FOR SERIES AIRCRAFT

FLIGHT HANDBOOK

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

Published under authority of the Secretary of the Air Force.

This reissue replaces T. O. 1F-86H-1, dated 29 July 1955, and Safety of Flight Supplements -1CS and -1CT. Supplement -1CR and any supplement subsequent to -1CT remain active.

This handbook is incomplete without Confidential Supplement T. O. 1F-86H-1A.

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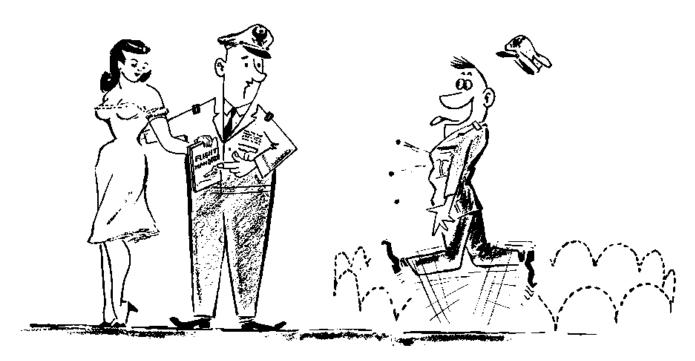
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^{*} Refer to Confidential Supplement, T.O. 1F-86H-1A, for this information.



"... No! No! Lieutenant! Just the Flight Handbook for your own personal use."

It is the intent of Air Force Regulation 5-13, dated 11 August 1953, that each pilot (except those attached to an administrative base) be entitled to his own copy of the Flight Handbook for his airplane. However, since the Flight Handbook is Government property and subject to specific controls, distribution responsibility rests with the Base Commander.

SCOPE. This handbook contains all the information necessary for safe and efficient operation of the F-86H 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 handbook 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 Handbook takes a "positive approach," and normally tells you only what you can do. Any unusual operation or configuration (such as asymmetrical loading) is prohibited unless specifically covered in the Flight Handbook. Clearance must be obtained from ARDC before any questionable operation is attempted which is not specifically covered in the Flight Handbook.

STANDARDIZATION. Once you have learned to use one Flight Handbook, you will know how to use them all—closely guarded standardization ensures that the scope and arrangement of all Flight Handbooks is identical.

ARRANGEMENT. The handbook has been divided into 10 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, these three sections must be read thoroughly and fully understood. Section IV covers all equipment not essential to flight but which permits the airplane to perform special functions. The contents of Sections V and VI are obvious from their titles. Section VII covers lengthy discussions on any technique or theory of

operation which may be applicable to the particular airplane in question. The experienced pilot will probably not need to read this section, but he should check it for any possible new information. The contents of the remaining sections are fairly obvious from their titles.

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

BINDERS AND TABS. Flexible binders and loose-leaf tabs have been provided to hold your personal copy of the Flight Handbook. These good-looking, simulated-leather binders will make it much easier for you to revise your handbook as well as to keep it in good shape. These tabs and binders are secured through your local contracting officer.

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

SAFETY OF FLIGHT SUPPLEMENTS. Safety of Flight Supplements are used to get information to you in a hurry. Safety of Flight Supplements use the same number as your Flight Handbook, 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 6 days. You can determine the status of Safety of Flight Supplements by referring to the Index of Technical Publications (T. O. 0-1-1) and the Weekly Supplemental Index (T. O. 0-1-1A). The title page of the Flight Handbook and title block of each Safety of Flight Supplement should also be checked to determine the effect that these publications may have on existing Safety of Flight Supplements. If you have ordered your Flight Handbook on the Publications Requirements Table, you automatically will receive all supplements pertaining to your airplane. Technical Order 0-5-1 covers some additional information regarding these supplements.

WARNINGS, CAUTIONS, AND NOTES. For your information, the following definitions apply to the "Warnings," "Cautions," and "Notes" found throughout the handbook:



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



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

Note

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

MAINTENANCE HANDBOOKS. 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 Handbook, refer to the Systems Maintenance Handbooks (T. O. 1F-86H-2 Series) for your airplane.

COMMENTS AND QUESTIONS. Comments and questions regarding any phase of the Flight Handbook program are invited and should be addressed to HQ Air Research and Development Command, Wright-Patterson AF Base, Ohio, Attention: RDZSTH.

Note

All classified performance data, from applicable sections, has been deleted from this handbook. This information is covered in the Confidential Supplement T. O. 1F-86H-1A.

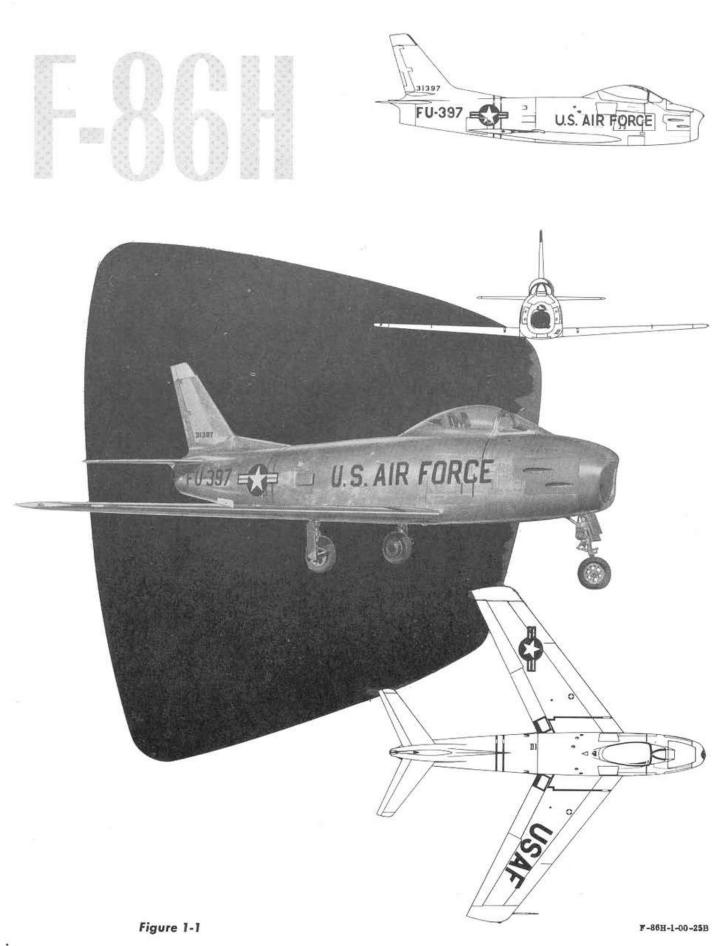




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AIRPLANE.

The North American F-86H is a single-place, highperformance fighter-bomber, powered by an axial-flow turbojet engine. The familiar swept-back wing and empennage, typical of all F-86 Series Airplanes, is retained in this version. Design features of the airplane include the hydromechanical engine fuel controller, the self-sufficient engine starting system, and the fuselagemounted speed brakes. In addition, the elevator and stabilizer are interconnected and controlled as one unit, with the result that the entire horizontal tail assembly is a primary control surface, known as the controllable horizontal tail. To provide desirable handling characteristics throughout the speed range of the airplane, the ailerons and horizontal tail are actuated by an irreversible hydraulic control system. Use of this irreversible control system necessitates an artificial feel system to simulate desired aerodynamic feel, and has the advantage of providing comfortable stick forces. Most airplanes are equipped with the nonslatted (fixedcontour) wing leading edge. Some airplanes are equipped with slats on the wing leading edge to pro-

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vide more favorable low-speed characteristics and to improve maneuverability, particularly at high altitude.

AIRPLANE DIMENSIONS.

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

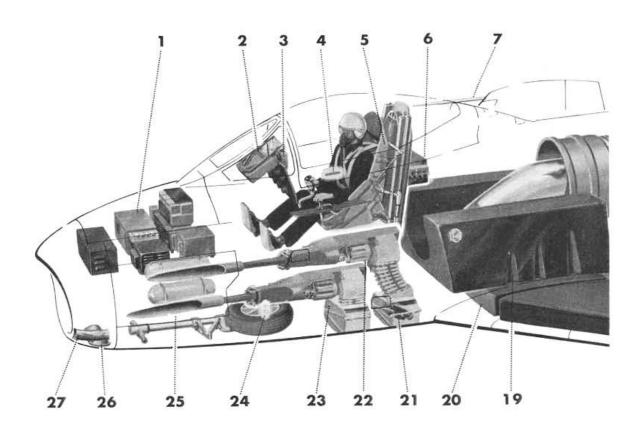
Wing span	.39 f	eet	1 inch
Length	.38 f	eet	6 inches
Height	.14 f	eet	11 inches

AIRPLANE GROSS WEIGHT.

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

F-86H-1 AIRPLANES

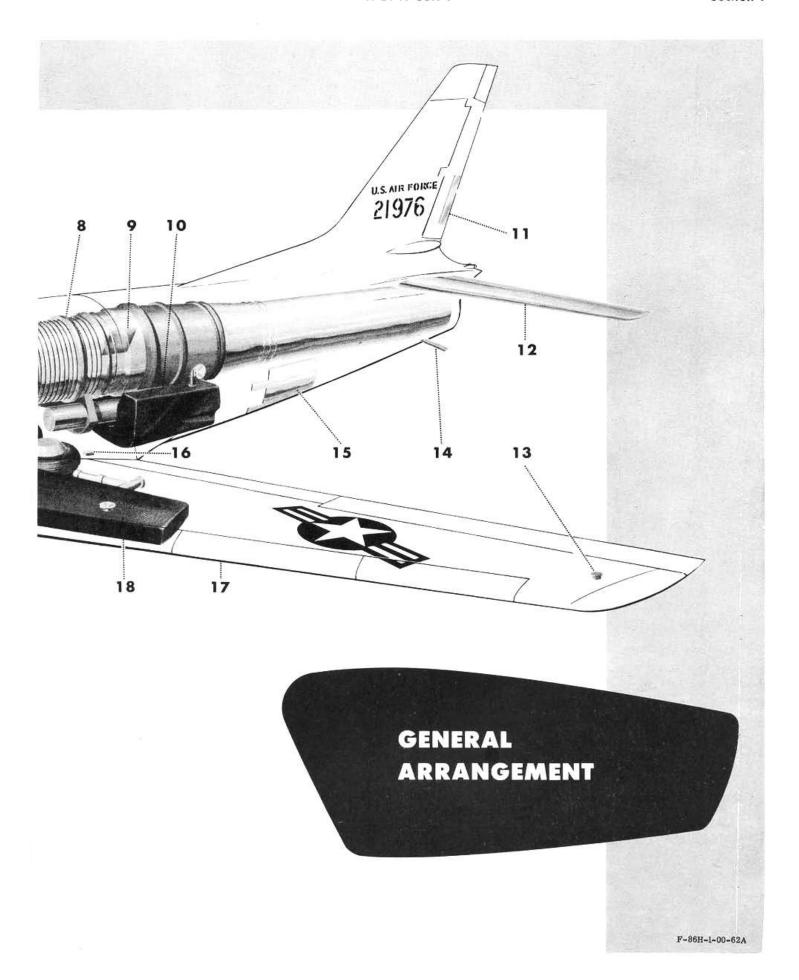
No external load	18,900 pounds
With two 200-gallon drop tar	nks plus
two 1000-pound GP bomb	s with
T-142 fins	24,300 pounds

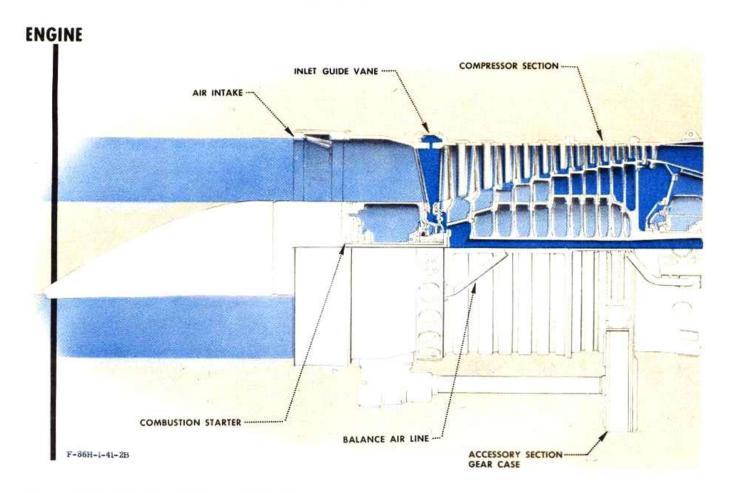


- 1. AN/APG-30 Radar Ranging Equipment
- 2. A-4 Sight
- 3. GSAP Camera
- 4. Canopy External Emergency Release
- 5. Ejection Seat
- 6. Battery
- 7. Pitot-Static Boom
- 8. J73-GE-3 Series Engine
- 9. Data Case
- 10. Aft Fuselage Fuel Tank
- 11. Rudder Trim Tab
- 12. Controllable Horizontal Tail
- 13. Slaved Gyro Magnetic Compass Flux Valve
- 14. Fuel Tank Vent Bayonet

- 15. Speed Brake
- 16. External Power Receptacle
- 17. Wing Slats (Some Airplanes)
- 18. Outer Wing Fuel Tank
- 19. Forward Fuselage Fuel Tank (Upper Cell)
- 20. Forward Fuselage Fuel Tank (Lower Cell)
- 21. Strike Camera
- 22. Gun Compartment (20 MM Guns Shown)
- 23. Ammunition Compartment
- 24. Canopy External Control Buttons
- 25. D-2 Oxygen Cylinders
- 26. Retractable Landing and Taxi Lights
- 27. Cockpit Ram-air Inlet

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F-86H-5 AND SUBSEQUENT AIRPLANES

No external load	19,300 pounds
With two 200-gallon drop	tanks plus
two 1000-pound GP bon	nbs with
T-142 fins	24 700 pounds

ARMAMENT.

Some airplanes have six .50-caliber machine guns, while other airplanes have four 20 mm guns. In addition, bombs or rockets can be carried on the lower surface of the wings. An automatic lead-computing sight, coupled with radar ranging equipment, is installed for gun and rocket firing and bomb release. (Refer to "Armament Equipment" in Section IV for detailed information.)

BLOCK NUMBER DESIGNATIONS.

The block number designations for this airplane are:
F-86H-1
AF52-1975 through -2089
F-86H-5
AF52-2090 through -2124
AF52-5729 through -5753
F-86H-10
AF53-1229 through -1528

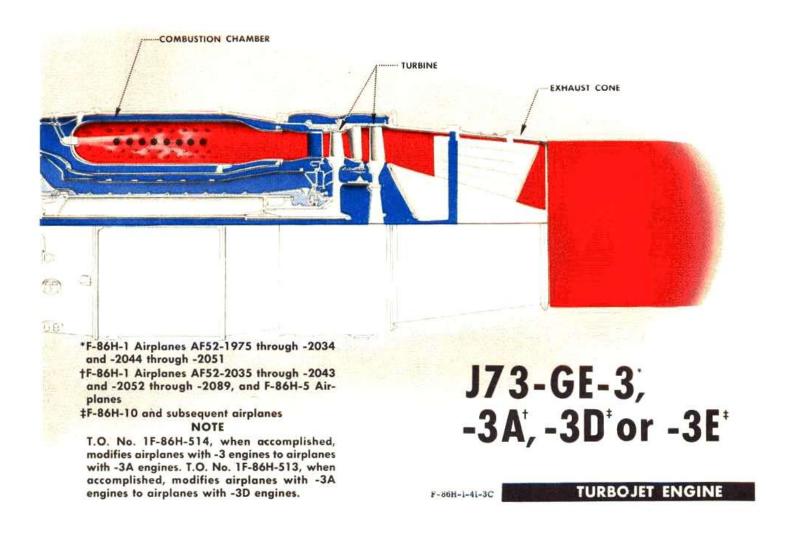
ENGINE.

The airplane is powered by a General Electric J73-GE-3, -3A, -3D, or -3E axial-flow turbojet engine. (See figure

Figure 1-3

1-3.) At Military Power, the rated sea-level static thrust of the engine is 8920 pounds. During engine operation, ram air from the intake duct passes under the cockpit to the engine compressor, where it is progressively compressed through 12 stages. This compressed air then flows to 10 combustion liners (encased in a single cannular combustion chamber) where it mixes with the atomized fuel injected into each liner. This mixture burns continuously once ignition has been established during engine starting. From the combustion chamber, the hot exhaust gases pass through the two-stage turbine and out the tail pipe, to provide high-velocity jet thrust. The two-stage turbine, which is rotated by exhaust gas, is directly connected to and drives the compressor. The engine-driven accessories are on a gear box beneath the compressor casing and are driven by the compressor rotor assembly. The J73-GE-3A engine is an advanced version of the J73-GE-3. The main difference between the engines is that the J73-GE-3A includes modulated inlet guide vanes (PE-3B fuel controller) while the J73-GE-3 includes two-position inlet guide vanes and a PE-3A fuel controller. The J73-GE-3D engine, an advanced version of the J73-GE-3A, has an improved automatic start system, including a fuel manifold priming

T. O. 1F-86H-1 Section I



line which by-passes a major part of the engine fuel system to prime the small-slot manifold during starting. It also has an electronic temperature control amplifier which controls fuel flow during starting, to maintain engine operation within the limit temperature. The J73-GE-3E engine is a lightweight version of the -3D engine. On all engines, the guide vanes are automatically actuated and limit compressor airflow within certain engine speed ranges. The engine compartment is divided by a fire wall. The forward compartment contains the relatively cool compressor and accessory sections of the engine; the aft compartment includes engine combustion liners and turbine section and tail-pipe.

ENGINE ANTI-ICE PROVISION.

All parts of the engine that have a frontal area exposed to the inlet air stream have icing protection. The inlet guide vanes and three of the four engine front frame struts are heated continuously and automatically by air bled from the engine compressor. However, the bled air furnishes effective anti-icing protection only when the

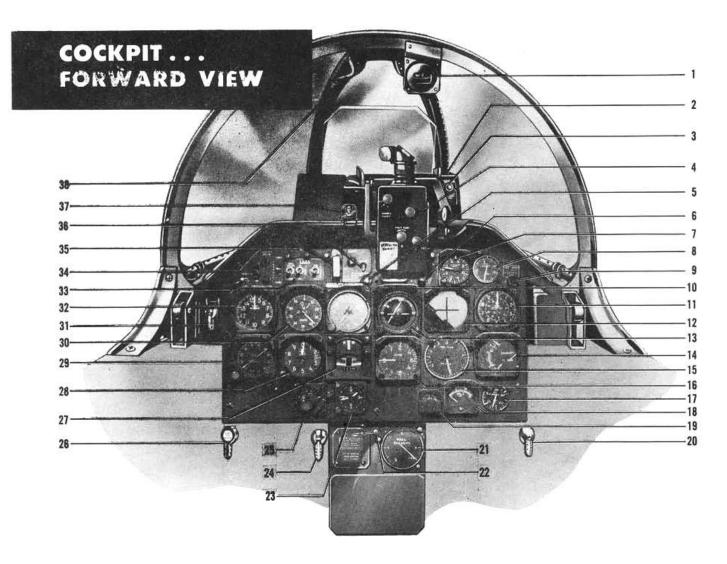
engine speed is above 95% rpm. The fourth frame strut is heated by a continuous flow of engine lubricating oil.

VARIABLE-INLET GUIDE VANE SYSTEM.

On airplanes with the -3 engine, the automatically actuated (dc electric) variable-inlet guide vane system permits fast engine accelerations without surge or compressor stall. The guide vanes are mounted at the inlet of the engine compressor section and restrict compressor airflow during engine operation below about 77% or about 86% rpm, as determined by engine inlet air temperature. When engine inlet air temperature is above 25°F, the inlet guide vanes will open (engine accelerating) or close (engine decelerating) when the engine rpm reaches 86%. If the temperature is below 4°F, the guide vanes will open (engine accelerating) or close (engine decelerating) when the engine rpm reaches 77%. The range between 4°F and 25°F is a dead-band range incorporated in the temperature referencing circuit to provide stability. During transient temperature conditions which bracket this range, the guide vane change point will remain at 86% as the temperature decreases from above 25°F to 4°F and

MAIN DIFFERENCES TABLE

F-86H	173-06-3, -34,-30, OR-36	HYDRO- MECHANICAL	NO	CONTROLLANE STABILIZER AND REVATOR	HYDRAUUC IRREVERSIBLE	YES	MACHINE DUMS, BOMES, ROCKITS, OR. SPECIAL EXTERNAL. STORE	HLAT.	GINER HANDORIP ON SEAT	CLAMSHEL	SIATS ON EXTENDED LEADING EDGE AND WHIGHMACI 7-46-1-90-94
F-86F	J47-GE-27	MECHANICAL	Ou	CONTROLLABLE STABILIZER AND ELEVATOR	HYD&A ULIC Irreversible	YES	MACHINE GUNS, BOMBS, ROCKETS, OR CHEMICAL TANKS	FLAT	RIGHT HANDGRIP ON SEAT	5NIG1S	SLATS OR EXTENDED LEADING EDGE AND WING FENCE
F-86E	147-GE-13	MECHANICAL	ON	CONTROLLABLE STABILIZER AND ELEVATOR	HYDRAUJIC IRREVERSIBLE	YES	MACHINE GUNS, BOMBS, ROCKETS, OR CHEMICAL TANKS	"V" OR FLAT	RIGHT HANDGRIP ON SEAT	SNIGITS	stats
F-86D and F-86K	J47-5E-17, -178, or -30 AFTERBURNER	ELECTRONIC	YES	SINGLE CONTROL- LABLE SURFACE	HYDRAULIC	SAY	F-86D; ROCKETS IN FUSELAGE PACKAGE F-86K; 20 MM GUNS	FLAT	RIGHT HANDGRIP ON SEAT	CLAMSHELL	\$LA7\$
F-86A	147-06-7 OR -13	MECHANICAL	Ş	CONVENTIONAL	CONVENTIONAL AND HYDRAULIC BOOST	NO	MACHINE GUNS, BOMBS, ROCKETS, OR CHEMICAL TANKS	CURVEO OR "V"	HANDLE ON PEDESTAL, RIGHT HANDGRIP ON SEAT	SMIGHTS	SLATS
	ENGINE	ENGINE CONTROL	AUTOMATIC PILOT	HORIZONIAL TAIL	AUFRON AND HORIZONTAL TAIL CONTROL	ALLERON AND HORIZONTAL TALL ARTIFICIAL FER SYSTEM	ARMAMENT	WINDSHIELD	CANOPY EJECTION	CANOPY	WING LEADING EDGE

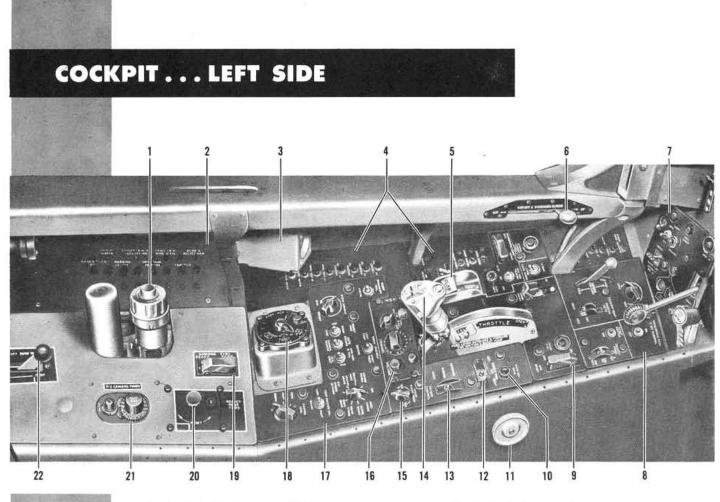


- 1. Stand-by Compass
- 2. A-4 Sight
- 3. Special Store Reset Light
- 4. Gun Camera
- Slaved Gyro Magnetic Compass Fast Slaving Button
- 6. Hydraulic Pressure Gage Selector Switch
- 7. Accelerometer
- 8. Hydraulic Pressure Gage
- Alternate-on Warning Light (Flight Control Alternate Hydraulic System)
- 10. Slaved Gyro Magnetic Compass
- 11. Tachometer
- 12. LABS Dive-and-Roll Indicator*
- 13. Attitude Indicator*
- 14. Exhaust Temperature Gage
- 15. Fuel Flow Indicator
- 16. Rate-of-Climb Indicator
- 17. Oil Pressure Gage
- 18. Voltmeter
- 19. Electrical Loadmeter
- *Some airplanes (see applicable text)

- 20. Landing Gear Emergency Release Handle
- 21. Fuel Quantity Gage
- 22. Fuel Quantity Gage Test Button
- 23. Clock
- 24. Emergency Jettison Handle
- 25. Bomb-Target Wind Control
- 26. Flight Control Emergency Change-over Handle
- 27. Turn-and-Bank Indicator
- 28. Altimeter
- 29. Radio Compass Indicator
- 30. Airspeed Indicator
- 31. Special Store Jettison Handle
- 32. Machmeter
- 33. LABS Control Panel*
- 34. Engine Fuel Control Panel
- 35. Gun Safety Switch
- 36. Gun Selector Switch*
- 37. LABS Gyro Angle Selector Switch*
- 38. Handhold

F-86H-1-00-93

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- Anti-G Suit Pressure-regulating
 Valve
- 2. Circuit-breaker Panel
- 3. Thunderstorm Light
- 4. Circuit-breaker Panel
- 5. Wing Flap Lever
- 6. Canopy and Windshield Defrost Handle
- 7. Left Forward Switch Panel
- 8. Air Conditioning Control Panel
- 9. Engine Control Panel
- 10. Take-off Trim Indicator Light
- 11. Throttle Friction Wheel

- 12. Rudder Trim Switch
- 13. Flight Control Switch
- 14. Throttle
- 15. Radar Range Sweep Rheostat
- 16. UHF Command Radio Control Panel
- 17. Armament Control Panel
- 18. Sight Function Selector Unit
- 19. Ground Fire Safety Switch*
- 20. Rocket Projector Release
- 21. Strike Camera Timer*
- 22. Speed Brake Dump Valve Lever*

*Some airplanes. (Refer to applicable text.)

F-86H-1-00-78

Figure 1-6

conversely will remain at the low change point, 77%, as the temperature increases from below 4°F to 25°F. On airplanes with the -3A, -3D, or -3E engine, the inlet guide vanes are modulated through the transient range (about 6000 to 7000 rpm) as a function of corrected engine speed. The modulated inlet guide vane system uses a hydraulic actuator which follows a schedule of corrected engine speed taken from the computer section of the engine fuel controller. The system provides maximum-rate, stall-free acceleration without the large thrust discontinuity characteristic of the earlier inlet guide vane system.

ENGINE FUEL SYSTEM.

Fuel supply to the engine passes through, and is regulated by, the hydromechanical fuel controller, which is mechanically linked to the throttle. The fuel controller includes a main fuel system for all normal operation and an emergency fuel system, which is selectively engaged, for use when the main system fails or functions improperly. The emergency system can be selectively engaged or armed for automatic engagement during take-off. On airplanes with the -3 and -3A engines, only manual starts on the emergency fuel system can be



Figure 1-7

made. On airplanes with the -3D or -3E engine, automatic starts must be made on the main fuel system. However, if necessary, manual starts can be made on the emergency fuel system on these airplanes. Fuel from the airplane fuel system is routed to the engine-driven booster and dual fuel pump, which boosts fuel pressure to the pilot-controlled fuel selector valve in the engine fuel controller. On airplanes with the -3D or -3E engine, a fuel manifold priming line is incorporated in the engine fuel system to provide optimum automatic starts. The priming line by-passes a major portion of the en-

gine fuel system and serves as a rapid means of priming the small-slot fuel manifold during starting. The engine fuel system is shown schematically in figure 1-8.

ENGINE FUEL CONTROLLER.

The engine fuel controller unit meters fuel for all engine operation through either the main or emergency fuel system incorporated within the unit. The fuel controller is a completely hydraulic (engine oil) unit except for connections for an electronic temperature control amplifier which senses exhaust gas temperature. Control oil for operation of the fuel controller is supplied from the engine oil system. The hydromechanical unit consists of various components, including a solenoid fuel selector valve, a main fuel system (metering valve, pressure-regulating valve and metering head detector, and computer), an emergency fuel system (metering valve and regulating valve), and a fuel stopcock. These components are regulated (by throttle setting and signal output from the computer and metering head detector) to maintain the fuel flow necessary for desired engine operation. Any excess fuel (fuel not required by the engine) is by-passed back to the dual fuel pump, and minimum fuel flow is limited to preclude possibility of flame-out. The fuel stopcock, incorporated in the controller, is connected to the throttle. When the throttle is OFF, the stopcock is closed, shutting off all fuel from the controller to the engine. On airplanes with the -3D or -3E engine, engine overtemperature control is provided during automatic starts by the engine electronic temperature control amplifier which is connected to thermocouples in the exhaust area. In event of overtemperature, fuel flow is reduced until engine operation is within the limit temperature. The engine ignition and starter circuits cannot be energized for automatic starts on these airplanes until the temperature control amplifier is operative. (A 30-second warm-up period is required for the amplifier to become operative.) This safety feature prevents automatic start attempts without overtemperature control. The amplifier is powered from the three-phase ac bus.

MAIN FUEL SYSTEM.

In normal operation, the main fuel system of the fuel controller meters fuel to the engine, compensating automatically for changes in airspeed, altitude, and outside air temperature to maintain engine speed constant at each throttle setting. During rapid acceleration, the maximum allowable rate of fuel flow can be obtained under all flight conditions. During rapid deceleration, minimum fuel flow is scheduled to prevent flame-out. Fuel is supplied to the metering valve of the main fuel system through the fuel selector valve. Here the fuel flow to the engine is metered according to throttle setting and engine requirements as called for by the hydromechanical computer and metering head detector. The computer receives signals of compressor inlet pressure, compressor inlet temperature, and engine speed and combines them into one mechanical (oil pressure) signal to the main metering valve. The main pressure-regulating valve is actuated by the metering head detector to maintain the desired fuel pressure drop across the main metering valve, thus controlling fuel flow to the engine. The metering head detector receives signals of engine speed and reduces fuel flow when signals indicate engine overspeed. The fuel not metered to the engine is by-passed through the main pressure-regulating valve to return to the dual fuel pump. From the main metering valve, the metered fuel is directed through the stopcock to the flow divider and then to the fuel manifolds and into the combustion liners. The controller provides metered fuel for starting at all altitudes. Operation on the main fuel control system protects the engine against compressor stall, overtemperature, and overspeed.

EMERGENCY FUEL SYSTEM.

The emergency fuel system of the controller regulates fuel flow to the engine when selected manually, or automatically when the main system fails and the fuel system selector switch is at TAKE OFF. When the emergency system is selected, the fuel selector valve is positioned so that fuel is directed through the emergency metering valve instead of through the main metering valve. The emergency metering valve is mechanically controlled by throttle position only and is not connected to the computing unit of the hydromechanical controller. The emergency system meters fuel flow to engine according to throttle setting and altitude only, and therefore does not offer overtemperature, compressor stall, overspeed, and engine flame-out preventive features.



When the emergency fuel system is engaged, the fuel is manually controlled and the throttle should be moved cautiously; otherwise, overtemperature operation, compressor stall, or engine overspeed is likely to occur, especially at high altitudes.

Fuel not needed by the emergency fuel system is bypassed back to the fuel pump through the emergency pressure-regulating (by-pass) valve, which receives signals from compressor inlet pressure to control metered fuel to the engine. An amber indicator light comes on when the emergency fuel system is selected manually or automatically. Operation of the emergency system can be checked before take-off by the fuel system selector switch.

DUAL FUEL PUMP.

The engine-driven centrifugal booster and a dual fuel pump provides the fuel pressure boost required by the engine fuel controller and fuel nozzles. Should either element of the dual fuel pump fail, the remaining element will produce enough fuel flow to maintain satisfactory engine operation.

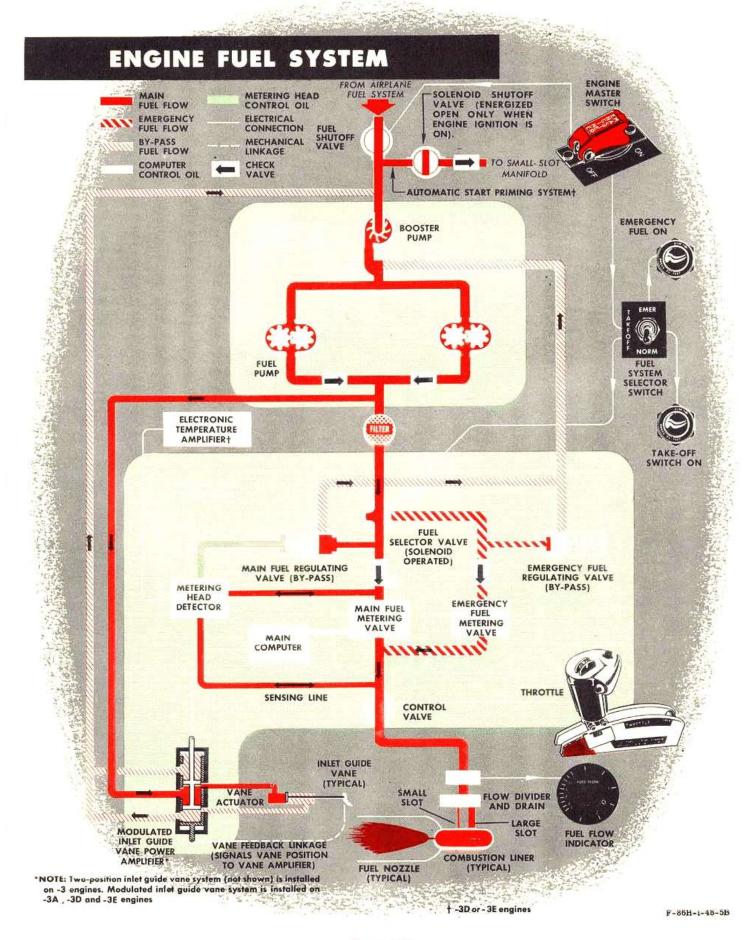


Figure 1-8

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FLOW DIVIDER.

The engine fuel flow divider is downstream of the engine fuel controller. It automatically directs fuel to one or both engine fuel manifolds, depending on engine operating conditions. A duplex fuel nozzle with a large slot and small slot is in each combustion liner to atomize the fuel. The flow divider pressurizes only the small-slot manifold during periods when flows are low, as in starting and high-altitude operation. This gives the proper spray pattern and atomization for combustion. For operation when fuel pressure is in excess of 50-60 psi, the flow divider routes fuel through both the small- and large-slot manifolds. To make starting easier, the flow divider directs fuel through the smallslot manifold when fuel pressure is below 40 psi. For normal operation, the flow divider routes fuel through the large-slot manifold, as well as through the smallslot manifold, when fuel pressure is above 40 psi. When the fuel stopcock in the engine fuel controller is closed, a drain valve in the flow divider opens to permit residual fuel in both manifolds to drain overboard. On airplanes with the -3D or -3E engine, the drain valve is in the small-slot manifold.

ENGINE FUEL SYSTEM CONTROLS.

ENGINE MASTER SWITCH.

The guarded engine master switch (figure 1-10), on the left console, supplies primary bus power for controlling various engine and fuel system units. When the switch is ON, the electric-motor-operated fuel shutoff valve is opened. Moving the switch to ON also completes the electrical circuit to the starter button (battery switch ON, or external power connected) and the emergency fuel selector switch, and permits the throttleactuated limit switch to operate the tank-mounted primary fuel booster pump when the throttle is moved from OFF. (The secondary fuel pump will also operate if secondary bus power is available.) On airplanes with the -3D or -3E engine, the starter circuit cannot be energized for automatic starts until the temperature control amplifier is warmed up. When the engine master switch is OFF (switch guard raised), the fuel system shutoff valve is closed and the fuel booster pump circuit is de-energized.

CAUTION

Do not turn engine master switch OFF, during any shutdown, before the engine has coasted down to 5% rpm or less; otherwise, starter fuel will be depleted. This will necessitate ground servicing before a later start. If a later start is attempted without ground servicing under this condition, a hot start may result.

THROTTLE.

Engine power is controlled by the throttle (14, figure 1-6), which is on a quadrant on the left console. The throttle is mechanically connected to the hydromechanical engine fuel controller. To move the throttle forward from the OFF position, it must first be moved outboard past a mechanical stop. Once forward of the mechanical stop, the throttle need not be held outboard for further forward movement. When the engine master switch is ON, initial forward movement of the throttle from OFF starts the primary fuel booster pump and permits ignition to be turned on when the starter system is energized. On airplanes with the -3D or -3E engine, the starter circuit cannot be energized for automatic starts until the temperature control amplifier is warmed up. Initial forward throttle movement also opens the fuel stopcock in the fuel controller to permit fuel to flow to the nozzle manifolds. (Ignition is automatically cut off when engine speed reaches about 38% rpm.) When operating on the main fuel system, starting fuel flow is controlled to a fixed value regardless of throttle position. With the engine running, further throttle advancement actuates the engine fuel controller to increase engine rpm. The throttle mounts the microphone switch, speed brake switch, and electrical caging button for the gun sight. Rotation of the throttle grip supplies manual range data to the sight. Throttle friction is adjusted by a disk-type wheel (11, figure 1-6) on the inboard side of the left console. To prevent accidentally shutting off fuel supply when throttle is retarded, a stop is provided on the quadrant at the IDLE position.

FUEL SYSTEM SELECTOR SWITCH.

The three-position fuel system selector switch, located on the engine fuel control panel (figure 1-9) on the instrument panel, permits selection of either main or emergency fuel system operation of the engine fuel controller. The switch is energized by primary bus power only when the engine master switch is ON. The fuel system selector switch should be at NORM during all normal in-flight conditions; the switch should be at EMER for in-flight conditions only when the main system fails, and at TAKE OFF only during take-off and initial climb. For manual starting on all airplanes, the switch must be at EMER. For automatic starts (airplanes with -3D or -3E engine), the switch must be at NORM. When the switch is at NORM, the solenoid-operated fuel selector valve is de-energized (energized, on airplanes with the -3 engine), allowing all fuel from the dual fuel pump to be directed to the main fuel system. Setting the fuel system selector switch at EMER energizes (de-energizes, on airplanes with the -3 engine) the fuel selector valve, so that all fuel is directed to the emergency fuel system of the engine fuel controller.

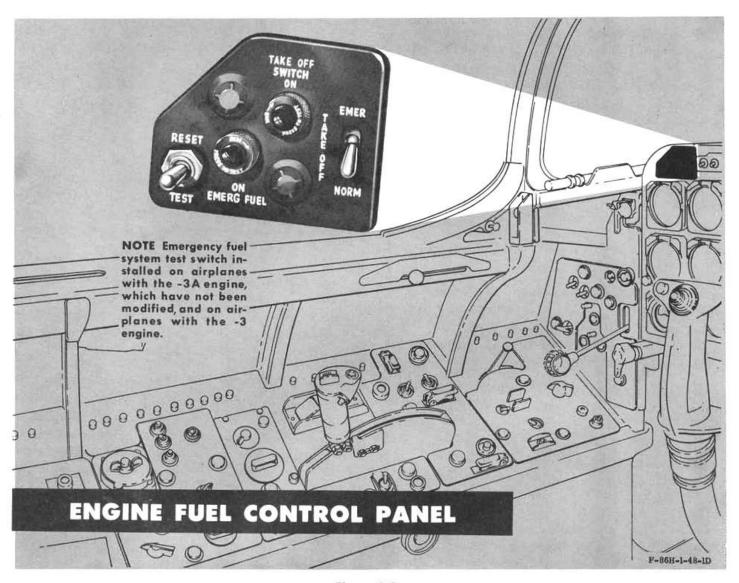


Figure 1-9

An amber indicator light comes on whenever the emergency system is engaged.

CAUTION

- To prevent overtemperature operation, compressor stall, or engine overspeed, especially at high altitudes, rapid throttle bursts should not be made when the emergency fuel system is engaged.
- If, during engine operation, primary bus power fails or the battery switch is OFF when generator output is not available, the fuel selector valve will be de-energized, thus engaging the main fuel system (emergency system, on airplanes with the -3 engine) regardless of the fuel system selector switch position.

Placing the switch at TAKE OFF above 95% to 97% engine rpm de-energizes (energizes, on airplanes with the -3 engine) the fuel selector valve to the main fuel system position. However, if for any reason engine rpm drops into the speed range of about 85% to 97%, an electrical circuit is automatically energized (de-energized, on airplanes with the -3 engine), allowing the fuel selector valve to change over and supply fuel to the emergency fuel system. Before the switch is moved to TAKE OFF, the engine must be operating above about 96% rpm with the switch at NORM to engage the automatic change-over circuit. A green indicator light comes on when the switch is at TAKE OFF.



Since engine characteristics are such that stallfree throttle bursts cannot be accomplished on the emergency fuel system at low engine speeds, a lockout circuit is employed to prevent operation of the emergency system if engine speed is below 86% rpm when the selector switch is at TAKE OFF. Should the main fuel system fail with the switch at TAKE OFF and the engine operating above 95% to 97% rpm, the emergency fuel system will take over automatically. However, if the throttle is retarded below 85% to 88% engine rpm, the main system will take over and flame-out may occur. Because of this, the fuel system selector switch must be moved to EMER before any throttle movement if the main fuel system fails during take-off.

After take-off and initial climb, the fuel system selector switch must be returned to NORM before the throttle is retarded from Military Power. Otherwise, the emergency fuel system will take over when engine speed is reduced to about 95% to 97% rpm.

EMERGENCY FUEL SYSTEM TEST SWITCH (AIRPLANES WITH -3 OR -3A ENGINE NOT CHANGED BY T.O.).

The emergency fuel system test switch is on the engine fuel control panel (figure 1-9) on the instrument panel. The switch is spring-loaded to the center (OFF) position and is operable only if the engine master switch is ON. (The TEST position of the emergency fuel system test switch has been disconnected, and emergency fuel system operation must be checked before take-off by use of the fuel selector switch and the throttle.) To check emergency fuel system operation before take-off, the fuel selector switch may be moved to TAKE OFF after the engine is at 100% rpm, and throttle may then be retarded to below 95% to 97% rpm. The amber emergency fuel-on indicator light should come on, showing that the emergency fuel system is supplying fuel to the engine. Advancing the throttle to full OPEN should increase rpm to conform to the schedule shown in figure 2-4. Moving the fuel selector switch to NORM transfers control back to the main fuel system. The amber emergency fuel-on light should go out and rpm should increase to 100%. This method of re-engaging the main fuel system before take-off always should be used. In general, depending on outside air temperature, this check may result in a slight change in rpm. (See figure 2-4.) If the amber emergency fuel-on light does not go out when the fuel system selector switch is returned to NORM, the system should be checked before flight. The main fuel system can be re-engaged without moving the fuel system selector switch from TAKE OFF position, by holding the emergency fuel system test switch at RESET until the amber emergency fuel-on light goes out. However, this method of re-engaging the main fuel system before

take-off should not be used, inasmuch as a single procedure which is acceptable for all four types of engines obviously will be more readily remembered.

ENGINE FUEL SYSTEM INDICATORS.

FUEL FLOW INDICATOR.

A fuel flow indicator (15, figure 1.5), on the instrument panel, shows the rate of fuel consumption in pounds per hour. The flow indicator is electrically operated by single-phase ac power obtained through a step-down transformer from the three-phase (instrument) inverter.

EMERGENCY FUEL-ON INDICATOR LIGHT.

An amber indicator light, on the engine fuel control panel (figure 1-9) on the instrument panel, comes on during emergency fuel system operation of the engine fuel controller. The indicator light receives power from the primary bus.

TAKE-OFF SWITCH-ON INDICATOR LIGHT.

A green indicator light, on the engine fuel control panel (figure 1-9) on the instrument panel, comes on when the fuel system selector switch is positioned at TAKE OFF. The engine master switch must be ON before the indicator light receives power from the primary bus.

ENGINE STARTER AND IGNITION SYSTEMS.

STARTER SYSTEM.

The engine has a self-sufficient starter of the fuel-air combustion type, capable of starting the engine without any external source of power. The starter is a complete unit, located on the front of the engine, and incorporates its own fuel and ignition system, combustion chamber, turbine, and overrunning clutch. Fuel for each starter operation (about 4 seconds duration) is supplied by the starter fuel accumulator, which is replenished from the airplane fuel system at the end of each starter cycle. Compressed air for operating the starter is contained in an air storage bottle (two bottles on F-86H-5 and subsequent airplanes). To enable two successive start attempts, pressure must be 3000 psi initially. For maximum starter performance on a single start, pressure must be 1900 psi minimum. A safe start can be obtained at pressures above 1700 psi. The air bottle is behind an access door aft of the nose wheel door on F-86H-1 Airplanes; on F-86H-5 and subsequent airplanes, the bottles are behind an access door forward of the right-hand ammunition door. In flight, the air storage bottle is replenished by an air compressor, which is operated by utility hydraulic system pressure. On most airplanes,* the compressor

^{*}F-86H-1 Airplane AF52-2070 and all subsequent airplanes

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motor may be selectively disabled through the air compressor switch. The starter unit is controlled by the ground start push button, which opens the starter fuel and air shutoff valves and energizes starter ignition. The starter will accelerate the engine to about 20% rpm, at which time the fuel supply in the accumulator is exhausted and the starter automatically disengages, then resets for the next starting operation. An external air receptacle is provided to refill the air storage bottle (high pressure). The starting system also has connections for attaching an external ground air supply (low pressure) for operating the starter. A push-button switch, which must be held down for motoring operation, is on the starter pneumatic panel. It is accessible through the camera access door on the lower fuselage on early airplanes,* and through the pneumatic system access door on the right side of the fuselage just ahead of the ammunition access door on all other airplanes. If the engine does not start during the initial attempt, a second starting cycle can be made one minute after the first firing. Where the time interval between the first and second firings is less than 15 minutes, the two firings are defined as a double start. If a double start is made, the third firing may be made only after 45 minutes or more from the time of the first firing. All subsequent starts require a 30-minute interval between firings. A double start may be repeated only if the starter is allowed to cool to outside temperature (about 3 hours unless artificial cooling is applied). If the time interval between the first and second attempted starts is greater than 15 minutes, the starts are defined as single starts. Additional single starts after the second starting attempt require a time interval of 30 minutes minimum between firings, and may be repeated indefinitely.

ENGINE IGNITION.

The engine has a capacitor discharge ignition system with two igniter plugs. Ignition is energized only during engine starting, as combustion is continuous after the engine has been started. During ground start, with engine master switch on, battery switch on or external de power connected, and throttle moved from OFF, the ignition circuit to the spark plugs in combustion liners 4 and 7 is armed. Pressing the ground start button then energizes the ignition circuit and, on airplanes with the -3D or -3E engine, opens the fuel manifold priming solenoid valve. Ignition will remain energized until the generator-off warning light goes out. On some airplanes, if a start is aborted for any reason before the generator cuts in, the ignition circuit will remain armed until the battery switch is moved to OFF and external dc power, if used, is disconnected. Should a second start attempt be made without first disarming the ignition circuit, initial forward movement of the throttle will cause engine ignition and,

on airplanes with the -3D or -3E engine, priming fuel will enter the engine. Since the engine would not be rotating, fire would occur, with probable resultant damage to the engine. These airplanes can be identified by either of two placards, located on the engine control panel (figure I-10), giving shutdown instructions for an aborted start. The placard wording is as follows: "CAUTION IF STARTER IS OPERATED AND ENGINE IS NOT ACCELERATED TO MIN OF 41% RPM PRIOR TO SHUTDOWN 1. TURN BATTERY SW OFF 2. DISCONNECT EXTERNAL DC POWER MOMENTARILY" or "CAUTION IF STARTER IS OPERATED AND PRIOR TO SHUT-DOWN, GENERATOR OFF WARNING LIGHT DOES NOT EXTINGUISH 1. TURN BATTERY SW OFF 2. DISCONNECT EXTERNAL DC POWER MOMENTARILY." Whichever placard wording is found in these airplanes, if a start is aborted, rely on the generator-off warning light indication, not engine rpm indication, to determine if this shutdown procedure is necessary, since generator cutin will not always occur by 41% engine rpm. On airplanes which do not have the aborted-start shutdown procedure placard on the engine control panel (figure 1-10), the throttle is in equal control with the generator of ignition arming. Therefore, if a start is aborted on these airplanes, the ignition circuit is disarmed when the throttle is retarded to full OFF position. For an air start, ignition is supplied by the air start switch when the engine master switch is ON, the battery switch is ON, and the throttle is moved from OFF.

STARTER AND IGNITION SYSTEM CONTROLS.

THROTTLE.

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

BATTERY SWITCH.

Refer to "Electrical Power Supply System Controls" in this section.

ENGINE MASTER SWITCH.

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

GROUND START BUTTON.

The ground start push button is on the engine control panel (figure 1-10) on the left console. With the battery switch at ON, engine master switch at ON, and throttle moved from OFF, in that order, momentarily pressing the ground start button supplies dc power to the starter and ignition unit. An electrical holding relay keeps the ignition circuit energized until the engine reaches about 38% rpm and the generator is operating. If the engine does not start, ignition can be de-energized by moving the throttle to OFF.

AIR START SWITCH.

To provide ignition during an air start, a two-position switch (figure 1-10) is on the left console. When the

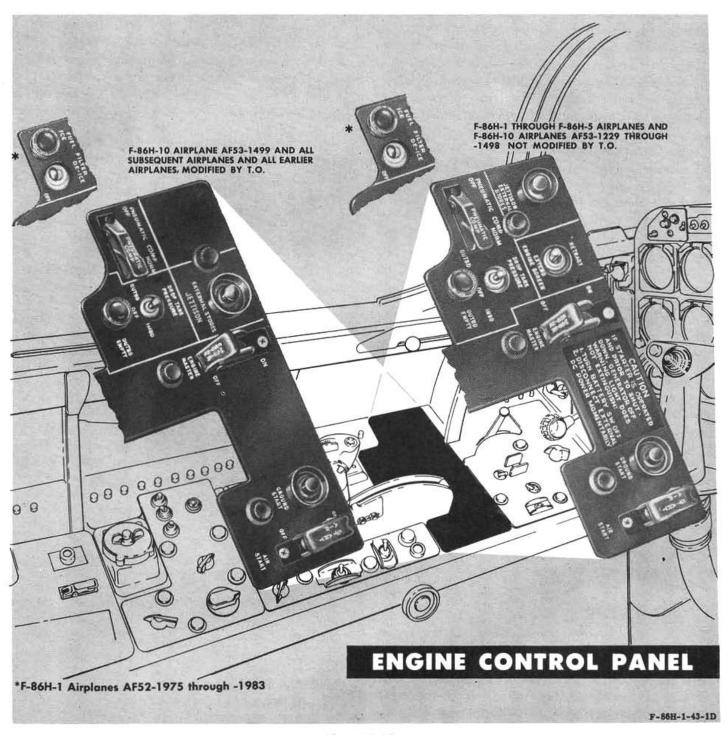


Figure 1-10

switch is moved from the guarded OFF position to ON (with engine master and battery switches ON, and throttle moved from OFF), ignition is energized by battery bus power (primary bus power on late airplanes*). Moving the air start switch to ON also cuts the generator out of the circuit (de-energizing the secondary bus) to reduce battery loads. When the air start switch is at ON, the generator-off warning light will

*F-86H-10 Airplane AF53-1289 and all subsequent airplanes

come on. The switch *must be* moved to OFF to deenergize ignition and reconnect the generator for normal operation.

CAUTION

Use of the air start ignition circuit is limited to 3 minutes per start. Longer continuous periods of use will damage ignition vibrator units.

AIR COMPRESSOR SWITCH.*

The starter air compressor motor may be selectively disabled by a guarded, two-position "PNEUMATIC COMP" switch (figure 1-10) on the engine control panel. When the primary bus powered switch is at NORM (guard down), a solenoid valve allows utility hydraulic system pressure to operate the compressor motor, provided the generator is operating, air storage bottle pressure is below 2700 psi, and the speed brakes or landing gear are not being operated. (Switches in the speed brake and landing gear control circuits open the circuit to the air compressor solenoid valve when either system is being operated. Utility pressure is then cut off from the compressor motor.) With the compressor motor switch at OFF, the circuit to the air compressor solenoid valve is open, regardless of other conditions.

PRIMARY ENGINE INDICATORS.

EXHAUST TEMPERATURE GAGE.

The exhaust temperature gage (14, figure 1-5), on the instrument panel, shows engine exhaust temperature in degrees centigrade. Gage indications are received from thermocouples in the engine tail cone. The temperature indicator system is of the self-generating type and therefore does not require power from the airplane electrical system.

TACHOMETER.

The tachometer (11, figure 1-5), on the instrument panel, registers engine speed in percentage of maximum rated rpm (7950). This indication, when used in conjunction with that of the exhaust temperature gage, permits setting engine power accurately without exceeding engine limitations. The tachometer receives its power from a tachometer generator geared to the engine accessory section and driven by the compressor rotor and is therefore independent of the airplane electrical system.

OIL PRESSURE GAGE.

The oil pressure gage (17, figure 1-5), on the instrument panel, registers engine oil pressure in pounds per square inch. Electrically operated, the gage is applied with single-phase ac power obtained through a step-down transformer from the three-phase (instrument) inverter.

OIL SYSTEM.

Lubrication is supplied from a 5-gallon tank of oil by a recirculating, pressure-type oil system with scavenge pump return. To allow for expansion, an additional 2-gallon expansion tank is used. A regulator valve

permits the return oil to by-pass or go through a fuelcooled oil cooler, depending on the oil temperature. No manual control is provided, as operation of the system is fully automatic. The oil system also supplies control oil for operation of the hydromechanical engine fuel controller. See figure 1-23 for oil specification.

AIRPLANE FUEL SYSTEM.

