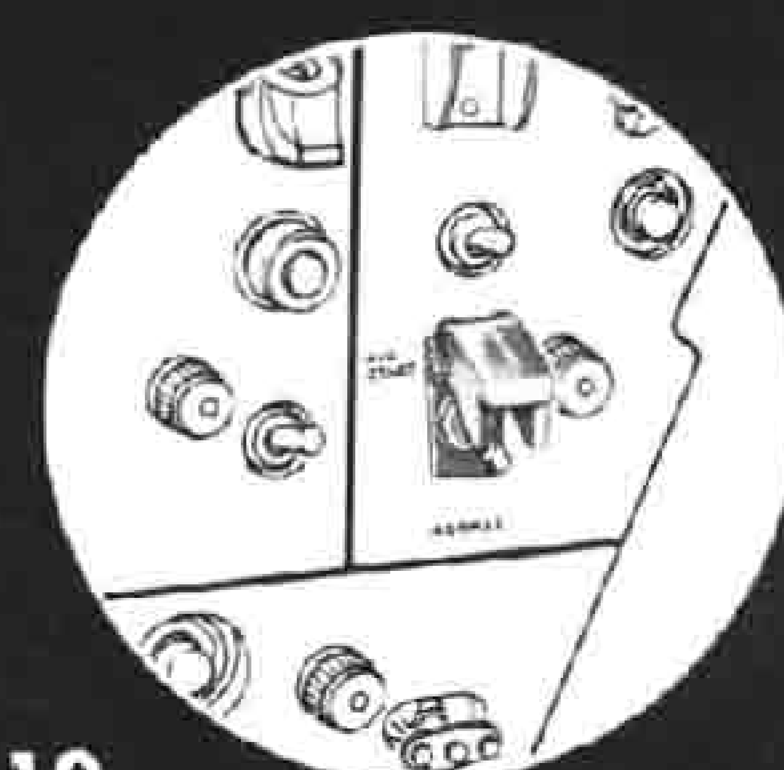


8

Exhaust temperature—Regulate throttle to maintain about 400°C.
Very cautiously regulate throttle until engine speed stabilizes.

9

Throttle—Advance to desired power setting.
Keep exhaust temperature below 750°C.

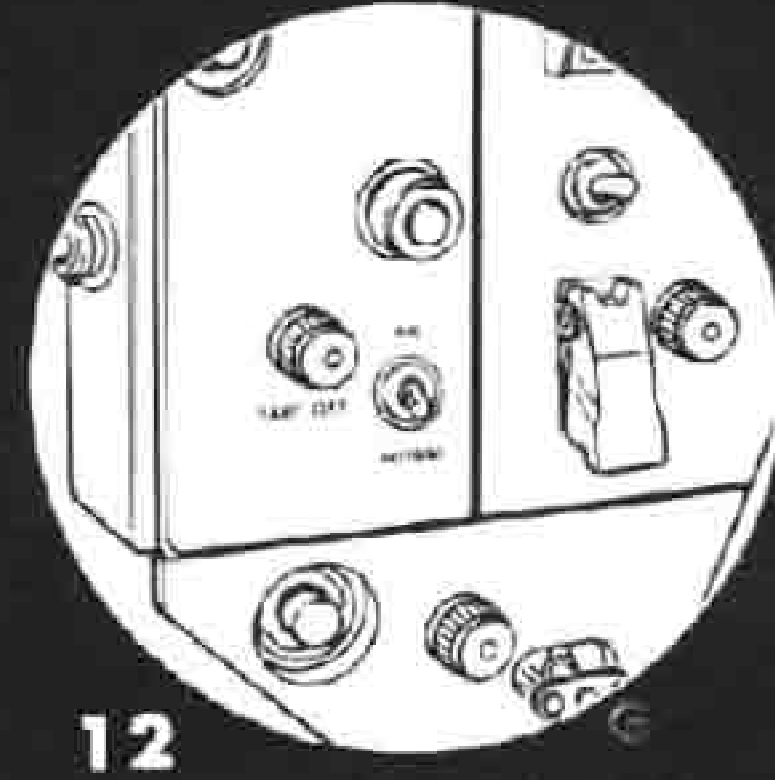


10

Air start switch—*NORMAL* after reaching 37% rpm or above, so that generators are again operating.

11

Variable-nozzle switch—*AUTO*.
After lockup, caution light is extinguished.



12

Emergency fuel switch—*NORM*.

CAUTION

If a sufficient warm-up period is not allowed before the emergency fuel system switch is moved to ***NORM***, another flame-out may result. However, if main fuel system failure is suspected, leave emergency fuel system switch at ***ON*** and land as soon as practical.

FY-43

F-86K-1-73-7C

Figure 3-1

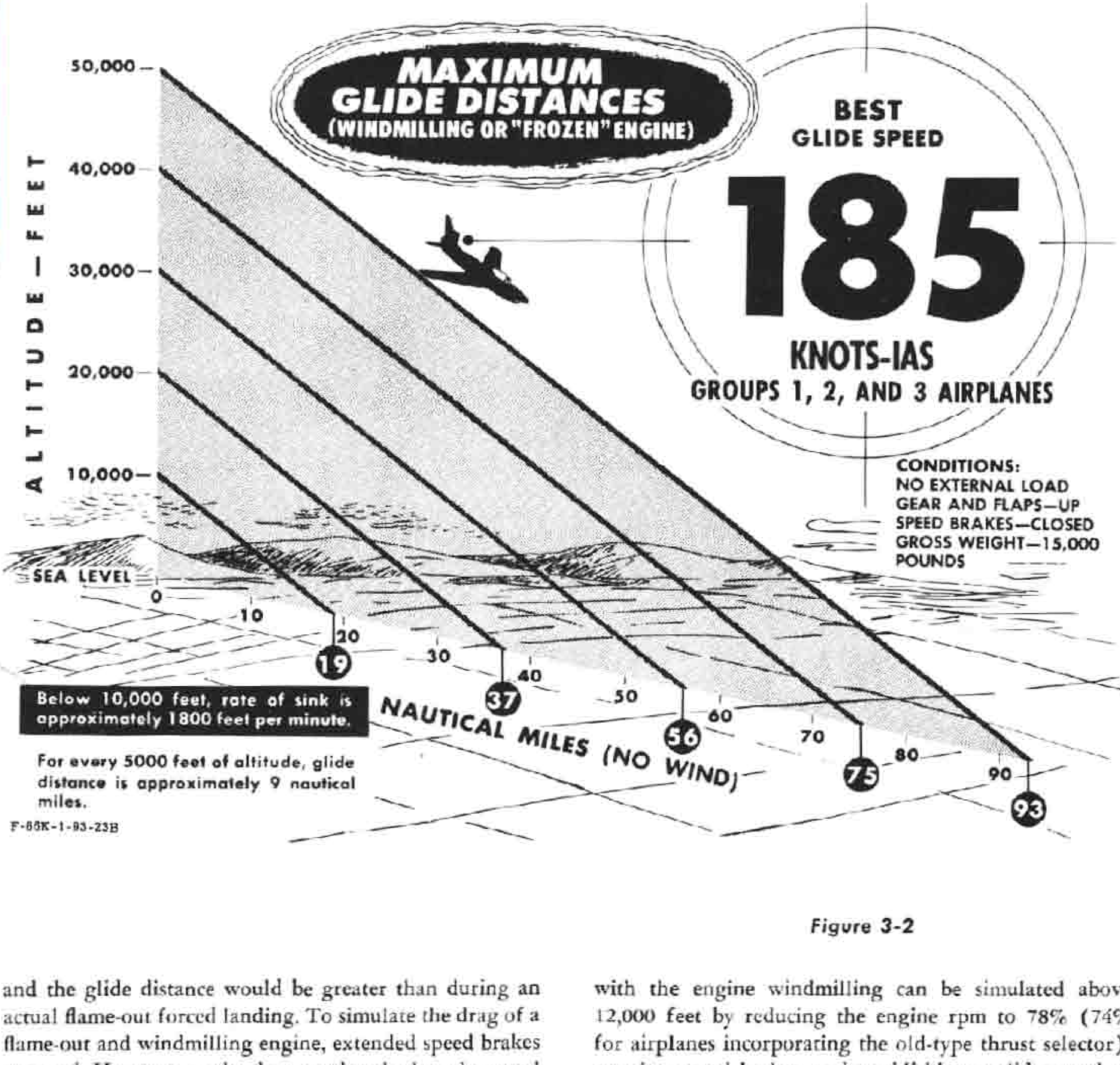
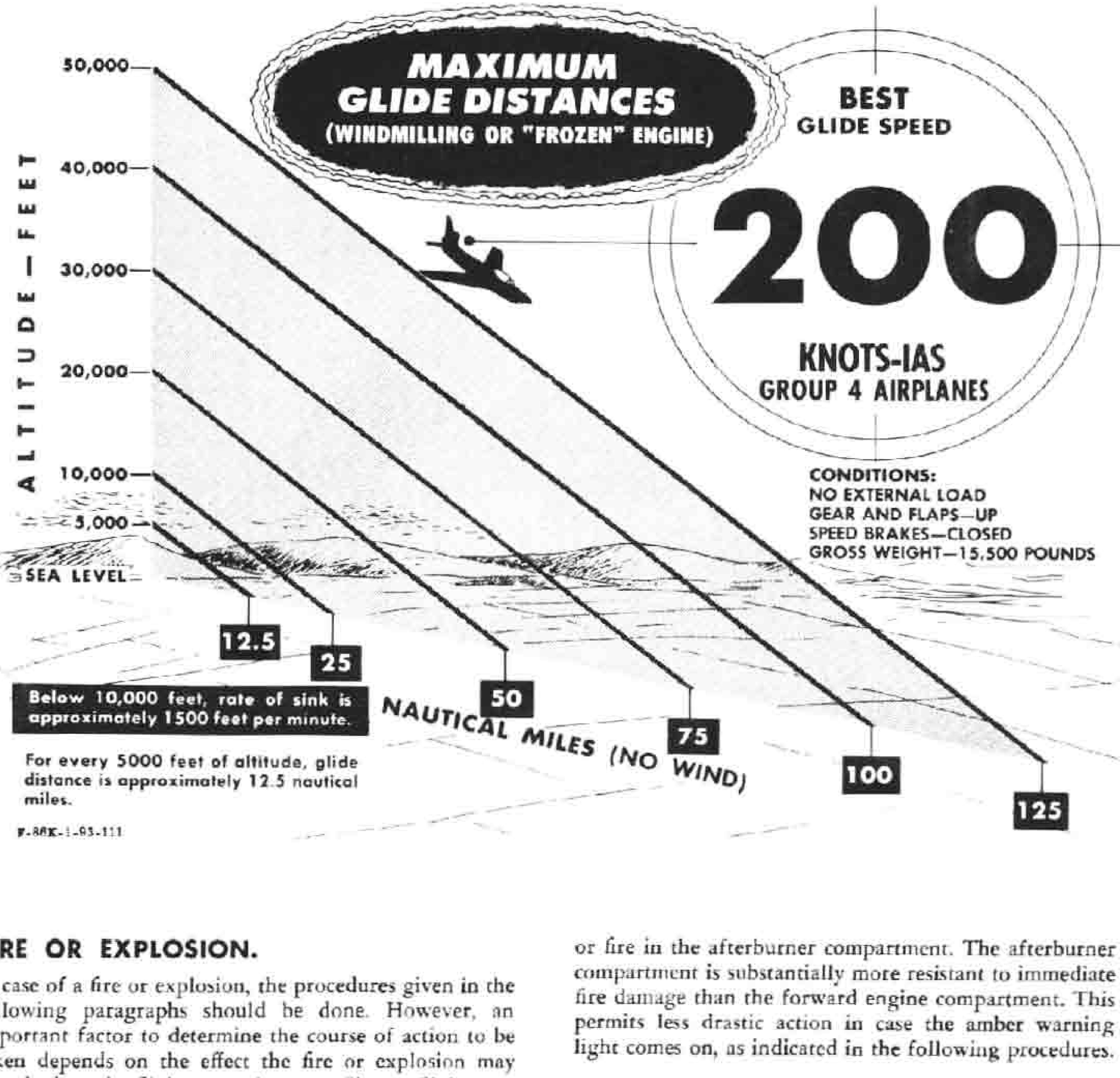