The airplane fuel system includes four self-sealing tanks, two in the fuselage and one in each wing outer panel. With the exception of the forward fuselage tank, which consists of two cells (upper and lower), the fuel tanks are of the single-cell type. All tanks are connected to the lower cell of the forward fuselage tank, and no selection of internal tanks is necessary, as the system functions as a single source of fuel. During normal operation, fuel from all internal tanks flows by gravity to the forward fuselage tank lower cell. Normal flow from the aft fuselage tank is accomplished by an electrical transfer pump within the tank that is actuated automatically when fuel level in the forward fuselage tank upper cell drops to about 173 gallons (70 gallons on late airplanes?). The transfer pump forces fuel into the forward fuselage tank lower cell until the level in the forward fuselage tank upper cell increases to 180 gailons (90 gallons on late airplanes†); then the pump is automatically turned off. In event of transfer pump failure, all but 50 gallons of fuel will flow by gravity from the aft fuselage tank to the forward fuselage tank lower cell when the airplane is in cruise attitude. To prevent a backflow of fuel to the aft fuselage or wing tanks, check valves are installed in the system. Two tank-mounted electric booster pumps supply fuel under pressure to the engine from the lower cell of the forward fuselage tank. Individual filler openings are on all internal tanks except the forward fuselage tank lower cell, which is filled through the upper cell. In addition, a single-point refueling system is included to reduce ground servicing time. The system permits all internal tanks to be filled through a single filler receptacle in about 5 minutes. During gravity refueling, the forward fuselage tank must be filled first in order to use full fuel capacity; if the wing tanks or aft fuselage tank is filled first, fuel will drain slowly into the forward fuselage tank lower cell while the forward fuselage tank is being serviced. The access doors at the fuel filler receptacles cannot be closed unless the filler caps are secured in the locked position. Internal fuel can be augmented by installation of drop tanks on the undersurface of the wing outer panels. The airplane can carry two 200-gallon combat tanks, two 120-gallon ferry tanks, or a combination of two 120-

^{*}F-86H-1 Airplane AF52-2070 and all subsequent airplanes

[†]F-86H-10 Airplane AF53-1439 and all subsequent airplanes

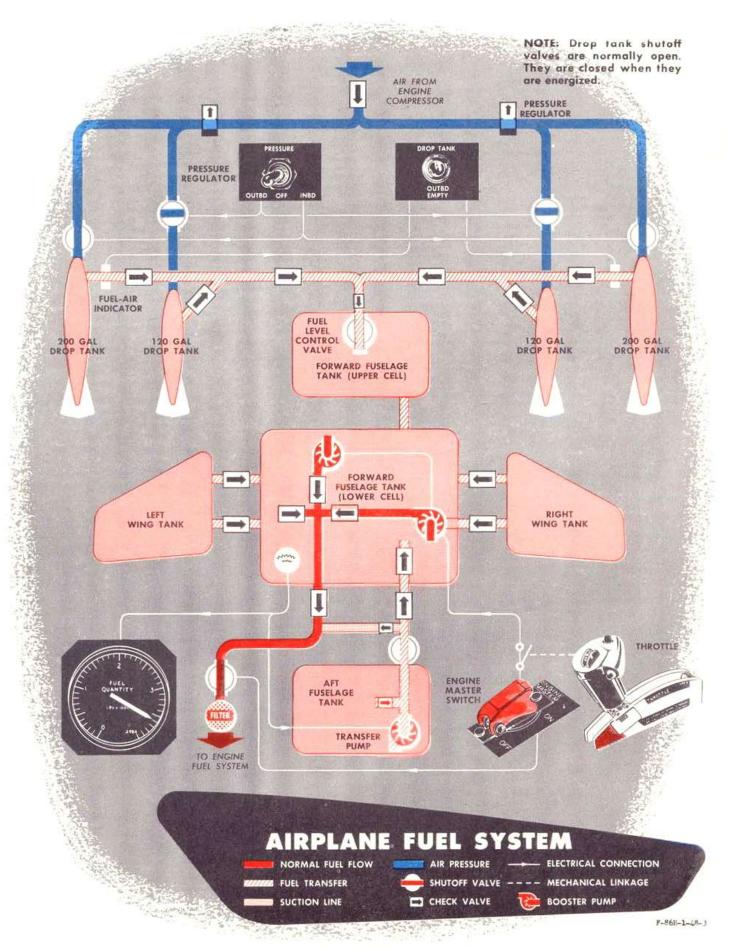


Figure 1-11

gallon and two 200-gallon tanks. (The 200-gallon tanks can be installed on the outboard tank mounting station only.) Controls permit selection of drop tank fuel; however, the fuel in the drop tanks should be used before internal fuel. When the drop tank system is turned on, compressed air from the engine compressor forces fuel from the selected drop tanks into the forward fuselage tank upper cell through a fuel level control valve. Fuel tank capacities are shown in figure 1-12; for fuel specification, see figure 1-23.

FUEL BOOSTER PUMPS.

Two electric fuel booster pumps (primary and secondary), submerged in the lower cell of the forward fuselage tank, supply fuel under pressure from the tank to the engine. The pumps are energized when the engine master switch is ON and the throttle is moved outboard from the OFF position to pass the idle stop. Both pumps are powered by the primary bus; however, the secondary pump is controlled by secondary bus power and, therefore, is operable only when this bus is energized. For ease in ground testing the booster pumps (and the fuel transfer pump in the aft fuselage tank), test switches are on the canopy deck. Before the test switches are operated, the engine master switch should be in the OFF position and external power should be connected to the airplane. Each pump can then be tested individually by holding its respective test switch at the TEST position while listening for pump operation.

FUEL SHUTOFF VALVE.

The fuel shutoff valve, upstream of the low-pressure filter, is electrically controlled by the engine master switch. When the switch is ON, primary bus power opens the valve, allowing fuel to feed to the engine fuel control system.

FUEL FILTER DEICING SYSTEM.

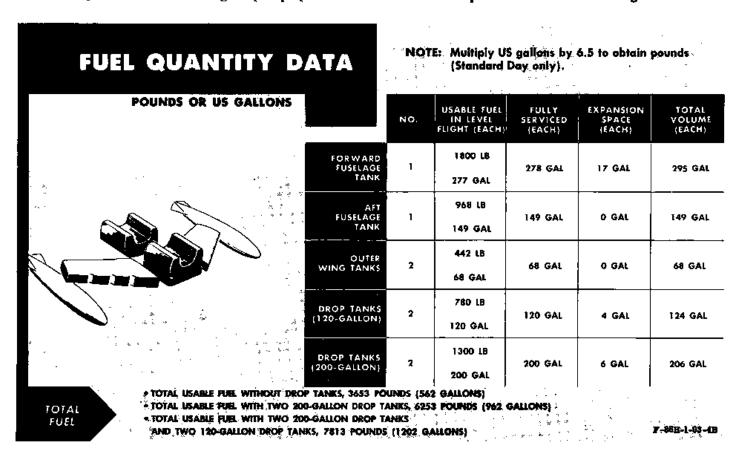
A fuel filter deicing system is incorporated to accomplish fuel filter deicing on some airplanes.* Refer to "Defrosting and Rain and Ice Removal Systems" in Section IV.

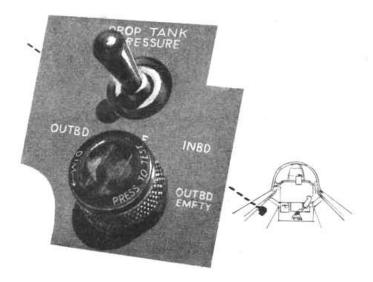
AIRPLANE FUEL SYSTEM CONTROLS.

DROP TANK PRESSURE SWITCH.

A three-position switch (figure 1-10), on the left console, controls pressurization of the drop tanks. Through secondary bus power, the switch actuates the solenoid shutoff valves in the air pressure lines between the engine compressor section and the drop tanks. When the switch is at OUTBD, the normally open air valves to the inboard tanks are closed; all air pressure is directed to both outboard drop tanks, forcing outboard tank fuel to the forward fuselage tank upper cell through a fuel level control valve. With the switch set at INBD,

*F-86H-1 Airplanes AF52-1975 through -1983





both inboard drop tanks are pressurized. Fuel from the outboard tanks should be used first, and then fuel from the inboard tanks, because the inboard drop tanks should not be jettisoned until after the outboard tanks have been released.



Caution

If empty inboard drop tanks are retained, the pressure switch should be left at INBD to maintain pressurization to prevent possible tank collapse during descent. (Outboard tanks need not be pressurized when empty, since they are designed to withstand the most adverse flight conditions the airplane itself will withstand).

WARNING

If inboard tanks are dropped before outboard tanks, they may strike the airplane or the outboard tanks.

After all fuel is transferred from the drop tanks, fuel from the internal tanks will be used automatically.

Note

- On early airplanes* not changed by T. O., completion of drop tank fuel transfer may be accompanied by a very pronounced audible rumble, possible severe pounding throughout the airplane, and, in some cases, fuel venting. The rumble, pounding, and venting, which is not dangerous and therefore no cause for alarm, will stop about one minute after drop tank transfer air is turned off.
- When outboard tanks are empty, drop tank pressure switch should be moved to INBD if inboard tanks are installed, or to OFF if inboard tanks are not installed. If inboard tanks are installed, drop tank pressure switch should be left at INBD after all drop tank fuel has been expended, to prevent possible collapse of the inboard tanks during descent.

DROP TANK RELEASE.

On early airplanes† not changed by T. O., drop tanks are selectively released in pairs when the master armament selector switch (figure 4-9) is positioned to INBD TANKS SALVO OF OUTB'D TANKS SALVO and the bombrocket release button is pressed. If the switch is positioned at EXT STORES JETTISON, all external stores are released at the same time when the bomb-rocket release button is pressed. On late airplanes; and early airplanes† changed by T. O., drop tanks may be dropped individually or in pairs by positioning the master armament selector switch (figure 4-9) to INB'D TANKS or OUTB'D TANKS and positioning the tank release selector switch to LEFT, SALVO, or RIGHT. The selected tank or pair of tanks will drop when the bomb-rocket release button is pressed. Emergency jettisoning of the drop tanks and other external stores can be accomplished electrically (battery bus power), regardless of armament selector switch positioning, by the external stores iettison button on the left console.

^{*}F-86H-1 Airplanes and F-86H-5 Airplanes AF52-2090 through -2124 and -5729 through -5737

[†]F-86H-1 and F-86H-5 Airplanes

^{*}F-86H-10 and subsequent airplanes

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To prevent accidental explosion of drop tanks, 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.

EMERGENCY JETTISON HANDLE.

In case of an electrical release failure, the drop tanks can be jettisoned mechanically by the emergency jettison handle (24, figure 1-5), to the left of the instrument subpanel. When the handle is turned clockwise 45 degrees and then pulled out about 3½ inches, only the outboard tanks are jettisoned. When the handle is pulled straight out to its full extension (about 6½ inches), all external stores (drop tanks, bombs, or rockets) are released at the same time.

FUEL SYSTEM INDICATORS.

FUEL QUANTITY GAGE AND TEST BUTTON.

The fuel quantity gage (21, figure 1-5) is on the center pedestal and shows the total internal fuel supply in pounds, as determined by a capacitance-type indicating system. The system operates on power from the three-phase (instrument) inverter. It automatically compensates for changes in fuel density so that the quantity gage registers the actual number of pounds of fuel, regardless of type of fuel or fuel expansion or contraction caused by temperature changes.

Note

Before drop tank is used, approximately 143 pounds of internal fuel is consumed. After showing this decrease, the fuel quantity gage remains stationary until all fuel from the drop tanks is consumed and the engine begins to use internal fuel.

The fuel quantity gage test button (22, figure 1-5), on the center pedestal, is provided to determine whether the fuel quantity gage is operating. Holding the test button down unbalances the fuel indicating bridge circuit and causes the fuel quantity gage needle to move counterclockwise at the rate of about one revolution per minute. If the needle does not move when the button is pressed, the indicating system is not functioning properly.

OUTBOARD DROP TANK EMPTY INDICATOR LIGHT.

The outboard-drop-tank-empty indicator light (figure 1-10) is on the left console, outboard of the throttle.

With the drop tank pressure switch positioned at OUTBD, the indicator light will come on (secondary bus power) when the outboard drop tanks are empty. The drop tank pressure switch then should be moved to INBD if inboard tanks are carried, or to OFF if they are not installed. Either movement of the switch will turn off the outboard-drop-tank-empty indicator light which is of the push-to-test type.

CAUTION

If empty inboard drop tanks are retained, the pressure switch should be left at INBD to maintain pressurization to prevent possible tank collapse during descent.

ELECTRICAL POWER SUPPLY SYSTEM.

The airplane is equipped with ac and de electrical power systems. The 28-volt de system is powered by a 400-ampere, engine-driven generator, which becomes operative at about 38% engine rpm. A 24-volt, 36-ampere-hour battery serves as a stand-by for de power. During ground operation, direct current can also be supplied through a receptacle by an external power source. Power for the ac system is supplied by a single-phase inverter and two three-phase inverters.

DC ELECTRICAL POWER DISTRIBUTION.

DC power is distributed from three electrical busses: battery, primary, and secondary. The battery bus is connected directly to the battery and therefore is "hot" at all times, regardless of the position of the battery switch. The primary bus is energized by the battery (through the battery bus) when the battery switch is ON (generator not operating), by generator output when the generator is operating, or by external power when an external power source is used. The secondary bus receives its power through the primary bus and is energized only when generator output is available or when external power is connected.

AC ELECTRICAL POWER DISTRIBUTION.

Alternating current is normally supplied by a 1500-voltampere single-phase (radar) inverter and a 250-voltampere three-phase (instrument) inverter. An added three-phase (instrument) inverter serves as an alternate power source if the main instrument inverter fails. The radar inverter (single-phase) is powered by the secondary bus. Consequently, output of this inverter is available only when the generator is operating or when an external power source is connected. If the singlephase inverter output is interrupted, the following will become inoperative: sight radar ranging equipment,

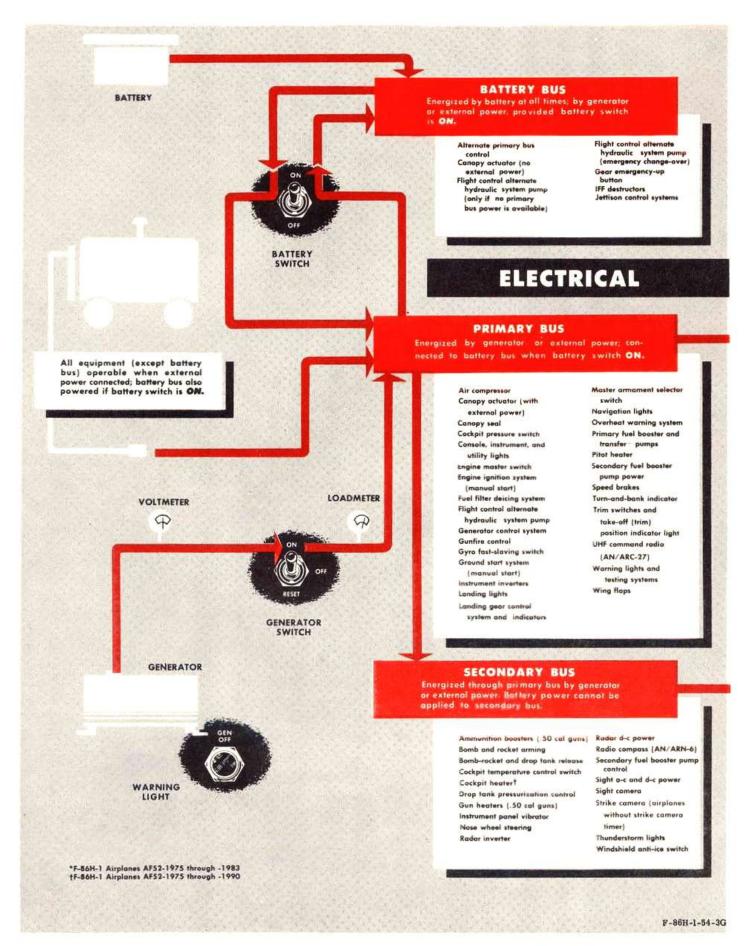


Figure 1-13

IFF radar, special store controls, strike camera timer,* and cockpit air conditioning control system.

The main and alternate instrument (three-phase) inverters are powered by the primary bus. The main instrument inverter serves the engine control amplifier, attitude gyro, and K-4 vertical gyro indicating system, slaved gyro magnetic compass, the fuel flow, oil pressure, hydraulic pressure, and fuel quantity indicating systems, and the 20 mm guns. If the main instrument inverter fails, the units normally powered by it can be transferred to the alternate instrument inverter by a manually controlled transfer switch. Warning lights show when instrument or radar inverter power is not available.

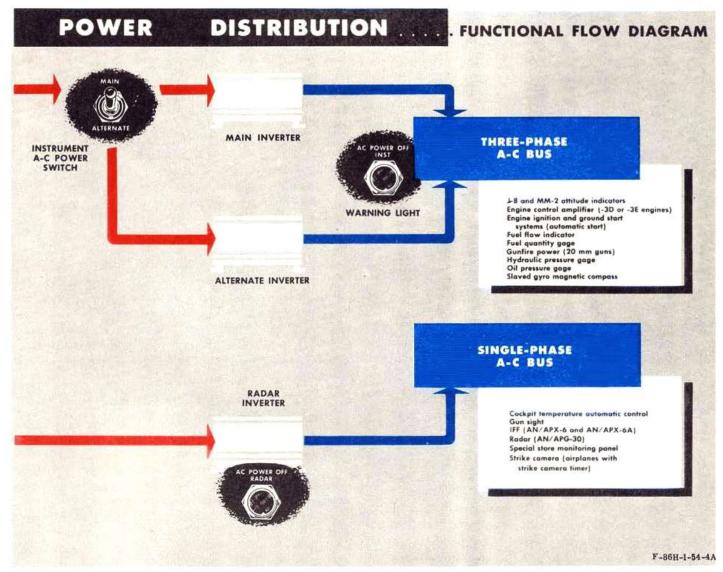
ELECTRICALLY OPERATED EQUIPMENT. See figure 1-13.

EXTERNAL POWER RECEPTACLES.

External power receptacles (dc and, on late airplanes,† ac) are within an access panel on the left side of the fuselage, below the wing trailing edge, for use during ground electrical checks. Neither dc nor ac external power is required for starting; however, to conserve battery current, external dc power should be connected to supply the various electrical systems.

CIRCUIT BREAKERS.

Most of the dc electrical circuits are protected by push-pull type circuit breakers or circuit-breaker



switches. Circuit breakers, accessible to the pilot, are on panels on each side of the cockpit. A number of circuit breakers, not accessible from the cockpit, are on the canopy deck and in the nose wheel well. Tripfree circuit breakers are installed on F-86H-10 and subsequent airplanes. This type of circuit breaker is designed to prevent the pilot from holding the push button in against the circuit fault which caused it to

[†]F-86H-10 Airplane AF53-1439 and all subsequent airplanes

open, and thus sustaining a potentially dangerous overload condition. On F-86H-1 and F-86H-5 Airplanes, nontrip-free circuit breakers are installed; therefore, on these airplanes, it is possible to reset the push-pull circuit breakers against the circuit fault. The ac circuits are protected by fuses, the majority of which cannot be replaced in flight. The main and alternate instrument inverters are protected by on-off, switch-type circuit breakers, so that the inverters may be turned off during ground testing of the dc electrical system. These switch-type circuit breakers are on the right console. (See 7, figure 1-7.)

CAUTION

It is considered highly undesirable to reclose a circuit breaker (on F-86H-1 and F-86H-5 Airplanes) that has opened in flight. Reclosure in general should be attempted only in cases of emergency, and then only with full realization of the hažards involved and a careful evaluation of the advantages versus the disadvantages. (Since F-86H-10 and subsequent airplanes are equipped with trip-free circuit breakers, the circuit breakers on these airplanes cannot be reclosed.)

ELECTRICAL POWER SUPPLY SYSTEM CONTROLS.

BATTERY SWITCH.

The battery switch (figure 1-14) is on the right forward switch panel. When the switch is ON, the battery bus is connected to the primary bus, and the battery bus can be energized by generator output or by power applied through the external power source. When the switch is OFF, battery power is supplied only to those units connected to the battery bus.

GENERATOR SWITCH.

The three-position generator switch (figure 1-14), on the right forward switch panel, uses primary bus power to control generator operation. When the switch is in the guarded ON position, the generator is connected; when it is in the OFF position, the generator is "off the line." The switch is spring-loaded from its RESET position to OFF. If an overvoltage condition occurs when the switch is ON, the generator is automatically cut out, as shown by illumination of the generator-off warning light. The switch should then be momentarily held at RESET and then to OFF. If normal voltage is shown on voltmeter, return switch to ON. This will reset the circuit so that the generator will be automatically reconnected if the malfunction no longer exists and the system has reverted to normal operation.

INSTRUMENT AC POWER SWITCH.

The instrument ac power switch (figure 1-14) is on the right forward switch panel and is used to select the source of three-phase ac power. With the switch at MAIN, the main instrument inverter supplies three-phase ac power; with the switch at ALTERNATE, the alternate instrument inverter supplies the power. A warning light comes on when the output of the selected inverter is not satisfactory. The instrument power switch operates on power from the primary bus.

ELECTRICAL POWER SUPPLY SYSTEM INDICATORS.

GENERATOR VOLTMETER.

The generator voltmeter (18, figure 1-5), on the instrument panel, shows generator voltage.

ELECTRICAL LOADMETER.

The electrical loadmeter (19, figure 1-5), on the instrument panel, is marked "LOAD" and shows percentage of total system amperage being used.

GENERATOR-OFF WARNING LIGHT.

The generator-off warning light (figure 1-14), on the right forward switch panel, is illuminated by primary bus power whenever generator failure occurs, if the voltage drops below that required to close the reverse-current relay, or if the generator switch is OFF. Should generator voltage output become excessive (over 31 volts), the generator will be automatically cut out of the circuit and the generator warning light will come on. Illumination of the warning light (except when external power is connected) shows that the equipment powered by the secondary bus is inoperative and that the battery is powering the primary bus; therefore, all nonessential electrical equipment should be quickly turned off to conserve battery power. The light is of the push-to-test type.

AC POWER-OFF WARNING LIGHTS.

Two push-to-test type inverter failure warning lights are on the right forward switch panel and operate by means of primary bus power. A red warning light (figure 1-14) comes on to show failure of the main or alternate three-phase instrument inverter, whichever is selected. If the light remains on after the stand-by power source is selected, then both inverters are inoperative. An amber indicator light (figure 1-14) comes on when the single-phase radar inverter fails. There is no alternate source of single-phase power.

HYDRAULIC POWER SUPPLY SYSTEMS.

The airplane has three separate and independent constant-pressure type hydraulic systems: a utility hydraulic system, a flight control normal hydraulic system, and a flight control alternate hydraulic system. The three systems are completely isolated and independent of one

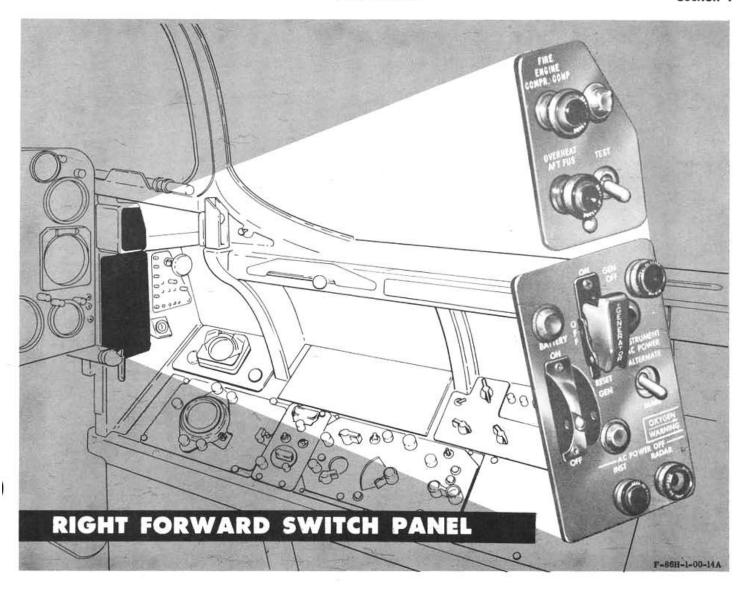


Figure 1-14

another. Pressure in any one of the three hydraulic systems can be selectively read on a single hydraulic pressure gage, according to the position of the pressure gage selector switch. For hydraulic fluid specification, see figure 1-23.

UTILITY HYDRAULIC SYSTEM.

The utility hydraulic system (figure 1-15) is a constantpressure type system. It supplies power for normal operation of landing gear, wheel brakes, nose wheel steering, speed brakes, purge doors,* and air compressor for the pneumatic system. Fluid is supplied to the system from a reservoir in the right side of the fuselage; system pressure is maintained by an engine-driven, variable-displacement pump at 3000 psi.

FLIGHT CONTROL HYDRAULIC SYSTEMS.

Refer to "Flight Control Hydraulic Systems" in this section.

HYDRAULIC PRESSURE GAGE AND SELECTOR SWITCH.

The hydraulic pressure gage and selector switch (8 and 6, figure 1-5), are on the upper part of the instrument panel. When the three-position pressure gage selector switch is at UTILITY, NORMAL (flight control normal hydraulic system), or ALTERN (flight control alternate hydraulic system), the pressure of the respective system is shown by the pressure gage. The hydraulic pressure indicating system is operated by three-phase ac power.

FLIGHT CONTROL SYSTEM.

The flight control system incorporates several unique features. The entire horizontal tail acts as one primary control, the elevator and stabilizer being interconnected and both units moved by stick action. This type of longitudinal control system affords more positive action

^{*}F-86H-5 and subsequent airplanes

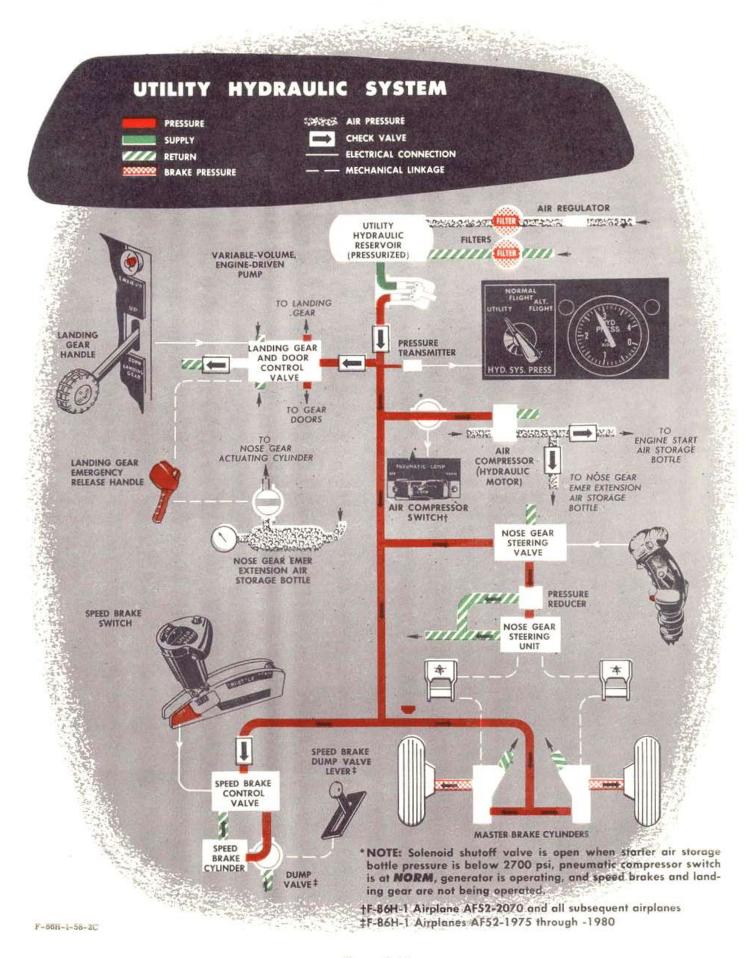


Figure 1-15

and greater control effectiveness with less control surface movement than a conventional control system. The horizontal tail and the ailerons are actuated by a constant-pressure hydraulic system; movement of the control stick mechanically positions hydraulic control valves, which direct pressure to the actuating cylinder of the respective control surface. The irreversible characteristic of the hydraulic control system holds the control surfaces against any forces that do not originate from control stick action, and prevents these forces from being transmitted back to the stick. Thus, aerodynamic loads of any kind cannot reach the pilot. Because of this irreversibility, an artificial feel system is built into the aileron and horizontal stabilizer control system. Trim tabs are not required for aileron and horizontal stabilizer; trimming is accomplished by electric trim actuators, which change the neutral (no-load) position of the control bungee, thus changing the trim position of the surfaces. The rudder is conventionally operated by a cable control system and has an electrically actuated trim tab. A rudder damper is installed in the rudder on the hinge line to prevent rudder buzz in high Mach number dives. This unit is a viscous-type damper and results in increasing the pedal forces in proportion to the rate of movement of the rudder.

CONTROLLABLE HORIZONTAL TAIL.

The elevators and horizontal stabilizer are controlled and operated as one unit, known as the controllable horizontal tail. The horizontal stabilizer is pivoted at its rear spar so that the leading edge is moved up or down by normal control stick action. The elevator is connected to the stabilizer by mechanical linkage and moves in a definite relationship to stabilizer movement. Travel of the elevator is slightly greater than that of the stabilizer. This type control surface eliminates many of the undesirable effects of high speed, such as loss of control effectiveness at high Mach numbers due to compressibility.

ARTIFICIAL FEEL SYSTEM.

Because of the irreversible characteristics of the aileron and horizontal tail hydraulic control system, air loads are not transmitted to the stick and no conventional stick feel is present. Therefore, an artificial feel system is installed to supply the desired stick feel under all flight conditions. Control surface air loads are simulated by spring bungees connected into the control system. To improve flight stability, a bobweight is incorporated in the horizontal stabilizer system to provide a force directly proportional to normal gravity acceleration. The bungees apply loads to the stick in proportion to the degree of stick deflection from the trim position. The ailerons and horizontal tail are trimmed by means of the normal trim switch, which changes the no-load position of the stick by repositioning the artificial feel bungees.

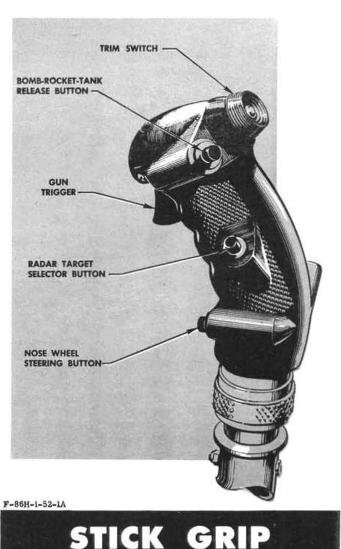
FLIGHT CONTROLS AND INDICATOR.

CONTROL STICK.

The control stick is of conventional design and is mechanically connected to the hydraulic control valves at the control surfaces. Movement of the stick positions the control valves so that pressure from the flight control hydraulic system is directed to the actuating cylinders. The stick has a Type B-8 grip that incorporates the following switches: radar target selector button, bombrocket release button, nose wheel steering button, gun trigger, and the trim switch for ailerons and horizontal tail.

RUDDER PEDALS.

The rudder is controlled by a cable system from conventional hanging-type rudder pedals, which are adjustable fore and aft by a lever on the outboard side of each pedal assembly. A position indicator on the outboard side of each pedal aids in exact alignment



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of the pedals during adjustment. Each indicator consists of a numbered dial; when the visible dial numbers correspond, the pedals are adjusted evenly. Toe action on the rudder pedals operates the wheel brakes.

CONTROL SURFACE LOCKS.

Gust locks are not necessary for the aileron and horizontal tail, as these surfaces are locked against externally applied loads at all times because of the irreversible characteristics of the flight control hydraulic system. The cable-operated rudder can be locked by a latch-type lock provided for each rudder pedal. The locks are recessed in the cockpit floor, one aft of each rudder pedal. To lock the rudder, the pedals must be adjusted to the full aft position and the locks should be opened by pushing down on the aft portion of each lock. The pedals should then be rotated aft to engage the locks. It is necessary to slide the lock aft and then to allow it to return forward so that it will engage the pedal. To release the pedals, the lock is slid aft until the pedal is disengaged. The pedals should be returned to their normal position, and the locks should be pushed down until flush with the floor.

Note

Rudder locks need not be engaged after flight, since the viscous-type damper installed in the rudder will prevent gust damage.

TRIM SWITCH.

Ailerons and horizontal tail are trimmed by a fiveposition, thumb-actuated switch on top of the control stick grip. Trimming is accomplished by means of the trim switch, to remove or reduce stick loads after the stick is positioned to maintain the desired flight attitude. Holding the trim switch to either side energizes the electric lateral trim actuator. Holding the switch forward or aft energizes the longitudinal trim actuator. The trim actuators, when energized, reposition the artificial feel bungees. The bungees, in turn, apply the necessary force to establish a new neutral (no-load) position of the stick, thereby eliminating or reducing control stick loads. The trim circuit is powered by the primary bus. The trim switch is spring-loaded to the center (OFF) position; when released, it automatically returns to this position and trim action stops.

CAUTION

The trim switch is subject to sticking in any or all of the actuated positions, resulting in application of extreme trim. If the switch sticks in any actuated position during ground checks, the airplane must not be flown. The deficiency must be entered on DD Form 781 (formerly Form 1) with a red cross.

RUDDER TRIM SWITCH.

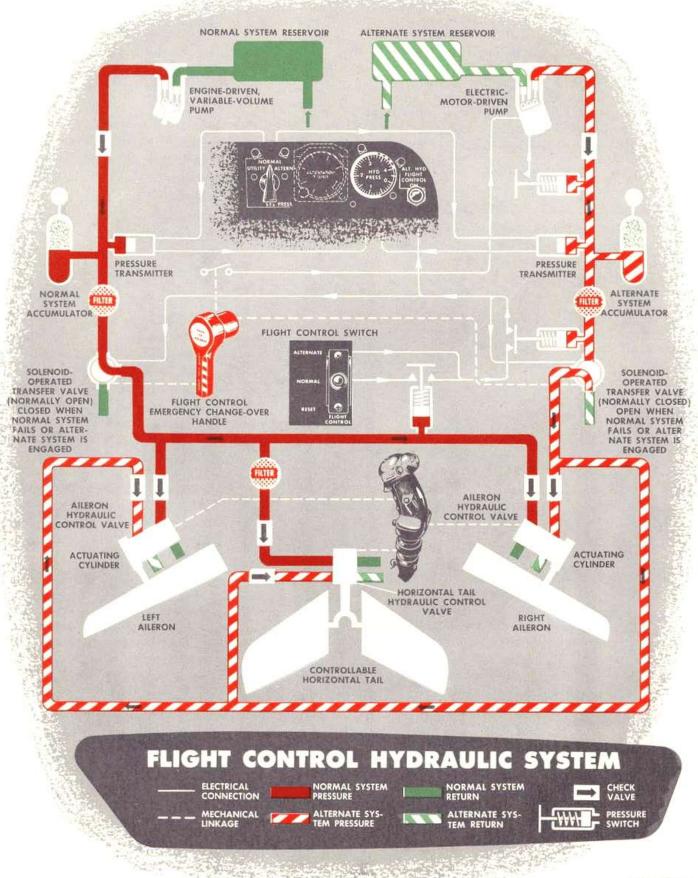
The electrically (primary bus) actuated rudder trim tab is controlled by a three-position switch (38, figure 1-6) on the left console, inboard of the throttle quadrant. The switch is held at LEFT or RIGHT for corresponding rudder trim and is spring-loaded from these positions to the OFF position.

TAKE-OFF TRIM INDICATOR LIGHT.

An amber light (10, figure 1-6) on the left console shows take-off trim position of the ailerons, horizontal tail, and rudder. The light comes on whenever any one of these control surfaces is trimmed to its take-off position and goes out when the respective trim switch is released; it comes on again as each subsequent control is trimmed for take-off. The take-off trim position for the ailerons and rudder is neutral; horizontal tail take-off trim position is that used for a minimum-run take-off. (The leading edge of the horizontal stabilizer is set with the leading edge down about 3 degrees, to induce an airplane nose-up condition.) The light operates on primary bus power.

FLIGHT CONTROL HYDRAULIC SYSTEMS.

Two completely independent hydraulic systems (figure 1-17) provide alternate sources of power for the ailerons and horizontal tail. A constant-pressure hydraulic system, powered by an engine-driven pump, serves as the normal flight control hydraulic system. An alternate constant-pressure hydraulic system is pressurized by an electrically powered pump and operates the controls should the normal hydraulic system fail. The transfer from normal to alternate system is automatic in case of normal system failure, but also may be selected manually by the pilot. Automatic change-over is accomplished electrically by pressure switches and solenoid-operated transfer valves. When normal system pressure drops below about 650 psi, the pressure switch actuates the transfer valves. A warning light on the instrument panel comes on when flight controls are operated on the alternate system. A selector switch permits the pilot to electrically change over from one system to the other for test purposes or for actual operation. If the automatic or selective electrical transfer systems fail, actuation of the emergency change-over handle mechanically positions the transfer valves to select the alternate system, regardless of pressure, and connects the alternate pump motor directly to the battery bus. Hydraulic control valves, positioned mechanically by the control stick, direct pressure to the respective tandemtype actuating cylinders. One is supplied by the normal hydraulic system; the other, by the alternate system. Each is hydraulically independent of the other,



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Note

Automatic or pilot-controlled electrical transfers to the alternate system are prevented if pressure in the alternate system is below the minimum operating pressure. Pilot-controlled transfer from the alternate to the normal system is also prevented if normal system pressure is low. Manual transfer to the flight control alternate hydraulic system can be accomplished regardless of alternate system pressure.

FLIGHT CONTROL NORMAL HYDRAULIC SYSTEM.

The flight control normal hydraulic system has a separate reservoir and is pressurized by an engine-driven, variable-volume pump. Normal system pressure is about 3000 psi, but pressure may be lower during control stick movement. The pump is supplemented by an accumulator for sudden high rates of demand. The accumulator air pressure gage, in the engine accessory well, behind an access door on the bottom of the fuselage just aft of the main gear doors, should be checked by ground personnel before flight for 600 to 650 psi air precharge with hydraulic pressure depleted. The system reservoir is behind an access door on the right side of the fuselage, just forward of the fuselage break. The fluid level indicator pin should extend out from the reservoir to within 1/4 inch of the top of the pin gage.

FLIGHT CONTROL ALTERNATE HYDRAULIC SYSTEM.

The flight control alternate hydraulic system has a separate reservoir, an electrically driven pump, and an accumulator to provide an alternate source of control power. The accumulator air pressure gage, just to the left of the normal system accumulator gage in the engine accessory well, should be checked by ground personnel before flight for 600 to 650 psi air precharge with hydraulic pressure depleted. The system reservoir is behind an access door on the left side of the fuselage, just forward of the fuselage break. The fluid level indicator pin should extend out from the reservoir to within 1/4 inch of the top of the pin gage. The system has separate hydraulic lines to each cylinder, and system pressure is automatically maintained by pressure switches that operate the pump motor, as required, to supply the system and keep the accumulator charged.

Note

When the flight control alternate system is in operation, rapid movement of flight controls for prolonged periods may result in a slightly lower rate of control surface response than when the normal system is in operation. This is accompanied by a reduction in indicated alternate system pressure.

CAUTION

The flight control alternate hydraulic system is engaged automatically when external power is connected for engine start, as normal system pressure is not built up until after the engine is running. Therefore, the flight control switch should be held at RESET to effect change-over to the normal system after engine start.

During flight, the alternate system pump motor is normally powered by the primary bus. If the primary bus fails during flight, the alternate system circuit is automatically transferred to the battery bus. On the ground, the pump motor circuit is automatically powered by the primary bus. Therefore, unless the generator is operating or an external power source is connected, the battery switch must be on to provide power for alternate system operation when the airplane is on the ground. However, because of the heavy drain on the battery by the alternate pump motor, the alternate system should not be operated on the ground unless an external dc power source is connected or the generator-off warning light is not on when external dc power is not connected.

FLIGHT CONTROL HYDRAULIC SYSTEM CONTROLS.

FLIGHT CONTROL SWITCH. The three-position flight control switch (13, figure 1-6), on the left console inboard of the throttle quadrant, provides a means of manually selecting the normal or alternate flight control hydraulic system. With the switch at NORMAL (engine running), the normal system supplies hydraulic pressure to the flight controls, and the alternate system will cut in automatically should the normal system pressure fall below about 650 psi. When the switch is moved to ALTERNATE, a transfer valve in the normal system is actuated to block normal system pressure, and a transfer valve in the alternate system is opened, permitting alternate system pressure to power the flight controls. (This transfer cannot be completed unless adequate pressure is available in the alternate system.) When the switch, which is spring-loaded to NORMAL, is momentarily positioned at RESET, it de-energizes both the normal and alternate system shutoff valves. This allows them to return to their normal positions (normal system operating). The RESET position of the flight control switch must be used whenever an intentional transfer from the alternate to the normal system is made. Should the alternate system fail, transfer to the normal system will take place automatically.

FLIGHT CONTROL EMERGENCY CHANGE-OVER HANDLE. The flight control emergency change-over handle (26, figure 1-5), below the left side of the instrument panel, permits the flight control alternate hydrau-

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lic system to be engaged if the automatic or selective electrical transfer systems fail. Pulling the handle aft to its full out position (about 4 inches) mechanically actuates two transfer valves (normally solenoid-operated) to transfer flight control operation to the alternate system and connects the alternate system pump directly to the battery bus, thus by-passing pressure switches that normally control pump operation. As a result, when the handle is extended, pump operation is continuous, regardless of system pressure.

Note

Since the automatic pressure control of the alternate system is by-passed when the emergency change-over handle is extended, alternate system pressure will be about 3500 psi.

If the handle is returned to its normal position, the alternate system will remain in operation until the flight control switch is held momentarily at RESET and then released to NORMAL. On some airplanes, a button in the face of the handle must be pressed before the handle can be pushed in to the stowed position.

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 changeover handle in flight, except when the normal system fails and automatic (electrical) changeover to the alternate system does not occur, or just before entering the landing pattern when flying on the alternate system after normal system failure.

FLIGHT CONTROL HYDRAULIC SYSTEM INDICATORS.

ALTERNATE-ON WARNING LIGHT. The amber alternate-on warning light (9, figure 1-5), on the instrument panel, comes on whenever the flight control alternate hydraulic system is operating. The primary bus normally provides power for illuminating the light. However, if no primary bus power is available, the light will come on by power from the battery bus.

HYDRAULIC PRESSURE GAGE AND SELECTOR SWITCH, Refer to "Hydraulic Power Supply Systems" in this section.

WING LEADING EDGE.

NONSLATTED LEADING EDGE.

Most airplanes have the nonslatted (fixed-contour) wing leading edge assembly. A wing fence on the upper surface of each wing gives favorable low-speed characteristics.

SLATTED LEADING EDGE.

On some airplanes, the leading edge has been changed to include slats. (See figure 1-2.) Addition of wing slats improves low-speed characteristics and highaltitude maneuverability. The slats on each wing are divided into four segments. Aerodynamic force acting upon the slats cause them to open and close automatically, depending on the airspeed and the attitude of the airplane. Upon opening, the slats move forward along a curved track to create a slot in the wing leading edge. This slot formation controls the airflow over the upper surface of the wing and increases lift, resulting in lower stalling speeds. At higher airspeeds in unaccelerated flight, the slats close automatically to offer minimum drag for maximum flight performance. For detailed comparisons of the flight characteristics afforded by either leading edge configuration, refer to applicable paragraphs in Section VI.

WING FLAP SYSTEM.

Electrically controlled and operated (dc) slotted-type wing flaps extend spanwise from the fuselage to the aileron on each wing panel. An individual electrical circuit and individual electric motor actuate each flap. The flaps are mechanically interconnected so that if one actuating motor or electrical circuit fails, the respective flap will be actuated through mechanical interconnection with the opposite flap. This mechanical interconnection also prevents individual or uneven flap operation, and a brake within each actuator prevents air loads from moving the flaps. No emergency system is provided, as enough protection is afforded in the normal system by the mechanical interconnection, the individual actuator motors, and the individual actuator motor circuits. There is no flap position indicator.

WING FLAP HANDLE.

The wing flap handle (5, figure 1-6), outboard of the throttle on the left console, controls flap actuation by primary bus power. To position the flaps, the flap

handle is moved to the selected UP, MID, or DOWN position. Moving the handle to UP will raise the flaps to the streamlined position. With the handle at DOWN, the flaps will lower to the full down position (about 38 degrees). When the handle is moved from UP to MID position, the flaps will lower to mid-position of their travel (about 20 degrees). To raise the flaps from full-down position or mid-position, the flap handle must be placed at the UP position. A spring-loaded sliding bolt, next to the flap handle, can be moved to limit the flap handle travel to the MID position (from the UP position) for certain airplane load conditions.

Note

The MID position is not a neutral position. The flaps will move to mid-position only from the full up position.

SPEED BRAKE SYSTEM.

Hydraulically operated speed brakes are on each side of the fuselage, below the dorsal fin. Each speed brake consists of a panel hinged at the forward edge; the panel, when open, extends forward into the air stream. Pressure for normal operation of the speed brakes is supplied by the utility hydraulic system through a solenoid-operated selector valve. The speed brakes open in about 2 seconds with high engine rpm. About 4½ seconds is needed to close the brakes on the ground with high engine rpm. There is no speed brake position indicator. If the solenoid-operated selector valve fails, a dump valve, installed on early airplanes,* may be mechanically positioned to allow air loads to close the speed brakes.

SPEED BRAKE SYSTEM CONTROLS.

SPEED BRAKE SWITCH.

A serrated switch, on top of the throttle, controls speed brake operation, using power from the primary bus. The switch has three fixed positions: IN, OUT, and a neutral (HOLD) position shown by a white alignment mark on the switch guide. The speed brakes can be stopped at any position by movement of the switch to neutral. After the speed brakes have been opened or closed, the switch should be returned to the neutral position. Should the switch be left in the IN position, for example, the click into the neutral position may be mistaken for the OUT position, and the expected braking action will not occur.

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 hydraulic pressure and minimize the fire hazard in case of a damaged line.

CAUTION

If the speed brakes are actuated during taxiing, hydraulic boost pressure will not be available for applying the wheel brakes until speed brake operation is completed and system pressure is restored. However, conventional hydraulic braking action will be available in direct proportion to pilot pressure on the brake pedals.

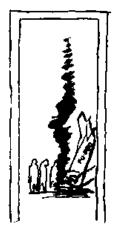
SPEED BRAKE DUMP VALVE LEVER.*

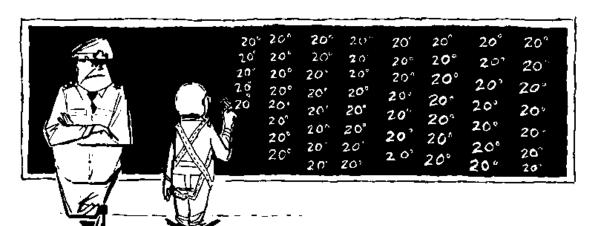
To provide a means of closing the speed brakes if normal operation fails, an emergency lever (22, figure 1-6)

*F-86H-1 Airplanes AF52-1975 through -1980

Warning

Because of restricted clearances, do not lower wing flaps more than 20 degrees (MID position of wing flap handle) when EX-10 bombs or 1000-pound GP bombs with the T-142 fin are carried.





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is installed on the left aft console. Normally, the lever is forward. When pushed aft, the lever mechanically opens a dump valve, which relieves hydraulic pressure from the speed brake actuating cylinders and permits air loads to close the brakes to a slightly open trail position which offers very little drag.

LANDING GEAR SYSTEM.

The fully retractable tricycle landing gear, as well as the gear and wheel fairing doors, are hydraulically actuated and electrically (dc) controlled and sequenced. A pneumatic system is provided for emergency lowering of the nose gear. The main gear retracts inboard into the lower surface of the wing and fuselage; the nose gear retracts aft into the fuselage, pivoting 90 degrees so that the nose wheel is horizontal when retracted. After the gear is down and locked, the wheel fairing doors are retracted to the closed position to prevent mud, dirt, etc, from entering the wheel wells during landing, taxiing, and take-off. Landing gear and wheel fairing door extension and retraction time is about 8 seconds. A hydraulic steering unit is built into the nose gear assembly and serves as a conventional shimmy damper when the steering machanism is not engaged. The main wheels are equipped with hydraulically operated, segmented rotor-disk type brakes.

LANDING GEAR SYSTEM CONTROLS.

LANDING GEAR HANDLE.

The landing gear handle (figure 1-18), located on the left forward switch panel, electrically (primary bus) controls the gear and gear door hydraulic selector valve. Moving the handle to UP or DOWN causes utility hydraulic system pressure to position the gear correspondingly. When the gear is down and locked and the weight of the airplane is on the gear, two ground safety switches prevent gear retraction if the control is inadvertently moved to UP. The wheel fairing doors are not controlled by the safety switch; they will follow their normal sequence, opening when the handle is moved to UP and thereby providing a warning to the ground crew that the landing gear handle is in the wrong position for ground operation.

Note

For ease in ground servicing, the wheel well cover doors may be opened (without the gear handle being moved) by a switch in the left gear strut well. If the switch has been used, it must be moved to CLOSE before flight. Otherwise, the doors will not close after gear is extended for landing.

The wheel portion of the handle glows red to serve as the landing-gear-unlocked or door-unlocked warning light.

LANDING GEAR EMERGENCY RELEASE HANDLE.

Should the utility hydraulic system or electrical system fail, the gear may be lowered by the landing gear emergency release handle (20, figure 1-5), to the right of and below the instrument panel. Pulling the release handle out fully mechanically unlocks all gear and fairing doors, positions the gear and door hydraulic selector valves to neutral, and opens an air selector valve. The main gear then falls free, and air pressure is directed from the emergency air bottle to extend the nose gear. This air pressure is sufficient for one extension only. A pressure switch de-energizes the landing gear selector electrical circuit at any time air pressure is in the nose gear cylinder, to prevent return of the high-pressure air to the utility hydraulic reservoir.

CAUTION

- The emergency release handle must be pulled to the full extension of about 11 inches to ensure release of all gear uplocks and proper positioning of the hydraulic selector valves. A pull force on the handle of about 45 pounds is enough to release the landing gear.
- Landing gear cannot be retracted in flight after being lowered by the landing gear emergency release handle. Therefore, to restore normal operation, the emergency extension reset button must be reset before the next flight if the gear emergency release handle has been used.

LANDING GEAR EMERGENCY-UP BUTTON.

Use of the guarded emergency-up button (figure 1-18), which overrides the landing gear ground safety switches, permits the gear to be retracted on the ground if necessary. When the landing gear handle is at UP, holding the emergency-up button down by-passes the ground safety switches and directs battery bus power to the gear and door selector valve, so that the gear is retracted hydraulically. Retraction is normal, except that the wheel well doors may not have enough time to fully open. To ensure positive gear retraction, the button must be held down until the gear completely retracts, or at least 5 seconds.

Note

When the emergency-up button is used, gear retraction time can be reduced if the airplane is yawed by alternately applying wheel brakes or by engaging nose wheel steering and applying rudder alternately. (Yawing relieves the load on main gear downlock pins.)

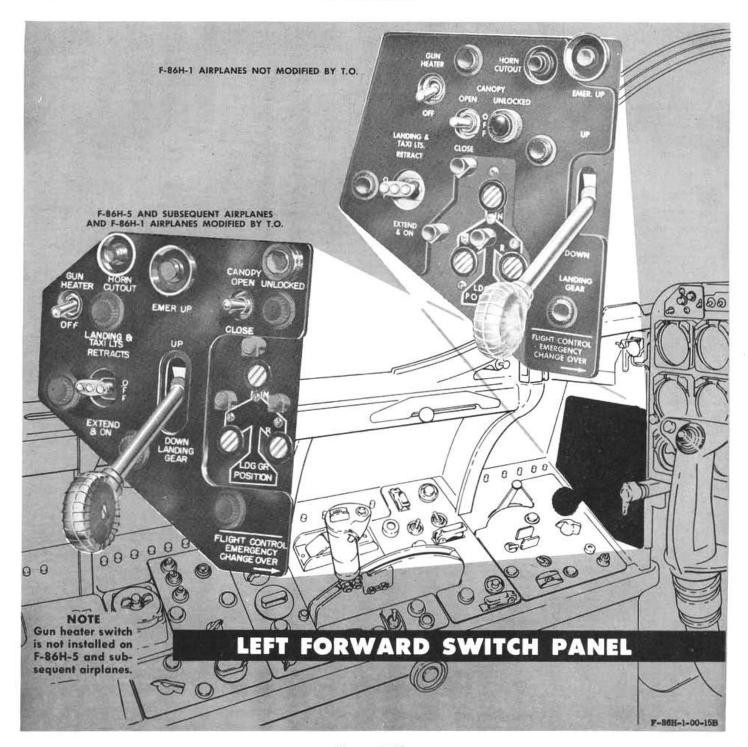


Figure 1-18

EMERGENCY EXTENSION RESET BUTTON.

A red emergency extension reset button is located externally on the right side of the fuselage nose section, just forward of the external canopy control buttons. The button is linked to the selector valve in the nose gear hydraulic system. As the selector valve moves to allow compressed air to enter the nose wheel actuating cylinder when emergency release handle is used to lower the nose wheel, the reset button protrudes from the side of the fuselage. Once the emergency system has been used to lower the nose wheel, the air must be released from the actuating cylinder before the nose wheel will again retract. Pushing the reset button repositions the selector valve, releasing the air from the actuating cylinder.

LANDING GEAR SYSTEM INDICATORS.

LANDING GEAR POSITION INDICATOR.

The position of the landing gear is shown by an indicator (figure 1-18) on the left forward switch panel. The indicator consists of three windows, one for each gear. Each window displays a simulated wheel when its respective gear is down and locked, the word "UP" when the gear is up and locked, and red and yellow diagonal lines when the respective gear is in an unlocked condition.

Note

Since the indicator is actuated by primary bus power, the diagonal lines also appear when the primary bus is not energized.

LANDING GEAR UNSAFE WARNING LIGHT.

The red warning light in the wheel of the landing gear handle (figure 1-18) comes on (primary bus) when any gear is in any unlocked condition. This light also comes on if the gear is up and locked when the throttle is retarded below minimum cruising rpm, if the gear is up and locked and any gear door is not completely closed, or if the landing gear handle is moved to UP when the airplane is on the ground. The warning light is dimmed automatically when the instrument panel primary light rheostat is more than 30 degrees from the OFF position. Operation of the warning light may be tested on the ground by pressing the horn cutout button when throttle is at OFF.



If the switch in the landing gear handle should fail, the landing gear unsafe warning light and the landing gear warning horn would not operate, and the landing gear could not be raised or lowered (except by emergency lowering method). For this reason, you must use the landing gear position indicator as the primary indication of gear position.

LANDING GEAR WARNING HORN.

If the gear is not down and locked when the throttle is retarded below cruising rpm, a warning horn in the cockpit sounds automatically. Depressing the horn cutout button (figure 1-18) on the left forward switch panel silences the horn. Advancing the throttle resets the horn circuit, which is powered by the primary bus.

NOSE WHEEL STEERING SYSTEM.

Nose wheel steering is electrically engaged (dc), hydraulically powered, and controlled by the rudder pedals. Steering is accomplished when a switch on the control stick grip is depressed and the rudder pedals are operated to control a hydraulically operated nose wheel steering unit. This unit permits the wheel to be turned about 40 degrees each side of center by pressure on the respective rudder pedal. When not engaged



Caution

If speed brakes are actuated during taxiing, hydraulic pressure will not be available for nose wheel steering until speed brake operation is completed.

for steering, the unit serves as a conventional hydraulic shimmy damper. A safety switch, on the nose wheel strut torque link, prevents engagement of the steering unit when the weight of the airplane is off the nose gear. Utility system pressure is reduced by the pressure reducer valve for operation of the steering system.

NOSE WHEEL TOWING RELEASE PIN.

The nose wheel towing release pin, on the forward side of the nose gear strut, just above the wheel fork, must be disengaged from the strut before the airplane is towed, to allow the nose wheel fork to swivel. When the pin is engaged, as required for normal steering operation, the pin handle is held downward in the vertical position by a detent and by a retaining cap screwed on the pin assembly. The downward extension of the pin handle prevents the tow bar from being attached to the towing lugs on the nose wheel fork until the pin is disengaged. The pin is disengaged, to permit tow bar attachment, by unscrewing the retaining cap. The pin can then be pulled forward and rotated 180 degrees to the upward vertical position, where it is held by a detent. On late airplanes,* the nose wheel strut also has provisions for attaching a standard Army-Navy tow bar to the axle. The towing release pin handle does not prevent attachment of this type tow bar; however, the pin must be disengaged to permit the nose wheel fork to swivel.

CAUTION

The nose wheel towing release pin should be disengaged after shutdown; otherwise, the steering unit will be damaged if the airplane is towed.

NOSE WHEEL STEERING BUTTON.

The push-button type nose wheel steering button, on the control stick grip, actuates a shutoff valve (secondary bus power) to supply hydraulic pressure to the nose gear

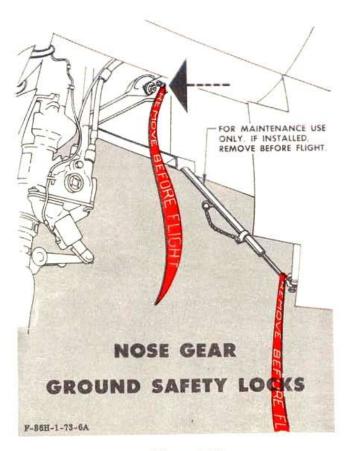


Figure 1-19

steering unit. To engage the steering unit, the switch must be pressed and the rudder pedals aligned in the direction the nose wheel is turned. When the nose wheel and rudder pedals are coordinated in this manner, the nose wheel steering unit is automatically engaged by a hydraulically actuated clutch within the steerdamp unit.

Note

The nose wheel steering unit will not engage if the nose wheel is more than about 40 degrees either side of center. Should the nose wheel be turned more than this, it must be brought into the steering range by use of the wheel brakes.

WHEEL BRAKE SYSTEM.

The segmented rotor-disk type hydraulic wheel brakes are conventionally operated by toe action on the rudder pedals. Brake pressure is supplied from the brake master cylinders and supplemented by power boost from the utility hydraulic system. A brake reservoir† retains a quantity of return fluid from each brake. If utility system pressure fails or is reduced, the master cylinders will operate as manual brakes with fluid from the reservoir.

CAUTION

- Because of light brake forces required, care should be exercised to prevent sliding wheels.
- If the speed brakes are actuated during taxiing, hydraulic boost pressure will not be available for applying the wheel brakes until speed brake operation is completed and system pressure is restored. However, conventional hydraulic braking action will be available in direct proportion to pilot pressure on the brake pedals.

Note

This airplane is not equipped with parking brakes.

INSTRUMENTS.

Only instruments which are not part of a complete system, such as fuel system, engine, etc, are discussed

*F-86H-5 and subsequent airplanes †F-86H-1 Airplanes in the following paragraphs. Most of these instruments are on the instrument panel and are powered by the ac and/or dc electrical system. An automatic electric vibrator, powered by the secondary bus, is on the forward side of the instrument panel. This automatic vibrator prevents instrument lag or sticky pointer indications. Refer to the applicable system for information on instruments not discussed in the following paragraphs.

AIRSPEED INDICATOR.

The airspeed indicator (30, figure 1-5 and figure 5-1) is on the instrument panel. The fluorescent pointer registers indicated airspeed. The striped pointer shows the airspeed corresponding to the limiting Mach number for the airplane with no external load. In addition, a mechanical adjustment limits movement of the striped pointer so that it cannot exceed the limit airspeed for the airplane with no external load. The pitot-static head is installed on a boom on the right wing tip, and installation error is negligible so far as the pilot is concerned.

MACHMETER.

The Machmeter (32, figure 1-5) serves as a primary flight instrument for indicating speed. It interprets indicated (pressure) altitude and indicated airspeed to show indicated Mach number. The instrument is extremely valuable, particularly at high altitudes, as its reading is more closely related to true airspeed than is indicated airspeed. (Refer to "Mach Number" in Section VI.)

ACCELEROMETER.

A three-pointer accelerometer (7, figure 1-5) shows positive and negative G-loads. In addition to the normal indicator pointer, there are two movable recording pointers (one for positive G-loads and one for negative G-loads) that follow the indicator pointer to its maximum travel. The recording pointers remain at the respective maximum travel positions, thus providing a record of maximum G-loads encountered. To return the recording pointers to the normal (1 G) position, it is necessary to press the knob on the lower left corner of the instrument ring.

STAND-BY COMPASS.

A conventional magnetic compass (1, figure 1-5), mounted on the windshield bow to the right of the armor glass, 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

right console, and brilliancy of illumination is controlled by the console lighting rheostat.

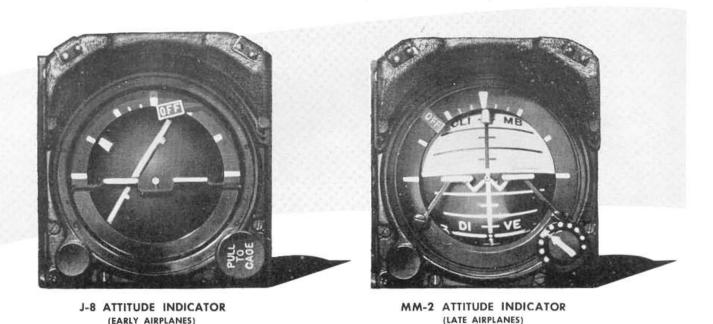
J-8 ATTITUDE INDICATOR.*

On most airplanes, visual indication of the flight attitude of the airplane in pitch and roll is provided by the gyro-controlled J-8 attitude indicator (13, figure 1-5 and figure 1-20) on the instrument panel. The unit is electrically operated (three-phase ac) and has an "OFF" indicator flag, which appears in the upper right arc of the dial whenever power is not being supplied or the gyro is not up to speed. Within a range of 27 degrees in a climb or dive, the pitch attitude of the airplane is presented on the indicator by displacement of the horizon bar in relation to the miniature indicator airplane. When the pitch attitude of the airplane exceeds 27 degrees, the horizon bar remains in the extreme position, and the sphere then serves as the reference. If the climb or dive angle is further increased, with the airplane approaching a vertical position, the attitude is shown by graduations on the sphere. During extreme maneuvers, when pitch angle approaches and passes 90 degrees in a dive or climb, a controlled precession of the gyro occurs, causing the sphere and horizon bar to rotate 180 degrees about the roll axis. Thus, correct attitude indication is provided throughout the maneuvering range of the airplane. In a roll, the attitude of the airplane is shown by the angular setting of horizon bar with respect to miniature indicator airplane and by the relation of the bank index to the degree markings on the bezel mask. After certain maneuvers, the attitude indicator will "lag" about 5 degrees upon return to straight-and-level flight. The unit begins to correct these errors immediately. The gyro may be manually caged by use of the caging knob on lower right side of the bezel. Caging is accomplished by smoothly pulling the knob away from the instrument and releasing it quickly as soon as it reaches the limit of travel. The manual caging feature permits fast gyro erection for scramble take-offs or for correcting in-flight errors caused by turns or aerobatics. For scramble take-offs, 30 seconds should be allowed after power is applied to bring the gyro up to speed, and then the gyro should be caged immediately. When the gyro is caged to correct in-flight errors, caging should be used only when the airplane is in straight-and-level flight as determined by visual reference to a true horizon, since the indicator cages to the attitude of the airplane. A knob on the lower left side of the bezel permits the miniature indicator airplane to be adjusted to compensate for longitudinal trim changes.

^{*}F-86H-1 and F-86H-5 Airplanes, and F-86H-10 Airplanes AF53-1229 through -1468

Section I T. O. 1F-86H-1

J-8 AND MM-2 ATTITUDE INDICATORS



F-86H-1-51-6B

Figure 1-20

MM-2 ATTITUDE INDICATOR.*

On late airplanes, a visual indication of the flight attitude of the airplane in pitch and roll is provided by the MM-2 attitude indicator which is part of the K-4 attitude indicator system. The synchro-type MM-2 indicator (figure 1-20), on the instrument panel, is electrically controlled by a remote gyro in the K-4 control assembly. The gyro establishes the vertical reference line from which pitch-and-roll deviation is measured. Electrical signals caused by airplane attitude change are relayed to the indicator through the K-4 control assembly. The signals cause displacement of the indicator sphere and horizon bar in relation to a miniature airplane, which is fixed to the indicator case. The amount of displacement is directly proportional to actual airplane attitude change from level flight. The K-4 system is powered from the dc and three-phase ac busses. Erection of the gyro requires about 21/2 minutes after application of power and can be observed by disappearance of the "OFF" power failure flag which is visible through the cover glass of the MM-2 indicator. The "OFF" flag will appear in the event of complete dc or three-phase ac power failure.

WARNING

A slight reduction in three-phase ac or dc power, or failure of certain components in the

*F-86H-10 Airplane AF53-1469 and all subsequent airplanes

K-4 system will not cause the "OFF" flag to appear, even though the indicating system is not functioning properly. Therefore, periodically in flight, check the attitude indications given by the MM-2 against the other flight instruments, such as the slaved gyro magnetic compass and turn-and-bank and rate-of-climb indicators.

The indicating system is operative through 360 degrees of pitch and roll and is not likely to tumble, even during extreme maneuvers. It is so designed that, as the airplane approaches and passes through 90 degrees of dive or climb, the gyro (and consequently the indicator) precesses 180 degrees about the airplane roll axis. Thus, correct attitude indication is provided throughout the maneuvering range of the airplane. Indication error for the system is less than ½ degree in level flight, and, up to a turn rate of 40 degrees per minute, the indication error compares to that of a conventional attitude indicator. In turns of more than 40 degrees per minute, a compensating mechanism in the system limits turn error indication to 2 degrees.

WARNING

A slight amount of pitch error in the indication of the MM-2 indicator will result from accelerations or decelerations. It will appear 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 will be most noticeable at the time the airplane breaks ground during the take-off run. At this time, a climb indication error of about 1½ horizon bar widths will normally be noticed; however, the exact amount of error will depend upon the acceleration and elapsed time of each individual take-off. The erection system will automatically remove the error after the acceleration ceases.

The gyro does not have a manual caging knob. When 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 level-flight pitch attitude 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 and sphere after the airplane has been trimmed for level flight.

ALTIMETER.

Some airplanes have a conventional type altimeter (28, figure 1-5). Other airplanes have a modified altimeter (figure 1-21) which, in addition to the standard 1000-and 100-foot pointers, incorporates a new 10,000-foot pointer (notched disk with extension pointer) which

MODIFIED ALTIMETER



Figure 1-21

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 below 16,000 feet.

TURN-AND-BANK INDICATOR.

The conventional turn-and-bank indicator (27, figure 1-5), on the instrument panel, is electrically driven by power from the primary bus.

SLAVED GYRO MAGNETIC COMPASS.

Refer to "Navigation Equipment" in Section IV.

EMERGENCY EQUIPMENT.

ENGINE FIRE AND OVERHEAT DETECTOR SYSTEM.

Two fire and overheat detector systems detect and show fire or overheat conditions in the forward or aft engine compartment. (The forward engine compartment, which includes the compressor section, and the aft compartment, which includes the combustion chambers and the tail pipe, are divided by a fire wall at the engine mid-frame.) The system consists of overheat detector units, mounted throughout the engine and engine compartments, and warning lights and a test switch in the cockpit. No fire extinguisher system is installed.

OVERHEAT WARNING LIGHTS.

An abnormal temperature rise in the engine compressor compartment is shown by illumination of a red warning light labeled "FIRE ENGINE COMPR. COMP." (figure 1-14). An unsafe overheat temperature in the aft engine compartment is shown by illumination of an amber light labeled "OVERHEAT AFT FUS" (figure 1-14). The two lights are on the right forward switch panel. Operation of the system and the lights can be checked by a switch next to the lights. When the switch is held at the TEST position, the warning lights should come on. The switch is spring-loaded to the unmarked position. The lights are of the push-to-test type, permitting a check of bulb illumination independent of the system operation check, and are powered from the primary bus.

CANOPY.

The electrically operated clamshell canopy, which opens and closes by rotating about a hinge point at the rear, may be controlled either from the cockpit or outside of the airplane. From the closed position, the canopy slides aft about one inch to clear the canopy hold-down hooks before rising to the open position (32 degrees); when closing, the reverse is true. The reversible electric actuator is powered from the primary

bus if external power is connected to the airplane or the engine is running; otherwise, it is powered from the battery bus, so that the canopy is operable regardless of the battery switch position. Provision is made also for manual operation of the canopy. In flight, emergency release of the canopy is accomplished by a remover, which fires the canopy up and aft from the airplane. If the canopy does not jettison, the seat may be ejected through the canopy. The airplane may be taxied at speeds up to 50 knots IAS with the canopy open. A warning light comes on whenever the canopy is in any position except latched fully closed.

CANOPY SEAL.

Pressure for inflation of the canopy seal, which seals the canopy in the closed position, is provided by air from the engine compressor section and is automatically controlled by a pressure regulator. The seal is automatically inflated whenever the canopy is fully latched and the engine is running. When the canopy is unlocked, the seal is automatically deflated to allow the canopy to move. The seal is automatically deflated before canopy ejection.

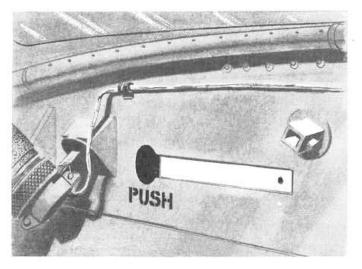
CANOPY CONTROLS AND INDICATOR.

CANOPY EXTERNAL CONTROL BUTTONS.

The canopy is operated externally by means of two electrical spring-loaded push buttons on each side of the fuselage, about $3\frac{1}{2}$ feet below and in line with the windshield bow. One button is marked "OPEN," and the other, "CLOSE." Pressing either button results in corresponding operation of the canopy.

CANOPY SWITCH.

The canopy is controlled from within the cockpit by a three-position toggle switch (figure 1-18), on the left forward switch panel. The switch is spring-loaded to the OFF position. To close the canopy, the switch must be held at the CLOSE position until 2 seconds



after the canopy-unlocked warning light goes out. This will ensure that canopy is fully closed and hold-down hooks are engaged. (Limit switches cut off the power when the canopy locks.) Holding the switch at the OPEN position energizes the actuator to open the canopy; switch must be held at OPEN until the canopy reaches the fully open position, when limit switches automatically cut off power to the canopy actuator. When the switch is at its center (OFF) position, the canopy is safe for taxiing, whether open, partly open, or closed.

CANOPY MANUAL RELEASE HANDLE.

A handle on the right side of the cockpit, recessed in the canopy frame, is used for pulling the canopy open on the ground if it cannot be opened electrically. On early airplanes,* this handle releases the canopy from the hold-down hooks and actuator only if the canopy is in the closed position. On late airplanes,† the handle releases the canopy from the hold-down hooks and from the actuator with the canopy in any position. When the handle is pulled out from the recessed position, the hooks are released from the drag rollers and actuator so that the canopy can be manually pulled back and lifted to the open position or off the airplane. On early airplanes,* the canopy will not hold in an open position after it has been opened manually. On late airplanes,† the canopy will latch and remain open, when opened manually, if raised slightly above the normal open position.

CANOPY EMERGENCY RELEASE (EJECTION SEAT ARMRESTS).

When the armrest on the ejection seat is pulled full up in preparation for seat ejection, the canopy remover is fired to jettison the canopy for emergency bail-out. (The canopy can be ejected at any airspeed or airplane attitude.) The canopy remover is actuated by an initiator and exactor system. Raising either armrest to its full up position fires a cartridge within the initiator unit located in the right console. The expanding gases thus produced are discharged to the exactor unit on the canopy remover catapult. A piston in the exactor is moved by the gas pressure and pulls the sear pin from the canopy remover, causing the remover to fire and jettison the canopy.

WARNING

A ground safety pin in the canopy initiator (located in the right console) prevents the

^{*}F-86H-1 and F-86H-5 Airplanes

[†]F-86H-10 and subsequent airplanes

canopy remover from being fired accidentally while the airplane is on the ground. The pin must be removed before flight and stowed in the fabric container aft of the seat headrest. After flight, the safety pin must be replaced in the initiator.

CANOPY EXTERNAL EMERGENCY RELEASE HANDLE.

If electrical operation of the canopy fails or cannot be used, the canopy can be opened on the ground from the outside of the airplane by the canopy external emergency release handle. On early airplanes,* this handle releases the canopy from the hold-down hooks and actuator only if the canopy is in the closed position. On late airplanes,† the handle releases the canopy from the hold-down hooks and from the actuator with the canopy in any position. The emergency release handle is painted yellow and is recessed in the canopy frame on the left side. When opened, the handle can be pulled back to release the hooks from the drag rollers, and the canopy can then be lifted to the open position or off the airplane. On early airplanes,* the canopy will not hold in an open position after it has been opened manually. On late airplanes,† the canopy will latch and remain open, when opened manually, if raised slightly above the normal open position.

WARNING

On some airplanes! not changed by T. O. 1F-86H-587, to ensure that canopy external emergency release handle is securely locked, the handle must be safety-wired to the spring-loaded catch. If the safety wire is not installed, the handle may open in flight and actuate the canopy unlocking mechanism, resulting in loss of the canopy.

CANOPY-UNLOCKED WARNING LIGHT.

Whenever the canopy is in any position except locked closed (battery switch ON, generator operating, or external power connected), the canopy-unlocked warning light (figure 1-18), on the left forward switch panel, comes on. On early airplanes,* when the canopy is being closed, the canopy switch must be held at the CLOSE position until 2 seconds after the red light goes

out, to allow the actuator to fully close the canopy. The warning light, marked "UNLOCKED," operates on primary bus power.

Note

On most airplanes not changed by T. O., the canopy-unlocked warning light should be adjusted to full bright before flight; otherwise, the warning light may not be noticed if it comes on, especially during daylight. Other airplanes, and most airplanes changed by T. O., incorporate a nondimmable warning light.

EJECTION SEAT.

An ejection seat (figure 1-22) permits emergency bail-out at any speed or flight attitude. An explosivecartridge-type catapult is mounted vertically behind the seat and, when fired, supplies the necessary propulsion to eject the seat and pilot from the airplane. The seat is adjustable vertically. If additional height in the seat is needed when the one-man life raft or survival kit is carried, use a solid filler block, provided the combined thickness does not exceed 5 inches. Raising the seat armrests, which are mechanically connected and rise at the same time, locks the shoulder harness, lifts both triggers to cocked position, and fires the canopy. When either trigger is squeezed, an initiator on the respective armrest is actuated mechanically and delivers gaseous pressure to the pneumatically operated catapult firing mechanism, firing the catapult. The radio lead and the anti-G suit and oxygen hoses are fitted into a single disconnect on the forward edge of the seat, between the footrests. When the seat is ejected, these connections are automatically disconnected at the disconnect assembly.



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

^{*}F-86H-1 and F-86H-5 Airplanes

^{*}F-86H-10 and subsequent airplanes

³F-86H-1 and F-86H-5 Airplanes, and F-86H-10 Airplanes AF53-1229 through -1404

[§]F-86H-1 and F-86H-5 Airplanes, and F-86H-10 Airplanes AF53-1229 through -1422

F-86H-10 Airplane AF53-1423 and all subsequent airplanes

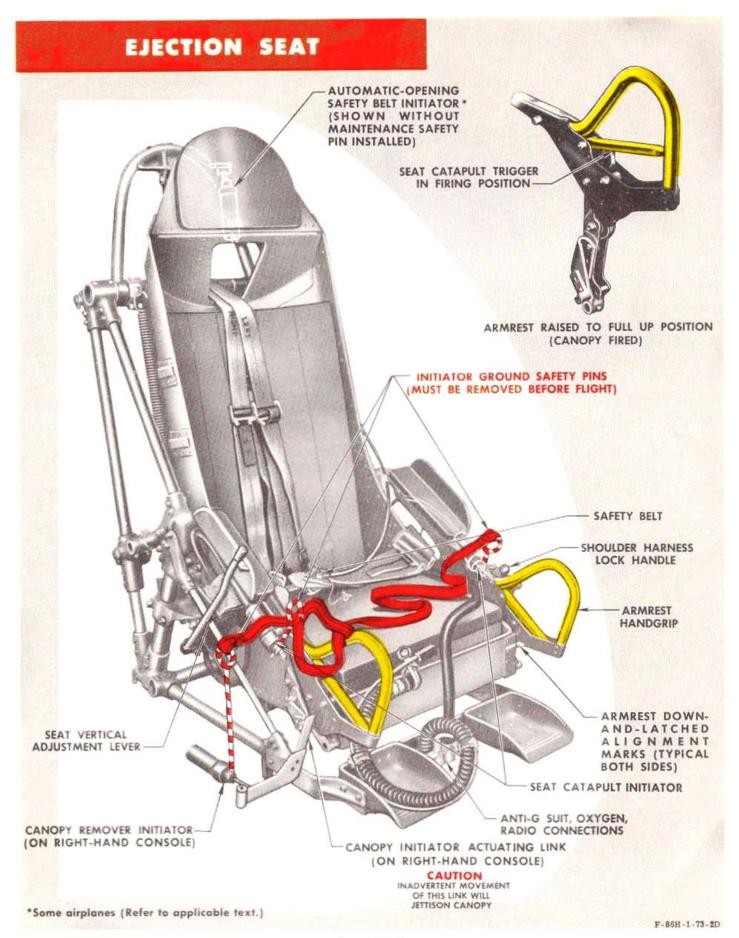


Figure 1-22

T. O. 1F-86H-1 Section I

EJECTION SEAT CONTROLS.

SEAT ARMRESTS.

When either armrest is raised to its full up position, the canopy is ejected by the canopy remover. The armrests are connected so that when one armrest is raised, the other rises at the same time. Raising the armrests also locks the shoulder harness and cocks the triggers. Each armrest has a spring-loaded latch which prevents the armrest from accidentally rising out of its stowed (full down and latched) position and possibly jettisoning the canopy and exposing the ejection trigger. The restraining action of the latch can be readily overcome if ejection is necessary. To help you determine that the armrests are full down and latched, there is a white stripe on each end of the front face of the seat bucket and a matching white stripe on the inner face of each trigger guard. When these stripes are in perfect alignment, the armrests are full down and latched. In addition, the inside face of each armrest bracket is painted with alternate red and white stripes. If these stripes are not visible above the top of the seat bucket, the armrests are full down and latched.

SEAT CATAPULT TRIGGERS.

A seat catapult trigger is located within a guard in the lower portion of each seat armrest. As the armrests are raised to the full up position, the triggers are raised out of the guards. The armrests lock in the full up position, and the triggers are then in the firing position, within reach of the fingers. Squeezing the trigger in either handgrip fires a cartridge in its respective initiator. The gases produced by this action are transmitted to the ejection seat catapult. The pressure of the expanding gases actuates the striker pin, which fires the seat catapult cartridge, ejecting the seat.

WARNING

- Ground safety pins in the initiators, located on either side of the seat armrests, prevent the seat catapult from being fixed accidentally while the airplane is on the ground. The pins must be removed before flight and stowed in the pouch behind the seat headrest. After flight, the safety pins must be replaced in the initiators.
- The seat catapult is armed whenever an initiator ground safety pin is removed.

The seat ejection system is independent of the canopy jettison system. If raising the armrests fails to release the canopy, the seat will be ejected through the canopy when the trigger is squeezed.

SEAT VERTICAL ADJUSTMENT LEVER.

Seat adjustment is accomplished mechanically by operation of the seat vertical adjustment lever, located on the right side of the seat. Pushing the lever forward to the unlocked position releases the seat for adjustment. With the lever at this position, the spring-loaded seat is raised when the pilot lifts his weight off the seat by using the handhold (38, figure 1-5). When the desired adjustment is obtained, the lever should be moved aft to the locked position, which is shown by the alignment of the white pin on the adjustment lever with the white index marker on the armrest side panel.

CAUTION

After adjusting seat, check that adjustment lever is locked (white pin on lever and white index marker on armrest side panel aligned). If seat is not locked, G-loads in flight may cause it to move, possibly allowing armrests to raise and eject canopy.

SHOULDER-HARNESS LOCK HANDLE.

The shoulder-harness inertia reel lock handle, on the left side of the seat, outboard of the left armrest, is used to manually lock and unlock the shoulder harness. The shoulder-harness inertia reel is actuated mechanically when the top of the handle is moved fore and aft. Forward is the locked position; aft is unlocked. It is recommended that the shoulder harness be locked manually during maneuvers and flight in rough air, or as a safety precaution in event of a forced landing. The shoulder harness is locked automatically when either handgrip on the seat is raised during seat ejection.

Note

Because of the design characteristics of the shoulder-harness inertia reel, there is no preflight check to be made. The shoulder-harness inertia reel will automatically lock under a 2 to 3 G forward deceleration, as in a crash landing. Pulling on the shoulder-harness straps by hand will not check the inertia reel.

If the harness is manually locked while the pilot is leaning forward, the harness will retract with him as he straightens up, moving into successive 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 releasing it momentarily at the safety belt or releasing the harness buckles. After automatic locking of

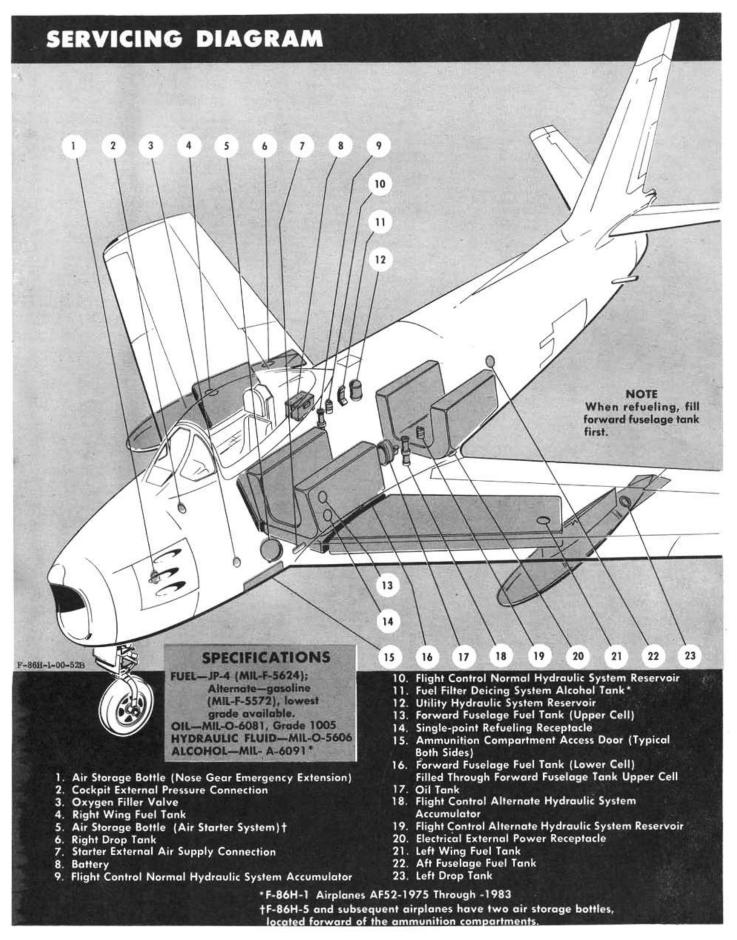


Figure 1-23



Before a forced landing, cut engine master, generator, and battery switches, which are not readily accessible with the shoulder harness locked.

the harness, it will remain locked until the lock handle is moved to the LOCKED position and then back to UNLOCKED.

SAFETY BELT.

A few early airplanes are equipped with a conventional, manually operated safety belt. Most airplanes are equipped with an automatic-opening safety belt which opens automatically after the seat is ejected. Upward movement of the seat catapult during ejection actuates the safety belt initiator. The gas charge from the initiator unfastens the safety belt 2 seconds after the seat is fired, allowing the pilot to kick free of the seat. A key, which may be attached to the safety belt or the arming lanyard on the automatic-opening parachute, must be inserted into the safety belt locking mechanism before the belt can be locked. (See figure 1-24.)

WARNING

Should the safety belt fail to open automatically after the seat is ejected, the belt must be opened manually.

AUTOMATIC-OPENING, ANEROID-TYPE PARACHUTE.

An automatic-opening, aneroid-type parachute can be opened only by pulling the aneroid arming lanyard on the parachute or by pulling the conventional rip cord "D" ring. As the aneroid arming lanyard is pulled, the parachute aneroid is armed and the parachute will open at the preset altitude. If ejection is accomplished below the preset altitude, the parachute will open after a preset time interval. The parachute should be opened only after kicking free of the seat, whether it is opened by pulling the aneroid arming lanyard or the "D" ring.

CAUTION

When bailing out at low altitudes (below 2000 feet above the terrain and in an upright position), open the parachute manually by pulling rip cord "D" ring, whether parachute is conventional or automatic. The "D" ring should be pulled immediately after separation from the seat.

AUXILIARY EQUIPMENT.

Information concerning the following auxiliary equipment is supplied in Section IV: cockpit air conditioning and pressurization, defrosting and anti-icing, communication and associated electronic, lighting, oxygen, armament, and miscellaneous equipment.

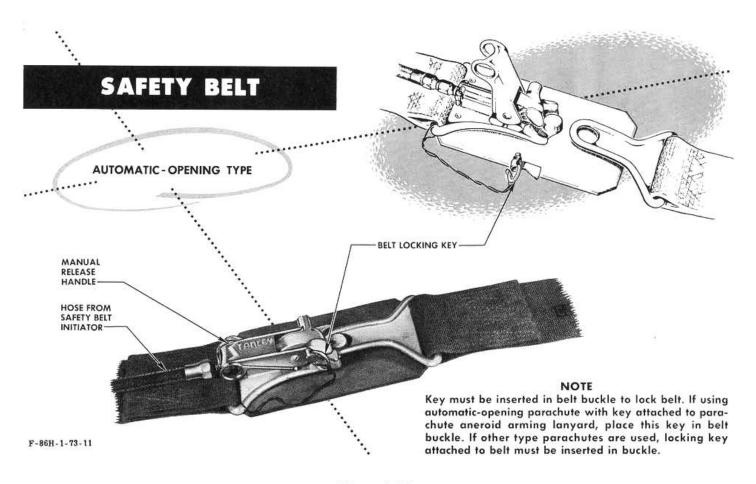


Figure 1-24





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STATUS OF THE AIRPLANE.

FLIGHT RESTRICTIONS.

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

FLIGHT PLANNING.

The performance data in Appendix I of the Confidential Supplement, T. O. 1F-86H-1A, is provided to determine fuel consumption and correct airspeed, power setting, and altitude for the intended flight mission.



WEIGHT AND BALANCE.

Refer to Section V for weight and balance limitations. For loading information, refer to Handbook of Weight and Balance Data, T. O. 1-1B-40. Before each mission, make the following checks:

- Check take-off and anticipated landing gross weight and balance.
- Check that weight and balance clearance DD Form 365F (formerly Form F) is satisfactory. If no guns or ammunition is installed, check for proper ballast installation.
- Check that fuel, oil, armament, oxygen, and special equipment carried is sufficient for mission to be accomplished.

ENTRANCE.

The cockpit can be entered from either side of the airplane. (See figure 2-1.) Normally, entry should be made with the aid of the ladder. If the ladder is not available, entry can be made by using the ammunition compartment door, hinged and kick-in steps, and a retractable handgrip. The ammunition compartment access door on each side of the fuselage hinges down to serve as a step. A retractable hinged step is located above each access door, and a kick-in step is recessed in the fuselage,



Handgrip on fuselage side must not be used for a step, as it may break and cause injury.

forward of each gun compartment door. A retractable hinged handgrip is provided in the gun compartment door on each side of the airplane.

Note

The ammunition compartment access door, hinged step, and handgrip cannot be closed from the cockpit; they must be closed by the ground crew.

BEFORE EXTERIOR INSPECTION.

Check DD Form 781 (formerly Form 1) for engineering status, and make sure the airplane has been properly serviced. See figure 1-23 for complete servicing data.

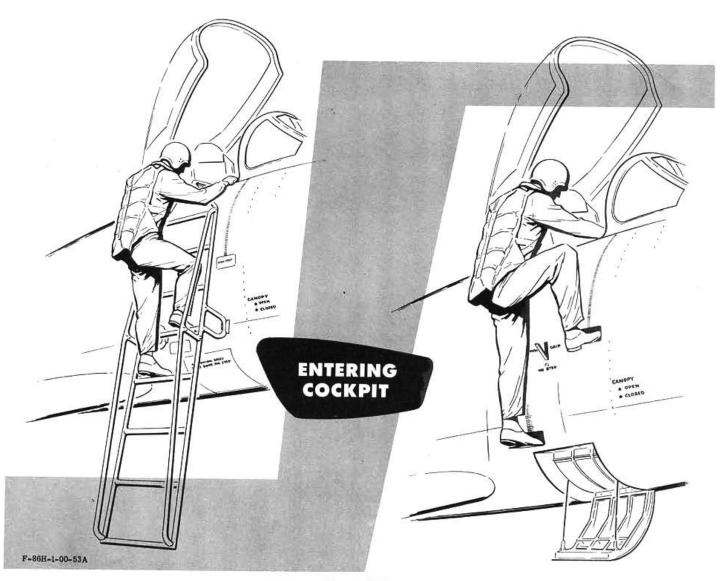


Figure 2-1

EXTERIOR INSPECTION NOSE Nose wheel chock removed. Nose gear ground safety lock re-NOTE • While making exterior inspection, check all moved. surfaces for cracks, distortion, loose rivets, and Tow pin safety cap tight. signs of damage; check for signs of hydraulic, Nose gear emergency extension air fuel, and oil leaks; check all access doors and bottle (in nose wheel well) * panels and fuel filler caps secured; check tires for general condition, slippage, and proper Nose gear emergency extension reinflation; check position of gear doors, gear set button in flush position. strut extension, and condition of wheels. Landing and taxi lights retracted. Intake duct clear, except nose screen Accumulator gage pressures (given on placard next to each gage) are for 70°F; pressure will installed. be higher on hot days. Gun part plugs removed, if on firing mission. FORWARD FUSELAGE AND RIGHT WING LEADING EDGE Slats for freedom of movement (some airplanes). Main gear wheels chocked LEFT WING LEADING EDGE Navigation light and wing tip. AND FORWARD FUSELAGE Pitot head uncovered. Navigation light and wing tip. Starter air storage bottles (access Slats for freedom of movedoor forward of right ammunition door on F-86H-5 and subsequent ment (some airplanes). Landing gear door ground airplanes; access door aft of nose control switch (in left gear wheel door on F-86H-1 Airplanes): strut well) at CLOSE 3000 psi for two starts; 1700 psi Canopy external emergency minimum for start.* release handle safety-wired to spring-loaded catch.t RIGHT WING TRAILING EDGE AND AFT FUSELAGE Aileron and flap. External load installation and mount. Speed brake. Utility hydraulic system reservoir sight gage level.* Pressure of Flight Control Normal and Alternate System Accumulators. * AFT FUSELAGE AND LEFT WING TRAILING EDGE Flight control normal hy-Speed brake. draulic system reservoir Oil tank filler cap secured.* fluid level indicator pin Oil tank dip stick safetywithin 1/4 inch of top of wired (airplanes without gage.* retaining clip).* Flight control alternate hydraulic system reservoir fluid level indicator pin within 1/4 inch of top of EMPENNAGE gage. * Tail-pipe cover removed. Tail cone and navigation lights.

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

†Some airplanes. (Refer to applicable text.)

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PREFLIGHT CHECK.

EXTERIOR INSPECTION.

The exterior inspection should be made as shown in figure 2-2.

CANOPY AND EJECTION SEAT INITIATOR CHECK.

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

- Open canopy fully to visually check canopy catapult mechanism.
- 2. Check that canopy remover initiator safety pin and two seat ejection initiator safety pins are installed.
- 3. Check that both seat armrests are full down and latched by applying a moderate downward force on each armrest. Check that white stripes on front face of seat bucket and inner face of each trigger guard are in perfect alignment. Also check that tops of red and white stripes on inside face of each armrest bracket do not extend above top of seat bucket.

WARNING

Do not raise armrests to determine whether latches are engaged; if you do, the canopy may jettison.

- Check that seat quick-disconnects are properly mated.
- 5. Check linkage from armrests and triggers to initiators.
- 6. Check tubing and hose fittings from initiators to ejectors.
- 7. Check that lead seal on canopy remover is not broken.
- 8. Make sure shoulder harness passes over upper tubular cross-member of seat, below headrest.
- On airplanes equipped with automatic safety belt, check that lap belt initiator safety pin has been removed.

WARNING

Do not place miscellaneous equipment, such as maps, DD Form 781, tools, etc, between either side of seat and cockpit vertical consoles; if you do, later vertical adjustment of seat may move canopy jettisoning mechanism and cause accidental jettisoning of canopy.

INTERIOR CHECK.



Before entering cockpit, check that circuit breakers on canopy deck are in. These circuit breakers, not accessible to the pilot from the cockpit, protect certain essential systems.

Note

A Pilot's Check List is on the sliding board stowed above the right console, below the canopy frame.

- 1. Fasten safety belt and shoulder harness.
- 2. Adjust seat.
- 3. Unlock and adjust rudder pedals.



After adjusting seat, check that adjustment lever is locked (white pin on lever and white index marker on armrest side panel aligned). If seat is not locked, G-loads in flight may cause it to move, possibly allowing armrests to raise and jettison canopy.

- 4. Armament switches off.
- 5. Throttle OFF, and adjust throttle friction as desired.
 - 6. Landing gear handle bown.
- 7. Test operation of landing gear unsafe warning light by pressing horn cutout button while throttle is at OFF. Light should come on.
 - 8. Speed brake switch at neutral position.
 - 9. Engine master, air start, and battery switches OFF.

Note

Check stick grip for security of mounting on control stick. Do not twist the grip, since such action may cause grip to become less secure.

- 10. Signal crew chief to plug in external dc power.
- 11. Check circuit breakers in (instrument inverter circuit-breaker switches ON).

Note

Starting can be accomplished without external dc power. However, external dc power is recommended for use if available, to conserve battery life. The following temperature limits apply to starting without external power: Below 0°F, external power should always be used; between 0°F and 31°F, only one start

should be attempted without external power; and at 32°F and above, two starts can be attempted without external power. External power units suitable for use on this airplane are the A3, A4, C-21, C-22, C-26, C-27, NC5, and V-1.

- 12. Oxygen regulator diluter lever at NORMAL OXYGEN.
 - 13. Emergency toggle lever at center position.
 - 14. Oxygen supply lever safetied ON.
- 15. Check oxygen system for proper 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 directly behind another operating jet airplane or during operation with tail into the wind, place oxygen diluter lever at 100% OXYGEN.

Note

If external dc power source is not plugged in, check oxygen system immediately after battery switch is turned ON.

- 16. Attach radio leads and anti-G suit line to disconnect block on seat. Check bail-out bottle connection.
- 17. Speed brake dump valve lever in normal (forward) position.*
- 18. Anti-G suit pressure-regulating valve HI or LO as desired.
- 19. Ground fire safety switch (on airplanes with 20 mm guns) SAFE.
 - 20. Camera lens selector switch as desired.
 - 21. Bomb release selector switch MANUAL RELEASE.
 - 22. AN/ARC-27 power switch OFF.
 - 23. Radar range sweep switch MIN.
 - 24. Flight control switch NORMAL.
 - 25. Rudder trim switch OFF.
 - 26. Wing flap handle UP.
 - 27. Drop tank pressure switch INBD if only inboard

tanks installed, OUTBD if outboard tanks are installed, OFF if tanks are not installed.

- 28. Air compressor switch at NORM.†
- 29. Fuel filter deice switch OFF.\$
- 30. Cockpit pressure switch at desired pressure schedule.
- 31. Cockpit temperature master switch AUTO; desired temperature selected on rheostat.
 - 32. Cockpit console airflow lever DECR.
 - 33. Pitot heater switch OFF.
- 34. Windshield anti-icing (rain and ice removals) switch OFF.
 - 35. Canopy and windshield defrost handle OFF.
 - 36. Landing and taxi light switch OFF.
- 37. Gun heater switch (airplanes with .50-caliber guns) OFF.
 - 38. Canopy switch OFF.

Note

On early airplanes not modified by T.O., adjust canopy-unlocked warning light to full bright; otherwise, you may not notice the light if it comes on, especially during daylight. Late airplanes** and early airplanes modified by T.O. incorporate a nondimmable warning light.

- 39. Special store jettison handle stowed (full in).
- 40. Flight control emergency change-over handle stowed (full in).
 - 41. Emergency jettison handle stowed (full in).
 - 42. Set clock, altimeter, and accelerometer.
- 43. Emergency fuel system test switch OFF (airplanes with -3 or -3A engine, which have not been modified by T. O.).
 - 44. Fuel system selector switch NORM.
- 45. Hydraulic pressure gage selector switch at NOR-MAL.
- 46. Gun selector switch†† at UPPER or ALL, as required.
 - 47. Special store disarming lever at DIS.
 - 48. Generator switch ON.
 - 49. Instrument ac power switch MAIN.
 - 50. Lighting controls and switches OFF.
- 51. Landing gear emergency release handle stowed (full in).

^{*}F-86H-1 Airplanes AF52-1975 through -1980

[†]F-86H-1 Airplane AF52-2070 and all subsequent airplanes

F-86H-1 Airplanes AF52-1975 through -1983

[§]F-86H-1 Airplane AF52-1991 and all subsequent airplanes

[¶]F-86H-1 and F-86H-5 Airplanes, and F-86H-10 Airplanes AF53-1229 through -1422

^{**}F-86H-10 Airplane AF53-1423 and all subsequent airplanes

^{††}F-86H-10 Airplane AF53-1349 and all subsequent airplanes

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Note

If external dc power is not available, the battery switch should be turned ON just before engine is started, and the following items should not be accomplished until after engine has been started and generator is supplying power. Otherwise, battery life may be impaired.

- 52. Check all warning lights and indicators for operation.
- 53. Check rudder, ailerons, and horizontal tail for proper response to control action.

CAUTION

The trim switch is subject to sticking in any or all of the actuated positions, resulting in application of extreme trim. If the switch sticks in any actuated position during ground checks, the airplane must not be flown. The deficiency must be entered on DD Form 781 (formerly Form 1) with a red cross.

Note

- The flight control alternate hydraulic system becomes operative automatically when external power is connected. The flight control normal hydraulic system must be manually engaged after the engine has started, by moving the flight control switch momentarily to the RESET position.
- The flight control alternate hydraulic system change-over valve may stick in closed position after the airplane has been sitting overnight with the valve under system pressure. If control stick cannot be moved while alternate system pressure is available, pull manual emergency change-over handle one time to manually position valve. Then return change-over handle to stowed position. Investigation shows valve will not stick again in closed position for balance of the day.
- 54. Check operation of communication and navigation equipment.
- 55. Check inverter operation with instrument ac power switch at ALTERNATE and then at MAIN; ac power warning light out.

- 56. Check fuel quantity. Momentarily depress fuel quantity gage test button and watch movement of fuel quantity gage needle.
- Check operation of all interior and exterior lights (night flights).
- 58. Check that a serviceable flashlight is included in personal gear (night flights).

STARTING ENGINE.

Before starting engine, make sure main gear wheels are securely chocked and that rotational plane of engine turbine wheel and danger areas fore and aft of airplane are clear of personnel, aircraft, and vehicles. (See figure 2-3.)

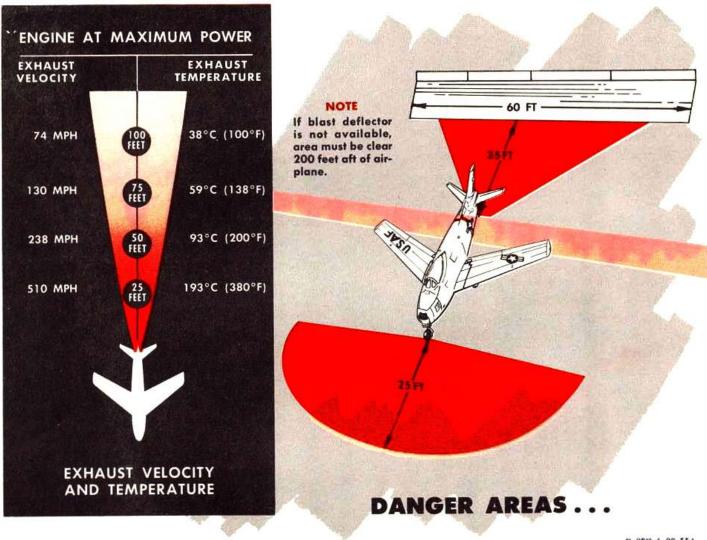
WARNING

- Before starting engine, make sure nose screen is installed, to reduce possibility of engine damage due to entrance of foreign objects into the intake duct and to protect personnel from being drawn into the intake duct. The nose screen must be installed during all ground operation, including taxiing.
- Danger aft of the airplane is created by the high exhaust temperature and blast from the tail pipe. (See figure 2-3.)

CAUTION

When operating within the jet blast of another F-86H Airplane, maintain a minimum of 70 feet distance to prevent heat damage to the canopy.

Whenever possible, start and run up engine on a paved surface to minimize the possibility of dirt and foreign objects being drawn into the compressor and damaging the engine. Start engine with airplane heading into or at right angles to the wind whenever possible, as exhaust temperatures may be aggravated by a tail wind. An external power source is not required for combustion starter operation; however, to conserve battery current, external power should be connected to supply the various electrical systems. The fuel-air starter is self-sufficient for two starting cycles; if start is not obtained, an external air source may be connected. Start engine as follows:



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Figure 2-3

AUTOMATIC START.

Note

When a satisfactory automatic start procedure has been established, it will be released as a Safety of Flight Supplement. Until that time, all engines are restricted to manual starts.

MANUAL START.



The following is a manual start procedure, and particular care should be exercised to manually operate the throttle to prevent an overtemperature condition.

- 1. Battery switch on.
- 2. Engine master switch on.
- 3. Fuel system selector switch EMER.



Do not proceed with start until the instrument ac power-off light goes out, as there will be no fuel flow indication by which to gage the start.

- 4. Place throttle at IDLE, holding outboard to clear idle stop.
 - Starter button depressed momentarily.

CAUTION

Starter normally fires in 0.2 second and is audible in the cockpit. If starter fails to fire, retard throttle to OFF position and have ground personnel check for fire in the air inlet duct.

 Upon indication of fuel flow, immediately adjust throttle to establish and maintain 1100 pounds per hour fuel flow until engine ignition occurs.

CAUTION

If engine does not obtain 16% rpm, if engine ignition does not occur by the time engine has coasted down to 16% rpm, or if fuel flow is less than 500 pounds per hour or more than 1500 pounds per hour, retard throttle immediately to full OFF position. Do not turn engine master switch OFF until engine has coasted down to 5% rpm or less; if you do, starter fuel may be depleted. This will necessitate ground servicing before a later start. If a later start is attempted without ground servicing under this condition, starter drop-out speed will be low and a hot start may result.

 After exhaust temperature has stabilized, advance throttle slowly to obtain 50% engine spm. Maintain exhaust temperature of about 750°C during this acceleration.

Note

If engine start is not obtained, retard throttle to OFF and wait one minute before attempting second start. If second start is not successful, starter air storage bottle must be refilled or an external air source connected. To avoid damaging the starter by overheating, adhere to starter operation limits. (Refer to "Starter System" in Section I.)

CAUTION

If starter is operated and generator-off warning light does not go off before shutdown, turn battery switch OFF and disconnect external dc power momentarily to de-energize ignition circuit holding relay. If this is not done, engine ignition and, on airplanes with the

-3D or -3E engine, priming fuel flow will occur at the instant the throttle is advanced for the second start, and a fire may result.

WARNING

Should any of the following overtemperature conditions occur, the engine must be removed for inspection:

During starting (30% engine rpm or less)-

- Exhaust temperature exceeds 975°C, even if only momentarily.
- Exhaust temperature stabilizes at any temperature within the range of 875°C to 975°C. (Momentarily peaking in this range is permissible as long as exhaust temperature gage pointer is in constant motion.)

Transient operation (above 30% engine rpm)—

 Exhaust temperature exceeds 875°C, even if only momentarily.

The temperature and duration of all overtemperature operation must be entered on DD Form 781 (formerly Form 1).

- 8. Check oil pressure. If there is no indication of pressure within 30 seconds, shut down engine and investigate.
 - 9. Retard throttle to IDLE.
- 10. Immediately place fuel system selector switch at NORM.
- 11. Check engine instruments for desired indications: engine rpm 41% to 43%; oil pressure 20 to 30 psi.
 - 12. Have external dc power disconnected, if used.
 - 13. Check generator-off warning light out.

Note

Refer to Section III for instructions in case of fire during starting.

ENGINE 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 slowly opened to full power. Idle rpm should be 41% to 43% rpm, but will vary with field altitude.

GROUND TESTS.

To ensure that flight control systems are operating properly, perform the following checks:

Note

This entire check is necessary to ensure proper operation of the flight control and utility hydraulic systems.



If engine run-up is made during ground tests, be sure wheels are securely chocked and, in addition, hold toe brakes on to prevent airplane from inadvertently moving. This airplane is not equipped with parking brakes.

- 1. Check hydraulic pressure gage selector switch at NORMAL.
- 2. Engage flight control normal hydraulic system by holding flight control switch at RESET momentarily. Check that alternate-on light is out.



When checking control surface movement on both normal and alternate systems, check rate of control stick travel by rapid, full-throw 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 Systems," Section VII.

- 3. Check flight control normal hydraulic system as follows: With flight control switch at NORMAL, move control stick and visually check for proper movement of control surfaces. Wait 5 seconds and then check that pressure returns to normal range of 2550 to 3200 psi (control stick not in motion).
- 4. Check flight control alternate hydraulic system as follows: With flight control switch at ALTERNATE, check that alternate-on warning light is illuminated. Move control stick and visually check for proper movement of control surfaces.
- 5. With hydraulic pressure gage selector switch at ALTERN, check that pressure returns to normal range of 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.

- Momentarily hold flight control switch at RESET and then release. Check that alternate-on warning light is out.
- Check operation of flight control system emergency change-over control as follows: Position hydraulic pressure gage selector switch at ALTERN.
- 8. Hold flight control switch at RESET and pull emergency change-over handle to its full extension. Holding flight control switch at RESET 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 the alternate system transfer valve is held in the open position by the mechanical emergency change-over handle only. The alternate-on light should not be illuminated. Continue holding flight control switch at RESET and move control stick. Visually check for proper control surface movement.
- 9. Release flight control switch to NORMAL. The alternate-on light should come on, indicating that the electrical circuit is complete. Check that pressure remains constant at a value between the maximum limits of 3050 and 4000 psi (control stick not in motion).
- 10. Return emergency change-over handle to its normal (stowed) position. Check that alternate pressure returns to normal range of 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 red limit value (3200 psi) and may even reach 4000 psi when the emergency change-over handle is actuated. These pressures are considered normal for this part of alternate system operation.

- 11. Check that flight control systems will automatically return to normal system operation. Leave flight control switch at NORMAL and move control stick rapidly to deplete alternate system pressure below about 650 psi. Check that alternate-on warning light goes out, indicating that normal system is in control again. Return hydraulic pressure gage selector switch to NORMAL and check that pressure is in normal range of 2550 to 3200 psi (control stick not in motion).
- 12. Check utility hydraulic system as follows (maintain a minimum of 60% engine rpm during check): Open speed brakes. Close speed brakes and return switch to neutral. With hydraulic pressure gage selector switch at UTILITY, check pressure indicated on gage (about 3000 psi).



Before operating speed brakes, check that aft fuselage area is clear, as speed brakes operate rapidly and forcibly and could injure any personnel in their path.

TAXHNG.

- 1. Sight mechanically caged.
- 2. Have wheel chocks removed.
- 3. Once airplane is moving, taxi at lowest practical rpm.



To prevent damage to canopy operating mechanism, do not exceed 50 knots IAS while taxing with canopy open.