Figure 3-2

and the glide distance would be greater than during an actual flame-out forced landing. To simulate the drag of a flame-out and windmilling engine, extended speed brakes are used. However, as the drag produced when the speed brakes are extended is greater than that of a windmilling engine, certain engine power has to be maintained. In the final approach, under actual forced landing conditions, it may be desired to extend speed brakes to prevent possible overshooting. This increased drag effect of speed brake extension can be simulated during a practice forced landing by removing engine power by retarding throttle to START IDLE. As the idling engine still produces some thrust, touchdown will be slightly farther down the runway than during an actual flame-out landing. Familiarization with forced-landing techniques and procedures, as shown in figure 3-3, can be attained by accurately practicing forced landings, using the recommended engine power (established by extensive flight tests) and extended speed brakes to simulate a flame-out engine condition. Rate of descent, glide distance, and flight characteristics with the engine windmilling can be simulated above 12,000 feet by reducing the engine rpm to 78% (74% for airplanes incorporating the old-type thrust selector), opening speed brakes, and establishing a glide speed of 185 knots IAS (200 knots IAS on Group 4 airplanes and those changed by T.O.). Landing gear should be lowered at 12,000 feet, and a glide speed of 170 knots IAS initiated, still using the same rpm setting. If approach during practice forced landing is not as desired, make a normal go-around and repeat forced landing until desired efficiency is attained. If the engine seizes (rotor locked), the airplane characteristics in actual forced landings are not noticeably changed. Actually, the drag of the airplane with the engine rotor locked is slightly less than with a windmilling engine. Although the decreased drag results in a decreased rate of descent, the difference will not be easily discerned. Thus, the techniques developed for forced landings with a windmilling engine are also applicable for forced landings with an engine in the rotor-locked condition.



FIRE OR EXPLOSION.

In case of a fire or explosion, the procedures given in the following paragraphs should be done. However, an important factor to determine 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.

Note

This airplane is not equipped with a fire-extinguishing system.

FIRE-WARNING CIRCUITS.

The fire-warning system consists of two detector circuits, each circuit controlling a cockpit warning light. The forward circuit (a red indicating light) senses fire in the forward engine compartment and main wheel wells. The aft circuit (an amber indicating light) senses overheat or fire in the afterburner compartment. The afterburner compartment is substantially more resistant to immediate fire damage than the forward engine compartment. This permits less drastic action in case the amber warning light comes on, as indicated in the following procedures.

ENGINE FIRE DURING STARTING.

If there is indication of fire:

1. Throttle—CLOSED.
2. Engine master switch—OFF.
3. Keep engine turning.
4. If fire persists—Press stop-starter button.
5. Battery-starter and generator switches—OFF.
6. Leave airplane as quickly as possible.

ENGINE FIRE DURING TAKE-OFF.

Illumination of the forward fire-warning light during take-off shows a fire in the engine forward section, necessitating immediate action. The exact procedure to follow will vary with each set of circumstances, and will depend upon altitude, airspeed, length of runway and overrun clearance remaining, location of populated areas, etc. The decision you make will depend on these factors. To help you decide, the following procedures are presented for your information.

Forward Fire-warning Light (Ground Roll)

If the forward fire-warning light comes on during ground roll and sufficient runway or overrun area is available to allow for aborting the take-off, proceed as follows:

1. Throttle—CLOSED.
2. External load—Jettison.
3. Drag chute—Deploy if necessary.
4. Use maximum braking (if necessary).

5 and 6. (Deleted)

7. Abandon airplane immediately upon stopping, if fire is apparent.

Forward Fire-warning Light (Air-borne).

If the forward fire-warning light comes on after the airplane becomes air-borne, and sufficient runway is not available and overrun area is congested, preventing aborting of the take-off, the following is recommended if altitude is too low for a safe ejection.

1. External load—Jettison.
2. Throttle—Maintain power.

   Maintain take-off power and begin immediate climb.

3. Maximum climb.

   Immediately climb to safe ejection altitude.

4. Throttle—Adjust to minimum practical power.

   Adjust throttle to minimum practical power to maintain safe ejection altitude.

5. Check for fire.

   Determine whether a fire actually exists by a report from another airplane, abnormal instrument readings, 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 is confirmed—Eject.

WARNING

Whenever existence of fire is confirmed, prompt ejection will ensure greatest chance for survival.

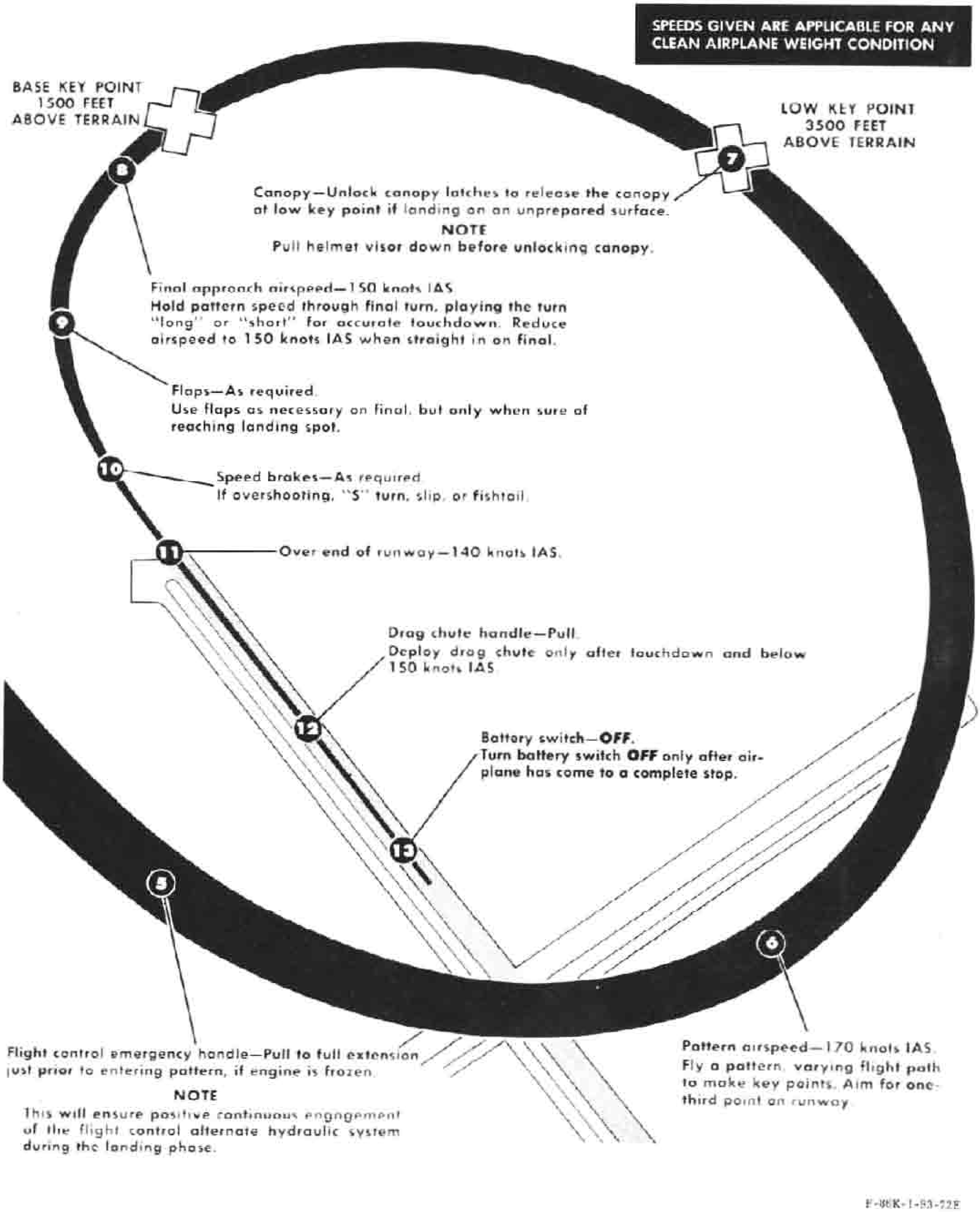

SPEEDS GIVEN ARE APPLICABLE FOR ANY CLEAN AIRPLANE WEIGHT CONDITION
BASE KEY POINT 1500 FEET ABOVE TERRAIN
LOW KEY POINT 3500 FEET ABOVE TERRAIN
7
Canopy—Unlock canopy latches to release the canopy at low key point if landing on an unprepared surface.
NOTE
Pull helmet visor down before unlocking canopy.
8
Final approach airspeed—150 knots IAS.
Hold pattern speed through final turn, playing the turn "long" or "short" for accurate touchdown. Reduce airspeed to 150 knots IAS when straight in on final.
9
Flaps—As required.
Use flaps as necessary on final, but only when sure of reaching landing spot.
10
Speed brakes—As required.
If overshooting, "S" turn, slip, or fishtail.
11
Over end of runway—140 knots IAS.
12
Drag chute handle—Pull.
Deploy drag chute only after touchdown and below 150 knots IAS.
13
Battery switch—OFF.
Turn battery switch OFF only after airplane has come to a complete stop.
5
Flight control emergency handle—Pull to full extension just prior to entering pattern, if engine is frozen.
NOTE
This will ensure positive continuous engagement of the flight control alternate hydraulic system during the landing phase.
6
Pattern airspeed—170 knots IAS.
Fly a pattern, varying flight path to make key points. Aim for one-third point on runway.
F-86K-1-93-72E

Figure 3-3

7. 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 power. Establish controllability of airplane and try to obtain assistance from other airplanes 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.

Aft Fire-warning Light (Ground Roll).

If the aft fire-warning light comes on during ground roll, and sufficient runway and overrun area is available to abort the take-off, proceed as follows:

1. Throttle—CLOSED.
2. External load—Jettison.
3. Use maximum braking (if necessary).
4. Drag chute—Deploy if necessary.
5. Warning light—Check.

   a. If light remains on after stopping—Leave airplane immediately.

   b. If light goes out—Engine master switch—OFF; then battery-starter switch—OFF.

Aft Fire-warning Light (Air-borne).

If the aft fire-warning light comes on after becoming air-borne, and take-off cannot be safely aborted, proceed as follows:

1. Throttle—Reduce power.

   Retard throttle from AFTERBURNER range to MILITARY and continue climb-out.

2. Warning light—Check.

   a. If light goes out—Continue flight at reduced power and land as soon as possible.

      It is remotely possible that fire may have damaged the fire detector circuit. To test circuit, hold fire-warning system test switch at TEST. If the light comes on while the switch is at TEST, the circuit is still operative.

   b. If light stays on—Continue climb.

      With reduced power, maintain climb and check for other signs of fire, such as trailing smoke, long exhaust flame, etc.

3. Visual indications of fire—Check.

   a. If no fire is apparent—Continue flight at reduced power and land as soon as possible.

   b. If fire exists—Eject.

      If positive signs of fire exist, maintain power and immediately climb to a minimum safe ejection altitude, and eject. (See figure 3-4 for minimum safe ejection altitude.)

ENGINE FIRE DURING FLIGHT.

Forward Fire-warning Light.

If the forward fire-warning light comes on, proceed as follows:

1. Throttle—Adjust to minimum practical power.

   Adjust throttle to minimum practical power to maintain safe ejection altitude.

2. Check for fire.

   Determine whether a fire actually exists by a report from another airplane, abnormal instrument readings, 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 is confirmed—Eject.

WARNING

Whenever existence of fire is confirmed, prompt ejection will ensure greatest chance for survival.

4. 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 power. Establish controllability of airplane en route to nearest available base and try to obtain assistance from other airplanes 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.

Aft Fire-warning Light.

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

1. Warning light—Check.

   a. Reduce power in attempt to extinguish light.

   b. If light goes out—Continue flight at reduced power, and land as soon as practical.

      It is remotely possible that fire may have damaged the fire detector circuit. To test circuit, hold fire-warning system test switch at TEST. If the light comes on while the switch is at TEST, the circuit is still operative.

   c. If light remains on with throttle retarded to START IDLE, indicating possible fire rather than overheat—proceed to step 2.

2. Check for other indications of fire, such as trailing smoke, engine noise, verification from another airplane, etc.

a. If no fire is apparent—Continue flight at minimum power and land as soon as practical.

b. If positive indications of fire exist—Proceed to step 3.

3. Throttle—CLOSED.
4. Engine master switch—OFF.
5. If fire continues—Eject.
6. If fire ceases—Make forced landing or eject.

ENGINE FIRE AFTER SHUTDOWN.

If there are signs of a fire in the engine or tail pipe after shutdown:

1. External power connected to both receptacles.
2. Throttle—CLOSED.
3. Battery-starter switch—Momentarily at STARTER.
4. As starter is engaged—Audibly check that engine begins to turn, or note tachometer indication.
5. Engine rpm—Approximately 9% (one minute maximum).
6. Stop-starter button—Press.

ELECTRICAL FIRE.

Circuit breakers or fuses protect most of the electrical circuits, to minimize the probability of electrical fires. However, if an electrical fire does occur, proceed as follows:

1. Battery-starter and generator switches—OFF.
   The fuel booster and transfer pumps are inoperative when all electrical power is shut off and the possibility of an engine flame-out is greatly increased when these pumps become inoperative.

1A. Emergency fuel switch—ON.

CAUTION

If it becomes necessary to move the battery-starter and generator switches to OFF, the emergency fuel system will take over fuel control, regardless of the position of the emergency fuel system switch and without illuminating the emergency fuel system caution light. Thus, all later throttle movements must be made cautiously to prevent compressor stall or flame-out.

2. Land as soon as practical.

Note

Battery power will last from 25 to 28 minutes unless the flight control normal hydraulic system goes out. If the flight control alternate hydraulic system must be used, battery power will last only about 20 minutes and alternate hydraulic accumulator pressure should be conserved by minimum movement of control surfaces. Operation from bases with low prevailing outside temperatures will make loss of battery power even more rapid.

ELIMINATION OF SMOKE OR FUMES.

If smoke or fuel fumes enter the cockpit, proceed as follows:

Note

When necessary to depressurize cockpit at high altitude, first descend to 20,000 feet or less; then depressurize cockpit.

1. Oxygen regulator diluter lever—100% OXYGEN.
2. Oxygen regulator emergency toggle lever—EMERGENCY.
3. Manual ram-air valve—OPEN.
4. If preceding steps are not successful—Pull canopy handle.

Note

Pull helmet visor down before ejecting canopy.

EJECTION.

If the decision has been made to abandon the airplane in flight, escape should be made with the ejection seat. The basic ejection procedure is shown in figure 3-4. Connection requirements for the zero-delay parachute lanyard are shown in figure 3-5.

WARNING

If overwater ejection is made, remove oxygen mask before hitting water, to prevent sucking water into mask.

Note

Refer to "Ejection VS Forced Landing" in this section for additional information.

The following information should be observed, when ejection must be accomplished:

a. Under level-flight conditions, eject at least 2000 feet above the terrain if possible.

b. Eject at the lowest practical airspeed at which level flight can be maintained.

c. If recovery from a spin has not been completed by the time the airplane passes through 7000 feet above the terrain, or ejection must be accomplished during an uncontrollable dive, eject 7000 feet above the terrain, if possible.

d. If the airplane is not controllable, ejection must be accomplished at whatever speed exists, as this offers

EJECTION SEAT OPERATION

1

Figure 3-4

the only opportunity of survival. At sea level, wind blast will exert minor forces on the body up to about 525 knots IAS, appreciable forces from about 525 to 600 knots IAS, and excessive forces above about 600 knots IAS. As altitude is increased, these speed ranges will be proportionately slightly lower.

e. The automatic safety belt must not be opened manually before ejection, regardless of altitude, for several reasons. If the automatic seat belt is opened manually, the automatic-opening feature of the parachute is eliminated and seat separations will be too rapid at high speeds.

LOW-ALTITUDE EJECTION.

The following are emergency minimum ejection altitudes, based on use of the BA-15 or B-18 parachute in level flight:

Zero-delay lanyard connected—100 feet above the terrain.

2

IF CANOPY FAILS TO JETTISON

SQUEEZE EITHER TRIGGER TO EJECT SEAT THROUGH CANOPY.

IF TIME AND CONDITIONS PERMIT BEFORE EJECTION,

Steps 1 and 2 are all that are necessary for ejection. If time and conditions permit, do as much of the following as possible.

- Stow all loose equipment.
- Actuate bail-out bottle.
- Stopcock throttle.
- Lower helmet visor.
- Brace for ejection:
  - Heels hooked firmly in footrests.
  - Arms braced in armrests.
  - Body erect.
  - Head hard against headrest.

AFTER EJECTION

- Immediately after ejection, attempt to manually open the safety belt, as a precaution against the belt failing to open automatically.
- As soon as the belt releases, a determined effort must be made to separate from the seat. This will result in maximum terrain clearance and maximum available time for parachute deployment. This is extremely important for low-altitude ejections.
- If the safety belt has been opened manually during ejections above 14,000 feet, immediately pull parachute arming lanyard to permit automatic opening of the parachute at the preset altitude.
- Manually pull the parachute ripcord handle for all ejections below 14,000 feet.

F-86K-1-73-4F

Zero-delay lanyard not connected—200 feet above the terrain.

WARNING

Emergency minimum ejection altitudes quoted were determined through extensive flight tests and are based on distance above terrain on initiation of seat ejection (i.e., time seat is fired). These figures do not provide any safety factor for such matters as equipment malfunction, delays in separating from the seat, etc. These figures are quoted only to show the minimum altitude that must be achieved in the event of such low-altitude emergencies as fire on take-off. They must not be used as the basis for delaying ejection when above 2000 feet, since accident statistics show a progressive decrease in successful ejections as altitude decreases below 2000 feet. Therefore, whenever possible, eject above 2000 feet.

During any low-altitude ejection (below 2000 feet above the terrain), the chances for successful ejection can be greatly increased by zooming the airplane (if airspeed permits) to exchange airspeed for altitude. Ejection should be accomplished while the airplane is in a positive climb. This will result in a more nearly vertical trajectory for the seat and pilot, thus providing more altitude and time for seat separation and parachute deployment. (Refer to "Engine Failure During Flight at Low Altitude" in this section for information on the zoom-up maneuver.)

(Deleted)

FAILURE OF SEAT TO EJECT.

If the seat does not eject when the triggers are squeezed, proceed as follows:

1. Speed brakes—Closed.
2. Safety belt—Unfasten.
3. Bail-out bottle—Actuate, if necessary.
4. Personal leads (oxygen, radio, and anti-G suit)—Disconnect.
5. Invert airplane and then push free of seat, or bail out over the right side (to avoid hitting the fuel vent bayonet).

If you have control of the airplane, trim nose down and pull stick back to slow airplane as much as possible; then invert airplane. Maintain positive G-load until inverted; then sharply release stick and push free of seat. If you do not have control of the airplane, slow airplane as much as possible, then bail out over the right side.

6. Parachute—Arming lanyard (automatic parachute), or "D" ring (manual parachute)—Pull.

WARNING

If bail-out occurs below 14,000 feet, pull "D" ring immediately whether parachute is automatic or manual type.