4. Maintain directional control through the steerable nose wheel by use of rudder pedals; hold steering switch depressed continuously while taxiing. Nose wheel and



Caution

When the special store is installed (alone or with any combination of drop tanks), taxiing must be done at low speeds, and short-radius turns must be avoided. Brakes must be applied slowly to prevent sudden stops. Operation from relatively smooth and hard surfaces is mandatory (concrete or "black-top" surfaces are preferred).

rudder pedals must be coordinated before steering mechanism will engage. Use nose wheel steering during slow taxiing.

- 5. Avoid excessive or rapid jockeying of throttle during taxiing.
- 6. Minimize taxi time, as airplane range is considerably decreased by high fuel consumption during taxiing and ground run. Fuel consumption with the engine operating at 42% rpm is about 2½ gallons (17 pounds) per minute.
- 7. Make operational check of gyro indicators during taxiing.

BEFORE TAKE-OFF.

PREFLIGHT AIRPLANE CHECK.

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

1. Nose screen removed.



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

2. Remove ground safety pins from canopy initiator on left side of seat and seat initiators outboard of each armrest; then stow the pins in an accessible place.



After seat and canopy initiator pins are removed, the seat and canopy are fully armed.

- 3. Safety belt tightened and shoulder harness fitted snugly, shoulder harness lock handle UNLOCKED.
- 4. All armament switches OFF. If external loads must be jettisoned on take-off, they may be jettisoned unarmed by means of the external store jettison button on the left console or by the emergency jettison handle.
- 5. Trim settings: horizontal tail, rudder, and ailerons trimmed individually until take-off trim indicator light glows.
 - 6. Wing flaps full down for take-off.

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CAUTION

When carrying EX-10 bombs and 1000-pound GP bombs with the T-142 fin, do not lower wing flaps more than 20 degrees (MID position of flap handle) because of the adverse clearance condition.

7. Canopy switch at CLOSE. Check canopy unsafe warning light out.

Note

On F-86H-1 and F-86H-5 Airplanes, canopy switch must be held at CLOSE for 2 seconds after the warning light goes out, to ensure that the canopy is fully closed and locked.

8. Check oxygen regulator diluter lever at NORMAL OXYGEN, unless carbon monoxide contamination is suspected. If such is the case, use 100% oxygen as long as considered necessary.

WARNING

Oxygen diluter lever must be returned to NOR-MAL OXYGEN as soon as possible, because use of 100% oxygen will so deplete the oxygen supply as to be hazardous.

9. Hold toe brakes.

PREFLIGHT ENGINE CHECK.

Complete the following emergency fuel system check in the take-off position, making sure airplane does not move forward and cause nose wheel to cant.

CAUTION

 An indication of compressor stall during this rapid throttle advancement may be due to inlet guide vane failure in the open position. Guide vane failure in the closed position is indicated by the following simultaneous instrument readings with the throttle in full open position:

Tachometer-99% to 100% rpm Exhaust temperature-520°C to 560°C Fuel flow-4000 to 5000 pounds per hour

If guide vanes fail in closed position, do not switch to emergency fuel system or at-

tempt an emergency fuel system check while at full throttle on main fuel system, since a destructive engine overspeed will result.

- If either of the afore-mentioned inlet guide vane failures is indicated, retard throttle immediately and investigate. Under no circumstances attempt a take-off. (Refer to "Inlet Guide Vane Failure" in Section VII for further information.)
- 1. Advance throttle rapidly to full open to maintain 100% rpm with fuel system selector switch at NORM. Do not exceed 100.5% engine rpm. Should any of the following overtemperature conditions occur, the engine must be removed for inspection:

Transient operation (30% engine rpm or above)-

 Exhaust temperature exceeds 875°C, even if momentarily.

Steady-state operation-

Exhaust temperature exceeds 650°C.

Note

- Steady-state exhaust temperature operating limit is 640°C. If temperature inadvertently drifts into the range of 640°C to 650°C, retard throttle as required to maintain temperature within operating limit.
- White smoke from the engine may escape through the fuselage in the engine area at high engine rpm. This condition is normal and does not indicate a hazardous condition.
- Move fuel system selector switch to TAKE OFF position. Check that green take-off switch-on indicator light comes on.
- 3. Retard throttle to below 95% rpm and note that amber emergency fuel-on indicator light comes on. Readvance throttle to full open; rpm obtained on emergency fuel system should conform to the limits shown in figure 2-4.

Note

If the throttle is retarded to the 86% engine rpm setting, a cycling of fuel control between main and emergency systems occurs, resulting in unstable engine operation (rpm and thrust surges). The lockout circuit (used to prevent inadvertent operation on the emergency system in the low range of engine rpm) returns fuel control to the main system below 86% rpm. The main system, with its higher fuel schedule, accelerates the engine above 86%

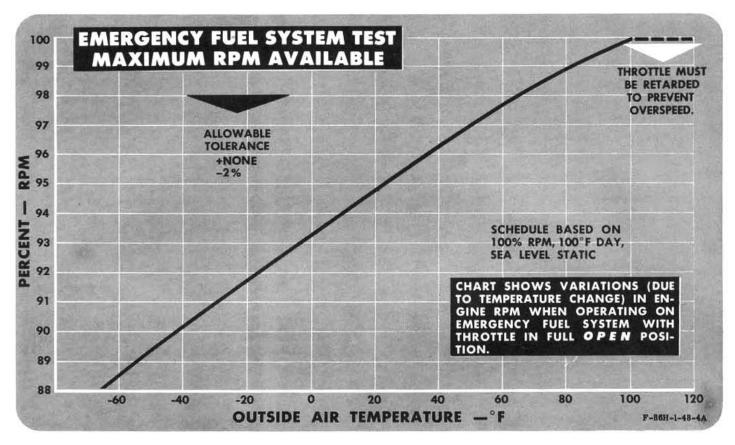


Figure 2-4

rpm, and control then is restored to the emergency system. As rpm drops because of the lower emergency system schedule, lockout again occurs. The cycling will continue unless the throttle is advanced. The cycling condition is not dangerous; however, the throttle should be advanced to avoid prolonged operation under this condition.

4. To re-engage main fuel system, place fuel system selector switch at NORM until engine rpm stabilizes at 100%; then place selector switch at TAKE OFF. Check amber emergency fuel-on indicator light out and that green take-off switch-on indicator light comes on.



A slight change in engine rpm may be noted when the main fuel system is re-engaged, depending on ambient air temperature. If the emergency fuel-on indicator light does not go out, the system should be checked before flight.

Leave fuel system selector switch at TAKE OFF position for take-off.

WARNING

If it is necessary to retard the throttle to below 95% rpm (either before or after take-off), the fuel system selector switch should be first moved to NORM. Otherwise, emergency fuel system will take over when throttle is retarded below 95% and will remain in control until main system is manually re-engaged.

 Check engine instruments for desired readings:
 Tachometer—not less than 99% and not more than 100.5% rpm

Exhaust temperature-600°C to 640°C

Oil pressure-25 to 45 psi

Fuel flow-5000 to 9000 pounds per hour

Note

Exhaust temperature limit for fully stabilized engine operation at 100% rpm is 630°C to 640°C. However, exhaust temperature at takeoff will be about 30°C below the fully stabilized value when normal take-off technique is used. (Refer to "Ground Temperature Stabilization Characteristics" in Section VII.)

WARNING

Should the following overtemperature condition occur during transient operation (30% engine rpm or above), the engine must be removed for inspection:

 Exhaust temperature exceeds 875°C, even if momentarily.

Should the following overtemperature condition occur during steady-state operation, the engine must be removed for inspection:

Exhaust temperature exceeds 650°C.

Note

- Steady-state exhaust temperature operating limit is 640°C. If temperature inadvertently drifts into the range of 640°C to 650°C, retard throttle as required to maintain temperature within operating limit.
- The temperature and duration of all overtemperature operation must be entered on DD Form 781 (formerly Form 1).
- Engine speeds of more than 104% rpm necessitate engine overhaul.

TAKE-OFF.

NORMAL TAKE-OFF.

For normal take-off with or without drop tanks, proceed as follows:

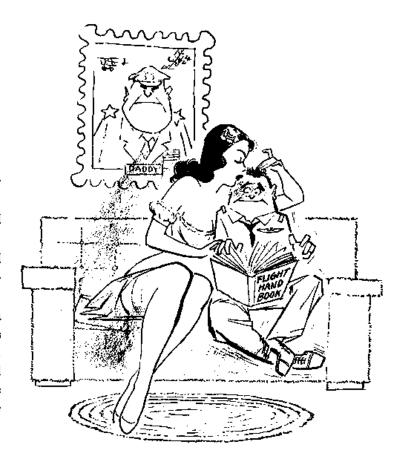
- 1. With throttle at take-off rpm, release brakes and begin take-off run.
- 2. Maintain directional control by use of nose wheel steering during early part of run. Rudder becomes effective at about 60 knots IAS.
- 3. During take-off, the airplane should be held in a near-level attitude at nose wheel lift-off. This results in the nose wheel being just slightly off the runway. This attitude should be held until the recommended take-off speed is attained, at which time the nose of the airplane should be pulled well up and the airplane flown off the ground.

WARNING

Do not assume a nose-high attitude before recommended take-off speed. Any attempt to take off at lower than recommended speeds can bring about a stalled condition. This could be disastrous because of the resultant excessively long take-off run. If a ground stall does occur, shown by failure of the airplane to lift off and loss of acceleration, the nose must be lowered to a three-point attitude to eliminate the stalled condition of the wings.

The recommended nose wheel lift-off and take-off speeds for airplanes without slats are distinctly different from those for airplanes with slats, and you must learn them for each type of airplane. Because of the lower speeds for airplanes with slats, the control stick must be pulled back farther in order to pull the nose wheel off the runway.

4. After take-off, use a slight push or pull stick force, as necessary, to maintain take-off attitude. It is recommended that stick forces be trimmed out after airplane is safely air-borne.



Note

The procedures set forth will produce the results shown in the Appendix. (Refer to Take-off Distances Chart.) Refer to Section III for take-off emergencies.

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Airplanes without slats are noticeably more adversely affected when taking off with external loads installed than are airplanes with slats.

A nose-high attitude must be maintained for take-off. (After take-off, the airplane will assume a more normal attitude as airspeed increases and the flaps are raised.)

CAUTION

Because airspeed will increase rapidly after the airplane breaks ground, retract gear and flaps as soon as possible after take-off to prevent exceeding gear- and flap-down limit speed. Hold the nose as high as practicable after take-off until gear and flaps are completely retracted, to hold airspeed build-up to a minimum.

WARNING

Abrupt or excessively steep pull-ups immediately after take-off must be avoided; otherwise, stall is likely to occur.

Note

See Take-off Distances charts in the Appendix of the Confidential Supplement, T. O.

1F-86H-1A, for required take-off distances at various temperatures and wind velocities.

 Nose wheel lift-off and airplane lift-off speeds with full flaps are as follows:

AIRPLANES WITHOUT SLATS

CONFIGURATION	NOSE WHEEL LIFT-OFF SPEED (KNOTS IAS)	AIRPLANE LIFT-OFF SPEED (KNOTS IAS)
No external load	120	135
With two 200-gallon drop tanks	135	150
With two 200-gallon drop tanks and two 120-gallon drop tanks	140	155

AIRPLANES WITH SLATS

CONFIGURATION	NOSE WHEEL LIFT-OFF SPEED (KNOTS IAS)	AIRPLANE LIFT-OFF SPEED (KNOTS IAS)
No external load	110	125
With two 200-gallon drop tanks	120	135
With two 200-gallon drop tanks plus two 120-gallon drop tanks	125	140

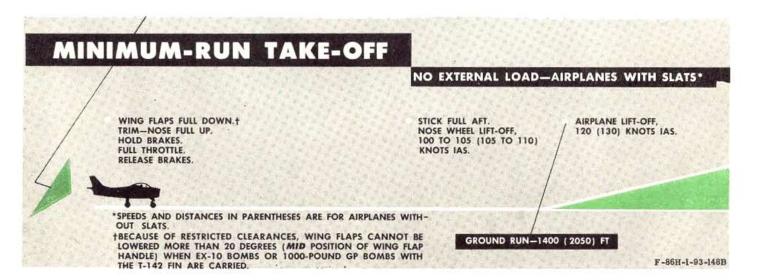


Figure 2-5

MINIMUM-RUN TAKE-OFF.

A minimum-run take-off is a maximum performance maneuver with the airplane lifting off near the stalling speed. It is closely related to slow flying with the airplane in a high angle-of-attack attitude. Consequently, you should be familiar with the characteristics of this maneuver in order to be able to maintain the necessary safe margin above stall. The complete "before take-off" check should be made. The initial take-off run is the same as for normal take-off. With the stick in the full aft position, nose wheel lift-off should occur as shown in figure 2-5. It is necessary to pull about 20 pounds stick force before lift-off when full nose-up trim is used. This force is reduced to 0 pounds to maintain the proper attitude when the airplane breaks ground. Therefore, as the airplane lifts off, reduce 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 normal take-off speed; normal take-off speed for the particular gross weight and external loading is about 5 knots faster than the minimum-run take-off speed.

WARNING

When the airplane is close to stall speed, retracting the landing gear may cause a nose-up pitch sufficient to cause a stall. Waiting until normal take-off speed is reached or exceeded eliminates this hazard. After all obstacles are cleared, retrim airplane to reduce stick forces and accelerate to best climb speed.

FORMATION TAKE-OFF.

If formation take-off is to be made, the procedure is the same as for a normal take-off, except that the fuel system selector switch must be at NORM. Formation take-off requires some throttle movement. With the fuel system selector switch at TAKE OFF, the emergency fuel system would take over control of fuel flow to the engine when the throttle is retarded to engine speeds below 95% to 97% rpm. Thus, the remainder of the take-off would be conducted on the emergency fuel system, with its inherently lower maximum power setting and lack of overspeed and overtemperature protection.

WARNING

- During formation take-off where slatted and nonslatted leading edge airplanes are scheduled together and if you are flying an airplane without slats, do not instinctively attempt to break ground at the same time as a slatted leading edge airplane; if you do, you may induce a dangerous stall condition.
- Monitor engine instruments during formation take-off, being watchful for power loss and placing fuel system selector switch at EMER if main fuel system failure is indicated.



CROSS-WIND TAKE-OFF.

In addition to the procedures used in a normal take-off, the following steps should be observed:

 Increase nose wheel lift-off speed about 10 to 15 knots IAS by holding nose wheel down a little longer during ground run.

Note

Increased speed is necessary to counteract reduced controllability caused by loss of lift on up-wind wing at normal speeds.

2. Be prepared to counteract airplane lifting at liftoff by lowering a wing into the wind or crabbing.

AFTER TAKE-OFF.

When airplane is definitely air-borne:

1. Landing gear handle UP below gear- and flap-down limit speed. About 8 seconds is required for gear retraction. Check position indicators and check that red warning light in landing gear handle is out.

CAUTION

Do not retract landing gear while airplane is yawing or slipping; if you do, damage to gear doors may result.

 Wing flap lever UP, above 155 knots IAS. Rapid acceleration will prevent any tendency for airplane to sink.

CAUTION

Raise gear and flaps below the gear- and flapdown limit airspeed; otherwise, excessive air loads may damage gear or flap operating mechanism and prevent later operation. If flaps do not fully retract, land as soon as possible. Failure of the flap actuating mechanism may occur if the flaps are not supported against the up-stop (fully retracted) during accelerated maneuvers at high speed.

- 3. Trim horizontal tail as required.
- Level off and accelerate immediately to best climbing speed. (See climb graphs in Appendix of Confidential Supplement, T. O. 1F-86H-1A.)

Note

Exhaust temperature may exceed 640°C at full throttle after take-off. If this occurs, retard throttle to maintain exhaust temperature within prescribed limits. The condition of exceeding the Military Power maximum exhaust temperature of 640°C at full throttle after take-off is not abnormal.

- 5. After safe altitude is reached and with engine operating at 100% rpm, move fuel system selector switch to NORM. If the amber emergency fuel-on indicator light is on before fuel system selector switch is moved to NORM, and it is unknown whether main fuel system failure or throttle movement caused the emergency fuel system to take over, proceed as follows:
 - a. At a safe altitude, with engine operating at full throttle, move fuel system selector switch to NORM. Transfer to the main fuel system will be shown by a momentary drop in fuel flow followed by an immediate rise and engine acceleration to 100% rpm.
 - b. If engine rpm does not rise but continues to fall, position fuel system selector switch to EMBR before rpm drops to 95%.

WARNING

If engine falls below 95% rpm, retard throttle to IDLE before switching to EMER; readvance throttle carefully to prevent overtemperature.

6. If 100% oxygen was used for take-off, return oxygen regulator diluter lever to NORMAL OXYGEN, unless carbon monoxide contamination still is suspected. If such is the case, continue use of 100% oxygen as long as necessary.

WARNING

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

7. Position armament switches as desired for mission.



After each time seat is adjusted in flight, check seat adjustment lever locked (white pin on lever and white index marker on armrest side panel aligned). If seat is not locked, G-loads in flight may cause it to move, possibly allowing armrests to raise and jettison canopy.

CLIMB.

Climb at take-off rpm (time limit 30 minutes). See figure 6-7 for best climb speeds. Refer to climb graphs in Appendix of Confidential Supplement, T.O. 1F-86H-1A, for recommended indicated airspeeds to be used during climb and for estimated rates of climb and fuel consumption. Initial climb speed after acceleration from take-off should be about 510 knots IAS at sea level for a clean airplane.

FLIGHT CHARACTERISTICS.

Refer to Section VI for information on flight characteristics.

SYSTEMS OPERATION.

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

DESCENT.

Circumstances may arise which require a descent from high altitude in the shortest possible time. This may be accomplished by increasing the dive angle until limit airspeed and/or Mach number is reached. Refer to "Cockpit Air Conditioning and Pressurization System" in Section IV for minimum throttle settings at various altitudes to maintain cockpit pressurization during descent. See descent charts in Appendix of Confidential Supplement, T. O. 1F-86H-1A, for descent information.

CAUTION

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

PRE-TRAFFIC-PATTERN CHECK.

During the approach to the field, make the following checks:

- 1. Gun safety switch OFF.
- 2. Bomb release selector switch MANUAL RELEASE.
- 3. Bomb arming, master armament selector, and rocket fuze (arming) switches OFF.
 - 4. Sight mechanically caged.
 - 5. Hydraulic pressure normal.
- 6. Fuel system selector switch NORM. Do not position fuel system selector switch to TAKE OFF during approach and landing, as the emergency fuel system will take over when throttle is retarded below 95% rpm.
 - 7. Safety belt and shoulder harness tightened.
 - 8. Shoulder-harness lock handle UNLOCKED.
- 9. If vision is impaired by rain, move windshield anti-icing switch* (windshield rain and ice removal switch†) to ON to improve forward vision.

Note

Rain removal airflow over the windshield on late airplanes† is sufficient to clear rain from a large area of the windshield under most rain conditions at traffic-pattern speeds. Anti-icing airflow over the windshield on early airplanes* is sufficient to improve forward vision under moderate rain conditions if a minimum of 75% engine rpm is maintained. If rain still is encountered as power is reduced, vision through the windshield side panels may be necessary.

CAUTION

If windshield overheat light illuminates on early airplanes,* try to extinguish it by reducing power if possible or move cockpit pressure switch to RAM DUMP. The anti-icing system may be left on, if necessary to improve forward vision, even though the overheat light illuminates.

TRAFFIC-PATTERN CHECK.

See figure 2-6 for complete approach and landing procedures.

*F-86H-1 Airplanes AF52-1975 through -1990 †F-86H-1 Airplane AF52-1991 and all subsequent airplanes

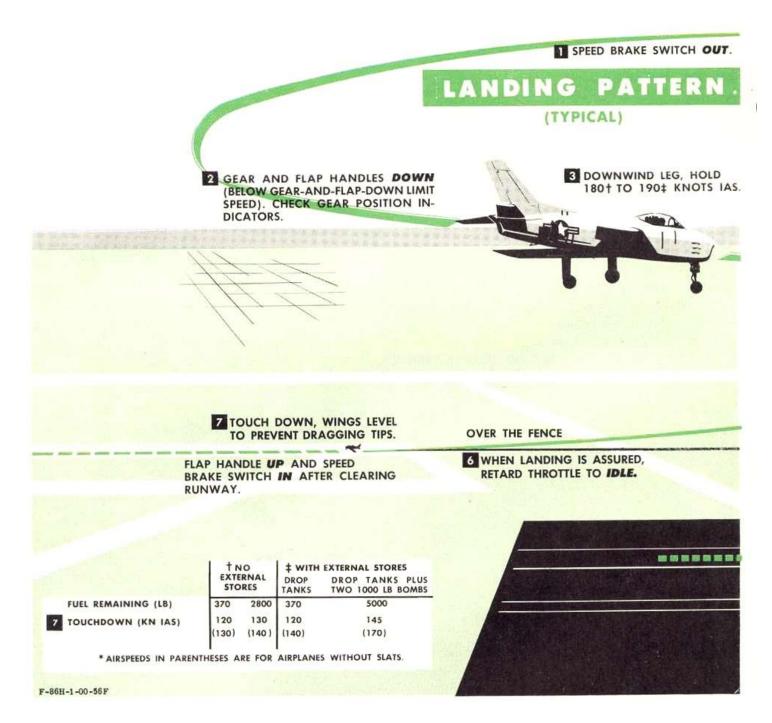
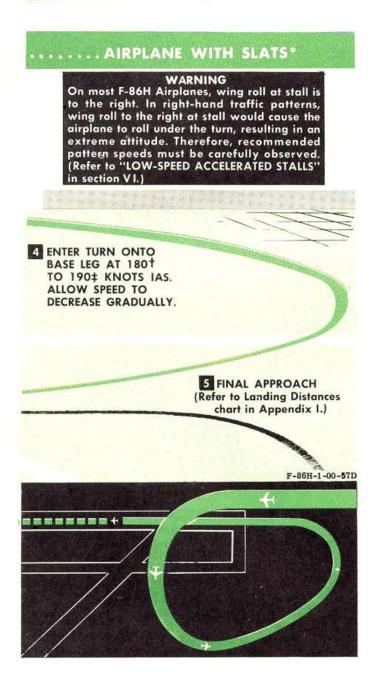


Figure 2-6

WARNING

Since very little stall warning exists for airplanes without slats under landing-pattern flight conditions and since G-loads imposed by abrupt flare-out at touchdown may cause wing drop, the landing pattern should be widened and speeds increased with respect to airplanes equipped with slats, as shown in figure 2-6. Also note increased stall speeds for airplanes without slats, as shown in figure 6-2.

Rapid increases in thrust are possible only above about 60% engine rpm, Military Power being reached in about 8 seconds from this power setting. Therefore, to ensure adequate acceleration in an emergency, it is desirable to use speed brakes and, after the gear is lowered, full flaps as early in the traffic pattern as possible. In this configuration, 60% to 70% engine rpm will be required on final approach. Use of speed brakes also



improves deceleration when required and shortens ground roll.



Do not lower landing gear in turns or pull-ups, above gear- and flaps-down limit speed, or while airplane is yawing or slipping; if you do, damage to gear operating mechanism or gear doors may result.

Note

Landing gear extension requires about 8 seconds.

LANDING.

NORMAL LANDING.

See figure 2-6 for landing pattern procedures. When properly followed, these procedures will produce the results tabulated in the Landing Distances charts in the Appendix of the Confidential Supplement, T.O. IF-86H-1A.



Do not attempt a full-stall landing, since the angle of attack is so high at stall that the tail will drag.

After touchdown, do not apply brakes hard before nose wheel has touched down and speed diminished enough for effective braking.

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 when bringing the airplane to a stop.

Maintain directional control by nose wheel steering during last part of landing roll, if desired. If nose wheel steering has not been engaged by then, engage it after clearing runway and when slow taxiing becomes necessary.

Note

Refer to Section III for emergency landing procedures.

HEAVY-WEIGHT LANDING.

The same technique for normal landing applies for heavy-weight landing except for necessary increases in power settings. As gross weight increases, approach and touchdown speeds should be increased accordingly. A stall landing should be avoided, if at all possible, in an attempt to keep G to a minimum at point of touchdown.

Note

If a hard heavy-weight landing is made, the airplane should be checked for signs of overstress before the next flight.

CROSS-WIND LANDING.

A cross-wind landing requires higher than normal pattern and approach speeds. You should maintain about 205 knots IAS into the turn onto final approach. After rolling out onto final, crab or drop wing to keep lined up with runway and maintain 140 to 160 knots IAS (155 to 175 knots IAS for airplanes without slats). Reduce speed during flare to touchdown at 130 knots IAS with minimum fuel (140 knots IAS for airplanes without slats). If crabbing, align airplane with runway before touchdown; if using wing-down approach, lift wing before touchdown. After touchdown, lower nose wheel to runway as soon as possible, to permit use of brakes and prevent weather-vaning.

CAUTION

Approach speed should be increased with an increase in cross-wind velocity, to provide better control of the airplane.

MINIMUM-RUN LANDING.

WARNING

Since a minimum-run landing is a maximum performance maneuver and final approach speeds will be nearer to stall than in a normal landing, a straight-in final approach should be used; otherwise, stall will be more likely to occur when G-loads are imposed during shallow turns.

Final approach speed for a minimum-run landing should be about 20% above stall speed for the particular weight and wing leading edge configuration you are flying. (Final approach speeds for airplanes with slats would vary from about 125 knots IAS at 15,500 pounds to 160 knots IAS at 24,000 pounds and for airplanes without slats from about 140 knots IAS at 15,500 pounds to 185 knots IAS at 24,000 pounds. After touchdown

on a dry runway, set nose wheel down quickly and smoothly, to allow for braking. Apply brakes smoothly and steadily to the point just short of locking the wheels; then release and apply brakes intermittently and forcefully at one-second intervals, holding them for about 2 to 3 seconds, but avoid sliding wheels. After touchdown on a slippery runway, maintain a high angle of attack for as long as possible, keep flaps full down, and apply brakes cautiously only after nose wheel touches down.

GO-AROUND.

See figure 2-7 for complete go-around procedure.

AFTER LANDING.

- 1. Speed brake switch at neutral.
- 2. Maintain directional control while taxiing by nose wheel steering.



If the speed brakes are actuated during taxiing, hydraulic boost pressure will not be available for use of nose wheel steering or application of the wheel brakes until speed brake operation is completed and system pressure is restored. Manual wheel brake pressure, bowever, will be available.

WARNING

Nose screen must be installed, while engine is at idle rpm, before taxiing. Ground personnel installing screen must not wear articles of loose clothing nor carry equipment likely to be drawn into intake duct.

STOPPING ENGINE.

- 1. Hold brakes.
- 2. Operate engine at 50% rpm for one minute to stabilize temperatures.

Note

This is a precautionary procedure to minimize turbine bucket scrape by stabilizing temperatures. If required by emergency conditions, engine may be shut down from any rpm setting merely by moving throttle to OFF.

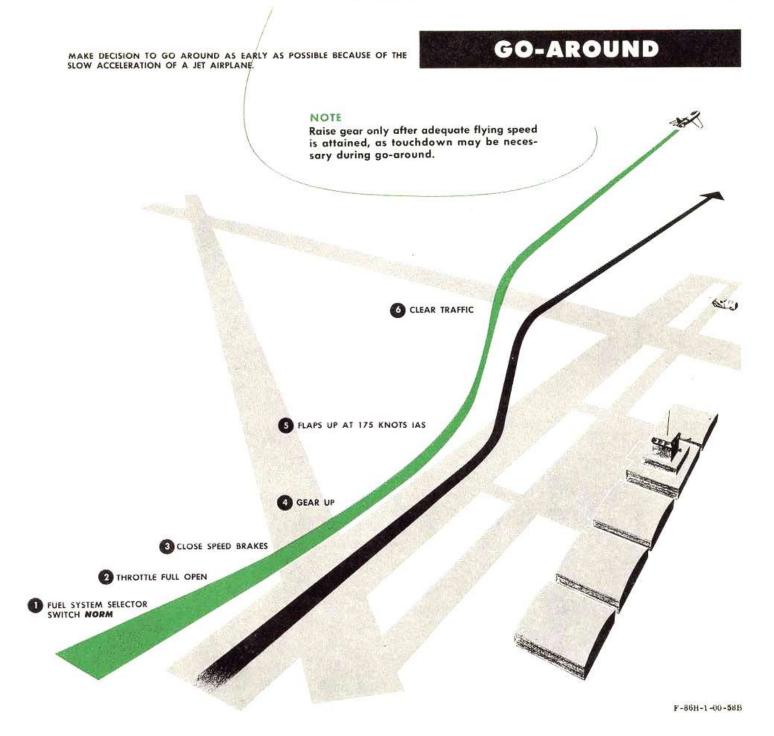


Figure 2-7

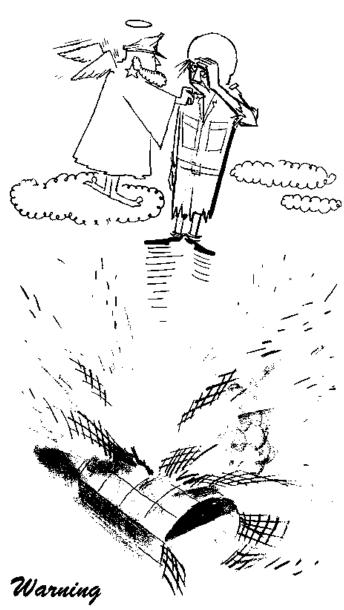
- 3. Pull throttle sharply to OFF.
- 4. Turn engine master switch OFF.
- 5. Wait a few seconds before turning battery switch OFF, to allow fuel shutoff valve to close.



Do not turn engine master switch OFF until engine has coasted down to 5% rpm or less;

if you do, starter fuel will be depleted. This may require ground servicing before a later start. If a later start is attempted without ground servicing under this condition, starter drop-out speed will be low and a hot start may result.

Turn off all switches except generator switch and instrument inverter circuit-breaker switches.



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.

SMOKE FROM TURBINE DURING SHUTDOWN.

WHITE SMOKE.

When the engine is shut down, fuel may accumulate in the turbine housing, where heat of the turbine section of the engine causes the fuel to boil. (Although a turbine housing drain is provided, the drain may not prevent accumulation of some fuel.) If this residual fuel is present in the engine, fuel vapor or smoke will emit from the tail pipe or inlet duct. Boiling fuel, indicated by appearance of white fuel vapor, does not injure the engine, but does create a hazard to personnel because of the possibility of explosion if the vapor is allowed to accumulate in the engine and fuselage.

BLACK SMOKE.

The appearance of black smoke out of the tail pipe after shutdown indicates burning fuel, which will damage the engine and should be cleared immediately as follows:

- 1. Throttle OFF.
- 2. Fuel system selector switch at EMER (necessary on airplanes with -3D or -3E engine to energize starter).
 - 3. Battery switch on.
 - 4. Engine master switch on.
 - Hold ground starter button momentarily depressed.
- 6. When starter operation ceases (in about 4 seconds), turn engine master and battery switches OFF.

Note

Starter must be primed by ground personnel before any later starting attempt.

BEFORE LEAVING AIRPLANE.

Note

Leave landing gear handle DOWN when airplane is on ground, to prevent possibility of landing gear retracting before airplane is completely air-borne.

Make the following checks before leaving airplane:

- 1. Safety pins installed in ejection seat and canopy initiators.
- 2. Check that both seat armrests are full down and latched, by applying a moderate downward force on each armrest. Check that white stripes on front face of seat bucket and inner face of each trigger guard are in perfect alignment. Also check that tops of red and white stripes on inside face of each armrest bracket do not extend above top of seat bucket.

WARNING

Do not raise armrests to determine whether latches are engaged; if you do, canopy may jettison.

- Check all electrical controls off except generator switch.
 - 4. Drop tank pressure switch OFF.
 - 5. Complete DD Form 781 (formerly Form 1).
 - 6. Canopy closed.

Note

You may rely on your crew chief to check the following items. However, if you are at a base where ground personnel are not completely familiar with your airplane, you should check these items yourself.

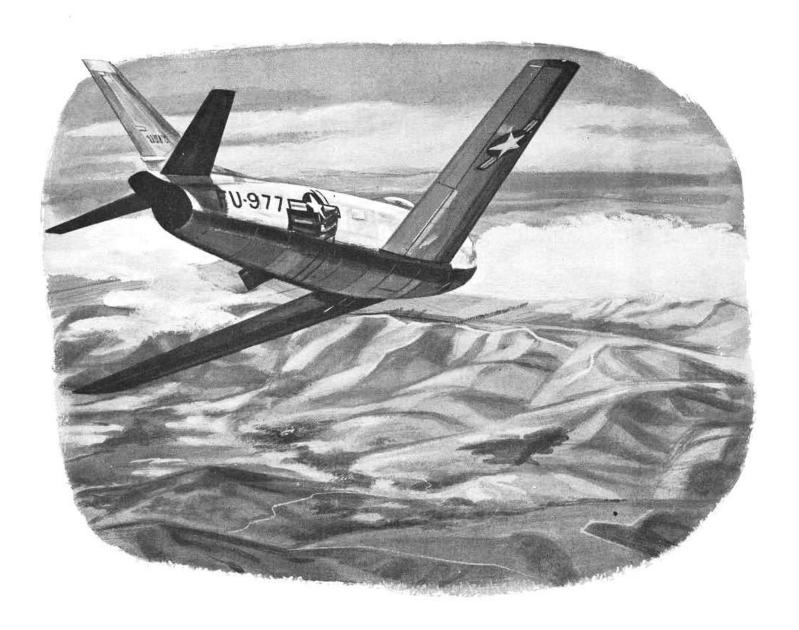
- 7. Main gear wheels chocked.
- 8. Nose gear ground safety lock installed.
- 9. Disengage nose wheel towing release pin.
- 10. Have intake duct plug, pitot tube cover, and tail-pipe cover installed.



Intake duct plug and tail-pipe cover should not be installed until engine has cooled, to prevent formation of excessive moisture.

CONDENSED CHECK LIST.

Refer to pages 2-25 through 2-35 for the Condensed Check List.





F-86H CONDENSED CHECK LIST

NOTE

The following check lists are condensed versions of the procedures presented in Section II. These condensed check lists are arranged so that you may remove them from your Flight Handbook and insert them into a flip pad for convenient use. They are arranged so that each action is in sequence with the expanded procedure given in Section II. Presentation of these condensed check lists does not imply that you need not read and thoroughly understand the expanded versions. To fly the airplane safely and efficiently, you must know the reason why each step is performed and why the steps occur in certain sequence.

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Utility hydraulic system reservoir sight gage level.

Speed brake.

External load installation and mount.

Aileron and flap.

3. RIGHT WING TRAILING EDGE AND AFT FUSELAGE:

mum for start.

Starter air storage bottles-3000 psi for two starts, 1700 psi mini-

Pitot head uncovered.

Navigation light and wing tip.

Main gear wheels chocked.

Slats for freedom of movement (some airplanes).

3. FORWARD FUSELAGE AND RIGHT WING LEADING EDGE:

Gun port plugs removed, if on firing mission.

Intake duct clear, except nose screen installed.

Landing and taxi lights retracted.

Nose gear emergency extension reset button in flush position.

Nose gear emergency extension air bottle pressure.

Tow pin safety cap tight.

Nose gear ground safety lock removed.

Nose wheel chock removed.

I' MOSE:

sion, and condition of wheels,

page, and proper inflation; check position of gear doors, gear strut extenpanels and fuel filler caps secured; check tires for general condition, slipcheck for signs of hydraulic, fuel, and oil leaks; check all access doors and Check all surfaces for cracks, distortion, loose rivets, and signs of damage;

EXTERIOR INSPECTION.

PREFLIGHT CHECK.

DD Form 781 — CHECK.

BEFORE EXTERIOR INSPECTION.

STATUS OF THE AIRPLANE.

Flight control normal and alternate system accumulator pressures. Flight control normal hydraulic system reservoir fluid level indicator pin within 1/4 inch of top of gage.

4. EMPENNAGE:

Tail-pipe cover removed.

Tail cone and navigation lights.

5. AFT FUSELAGE AND LEFT WING TRAILING EDGE:

Make same checks as in step 3, in reverse order.

Oil tank filler cap secured,

Oil tank dip stick safety-wired (airplanes without retaining clip).

Flight control alternate hydraulic system reservoir fluid level indicator pin within 1/4 inch of top of gage.

6. LEFT WING LEADING EDGE AND FORWARD FUSELAGE:

Navigation light and wing tip.

Slats for freedom of movement (some airplanes).

Landing gear door ground control switch CLOSE.

Canopy external emergency release handle safety-wired to spring-loaded catch (F-86H-1 and F-86H-5 Airplanes and F-86H-10 Airplanes AF53-1229 through -1404, not modified by T. O. 1F-86H-587).

CANOPY AND EJECTION SEAT INITIATOR CHECK.

- Canopy OPEN.
- Canopy initiator safety pin and seat ejection initiator safety pins INSTALLED.
- 3. Both seat armrests FULL DOWN AND LATCHED.
- 4. Seat quick-disconnects PROPERLY MATED.
- Linkage from armrests and triggers to initiators CHECK.
- 6. Tubing and hose fittings from initiators to ejectors CHECK.
- Lead seal on canopy remover CHECK.
- 8. Shoulder harness routing CHECK.
- 9. Safety belt initiator safety pin REMOVED (some airplanes).

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INTERIOR CHECK.

- Fasten safety belt and shoulder harness.
- 2. Adjust seat.
- Unlock and adjust rudder pedals.
- 4. Armament switches OFF.
- Throttle OFF and adjust friction as desired.
- Landing gear handle DOWN.
- 7. Depress born cutout button while throttle is OFF. (Landing gear
- unsafe warning light should come on.)
- Speed brake switch NEUTRAL.
- 9. Engine master, air start, and battery switches OFF.
- External power CONNECTED.
- Circuit breakers IN (instrument inverter circuit-breaker switches
- (NO-
- 12. Oxygen regulator diluter lever NORMAL OXYGEN (100%
- OXYGEM if carbon monoxide is suspected).
- Emergency toggle lever CENTERED.
- 14. Oxygen supply lever Safetied ON.
- Oxygen system operation CHECK.
- 16. Radio leads, anti-G suit, and bail-out bottle CONNECTED.
- Speed brake dump valve lever FORWARD.
- 18. Anti-G suit pressure regulating valve As desired.
- Ground five safety switch SAFE (20 mm guns).
- 20. Camera lens selector switch As desired.
- Bomb release selector switch MANUAL RELEASE.
- 22. AN/ARC-27 power switch OFF.
- 23. Radar range sweep switch MIN.
- 24. Flight control switch NORMAL.
- 25. Rudder trim switch OFF.
- 26. Wing flap handle UP.

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- Drop tank pressure switch IMBD if only inboard tanks installed,
- OUTBD if outboard tanks installed, OFF if no tanks installed.
- Air compressor switch NORM (some airplanes).
- 29. Fuel filter deice switch OFF (some airplanes).
- Cockpit pressure switch As desired.
- theostat. 31. Cockpit temperature master switch - AUTO; set temperature
- 33. Pitot heater switch OFF. Cockpit console airflow lever – DECR.
- 34. Windshield anti-icing (rain and ice removal) switch OFF.

CUT ON SOLID LINE

- 35. Canopy and windshield defrost handle OFF.
- 36. Landing and taxi light switch OFF.
- 37. Gun heater switch OFF (.50-caliber guns).
- 38. Canopy switch OFF.
- 39. Special store jettison handle STOWED.
- 40. Flight control emergency change-over handle STOWED.
- 41. Emergency jettison handle STOWED.
- 42. Clock, altimeter, and accelerometer SET.
- 43. Emergency fuel system test switch OFF (some airplanes).
- 44. Fuel system selector switch NORM.
- 45. Hydraulic pressure gage selector switch NORMAL.
- 46. Gun selector switch UPPER or ALL, as required (some airplanes with 20 mm guns).
- 47. Special store disarming lever DIS.
- 48. Generator switch ON.
- 49. Instrument ac power switch MAIN.
- 50. Lighting controls and switches OFF.
- 51. Landing gear emergency release handle STOWED.
- 52. All warning lights and indicators Check operation.
- 53. Rudder, ailerons, and horizontal tail Check for proper response.
- 54. Communication and navigation equipment Check operation.
- 55. AC power switch ALTERNATE, then MAIN (ac power warning light out).
- 56. Fuel quantity gage test button DEPRESS and observe movement of fuel quantity gage needle.
- 57. All interior and exterior lights Check operation.
- 58. Flashlight CHECK.

STARTING ENGINE.

MANUAL START.

- Battery switch OM.
- Engine master switch ON.
- Fuel system selector switch EMER.
- 4. Throttle IDLE and outboard.
- 5. Starter button DEPRESSED momentarily.
- 6. Establish and maintain 1100 pounds per hour fuel flow until ignition occurs.
- 7. After exhaust temperature stabilizes, advance throttle slowly to obtain 50% engine rpm. Maintain about 750°C during this acceleration.
- 8. Oil pressure CHECK. (If there is no indication of oil pressure within 30 seconds, shut down engine.)
- 9. Throttle IDLE.
- Fuel system selector switch MORM.
- 11. Engine rpm 41% to 43% and oil pressure 20 to 30 psi CHECK.
- 12. External power Disconnected.
- 13. Generator-off warning light Out.

GROUND TESTS.

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- I. Hydraulic pressure gage selector switch NORMAL.
- 2. Flight control switch RESET (alternate-on light out).
- 3. Flight control switch NORMAL. Move control stick and visually check control surface movement, Wait 5 seconds; then check pressure for 2550 to 3200 psi (control stick not in motion),
- 4. Flight control switch ALTERNATE (alternate-on warning light
- on). Move control stick and visually check control surface movement.
- 5. Hydraulic pressure gage selector switch ALTERN and check pressure for 2550 to 3200 psi (control stick not in motion).
- 6. Flight control switch RESET momentarily (alternate-on warning light out).

CUT ON SOLID LINE

- 7. Hydraulic pressure gage selector switch ALTERN.
- 8. Flight control switch RESET. Emergency changeover handle fully extended, alternate-on warning light out. Move control stick and visually check control surface movement.
- 9. Flight control switch NORMAL. Alternate-on warning light on. Alternate pressure constant value between 3050 and 4000 psi (control stick not in motion).
- 10. Emergency change-over handle STOWED. Alternate pressure 2550 to 3200 psi (control stick not in motion).
- 11. Move control stick to deplete alternate system pressure below 650 psi, alternate-on warning light out. Hydraulic pressure gage selector switch NORMAL, check pressure for 2550 to 3200 psi (control stick not in motion).
- 12. Engine at minimum of 60% rpm. Open and close speed brakes; then return switch to NEUTRAL. Hydraulic pressure gage selector switch UTILITY, pressure about 3000 psi.

TAXIING.

- Sight Mechanically caged.
- 2. Wheel chocks Removed.
- 3. Taxi at lowest practical rpm.
- Nose wheel steering switch DEPRESSED continuously.
- 5. Throttle movements Slow and at minimum.
- 6. Minimize taxi time.
- 7. Gyro indicators Check operation.

BEFORE TAKE-OFF.

PREFLIGHT AIRPLANE CHECK.

- Nose screen Removed.
- 2. Canopy initiator and seat initiators safety pins Removed and stowed.
- 3. Safety belt Tightened. Shoulder harness Fitted snugly. Shoulder
- barness lock bandle UNLOCKED.
- 4. All armament switches OFF.
- 5. Horizontal tail, rudder, and ailerons trimmed individually until
- take-off indicator light glows.
- 6. Wing flaps Full down.
- 7. Canopy switch CLOSE, canopy unsafe warning light out.
- 8. Oxygen regulator diluter lever NORMAL OXYGEN (100% OXY-
- GEM if carbon monoxide suspected).
- Toe brakes Hold.

PREFLIGHT ENGINE CHECK.

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- 1. Throttle Full open with fuel system selector switch at NORM.
- 2. Fuel system selector switch TAKE OFF, green take-off switch-on indicator light illuminated.
- 3. Throttle retarded below 95% rpm, amber emergency fuel-on light illuminated. Throttle full open, Check that rpm is within allowable limits.
- 4. Fuel system selector switch NORM, then TAKE OFF; amber emergency fuel-on indicator light out and green take-off switch-on
- indicator light on.
- 5. Fuel system selector switch TAKE OFF.
- 6. Engine instruments Check for desired readings.

CUT ON SOLID LINE

TAKE-OFF.

- 1. With throttle at take-off rpm, release brakes and begin take-off run.
- 2. Maintain directional control by use of nose wheel steering during early part of run.
- 3. Hold airplane in a near-level attitude at nose wheel lift-off. Hold attitude until recommended take-off speed is attained. Pull nose up and fly off ground.
- 4. After take-off, use stick force to maintain take-off attitude. Trim out stick forces after airplane is safely air-borne.

AFTER TAKE-OFF.

- Landing gear handle UP (check position indicators).
- 2. Wing flap lever UP.
- 3. Horizontal tail Trim as required.
- 4. Level off and accelerate to best climb speed.
- 5. Fuel system selector switch NORM with engine at 100% rpm.
- Oxygen regulator diluter lever NORMAL OXYGEN (100% OXY-GEN if carbon monoxide suspected).
 - 7. Armament switches As desired.

PRE-TRAFFIC-PATTERN CHECK.

- 1. Gun safety switch OFF (airplanes with 20 mm guns).
- 2. Bomb release selector switch MANUAL RELEASE.
- 3. Bomb arming, master armament selector, and rocket fuze (arming) switches OFF.
 - 4. Sight Mechanically caged.
 - 5. Hydraulic pressure -- Normal.
 - Fuel system selector switch NORM.
 - 7. Safety belt and shoulder harness Tightened.
 - 8. Shoulder harness handle UNLOCKED.
- 9. Anti-icing (windshield rain and ice removal) switch ON if vision impaired by rain.

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TRAFFIC-PATTERN CHECK AND LANDING.

- Speed brakes OPEN.
- Gear and flaps DOWN (check gear position indicators).
- Downwind leg Hold recommended speed.
- 4. Enter turn onto base leg at recommended speed. Allow speed to de-
- crease gradually.
- Confidential Supplement, T. O. 1F-86H-1A.) Final approach – (Refer to Landing Distances chart in Appendix of
- Through a lDLE, when landing is ensured.
- Touchdown Wings level to prevent dragging tips.
- After clearing runway Plaps UP and speed brakes IM.

GO-AROUND.

- Fuel system selector switch NORM.
- Throttle Full open.
- Speed brakes Close.
- 4. Gear UP.
- 5. Flaps UP.
- 6. Clear traffic.

AFTER LANDING.

- Speed brake switch NEUTRAL.
- Maintain directional control while taxiing by nose wheel steering.

STOPPING ENGINE.

- Brakes Hold.
- 2. Engine 50% rpm for one minute.
- 3. Thrortle OFF.
- 4. Engine master switch OFF.
- 5. Battery switch OFF.
- 6. All switches OFF (except generator and instrument inverter circuit-

breaker switches).

24 February 1956

CUT ON SOLID LINE

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BEFORE LEAVING AIRPLANE.

- 1. Safety pins Installed in ejection seat and canopy initiators.
- 2. Both armrests Full down and latched.
- 3. Drop tank pressure switch OFF.
- 4. DD Form 781 Complete.
- 5. Canopy Closed.
- 6. Main gear wheels Chocked.
- 7. Nose gear ground safety lock Installed.
- 8. Nose wheel towing release pin Disengaged.
- 9. Intake duct plug, pitot tube cover, and tail-pipe cover Installed.

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EMERGENCY Procedures

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ENGINE FAILURE.

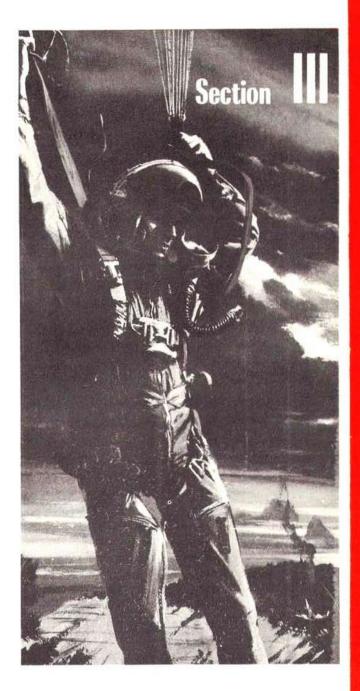
The majority of jet-engine flame-outs are the result of improper fuel flow caused by fuel control system malfunction or incorrect operating techniques during certain critical flight conditions. Specific information on this type of engine failure is given in "Fuel System Failure." Main fuel control system failure is often indicated by the engine instruments before the engine actually stops. When time and altitude permit, air starts usually are possible if engine failure is due to malfunction of the main fuel control system or improper operating techniques. Air starts should never be attempted if engine failure is obviously caused by mechanical failure within the engine proper.

ENGINE FAILURE DURING TAKE-OFF RUN.

If engine fails before airplane leaves the ground and, there is enough runway for a normal stop, proceed as follows:

- 1. Throttle OFF.
- 2. Apply brakes as necessary.

If there is not ample runway for a normal stop, and if runway is equipped with an overrun barrier, follow procedure given under "Engaging Runway Barrier."



In addition, accomplish as much of the following before engaging the barrier:

- 1. Throttle OFF.
- 2. Engine master, generator, and battery switches OFF, in that order.



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. If runway is not equipped with an overrun barrier and if gear must be retracted because of insufficient runway, proceed as follows:

1. Depress external stores jettison button.

Note

Rockets cannot be jettisoned when airplane weight is on the landing gear.

- 2. Throttle OFF.
- Landing gear handle UP; hold landing gear emergency button depressed until gear completely retracts.

Note

To accelerate gear retraction, yaw the airplane to relieve load on main gear downlock pins by alternately applying right and left wheel brakes or by applying rudder alternately with nose wheel steering engaged.

Engine master, generator, and battery switches OFF, in that order.

CAUTION

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

Jettison canopy (by raising either handgrip) before airplane comes to a complete stop.

WARNING

If canopy is not jettisoned before the airplane stops and if spilled fuel is in the vicinity of the airplane, use the mechanical means to open the canopy. If these systems fail, use the canopy jettison mechanism.

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

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

- 1. Depress external stores jettison button.
- 2. Throttle OFF.
- Landing gear handle DOWN, if gear already has been raised.

- 4. Speed brakes as desired.
- 5. Check wing flap handle DOWN.
- 6. Engine master, generator, and battery switches OFF, in that order.



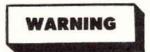
Do not turn battery switch OFF until engine master switch has been turned OFF, so that power will still be available to close fuel shutoff valve.

- 7. Raise either handgrip to jettison canopy.
- Land straight ahead, changing course only enough to miss obstacles.

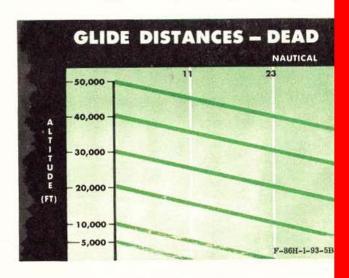
ENGINE FAILURE DURING FLIGHT.

If engine fails during flight, follow this procedure:

- 1. Throttle OFF.
- Establish glide at 200 knots IAS, with gear and flaps up and speed brakes closed for maximum glide distance. (Refer to "Maximum Glide.")
 - 3. Turn off all nonessential electrical equipment.



At normal gliding speeds, engine windmilling does not provide enough generator output, and the battery is then the only source of electric power. With the engine master switch, radio, pitot heater, and lights turned off, the battery can supply power for only 7 to 28 minutes (approximately). If engine damage



prevents windmilling (causing flight control normal hydraulic system pressure failure), the automatic operation of the electrically powered flight control alternate hydraulic pump imposes the maximum drain on battery power and results in minimum battery output time (about 6 to 7 minutes).

- Immediately attempt an air start. (Refer to "Engine Air Start.")
- If an air start is impossible, jettison external load and make a forced landing.
 - 6. If no suitable landing area is available, eject.

ENGINE AIR START.

The engine can be restarted at altitudes up to 45,000 feet, but air starts are characteristically easy at any altitude below 40,000 feet. Air starts must be made on the emergency fuel system, so careful attention should be given to recommended fuel flow and throttling precautions. For air starting, follow these procedures:

- 1. Throttle OFF immediately after flame-out.
- Air start switch ON to disconnect generator from battery, indicated by lighting of generator-off warning light.
 - 3. Fuel system selector switch at EMER.
- 4. Check engine master, battery, and generator switches on.

Note

- If possible, descend below 40,000 feet to ensure easy air start.
- If a long glide is considered, turn off all nonessential electrical equipment to conserve battery power.

- 5. If altitude is available, hold airplane as level as possible for at least 15 seconds to drain any fuel that may have collected in the combustion chambers or turbine section.
- 6. Establish glide of about 200 knots IAS to provide optimum engine windmilling speed for any altitude. It will be noted that 200 knots IAS will result in engine windmilling speeds of about 13% rpm at low altitude to 30% rpm at high altitude.
- 7. Advance throttle to obtain fuel flow of 500 (higher altitudes) to 800 (lower altitudes) pounds per hour. If there is no indication of ignition after 45 seconds, pull throttle to OFF and repeat starting procedure.
- As soon as engine is started, allow rpm and exhaust temperature to stabilize; then advance throttle cautiously to desired power setting.

CAUTION

As restart is made on emergency system, throttle should be advanced cautiously, making sure the engine accelerates and that exhaust temperature remains within limits.

Note

Failure of the engine to accelerate and low exhaust temperature indicate a partial lightoff. If this occurs, retard throttle to initial starting fuel flow to allow complete flame propagation; then readvance throttle cautiously.

Air start switch OFF to de-energize ignition system and return generator to the electrical system.

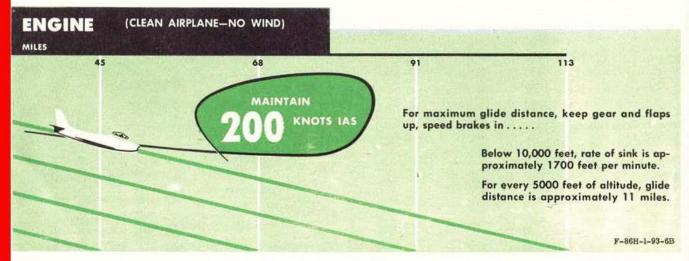


Figure 3-1

Note

The air start switch must be moved to OFF after ignition is obtained, as ignition units may be damaged if energized any longer than 5 minutes of continuous operation.