Note

If you lose your oxygen mask and you do not have an automatic parachute, you should "free-fall" to 14,000 feet if possible, then pull "D" ring. The length of time you can "free-fall" before anoxia prevents you from pulling the "D" ring depends on your physical condition and bail-out altitude.

TAKE-OFF AND LANDING EMERGENCIES.

ENGAGING RUNWAY OVERRUN BARRIER.

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.

Note

Barrier engagement is unlikely with the GAR-8 missiles or empty missile launchers installed.

In this airplane, successful engagements have been made with the nylon net runway overrun barrier up to 130 knots ground speed. The speed range where drop tanks are beneficial to engagement of the runway overrun barrier is extremely small (40 to 60 knots). In an emergency, it is impractical to retain the drop tanks and attempt to control the airplane speed for barrier engagement within this speed range. Therefore, when engagement of the runway overrun barrier is imminent, jettison the drop tanks. If the runway overrun barrier is to be engaged, engage it as close to the center of the barrier as possible. Off-center engagements can be made successfully, but the airplane swerves as a result of the webbing pulling unevenly on the nose wheel. If for any reason you are unable to bring the airplane to a stop or to a safe taxiing speed after a landing before reaching the end of the runway, and if the runway is equipped with a nylon net overrun barrier, do the following:

1. Drop tanks—Jettison.

WARNING

Make decision to jettison drop tanks as early as posible, to ensure greatest possible separation of tanks and airplane and to minimize possibility of tanks sliding ahead of the airplane and prematurely tripping the barrier. In case of emergency, jettison external load over an open area.

1A. Drag chute—Deploy.
2. Throttle—CLOSED.
3. Aim for center of barrier and contact barrier as close to 90 degrees as possible.
4. Brakes—Avoid excessive use during engagement to barrier, to prevent tire blowouts and subsequent loss of directional control of airplane.

5. Engine master, generator, and battery-starter switches —OFF.
6. Engage barrier.

CAUTION

Do not turn battery switch off until engine master switch has been turned off, so that power will be available to close fuel shutoff valve.

BELLY LANDING.

If a belly landing is unavoidable, and if time and terrain will allow, fire out all ammunition and expend excess fuel. (This will lighten the landing load, establish an aft CG condition, and minimize the danger of explosion or fire after landing.) Proceed as follows:

1. Canopy—Unlock.

   Unlock latches manually after turning final to allow airstream to break canopy away from fuselage.

   Note

   Pull helmet visor down before unlocking canopy.

WARNING

- The canopy should be released before landing, to prevent the possibility of being trapped in the cockpit if the fuselage warps and the canopy jams in the closed position.
- Jettisoning the canopy after a belly landing during which the fuel tanks have ruptured can cause spilled fuel to ignite.

2. Drop tanks—Jettison if they contain fuel.

WARNING

Empty drop tanks should be retained to reduce possible pilot injury, impact damage, and fire hazard.

3. Make normal approach.
4. Wing flap handle—DOWN, for final approach.
5. Speed brake switch—OUT.
6. Landing gear handle—UP.
7. Throttle—CLOSED, when landing is ensured.
8. Engine master, generator, and battery-starter switches OFF.

   Just before touchdown, turn engine master, generator, and battery-starter switches OFF. Battery-starter switch should be turned off last, so that power is available to close the fuel shutoff valve when the engine master switch is turned OFF.

9. Shoulder harness lock handle—LOCKED.
10. Touch down in normal landing attitude.
11. Drag chute—Deploy immediately after touchdown.

WARNING

If drag chute is deployed at speeds in excess of approximately 160 knots IAS, it automatically jettisons.

Note

Flight tests have shown that a properly packed chute has the least compartment pull-out resistance and deploys at speeds as low as 60 knots IAS in about 4 seconds. However, to ensure consistent and proper operations, it is recommended that the chute be deployed above 75 knots IAS.

12. Leave airplane immediately after it stops.

ZERO-SECOND LANYARD CONNECTION REQUIREMENTS

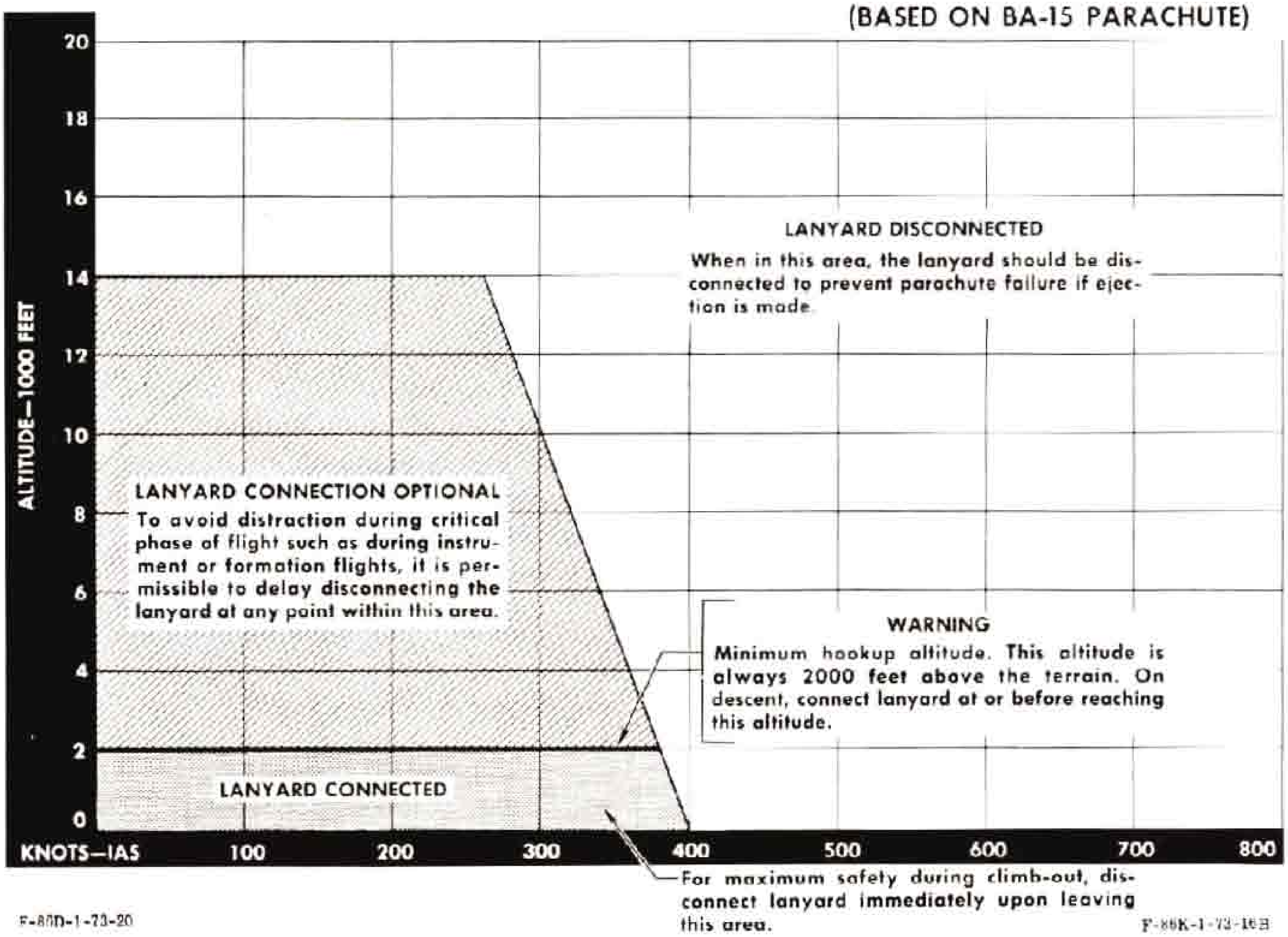


Figure 3-5

LANDING GEAR UNSAFE INDICATIONS.

If an unsafe gear-down indication still exists after the emergency lowering procedure (figure 3-7) has been accomplished, attempt to obtain from the tower or chase plane a positive confirmation of the gear condition. Either of two courses of action should be followed, depending upon the gear condition. If an unsafe main gear condition is *positively* confirmed, follow the procedures under "Main Gear-up Landing (Prepared Surfaces Only)." If no positive confirmation can be obtained, then follow the procedure given under "Any One Gear Up or Unlocked."

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 landing on only one main and nose gear. This should not be done unless the tower or chase plane can *positively* confirm that one or both main gear 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 should be used. 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 using the emergency lowering procedure, the following procedure should be used:

1. Landing gear handle—UP.
   Retract main gear so that landing can be made on nose gear and aft fuselage (or empty drop tanks).
2. Canopy—Unlocked.
   Unlock latches manually after turning final approach to allow air stream to break canopy away from fuselage.

Note

Pull helmet visor down before unlocking canopy.

WARNING

- The canopy should be released before landing to prevent the possibility of being trapped in the cockpit if the fuselage warps and the canopy jams in the closed position.
- Jettisoning the canopy after a landing during which the fuel tanks have ruptured can cause spilled fuel to ignite from a hot powder spark when the canopy catapult is actuated.

3. Rocket package—Jettison if loaded; retain if empty.
4. Drop tanks—Jettison if they contain fuel.

WARNING

Empty drop tanks should be retained to reduce possible pilot injury, impact damage, and fire hazard.

5. Plan approach to touch down as near end of runway as possible.
6. Wing flap handle—DOWN on final approach.
7. Speed brake switch—OUT.
8. Throttle—CLOSED just before touchdown.
9. Engine master switch—OFF.
10. Battery switch—OFF.
    Wait one second to allow fuel shutoff valve to close; then move battery switch to OFF.
11. Generator switches—OFF.
12. Shoulder harness lock handle—LOCKED.
13. Touchdown—Attempt to touch down on nose gear and aft fuselage simultaneously.
14. Drag chute—Deploy immediately after touchdown.

Note

The drag chute is designed to jettison automatically at speeds above approximately 160 knots IAS.

15. Leave airplane immediately after stopping.

ANY ONE GEAR UP OR UNLOCKED.

If any one gear will not extend or lock down, leave remaining gear down and proceed as follows:

1. Canopy—Unlock.
   Unlock latches manually after turning final approach to allow airstream to break canopy away from fuselage.

Note

Pull helmet visor down before unlocking canopy.

WARNING

- The canopy should be released before landing, to prevent the possibility of being trapped in the cockpit if the fuselage warps and the canopy jams in the closed position.

- Jettisoning the canopy after a belly landing during which the fuel tanks have ruptured can cause spilled fuel to ignite from a hot powder spark when the canopy catapult is actuated.

2. Ammunition—Expend.

   If time and terrain will allow, fire out all ammunition and expend excess fuel. This will lighten the landing load and establish an aft CG condition, and minimize the danger of explosion or fire after landing.

3. Drop tanks—Jettison if they contain fuel.

WARNING

Empty drop tanks should be retained to reduce possible pilot injury, impact damage, and fire hazard.

4. Plan approach to touch down as near end of runway as possible.
5. Wing flap handle—DOWN, on final approach.
6. Speed brake switch—OUT.

Note

If nose gear is down but not locked, you can attempt to snap it down and locked by making a touch-and-go landing. Attempt this procedure only after all other emergency measures have failed.

7. Throttle—CLOSED, just before touchdown.
8. Engine master switch—OFF.
9. Battery-starter switch—OFF.

   Wait one second to allow fuel shutoff valve to close, then move battery switch to OFF.

10. Generator switches—OFF, if time permits.
11. Shoulder harness lock handle—LOCKED.
12. After touchdown—Hold unsafe gear off runway as long as possible.

    After touchdown, hold unsafe gear off runway as long as possible, easing it down before flight controls become ineffective.

13. Drag chute—Deploy immediately after touchdown.

WARNING

If the chute is deployed at speeds above about 160 knots IAS, the chute automatically jettisons.

14. Brakes—Do not use if stop can be made without them.
15. Leave airplane immediately after stopping.

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.

TIRE FAILURE.

Tire failure on take-off may present more problems than a tire failure on landing. Directional control is more difficult at the higher gross weights during take-off abort; therefore, if speed is at or near take-off speed, continue take-off and burn fuel down before landing.

Nose Gear Tire Failure on Take-off.

If the nose gear tire fails during take-off run and if speed is too slow to continue take-off, the take-off should be aborted.

Note

- If nose gear tire failure occurs at or near nose wheel lift-off speed, the pilot may elect to continue the take-off to reduce the gross weight of the airplane. Control on the ground is much easier 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.

Nose Gear Tire Failure on Landing.

When a landing is to be made with the nose gear tire flat, lower landing gear in normal manner and proceed as follows:

1. Touchdown—Hold nose gear off runway as long as possible.
2. Drag chute—Deploy.
3. Nose wheel steering—Engage.
   After nose wheel touchdown, use combination of braking and nose wheel steering.

Main Gear Tire Failure on Take-off.

The following procedure is recommended when a main gear tire fails during the take-off run. The recommended technique applies to all gross weights and airplane configurations. Directional control of the airplane is naturally more difficult at the higher gross weights.

1. If speed is greater than 110 knots IAS—Jettison drop tanks and continue take-off.
2. If speed is less than 110 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 is suspected to have failed. Tire fragments may damage equipment in the wheel well.

CAUTION

- Avoid extreme rudder pedal deflections when nose wheel steering is engaged, since this may cause nose wheel to skid or skip sideways, and steering effectiveness will be lost.
- Deliberately blowing the good tire may not be helpful in keeping the airplane on the runway. 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.

Main Gear Tire Failure on Landing.

When a landing is to be made with a main gear tire flat, lower landing gear in normal manner and proceed as follows:

1. Touchdown—Land on side of runway away from flat tire.

   Note

   This is necessary to minimize the amount of differential braking required if the airplane pulls toward the flat tire.

2. Drag chute—Deploy.
3. Nose wheel steering—Engage.
   After nose wheel touchdown, use a combination of differential braking and nose wheel steering.

NO-FLAP LANDING.

No special technique is required for landing without wing flaps. Speed during final approach and touchdown should be increased 10 percent over recommended speeds for load and configuration.

LOSS OF CANOPY.

The flight characteristics with or without the canopy are the same. Stall speeds with or without the canopy are the same, and the stall warning of general airframe buffet remains unchanged. At about 5 to 10 knots IAS above stall, turbulence around the empennage causes a directional oscillation with accompanying roll. Without the canopy, the noise level caused from airflow over the open cockpit is extremely disturbing, but not considered dangerous. If the canopy should come off during the take-off roll and there is not enough runway remaining to abort the take-off, it is recommended that the take-off be completed. Use higher power settings and maintain normal approach speed during landing. The normal approach speed is 30 knots IAS above stall speed; however, it should be remembered that, if a landing is made immediately after take-off, the airplane weight will be higher than normal and therefore the approach and touchdown speeds will be higher. The stall speeds and the recommended approach and touchdown speeds for various conditions are shown in the appendix.

EMERGENCY ENTRANCE.

See figure 3-6.

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; therefore, there is no advantage in riding the airplane down. However, if altitude is not sufficient for emergency exit, and ditching is unavoidable, proceed as follows:

1. Follow radio distress procedure.
2. Jettison (salvo) button—Depress (or emergency jettison handle—Pull).

   Drop tanks must be jettisoned regardless of amount of fuel contained. The tanks cause the airplane to dive violently upon contact with the water.
3. Personal equipment—Disconnect.

   Check that leads will not foul when leaving cockpit (leave oxygen connected).
4. Oxygen regulator diluter lever—100% OXYGEN.

   Note

   In the event of ditching and sinking in water where you find yourself unable to immediately escape due to any number of factors, it is possible for you to survive under water with your oxygen equipment until you can free yourself and escape. The A-14 or A-13A pressure-demand type oxygen mask and the diluter-demand oxygen regulator is suitable for an underwater breathing device 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. The bail-out bottle cannot be used under water.
5. Landing gear handle—UP.
6. Speed brake switch—IN.
7. Canopy—Unlock.

   Allow airstream to carry canopy away.

   Note

   Pull helmet visor down before unlocking canopy.
8. Throttle—CLOSED.
9. Wing flap handle—DOWN.

   Flaps collapse on impact and do not tend to make airplane dive.
10. Engine master, generator, and battery-starter switches—OFF.

    Turn battery-starter switch OFF last, so that power will be available to close fuel shutoff valve when engine master switch is turned OFF.
11. Safety belt and shoulder harness—Tighten.
12. Shoulder harness lock handle—LOCKED.
13. Surface conditions—Check.

    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.
14. Approach and flare—Normal.
15. Touchdown—Keep nose high, and attempt to touch down at minimum flying speed.

    WARNING

    If airplane is ditched in a near-level attitude, it will dive violently soon after contact.
16. Oxygen mask—Remove.
17. Leave airplane.

DROP TANK EMERGENCY JETTISON IN FLIGHT.

To release drop tanks, depress drop tank jettison button on left instrument subpanel. The drop tanks can also be

EMERGENCY ENTRANCE

NOTE:
If canopy cannot be readily lifted off, emergency entrance must be made forcibly.

CANOPY EMERGENCY RELEASE

CANOPY HOOK RELEASE

1 Pull canopy emergency release handle to release canopy latches. Then, to complete canopy opening electrical circuit, close access door or hold switch depressed with finger while opening electrically by pushing external control button marked "OPEN." Hold button fully depressed until canopy is completely open.

2 If canopy will not open, lift canopy with handholds in canopy frame and remove canopy from airplane. It may be necessary to pull and hold extended (or secure in extended position) the canopy hook release in order to free canopy.

WARNING

When canopy has been jettisoned, the ejection seat is armed.

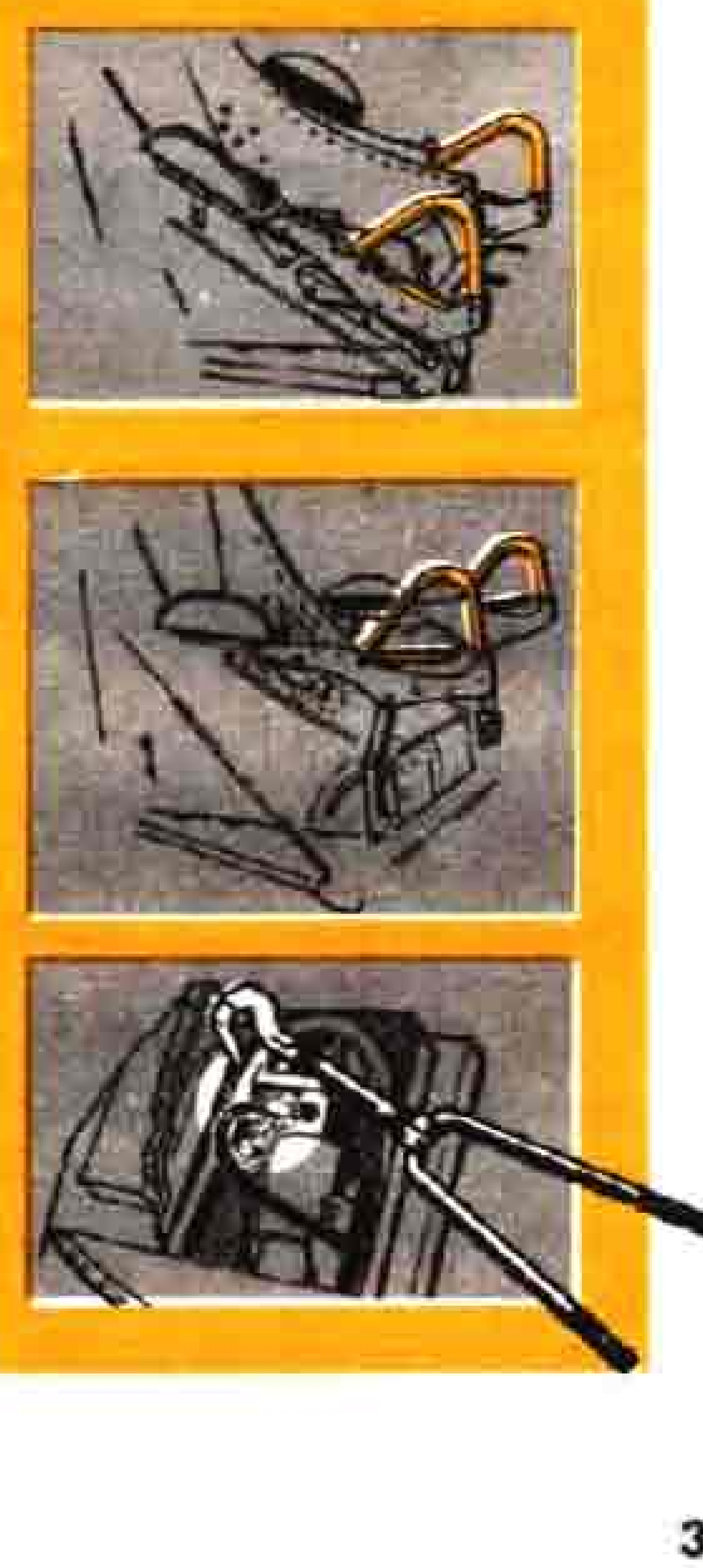
3 Determine position of seat armrests:
If both seat armrests are in normal down or stowed position, complete rescue operation, being sure to keep clear of armrests at all times.