10. Continue flight on emergency system, or investigate possibility of operation on main fuel system if there is no indication that flame-out was caused by main fuel system failure.

MAXIMUM GLIDE.

For maximum glide distance, the best gliding speed is 200 knots IAS with gear and flaps up, speed brakes closed, and no external load. (See figure 3-1.) Glide ratios and rates of descent for various airplane conditions at 200 knots IAS are as follows:

CONDITION	SPEED (KN IAS)	GLIDE RATIO	RATE OF DESCENT
Gear and flaps up, speed brakes in	200	13.8 to 1	2970 fpm at 40,000 ft 1710 fpm at 10,000 ft
Gear and flaps down, speed brakes in	200	5.3 to 1	4330 fpm at 10,000 ft
Gear down, fla	ps		
up, speed brakes out	200	5.3 to 1	4310 fpm at 10,000 ft
Gear down, fla	ps		
down, speed brakes out	200	3.7 to 1	6010 fpm at 10,000 ft

LANDING WITH ENGINE INOPERATIVE.

If a forced landing is considered, maintaining the glide at 200 knots IAS (gear and flaps up, speed brakes closed) will provide the maximum gliding distance. Unless the engine is damaged, it will windmill at ample speed to produce power for the hydraulic system, although landing gear operation will be considerably slower than usual. The flight control hydraulic system will operate normally; however, excessive use of the controls should be avoided in order to conserve accumulator pressure. See figure 3-2 for procedure to follow in case of forced landing.

PRACTICE FORCED LANDING.

The normal procedure of retarding the throttle to IDLE to practice a forced landing does not apply to airplanes powered by turbojet engines. With the throttle at IDLE,

this engine continues to provide thrust (about 650 pounds), whereas with complete power failure, the windmilling engine creates drag. Thus, if the throttle is retarded to IDLE to simulate engine failure, the thrust still produced will cause the rate of descent to be less and the glide distance to be greater than during an actual flame-out forced landing. The drag of a windmilling engine can be simulated for practice forced landings by opening the speed brakes. However, the drag created by the open speed brakes is actually greater than that of the windmilling engine; as a result, a certain amount of engine power is required to offset this excessive drag. Rate of descent, glide distance, and flight characteristics with the windmilling engine can be simulated above 12,000 feet by reducing the engine rpm to about 67%, opening speed brakes, and establishing a glide speed of 190 knots IAS. Landing gear should be lowered at 12,000 feet and a glide speed of 185 knots IAS initiated. To simulate the drag of a windmilling engine at 185 knots IAS, engine rpm should be reduced to about 63%, because of decrease in drag at the lower airspeed. Familiarization with forced landing techniques and procedures (figure 3-2) can be attained with practice. During an actual forced landing, the speed brakes may be extended as desired to prevent possible overshoot. On practice forced landings, however, since the speed brakes have been opened previously, it is necessary to retard the throttle to IDLE when speed brake effect is desired. With minimum fuel aboard, final approach speed and over-the-fence speed are 160 knots IAS and 145 knots IAS, respectively. It should be remembered that since the idling engine produces some thrust, landings made during practice will be slightly farther down the runway than a landing made with a dead engine. If approach during practice forced landing is not as desired, make a normal go-around and repeat the forced landing procedures until desired proficiency is attained.

FIRE.

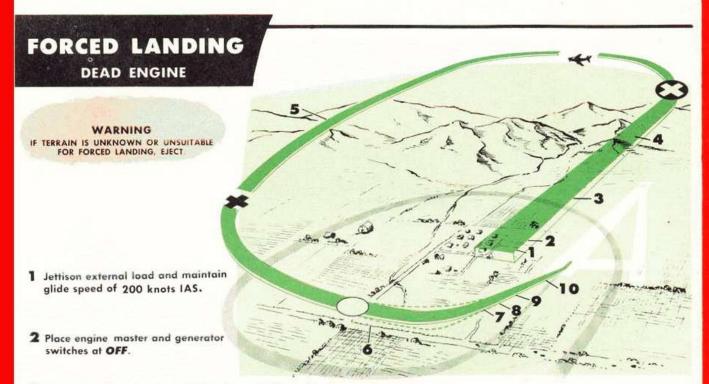


There is no fire extinguishing system on this airplane.

ENGINE FIRE DURING STARTING.

If there is an indication of fire in the engine compartment, such as lighting of the forward fire-warning light or aft overheat light:

1. Throttle OFF.



3 Lower landing gear above 12,000 feet (field made); then establish glide speed of 185 knots IAS. If altitude is too low to enter pattern at high key point, leave gear up until a subsequent key point can be reached.

WARNING

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

NOTE

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

- Fly rectangular pattern at 185 knots IAS, varying flight path to make key points. Aim for one-third point of runway.
- 5 If landing on an unprepared surface, open canopy electrically prior to entering final approach, allowing air stream to tear canopy away.
- 6 Fly turn "long" or "short" for accurate touchdown.
- 7 Hold 150 knots IAS with minimum fuel (160 knots for airplanes without slats) on final and use straight-in approach.
- 8 Use flaps and speed brakes as necessary on final when sure of reaching landing spot.

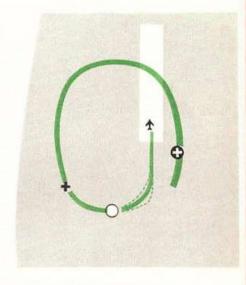
CAUTION

Speed brake operation will be slower than usual. If engine is "frozen," speed brakes will be inoperative.

- 9 Battery switch OFF, only after speed brake operation no longer is necessary.
- 1 Over end of runway at 135 knots IAS with minimum fuel (145 knots IAS for airplanes without slats).

NOTE

If engine is "frozen," nose wheel steering will not be available if needed after touchdown.



- Estimated high key point 7000 feet above terrain.
- + Estimated low key point 3500 feet above terrain.
- Estimated base key point 1500 feet above terrain.

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- 2. Engine master switch OFF.
- Generator switch OFF, if generator-off warning light is not on.
 - 4. Check battery switch OFF.
 - 5. Leave airplane as quickly as possible.

ENGINE FIRE DURING TAKE-OFF.

FORWARD FIRE-WARNING LIGHT.

Illumination of the forward ("FIRE ENGINE COMPR. COMP.") fire-warning light during take-off indicates a fire in the engine compressor compartment, necessitating immediate action. The exact procedure to follow will vary with each set of circumstances and will depend on altitude, airspeed, length of runway and overrun clearing remaining, location of populated areas, etc. The decision you make will depend on these factors. To help you make a decision, the following procedures are presented for your consideration.

ENGINE FIRE BEFORE BECOMING AIR-BORNE. If light goes on during ground roll and sufficient runway or overrun is available to allow aborting the take-off, proceed as follows:

- 1. Chop throttle to OFF.
- 2. Jettison external load.
- Abandon airplane immediately upon stopping, if fire is apparent.

ENGINE FIRE AFTER BECOMING AIR-BORNE.

If light goes on after becoming air-borne and sufficient runway is not available and overrun area is congested, preventing aborting take-off, the following is recommended if altitude is too low for a safe ejection:

- Jettison external load.
- Maintain power and immediately climb to a safe ejection altitude; then eject. (See figure 3-4 for minimum safe ejection altitudes.)

AFT OVERHEAT LIGHT.

Illumination of the aft overheat ("OVERHEAT AFT FUS") light indicates an overheat condition or possible fire in the aft engine compartment.

ENGINE FIRE BEFORE AIRPLANE IS AIR-BORNE. If aft overheat light goes on during ground roll and enough overrun area is available to abort take-off, proceed as follows:

- 1. Chop throttle to OFF.
- 2. Jettison external load and use maximum braking.
- If light is still on after stopping, abandon airplane immediately.
- 4. If light is off after stopping, turn engine master and battery switches OFF, in that order.

ENGINE FIRE AFTER AIRPLANE IS AIR-BORNE. If aft overheat light comes on after airplane is airborne, and take-off cannot be safely aborted, proceed as follows:

- 1. Retard throttle to reduce power but still maintain climb, and continue climb-out.
- 2. If light is extinguished, continue flight at reduced power, landing as soon as possible. (It is remotely possible that fire may have damaged the overheat detector circuit. To test the circuit, hold fire and overheat warning system test switch at TEST. If the light come on while the switch is at TEST, circuit is still operative.)
- 3. If light does not go off with reduced power, or if light does not go on while the fire and overheat warning system test switch is at TEST, maintain climb at reduced power and check for other indications of fire such as trailing smoke, long exhaust flame, etc.
- 4. If no fire is apparent, continue flight at reduced power, landing as soon as possible.
- 5. If positive indications of fire exist, maintain power, immediately climb to a minimum safe ejection altitude, and eject. (See figure 3-4 for minimum safe ejection altitudes.)

ENGINE FIRE DURING FLIGHT.

FORWARD FIRE-WARNING LIGHT.

Illumination of the red engine compressor compartment ("FIRE ENGINE COMPR. COMP.") fire-warning light indicates a fire in the forward compartment of the engine, necessitating action as follows:

- 1. Chop throttle to OFF position and place engine master switch at OFF.
- 2. If the light is extinguished and there is no other indication of continuing fire, such as smoke in the cockpit, engine roughness, trailing smoke, verification from other airplanes, etc, make a power-off emergency landing or eject. (It is remotely possible that fire may have damaged the fire detector circuit. To test the circuit, hold fire and overheat warning system test switch at TEST. If the light illuminates while the switch is at TEST, circuit is still operative.)
- If the light remains on or if light does not illuminate while the fire and overheat warning system test switch is at TEST, eject.

AFT OVERHEAT LIGHT.

The aft engine compartment is substantially more resistant to immediate fire damage than the forward compartment. This permits less drastic action in case the amber aft engine compartment overheat ("OVERHEAT AFT FUS") light goes on. Illumination of the

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

- 1. Reduce power in an attempt to extinguish light.
- a. If light is extinguished, continue flight at reduced power, landing as soon as possible. (It is remotely possible that fire may have damaged the overheat detector circuit. To test the circuit, hold fire and overheat warning system test switch at TEST. If the light illuminates while the switch is at TEST, the circuit is still operative.)
- b. If light cannot be extinguished with throttle retarded to IDLE, indicating possible fire rather than overheat, or if light does not illuminate while the test switch is at TEST, proceed to step 2.
- 2. Check for other indications of fire, such as trailing smoke, engine noise, verification from another airplane,
 - a. If no fire is apparent, continue flight at minimum power, landing as soon as possible.
 - b. If positive indications of fire exist, proceed to step 3.
- Chop throttle to OFF and place engine master switch at OFF.
 - a. If fire continues, eject.
 - b. If fire ceases, make a power-off emergency landing or eject.

ELECTRICAL FIRE.

Circuit breakers and fuses protect the circuits and tend to isolate an electrical fire. However, if electrical fire occurs, turn battery and generator switches OFF and land as soon as possible.

WARNING

- With battery and generator switches OFF, the engine fuel controller automatically operates on the emergency system on airplanes with the -3 engine, regardless of the position of the fuel system selector switch. Use caution when moving throttle under this condition on these airplanes, as rapid throttle bursts may cause overtemperature or compressor stall conditions.
- If engine has to be shut down or flight control normal hydraulic system fails, battery output for operation of the electrically powered pump in the flight control alternate hydraulic system will be available for only approximately 6 to 7 minutes.

CAUTION

When the electrical power source is turned off, most of the electrical equipment (including fire-warning lights) and some instruments are inoperative.

ELIMINATION OF SMOKE OR FUMES.

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

- 1. Cockpit pressure switch RAM DUMP.
- 2. Oxygen regulator diluter lever 100% OXYGEN.
- 3. Push oxygen regulator emergency toggle lever either way from center.

LANDING EMERGENCIES.

BELLY LANDING.

If a belly landing is unavoidable, proceed as follows:

1. Jettison drop tanks and external stores.

Note

Empty drop tanks should be retained if landing on a prepared surface, to reduce possible pilot injury, impact damage, and fire hazard.

- 2. Prior to entering final approach, open canopy electrically, allowing air stream to tear canopy away. (Jettison canopy if it will not open electrically.)
- 3. Make normal approach with flaps down, speed brakes open, and landing gear up.
 - 4. When landing is ensured, throttle OFF.
- 5. Just before touchdown, engine master, generator, and battery switches OFF. (Battery switch last, so that power will be available to close fuel shutoff valve when engine master switch is turned OFF.)
 - 6. Shoulder harness locked.
- 7. Touchdown should be made in the normal landing attitude.
 - 8. Abandon airplane immediately after it stops.

ANY ONE GEAR UP OR UNLOCKED.

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

Salvo or jettison external load, and, if time permits, fire all ammunition and expend excess fuel to establish an aft CG condition and to minimize possible fire hazard.

Note

Empty drop tanks should be retained if landing on a prepared surface, to reduce possible pilot injury, impact damage, and fire hazard.

- Prior to entering final approach, open canopy electrically, allowing air stream to tear canopy away. (Jettison canopy if it will not open electrically.)
- Plan approach to touch down as near end of runway as possible.
- Make normal approach with wing flaps down and speed brakes open.
- Just before touchdown, close throttle and turn engine master switch OFF. Wait one second for fuel shutoff valve to close; then move battery switch to OFF.
 If time permits, turn generator switch OFF.
 - 6. Shoulder-harness lock handle LOCKED.
- After touchdown, hold unsafe gear off as long as possible, easing it down to the runway before flight controls become ineffective.
 - 8. Do not use brakes if you can stop without them.
 - 9. Get clear of airplane as soon as possible.

ENGAGING RUNWAY BARRIER.

Successful engagements have been made with the overrun barrier in this airplane up to 130 knots ground speed. However, minimum speeds have been established which must be exceeded to ensure successful engagement. Whenever the overrun barrier is to be engaged, you should engage it as close to the recommended minimum speeds as possible. Off-center engagements can be made successfully but will result in the airplane swerving as a result of the webbing pulling the nose wheel unevenly. This momentary swerve is not dangerous and therefore should be disregarded. If for any reason you are not able 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 an overrun barrier, observe the following:

- Avoid excessive braking during engagement of the barrier, to prevent tire blowouts.
- 2. If no external loads are installed, minimum speed to engage the barrier is 17 knots ground speed.
- If 120-gallon drop tanks are installed at the inboard station, minimum speed to engage the barrier is about 40 knots ground speed.
- Jettison 200-gallon drop tanks, if installed; otherwise, main landing gear will not engage the barrier.

Note

In cases of known emergency, jettison external loads before landing.

EMERGENCY ENTRANCE.

See figure 3-3.

DITCHING.

Note

Inspect emergency equipment, life vest, and raft pack before each overwater flight.

Ditching the airplane is not recommended, since all emergency survival equipment is carried by the pilot; consequently, there is no advantage in riding the airplane down. However, if altitude is not enough for ejection and ditching is unavoidable, proceed as follows:

- 1. Follow radio distress procedure.
- 2. Jettison external stores.
- See that personal equipment will not foul when you leave the cockpit. Disconnect anti-G suit and oxygen hose.
 - 4. Tighten safety belt and shoulder harness.
 - 5. Check gear up and speed brakes closed.
- Open canopy electrically, allowing air stream to tear canopy away.
- Lock shoulder harness (shoulder-harness lock handle moved forward).

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 D-2 oxygen regulator are suitable underwater breathing devices when the regulator is set at 100% OXYGEN. It is essential that the mask be in place and tightly strapped, and that the regulator be set at 100% OXYGEN. Remember that the bail-out bottle cannot be used under water.

- 8. Throttle OFF.
- Wing flap handle DOWN. Flaps collapse on impact and do not tend to make airplane dive.
- 10. Engine master, generator, and battery switches OFF. (Battery switch last, so that power will be available to close fuel shutoff valve when engine master switch is turned OFF.)
 - 11. Shoulder harness locked.
- 12. 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

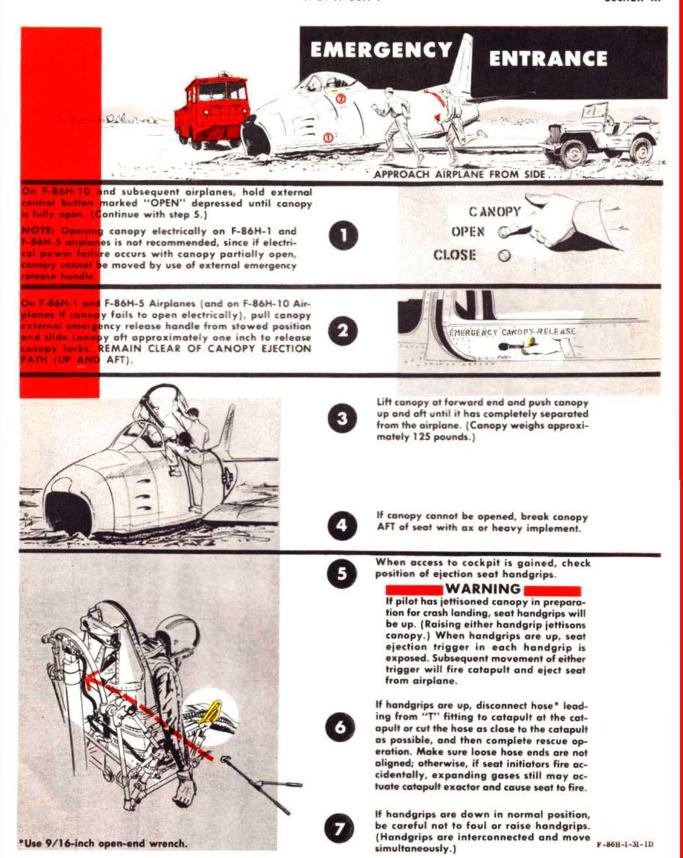


Figure 3-3

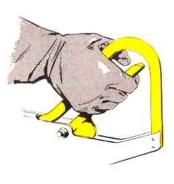
Pull up either right or left handgrip to jettison canopy. (Shoulder harness locks automatically when handgrip is raised.)





2

Squeeze either trigger to eject seat.



BEFORE EJECTION, IF TIME AND CONDITIONS PERMIT . . .

- Hook heels in footrests and brace arms in armrests. Sit erect, head hard back against headrest, chin tucked in.
- · Actuate bail-out oxygen bottle.
- · Stow all loose equipment.

MINIMUM SAFE EJECTION ALTITUDES

MANUAL SAFETY BELT AND MANUALLY ACTUATED PARACHUTE

2000 FEET

AUTOMATIC SAFETY BELT (OR MANUAL BELT OPENED PRIOR TO EJECTION) AND MANUALLY ACTUATED PARACHUTE.

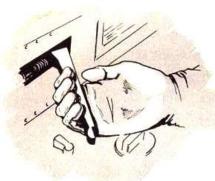
1000 FEET

AUTOMATIC SAFETY BELT AND AUTOMATIC PARACHUTE IF PARACHUTE-ATTACHED LANYARD KEY IS INSERTED INTO SAFETY BELT BUCKLE

500 FEET

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PROCEDURES



IF CANOPY FAILS TO JETTISON, ATTEMPT TO RELEASE CANOPY AS FOLLOWS...

- Hold canopy switch at OPEN until canopy is sufficiently open to permit air stream to break canopy away from airplane.
- If canopy cannot be opened electrically, use manual release handle to pull canopy aft so that air stream can break canopy free.

NOTE On early airplanes,* the manual release handle will free the canopy from the hold-down locks and actuator only from the fully closed position.

WARNING Manual opening of canopy may cause handle to inflict serious injury when canopy releases. (Canopy breakaway is extremely rapid.) Grasp handle with palm of hand upward and with thumb under handle.

 As a last resort if canopy does not release or if time and conditions do not permit, make sure chin is tucked in and head is against headrest. Then squeeze either trigger to eject through canopy.

AFTER SEAT EJECTS . . .

AIRPLANES WITHOUT AUTOMATIC-OPENING SAFETY BELT:

- · Unfasten safety belt and kick free of seat.
- If wearing a conventional manually operated parachute, pull "D" ring when altitude is reached where normal breathing is possible.
- If wearing automatic parachute, pull lanyard manually. Parachute will open at a preset altitude. If below preset altitude, parachute will open at a preset time interval.

WARNING Before low-altitude ejections, unfasten safety belt prior to ejection, to aid in separating from the seat. After ejection, pull "D" ring immediately after separating from seat to open either conventional or automatic parachute.

AIRPLANES WITH AUTOMATIC-OPENING SAFETY BELT:

- If safety belt fails to open automatically after 2 seconds, manually unfasten belt and kick free of seat. Then pull parachute arming lanyard.
- If pilot is wearing automatic parachute WITH lanyard key inserted into safety belt buckle, parachute opens at a preset altitude after pilot kicks free of seat. (Parachute opens after a preset time interval if below preset altitude.)
- If wearing automatic parachute WITHOUT lanyard key inserted into safety belt buckle, kick free of seat and pull parachute arming lanyard.
- If wearing manually operated parachute, kick free of seat; pull "D" ring at altitude where normal breathing is possible.

WARNING

After leaving seat, manually pull "D" ring for all ejections below 2000 feet to open parachute immediately.

crest passes. If wind is as high as 25 knots or surface is irregular, the best procedure is to approach into the wind and touch down on the falling side of a wave.

13. Make normal approach and flare-out, using care to keep the 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 shortly after contact.

EJECTION.

Escape from the airplane in flight must be made with the ejection seat, if possible. The basic seat ejection procedure is shown in figure 3-4.

CAUTION

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

FAILURE OF SEAT TO EJECT.

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

- 1. Unfasten safety belt, actuate bail-out bottle (if necessary), and disconnect personal leads (oxygen, radio, and anti-G suit).
- 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.
- 3. If you do not have control of the airplane, slow airplane as much as possible; then bail out over the side.
- 4. Pull automatic parachute arming lanyard or, if at low altitude, pull "D" ring.

Note

If you lose your oxygen mask and you do not have an automatic parachute, you should free fall to as low an altitude as 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.

FUEL SYSTEM FAILURE.

Failure of the hydromechanical engine fuel controller is indicated by sudden loss of fuel flow and decrease in engine rpm requiring selection of the emergency fuel system for proper engine operation as follows:

- 1. Retard throttle to IDLE.
- 2. Fuel system selector switch EMER.

WARNING

If rpm is below 95%, do not turn fuel system selector switch to EMER without first retarding throttle to IDLE. To do so may cause dangerous engine overheating or compressor stall.

3. Slowly advance throttle to desired setting.

CAUTION

During operation on the emergency fuel system, move throttle cautiously at all times; otherwise, overtemperature operation, compressor stall, or engine overspeed is likely to occur, especially at high altitudes.

Erratic fluctuations of fuel flow at high altitudes, accompanied by decrease or variation of exhaust temperature, may indicate fuel tank booster pump failure. Should both elements of the dual fuel pump fail, engine failure will result.

ENGINE FLAME-OUT.

Flame-outs above 35,000 feet may be caused by faulty fuel flow regulation or by negative G maneuvers. Flame-out resulting from faulty fuel flow regulation will usually occur during rapid throttle movements. Flame-out is indicated by loss of thrust, drop-off of exhaust temperature, and failure of the engine to accelerate when the throttle is advanced.

Note

Under certain operating conditions, such as in descents from altitude with the throttle at IDLE, exhaust temperature will drop below the recommended operating minimum. The recommended operating minimum does not necessarily indicate the temperature level below which flame-out occurs, but signifies the minimum safe temperature to maintain sustained engine operation. The engine should

not be operated at exhaust temperatures below the recommended minimum unless absolutely necessary.

Air starts must be made on the emergency fuel system. (Refer to "Engine Air Start.")

ELECTRICAL POWER SYSTEM FAILURE.

If a complete electrical failure occurs, or if for any reason it becomes necessary to turn off both the battery and generator, many of the units and controls will be inoperable. Flight under these conditions will be limited, and the following precautionary measures should be observed:

WARNING

On airplanes with the -3 engine, if primary bus failure occurs or if battery switch is turned OFF when generator power is not available, the emergency fuel system of the engine fuel controller automatically takes over. Use caution when moving throttle under this condition, as rapid throttle movement when on the emergency system may cause compressor stall or flame-out.

- If possible, reduce airspeed and readjust trim before turning off electrical power, as trim is not available without electrical power.
- 2. The fuel booster and transfer pumps are inoperative when power is shut off; consequently, it may be necessary to reduce altitude and engine rpm to maintain satisfactory engine operation. (This condition will be aggravated by low outside air temperature and high airspeed.) If reduction in rpm is necessary, airplane may have to be held in a slightly nose-high attitude to maintain altitude. If prolonged flight in this attitude is necessary, a small amount of fuel will be trapped in the aft fuselage tank. If sufficient altitude is available, nose airplane down slightly for a short period to drain some of the trapped fuel in the forward tank.
- 3. Use emergency gear lowering system to lower landing gear. This will ensure a safe down-and-locked condition. (Refer to "Landing Gear Emergency Extension" for gear lowering procedure.)

Note

If battery power is not available to primary bus or if battery switch is turned off, landing gear position indicators will be inoperative and will continuously show an unsafe condition.

4. Land as soon as possible.

GENERATOR FAILURE.

If the generator-off warning light goes on (indicating that malfunction has caused the generator to drop out of the circuit), all equipment powered by the secondary bus will be inoperative, and equipment on the primary bus will be operated by battery power only. Circuits for units powered by the single-phase (radar) inverter are controlled by the secondary bus and are rendered inoperative when the generator drops out of the circuit. When the generator drops out of the circuit, all nonessential equipment should be turned off to reduce load on battery. The length of time that usable battery power is available for continued operation is about 7 to 28 minutes. Battery output duration may be decreased, however, by a number of variable factors, including low state of battery charge, excessive electrical loads, and low battery temperature. If generator output is off because of engine failure, the engine master and generator switches should be moved to OFF to lessen battery loads. (Generator output will be low and the battery will attempt to motor the generator.)

WARNING

In case the flight control normal hydraulic system fails while generator is out, battery power for operation of the electrically powered alternate system hydraulic pump will last only approximately 6 to 7 minutes (battery fully charged).

For all landings after generator failure has occurred, lower the landing gear by the emergency system, to ensure that gear will extend and lock down. (Refer to "Landing Gear Emergency Extension.") Battery power may not be enough to position landing gear and door control valves when the normal gear lowering system is used.

Note

If generator has failed and battery power is not available to primary bus or battery switch is turned off, landing gear position indicators will be inoperative and will continuously show an unsafe condition.

GENERATOR OVERVOLTAGE.

Illumination of the generator-off warning light may indicate a generator overvoltage condition. Attempt to bring the generator back into the circuit as follows:

- Hold generator switch at RESET momentarily; then turn switch to OFF. If the voltmeter shows normal system voltage, overvoltage was temporary. Turn generator switch ON. Generator-off warning light will go out.
- If voltage does not return to allowable limit, leave generator switch OFF, reduce load on battery, and land as soon as possible.

INVERTER FAILURE.

RADAR (SINGLE-PHASE) INVERTER FAILURE.

Failure of the radar (single-phase) inverter is indicated by illumination of the amber radar ac power-off warning light. The radar inverter is controlled by the secondary bus; consequently it will be energized only when the generator is operating or external power is connected. There is no alternate source of single-phase ac power.

CAUTION

When single-phase power is lost, failure of the sight, cockpit temperature control system, IFF, sight radar, and strike camera (airplanes with strike camera timer) occurs.

INSTRUMENT (THREE-PHASE) INVERTER FAILURE.

Illumination of the instrument ac power-off warning light indicates that the instrument (three-phase) inverter selected for use is inoperative. If the red warning light goes on when the instrument ac power switch is at MAIN, the switch should be moved to ALTERNATE. If the alternate inverter is operating satisfactorily, the light will go out.

CAUTION

Loss of three-phase ac power results in failure of the fuel flow, oil, and hydraulic pressure gages, slaved gyro magnetic compass, attitude indicator, fuel quantity and flow indicators, engine control amplifier (airplanes with the -3D or -3E engine), and gunfire power (airplanes with 20 mm guns). The fuel quantity gage while inoperative will provide an erroneous indication, as it will continue to register the condition prevailing at time of power failure.

Note

If for any reason the instrument ac power switch is moved from one position to the other, the gyromagnetic compass may be thrown off as much as 100 degrees; therefore, if instrument inverter selection is changed, check gyromagnetic compass indicator reading against the stand-by compass and, if necessary, use fast slave button for fast gyro recovery to true heading.

UTILITY HYDRAULIC SYSTEM FAILURE.

There is no emergency provision in the utility hydraulic system. (Nose gear lowering can be accomplished pneumatically in case normal hydraulic operation fails.)

FLIGHT CONTROL HYDRAULIC SYSTEM FAILURE.

In case the flight control normal hydraulic system fails, the alternate hydraulic system automatically takes over (provided ample alternate system pressure is available), as indicated by illumination of the alternate-on warning light.



Note

The change-over from the normal to the alternate flight control hydraulic system is momentary and usually not noticeable, although a slight surge or "nibble" may be felt on the stick during the change-over.

If the alternate system does not take over automatically, pull the emergency change-over handle to its full extension (about 4 inches).

WARNING

- When the emergency change-over handle is pulled out, the alternate system pump is engaged and operates continuously, regardless of system pressure. If generator output is not available, the pump will deplete battery power in about 6 to 7 minutes.
- If both flight control hydraulic systems are completely inoperable, stick forces will become extremely high. As a result, under such conditions, control of the airplane in cruising flight becomes very difficult, and control at high speeds or during extreme maneuvers is impossible. Therefore, should both systems fail, attempt to reduce airspeed to about 220 knots IAS and try to maintain all possible control by using rudder and varying power as necessary. Attempt to neutralize the ailerons and horizontal stabilizer by steady push or pull forces on the stick, allowing air loads to streamline the surfaces. If control cannot be maintained, eject immediately. If some control is available, however, and altitude permits, attempt to effect recovery and return to a suitable area. Then eject, as extended flight and a landing with these high stick forces should not be attempted under any circumstances.

If complete failure of the flight control normal hydraulic system has been determined (i.e., system will not deliver 1000 psi), pull the manual emergency changeover handle just prior to entering the traffic pattern, to ensure positive, continuous engagement of the flight control alternate hydraulic system during the landing phase.

Note

This action will prevent cycling from the alternate to the failed normal system and possibly momentarily freezing the controls.

FLIGHT CONTROL ARTIFICIAL FEEL SYSTEM FAILURE.

Artificial feel system failure can be indicated by any combination of the following: lightening of stick forces (resulting in overcontrol); lack of trim response; and poor stick centering characteristics. Failure of the artificial feel system leaves the pilot with no possible means of airplane recovery. Reduction of engine power may relieve the severity of oscillations of the airplane; however, when such failure occurs, ejection is recommended.

TRIM FAILURE.

There is no alternate trim system on this airplane. A maximum pilot control stick force of 22 pounds would be required to neutralize the stabilizer and 6 pounds to neutralize the ailerons in the event either trim system should fail in an extreme travel position. Movement of the control stick to the opposite extreme of travel after this type of failure requires a maximum force of 50 pounds on the stabilizer and 22 pounds on the aileron.

CAUTION

The trim switch on the B-8 stick grip may be subject to occasional sticking in an actuated position, resulting in application of extreme trim. When this occurs in flight, the switch should be returned manually to the center OFF position after the proper amount of trim is obtained.

LANDING GEAR EMERGENCY OPERATION.

LANDING GEAR EMERGENCY RETRACTION.

If it is necessary to retract the landing gear when the airplane is on the ground, move landing gear handle to UP and hold landing gear emergency-up button depressed until gear completely retracts. To reduce gear retraction time when emergency-up button is used, yaw the airplane by alternately applying right and left wheel brakes or by applying rudder alternately with nose wheel steering engaged.



Gear will retract only if hydraulic pressure and electric power are available.

LANDING GEAR IN-FLIGHT EMERGENCY OPERATION.

If the red landing gear unsafe warning light remains on after the gear retraction, or lights up during flight, proceed as follows:

- 1. Before moving landing gear handle, have gear and gear door position check made by tower on a fly-by or by a formation member.
- 2. If gear appear to be up and locked on check, or if check cannot be made, reduce speed to below 220 knots IAS and cycle gear.
 - 3. If warning light again remains on after the gear

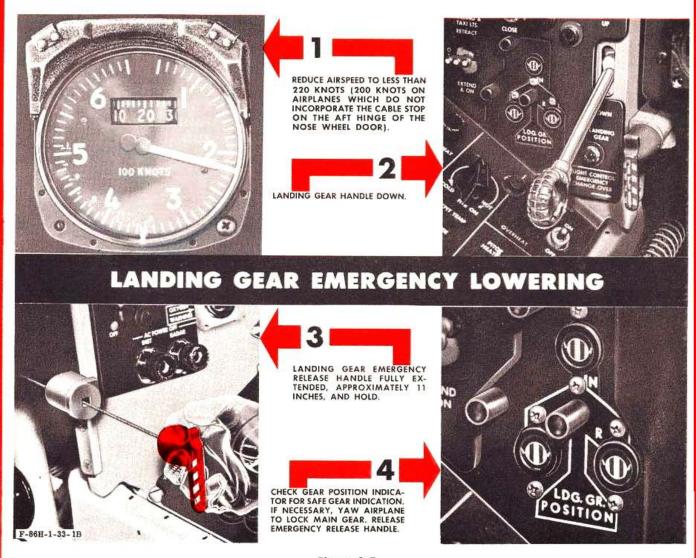


Figure 3-5

are retracted, lower gear (below 220 knots IAS) and land as soon as practical.

CAUTION

Do not move landing gear handle when red gear unsafe warning light is on and speed is above 220 knots IAS, as gear doors may be torn off when hydraulic pressure is released from door actuating cylinders.

LANDING GEAR EMERGENCY EXTENSION.



Landing gear cannot be retracted after being lowered by means of the landing gear emergency release handle until the selector valve is reset on the ground.

In case the landing gear does not extend by normal operation, follow the landing gear emergency extension procedure as shown in figure 3-5.

SPEED BRAKE SYSTEM FAILURE.

On some airplanes,* the speed brakes can be closed in flight in the event of electrical or hydraulic failure, by moving the speed brake dump valve lever aft. This mechanically positions a dump valve that opens the speed brake hydraulic lines to return, allowing air loads to close the speed brakes. There is no emergency system to open the speed brakes.

^{*}F-86H-1 Airplanes AF52-1975 through -1980

WING FLAP SYSTEM FAILURE.

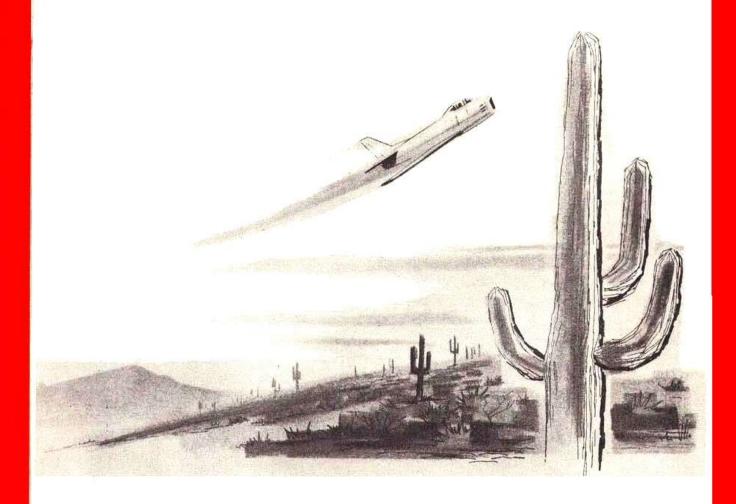
No emergency system for flap operation is provided. If the flaps retract or extend unequally during normal flap operation, hold airplane level and return flap handle to original position to try to equalize the flaps. (Enough aileron control is available to hold wings level in this condition or to roll against the down flap if necessary.) Land as soon as possible without any further attempt to operate the flaps.

EXTERNAL LOAD EMERGENCY RELEASE.

To drop any external load during an in-flight emergency, follow this procedure:

- 1. Push external stores jettison button.
- 2. Make sure load has released.
- 3. If no electrical power is available or load fails to release, pull emergency jettison handle.





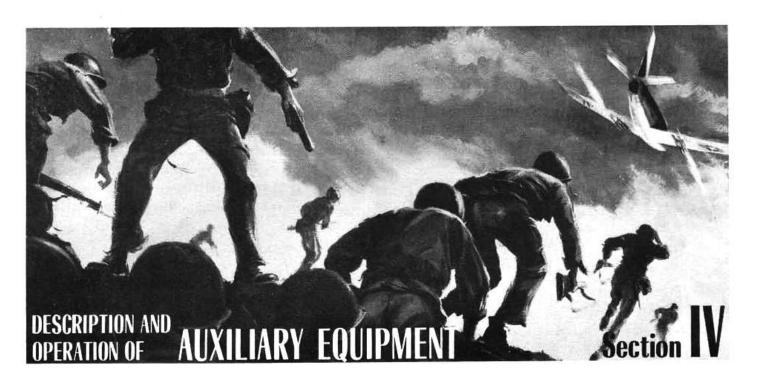


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COCKPIT AIR CONDITIONING AND PRESSURIZATION SYSTEM.

COCKPIT AIR CONDITIONING.

The air conditioning system supplies air for cockpit pressurization and cockpit temperature control. In addition, the system provides air for defrosting the windshield, the canopy, and the camera window, and for windshield anti-icing* or windshield rain and ice removal.† On early airplanes,* the windshield anti-icing system has limited rain removal capabilities. (Refer to "Defrosting and Rain and Ice Removal Systems.") Engine compressor discharge air is routed through a primary heat exchanger for initial cooling, and then directed either through or around a refrigeration unit to maintain a preselected cockpit temperature. Cockpit air temperature is regulated by an automatic temperature control system. This system proportions the mixing

of hot air from the engine compressor and cool air

from the refrigeration unit by positioning the hot-air by-pass valve and the heat exchanger modulating valve. (On early airplanes,* if air from the compressor does not supply enough heat, an electric cockpit heater can be energized; it will then cycle on and off to maintain the desired cockpit temperature.) When maximum cockpit cooling is required, the by-pass valve directs all the air through the refrigeration unit, which consists of an air-to-air heat exchanger combined with an expansion turbine; at the same time, the modulating valve is positioned for maximum cooling. The cockpit air conditioning and pressurization system is shown schematically in figure 4-1. Cockpit air outlets are located along the consoles on either side of the pilot and between the rudder pedals. On early airplanes,* air for windshield anti-icing is routed directly from the primary heat exchanger to the windshield anti-icing outlet, with air temperature controlled by the cockpit temperature control regulator. On most airplanes,† air for windshield rain and ice removal also is routed from the primary heat exchanger to the windshield air outlet, but an

Lighting Equipment
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^{*}F-86H-1 Airplanes AF52-1975 through -1990 †F-86H-1 Airplane AF52-1991 and all subsequent airplanes

auxiliary temperature regulator assumes automatic control of the temperature of the air to the windshield outlet. In both systems, the temperature control is effected through positioning of the heat exchanger cooling-air modulating valve. The air to the windshield anti-icing system* can exceed design limit, whereas it will automatically be maintained within the design limit in the rain and ice removal system.† Compressed air is also used for anti-G suit, starter compressor, pressurization of drop tanks and hydraulic reservoirs, canopy seal, and anti-icing of the generator cooling-air inlet scoop. Ram-air flow may be selected if the air conditioning system does not function correctly, and on some airplanes* it may be heated by the electric heater.

PRESSURIZATION.

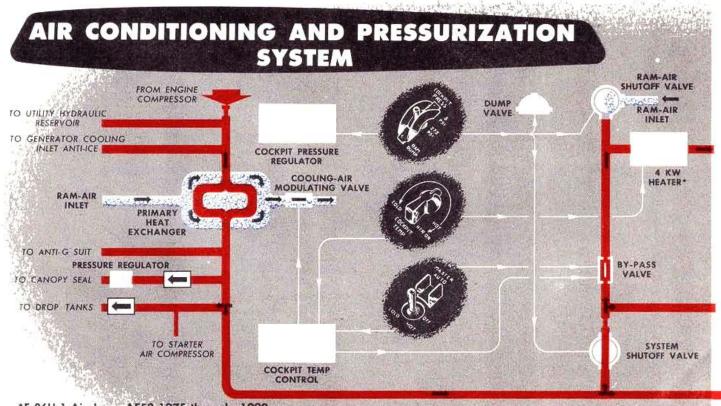
Cockpit pressure is maintained at a predetermined schedule for various flight altitudes by a pressure regulator which controls the outflow of cabin air. (The

*F-86H-1 Airplanes AF52-1975 through -1990 †F-86H-1 Airplane AF52-1991 and all subsequent airplanes cockpit pressure schedule is shown in figure 4-2.) The cockpit is nonpressurized from sea level to 12,500 feet. Above this altitude, either of two pressure schedules (2.75 psi or 5 psi) is maintained by the automatic pressure regulator. If 2.75 psi is selected, a cockpit pressure of 12,500 feet is maintained to an altitude of 21,200 feet and a constant pressure of 2.75 psi cockpit differential at all altitudes above. If 5 psi is selected, a cockpit pressure of 12,500 feet is maintained to about 31,000 feet and a constant 5 psi cockpit differential at all altitudes above.

Note

Below a flight altitude of about 12,500 feet, the differential between cockpit altitude and flight altitude increases with airspeed and is usually 1000 feet or less when only the cockpit air conditioning system is on. If the windshield and canopy defrost systems are on, the difference in altitude should not exceed 5000 feet.

The minimum engine rpm necessary for adequate cockpit pressurization, air conditioning, and defrosting for any particular altitude is as follows:



*F-86H-1 Airplanes AF52-1975 through -1990

F-86H-1-53-3A

[†]F-86H-1 Airplane AF52-1991 and all subsequent airplanes

[‡]Valve off when windshield rain and ice removal (windshield anti-ice) switch ON.

ALTITUDE	RPM
10,000 feet	70%
15,000 feet	73%
20,000 feet	75%
30,000 feet	80%
40,000 feet	92%
45,000 feet	100%

A dump valve releases all cabin pressure when selected by the pilot and automatically relieves any excess pressure above 5.3 psi if the pressure regulator fails. An external pressurized air source may be used for ground pressurization and cooling of the cockpit.

COCKPIT AIR CONDITIONING AND PRESSURIZATION SYSTEM CONTROLS AND INDICATOR.

A cockpit air conditioning and pressurization control panel is located on the left console, forward of the throttle quadrant. The panel contains the controls for cockpit temperature, cockpit pressure, cockpit console airflow, windshield anti-icing, rain removal, and pitot heater, and on some airplanes* the windshield overheat indicator light.

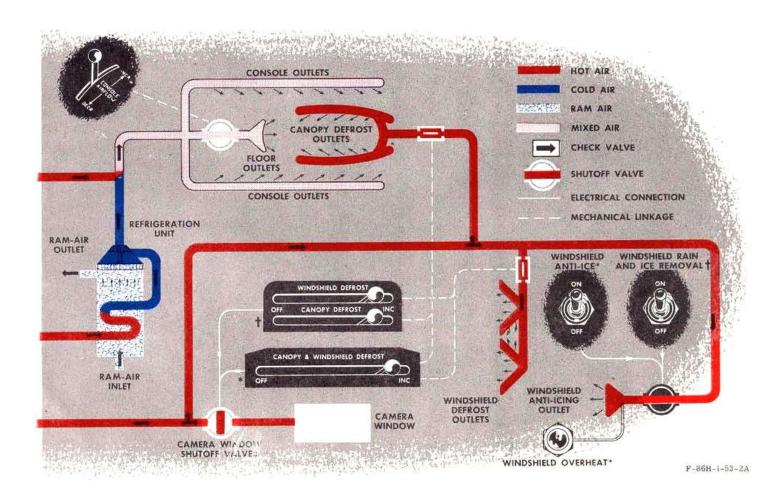
*F-86H-1 Airplanes AF52-1975 through -1990

COCKPIT PRESSURE SWITCH.

A three-position switch, located on the air conditioning control panel, (8, figure 1-6; figure 4-3), provides primary bus power for selection of cockpit pressure. When the switch is at RAM DUMP, the dump valve opens to depressurize the cockpit, the ram-air shutoff valve opens to admit ram air into the cockpit, the system shutoff valve closes, and the cockpit temperature control becomes inoperative. On some airplanes,* the ram air is heated by the electric heater when the cockpit temperature rheostat is moved to HTR ON. When the pressure switch is moved to either 2.75 PSI or 5 PSI, the ram-air valve is closed and the system shutoff valve is opened. The regulator will then maintain the selected pressure differential between cockpit and atmospheric pressure above 12,500 feet.

COCKPIT TEMPERATURE MASTER SWITCH.

A four-position switch on the air conditioning control panel (8, figure 1-6; figure 4-3) controls cockpit air inlet temperature by means of secondary bus power. The switch, with AUTO, HOT, COLD, and OFF positions, is operable only when the cockpit pressure switch is at 5 PSI or 2.75 PSI. For automatic temperature control, the switch should be positioned at AUTO and the cockpit



temperature rheostat adjusted to obtain the desired temperature.

Note

The cockpit temperature control unit operates on single-phase ac power. Therefore, if singlephase ac power is not available, automatic temperature control of the cockpit cannot be maintained.

Should the automatic control system function improperly or single-phase ac power failure occur, the cockpit temperature may be manually controlled by means of the master switch. Moving the switch to HOT opens the hot-air by-pass valve; to COLD closes the hot-air by-pass valve and directs air through the refrigeration unit. The switch should be returned to OFF when desired temperature is attained. To control cockpit temperature when ram air is selected, the cockpit temperature rheostat on some airplanes* must be moved to HTR ON to actuate an electric heater. When the temperature master switch is OFF, the automatic control system is inoperative and the by-pass valve will remain in the position prevailing when the switch was set at OFF.

COCKPIT TEMPERATURE RHEOSTAT.

When the cockpit temperature master switch is at AUTO, the temperature rheostat (figure 4-3) may be set at any point between COLD and HOT to maintain desired cockpit inlet air temperature to the cockpit. On some airplanes,* when the rheostat is turned clockwise to HTR ON, the electric heater (secondary bus power) is turned on to supply added heat to the hot compressed air from the primary heat exchanger. The rheostat control is inoperative for selective temperatures if the temperature master switch is not in the AUTO position; however, the HTR ON position* is operative regardless of the position of the master switch.

COCKPIT CONSOLE AIRFLOW LEVER.

Cockpit airflow is determined by a lever (figure 4-3) on the air conditioning control panel. The lever is used to direct the flow of air to the outlets along the console and to the outlet between the rudder pedals. Positioning the lever toward INCR mechanically positions a diverter valve so that a greater share of the cockpit air is directed through the console air outlets. Moving the lever toward DECR directs a larger portion of the air to the pilot's feet, reducing cockpit air circulation, but still retaining the same airflow for pressurization.

*F-86H-1 Airplanes AF52-1975 through -1990

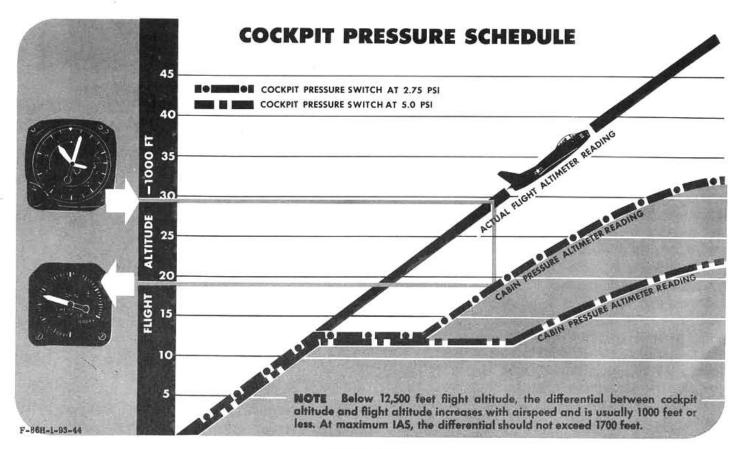


Figure 4-2

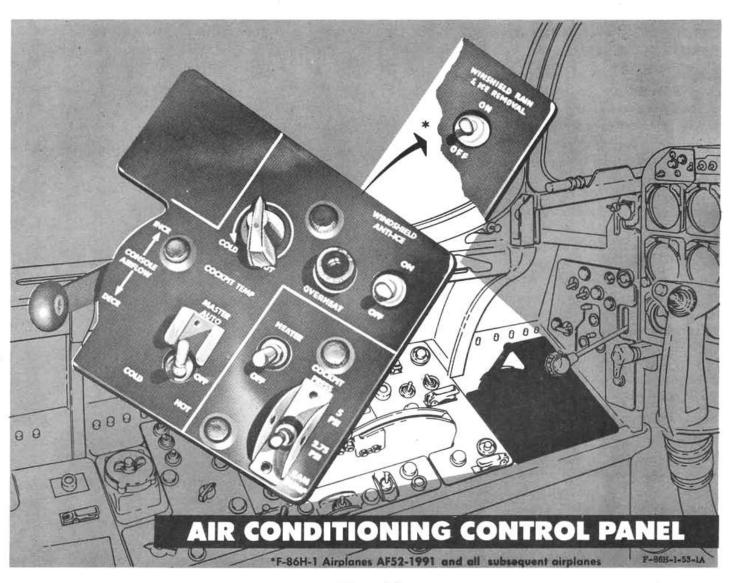


Figure 4-3

CABIN PRESSURE ALTIMETER.

The pressure altitude of the cockpit is indicated by the cabin pressure altimeter (4, figure 1-7), located outboard and forward on the right console. The cabin pressure altimeter is vented only to pressure within the cockpit.

NORMAL OPERATION OF COCKPIT AIR CONDITIONING AND PRESSURIZATION SYSTEM.

Normal operation of the air conditioning and pressurization system is done as follows:

- 1. Cockpit pressure switch at either 2.75 PSI or 5 PSI.
- 2. Cockpit temperature master switch at AUTO.
- 3. Cockpit temperature rheostat set as desired.
- Cockpit console airflow lever set for desired airflow distribution.
- 5. Move canopy and windshield defrost handle to INC if further cockpit heating is desired.

EMERGENCY OPERATION OF COCKPIT AIR CONDITIONING AND PRESSURIZATION SYSTEM.

If sudden depressurization of cockpit is necessary:

- Turn oxygen regulator diluter lever to 100% OXYGEN, and push emergency toggle lever from center position for positive pressure to mask.
 - 2. Move cockpit pressure switch to RAM DUMP.
- 3. If circumstances permit, descend to 25,000 feet or below.

If cooling unit functions improperly, and temperature of cockpit remains high:

- 1. Turn cockpit temperature rheostat to COLD.
- 2. If temperature remains high, move cockpit temperature master switch to COLD position.
- If temperature is still uncomfortably high, check oxygen mask and regulator and move cockpit pressure switch to RAM DUMP.
- 4. If circumstances permit, descend to 25,000 feet or below.

Section IV T. O. 1F-86H-1

DEFROSTING AND RAIN AND ICE REMOVAL SYSTEMS.

Heated air for canopy and windshield defrosting is supplied from the air conditioning system; air from the primary heat exchanger is directed over the inner surface of the canopy and windshield. The canopy must be closed and locked for defrosting operation. For strike camera window defrosting, air is directed over the inside and outside of the camera window* or inside of the camera window.† For windshield anti-icing and limited rain removal on early airplanes* and rain and ice removal on most airplanes,‡ a layer of heated air is directed over the outside of the windshield from an external outlet. The pitot head has a conventional resistance-type electrical heater to prevent formation of ice within the unit. Some airplanes have an alcohol deicing system to allow removal of ice from the fuel filter. (Refer to "Fuel Filter Deicing System.")

DEFROSTING AND RAIN AND ICE REMOVAL SYSTEM CONTROLS AND INDICATOR.

CANOPY AND WINDSHIELD DEFROST HANDLE.

Defrosting of canopy, windshield, and camera window is controlled by means of a defrost handle (6, figure 1-6), located above the cockpit air conditioning control panel. When the handle is moved to the INC position, butterfly valves in the system are opened mechanically to distribute heated air to the canopy and windshield, and an electrically actuated shutoff valve is opened to direct air to the camera window. However, when windshield rain and ice removal (anti-icing) is being used, the camera shutoff valve closes and camera defrosting facilities are inoperative. When the handle is in the OFF position, the canopy and windshield defrost butterfly valves are closed and the camera valve is closed. On most airplanes,‡ a separate handle is provided for controlling the canopy defrost system; another is provided for the windshield defrost system.

WINDSHIELD ANTI-ICING SWITCH AND OVERHEAT INDICATOR.*

Control of windshield anti-icing airflow is provided by a switch (figure 4-3) located on the air conditioning control panel. Moving the switch to ON opens the anti-ice shutoff valve to supply hot air to the outer surface of the windshield and closes the camera defrost valve. An indicator light (figure 4-3) goes on (secondary bus power) whenever the temperature of air for windshield anti-icing exceeds the design limit of 300°F. However, this does not mean the windshield itself is overheated or in immediate danger of damage. An attempt should be made to reduce windshield air

outlet temperature, though, by reducing engine rpm or by placing the cockpit pressure switch at RAM DUMP. If either action is not desirable or fails to correct the overheat condition, the anti-icing system should be left on to improve forward vision, especially during the landing approach.

WINDSHIELD RAIN AND ICE REMOVAL SWITCH.:

The flow of hot air to the outer surface of the windshield for rain and ice removal is controlled by a twoposition switch (figure 4-3) on the air conditioning control panel. When the switch is moved to ON, hot air is directed to the windshield, and the camera defrost valve is closed. There is no overheat indicator on these airplanes, since windshield outlet air will not exceed the design limit when the system is functioning normally.

PITOT HEATER SWITCH.

The electrical heater in the pitot head is controlled by the pitot heater switch (figure 4-3), located on the left console. The switch has two positions, PITOT HEATER and OFF, and controls primary bus power for heater operation.



The pitor heater should not be used for extended periods of time on the ground, because lack of sufficient airflow will cause overheating of the unit, which could result in serious injury to personnel.