WARNING

Avoid unnecessary handling of any portion of seat and canopy firing mechanisms at all times and stay clear of line of canopy ejection.

4 If either armrest is raised:
Disarm catapult by cutting or disconnecting* hose leading from seat catapult to "T" fitting on back of seat. Cut hose, using cutter as shown, as close to seat catapult as possible. Make sure loose hose ends are not aligned; otherwise, if seat initiators fire accidentally, expanding gases may still actuate catapult exactor and cause seat to fire.

*Use 9/16-inch open-end wrench.



F-86K-1-31-1C

Figure 3-6

the afterburner range, at which time the exhaust nozzle position is controlled directly by the engine thrust selector and all engine operation up to Military Thrust will be nearly normal. However, the exhaust gas temperature should be closely monitored, as it is possible to obtain a slight overtemperature in the full Military Thrust position. When this procedure is followed, the pilot will have maximum power (Military Thrust) and faster engine acceleration in the event of a go-around. Also during the landing roll phase, the exhaust nozzle will open (approximately one-half position) and minimum thrust is provided (400 pounds) which will require the least amount of braking. If nozzle closure is evident, proceed as follows:

1. Discontinue afterburner operation immediately. Do not relight afterburner at any time.
2. Retard throttle—Maintain exhaust temperature at 685°C maximum.
3. Land as soon as possible.

INADVERTENT NOZZLE OPENING.

There are certain critical phases of flight, such as during and immediately following take-off, when an inadvertent nozzle opening will require pilot action, the urgency of which will depend on conditions existing at the time of the emergency. If such a failure should occur before becoming committed to take-off, the take-off should be aborted. If nozzle opening should occur after becoming committed to take-off, maintain Maximum Thrust (or ac throttle to Maximum Thrust afterburner range) and climb until a safe altitude is reached. If the nozzle opening occurs when the throttle is retarded from the afterburner range to the Military Thrust position following take-off, proceed as follows:

1. Variable nozzle—Manually close to 1/4 position.
2. Throttle—Retain at Military Thrust position.

Note

If thrust (acceleration) is not considered adequate, it may be necessary to jettison drop tanks, if installed.

3. Variable nozzle—Adjust to maintain exhaust temperature at approximately 685°C.

Note

The primary concern is to maintain sufficient thrust to perform a subsequent landing; therefore, maintaining exact exhaust gas temperature within limits is of secondary importance.

4. Land as soon as possible.

OIL SYSTEM FAILURE.

In case of an oil system malfunction, causing either high or low oil pressure, possible oil starvation accompanied by failure of one or more of the main bearings may occur. If the engine rpm is reduced after oil starvation of one or more main bearings, it is possible that the resistance to rotation offered by a "failed" bearing will be great enough to cause further deceleration of the engine. Engine seizure would probably occur regardless of the fact that the throttle may be advanced after the engine has begun to decelerate. The engine may possibly operate for a longer period of time, with one or more "failed" main bearings, if the rpm is increased immediately after oil system malfunction is detected. In case of high or low oil pressure, the following procedures should be used.

1. If power setting is above 80% rpm, do not move throttle until landing is ensured.
2. If power setting is below 80% rpm, advance throttle until engine rpm is 80% or more, and do not move throttle until landing is ensured.
3. Land as soon as possible using recommended flameout landing pattern to ensure landing in case of complete power failure.

WARNING

- Retarding the throttle at any time during an oil system malfunction may result in engine seizure and subsequent forced landing.
- In case of an oil system malfunction, switching to the emergency fuel system is not recommended unless malfunction of the main fuel controller is detected. Switching fuel systems will generally cause momentary engine deceleration and possible engine seizure.

MAIN FUEL CONTROL SYSTEM FAILURE.

MAIN FUEL CONTROL SYSTEM FAILURE DURING TAKE-OFF.

Three-position Emergency Fuel System Switch.

On airplanes equipped with the three position emergency fuel system switch, take-off will be made with the switch in the TAKE-OFF position, thus putting the emergency fuel regulator in a stand-by condition. In the event of a main fuel regulator failure, there will be no indication except for a slight drop in rpm (4% to 10%) down to the emergency fuel system setting. If a slight rpm drop is detected during an early stage of take-off (before committed to take-off) and speed and distance permit, the take-off should be aborted. Refer to "Engine Failure During Take-off Run (No Runway Overrun Barrier)" in this section. If an rpm drop is detected after committed to a take-off, leave emergency fuel system switch at TAKE-OFF until safe altitude is reached, and then move switch to NORM. If any decrease in rpm then occurs, failure of the main fuel control system is the probable cause in which case the emergency fuel control system switch should be immediately moved to ON.

Two-position Emergency Fuel System Switch.

The emergency fuel system switch is in the NORM position for take-off, climb, and all normal operation. In this case, the emergency fuel regulator will not be in a "stand-by condition"; therefore, it will be necessary for the pilot to recognize a main fuel control system failure (shown by a drop in rpm and a decrease in exhaust temperature) and immediately move the emergency fuel switch to ON. In view of the different circumstances and conditions that may be encountered at time of failure, such as runway length, speed, field elevation, and stage of take-off at which failure occurs, the emergency procedures are prescribed in three phases:

- Main fuel system control failure before committed to take-off. Abort the take-off. Refer to "Engine Failure During Take-off Run (No Runway Overrun Barrier)" in this section.
- Main fuel system control failure after committed to take-off and before rpm drops below 85%. Position emergency fuel switch to ON and continue take-off.
- Main fuel system control failure after committed to take-off and rpm is inadvertently allowed to drop below 85% rpm. Refer to "Engine Failure During Take-off (Airplane Air-borne)" in this section.

MAIN FUEL CONTROL SYSTEM FAILURE DURING CLIMB.

Three-position Emergency Fuel System Switch.

On airplanes equipped with the three-position emergency fuel switch, a main fuel control system failure during climb will not be shown, except for a slight drop in rpm (4% to 10%) down to the emergency fuel system setting, when the emergency fuel system switch is at TAKE-OFF position. However, when the emergency fuel system switch is moved from TAKE-OFF to NORM (after a safe altitude is reached) any failure will be evidenced by rapid decrease in engine speed or by no response when throttle is retarded. If any decrease in rpm is evident, showing failure of the main fuel control system, immediately move switch to ON. If engine speed is inadvertently allow to drop below 85% rpm before the emergency fuel system switch is moved to ON position, the throttle should be retarded to START IDLE before the switch is placed ON to prevent an overtemperature condition. If failure occurs proceed as follows:

1. Emergency fuel system switch—ON (when a safe altitude is reached).
2. Throttle—Retard from AFTERBURNER to START IDLE.
3. Variable-nozzle switch—CLOSE, then OFF (only if nozzle fails to work automatically).

   If the automatic control of the nozzle does not work properly, the nozzle can be closed manually. If the nozzle works automatically, it will move toward a closed position as the throttle is moved from AFTERBURNER to START IDLE, even if the emergency fuel system is controlling the engine.
4. Throttle—Cautiously advance to MILITARY (avoid overtemperature condition).

Two-position Emergency Fuel System Switch.

It is necessary for the pilot to recognize a main fuel control system failure (shown by rpm drop and decrease in exhaust temperature) and immediately move the emergency fuel system control switch to ON. If engine speed in inadvertently allowed to drop below 85% rpm before the emergency fuel system switch is moved to the ON position, the throttle should be retarded to START IDLE before the switch is placed ON, to prevent an overtemperature condition. During take-off and climb to altitude, failure of the main fuel control system, which results in locking of the main fuel control valve, may not be detected until the lower fuel requirements of increased altitude produce a gradual increase in engine rpm or until the throttle is retarded after take-off and there is no response. When failure occurs, proceed as follows:

1. Emergency fuel system switch—ON (as soon as failure is detected).

CAUTION

If engine speed is allowed to drop below 85% rpm before switch is moved to the ON position, retard throttle to START IDLE; then move switch to ON. Cautiously readvance throttle to prevent an overtemperature condition.

2. Throttle—Retard rapidly from AFTERBURNER to START IDLE.
3. Variable-nozzle switch—CLOSE, then OFF (only if nozzle fails to close automatically).
4. Throttle—Cautiously advance to MILITARY (avoid overtemperature condition).

MAIN FUEL CONTROL SYSTEM FAILURE DURING FLIGHT.

WARNING

If the main fuel control system fails during flight, a landing must be made using the emergency fuel system. The throttle should not be retarded to START IDLE during a landing approach if the emergency fuel system is used, since the time required to accelerate the engine from speeds below 75% rpm may be too long if a go-around is necessary. Therefore, caution must be exercised to maintain the rpm at 75% or above when operating on the emergency fuel system during an approach.

Failure of the main fuel control system, with a resulting excessively open position of the main fuel control valve, will be evidenced by engine overspeeding to the overspeed governor setting and/or stalling. Should such a failure occur, the emergency fuel system switch should be moved immediately to ON. Sudden loss of fuel flow and any decrease in engine rpm during flight show failure of the main fuel control system (unless fuel starvation has occurred) and necessitate operation on the emergency fuel regulator. To recover power following failure of the main fuel control system:

1. Throttle—Retard to START IDLE (if rpm drops below 85%).
2. Emergency fuel system switch—ON.
3. Slowly readvance throttle.

CAUTION

When the emergency fuel system is in operation, throttle movement must be slow and smooth to avoid flame-out or engine overtemperature, particularly at high altitudes.

4. Variable nozzle—Jog to desired position.

   Return nozzle switch to OFF to lock nozzle in position.
5. If engine flame-out occurs before throttle is readvanced, attempt an air start. (Refer to "Engine Air Start.")

ELECTRICAL SYSTEM EMERGENCY OPERATION.

FAILURE OF ONE GENERATOR.

If a generator warning light comes on, showing that one generator has failed or has been disconnected because of overvoltage, equipment powered by the monitored bus No. 3, secondary inverter, alternator, and radar will be automatically shut off. Try to bring the generator back into the circuit as follows:

1. Voltmeter selector switch—Move to related generator position.
2. Momentarily hold related generator switch—RESET.
3. Generator switch—ON.

   If warning light remains out and voltmeter shows normal system voltage, it shows that the overvoltage was temporary.
4. If warning light comes on again, move generator switch to OFF.

FAILURE OF BOTH GENERATORS.

If both generator warning lights come on, indicating that both generators are out, equipment powered by monitored busses No. 2 and No. 3 and dc gyro power will be shut off. This will result in loss of power from the primary inverter to the ac bus.

CAUTION

The electronic engine control is inoperative when ac power is cut off. To provide subsequent engine control on the emergency fuel system, the emergency fuel system switch should be immediately placed to ON. All subsequent throttle movements must be made cautiously to prevent compressor stall or flame-out.

With ac power removed, the fuel flowmeter, fuel quantity, fuel pressure, oil pressure, and hydraulic pressure gages will be inoperative. These instruments, while inoperative, will deceptively continue to indicate the condition that existed at the time of power failure. Attempt to bring the generators back into the circuit as follows:

1. Emergency fuel system switch—ON.
2. All nonessential electrical equipment—OFF.

Note

Failure of both generators does not automatically turn off all nonessential equipment. In order to effectively prolong battery life, you must turn off equipment you don't absolutely need.

3. Voltmeter selector switch—Move to related generator position.
4. Momentarily hold related generator switch at—RESET.
5. If related warning light goes out—Make a single attempt to reset other generator.

CAUTION

Repeated attempts to reset the inoperative generator may result in disconnecting the operative generator. If this occurs, leave the inoperable generator switch OFF and again reset the operable generator.

6. When at least one generator is operating:

   a. Wait 2 minutes—Allow electronic engine control to warm up (lockup light out).

   b. Emergency fuel switch—NORMAL.

COMPLETE ELECTRICAL FAILURE.

In the event of complete electrical failure, or if it is necessary to turn off the battery and generator switches, the fuel booster and transfer pumps will be inoperative. Under these conditions it is possible to have an engine flame-out with as much as 1200 to 1700 pounds of fuel remaining, since fuel will be supplied to the engine by suction feed only. With the booster pumps in the center wing cell inoperative and the aft fuselage tank empty or nearly empty, air will be drawn through the suction feed valve in the aft fuselage tank. This will result in intermittent fuel flow and possibly cause a flame-out. Under some conditions such as extreme pitch attitudes, rapid airplane acceleration or deceleration, and/or high thrust settings, a flame-out is possible even with more fuel remaining.

If complete electrical failure occurs, if it is necessary to turn off battery and generator switches, or if fluctuations of rpm, fuel flow, or exhaust temperature occur, proceed as follows:

1. Reduce altitude and engine rpm to maintain satisfactory engine operation.
2. Land as soon as possible using forced landing pattern.

WARNING

Avoid extreme pitch attitudes and rapid airplane acceleration or deceleration to minimize the possibility of engine flame-out.

Note

Use landing gear emergency lowering system to ensure that gear lowers and locks. (Refer to "Landing Gear Emergency Lowering" in this section.) When electrical power is not available to the primary bus, the landing gear position indicators are inoperative and continuously show an unsafe condition.

INVERTER FAILURE (AUTOMATIC LOCKUP SYSTEM).

When failures of the main inverter or both inverters occur, such failures are shown by the inverter warning lights coming on. Should inverters fail while operating under electronic engine control, no manual emergency procedures are mandatory until power changes are required. The automatic lockup system automatically locks the electronic engine controls in position and illuminates the amber engine control lockup indicator light. (Refer to "Automatic Lockup System Characteristics" in Section VII.) Failure of the main inverter (with inverter selector switch at MAIN) causes both the "MAIN" and "BOTH" inverter failure warning lights to come on. The inverter selector switch must then be moved to SPARE; this will allow the secondary inverter to assume the load of the failed main inverter and extinguish the "BOTH" inverter failure warning light.

Inverter Failure During Take-off Roll (Continued Take-off).

If, during the take-off roll, the main inverter fails (shown by inverter failure warning light or lights coming on) and the engine controls automatically lock up (shown by the engine control lockup caution light coming on), and it is desired to continue the take-off in a locked-up condition, follow this procedure.

1. Continue take-off.
   Climb to a safe altitude, leaving throttle set at Maximum Thrust.
2. Inverter selector switch—SPARE.

Note

The engine controls will automatically unlock when ac power is restored (above about 98 volts) and the electronic engine control will then govern engine operation.

3. If lockup light does not go out within 30 seconds:
   a. Throttle—Rapidly retard to START IDLE.
   b. Emergency fuel switch—ON.
      Immediately switch to the emergency fuel system as the throttle is retarded to start IDLE.
   c. Variable nozzle—Jog closed.
   d. Throttle—Cautiously readvance to desired power setting.
4. Land as soon as practical.

Inverter Failure During Take-off Roll (Aborted Take-off).

During the take-off roll, if the main inverter fails (shown by inverter failure warning light or lights coming on) and the engine controls automatically lock up (shown by the engine control lockup caution light coming on), and it is desired to abort the take-off, perform the following:

1. Throttle—Rapidly retard to START IDLE.

Note

On airplanes with the three-position emergency fuel system switch, this action automatically converts engine control to the emergency fuel system by actuation of the 72-degree thrust selector switch. On airplanes with the two-position emergency fuel system switch, the

This page intentionally left blank

throttle has to be retarded with enough force to actuate the idle detent switch.

2. Brakes—Apply as necessary.
3. Drag chute—Deploy.

WARNING

- The heat generated in the brakes during an aborted take-off continues to build up during taxiing operation back to the take-off position. This heat is transmitted to the wheel and into the tire itself. This heat in the tire melts the rubber and weakens the cords until the casing blows out.
- After an aborted take-off, for any reason, the airplane must be taxied back to the line. Shut down engine. Make sure brake assembly is cool enough to touch by hand before flight.

4. Emergency fuel system switch—ON (before readvancing throttle).
5. Inverter selector switch—SPARE.
6. Throttle—Readvance as desired for taxiing.
   Keep in mind that all throttle movements must be made cautiously during operation on emergency fuel system.
7. Electronic engine control lockup—Removed.
   Engine control lockup caution light and inverter failure warning light or lights are no longer on.
8. Emergency fuel system switch—NORM.

Inverter Failure During Flight.

During flight, if the engine control lockup caution light comes on (showing that ac power has failed and the electronic engine control is in automatic lockup), maintain altitude and power settings. If conditions arise that require power readjustment before automatic unlocking of the engine electronic controls, it will be necessary to change to the emergency fuel system to restore engine control. The switch-over to the emergency fuel system is accomplished as follows:

1. Throttle—Rapidly retard to START IDLE.
   Immediately switch to the emergency fuel system as the throttle is retarded to START IDLE.
2. Emergency fuel system switch—ON.
3. Variable nozzle—Close to desired position.
   Return variable nozzle switch to OFF to lock nozzle in position.
4. Throttle—Advance cautiously to desired power setting.
5. Inverter selector switch—SPARE.

The inverter selector switch must be placed at SPARE before the lockup indicator light will go out. Placing the switch at SPARE selects the secondary inverter as the electronic engine control power source. When ac power is restored, the lockup system requires about 15 seconds to release the lockup condition. If automatic electronic engine control lockup occurs during approach or landing, position throttle at about mid-throttle position before moving emergency fuel system switch to ON.

LANDING GEAR EMERGENCY OPERATION.

(Deleted.)

LANDING GEAR IN-FLIGHT EMERGENCY RETRACTION.

During flight, the following condition may be encountered. The landing gear red unsafe warning light may remain on after landing gear handle is placed at UP. This does not necessarily constitute an emergency condition, but under certain conditions, air loads on the landing gear doors can prevent the gear from retracting. This would be shown by a safe "down" indication on all three gear, with the unsafe warning light on and the handle at UP. If such a condition occurs, proceed as follows:

1. Leave landing gear handle—UP.
2. Maintain straight flight path—Minimize G and eliminate yaw.
3. Reduce speed to below 185 knots IAS.
   155 to 160 knots IAS is recommended to minimize air loads on doors.
   a. If a safe indication is obtained—Continue flight.
   b. If unsafe condition still exists—Extend gear.
   c. When a safe gear-down indication is obtained—Return for landing.

   If mission is of importance, maintain straight flight path to minimize G and eliminate yaw, hold airspeed below 185 knots IAS (155 to 160 knots IAS is recommended), and cycle gear down and up. If unsafe warning light goes out, continue mission; if unsafe light remains on, extend gear and land as soon as practical.

LANDING GEAR EMERGENCY LOWERING.

If a safe landing gear down indication is not obtained after several attempts using the normal procedure, the landing gear emergency lowering procedure, as shown in figure 3-7, should be used. If, after using the emergency lowering procedure, an unsafe gear indication still exists on either or both main gear, pull the "LANDING GEAR CONTROL" circuit breaker and repeat the emergency lowering procedure, making sure to rock the wings and yaw the airplane so that the gear will swing free in an attempt to jolt the downlocks into the locked position.

Note

The nose gear will not retract if the landing gear has been lowered by means of the emergency lowering system.

FLIGHT CONTROL HYDRAULIC SYSTEM FAILURE.

If flight control normal hydraulic system pressure drops below about 650 psi, the flight control alternate system is automatically engaged if alternate system pressure is available. The alternate system will supply pressure for all normal flight requirements.

WARNING

In case of failure of the flight control normal hydraulic system, do not fly close formation, perform aerobatics, or engage in unnecessary low-altitude flying. Do not attempt to reset to normal system even if pressure builds back up to operating range.

If the flight control normal system fails, use the following procedure:

1. Flight control alternate system indicator light on—Check.
2. Hydraulic pressure gage selector switch—ALTERNATE FLIGHT CONT.

   Constantly check alternate system pressure.
3. Do not prolong flight; land as soon as practical.
4. Flight control emergency handle—Pull.

   a. Before entering traffic pattern—Pull handle.

   Note

   This will ensure positive continuous engagement of flight control alternate hydraulic system during the landing phase.

   b. If automatic transfer to flight control alternate system does not occur—Pull handle.

CAUTION

Pull emergency handle only if automatic transfer to alternate system does not occur; otherwise, the alternate system pump will operate continuously and drain the battery power (if generators are inoperative).