NORMAL OPERATION OF WINDSHIELD AND CANOPY DEFROSTING AND WINDSHIELD ANTI-ICING SYSTEMS.*

Note

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

If inner surface of windshield or canopy becomes fogged, follow this procedure:

1. Move canopy and windshield defrost handle toward INC, as desired.

^{*}F-86H-1 Airplanes AF52-1975 through -1990

^{*}F-86H-5 and subsequent airplanes

^{\$}F-86H-1 Airplane AF52-1991 and all subsequent airplanes

2. If atmospheric or flight conditions cause fog to be emitted from the windshield defrost or airflow outlets, turn cockpit temperature rheostat to the full HOT position.

If windshield becomes iced, fogged or frosted, or rain obscures forward vision, move windshield anti-icing switch to ON to engage windshield anti-icing system.

Note

- If windshield icing is frequently encountered during letdowns, the windshield anti-icing system should be turned on 10 minutes before letdown. However, the system should not be turned on and off unnecessarily, since windshield breakage can occur because of thermal shock.
- The windshield anti-icing airflow will improve forward vision under moderate rain conditions at engine speeds above 75% rpm. If it is necessary to reduce power, such as during landing approach, vision through the windshield side panels may become necessary.



If the windshield overheat light goes on, try to reduce windshield air temperature by reducing engine rpm or by placing cockpit pressure switch at RAM DUMP. If either action is not desirable or fails to correct the overheat condition, the anti-icing system should be left on to improve forward vision, especially during the landing approach.

NORMAL OPERATION OF WINDSHIELD AND CANOPY DEFROSTING AND WINDSHIELD RAIN AND ICE REMOVAL SYSTEMS.*

Note

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

- 1. If inner surface of canopy becomes fogged, move canopy and windshield defrost handle toward INC, as necessary.
- If inner surface of windshield becomes fogged, move canopy and windshield defrost handle toward INC.

- 3. If atmospheric or flight conditions cause fog to be emitted from defrost outlets, turn cockpit temperature rheostat to full HOT position.
- 4. If windshield becomes iced, fogged or frosted, or if forward vision is obscured by rain, set windshield rain and ice removal switch to ON.

FUEL FILTER DEICING SYSTEM.

Alcohol is injected into the fuel filter inlet line to deice the fuel filter. Alcohol flow from the tank to the filter is pilot-controlled. The 3-gallon alcohol supply will last for about 3 minutes of continuous deicing operation. A warning light goes on whenever fuel flow through the filter is restricted by ice formation.

FUEL FILTER DEICING SYSTEM CONTROL AND INDICATOR.

FUEL FILTER DEICE SWITCH. The fuel filter deice switch (figure 1-10), located on the left console, controls the alcohol system for deicing the fuel filter. When the switch is moved to DE-ICE, primary bus power opens a shutoff valve and starts the alcohol pump to inject alcohol into the fuel filter inlet line. When the ice warning light goes out, indicating that the filter is free of ice, the switch should be returned to OFF.

FUEL FILTER ICE WARNING LIGHT. Ice formation within the fuel filter creates a pressure differential across the filter, which in turn lights the fuel filter ice warning light (figure 1-10) on the left console. The light goes out when ice has been removed from the filter by the alcohol. The light operates on primary bus power.

Note

- The fuel filter ice warning light may flicker under certain engine operating conditions, such as rapid acceleration. Therefore, since the alcohol supply will last for only 3 minutes of deicing operation, make certain the light burns steadily before actuating the deice switch.
- An accumulation of dirt or other foreign matter in the fuel filter sufficient to restrict the fuel flow can also cause lighting of the fuel filter ice warning light. The deicing system will not remove such restrictions, and ground servicing of the filter is required for cleaning.

^{*}F-86H-1 Airplane AF52-1991 and all subsequent airplanes

[†]F-86H-1 Airplanes AF52-1975 through -1983

COMMUNICATION AND ASSOCIATED ELECTRONIC EQUIPMENT.

UHF COMMAND SET-AN/ARC-27.

The AN/ARC-27 radio equipment provides two-way voice communication in the frequency range of 225 to 399.9 megacycles between aircraft and ground stations or between aircraft. Selection of 18 preset frequencies may be made plus a guard frequency that can be operated alone or with the selected frequency. The radio set control, which is a remote-control panel, contains three control devices: a power switch, a channel selector, and an audio volume control. (See figure 4-4.)

Note

Desired frequencies can be preset before flight on the control box in the left-hand radio bay.

OPERATION OF AN/ARC-27 COMMAND RADIO.

To operate the command set, proceed as follows:

- 1. Move power switch from OFF to T/R. Allow one minute for warm-up.
- 2. Move power switch to T/R + G REC. This allows monitoring of an added independent receiver preset to a frequency that is guarded continuously throughout schedule periods.
- 3. Move frequency channel selector to desired preset frequency. Reception and transmission will be on this frequency.

Note

Volume control should not be forced beyond its rotational travel limits to obtain desired audio level; if this is done, intermittent or complete loss of audio signal will result.

- 4. Adjust volume control for desired audio level.
- 5. To transmit, press microphone button on throttle.
- 6. To operate with separate guard receiver off, move power switch to T/R. For operation of both receivers, rotate power switch to T/R + G REC. To transmit on guard frequency, move power switch to T/R and frequency channel selector to G.
- 7. To turn command radio off, move power switch OFF.

Note

The ADF position is inoperative on this airplane.

RADIO COMPASS-AN/ARN-6.

The AN/ARN-6 radio compass set is a visual and navigational aid used together with the radio compass indicator (29, figure 1-5), on the instrument panel. Four separate frequency bands are provided: band one, 100 to 200 kilocycles; band two, 200 to 410 kilocycles; band three, 410 to 850 kilocycles; band four, 850 to 1750 kilocycles. Controls on the radio compass control panel (13, figure 1-7; figure 4-4) permit selection of automatic or manual direction finding. A tuning meter, on the control panel, indicates signal strength and accuracy of tuning. The radio compass loop is installed within the aft portion of the canopy, and the sense antenna is incorporated in the upper arc of the canopy. (See figure 4-5.)

OPERATION OF RADIO COMPASS.

To operate the AN/ARN-6 radio compass, proceed as follows:

- Turn function selector switch from OFF to COMP, ANT., or LOOP.
 - 2. Move band switch to select desired frequency.
 - 3. Tune station with tuning crank.
 - 4. Turn audio control to adjust headset volume.
- 5. Set "VAR" knob on compass indicator (instrument panel) to adjust index.
- When function switch is at LOOP, use "LOOP L-R" switch to rotate loop as required for aural null orientation.
- 7. Return function selector switch to OFF to turn radio compass off.

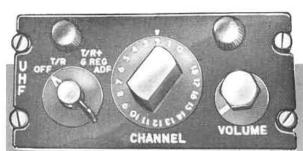
IDENTIFICATION RADAR—AN/APX-6.*

The AN/APX-6 radar identification set is used to automatically identify the airplane as friendly, whenever it is properly challenged by suitably equipped air or surface forces. The set also has provisions for identifying itself as a specific friendly airplane within a group of airplanes and means for transmitting a special distress code. Functionally, the AN/APX-6 receives challenges and transmits replies to the source of the challenges where the replies are displayed, together with the associated radar targets, on radar indicators. When a radar target is accompanied by a proper reply from the IFF set, the target is considered friendly. Controls for the set are located on the IFF control panel (14, figure 1-7; figure 4-4). Three destructors (installed on some airplanes†), mounted in the AN/APX-6 transponder, may be actuated by the pilot through a guarded, twoposition "DESTRUCT" switch. Raising the guard and moving the switch to ON fires the destructors. When the guard is down, the switch is at OFF. (See figure 4-4.) An impact switch on early airplanes‡ automatically actuates the destructors upon a crash landing.

^{*}F-86H-1 and F-86H-5 Airplanes and F-86H-10 Airplanes AF53-1229 through -1352 †F-86H-1 Airplanes AF52-1975 through -2069 (F-86H-1 Airplanes AF52-1975 through -1983)

COMMUNICATION

AND ASSOCIATED ELECTRONIC EQUIPMENT



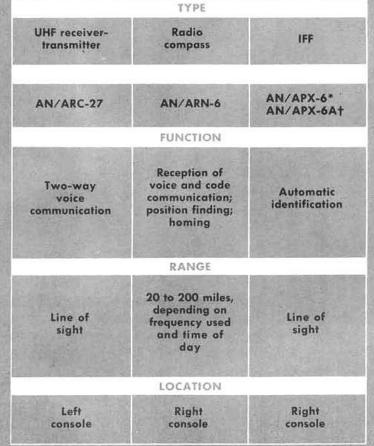
UHF COMMAND SET AN/ARC-27



IDENTIFICATION RADAR AN/APX-6*



IDENTIFICATION RADAR AN/APX-6A†



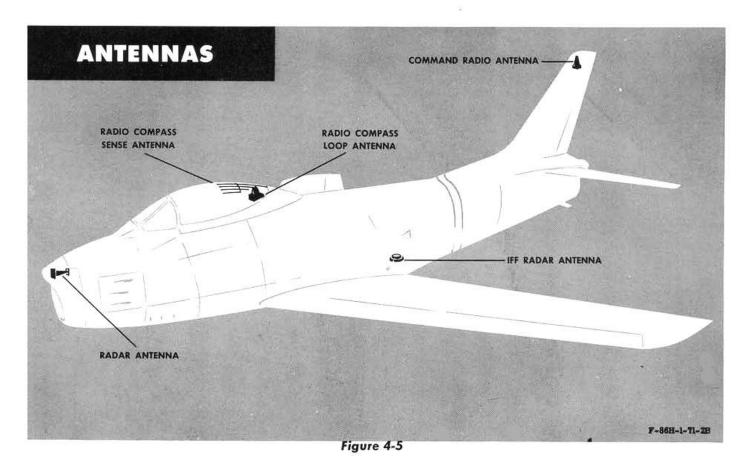
^{*}F-86H-1 through F-86H-5 Airplanes and F-86H-10 Airplanes AF53-1229 through -1352

†F-86H-10 Airplane AF53-1353 and all subsequent airplanes



RADIO COMPASS AN/ARN-6

F-86H-1-71-1A



OPERATION OF IDENTIFICATION RADAR.

Operation of the AN/APX-6 identification radar set is done as follows:

CAUTION

Before take-off, make sure that AN/APX-6 IFF frequency counters have been set to proper frequency channels and that destructors are inserted in face of transpondor. (IFF units can be reached through an access door in the bottom of the aft fuselage, between the speed brakes.)

- 1. To turn equipment on, move IFF master switch to NORM position (full sensitivity and maximum performance).
- Move master switch to STDBY to keep equipment inoperative but ready for instant use.
- The LOW position (partial sensitivity) of the master switch should not be used except upon proper authorization.
- Set three-position "MODE 2" and "MODE 3" switches to their OUT positions unless otherwise directed.
- *F-86H-1 Airplanes AF52-1975 through -2069 †F-86H-10 Airplane AF53-1353 and all subsequent airplanes

- 5. For emergency operation, press dial stop and move master switch to EMERGENCY position so that set will automatically transmit distress signals, indicating that airplane is in distress and needs immediate assistance.
- 6. To manually fire the destructors, (on airplanes so equipped*), lift guard and move destructor switch to ON position.

CAUTION

The destructors should be fired only when the IFF equipment is in danger of falling into enemy hands. If a forced landing must be made in an area of doubtful security, fire the destructors.

- 7. To turn off IFF set, move master switch to OFF.
- If IFF transpondor is destroyed during flight, report this information immediately after landing.

IDENTIFICATION RADAR-AN/APX-6A.

Late airplanes are equipped with the AN/APX-6A radar identification set (figure 4-4), in place of the AN/APX-6 set. As installed in this airplane, the AN/APX-6A is identical to the AN/APX-6, except that the AN/APX-6A has an "I/P-MIC" switch in place of the "DESTRUCT" switch and does not have

destructors or provisions for them. "I/P-MIC" switch has no function. With the above exceptions, operation of the AN/APX-6A is identical to that of the AN/APX-6. (Refer to "Identification Radar-AN/APX-6.")

LIGHTING EQUIPMENT.

INTERIOR LIGHTING.

Interior lighting consists of red incandescent light units for the instruments and indicators, auxiliary red flood-lighting for the consoles and instrument panel, and indirect console lighting (by means of plastic panel covers) for switch panels. The stand-by compass is lighted integrally. White thunderstorm lights provide a constant white light to protect vision against lightning flashes during any thunderstorm operation. A cockpit utility light (Type C-4A) is provided for map reading and general lighting. The control panel on the

right console contains lighting controls for the console, instrument, thunderstorm, and navigation lights. All interior lighting rheostats can be adjusted to give desired light brilliancy. Spare lamps for console and instrument lights are stored on the right instrument subpanel.

INTERIOR LIGHTING CONTROLS.

CONSOLE AND PANEL LIGHT RHEOSTAT. Console and switch panel indirect lighting and the console floodlights are controlled by a rheostat, located on the lighting control panel (6, figure 1-7; figure 4-6), and are powered from the primary bus. The rheostat has BRIGHT, DIM, and OFF positions and may be adjusted for desired light brilliancy. The console light rheostat also controls power to the stand-by compass light.

INSTRUMENT PANEL PRIMARY LIGHT RHEO-STAT. The illumination and brilliancy of the instrument panel lights, and the lights at the landing gear

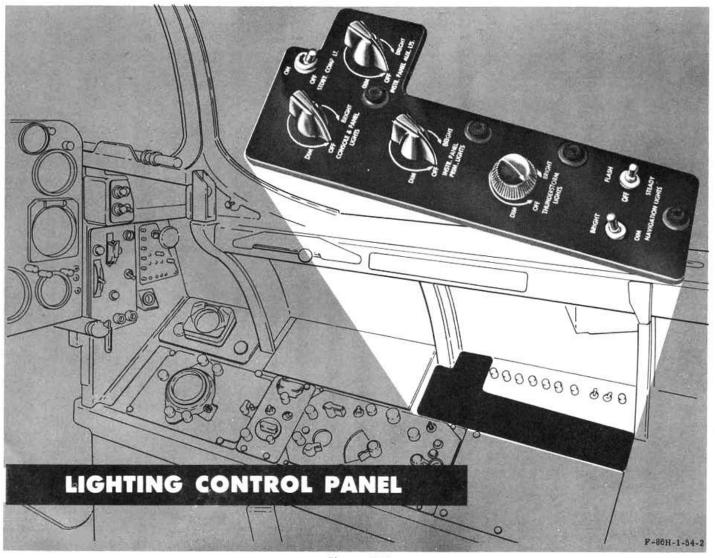


Figure 4-6

Section IV T. O. 1F-86H-1

position indicators and cabin pressure altimeter, which are powered from the primary bus, are controlled by a rheostat located on the lighting control panel (6, figure 1-7; figure 4-6). The rheostat, when more than 30 degrees from OFF, also dims the landing gear unsafe warning light; however, varying degrees of illumination are not available for this light.

INSTRUMENT PANEL AUXILIARY LIGHT RHEOSTAT. The two instrument panel auxiliary floodlights, mounted on the canopy, are controlled by a rheostat located on the lighting control panel (6, figure 1-7; figure 4-6), on the right console. The auxiliary lights operate from the primary bus.

THUNDERSTORM LIGHT RHEOSTAT. Two white lights (3, figure 1-6; 8, figure 1-7) are provided for use during thunderstorms and are controlled by a rheostat located on the lighting control panel (6, figure 1-7; figure 4-6). The lights operate on secondary bus power.

Note

To facilitate identification of the thunderstorm light control, the rheostat is equipped with a different style knob than the other lighting controls.

STAND-BY COMPASS LIGHT SWITCH. The compass light is controlled by an on-off switch located on the lighting control panel (6, figure 1-7; figure 4-6). The console lights must be turned on for the compass light switch to be operative (primary bus).

COCKPIT UTILITY LIGHT CONTROL. For general lighting, the cockpit utility light (12, figure 1-7) can be operated any time the primary bus is energized. The light control is an integral part of the unit.

EXTERIOR LIGHTING.

Exterior lighting consists of four navigation lights, two fuselage lights, and two landing and taxi lights. One navigation light is located on each wing tip and two are on the empennage. Each fuselage light (one in the aft portion of the canopy, the other on the lower surface of the fuselage) contains one large lamp and a small lamp for dimming purposes. The landing and taxi lights are retractable and are mounted in the lower surface of the fuselage nose section. Both lights extend for use as landing lights until the weight of the airplane is on the nose gear; then the left landing light extends farther to provide taxi lighting, and the right landing light is extinguished.

EXTERIOR LIGHTING CONTROLS.

NAVIGATION LIGHT SWITCHES. The navigation and fuselage lights are controlled by two switches located on the lighting control panel (6, figure 1-7; figure

4-6) on the right console. When the selector switch is at STEADY, the navigation and fuselage lights are lighted continuously by primary bus power. Moving the switch to FLASH causes the navigation lights to flash at 40 cycles per minute and the fuselage lights to remain steady. The dimmer switch, marked "DIM" and "BRIGHT," controls the intensity of the navigation and fuselage lights.

LANDING AND TAXI LIGHT SWITCH. The retractable landing and taxi lights are controlled by a three-position switch (figure I-18) on the left forward switch panel. When the switch is set at EXTEND & ON, both lights are extended to the landing position (about 58 degrees) and are lighted (primary bus). Upon touchdown, when the weight of the airplane is on the nose gear, the landing-light goes out automatically; and the taxi light extends further to the taxi position (about 70 degrees) and remains on, thus providing a properly directed beam for taxiing. If a touch-and-go landing is made and the switch is left in the EXTEND & ON position, the landing light goes on again and the taxi light returns to the landing position as the weight of the airplane is removed from the nose gear. Both lights go out and retract when the switch is moved to RETRACT. Limit switches automatically cut off power to the light actuation motors when the lights reach the fully retracted or extended position. Returning the switch to the center OFF position during extension or retraction stops the lights at any desired position.



To prevent damage to the lights, do not extend landing lights above 220 knots IAS.

OXYGEN SYSTEM.

The gaseous oxygen system is supplied from five Type D-2 cylinders installed in the nose section outboard of the intake duct, three on the right side and two on the left. Included in the system is a Type D-2 pressure-demand regulator having a pressure gage and flow indicator and a warning light. For safety, check valves are incorporated in the oxygen supply system in event of system failure or cylinder rupture. If a cylinder is punctured, it is isolated by check valves, and the pressure gage indication remains the same, although available oxygen supply is reduced. The oxygen system is serviced by means of a single-point refilling valve, located within the access door on the left side of the nose section. Normal minimum system pressure for

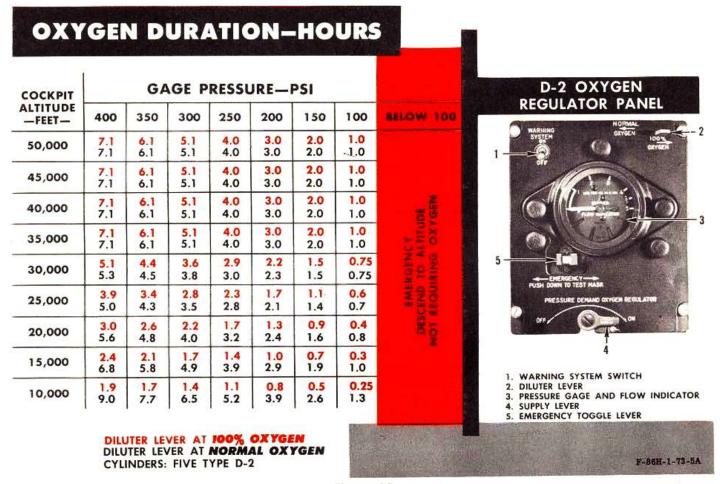


Figure 4-7

take-off is 400 psi. An oxygen duration table is shown in figure 4-7.

Note

As an airplane ascends to high altitudes, where the temperature is normally quite low, the oxygen cylinders become chilled. As the cylinders grow colder, the oxygen gage pressure is reduced, sometimes rather rapidly. With a 100°F decrease in temperature in the cylinders, the gage pressure can be expected to drop 20 percent. This rapid fall in pressure sometimes causes unnecessary alarm. All the oxygen is still there, and as the airplane descends to warmer altitudes, the pressure will tend to rise again, so that the rate of oxygen usage may appear to be slower than normal. A rapid fall in oxygen pressure while the airplane is in level flight, or while it is descending, is not ordinarily due to falling temperature, of course. When this happens, leakage or loss of oxygen must be suspected.

OXYGEN REGULATOR.

The Type D-2 continuous pressure-breathing, diluterdemand oxygen regulator (15, figure 1-7; figure 4-7) is mounted on the right console. The regulator mixes air with oxygen in varying amounts, according to the altitude, and delivers a quantity of the mixture each time the user inhales. At high altitudes, the regulator supplies positive pressure-breathing. The delivery pressure automatically changes with altitude. A red warning light is mounted next to the regulator to warn the pilot when the regulator is not operating normally. A pressure relief valve is provided on the outside of the regulator to relieve excess mask pressure.

OXYGEN REGULATOR CONTROLS.

SUPPLY LEVER. The supply lever (4, figure 4-7), on the regulator panel, is safetied in the ON position at all times.

DILUTER LEVER. A diluter lever (2, figure 4-7) is provided in the top right corner of the regulator panel for selecting either NORMAL OXYGEN for normal use or 100% OXYGEN for emergency conditions.

EMERGENCY TOGGLE LEVER. The emergency toggle lever (5, figure 4-7), located directly below the flow indicator, should be in the center position at all times, unless an unscheduled pressure increase is desired. Moving the toggle lever either way from its center position provides continuous positive pressure to the oxygen mask. When the toggle lever is in the center position, it may be depressed momentarily to provide positive pressure to test the mask for leaks.

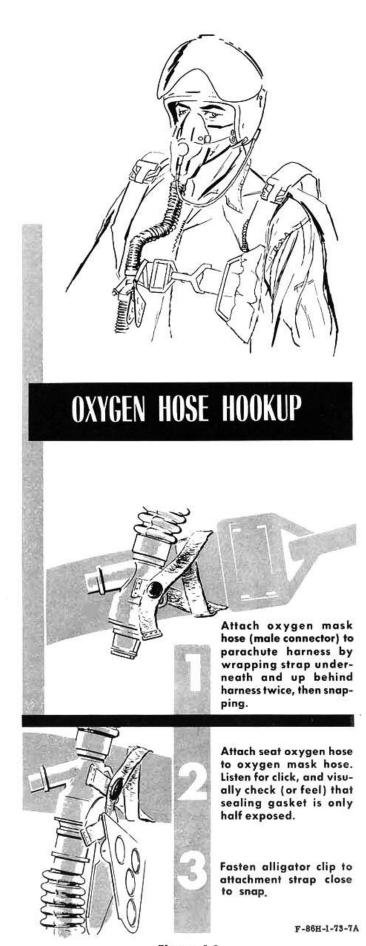


Figure 4-8

WARNING SYSTEM SWITCH. The warning system switch (1, figure 4-7), on the regulator panel, turns on the circuit for the red warning light. The switch should be ON whenever the regulator is used.

OXYGEN REGULATOR INDICATORS.

PRESSURE GAGE AND FLOW INDICATOR. The pressure gage and flow indicator (3, figure 4-7), on the regulator control panel, combines the oxygen pressure gage and the flow indicator in a single instrument. The pressure gage shows oxygen system pressure. The flow indicator consists of four small slots arranged symmetrically around the lower half of the gage dial face. These slots show black and white alternately with each breath.

OXYGEN WARNING LIGHT. The oxygen warning light (3, figure 1-7), is mounted on a bracket outboard of the right forward switch panel and is lighted by power from the primary bus. Within 15 seconds after the warning system switch is moved to ON, the light goes on and becomes bright, either blinking or remaining steady. If there is no oxygen flow, the light remains bright. If there is a continuous flow through the regulator, the light may dim within 10 seconds and return to bright within 60 seconds; it then remains bright. If the pilot has the mask on, the warning light becomes dim within 10 seconds after normal breathing causes proper oxygen flow through the regulator. The intermittent flow induced by the normal breathing cycle causes the warning light to remain dim. However, any departure from proper operation that causes oxygen to cease flowing or to flow continuously from the regulator will cause the light to become bright, again either blinking or remaining steady.

Note

The action of the warning light system is based on a normal breathing rate. Too fast or too slow a breathing rate may result in erratic warning light indications.

OXYGEN SYSTEM PREFLIGHT CHECK.

1. Check mask unit properly connected (figure 4-8) and note oxygen pressure gage indication (400 psi minimum).

CAUTION

If mask assembly is not connected, oxygen regulator may be damaged by full unrestricted flow during test of regulator warning system.

- 2. Check oxygen regulator with diluter valve first at NORMAL OXYGEN position and then at 100% OXYGEN position as follows: Remove mask and blow gently into end of oxygen regulator hose as during normal exhalation. There should be resistance to blowing. Little or no resistance to blowing indicates a leak or faulty operation.
- 3. Place oxygen regulator warning system switch in ON position. Warning light should emit a bright (steady or blinking bright) light. Move emergency toggle lever from center to left or right position. The warning light should change from a bright light to a dim glow and back to bright. Return emergency toggle lever to center (off) position.
- 4. With regulator supply valve ON, oxygen mask connected to regulator, and diluter lever in 100% OXYGEN position, breathe normally into mask and conduct the following checks:
 - a. Observe blinker for proper operation. Warning light should change from a bright to a dim glow.
 - b. Move emergency toggle lever to right or left. A positive pressure should be supplied to mask. Return emergency toggle lever to center position.
 - c. Depress emergency toggle lever straight in. A positive pressure should result within the mask. Hold breath to determine if there is leakage around mask. Release emergency toggle lever. Positive pressure should cease.
 - 5. Return diluter lever to NORMAL OXYGEN.

NORMAL OPERATION OF OXYGEN REGULATOR.

- 1. Before each flight, be sure oxygen pressure gage reads at least 400 psi. If pressure is below this minimum, have oxygen system charged to capacity before take-off.
 - 2. Oxygen supply lever safetied on.
 - 3. Diluter lever at NORMAL OXYGEN.
 - Warning system switch on.

Note

Above 30,000 feet, there may sometimes be a vibration or wheezing sound in the mask. This noise is a normal characteristic of regulator operation and may be overlooked.

EMERGENCY OPERATION OF OXYGEN REGULATOR.

If symptoms of anoxia develop or if smoke or fumes enter cockpit, proceed as follows:

- 1. Move diluter lever to 100% OXYGEN.
- 2. Push emergency toggle lever either way from center.
- If oxygen regulator becomes inoperative, pull ball handle on H-2 emergency oxygen bail-our bottle and descend to a cockpit altitude below 10,000 feet as soon as possible.

NAVIGATION EQUIPMENT.

STAND-BY COMPASS.

Refer to "Instruments" in Section I.

RADIO COMPASS.

Refer to "Communication and Associated Electronic Equipment."

SLAVED GYRO MAGNETIC COMPASS.

The slaved gyro magnetic compass indicator (10, figure 1-5), on the instrument panel, indicates magnetic headings without northerly turning error, oscillation, or swinging. The compass system is composed of four principal units: a flux valve transmitter, a directional gyro control, an amplifier, and a repeater indicator. The indicator is basically a gyro-stabilized compass that is automatically kept on a true magnetic north heading from a flux valve transmitter in the left wing, inboard of the tip. The flux valve transmitter is the directionsensing unit and senses the south-north flow of the earth's magnetic flux. The directional gyro control contains an electrically driven gyro whose spin axis is not only tangent to the earth's surface but is also slaved to the earth's magnetic meridian. The compass system is operable when electrical power from the dc primary bus and ac power are available (instrument inverter operating). For the first 3 or 4 minutes of operation, the gyro is on a fast slaving cycle and precesses rapidly; during this time, it should align with the magnetic heading. The gyro then begins a slow slaving cycle. The gyrocompass is free from drift and needs no resetting in normal operation.

Note

After the gyro reaches operating speed, the indicator should be checked against the stand-by compass to make sure indicator does not show a 180-degree ambiguity. The slaved gyro magnetic compass is not operating properly if such ambiguity exists.

A knob at the lower left of the indicator, marked "SET COURSE," permits the course index to be moved to a preselected heading. Indicator readings will be incorrect if the airplane exceeds 85 degrees of climb, dive, or bank.

FAST SLAVING BUTTON.

The fast slaving cycle of the slaved gyro magnetic compass can be selected by means of primary bus power through a push-button type switch (5, figure 1-5) on the instrument panel. Depressing the button momentarily de-energizes the slow slaving cycle. Releasing the button engages the fast slaving cycle to permit faster gyro recovery to the true heading.



Excessive use of the fast slaving button can damage the slaving torque motor. At least 10 minutes should elapse between each successive use of the fast slaving button.

ARMAMENT EQUIPMENT.

The basic armament installation on early airplanes* consists of six Type M-3 .50-caliber machine guns, mounted in the forward fuselage. On late airplanes,† four Type M-39 20 mm guns are installed in place of the .50-caliber guns. The external armament may consist of demolition or napalm bombs and rockets. The armament equipment includes an A-4 gun-bombrocket sight to enable the pilot to accurately utilize the available firepower. A Type P-2 strike camera is installed to record the effect of rocket fire and bombing on ground targets, and a Type N-9 or N6 camera is installed on the sight to record the sight reticle and target during gunfire, rocket fire, or bombing.

A-4 GUN-BOMB-ROCKET SIGHT.

The Type A-4 gyro computing sight automatically computes leads for gunnery, rocketry, or bombing. The sight computation is entirely automatic, requiring only that the pilot keep the reticle center dot on the target and track the target smoothly. The sight reticle image has a center dot and an outer circle composed of a number of diamond-shaped dots. The reticle image is projected on a reflector glass aft of the windshield and compensates for the required lead for gun and rocket firing. A dual-filament bulb provides lighting for the reticle image projection. Range data for gunnery is supplied either by the AN/APG-30 radar or by a manual range control. The sighting system is calibrated to automatically compute leads for ranges between 600 and 6000 feet. On overland targets (6000 feet or less above the terrain), radar ranging is usually erratic because of ground return effects. Under such conditions, radar ranging distances may be reduced by use of the radar range sweep rheostat, or manual ranging may be employed. When the sight is used as a bombsight, the line of sight is depressed about 10 degrees. This requires the approach to be made so that the flight path becomes tangent to the proper bomb release point, which is indicated by automatic extinction of the sight reticle image. Bombs of less than 500-pound size can be released either automatically at the proper release point by an accelerometer mechanism within the sight or manually. Bombs larger than 500-pound size cannot be released by use of the sight. In either case, the bombrocket release button must be depressed. The electrical power for the sight system (300-volt dc and 28-volt dc) is controlled by the gun safety switch. The sight can be operated as a fixed-reticle sight as long as dc power is available and the sight is manually caged.

RADAR-AN/APG-30.

The AN/APG-30 radar set provides range data to the A-4 sight computer. The radar system affords automatic search within its cone of coverage and range, and automatically locks onto and computes range of the target. An indicator light on the A-4 sight indicates when the radar has locked onto a target. A manual range control supplements the radar set and should be used for overland targets when operating at less than 6000 feet, as radar ranging below that altitude is usually erratic because of ground return effects. A horn-type antenna is installed in the upper leading edge of the engine air intake scoop fairing.

A-4 SIGHT CONTROLS.

GUN SAFETY SWITCH. Refer to "Gunnery Equipment Controls."

SIGHT DIMMER RHEOSTAT. The sight dimmer rheostat, located on the armament control panel (figure 4-9), adjusts the lighting intensity of the reticle image. When the sight is not in use, the rheostat should be turned counterclockwise to DIM to prevent damage to the reticle bulb in event of voltage surge. Turning the rheostat clockwise to BRIGHT increases reticle brilliance.

SIGHT FILAMENT SWITCH. Selection of either the primary or secondary filament in the dual-filament bulb is done by means of the sight filament switch, located on the armament control panel (figure 4-9) on the left console. The switch is normally set at PRIM and may be moved to SEC if the primary filament in the bulb fails.

SIGHT ELECTRICAL CAGING BUTTON. An electrical caging button is provided on the throttle grip. Depressing the caging button stabilizes the gyro reticle image by caging the two gyros in the computer. When the button is released, the gyros are uncaged and operable. The sight should be caged before an attack, to stabilize the sight reticle image. The image must be stabilized to limit gyro movement to the sight as a result of maneuvering on initial approach to target.

WING SPAN LEVER. The wing span lever and scale are mounted on the sight head. Graduated markings

^{*}F-86H-1 Airplanes

[†]F-86H-5 and subsequent airplanes

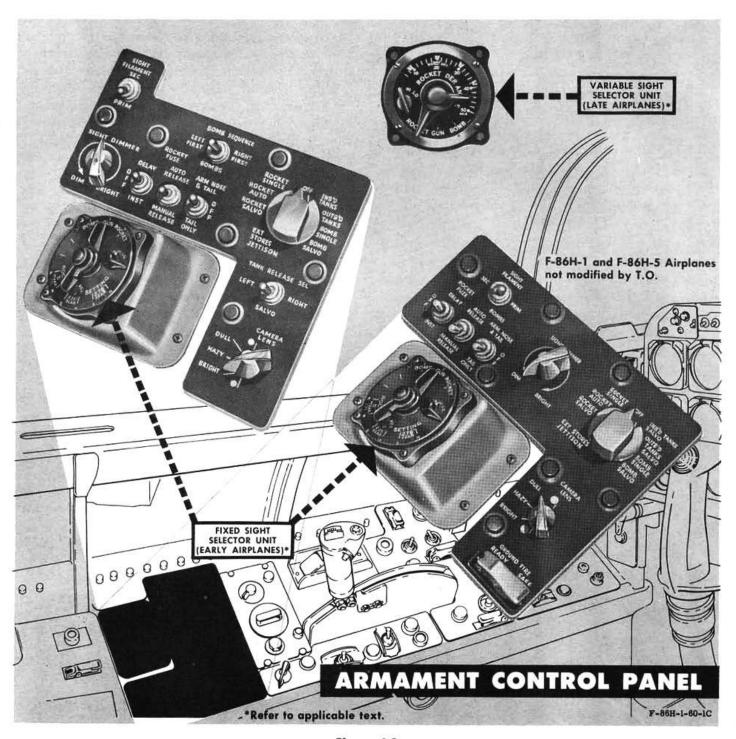


Figure 4-9

(from 30 to 120) on the scale represent the wing span, in feet, of the target airplane. The wing span lever is used for manual ranging and should be moved until aligned with the applicable span marking on the scale. Actuation of the lever inserts target size data into the sight, varying the reticle image circle diameter in proportion to the target size.

Note

It is necessary to swing the camera away from the sight to adjust the wing span lever. SIGHT MECHANICAL CAGING LEVER. Sight caging is done mechanically by a caging lever located on the sight head. The lever is set at UNCAGE for normal automatic operation of the sight. If desired for use during ground attacks, or in event the sight fails, the lever should be moved to CAGE to provide a fixed-reticle image circle. The size of the fixed reticle will depend on the setting of the wing span lever. (When lever is set at 60 feet, a 100-mil fixed reticle will be produced during mechanical caging.)

CAUTION

Sight should be mechanically caged during taxiing, take-off, and landing, to prevent damage to sight.

SIGHT SELECTOR UNIT. The airplane may be equipped with either a fixed sight selector unit (18, figure 1-6; figure 4-9) or a variable sight selector unit (figure 4-9), located on the left console. The fixed sight selector unit (figure 4-9), on the center pedestal, incorporates three independent sight controls-the rocket setting lever, the sight function selector lever, and the target speed switch. The rocket setting lever is used to provide a depression angle correction for the type of rocket to be fired and the intended dive angle of the attack. On this airplane, only the 5" HVAR setting is used. At each of the three positions, there are two detents, marked "S" and "N," for setting the intended dive angle into the sight system. For attack angles between 0 and 40 degrees, the control should be set on N (normal); for attack angles between 40 and 60 degrees, the control should be set at S (steep). The sight function selector lever, on the upper arc of the fixed unit, is set at either BOMB, GUN, or ROCKET to adjust the sight system for the desired operation. When the selector lever is moved to BOMB, the sight reticle image is depressed to approximate the bomb trajectory.

WARNING

To avoid damage to the airplane, do not use the automatic function of the A-4 sight for bombing operations involving bombs of 500pound size or heavier, as these bombs tend to strike portions of the airplane under this or any negative G release condition.

Moving the selector lever to ROCKET permits subsequent operation of the rocket setting lever to adjust the sight reticle image for the type of rocket to be fired. The selector lever will automatically return to GUN position, if set at either BOMB or ROCKET position, when the radar target selector button on the stick grip is depressed. The target speed switch, on the right side of the selector unit, is used during gunnery missions to control lead angle data in accordance with speed ratio between the attacking airplane and its target. When the speed of the attacking airplane is greater than that of the target, the target speed switch is set at LO. The switch is moved to HI, when the speeds of the attacking airplane and the target are about the same. The

TR. position is used when firing on a drogue or other training targets at low speeds. On the variable sight selector unit, the sight function selector lever (on the lower arc of the unit) and the target speed switch (on the left side of the unit) have the same function as on the fixed sight selector unit. The variable sight selector unit also incorporates a rocket depression angle selector, on the upper arc of the unit, with a scale calibrated in mils for sight reticle image depression. There are no specific rocket settings. Movement of the rocket depression angle selector lever depresses the sight reticle image in increasing amounts through the full range of the mil scale according to the position chosen. The nominal rocket depression angle selector lever setting for the 5-inch HVAR at a normal dive angle (0 to 40 degrees) is 17 mils. The pilot should determine, through testfiring runs, the settings for various dive angles most suitable to his own technique. The data thus obtained should be set on the mil scale with variable index markers so provided. The index markers, numbered from 1 through 4, are for reference only and have no function in the sight system. When pulled out, a pull tab near the 50-mil mark on the periphery of the selector unit face unlocks the index markers for adjustment.

MANUAL RANGING CONTROL. A twist grip in the throttle allows manual ranging during gunnery operations when radar ranging becomes inoperative or is erratic because of ground effects (at altitudes below 6000 feet on overland targets). The manual range control covers a span of 1500 feet, from about 1200 feet to 2700 feet, as indicated on the sight range dial. The grip should be turned to keep the target spanned by the reticle circle. Clockwise movement of the twist grip reduces the range (increases reticle diameter); counterclockwise movement increases range (decreases reticle diameter). The control is spring-loaded to the full counterclockwise position, where it must be for normal operation of radar ranging.

RADAR TARGET SELECTOR BUTTON. After detecting a target, the radar locks on it and measures the range. To override the range lock-on and shift the radar to another target, it is necessary to actuate the radar target selector button on the control stick grip. To reject the target, the button should be depressed momentarily. The radar can then lock on targets at ranges greater than the one rejected until the maximum sweep range of radar is reached. It then automatically recycles, commencing to sweep for minimum range. Depressing the selector button also automatically moves the sight function selector lever to GUN if the lever had been set at either BOMB or ROCKET position.

RADAR RANGE SWEEP RHEOSTAT. The radar range sweep rheostat (15, figure 1-6), on the left con-

sole, controls reduction of radar ranging distances. The rheostat is used to keep the radar from locking on the ground or ground objects when the airplane is at low altitude. Turning the rheostat toward MIN decreases range; toward MAX increases range. During normal operation, the control should be at MAX.

BOMB-TARGET WIND CONTROL. The bombtarget wind control (25, figure 1-5), on the instrument panel, adjusts the sight system for dive-bombing operations and is operative when the sight function selector lever is at BOMB. Turning the control knob clockwise from the ROCKET GUN position depresses the sight reticle image to determine the proper approach on the target. If, during the attack, the path of the airplane is parallel to the wind or to the direction of a moving target, the bomb-target wind control is used to compensate the sight system accordingly. For attacking stationary targets, corrections for wind speed are made on either the UPWIND or DOWNWIND portion of the scale to correspond with known or estimated wind velocity. (UPWIND scale is used when attack is made into a head wind; DOWNWIND, for attacks made with a tail wind.) If the wind direction is not parallel to the course of the attacking airplane, the amount of wind correction adjustment must be estimated. This correction approaches zero as the wind direction becomes 90 degrees to the airplane course. During attack on moving targets, added corrections must be made in consideration of target velocity. For approaching targets, correction is DOWNWIND; for receding targets, correction is UPWIND. No sight system correction is necessary when the target is moving at right angles to the path of attack; however, proper lead angle must be maintained. The ROCKET GUN position of the control is inoperative.

A-4 SIGHT INDICATORS.

SIGHT RANGE DIAL. Target range in hundreds of feet is indicated by the range dial visible through a window on the sight head. The dial is graduated in 100-foot intervals covering a range from 600 to 6000 feet and presents range distances as determined by either the manual range control or the radar ranging system.

RADAR TARGET INDICATOR LIGHT. The radar target indicator light, located on the sight head, lights when the radar ranging equipment locks onto the target during tracking.

GUNNERY EQUIPMENT.

On early airplanes,* six Type M-3 .50-caliber machine guns are mounted in a vertical bank of three on each

side of the fuselage, outboard of the cockpit. The removable ammunition containers are located below each gun compartment. The normal ammunition load per gun is 300 rounds. Electric gun heaters are installed on each gun and may be operated by the pilot. The gun blast panels are connected to blast tubes which seal around the gun barrels. Plugs are provided at the forward end of the blast tubes to prevent dust and moisture from entering the gun barrels. The plugs should be removed before ground firing and on the ground before air firing missions. The guns must be manually charged on the ground before take-off, as there are no provisions for gun charging during flight. On most airplanes,† four Type M-39 20 mm guns are installed in place of the .50-caliber guns. Each gun is supplied with 150 rounds of ammunition, which is electrically fired at the rate of about 1500 rounds per minute. The 20 mm guns are fired by ac, although the control circuits are primary bus dc. Therefore, if the red instrument ac power-off light illuminates, the guns will not fire. There are no gun heaters or gun-charging provisions for the 20 mm guns. The gun blast panels are connected to blast tubes which seal around the gun barrels. Plugs are provided at the forward end of the blast tubes to keep dust and moisture from entering the gun barrels. The plugs must be removed before ground firing and on the ground before air firing missions. Expended ammunition links are retained in a compartment below the guns. Expended cases are ejected overboard with enough velocity to clear the airplane through tubes having outlets in the fuselage bottom. The guns, ammunition, and expended link compartments have a purging system for removing explosive gases created during gun firing. The purging system utilizes air extracted from the engine air intake duct. Doors that control the purging air open automatically during gun firing. On late airplanes, either the two upper guns only or all guns may be selected for firing. Certain airspeed limitations have been imposed for firing the guns, until flight test data has been evaluated. (Refer to "Airspeed Limitations" in Section V.)

CAUTION

When the guns are fired on the ground, the gun compartment doors must be removed and the purge doors opened manually to allow gunfiring gases to escape.

F-86H-1 Airplanes

[†]F-86H-5 and subsequent airplanes

[©]F-86H-10 Airplane AF53-1349 and all subsequent airplanes

GUNNERY EQUIPMENT CONTROLS.

GUN SAFETY SWITCH. Electric power for operation of gun camera, sight, radar ranging, and guns is controlled by a guarded safety switch (35, figure 1-5) on the instrument panel. When the switch is at SIGHT CAMERA & RADAR, secondary bus power is supplied to the sight and radar equipment, and when the trigger is pressed, power is available to permit gun camera operation. Placing the switch at GUNS energizes the sight and radar and provides power to actuate the camera when the trigger is pressed. When the switch is at the guarded OFF position, power is disconnected.

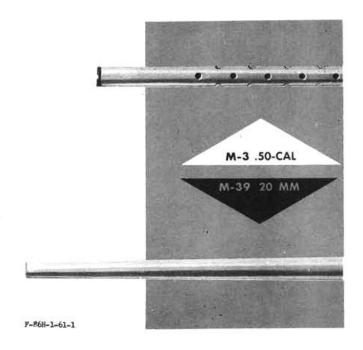
TRIGGER. Primary bus power actuates the gun-firing and gun camera circuits when the trigger on the control stick is depressed. The trigger has two depression positions. With the gun safety switch at GUNS, the first trigger position reached starts the gun camera and ammunition boost motors.* The second, or fully depressed position, fires the guns. The guns fire automatically as long as the trigger is depressed and no jam occurs. With the gun safety switch at SIGHT CAM-ERA & RADAR, only the gun camera is operative at either trigger position. When 20 mm guns are installed, the first depression of the trigger starts the sight camera and energizes the purge door selector valve so that utility hydraulic system pressure opens the purge door for gun, ammunition, and expended link compartment purging.

Note

If the purge doors fail to open, thereby prohibiting the flow of air to the compartments requiring ventilation, a door position switch prevents the gun-firing circuit from being energized.

As the second trigger depression is released, the guns stop firing; however, a time delay relay in the purging system circuit keeps the purging system operating for 5 seconds after the trigger is released.

GUN SELECTOR SWITCH. On late airplanes,† a gun selector switch (36, figure 1-5), located on the instrument panel, permits selective firing of either upper guns only or all guns. With the switch at UPPER, the gunfire control circuit for the left and right lower guns is opened, preventing operation of these guns. With the switch at ALL, the gunfire control circuits to the lower guns are completed, allowing these guns to be operative. The upper guns can be fired with the switch in either position.



GUN HEATER SWITCH (.50-CALIBER GUNS). Type J-4 electric gun heaters, one attached to each .50-caliber gun, are controlled by secondary bus power through the gun heater switch (figure 1-18), located on the left forward switch panel. When the switch is moved from OFF to GUN HEATER, the heaters are operative.

GROUND FIRE SAFETY SWITCH (20 MM GUNS).

A safety relay connected to the extend side of the landing gear handle opens the 20 mm gun-firing circuit to prevent accidental firing of the guns on the ground. This safety relay can be overridden to fire the guns for bore-sighting purposes by the ground fire safety switch (figure 4-9; 19, figure 1-6), located on the armament control panel or outboard of the rocket projector release. The switch is guarded in the SAFE position. The switch must be held in the momentary READY position to override the landing gear position control safety relay.



The safety relay circuit is protected by the landing gear control circuit breaker. Therefore, do not pull the landing gear control circuit breaker out, especially when on the ground; otherwise, the safety relay circuit will not be energized and accidental firing of the guns will be possible.

^{*}F-86H-1 Airplanes

[†]F-86H-10 Airplane AF53-1349 and all subsequent airplanes

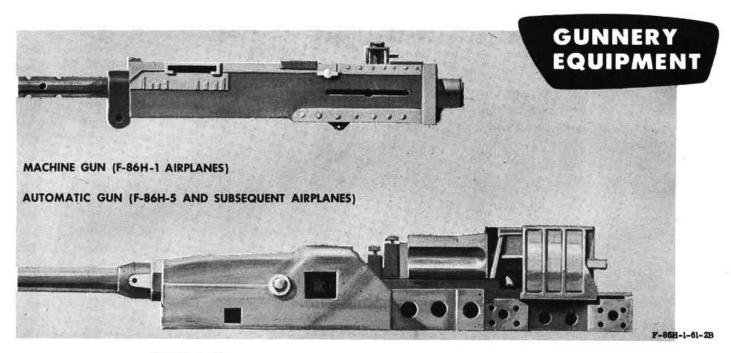


Figure 4-10

FIRING GUNS.

WARNING

If the .50-caliber guns are fired in continuous bursts of about 7 seconds or more, "cook-off" may occur. Short successive firing bursts with short cooling periods between bursts also may cause "cook-off" when firing time of the short bursts totals about 7 seconds. When air firing, except in combat, a cooling period should follow each burst, to prevent "cook-off." A cooling period equal to 4 minutes per 3-second continuous burst will preclude the possibility of "cook-off." A "cook-off" in .50-caliber guns will not damage the guns or the airplane, since the "cook-off" round is chambered in the barrel.

Note

"Cook-off" will not occur during air firing of 20 mm guns, because of the limited amount of ammunition carried in the airplane.

RADAR RANGING. To fire guns using A-4 sight and radar ranging, proceed as follows:

Note

When firing at stationary ground targets, or in case of failure of the automatic function of the sight, move mechanical caging lever to CAGE and use sight as conventional 100-mil fixed-reticle sight.

- Check that radar inverter light is not on.
- 2. Place gun safety switch at SIGHT CAMERA & RADAR to allow a 5- to 15-minute warm-up period (depending on outside air temperature) for sight and radar. Check sight mechanical caging lever at CAGE.
- Place gun selector switch* at UPPER to fire only the upper guns or at ALL to fire all guns, as required.
- 4. Sight filament switch at PRIM. If primary filaments are inoperative, move switch to SEC.
- Sight dimmer rheostat adjusted to desired image brilliance.
 - Move sight mechanical caging lever to UNCAGE.
- 7. Gun heater switch to GUN HEATER if outside air temperature is below 1.7°C (35°F) on .50-caliber guns only.
- 8. Make sure throttle twist grip is at full counterclockwise position (radar ranging engaged).
- Sight selector unit: sight function selector lever at GUN; target speed switch at TR., HI., or LO., depending on rate of closure.
 - 10. Gun safety switch to GUNS.
- 11. Set sight wing span lever to wing span of target airplane so that manual ranging can be set up in a minimum of time, should the radar ranging fail.

^{*}F-86H-10 Airplane AF53-1349 and all subsequent airplanes

- 12. Radar range sweep rheostat to MAX.
- 13. Depress sight electrical caging button to stabilize reticle image, and begin tracking, estimating correct lead.
- 14. After radar target indicator light is on, release sight electrical caging button. (As caging button is released, reticle will drift down and then back to the correct lead angle.)

Note

If more than one target is within range along airplane flight path, make sure radar is tracking desired target. As range is decreased, reticle should grow larger to span target continuously. Check range dial against estimated range of target. If radar has locked on undesired target, reject it by depressing radar target selector button on stick grip.

15. Continue tracking target smoothly, without slipping or skidding, for about one second after releasing caging button; then fire.

MANUAL RANGING. To accomplish gunnery if radar ranging fails (as indicated by the radar target indicator light going out or by improper range indications), or if at any other time it is necessary or desirable to employ manual ranging, proceed as follows:

- 1. Check wing span lever for correct target span setting.
- Move throttle grip clockwise to engage manual ranging. Continue to move grip until reticle image circle is reduced to minimum diameter.
- 3. Depress sight electrical caging button to stabilize reticle image and frame target within reticle circle.
- 4. Move throttle grip so that reticle circle continually frames target, and begin tracking.
- 5. On approaching target range, release sight electrical caging button.
- 6. After releasing caging button, continue tracking target smoothly for about one second; then fire,

CAMERAS.

GUN CAMERA.

A Type N9 or AN-N6 gun sight aiming point camera is mounted on the A-4 sight to record the sight reticle and target during gun firing, rocket firing, or bombing. The camera type is designated on the name plate, on the face of the N9 and on the left side of the AN-N6. To operate the gun camera exclusive of the guns, the gun safety switch must be positioned to SIGHT CAMERA & RADAR and the trigger depressed. With the gun safety switch at GUNS, depressing the trigger to the first posi-

tion starts the camera, which will continue to operate as long as the trigger is depressed, with an overrun which may be adjusted from 0 to 3 seconds on N9 cameras and 0 to 5 seconds on N6 cameras. For bombing or rocket fire, the gun camera is not started until the bomb-rocket release button is depressed to fire the rockets or release the bombs. For the camera to record during the entire rocket-firing or bombing run, the gun trigger must be held depressed, with the gun safety switch at SIGHT CAMERA & RADAR. (Refer to "Trigger.")

STRIKE CAMERA.

To record the impact of bombs and rockets against ground targets, a Type P-2 strike camera with a 15-foot (50-foot*) magazine is installed in the lower fuselage, directly aft (or forward*) of the ammunition compartments. When bombs are released or rockets are fired, the camera automatically takes a rapid sequence of exposures. Sliding doors protect the camera window. They open by mechanical linkage when the nose landing gear is retracted, or by an electrical actuator* not connected to the landing gear. Defrosting of the strike camera window is automatically controlled by the canopy defrost lever. However, if windshield deicing is being used, the camera defrost outlet is closed.

STRIKE CAMERA TIMER. Some airplanes have a camera timer (21, figure 1-6), to start and stop the P-2 strike camera. It is located on the left console just aft of the rocket projector release. The timer has two intervals which are adjustable. The camera also can be mechanically adjusted on the ground for a fixed overrun of 0 to 3 seconds after the timer ceases operation. The first timer interval represents the time in seconds from release of the bombs or rockets to start of camera operation. This is set before start of the run with the large timer knob marked "PILOT ADJ." The second timer interval is the camera running time in seconds for a given pass not including the 3-second overrun, and must be set by the ground crew with the small timer knob marked "PRESET." The following tables give interval settings for total number of passes to be made and various dive angles and release altitudes (the conditions chosen are representative of typical combat conditions and requirements):

WARNING

Use these tables only for conditions known to be safe. For example, bomb release at 2000 feet above the target from a 30-degree dive at 650 knots IAS would require more than 2000 feet altitude for recovery using a 6 G pull-up.

AIRPLANES WITH 50-FOOT MAGAZINE Based on release speeds ranging from 350 to 650 knots TAS

NUMBER	"PRESET"		RELEASE ALTITUDE	"PILOT ADJ." (CAMERA DELAY AFTER REL		
OF PASSES	PER PASS)	ANGLE	(ABOVE TARGET)	ROCKETS	BOMES	
1	30 (Max)	Any	Under 20,000 feet	0	0	
2	17	Any	Under 10,000 feet 10,000 to 20,000 feet	0 -	0 10	
3	10	30°	Under 5000 feet 5000 to 10,000 feet 10,000 to 15,000 feet 15,000 to 20,000 feet	0 4 - -	0 7 14 20	
		50°	Under 5000 feet 5000 to 10,000 feet 10,000 to 15,000 feet 15,000 to 20,000 feet	0 0 - -	0 5 10 16	
		70°	Under 5000 feet 5000 to 10,000 feet 10,000 to 15,000 feet 15,000 to 20,000 feet	0 0 - -	0 4 9 14	
4	7	30°	Under 4000 feet 4000 to 7000 feet 7000 to 10,000 feet 10,000 to 13,000 feet 13,000 to 16,000 feet 16,000 to 20,000 feet	0 0 5 - -	0 6 11 15 18 22	
		50°	Under 4000 feet 4000 to 7000 feet 7000 to 10,000 feet 10,000 to 13,000 feet 13,000 to 16,000 feet 16,000 to 20,000 feet	0 0 4 - -	0 4 8 11 14 18	
		70°	Under 4000 feet 4000 to 7000 feet 7000 to 10,000 feet 10,000 to 13,000 feet 13,000 to 16,000 feet 16,000 to 20,000 feet	0 0 0 -	0 3 6 9 12	

AIRPLANES WITH 15-FOOT MAGAZINE

NUMBER OF PASSES	"PRESET" (RUNNING TIME PER PASS)	ANGLE DIVE	RELEASE ALTITUDE (ABOVE TARGET)	"PILOT {CAMERA DELAY ROCKETS	
	Based on	roloase speeds ra	nging from 350 to 650 knots TAS	-	
1	9	30°	Under 4000 feet	0	0
			4000 to 8000 feet	0	6
	i		8000 to 12,000 feet	6	12
	1		12,000 to 16,000 feet	_	17
			16,000 to 20,000 feet	_	22
		50°	Under 4000 feet	0	0
			4000 to 8000 feet	0	4
	1		8000 to 12,000 feet	4	9

NUMBER OF PASSES	"PRESET" (RUNNING TIME PER PASS)	DIVE ANGLE	RELEASE ALTITUDE (ABOVE TARGET)	(CAMERA DELAY ROCKETS	
			12,000 to 16,000 feet		13
			16,000 to 20,000 feet	_	17
		70°	Under 4000 feet	0	o
		1 /0	4000 to 8000 feet	0	
		1		1	3
		ļ	8000 to 12,000 feet	0	l
			12,000 to 16,000 feet	-	11
			16,000 to 20,000 feet		15
	Based on	release speeds re	inging from 350 to 500 knots TAS		r
2	3	30°	Under 4000 feet	0	4
			4000 to 6000 feet	4	7
			6000 to 8000 feet	5	10
			8000 to 10,000 feet	7	13
			10,000 to 12,000 feet	_	16
			12,000 to 14,000 feet	_	19
			14,000 to 16,000 feet	_	21
1			16,000 to 18,000 feet	_	23
			18,000 to 20,000 feet	_	25
		50°	Under 4000 feet	0	2
			4000 to 6000 feet	0	5
			6000 to 8000 feet	4	8
			8000 to 10,000 feet	5	10
			10,000 to 12,000 feet	_	13
			12,000 to 14,000 feet	_	15
			14,000 to 16,000 feet	_	17
			16,000 to 18,000 feet	_	19
			18,000 to 20,000 feet	_	21
1		70°	Under 4000 feet	0	2
			4000 to 6000 feet	o	4
			6000 to 8000 feet	0	6
			8000 to 10,000 feet	4	9
			10,000 to 12,000 feet		11
			12,000 to 14,000 feet	_	13
			14,000 to 16,000 feet	_	15
			16,000 to 18,000 feet	_	17
			18,000 to 20,000 feet	_	19
	Based on	release speeds ro	ingles from 500 to 650 knots TAS	<u></u>	
2	3	30°	Under 6000 feet	2	5
l			6000 to 9000 feet	5	9
l			9000 to 12,000 feet	. 8	14
l			12,000 to 15,000 feet	_	17
l			15,000 to 18,000 feet	_	20
l			18,000 to 21,000 feet	-	24
l		50°	Under 6000 feet	0	4
1		~~	6000 to 9000 feet	3	6
1			9000 to 12,000 feet	5	10
		1	A	1	. ~~

NUMBER OF PASSES	"PRESET" (RUNNING TIME PER PASS)	DIVE ANGLE	RELEASE ALTITUDE (ABOVE TARGET)	"PILOT (CAMERA DELAY ROCKETS	
			15,000 to 18,000 feet	_	16
		ļ	18,000 to 21,000 feet	_	19
		70°	Under 6000 feet	o	4
		1	6000 to 9000 feet	0	5
		}	9000 to 12,000 feet	4	8
			12,000 to 15,000 feet	_	11
			15,000 to 18,000 feet	_	14
			18,000 to 21,000 feet	_	17

On F-86H-1 Airplanes, the strike camera is adjustable for viewing angles ranging from 35 to 70 degrees forward oblique and 105 to 145 degrees aft oblique. On F-86H-5 and subsequent airplanes, the adjustment range is from 40 degrees forward oblique to 145 degrees aft oblique. For rocket runs on all airplanes, the camera viewing angle should be the most forward oblique setting (35 degrees on F-86H-1 Airplanes and 40 degrees on F-86H-5 and subsequent airplanes). The following table gives the proper camera viewing angle for bombing runs. The viewing angle must be preset on the ground and varies with airspeeds and dive angle as follows:

AIRSPEED (KNOTS TAS)	DIVE ANGLE (DEGREES)	CAMERA VIEWING ANGLE (DEGREES)
450	30	108
	50	114
	70	123
550	30	114
	50	121
	70	131
650	30	122
	50	130
	70	136

Note

Camera viewing angles are based on 4 to 5 G pull-up at release to level flight.

CAMERA LENS SELECTOR.

The shutter of the N9 gun camera and the lens of the strike camera may be adjusted by a selector switch (figure 4-9) on the left console with BRIGHT, HAZY, and DULL positions. The switch is used to adjust the lens by means of secondary bus power.

BOMBING EQUIPMENT.

Provision is made for the installation of Type S-2 and

S-2A removable bomb racks on the lower surface of each wing outer panel. Although the airplane is equipped with four external store mounting stations, only the inboard stations may be used for bomb rack installation. (Outboard stations can be used for drop tank mountings only.) Each rack can carry single bombs of various types, ranging from 250- to 1000-pound sizes. Normally, depressing the bomb-rocket release button on the control stick energizes the selected circuits for bomb release; bombs may be dropped singly or simultaneously (salvoed). The automatic function of the A-4 sight is used for bomb sighting when releasing bombs of less than 500-pound size and may be employed to release these automatically. Separate controls are provided for normal or emergency bomb release. For emergency release, bombs may be jettisoned (unarmed) electrically either when the master armament selector is positioned at EXT. STORES JETTISON and the release button is actuated, or when the external stores jettison button is depressed regardless of armament selector position. In the event of an electrical malfunction, the bombs may be jettisoned mechanically by means of the emergency jettison handle. A rack may be installed under the left wing to carry a single special external store. A separate control panel is provided for operation with the special store; an additional jettisoning control (mechanical) is also provided to jettison only the special store.

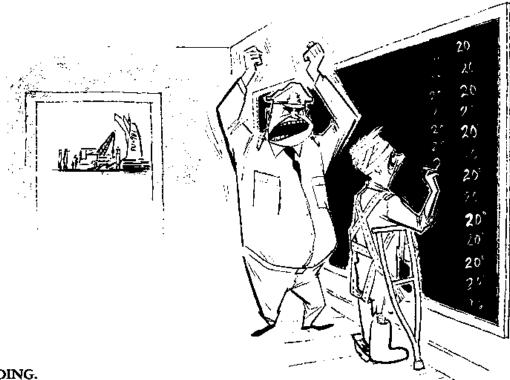
T-145 CONTROL PANEL

Refer to Confidential Supplement, T.O. 1F-86H-1A.

Figure 4-11

SPECIAL EXTERNAL STORE.

Refer to Section IV in the Confidential Supplement, T.O. 1F-86H-1A.



BOMB LOADING.

The bomb load may consist of one of the following in stallations:

Two M57A1 bombs (250-pound general-purpose)

Two MK-82 bombs (500-pound EX-12)

Two M64A1 hombs (500-pound general-purpose)

Two T-54 bombs (750-pound general-purpose)

Two E74R2 bombs (750-pound napalm)

Two MK-83 bombs (1000-pound EX-10)

Two M65A1 bombs (1000-pound general-purpose)

One special external store



When the special external store is installed (alone or with any combination of drop tanks), taxiing must be done at low speeds, and short-radius turns must be avoided. Brakes must be applied slowly to eliminate sudden stops. Operation from relatively smooth and hard surfaces is mandatory (concrete or "black-top" surfaces preferred).

BOMBING EQUIPMENT CONTROLS AND INDICATOR.

MASTER ARMAMENT SELECTOR. The master armament selector switch, located on the armament control panel (figure 4-9) on the left console, permits release selections of bombs, rockets, or drop tanks, and jettisoning of all external stores by primary bus power. Three positions of the armament selector are effective to select mode of bomb release. When the armament

Warning

Because of restricted clearances, do not lower wing flaps more than 20 degrees (MID position of wing flap handle) when EX-10 bombs or 1000-pound GP bombs with the I-142 fin are carried.

selector is properly positioned, bomb release circuits are energized when the bomb-rocket release button on the control stick is depressed. Bomb release may be selected for manual or automatic release, and bomb arming is selective (by means of bomb arming switch) when the armament selector is in either the BOMB SINGLE or BOMB SALVO position. When the armament selector is at the BOMB SINGLE position and the release button is depressed on early airplanes* not changed by T. O., the left bomb rack is tripped; a transfer circuit within the rack permits the right bomb rack to be tripped when the release button is depressed again. Early airplanes changed by T. O. and late airplanes† permit selective release. For simultaneous release of the bomb load, the armament selector should be positioned at BOMB SALVO. When the selector is at EXT STORES JETTISON, the bomb load is jettisoned unarmed when the release button is depressed; drop tanks are also released if carried. For other positions of the master armament selector, refer to "Rocket System Controls."

*F-86H-1 and F-86H-5 Airplanes †F-86H-10 and subsequent airplanes

WARNING

To prevent accidental release of external stores, do not press bomb release button on stick grip while armament master selector switch is being moved.

BOMB ARMING SWITCH. Bombs are armed by means of the arming switch, located on the armament control panel (figure 4-9). Power to the arming switch is supplied by the secondary bus. With the switch at TAIL ONLY, bombs are armed for delayed detonation. For bombs to explode instantly on impact, the switch must be positioned at ARM NOSE & TAIL. The bombs will be released unarmed if the switch is at OFF. Bomb arming is not effective except when the armament selector is at BOMB SINGLE OF BOMB SALVO and the mechanical jettison handle is in the normal position.

BOMB RELEASE SELECTOR SWITCH. A two-position selector switch, located on the armament control panel (figure 4-9), permits selection of either manual or automatic bomb release by means of secondary bus power. When the selector switch is at MANUAL RELEASE, bomb release occurs when the release button on the control stick is depressed. When the switch is at AUTO RELEASE and the release button is held closed, the mechanism within the A-4 sight automatically accomplishes bomb release when the path of the airplane during bomb run becomes tangent to the bomb trajectory. During either manual or automatic release conditions, the correct bomb release point is indicated by automatic extinction of the sight reticle image.

BOMB SEQUENCE SWITCH. On early airplanes* changed by T. O. and on late airplanes,† a bomb sequence switch, located on the armament control panel (figure 4-9), permits selective release of either right or left bomb rack first, as desired by the pilot. The bomb rack not selected will be released when the release button is pressed again.

BOMB-ROCKET RELEASE BUTTON. Bomb and rocket release circuits are energized (after the master armament selector is positioned) by power from the primary bus when the bomb-rocket release button on the control stick grip is depressed. Used primarily for normal release of bombs and rockets, the release button can also effect release of drop tanks and all external stores, depending on master armament selector positioning. If necessary, all normal external loads can be released at the same time by depression of the release button when master armament selection is positioned at EXT STORES JETTISON. The gun and impact cameras are started when the release button is depressed if the master armament selector is at BOMB SINGLE, BOMB

SALVO, ROCKET SINGLE, or ROCKET SALVO. The release button must be held depressed when bombs are being released automatically by means of the A-4 sight.

WARNING

Before actuating bomb-rocket release button, make sure master armament selector is positioned correctly for desired release condition. Failure to check selector positioning may cause accidental bomb, drop tank, or rocket release, or failure of desired store to release.

EXTERNAL STORES JETTISON BUTTON. To jettison all external stores at the same time, a guarded red push button (figure 1-10) is provided on the left console. When the button is depressed, all external stores (bombs, rockets, drop tanks, and special store) are jettisoned at the same time from left and right wings. Regardless of the position of bomb or rocket arming switches, bombs and rockets are dropped unarmed when the external stores jettison button is actuated, as the arming circuit is interrupted when the button is depressed. The jettison control is operable whenever battery power is available, as the jettison circuit receives electrical power from the battery bus.

CAUTION

Rockets cannot be jettisoned electrically when the airplane is on the ground, as the jettison circuit is interrupted when the weight of the airplane is on the landing gear.

EMERGENCY JETTISON HANDLE. The emergency jettison handle (24, figure 1-5) is located to the left of the instrument subpanel. If the electrical jettison release fails, the emergency jettison handle can be used to release all external load except the special store. Bombs, rockets, or drop tanks are mechanically released, independently of any of the electrical release systems, when the emergency jettison handle is actuated. To jettison the outboard tanks only, the emergency jettison handle should be turned 45 degrees clockwise and then pulled out about 31/2 inches. When the handle is pulled straight out to its full extension (about 61/8 inches), all external stores are released at the same time. The bomb and rocket arming circuits are interrupted automatically when the emergency jettison handle is pulled, and bombs or rockets are dropped unarmed, regardless of the position of the bomb or rocket arming switches.

^{*}F-86H-1 and F-86H-5 Airplanes *F-86H-10 and subsequent airplanes

Section IV T. O. 1F-86H-1

SPECIAL STORE JETTISON HANDLE. To jettison the special store in case of an electrical release failure, the mechanical release handle (31, figure 1-5) on the left instrument subpanel above the landing gear handle should be pulled to its full extension (about 2 inches).

A-4 SIGHT BOMB RELEASE INDICATOR. When the sight controls are set for the bombing function, the sight will indicate bomb release. During the bombing run, the proper bomb release point (point at which the path of the airplane becomes tangent to a bomb trajectory) is indicated by automatic extinction of the reticle image circle and dot. This indication occurs whether the bomb release system is set for automatic or manual release.

BOMB RELEASE.

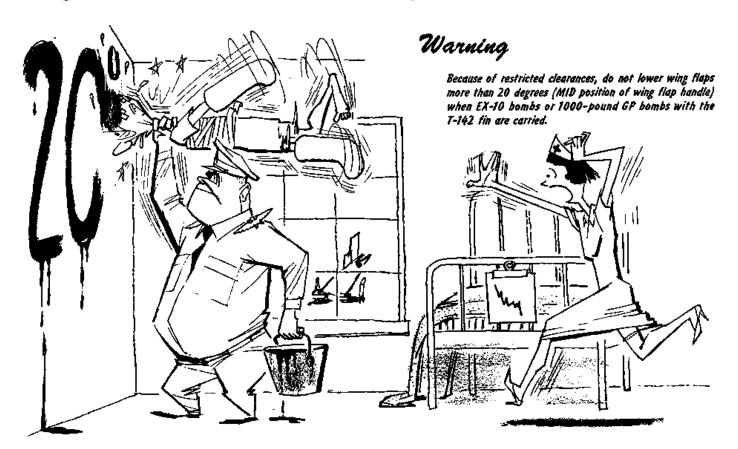
To release bombs using the A-4 sight, proceed as follows:

WARNING

To avoid damage to the airplane, do not use the automatic function of the A-4 sight for bombing operations involving bombs of 500-pound size or heavier, as these bombs tend to strike portions of the airplane under this or any negative G release condition.

- 1. Check that the radar inverter warning light is out.
- 2. Gun safety switch at SIGHT CAMERA & RADAR to allow a 5- to 15-minute warm-up period (depending on outside air temperature) for the sight. Check sight mechanical caging lever at CAGE.
- 3. Sight filament switch at PRIM. If primary filament is inoperative, set switch to SEC.
- 4. Sight dimmer rheostat adjusted for desired reticle image brilliancy.
 - 5. Move sight mechanical caging lever to UNCAGE.
- Master armament selector set at BOMB SINGLE for single release or BOMB SALVO for simultaneous release.
- 7. Set bomb sequence switch as desired (early airplanes* changed by T. O. and late airplanes*).
 - 8. Sight function selector lever to BOMB.
- 9. Bomb release selector switch at MANUAL RELEASE for selective release or AUTO RELEASE for release by means of the A-4 sight.
- 10. After sighting target and before starting approach, set bomb arming switch at ARM NOSE & TAIL or TAIL ONLY.
 - 11. Set strike camera timer to desired delay.\$
- Bomb-target wind control turned from ROCKET GUN to known or estimated target and wind velocities.

*F-86H-1 and F-86H-5 Airplanes †F-86H-10 and subsequent airplanes ‡F-86H-5 Airplane AF52-2092 and all subsequent airplanes



- 13. Make approach to target that will give desired dive angle during bombing run.
- 14. Depress sight electrical caging button to stabilize reticle image before pushing over into dive.
 - 15. Place reticle image dot on target.
- 16. After establishing dive, keep dot on target and release electrical caging button. If automatic release has been selected, depress bomb-rocket release button at this point.
 - 17. Track smoothly, keeping dot on target.
- 18. On an automatic release, bomb release will occur automatically at correct release point, as indicated by the disappearance of the reticle circle and dot. If release is manual, depress bomb-rocket release button as circle and dot are extinguished.

BOMB EMERGENCY RELEASE.

To jettison normal bomb load (unarmed) and drop tanks, any of the following methods may be used:

- Position master armament selector at EXT STORES JETTISON and depress bomb-rocket release button momentarily.
- Depress external stores jettison button on left console. (Position of master armament selector is ineffective.)

- To jettison only the bomb load and retain drop tanks, position master armament selector at BOMB SALVO and arming switch at OFF, and depress bomb-rocket release button.
- 4. In case of an electrical malfunction, pull emergency jettison handle straight out to its fully extended position (about 61/8 inches) to jettison bomb load and drop tanks mechanically.

LOW-ALTITUDE BOMBING SYSTEM (LABS).*

Refer to Section IV in the Confidential Supplement, T. O. 1F-86H-1A.

ROCKET SYSTEM.

Four removable, zero-rail rocket launcher assemblies may be installed to permit mounting eight 5-inch HVA rockets or four high-performance air-to-ground rockets. The launchers are fitted to the lower surface of the wing outer panels, two on each side. Two HVA rockets, one

*F-86H-1 Airplane AF52-1979 and all subsequent airplanes

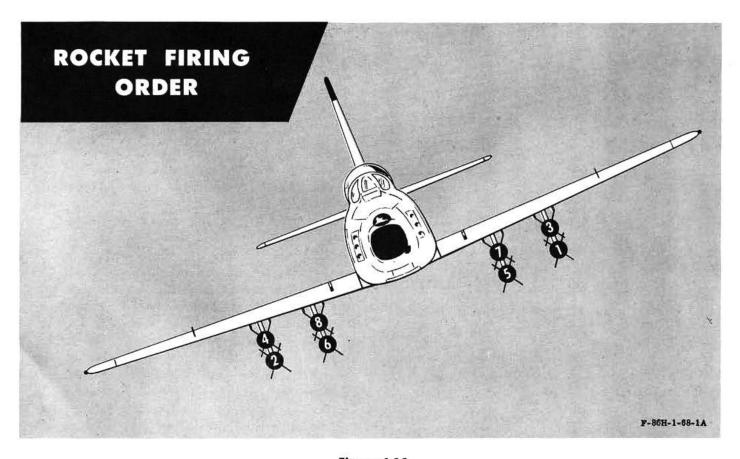


Figure 4-12

mounted directly below the other, or one high-performance rocket is hung from each launcher assembly. The Type A-4 gun-bomb-rocket sight is used for aiming the rockets, and controls are provided for normal or emergency rocket release. Gun and strike cameras are operated automatically when rockets are fired. (Refer to "Cameras.") Normal rocket release, single or automatic, is done electrically by means of a rocket projector release, which controls the firing sequence. Rockets may be salvoed unfired, either armed or unarmed. Rockets may be jettisoned simultaneously and unarmed through either the master armament selector and the bomb-rocket release button, or the external stores jettison button. In an emergency, the rockets may be jettisoned mechanically by the emergency jettison handle.

ROCKET SYSTEM CONTROLS.

SIGHT SELECTOR UNIT. Refer to "A-4 Sight Controls."

BOMB-ROCKET RELEASE BUTTON. Refer to "Bombing Equipment."

MASTER ARMAMENT SELECTOR. Four positions of the master armament selector, located on the armament control panel (figure 4-9), are effective for selecting rocket release (primary bus): ROCKET SINGLE and ROCKET AUTO for normal rocket firing, and ROCKET SALVO and EXT STORES JETTISON for dropping rockets rather than



Note Rockets cannot be jettisoned or salvoed electrically when the airplane is on the ground, as these circuits are inoperative with the weight of the airplane on the gear.

firing them. Normal rocket fire is done when the master armament selector is positioned for the desired mode of release and the bomb-rocket release button is depressed. This also automatically starts the gun and strike cameras. With the selector at ROCKET SINGLE, one rocket is fired each time the release button is depressed; with the selector at ROCKET AUTO, all rockets are fired in train when the button is held depressed. Automatic firing ceases when the button is released. When the selector is positioned to BOCKET SALVO, the rockets can be dropped from the mounts simultaneously by means of the bomb-rocket release button. Rocket nose fuze arming is selective during this type of salvo release, even though the rockets are dropped rather than fired. Rockets and drop tanks may be jettisoned electrically by movement of the master armament selector to EXT STORES JETTISON and depression of the bomb-rocket release button. All rockets will be jettisoned simultaneously and unarmed.

ROCKET FUZE (ARMING) SWITCH. Arming of the rocket nose fuze is controlled by secondary bus power through the rocket fuze (arming) switch, located on the armament control panel (figure 4-9). When the switch is at INST., the rocket nose fuze is armed upon release to provide instantaneous detonation on contact. The nose fuze is unarmed when the switch is at DELAY or OFF; however, when the rocket is fired, an internal fuze is primed and will cause delayed detonation after impact. During take-offs, the arming switch should always be OFF. Nose fuze arming is selective during salvo release, but for rocket jettison release, the nose fuze is unarmed. The internal fuze is inoperative during jettisoning.

ROCKET PROJECTOR RELEASE (INTERVALOM-ETER). Rocket-firing sequence during normal and automatic release is controlled by primary bus power by means of a rocket projector release (20, figure 1-6), located on the aft left console. When the master armament selector is at ROCKET SINGLE, one rocket is fired each time the bomb-rocket release button is depressed, and the projector release automatically maintains the correct firing sequence for each successive release. When the master armament selector is at ROCKET AUTO and the release button on the control stick grip is depressed, the projector release fires rockets in sequence at about 1/10-second intervals as long as the release button is held depressed. A numbered dial, visible through a window in the projector release bousing, indicates the rocket to be fired. The dial is set at the time of rocket loading and should be at 1 when a normal complement of rockets is carried. The reset knob is used to select release of any particular rocket in case of misfire or other malfunction during a "single" release.

Note

If the lower rocket fails to fire during a normal release, the upper rocket on the same mount cannot be fired. The unfired rockets should be jettisoned in a safe area. Jettisoning is not selective; all rocket stations jettison simultaneously.

EXTERNAL STORES JETTISON BUTTON. Refer to "Bombing Equipment Controls and Indicator."

EMERGENCY JETTISON HANDLE. Refer to "Bombing Equipment Controls and Indicator."

ROCKET JETTISON TEST SWITCH. A means of checking the rocket jettison circuit on the ground is provided by a manually operated test switch located on the canopy deck test switch panel.



If switch is closed while rockets are installed on launcher, rockets will be jettisoned.

FIRING ROCKETS.

Sight and armament controls should be set as follows for rocket firing:

- 1. Check radar inverter operation (warning light out).
- 2. Gun safety switch at SIGHT CAMERA & RADAR to supply power to the sight; allow 5- to 15-minute warm-up (depending on outside air temperature) period for sight. Check sight mechanical caging lever at UNCAGE.
 - Sight function selector lever to ROCKET.
- 4. Master armament selector set at ROCKET SINGLE OF ROCKET AUTO.
- 5. Rocket fuze (arming) switch at INST, or DELAY (in flight).
- 6. Rocket setting lever at 5" HVAR and at intended dive angle. (On airplanes equipped with the variable sight selector unit, set rocket depression angle selector at desired position.)
- Before initial rocket firing, make sure rocket projector release dial is set at 1 to ensure proper release of all rockets carried.
- 8. Sight filament switch at PRIM. If primary filaments are inoperative, set switch at SEC.
- 9. Sight dimmer rheostat adjusted to obtain desired reticle image brilliancy.
 - Set camera delay timer to desired delay.*
- 11. Make approach to target that will give desired dive angle during firing.
- *F-86H-5 Airplane AF52-2092 and all subsequent airplanes

- 12. Before pushing over into the dive, depress sight electrical caging button to stabilize reticle image.
 - 13. Put reticle image dot on target.
- 14. After establishing dive, keep dot on target and release electrical caging button.
- 15. Track smoothly, without skidding or slipping, keeping dot on target for about 3 seconds; then depress bomb-rocket release button to fire rockets.

ROCKET EMERGENCY RELEASE.

To salvo rockets unfired, proceed as follows:

- 1. Master armament selector at ROCKET SALVO.
- 2. Rocket fuze (arming) switch OFF. (Internal fuze is inoperative when rockets are salvoed.)
- 3. Press bomb-rocket release button to salvo all rockets simultaneously.

To jettison rockets unarmed, follow one of the following procedures:

- Master armament selector EXT STORES JETTISON, and depress bomb-rocket release button momentarily to jettison all external stores.
 - 2. Push external stores jettison button (left console).
- 3. In case of an electrical malfunction, jettison all external stores by pulling out emergency jettison handle to its full extension (about 61/8 inches).

MISCELLANEOUS EQUIPMENT.

ANTI-G SUIT PROVISIONS.

Air pressure for the anti-G suit bladders is taken from the final stage of the engine compressor and is then routed through a pressure-regulating valve to the suit attachment fitting. The line from the regulating valve to the attachment fitting passes through the quick-disconnect fitting on the front of the seat so that the line will sever automatically upon ejection. The pressure-regulating valve (1, figure 1-6) on the left aft console regulates air pressure to the suit and permits inflation of the suit only when positive G is encountered. The valve operates automatically and begins to function at about 1.75 G whether the cap has been moved to the HI (clockwise) or LO (counterclockwise) detent. When the valve is at 1.0, 1 psi of air pressure is exerted in the suit for each additional 1 G increase; when valve is at HI, 1.5 psi is delivered per G increase. Depressing the button on top of the valve permits valve operation to be checked manually and also allows the suit to be inflated momentarily when desired. Use of the suit in this manner will lessen fatigue during prolonged flights.

DATA CASE.

The data case is located in the right side of the aft fuselage. Access to the data case is provided by a hinged door marked "FIRE FIGHTING, FUEL PROBE, AND DATA ACCESS DOOR."

MAP CASE.

The map case and aircraft report holder (9, figure 1-7) is located on the aft right console, below the canopy sill.

CHECK LIST.

The pilot's check list is stowed above the right console.

REAR-VISION MIRROR.

An adjustable rear-vision mirror is suspended from the inner upper surface of the canopy, just aft of the canopy bow.

PILOT'S PROTECTIVE HOOD.

Some airplanes may be equipped with a pilot's protective hood which is made of white canvas duck material and which moves on metal guides attached to the canopy.

MOORING EQUIPMENT.

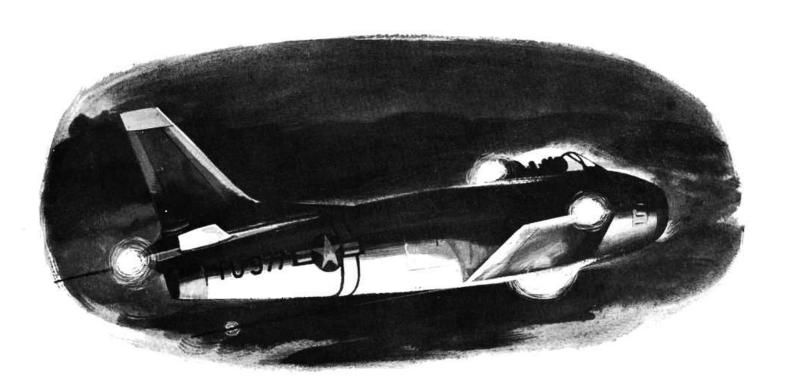
Mooring rings are furnished in the mooring and jacking kit. On nontactical missions, mooring and jacking kits are stowed in the left rear ammunition container. Two fuselage fittings and two wing fittings are provided for attaching the mooring eyes. Both fuselage fittings are on the lower surface of the fuselage on the airplane centerline. The forward mooring ring is screwed into the jack pad fitting, just aft of the nose wheel door; the aft mooring ring is screwed into a fitting forward of the tail-pipe aperture. The wing mooring rings screw into threaded holes outboard of the 200-gallon wing tanks. All mooring-ring fittings are identified by suitable markings on the adjacent skin. When the airplane is tied down for extreme weather, it should be headed into the wind, with the rudder locked and wheel chocks installed. A ½-inch cable or ¾-inch rope should be used for tie-down.

PROTECTIVE COVERS.

The removable covers, furnished for protecting the airplane while it is on the ground, include a cockpit canopy and intake duct cover, an air intake duct shield, a tail-pipe cover, and a pitot tube cover.



Intake duct shield and tail-pipe cover should not be installed until engine has cooled, to prevent formation of excessive moisture.



OPERATING LIMITATIONS

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GENERAL.

Careful attention must be given to the instrument markings (figure 5-1), as the limitations shown on these instruments and noted in the captions are not necessarily repeated in the text of this or any other section.

ENGINE LIMITATIONS.

All normal engine limitations are shown in figure 5-1.

ENGINE OVERSPEED.

Engine speeds of more than 104% rpm under any condition necessitate engine overhaul.

ENGINE OVERTEMPERATURE.

Should any one of the following conditions occur, the engine must be removed for inspection:

During starting (30% engine rpm or less)-

- Exhaust temperature exceeds 975°C, even if only momentarily.
- Exhaust temperature stabilizes at any temperature within the range of 875°C to 975°C. (Momentary peaking is permissible in this range as long as exhaust temperature gage pointer is in constant motion.)

Transient operation (30% engine rpm or higher)-

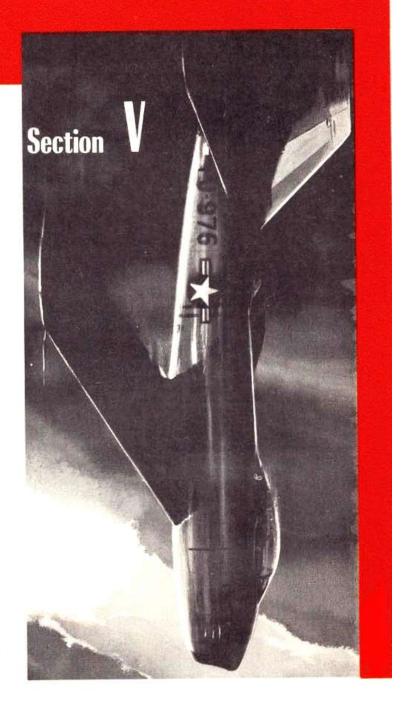
 Exhaust temperature exceeds 875°C, even if only momentarily.

Steady-state operation-

 Exhaust temperature exceeds 650°C, even if only momentarily.

Note

Steady-state temperature operating limit is 640°C. If temperature inadvertently drifts into the range of 640°C-650°C, retard throttle as required to maintain temperature below the 640°C operating limit.



The temperature and duration of all overtemperature operation must be entered on DD Form 781 (formerly Form 1).

AIRSPEED LIMITATIONS.

LANDING GEAR AND WING FLAP LOWERING SPEEDS.

Limit airspeed for lowering the flaps is 220 knots IAS. For airplanes which have the cable stop on the aft hinge of the nose wheel door, the limit airspeed for lowering the gear is 220 knots IAS. For airplanes which do not

have the cable stop on the aft hinge of the nose wheel door, the limit airspeed for lowering the gear is 200 knots IAS. Gear or flap lowering above the limit speed may cause damage to the fairings, doors, or operating mechanisms.

LANDING LIGHT EXTENSION SPEED.

The landing lights are designed for extension only on the final approach after the landing gear and wing flaps are lowered. Do not lower the landing lights at speeds above 220 knots IAS.

CANOPY OPENING SPEED.

The canopy is not to be opened in flight. During taxiing, the canopy may be operated at speeds not over 50 knots IAS. If canopy is operated at speeds above this value, damage to canopy operating mechanism will result.

MAXIMUM ALLOWABLE AIRSPEEDS.

The maximum allowable airspeeds for the airplane are shown in figures 5-1 and 5-2. The limits shown in figure 5-1 are for the airplane with no external load. The limits shown in figure 5-2 are for the airplane when carrying various external loads.

MINIMUM SPEED FOR FIRING 20 MM GUNS.

On some airplanes equipped with 20 mm guns, the guns must not be fired at airspeeds below 425 knots IAS. These airplanes can be identified by a placard installed on the canopy rail on the left-hand side of the cockpit. The placard reads: "DO NOT AIR FIRE GUNS BELOW 425 KNOTS I.A.S." This restriction against firing the guns at lower airspeeds has been imposed until certain changes in the gun gas purging system have been made.

WARNING

Do not fire the guns on F-86H-5 Airplanes AF52-2091 and -2097 through -2119. Tests have shown that dents and cracks may develop in the nose section of these airplanes just forward of the gun blast panels during gun firing.

DROP TANK RELEASE SPEEDS.

The limit airspeeds for symmetrical release of drop tanks are shown in figure 5-4. These airspeeds represent the limits imposed to assure that tanks will clear the airplane when released. For limit airspeeds when jettisoning drop tanks singly, based on lateral-directional control capabilities of the airplane, refer to "Asymmetrical Store Limitations," and see figure 5-5 in this section.





AIRSPEED INDICATOR

- † For airspeed limitations with specific external loads, refer to AIRSPEED LIMITA-TIONS, this section.
- ‡On airplanes which do not incorporate the cable stop on the aft hinge of the nose wheel door, maximum gear-down airspeed is 200 knots IAS.

MAXIMUM ALLOWABLE AIRSPEEDT

600 knots IAS, Mach 1.0, or airspeed where wing roll is excessive, whichever is lower.

- Limiting hand will show the limit airspeed of 600 knots IAS or the indicated airspeed that corresponds to Mach 1.0, whichever is lower.
 - Maximum gear- and flaps-down airspeed: 220 knots IAS.‡

Figure 5-1

HYDRAULIC PRESSURE

UTILITY HYDRAULIC SYSTEM FLIGHT CONTROL NORMAL HYDRAULIC SYSTEM

FLIGHT CONTROL
ALTERNATE HYDRAULIC SYSTEM

650-2550 psi Malfunction within systemunit operation sluggish 2550-3200 psi

Normal only if system is engaged and controls are operating

Normal – when systems are in operation*

Normal when controls are not in use

3200 psi Maximum Maximum

Engine-driven pump compensator failure

Normal only if emergency override handle is pulled

* For static (no-flow) condition, gage pressure should indicate 2900-3200 psi.



EXHAUST TEMP

640°C

200°C

875°C to 975°C

3200-4000 psi

Minimum

200°C to 577°C Continuous

Maximum (Take-off and Military

Power-30 Min Max)

Starting Only (Momentary Peaking Permissible in This Range as Long

as Gage Pointer is in Constant

Motion).

Max During Start Only 975°C†



†Refer to warning on hot starts and transient operation in starting procedure, Section II.





OIL PRESSURE

20 psi 20-45 psi 45 psi

Minimum Continuous Maximum

FUEL FLOW

350 lb/hr 480-12,000 lb/hr

Minimum Continuous

TACHOMETER

88% 88%-96% 96%

100%

Minimum Cruise

Continuous

Max Continuous (Operation Above This Limited to 30 Min Max)

Take-off and Military Power

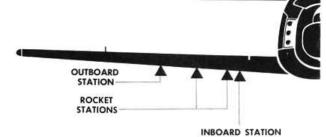


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AIRSPEED AND ACCELERATION LIMITATIONS

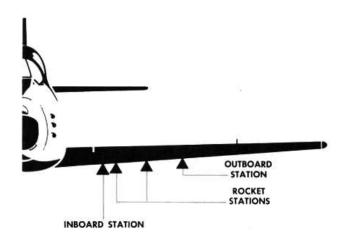
NOTE

For airspeed and acceleration limitations for configurations which include the special store, refer to Section V of the Confidential Supplement, T.O. 1F-86H-1A.



			INDUARD STATION	
CONFIGURATION	G-LIMIT	TATIONS	AIRSPEED LIMITATIONS	
	F-86H-1 AIRPLANES	F-86H-5 AND SUBSEQUENT AIRPLANES		
NO EXTERNAL LOAD	7.33 -3.0	+6.0 -2.0	Mach 1.0, 600 knots IAS, or airspeed where wing roll is excessive, whichever is lower.	
EIGHT 5 IN. HVA ROCKETS	+6.0 -3.0	+5.0 -2.0	Above 25,000 feet—Mach 1.0 Below 25,000 feet —Mach .95 NO CONTINUOUS ROLLS	
ANY OF THE FOLLOWING STORES AT INBOARD STATIONS:				
TWO TYPE II OR IV 120-GALLON DROP TANKS	+4.0 -2.0	+4.0 -2.0	Mach .9 or 500 knots IAS, whichever is lower. No abrupt maneuvers, no continuous rolls, rate of roll limited to 90 degrees per second.	
TWO TYPE I OR III 120-GALLON DROP TANKS			Above 25,000 feet—Mach 1.0 Below 25,000 feet —Mach .9 or 500 knots IAS, whichever is lower	
TWO 1000 LB GP BOMBS WITH T-142 FINS			Above 25,000 feet—Mach 1.0 Below 25,000 feet —Mach .8 NO CONTINUOUS ROLLS	
TWO 1000 LB EX-10 BOMBS	+6.0	+5.0	Mach 1.0, except avoid buffet regions if en- countered.	
TWO 750 LB NAPALM BOMBS	-3.0	-2.0	Mach 1.0, except avoid buffet regions if encountered. Avoid excessive yaw above Mach .9. NO CONTINUOUS ROLLS	
TWO 750 LB GP BOMBS OR TWO 500 LB GP BOMBS WITH T-127 FINS	1	-	Above 25,000 feet—Mach 1.0 Below 25,000 feet —Mach .85	
TWO 500 LB EX-12 BOMBS OR TWO 250 LB GP BOMBS WITH T-147 FINS			Above 25,000 feet—Mach 1.0 Below 25,000 feet —Mach .9	
TWO 500 LB GP BOMBS			Mach .70	
TWO NAA TYPE I OR III 200-GALLON DROP TANKS	+5.0 -2.0	+5.0 -2.0	Mach 1.0.	
TWO 5 IN. HVA ROCKETS AT OUTBOARD ROCKET STATIONS PLUS ANY OF THE FOL- LOWING STORES AT THE INBOARD STATIONS: TWO 1000 LB GP BOMBS WITH T-142 FINS			Above 25,000 feet—Mach 1.0 Below 25,000 feet —Mach .85	
TWO 1000 LB EX-10 BOMBS	+6.0 -3.0	+5.0 -2.0	Above 25,000 feet—Mach 1.0 Below 25,000 feet —Mach .95 or 550 knots IAS, whichever is lower	
F-86H-1-93-13G	1	1 1	NO CONTINUOUS ROLLS	

Figure 5-2



NOTE

- LOAD FACTOR LIMITS FOR F-86H-5 AND SUBSEQUENT AIRPLANES ARE TEMPORARY PENDING COMPLETION OF STRUCTURAL DEMONSTRA-TION.
- POSITIVE G-LIMITS FOR ROLL-ING PULL-OUTS ARE 2/3 OF LIMITS SHOWN. NEGATIVE G-LIMIT FOR ROLLING PUSH-DOWNS IS — 1.0 G.

CONFIGURATION	G-LIMITATIONS F-86H-1 AIRPLANES F-86H-5 AND SUBSEQUENT AIRPLANES		AIRSPEED LIMITATIONS
TWO 5 IN. HVA ROCKETS AT OUTBOARD ROCKET STATIONS PLUS TWO NAA TYPE I OR III 200-GALLON TANKS AT OUTBOARD STATIONS PLUS ANY OF THE FOLLOWING STORES AT INBOARD STATIONS: TWO 1000 LB GP BOMBS WITH T-142 FINS	+ 5.0 - 2.0	+ 5.0 - 2.0	Above 25,000 feet—Mach 1.0 Below 25,000 feet —Mach .85 NO CONTINUOUS ROLLS
TWO 1000 LB EX-10 BOMBS			Above 25,000 feet—Mach 1.0 Below 25,000 feet —Mach .95 or 550 knots IAS, whichever is lower NO CONTINUOUS ROLLS
TWO NAA TYPE I OR III 200-GALLON DROP TANKS AT OUTBOARD STATIONS AND ANY OF THE FOLLOWING STORES AT THE INBOARD STATIONS: TYPE II OR IV 120-GALLON DROP TANKS	+4.0 -2.0	+4.0 -2.0	Mach .9 or 500 knots IAS, whichever is lower. No abrupt maneuvers, no continuous rolls, rate of roll limited to 90 degrees per second.
TWO TYPE I OR III 120-GALLON DROP TANKS			Above 25,000 feet—Mach 1.0 Below 25,000 feet —Mach .9 or 500 knots IAS, whichever is lower
EIGHT 5 IN. HVA ROCKETS			Above 25,000 feet—Mach 1.0 Below 25,000 feet —Mach .95 NO CONTINUOUS ROLLS
TWO 1000 LB GP BOMBS WITH T-142 FINS			Above 25,000 feet—Mach 1.0 Below 25,000 feet —Mach .8 NO CONTINUOUS ROLLS
TWO 1000 LB EX-10 BOMBS	+ 5.0 - 2.0	+5.0 -2.0	Above 25,000 feet—Mach 1.0 Below 25,000 feet —Mach .9 or 550 knots IAS whichever is lower
TWO 750 LB NAPALM BOMBS			Above 25,000 feet—Mach 1.0. Avoid excessive yaw above Mach .9. Below 25,000 feet —Mach .9 NO CONTINUOUS ROLLS
TWO 750 LB GP BOMBS OR TWO 500 LB GP BOMBS WITH M-128 FINS			Above 25,000 feet—Mach 1.0 Below 25,000 feet —Mach .85
TWO 500 LB EX-12 BOMBS OR TWO 250 LB GP BOMBS WITH T-147 FINS			Above 25,000 feet—Mach 1.0 Below 25,000 feet —Mach .9
TWO 500 LB GP BOMBS			Mach .70

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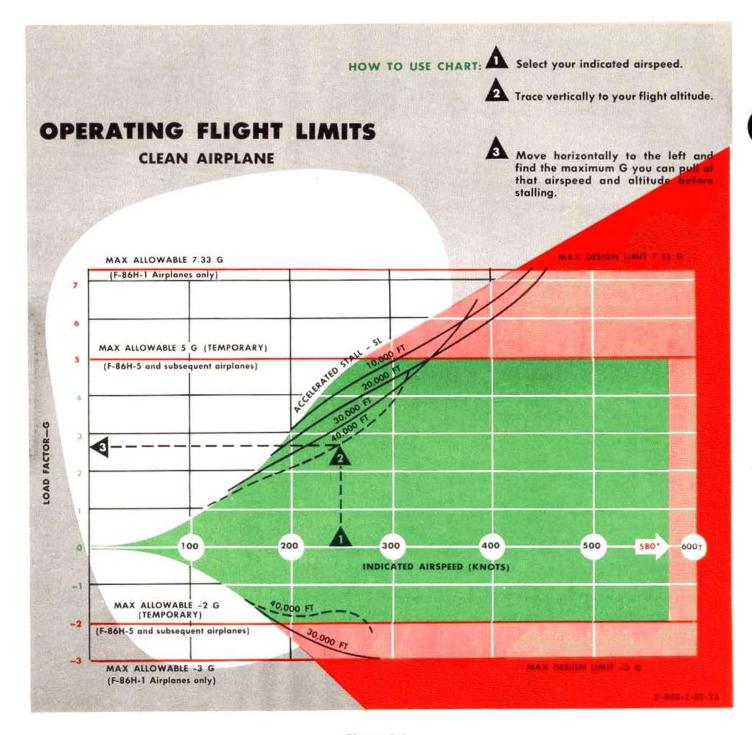


Figure 5-3

ASYMMETRICAL STORE LIMITATIONS.

If conditions require take-off with an asymmetrical external store loading, if an asymmetrical loading condition is encountered during flight, or if it is desired to drop a single store from a symmetrical loading condition in flight, the penetration limitations given in figure 5-5 should be observed. It should be noted that there is a definite relationship between drop tank release limits given in figure 5-4 and asymmetrical store penetration limits given in figure 5-5. While you may safely fly down to a certain low speed with the

airplane asymmetrically loaded and still maintain adequate lateral-directional control, you cannot jettison the 200-gallon drop tanks with stuka fins at the same speed, since the tank will not separate cleanly from the airplane.

PROHIBITED MANEUVERS.

The airplane is restricted from performing the following maneuvers:

1. Snap rolls or any snap maneuvers.

DROP TANK RELEASE LIMITS

NOTE For asymmetrical release limits, refer to "Asymmetrical Stores Limitations," in this section.

†For Types II and/or IV 120-gallon drop tanks, release limits are:

Below 20,000 feet—Release from straight-and-level flight above Mach .8 (or 400 knots IAS, whichever is higher).

Above 20,000 feet—Release from straight-and-level flight above Mach .82

DROP TANKS	STATION	NUMBER OF STORES CARRIED	ORIGINAL FIN	STUKA FIN (FIN WITH END PLATES)
200- GALLON	OUTBOARD	SINGLE OR DUAL	NOT RECOMMENDED FOR DROP; HOWEVER, IN EMERGENCY, DROP AT 275 KNOTS IAS OR ABOVE.	DROP AT ANY SPEED ABOVE 220 KNOTS IAS. IN AN EMER- GENCY, DROP AT ANY SPEED.
120- GALLON	INBOARD	SINGLE	NOT RECOMMENDED FOR DROP; HOWEVER, IN EMERGENCY, DROP	DROP AT ANY SPEED (Types I and III only). †
120- GALLON	INBOARD	DUAL	AS NEAR CRUISING SPEED AS PRACTICAL.	NOT RECOMMENDED FOR DROP; HOWEVER, IN EMERGENCY, DROP AS NEAR CRUISING SPEED AS PRACTICAL.

Figure 5-4

Temporary SPEED BOUNDARIES

FOR ASYMMETRICAL EXTERNAL STORES JETTISON OR PENETRATION

CONFIGURATION	ASYMMETRY AT	MINIMUM	MAXIMUM
One Store on One Wing Only or Two Stores on One Wing and One Store on the Other Wing	Outboard Station Only Inboard Station Only	150 Knots IAS •	500 Knots IA
Two Stores on One Wing Only† or Two Full Tanks on One Wing and Two Empty Tanks on the Other Wing†	Outboard and Inboard Stations	170 Knots IAS *	470 Knots IA

*Minimum speed to jettison 200-gallon drop tanks equipped with stuka fins is 220 knots IAS.

† Flight Not Recommended Under These Conditions

NOTE: Any airspeed limitation for a symmetrical configuration which is more restrictive than those shown above should also prevail for asymmetrical configurations.

F-86H-1-93-41C

T. O. 1F-86H-1 Section VI



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Vortey Generators	6.16

GENERAL.

This airplane is the latest of the Sabre series and is designed to serve a two-fold purpose as a fighter-bomber. Many of the flight qualities of the previous Sabres have been retained; however, by necessity this airplane is heavier because of a stronger airframe and the external loads it will carry. The added weight affects some flight handling characteristics, as well as increases indicated airspeeds during take-off and landing operations. The completely hydraulic flight control system enables you to handle this airplane with comfortable stick forces throughout its entire speed range. The horizontal stabilizer is somewhat larger than the previous Sabre's horizontal stabilizer, giving you very powerful pitch control. In some cases, you may find the flight controls too sensitive at first, but as you become familiar with this airplane, the light stick forces will present no problem. However, during your familiarization, be careful not to use abrupt fore and aft motions on the stick, as they may result in overcontrolling. Some airplanes have wing leading edge slats to improve lateraldirectional controllability at low speeds and to reduce the stalling speed. In addition, the slats increase available G-loads before stall at high altitudes and Mach numbers. The specific differences in flight characteristics between the two wing leading edge configurations are discussed in the applicable paragraphs of this section. The basic handling qualities have been thoroughly investigated and are included in this section. Successful handling of this airplane demands that you fully understand what it will do and the relationship of speed to weight and load factors. The airplane has no dangerous tendencies.

MACH NUMBER.

In this section, speeds are generally given in terms of Mach number rather than indicated airspeed. Speed references are presented in this form because to relate a flight characteristic to an indicated airspeed, it would be necessary to know the different airspeed for every altitude at which that particular characteristic occurred. When a flight characteristic is related to Mach number, however, the characteristic occurs at the same Mach number regardless of altitude and varies only in intensity, depending upon changes in altitude. When indicated airspeed is compared with Mach number, it will be

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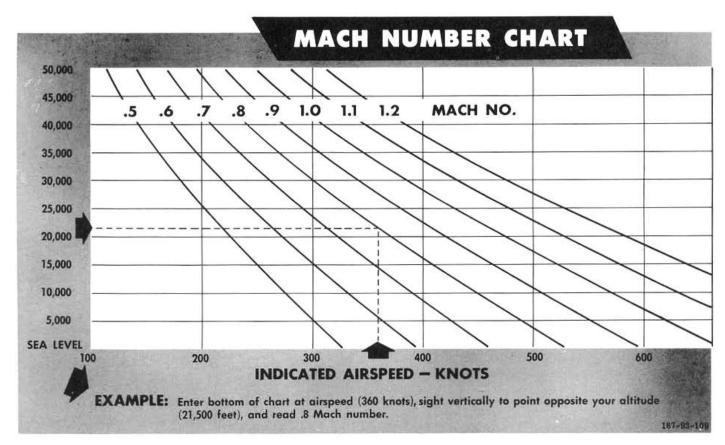


Figure 6-1

found that the lower the altitude, the higher the indicated airspeed for a given Mach number. This higher indicated airspeed is a result of the greater pressure forces that air exerts at lower altitudes. Consequently, although a specific handling quality occurs at the same Mach number at all altitudes, the effect on the airplane and on its control varies. At low altitudes, the effect could even be dangerous. Therefore, use of the Machmeter is very advantageous in high-speed and maneuvering flight. The Machmeter also provides an excellent means of obtaining maximum range. Maximum range is obtained by flying at high altitude and holding a constant Mach number and constant throttle setting. (The exact power setting and Mach number depend upon airplane gross weight at the start of cruising flight. Refer to Nautical Miles per Pound of Fuel charts in the Appendix of the Confidential Supplement, T. O. 1F-86H-1A.) Constant Mach number cruising is economical, because, as fuel is consumed, reducing gross weight, the airplane climbs slightly as long as flight is maintained at the same Mach number and throttle setting. This means that at a constant Mach number, the airplane automatically seeks the optimum cruising altitude for the particular gross weight, thereby providing maximum range. If the airspeed indicator is used to obtain maximum range, you must know and select a different airspeed for each slight change in airplane gross weight. Since the airplane

capabilities include high-speed, high-altitude operation, you should become very familiar with the Machmeter and know how to use it to obtain maximum performance from the airplane. A Mach number chart (figure 6-1) illustrates the variation of indicated airspeed with altitude for given Mach numbers.

STALLS.

The stall characteristics of this airplane are typical of a swept-back wing type of fighter airplane. The swept-back wing has a characteristic of a higher angle of attack at the stalling point than you would experience in a straight-wing airplane. The stall warning in this airplane is satisfactory during approach to accelerated stalls. See figure 6-2 for stall speeds for various configurations.

AIRPLANES WITH SLATS.

On airplanes with slats, mild to moderate airplane buffet precedes the straight-through, unaccelerated 1 G stall.

AIRPLANES WITHOUT SLATS.

On airplanes without slats, the complete absence of stall warning during the approach to an unaccelerated 1 G stall requires that the recommended approach and T. O. 1F-86H-1 Section VI

touchdown speeds be closely adhered to during landing maneuvers. Stall characteristics for airplanes without slats are definitely inferior to those for airplanes with slats. The nonslatted wing gives little or no buffet warning and causes an abrupt yaw accompanied by a roll before the stall point.

UNACCELERATED STALLS.

The power-on stall speeds shown in figure 6-2 (with gear and flaps either up or down) are slightly lower than power-off values for the same gross weight because of the added lift derived from engine thrust at high angles of attack. If the airplane is trimmed longitudinally into a stall, the push forces required for recovery will be high, but not uncomfortable.

AIRPLANES WITH SLATS.

On airplanes with slats, unaccelerated stalls with gear and flaps down are preceded by a light, general airplane buffet about 10 knots above the stall and a rudder buffet of medium intensity just before the stall. Without power, the stall point will be noted by a slight pitching motion, and the nose will drop straight through without appreciable roll. Unaccelerated stalls with gear and flaps up (with or without power) are preceded by a light rudder and airplane buffet about 10 to 20 knots above the stall, the buffeting becoming heavy just before the stall. The stall itself is characterized by a slight pitching, with the nose dropping as the airplane rolls about 10 degrees at the stall point.

AIRPLANES WITHOUT SLATS.

On airplanes without slats, unaccelerated stalls (stalls at 1 G) in any configuration occur without any noticeable general airframe buffet. The first indication of a stall is a slight yawing tendency as the stall is approached. This is followed by an abrupt roll and yaw in either direction. Below this speed, it is difficult to keep the wings level. These stalling characteristics are the same with gear and flaps up or down. Likewise, external loads, such as external wing tanks, do not alter this stall pattern of yaw and roll tendencies. The stall speeds shown in figure 6-2 for airplanes without slats are predicated on this roll and yaw initiation and therefore must be closely observed to prevent accidents.

ACCELERATED STALLS.

An accelerated stall (often termed a "high-speed stall") is primarily a stall that occurs while pulling more than 1 G. It results from pulling into a tight turn and rapidly increasing G through the buffet region to the stall point. Be alert for the buffet warning that precedes the stall.

LOW-SPEED ACCELERATED STALLS.