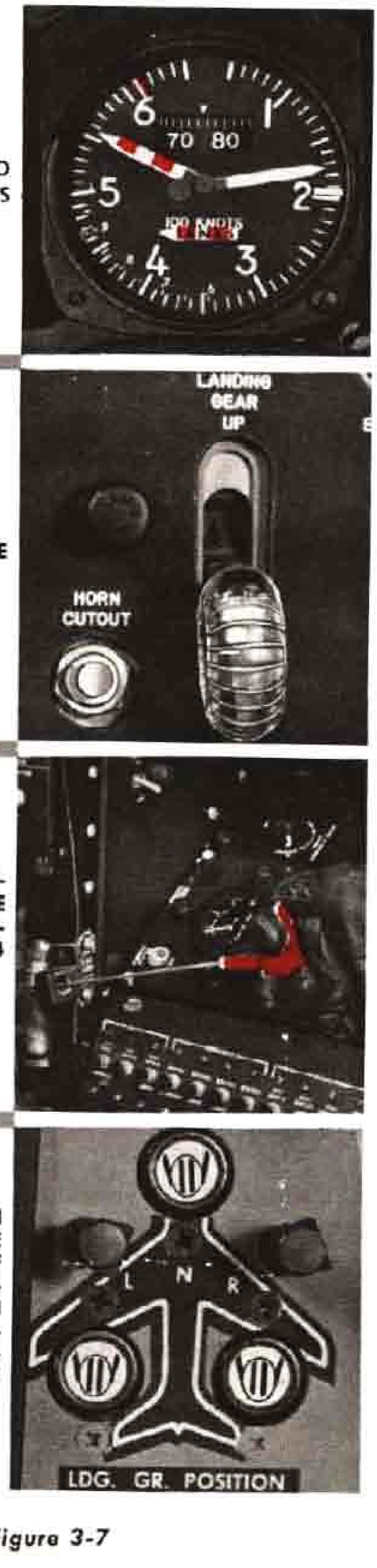
LANDING GEAR EMERGENCY LOWERING

1 REDUCE AIRSPEED TO LESS THAN 175 KNOTS IAS.

2 LANDING GEAR HANDLE *DOWN.*

3 LANDING GEAR EMERGENCY RELEASE HANDLE FULLY EXTENDED, APPROXIMATELY 14 INCHES, AND HOLD.

4 CHECK GEAR POSITION INDICATOR FOR SAFE GEAR INDICATION. IF NECESSARY, YAW AIRPLANE TO LOCK MAIN GEAR. RELEASE EMERGENCY RELEASE HANDLE. CHECK GEAR UNSAFE WARNING LIGHT OUT.



F-86K-1-33-1B

Figure 3-7

WARNING

If the flight control normal and alternate hydraulic systems fail, movement of the control stick will not cause corresponding surface movement, except to allow the surface to streamline under air loads. Reduce airspeed to about 200 knots IAS and try to maintain control by varying power settings and applying steady push and pull forces on stick, allowing air loads to streamline control surfaces. If control cannot be maintained, eject. If some control is possible, however, and if altitude permits, try to recover and return to a suitable area; then eject, because landing with these high stick forces should not be attempted under any circumstances.

FLIGHT CONTROL ARTIFICIAL-FEEL SYSTEM FAILURE.

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. Failure of the flight control artificial feel control system will result in loss of adequate control. Reduction of engine power may relieve severe oscillation of the airplane; however, when such a failure occurs, ejection is recommended.

HORIZONTAL TAIL NORMAL TRIM FAILURE.

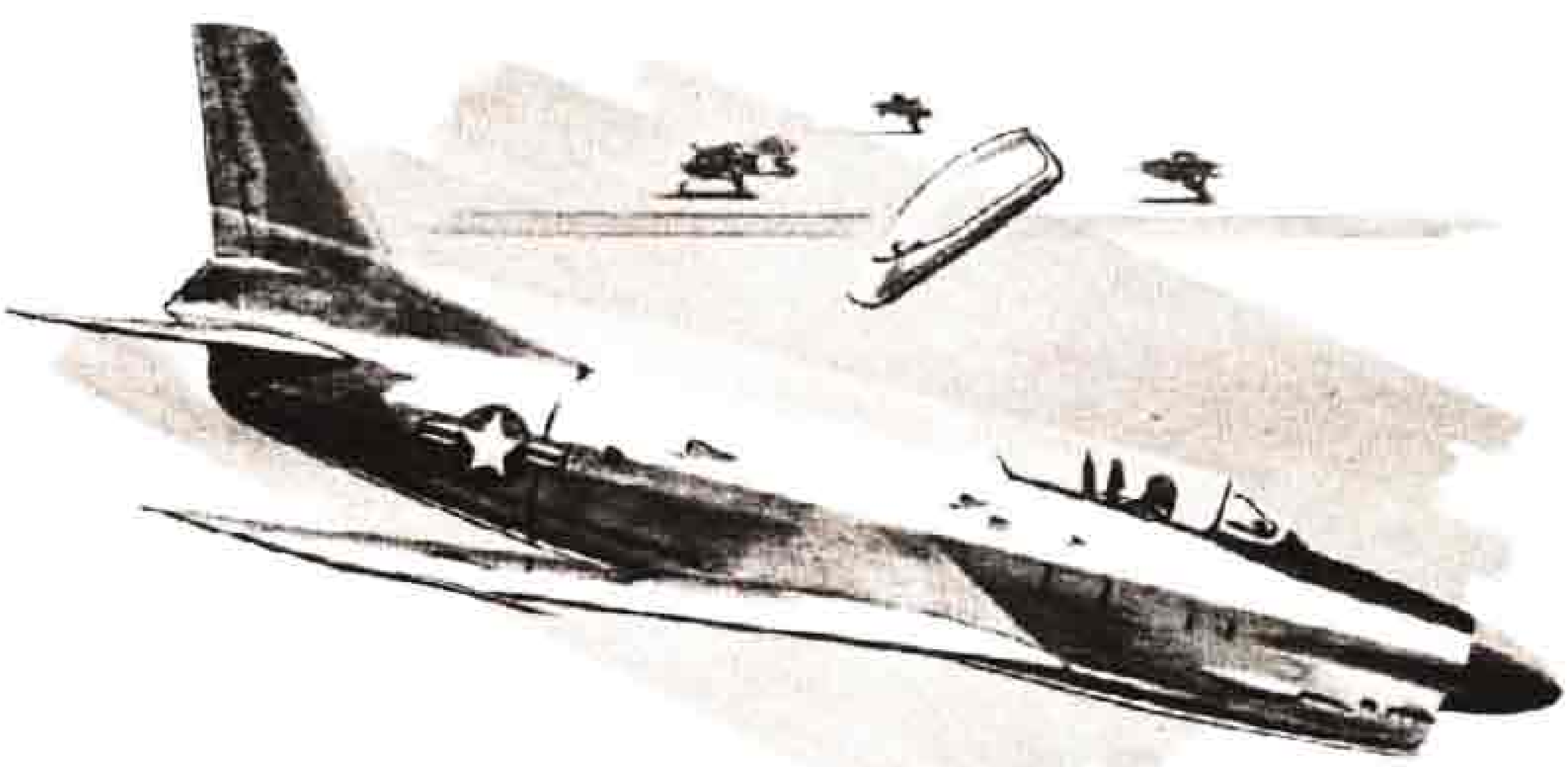
If a failure of the normal trim control for the controllable horizontal tail occurs, the controllable horizontal tail can be trimmed through use of the alternate longitudinal trim switch on the left side of the cockpit.

AILERON NORMAL TRIM FAILURE.

In event of failure of the normal aileron trim control, the ailerons can be trimmed through use of the alternate lateral trim switch on the left console, aft of the throttle.

CONDENSED CHECK LIST.

Your emergency condensed check list is now contained in T.O. 1F-86K-(CL)1-1.



released manually when the drop tank emergency jettison handle is pulled to full extension, about 3 inches.

Note

Refer to "Drop Tank Release Speed" in Section V for release speeds with various types of drop tanks. (See figure 5-1.)

AFTERBURNER FAILURE.

LOSS OF AFTERBURNER DURING TAKE-OFF.

If the afterburner fails during take-off, there will be a noticeable loss of thrust and a decrease in noise level. If the failure occurs before committed to take-off, abort the take-off. [Refer to "Engine Failure During Take-off Run (No Runway Overrun Barrier)" in this section.]

LOSS OF AFTERBURNER DURING CLIMB-OUT.

If afterburner fails after airplane is air-borne and take-off is to be continued, proceed as follows:

1. Variable nozzle will automatically go to closed position.

   Automatic closing of the variable-nozzle should restore operation to Military Thrust in about 2 seconds.

   Note

   If proper response to automatic closing of nozzle is not obtained, manually close nozzle to desired position.

2. Throttle—MILITARY.

3 through 6. (Deleted)

7. Landing gear—Retract immediately.
8. Wing flap handle—UP, as soon as a safe airspeed is reached.

CAUTION

With the emergency fuel system switch ON, the emergency fuel system is in control, and all throttle advancements must be slow, smooth, and gradual to prevent compressor stall or flame-out.

9 and 10. (Deleted)

LOSS OF AFTERBURNER DURING FLIGHT.

Note

In steady-state operation, if exhaust temperature climbs over 685°C or if nozzle operation becomes erratic, or thermocouples is indicated. Reduce power and land as soon as possible. Do not go into or return to afterburner after such a condition has existed.

When loss of afterburner occurs during flight, proceed as follows:

1. Variable-nozzle will automatically go to closed position.

   Automatic closing of the variable-nozzle should restore operation to Military Thrust in about 2 seconds.

2. Throttle—MILITARY.
3. Attempt to relight afterburner—Watch for signs of abnormal operation.

   If all cockpit indications of afterburner operation are normal on the relight, continue afterburner operation.

AFTERBURNER SHUTOFF FAILURE.

If retarding the throttle below MILITARY stop does not shut off the afterburner, move the afterburner shutoff switch to OFF. This shuts off the afterburner turbine-driven fuel pump, which allows the afterburner fuel shutoff valve to close.

VARIABLE-AREA NOZZLE AUTOMATIC CONTROL FAILURE.

A malfunction of the automatic control of the variable-area nozzle is shown by improper response of the nozzle to throttle movement, or inability to hold engine exhaust temperature near the Military Thrust limit. To manually control the variable-nozzle, proceed as follows:

1. Variable-nozzle switch—OPEN or CLOSE, as necessary.

CAUTION

- Do not attempt to light afterburner with variable-nozzle switch at OFF as this could result in an engine overtemperature condition.
- Do not move variable-nozzle switch from AUTO unless failure of nozzle automatic control is shown, or unless emergency fuel switch is moved to ON during a lockup condition, as this could result in an engine overtemperature condition.

Note

The variable-nozzle moves more slowly when actuated by means of the nozzle switch than when automatically controlled.

INADVERTENT NOZZLE CLOSURE.

Failure of the temperature sensing system permits inadvertent exhaust nozzle closure and creates an extremely dangerous engine operating condition and complete engine failure in a relatively short time. The first step in this emergency procedure is to bring the throttle out of