Low-speed accelerated stalls are usually preceded by a mild airplane buffet. On airplanes without slats, stall

onset is always characterized by yaw and wing roll. The amount of roll depends on the amount of G applied and is usually difficult to control as it becomes more pronounced. You should keep constantly alert to detect the onset of a stall, because the mild buffet that constitutes a stall warning may escape your attention. Once a pending stall is recognized, reduce back pressure immediately and use power to avoid excessive loss of altitude near the ground. On most F-86H Airplanes without slats, wing roll tendency at stall is to the right. In left-hand traffic patterns, if wing roll develops because of approaching stall, most airplanes without slats will tend to roll over the top of the turn. In right-hand traffic patterns, these airplanes will tend to roll under the turn, resulting in an extreme airplane attitude. Therefore, on airplanes without slats, recommended pattern speeds must be carefully observed. These recommended speeds are a calculated percentage above stall. Since the airplane attitude would be more extreme in a stall during right-hand turns, it is especially important to maintain the recommended speeds in right-hand traffic patterns.

HIGH-SPEED ACCELERATED STALLS.

An impending high-speed accelerated stall is preceded by a distinct warning in the form of airplane buffet. As the stall is approached, you will notice a considerable increase in the buffet. On airplanes with slats, the buffet will decrease noticeably when the slats open.

WARNING

A high-speed accelerated stall below 25,000 feet can cause damage to the airplane, or it can cause you to black out and possibly lose control.

Whenever you are pulling G, be alert for any signs of general airplane buffet; be prepared to relax back pressure and, if necessary, to apply forward stick pressure to avoid the stall. However, it is permissible to fly in the buffet region, provided you do not exceed the limit load factor of the airplane. Although the use of the horizontal stabilizer as the primary longitudinal control offers more positive control than can be obtained by means of the conventional elevator, caution still should be exercised. To prevent inadvertent highspeed accelerated stalls, do not pull back abruptly, especially while the speed brakes are opening. Also, do not trim out all feel during pull-outs.

STALL RECOVERY.

Stall recovery is made in the normal manner by applying forward stick and increasing power. If the gear

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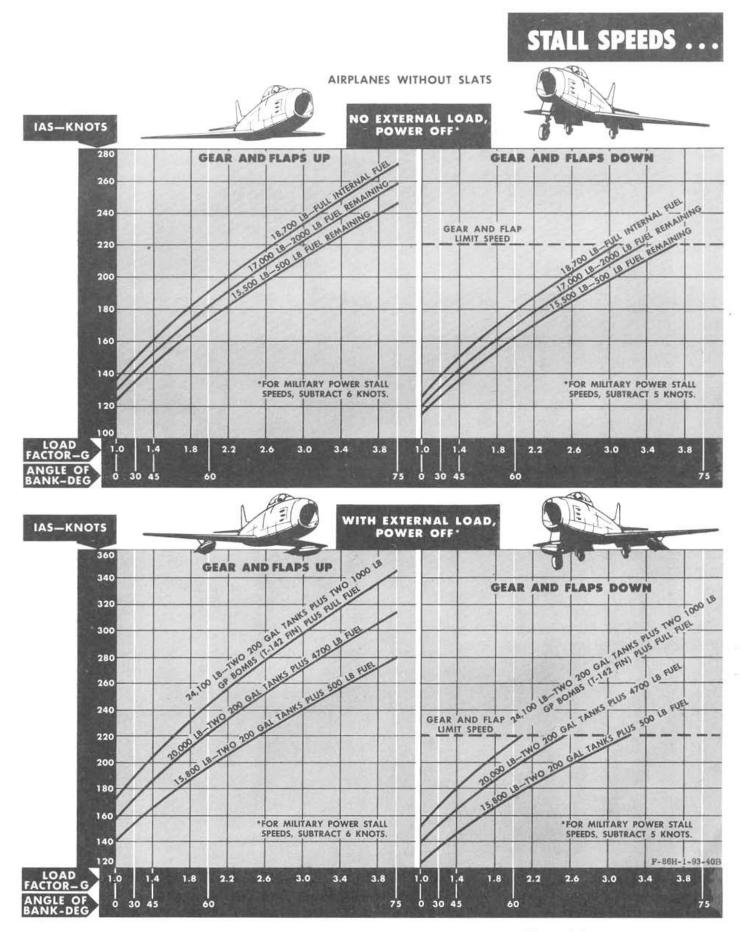
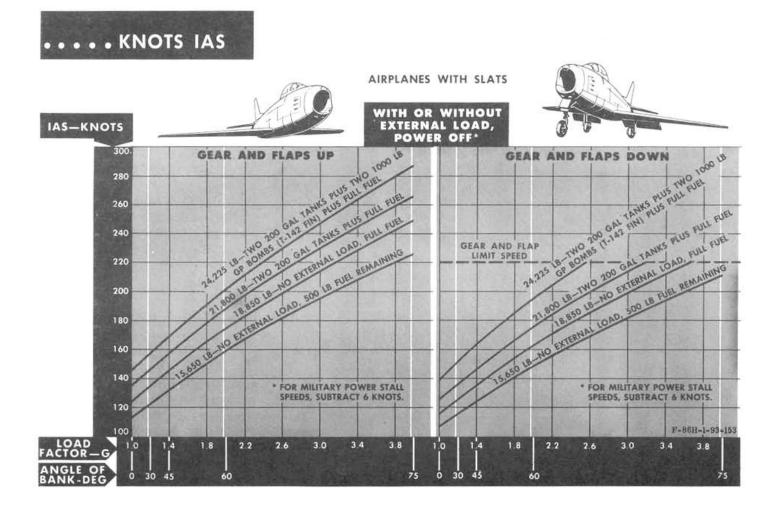


Figure 6-2



and/or flaps are down, you must be careful to avoid exceeding the maximum permissible gear- and flapsdown airspeed during stall recovery.

PRACTICE STALLS.

During a stall and recovery, the *normal altitude loss* will vary from 500 to 2000 feet. Because you might accidentally kick the airplane into a spin during these maneuvers, stalls should not be practiced below 15,000 feet altitude.

SPINS.

NORMAL SPINS.

The airplane has been spin-tested with no external load, 200-gallon drop tanks installed, gear and flaps up, gear and flaps down, speed brakes open, speed brakes closed, and power on and power off. Spin characteristics for these configurations are similar. The nose of the airplane pitches up at the beginning of the first turn of a spin and then pitches down as the spin develops, with the airplane rolling into the turn. Further turns result in a combined pitching and rolling oscillation. On airplanes with slats, the magnitude of the

oscillation is somewhat greater. On spins to the left, the airplane in all configurations tends to hesitate halfway through the first turn in a steep, nose-down attitude before the spin continues. There is no significant difference in time per turn between ailerons neutral and ailerons with the spin. For airplanes with slats, spin rates are about 25 percent less than for airplanes without slats. Altitude loss per turn is somewhat higher for airplanes with slats. The airplane will not enter a spin if ailerons are held against the direction of spin tendency at entry condition. However, if ailerons are applied against the spin after the spin has developed, the rotational rate will increase and recovery may be delayed, even using the recommended technique. Spins to the right are generally faster than spins to the left. If a spin is accidentally entered with gear and flaps down, airspeed may exceed placard limits during recovery. Therefore, retract gear and flaps immediately upon spin recovery, to avoid structural damage. Intentional spins with external loads installed are prohibited. If a spin is accidentally entered with external loads installed, use normal recovery technique; if the spin does not stop within 11/2 turns after recovery control application, jettison external loads and repeat normal recovery technique.

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SPIN RECOVERY.

To recover from a spin, proceed as follows:

- Retard throttle to IDLE upon spin entry, to prevent excessive altitude loss.
- 2. Apply full opposite rudder, followed immediately by well forward stick and neutral ailerons.
- If normal recovery technique fails, trim airplane nose-down and release all controls. About two turns will be required, but the airplane will recover itself.



Because confusion may exist as a result of the high rotational rates during a spin, you should make positive control movements by orienting control positions to the cockpit, to ensure ailerons neutral and stick forward recovery.



- Do not hold stick back during recovery, since this will prevent recovery.
- If horizontal stabilizer is trimmed airplane nose-up, airplane may not recover "hands off." Therefore, move stick forward to assist recovery.
- Do not apply ailerons against a spin either during spin or recovery, since this will adversely affect the spin (increase the rotational rate) or, during recovery attempt, may prevent recovery.
- After recovery controls are applied, spin rotation will speed up momentarily before rotation is stopped. Do not be misled into thinking that spin recovery is not effective, and do not change control positions until you are positive recovery is not being accomplished.

Flight test data indicates that about 7000 feet is the terrain clearance required to complete a recovery from a normal spin. To effect recovery from a one-turn spin (plus a one-turn recovery and pull-out), the altitude loss will be about 6500 feet. Therefore, if you get into a spin with less than 7000 feet terrain clearance, eject, since the margin of safety is too small to try a recovery. Practice spins generally should be entered at about 30,000 to 35,000 feet altitude.

FLIGHT CONTROL EFFECTIVENESS.

AILERON CONTROL.

In the low-speed range, the ailerons have control power similar to that of airplanes with conventional control systems. However, in the cruise Mach number region, the ailerons offer considerably greater roll ability. Until you are familiar with aileron effectiveness, be careful not to overcontrol in making abrupt or consecutive rolls. At low altitudes, however, during high-speed flight, i.e., below 5000 feet at speeds over 570 knots, the aileron control naturally becomes sluggish. The maximum rate of roll throughout the entire speed range is shown in figure 6-6. Because of the use of both a normal and an alternate flight control hydraulic system, each being irreversible, no "boost-out" provision is necessary. Therefore, in this airplane, particular care is not necessary in maintaining lateral trim. Should the flight control normal hydraulic system fail, automatic change-over to the alternate system occurs instantaneously, with no reduction in aileron control power or increase in pilot effort.

HORIZONTAL TAIL CONTROL.

In the low-speed range, controllability with the allmovable, hydraulically powered tail is comparable to that with a conventional control system. At high Mach numbers, it is definitely superior, since control effectiveness is not reduced by compressibility. This more positive and effective action enables you to recover more readily when conditions of G-overshoot or stall are encountered. Until you become familiar with the effectiveness of this type of control, use care to avoid overcontrolling, particularly in formation flight.

RUDDER CONTROL.

The conventional, cable-operated rudder provides directional control during take-off and landing at lower airspeeds. At higher airspeeds, the inherent stability of the airplane is such that coordinated maneuvers can be made with minimum use of the rudder.

TRIM TAB CONTROL.

AILERON AND HORIZONTAL TAIL.

Trim tabs are not necessary on either the ailerons or horizontal tail because of the features of the type of control system utilized. The hydraulic actuators at these surfaces do not transmit air loads to the pilot; therefore, control stick feel is simulated by an artificial feel system. Actuating the related trim controls merely relocates the neutral (no-load) position of the stick so that stick forces are "zeroed" for a particular flight speed

and attitude. To the pilot, this relocation of the neutral (no-load) position of the stick is identical to the result obtained from trim tab operation on a conventional control system.



Do not trim into turns or aerobatic maneuvers to reduce stick forces.

RUDDER.

The rudder trim tab is electrically controlled and actuated and is used to "zero" rudder pedal forces for a particular airspeed or flight attitude.

SPEED BRAKES.

Whenever deceleration is desired, and particularly in high-speed turns or during formation flight, the speed brakes may be opened without producing objectionable buffeting or changes in trim. An additional advantage in use of speed brakes is that they enable a steeper approach on a target at a given airspeed. In a pull-out, recovery may be effected with minimum altitude loss by first opening the speed brakes and then pulling the maximum permissible G.

WING SLATS.

Wing leading edge slats are installed on some airplanes to reduce stalling speeds in both accelerated and unaccelerated flight. However, whether open or closed, they do not appreciably change the action of the airplane during normal flight. The slats are fully automatic in operation and, depending upon the angle of attack and airspeed, float to closed, partially open, or fully open positions. Reduction in airspeed extends the slats; conversely, increase in airspeed causes the slats to retract. Figure 6-3 graphically illustrates slat characteristics for the airplane for varying G-loads and Mach numbers when at combat weight at 35,000 feet. At recommended climb and cruising flight Mach numbers, the slats will not open. However, the slats will be open at low climb and cruise Mach numbers.

LEVEL-FLIGHT CHARACTERISTICS.

LEVEL-FLIGHT STABILITY.

The stability characteristics of the airplane during speed changes from trim (near 1 G) are satisfactory. There are no stick reversal tendencies, and stick forces are light but positive. Any increase or decrease in airspeed from trim requires corresponding push or pull

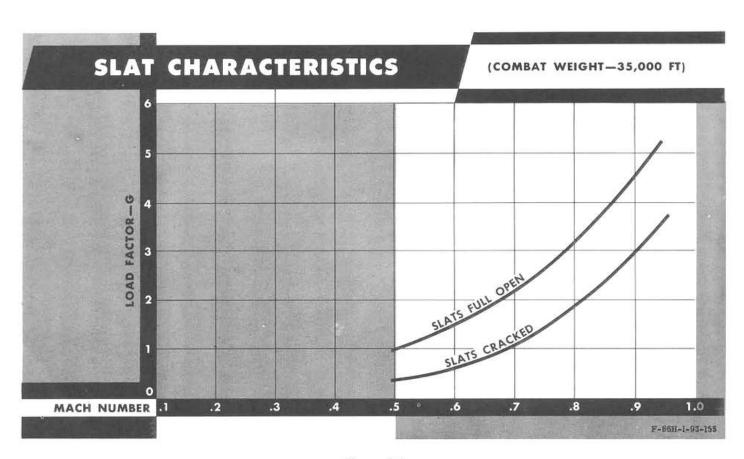


Figure 6-3

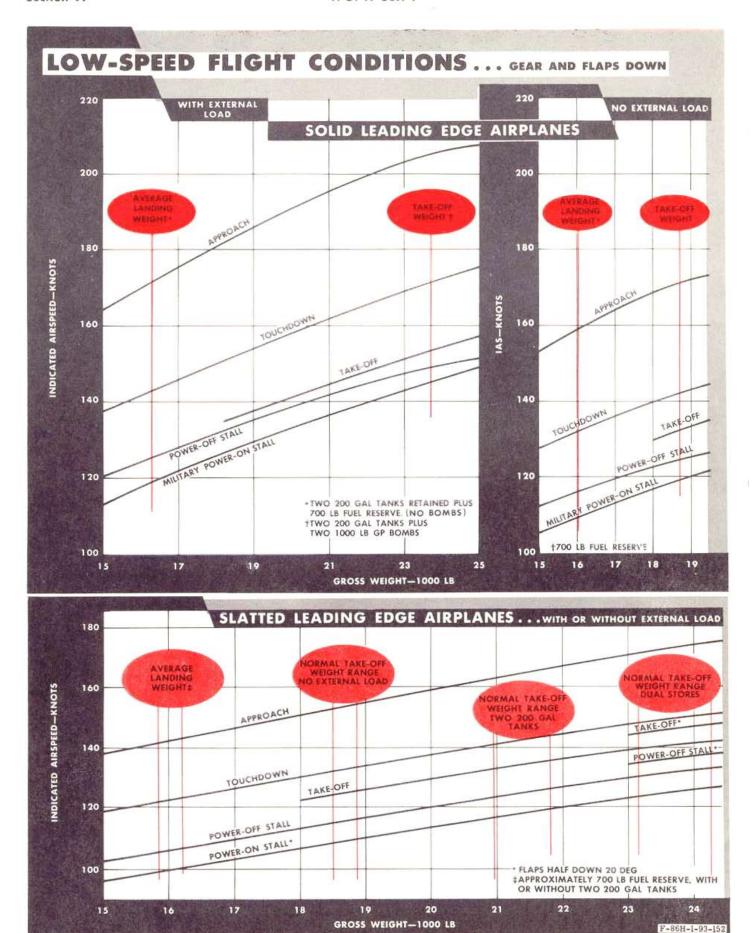


Figure 6-4

forces. On airplanes without slats, a change in airspeed from trim requires slightly more stick force than on airplanes without slats. As altitude is increased, the stick forces required to handle the airplane tend to increase slightly.

LOW SPEED.

The handling characteristics during low-speed, level flight are satisfactory, provided you carefully control airspeed when near the stall range. (See figure 6-4.) Except for a high angle of attack during take-off and landing, the airplane handles like a straight-wing fighter. The stabilizer remains effective when near the stall range; however, as stall is approached in airplane without slats, an abrupt roll-off may occur which is difficult to catch with aileron or rudder. Do not allow the positive response of the stick movement fore and aft to give a false sense of lateral control. Special attention should be given to the take-off and landing speeds shown in Section II.

CRUISE SPEED.

In the medium- to high-speed range, handling characteristics are considered good about all three axes (roll, pitch, and yaw). Compared to a conventional elevator, the controllable horizontal tail is more effective and is considerably more sensitive because of the faster airplane response to small stick movements. Therefore, it is advisable not to try close-in formation flight until you are accustomed to the control response. You will probably notice that the airplane is more sensitive to small fore and aft stick motions between .8 and .9 Mach number at low altitudes. This is more noticeable in airplanes without slats.

HIGH SPEED.

Stability and control in high-speed flight are unaffected by compressibility up to about .95 Mach number, with the exception of a slight flattening tendency in the stick force gradient for 1 G flight between .85 and .9 Mach number, At speeds about .95 Mach number, the normal nose-up tendency becomes more pronounced and requires steadily increasing push forces and forward stick movement to increase the speed of the airplane. As in other speed ranges, the use of the controllable stabilizer results in positive and immediate airplane reaction. The control power of this tail configuration is particularly noticeable above 500 knots IAS, especially in turbulent air. Caution should be used until you become familiar with the longitudinal control power available in this airplane. Wing heaviness, which may begin at about .96 Mach number, is controllable at medium and high altitudes. At low altitudes, however, where high indicated airspeeds are encountered, this wing heaviness may become a limiting factor. To regain positive control, reduce power, open speed brakes, and pull up to dissipate excess speed.

WING ROLL.

All F-86 Airplanes are subject to a wing roll condition. However, this characteristic is not of much concern except on certain airplanes which exhibit a strong tendency toward wing roll at high indicated airspeeds. This so-called wing roll or wing heaviness can be caused by two different flight influences. One is an influence induced by increasing the indicated airspeeds. The other results from a reduction in aileron control at high Mach numbers. The effect of increasing indicated airspeed works as follows: Slight variations in the angle of incidence between left and right wing panels may cause you to use a little aileron to hold a wings-level attitude at low speeds. This aileron displacement causes an aerodynamic twisting moment to be applied to the wing. As the airspeed increases, so does the twisting moment, and in such a direction that more than aileron angle must be used to regain wings-level trim. More aileron angle, in turn, means more wing twist, and so on. It can be seen that if incidence variations between left and right wing panels on certain airplanes are sufficiently large, it is possible to reach maximum aileron control before obtaining maximum level-flight speed near sealevel altitudes. It is possible to alleviate this tendency, on those airplanes which need an excessive amount of aileron for trim, by rigging the wing flaps to counteract the basic roll tendency. High Mach number wing heaviness is caused as follows: The aileron effectiveness is substantially reduced at a speed beginning around .95 Mach number. If, for example, the effectiveness fell to one-fourth of its value at low Mach numbers, and the amount of aileron required to hold the wings level at low Mach numbers were about one degree, then the amount of aileron required at high Mach numbers would have to be increased to 4 degrees. In addition to this, standing shock waves will gradually form over each wing panel and may be at slightly different chordwise locations. Since the standing shock waves can disturb the airflow behind them, they may induce a difference in lift between wing panels. This condition may add to the effect caused by the reduction in aileron control. Flap rigging to alleviate wing roll due to high indicated airspeeds will not help wing roll caused by high Mach numbers. It can be seen that, as the airplane altitude changes, the separate effects of indicated airspeed and Mach number on wing roll will combine in varying proportions. Generally, you should be aware of this wing heaviness characteristic of the particular airplane you are flying, so as to anticipate wing roll during combat at altitude, and also to make the required allowance during high-indicated-airspeed, low-level passes.

MANEUVERING FLIGHT.

MANEUVERING-FLIGHT STABILITY.

The stick forces produced during maneuvering flight are relatively uniform throughout the full speed and altitude ranges of the airplane. At very high Mach numbers and also at speeds below 200 knots IAS, the stick forces required to obtain a given G increase slightly.

Although this increase in stick forces may appear somewhat unusual during your first few hours of flight time in this airplane, remember that the absolute maximum stick force required at all airspeeds always remains within your normal control capabilities, since it is supplied artificially. In addition, the use of an artificial feel system allows the high Mach number range of the airplane to be exploited fully.

MANEUVERABILITY.

Maneuvers can be done with relative ease at all Mach numbers and airspeeds. All maneuvers can be performed with very little rudder action. The airplane is near its peak efficiency in maneuvering in the climb and cruise speed range, thus ensuring excellent handling qualities and combat performance. At all altitudes, more G can be pulled before stall on airplanes with slats than on airplanes without slats. Therefore,

maneuverability is increased at high altitudes on airplanes with slats. See figure 6-5 for a comparison of maneuvering characteristics between airplanes with slats and airplanes without slats. The maximum rate of roll (figure 6-6) at any one altitude occurs near the best climb speed for that altitude, and the peak airplane G response for the pull force you exert occurs in this speed range. Although speed is of primary importance, several other factors enter into any discussion of fighter maneuverability: climb potential, radius of turn, and time to turn. Climb potential is the difference between the graphical curves of the power available and the power required for straight-and-level flight. The difference between the two curves represents the excess thrust or power available for maneuvering flight, i.e., the extra power available to increase speed, increase rate of climb, or pull more G. The point of greatest difference between the two curves is the best climb speed. For the clean airplane, this best climb speed increases from about .76 Mach number at sea level to about .83 Mach number at 35,000 feet, then remains constant above that altitude. (See figure 6-7.) The best Mach number range at any given altitude is from the best climb speed to the maximum practical speed. Therefore, to maintain the maximum possible speed advantage, always fly at or above the best climb speed in combat. Below best climb speed, the rate of climb falls off rapidly and it also takes much longer to accelerate to high speed.

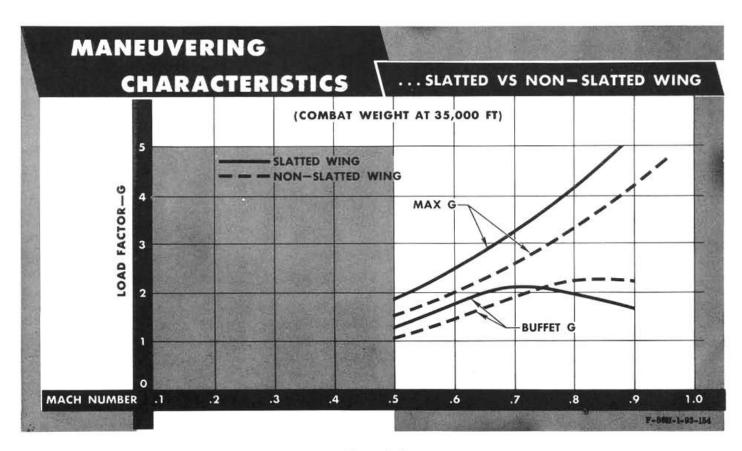


Figure 6-5

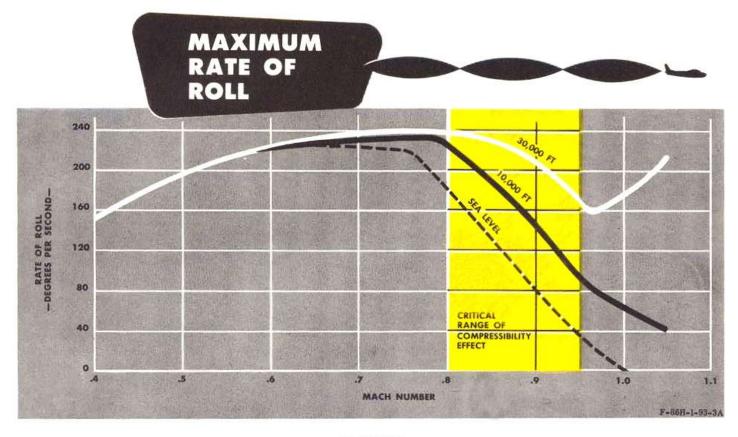


Figure 6-6

TURNING-RADIUS CONTROL.

Radius of turn or time to turn is important because it determines whether you can bring your guns to bear on a target or cease being a target yourself. At any constant Mach number, radius of turn increases with an increase in altitude and also increases with an increase in airspeed. These two factors are of primary importance to the control of turn radius, and both may be utilized to advantage in combat. If a loss of altitude is a disadvantage in combat, a reduction in speed may be used in turning-radius control. One method of slowing down is to exchange excess speed for altitude, as in a sharp climbing turn or Immelmann. Another is to pull into a maximum usable-G level turn and, if necessary, open the speed brakes as required, remembering to ease off on the stick while the brakes are opening to maintain the same G. In either case, be careful to prevent the speed from falling below the best climb speed.

RECOMMENDED SPEED FOR MINIMUM-RADIUS TURNS.

The recommended speed for minimum-radius turns is the best climb speed at any altitude. Therefore, in combat, you should not turn with a slower airplane (which generally has a lower best climb speed) because it would outturn your airplane every time. You would gain a distinct advantage by inducing a faster airplane (which generally has a higher best climb speed) to turn with you. If operating above best climb speed, open the speed brakes or lose speed by gaining altitude to make the fastest practical turn, but do not allow the speed to drop below that for best climb. If operating at or very near best climb speed, use full throttle to make the fastest practical turn, pulling only enough G to allow the best climb speed to be maintained. These, of course, are only general rules of procedure; in actual practice, situations may arise in which further loss of speed or even loss of altitude to maintain speed is desirable. The best climb speeds are shown in figure 6-7.

DIVES.

DIVES AND ACCELERATED FLIGHT.

In high Mach number dives and maneuvers, airplane stability is good. Stick forces are relatively light, and the airplane is easily controllable up to the limit Mach numbers and load factors that may be applied.

G-OVERSHOOT.

A distinctive characteristic of the airplane with which you must become completely familiar is its response to rapid pull-outs at higher Mach numbers. Because of the basic pitch characteristics at these Mach numbers, flight conditions can possibly be encountered in which the G-limit is exceeded inadvertently. The conditions at which this overshoot or "dig-in" may occur vary with Mach number, altitude, gross weight, and G. However, it is not necessary to remember the various combinations of these factors in order to avoid overshoot. The overshoot is likely to begin at the buffet boundary, that is, at the G at which you notice a distinct increase in the vibration or buffet of the airplane. This buffet increase or boundary is the warning of impending overshoot. To avoid overshoot and resultant possible damage to the airplane, observe the G-limits of the airplane and be prepared to immediately decrease the rate of pull-out when encountering buffet. This does not mean flight cannot be made in the buffer region, but it does mean that pulling up rapidly into the buffet region is dangerous. Because of the higher available load factor before buffet on airplane without slats, familiarization with airplane response during rapid pull-outs is recommended, particularly in the medium altitude range (15,000 to 30,000 feet). Remember, although the controllable horizontal tail permits effective and positive corrective action, it does not prevent initiation of oversboot.

RUDDER BUZZ.

During high Mach number dives (about 1 Mach number at high altitudes and .94 Mach number at medium and low altitudes), you may encounter a high-frequency rudder vibration called "rudder buzz." This condition is not a normal characteristic and should not be considered as such. It should not occur when the rudder damper, which is designed to prevent the buzz, is properly installed and serviced. If rudder buzz is encountered, reduce speed rapidly by a low-load pull-out. Any abnormal vibration during high-speed dives should be recorded in the DD Form 781.

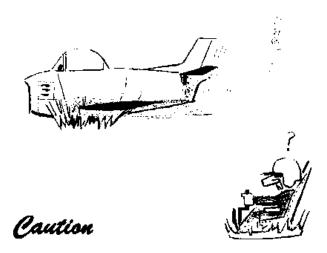
DIVE RECOVERY.

Because of the airplane trim changes which occur during pull-ups at high Mach numbers, the following procedure is recommended for recovering from high Mach number dives or maneuvers:

- 1. Open speed brakes.
- 2. Pull stick back as necessary to execute desired pull-out.

ALTITUDE LOSS IN DIVE RECOVERY.

The altitude lost during dive recovery is determined by four interdependent factors: (1) angle of dive, (2) altitude at start of pull-out, (3) airspeed at start of pull-out, and (4) G maintained during pull-out. Because these factors must be considered collectively in estimating the altitude required for recovery from any dive, their relationship is best presented in chart form, as shown in



During dive recoveries at low altitude, use caution to avoid overstressing the airplane, because excellent elevator effectiveness and light stick forces make it easy to exceed the G-limitations of the airplane.

figure 6-8. Note that one of the charts is based on a 4 G pull-out, and the other on a 6 G pull-out. Compare the altitude lost during a recovery from a 4 G pull-out with that lost during recovery from a 6 G pull-out; also compare the effects of variations in the other three factors. Remember that a value obtained from either chart is the altitude lost during recovery-not the altitude at which recovery is completed. Therefore, in planning maneuvers that involve dives, consider first the altitude of the terrain and then use the charts to determine the altitude at which recovery must be started for pull-out with adequate terrain clearance. In using the charts, you should allow for the fact that without considerable experience in this airplane, you cannot determine exactly what your dive angle and speed are going to be at the start of the pull-out. If you come out of a split "S" or other high-speed maneuver in a near-vertical dive, speed builds up rapidly. Consequently, until you know the airplane well, go into the chart at the highest speed and dive angle you might expect to reach after completing your maneuvers. If, for instance, you are in a 90-degree dive at an airspeed above .8 Mach number and you wait until 10,000 feet above the terrain to start your pull-out, you will have to make a 6 G pull-out; a 4 G pull-out will not permit you to clear the terrain. (See figure 6-9.) Maneuvers should be planned so that if they end in a near-vertical dive, the airplane may be pulled on through to a shallower dive angle before the speed becomes excessive, or too low an altitude is reached.

Note

It is a good idea to memorize a few specific conditions from the dive charts so that you have a basis for judgment on pull-outs.

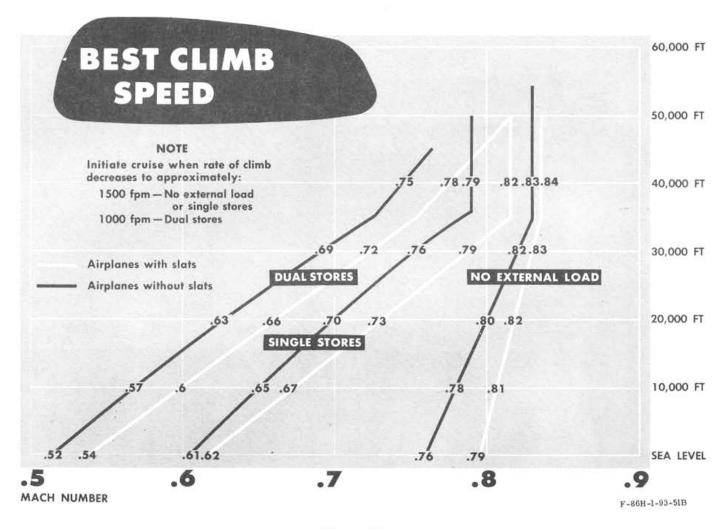


Figure 6-7

LETDOWN.

Normally, the most economical letdown speed with a clean airplane is .8 Mach number with the throttle at IDLE. For emergency letdown, descent can be made in minimum time by a vertical dive (power on, if available), and the rate of descent is limited only by the maximum allowable airspeed and/or Mach number.

FLIGHT WITH EXTERNAL LOADS.

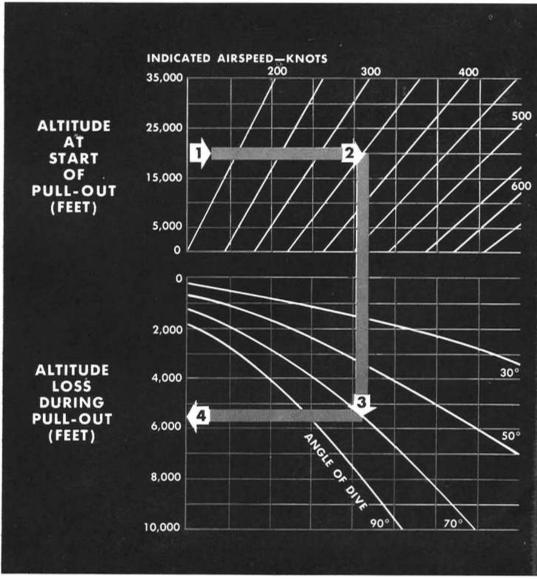
Flying qualities of the airplane are essentially unaffected by drop tanks or externally mounted armament. However, because of the increased drag and weight when external stores are carried, naturally take-off distances will be greater and rate of climb and acceleration will be reduced. Also, maximum level flight and diving speeds will be somewhat lower than for the clean airplane, the reduction in speed depending on the type of stores carried. Airplane stability and control are unaffected by the presence of rockets, and dives up to the maximum speed obtainable can be performed without

difficulty. Excessive buffeting of the wing flaps, aileron vibration, and/or lateral oscillation, depending on the type of external stores carried, will be present at speeds in excess of the established limits. (Refer to "Airspeed Limitations" in Section V.) Vibration or oscillation increases as Mach number increases and, at slightly higher Mach numbers, the buffeting becomes so pronounced that it can be felt in the control stick. Bomb dropping is evidenced by a momentary pitch-up of the airplane; however, the pitch-up is not objectionable, since the airplane immediately returns to trim.

ASYMMETRICAL STORE EFFECTS.

Adding a drop tank or armament store under the wing alters the flow or pressure distribution around the wing in that area so that there is a loss in lift. The actual number of pounds of lift lost because of the presence of the store grows rapidly as the indicated airspeed increases. The ailerons steadily lose their power as the indicated airspeed increases, because the wings twist when they are deflected. It may be anticipated,

ALTITUDE LOSS IN DIVE RECOVERY

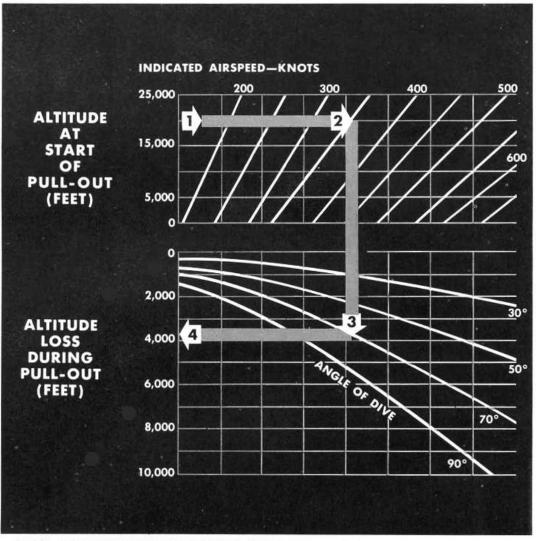


ALTITUDE LOSS AT CONSTANT 4 G PULL-OUT

F-86H-1-93-9A

Figure 6-8





SELECT APPROPRIATE CHART DEPENDING UPON ACCELERATION (4 G OR 6 G) TO BE HELD IN PULL-OUT; THEN-





Enter chart at altitude line nearest actual altitude at start of pull-out (for example, 20,000 feet).



On scale along altitude line, select point nearest the IAS at which pull-out is started (350 knots IAS).



Sight vertically down to point on curve of dive angle (70°) directly below airspeed.



Sight back horizontally to scale at left, to read altitude lost during pull-out (constant 4 G pull-out, 5700 feet; constant 6 G pull-out, 3800 feet).

F-86H-1-93-10A

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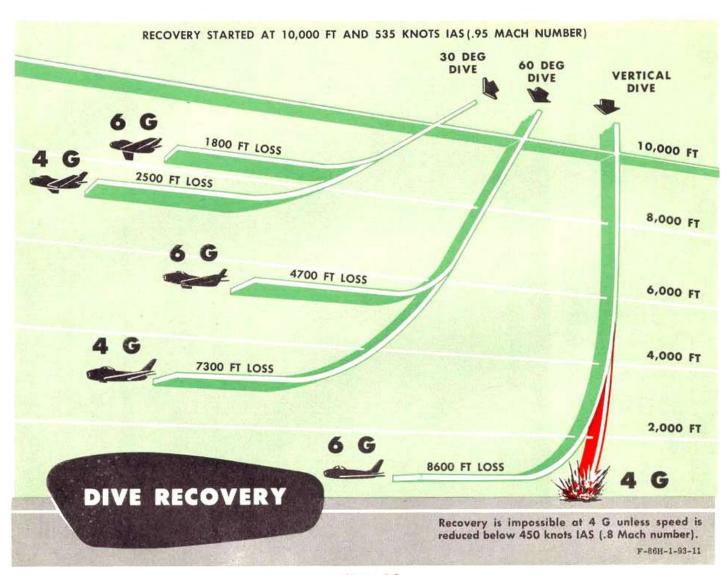


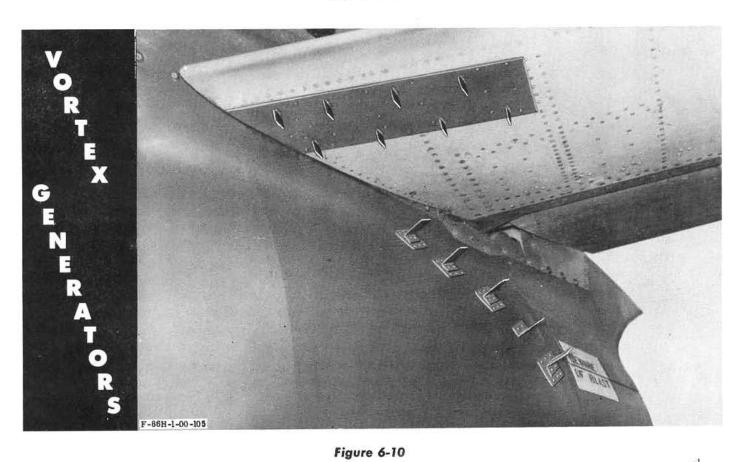
Figure 6-9

therefore, that at some high indicated airspeed, the ailerons no longer would be able to hold the wings level if asymmetrical stores were carried. The greater the asymmetry (either weight or installation), the more the condition is aggravated. Of course, a minimum speed also exists below which the ailerons cannot produce enough rolling moment to offset a certain lateral unbalance of weight. These effects are in roll. In addition, the effect of an asymmetrical external store configuration in yaw is to cause a sideslip in order to maintain constant heading. Naturally, rudder pedal forces become high and rudder trim has to be used. However, rudder trim loses effectiveness at high Mach numbers and, therefore, a high-speed limit is created. The effect of various combinations of asymmetrical external stores on either roll or yaw is summarized in figure 5-5 as minimum and maximum speed boundaries between which you should stay. If you have taken off with, or somehow attained, an asymmetrical external loading configuration in flight, do not penetrate beyond the

speed boundaries for the applicable asymmetrical condition; and if you plan to make an unbalanced jettison from a symmetrical external configuration, make certain you are within the applicable boundaries.

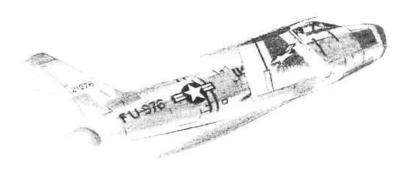
VORTEX GENERATORS.

To minimize buffet caused by shock waves between .89 and .95 Mach number, a series of small vanes (figure 6-10) are installed on the underside of the horizontal tail and on the fuselage below the horizontal tail. Installation of these vanes eliminates the turbulent airflow which produces the buffet; and, with the elimination of the turbulent airflow, airplane drag is also reduced. These vanes are termed "vortex generators" because they create small whirlpools of air, commonly called "vortexes." These vortexes stir up the slow-moving air found close to the fuselage, thus allowing the smooth flow of air to continue further aft on the fuselage before becoming turbulent.



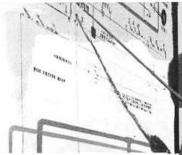


Section VI T. O. 1F-86H-1





Section VII

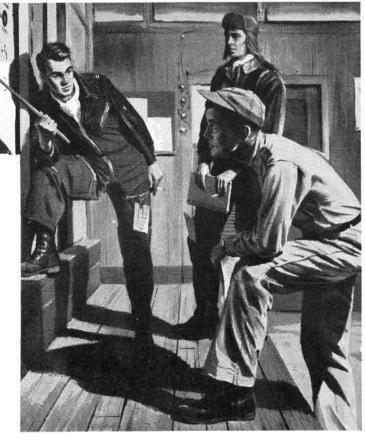


SYSTEMS OPERATION

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COMPRESSOR STALL.

The possibility of compressor stall is unlikely during operation on the main fuel system. However, in the event of main fuel regulator malfunctions, improper fuel scheduling, or inlet guide vane failure in the open position, a compressor stall may occur during any rapid advancement of the throttle. Should the main fuel regulator malfunction, rapid throttle advancement may inject more fuel into the combustion chambers than the engine can safely use for acceleration at the existing rpm. The burning of this additional fuel increases the pressure ratio across the compressor, beyond the point where the compressor can operate in an unstalled condition. Stall occurs because of attempting to exceed the amount of "lift" of which the individual compressor stages or blades are capable. During stall, an alternate breakdown and build-up of airflow occurs, resulting in a pulsating condition characteristic of stalled operation. If the engine is allowed to continue operation in a



stalled condition, combustion temperatures can increase until serious damage occurs to the turbine section of the engine. A roaring, pulsating noise and heavy vibration accompany compressor stall and may precede any engine instrument indication of changing engine conditions. In addition to the pulsating noise and vibration, the following indications of compressor stall may be present, depending upon the severity of the stall: rapidly rising exhaust temperature, failure of the engine to accelerate, a long flame from the tail pipe, and loss of thrust. If the stall is encountered during a rapid engine acceleration, action should be taken to eliminate it by immediately retarding the throttle. In flight, the throttle should be readvanced slowly while carefully monitoring exhaust temperature. However, if after the throttle is retarded, exhaust temperature continues to drop below 100°C, flame-out has occurred, and an air start should be attempted. (Refer to "Engine Air Start" in Section III.) In general, injection of excessive fuel into the engine at altitudes below 25,000 feet tends to cause compressor stall. Above this altitude, flame-out usually results. The inlet guide vanes are utilized to maintain compressor air flow and pressures for optimum acceleration through the critical range (below 7000 rpm). Failure of the inlet guide vanes in the open position creates compressor flow conditions which can result in stall during rapid throttle advancement when engine rpm is in the critical range. (Failure of the guide vanes in intermediate positions results in less violent stall conditions.) The stall characteristics and recovery procedures outlined in this paragraph are applicable to compressor stall resulting from inlet guide vane failure in the open position.

WARNING

If compressor stall occurs during rapid throttle advancement while operating on the main fuel system, main fuel regulator malfunction or inlet guide vane failure in the open position should be suspected. Consequently, use extreme caution during the landing phase, since any attempt to rapidly increase power, if needed, will probably result in compressor stall, reduced thrust, and possibly flame-out.

INLET GUIDE VANE FAILURE.

Failure of the inler guide vanes in the closed position will result in a substantial loss in thrust in the high engine speed range (above 7000 rpm) due to restriction of engine airflow. The closed position failure of the inlet guide vanes will most likely be detected by abnormally low exhaust temperatures in the high power setting ranges. Engine fuel flow will also be affected in a like manner; however, this change is not always as obvious because of effects of outside air temperature and pressures. Failure of the inlet guide vanes in the open position can result in compressor stall during rapid throttle advancement. (Refer to "Compressor Stall" in this section.) Failure of the guide vanes in an intermediate position may cause either effect of the two extreme position failures in lesser degrees. If any of the preceding conditions are encountered during ground operation, the engine should be thoroughly inspected before any flight is attempted. If any of these conditions are encountered in flight, extreme caution should be used in engine operation during the remaining flight period. The flight should be terminated as soon as practicable.

WARNING

Extreme caution should be used during the landing phase under these conditions, since any attempt to rapidly increase power, if needed, can result in compressor stall, reduced thrust, or flame-out.

FLAME-OUT.

Flame-outs are just what the name implies and are caused by combustion chamber fuel-air mixtures that are either too rich or too lean to support combustion, or by complete fuel starvation. These conditions leading to a flame-out may be the result of a system component malfunction. However, flame-outs can also be caused by violent throttle manipulation at high altitude or by maneuvers in which negative G is maintained for excessive periods, causing fuel starvation. Flame-outs are indicated by loss in thrust, drop in exhaust temperature, and possibly by loud noise similar to engine backfire.

GROUND TEMPERATURE STABILIZATION CHARACTERISTICS.

It is characteristic of the J73 engine to require approximately 4 to 6 minutes for engine exhaust gas temperature to rise to a stabilized maximum during operation at full open throttle (100% engine rpm) on the ground. This characteristic may be noticed on take-off, since the normal procedure is to advance the throttle to full open just prior to initiating the take-off roll; this results in an exhaust temperature during take-off of approximately 600°C.

IN-FLIGHT EXHAUST TEMPERATURE CHARACTERISTIC.

With the J73 engine, it is characteristic for exhaust temperature to tend to rise as flight altitude increases. In order to prevent exhaust temperature from exceeding Military Power limit, it will be necessary to reduce rpm, as required, by retarding the throttle.

ENGINE FUEL CONTROLLER SPEED REGULATION.

The speed governing characteristics of the engine fuel controller may allow engine speed to decrease slightly at full throttle as flight altitude is increased. Locked throttle speed losses up to 1% rpm may be encountered during climb and are considered acceptable. In cases where such loss occurs, the regulator speed drop-off condition can readily be detected and evaluated by noting engine speed and exhaust gas temperature drop-off during climb with full throttle. The condition should not be confused with manually throttling back during climb to maintain limit exhaust gas temperature.

AMBIENT TEMPERATURE EFFECTS ON EXHAUST TEMPERATURE.

Changes in ambient air temperatures will have a related effect on operating exhaust temperature for a T. O. 1F-86H-1 Section VII

given adjusted engine. The effect of normal day to day outside air temperatures is negligible, but seasonal changes are taken care of by adjusting the exhaust outlet area through the use of tail-pipe segments. It has been found that on some -3F engines the range of adjustment in the exhaust outlet may not be sufficient for proper engine adjustment under extreme hot weather conditions (100°F day and above). Therefore, on hot days, it may be necessary on these engines to retard the throttle slightly when stabilizing exhaust temperature on the ground at 100% rpm in order to maintain exhaust temperature within the maximum limit. Generally, it will be unlikely that this condition will be encountered; the engine is not usually operated at full power on the ground long enough for exhaust temperature to rise to the stabilized maximum.

NOISE AND ROUGHNESS.

Any unusual noise or roughness noticed in flight that can definitely be attributed to the engine and cannot be eliminated when the engine speed or altitude is varied, indicates some mechanical failure and requires an immediate landing. The most probable source of noise in flight is the pressurization system; when cabin pressure is dumped for a few minutes, noise should stop. If noise continues, engine should be checked during shutdown after landing. On some airplanes, roughness may develop in the engine during operation at high power above 15,000 feet. Engine roughness can usually be eliminated if the rpm is changed; however, if the roughness continues, the pilot should land as soon as possible.

TURBINE NOISE DURING SHUTDOWN.

The light scraping or rasping noise heard during engine shutdown results from interference between the turbine buckets and turbine shroud ring. Contact of the two parts is due to the tendency of the shroud to shift and distort under varying temperature conditions induced by engine shutdown. The scraping, while undesirable, does not damage either part. To minimize the scraping, it is necessary to run the engine at 50% rpm for approximately 3 minutes before shutdown after any high-power operation (either flight or ground). If, despite this precaution, heavy scraping does occur on shutdown, no attempt to restart engine should be made until turbine temperature has dropped sufficiently to provide adequate clearance between the buckets and shroud. If start must be made when interference is suspected, have the ground crew air-motor the starter prior to starting the engine.

SMOKE FROM TURBINE DURING SHUTDOWN.

During engine shutdown, fuel may accumulate in the turbine housing, where heat of the turbine section causes

the fuel to boil. (Although a turbine housing drain is provided, it may not prevent accumulation of some fuel.) Presence of this residual fuel in the engine will be indicated by emission of fuel vapor or smoke from the tail pipe or inlet duct.

WHITE SMOKE.

Boiling fuel, indicated by the appearance of white fuel vapor, is not injurious to the engine, but does create a hazard to personnel, since the vapor may ignite with explosive violence if allowed to accumulate in the engine and fuselage. Therefore, all personnel should keep clear of the tail pipe for at least 10 minutes after shutdown and at all times when fuel vapor or smoke issues from the tail pipe.

BLACK SMOKE.

The appearance of black smoke out of the tail pipe after shutdown indicates burning fuel, which will eventually damage the engine and should be cleared immediately as follows:

- 1. Throttle OFF.
- 2. Fuel system selector switch at EMER (airplanes with -3D or -3E engines).
 - 3. Battery switch on.
 - 4. Engine master switch on.
- Hold ground starter button momentarily depressed.
- 6. When starter operation ceases (in approximately 4 seconds), turn engine master and battery switches OFF, in that order.

TAIL-PIPE SEGMENTS.

On turbojet engines equipped with fixed-area exhaust outlets, the exhaust temperature is a direct indication of thrust output, or power, at a given speed. As the exhaust temperature is increased, the velocity of the exhaust jet is increased and, consequently, engine thrust. It is apparent that although exhaust temperature should be kept below the maximum operating limit to prevent excessive engine wear, it must be held near the limit to obtain maximum thrust output. In order to obtain maximum operating exhaust temperature, tail-pipe segments (figure 7-1) are added to, or removed from, the aft end of the tail pipe. These segments correctly adjust the exhaust outlet area to produce, as nearly as possible, a stabilized exhaust temperature of 640°C at 100% rpm during ground run-up. Fixed-area outlets can be adjusted for only one set of operating conditions; thus, for a majority of operating conditions, the exhaust outlet will

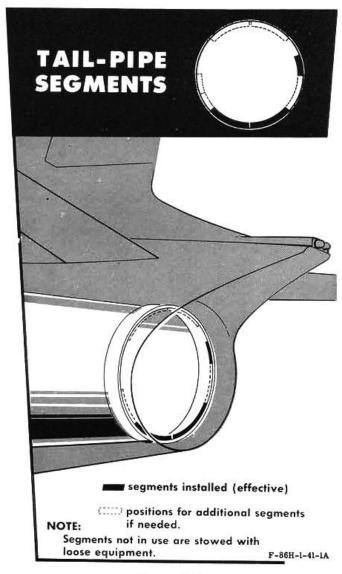


Figure 7-1

usually be too large or too small, resulting in low or high exhaust temperatures, respectively. When tail-pipe segments are added, increased thrust will be evidenced on an engine previously operating with low exhaust temperature. The initial segments are installed at the bottom of the tail pipe. As additional segments are needed, they are installed as symmetrically as possible on each side of the tail pipe, starting from the bottom of the tail pipe. Initial segment installation beginning at the top of the tail pipe is not recommended, because it will reduce the down-tail load. Down-tail loading aids nose-wheel lift-off and is a reaction caused from the tendency of the jet exhaust stream to cling to the upper fairing shelf aft of the tail pipe. Whenever this tendency to cling is spoiled, the normal down-tail load is lost. Whenever this down-tail loading is reduced or lost, nose-wheel lift-off speed will increase substantially. Efficient minimum-run take-offs depend upon early nose-wheel lift-off; thus, if the tail-pipe segments are improperly located, a longer ground run will be required during take-off.

Note

If more than $4\frac{1}{2}$ tail-pipe segments are installed, the exhaust temperature indicating system may not be functioning properly. If so, the engine can be operated at overtemperature condition without proper indication on the exhaust temperature gage. Therefore, if more than $4\frac{1}{2}$ tail-pipe segments are installed, determine from responsible ground personnel if the exhaust temperature indicating system has been checked.

FUEL SYSTEM.

Operation of the fuel system is essentially automatic, requiring no action from the pilot during flight. However, it is essential that the pilot keep the following precautions in mind:

- Keep fuel selector switch at NORM for all normal operation, except during take-off and in case of actual main fuel regulator failure.
- 2. Use fuel from the outboard tanks first. When outboard tanks are empty, switch to inboard tanks (if carried) or turn drop tank pressure switch to OFF.

CAUTION

If empty inboard drop tanks are retained, the drop tank pressure switch should be left at INBD to maintain pressurization to prevent possible tank collapse during descent.

After all fuel is transferred from the drop tanks, fuel from the internal tanks will be used automatically.

3. Before depressing fuel filter deicer button,* be sure fuel filter ice warning light burns steadily. As deicer alcohol supply is of 3-minute duration, deice no longer than necessary to extinguish warning light.

HYDRAULIC SYSTEMS.

Hydraulic system pressure should be checked periodically during flight. The utility hydraulic system pressure can be checked by placing the hydraulic pressure gage selector switch at UTILITY and reading the gage for proper system pressure. To check flight control hydraulic system pressure, fly straight and level for 30 seconds; then, with hydraulic pressure gage selector switch positioned at NORMAL, read flight control normal system pressure on pressure gage. Continue holding control

stick steady, and position hydraulic pressure gage selector switch at ALTERN to read pressure in flight control alternate hydraulic system.



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) changeover does not occur, or just prior to entering the landing pattern when flying on the alternate system after normal system failure.

With conventional flight control systems, intermediate and maximum rate of control movements are both directly proportional to pilot effort. In constant-pressure, irreversible hydraulic systems, such as on this airplane, the rate of control movement will vary with pilot effort only until the actuator valve is completely open. Any additional effort by the pilot will not result in further increase in rate of movement. Thus, the maximum rate obtainable is not determined so much by pilot effort as by the hydraulics and kinematics of the system. With a conventional system, almost any malfunction which could occur that would limit maximum rate of control movement would also be readily apparent at some lesser rate. It would be difficult for it to continue undetected. The same is not true of irreversible systems. Should there be some restriction in rate of flow of hydraulic fluid in the irreversible system, it will not be apparent until an attempt is made to move the controls faster than the restriction will permit. Also, the rate of movement imposed by the restriction will be maximum, regardless of pilot effort. Failure to lift the nose wheel during take-off can result from the fact that the stabilizer actuator control valves of the normal and alternate systems were not properly synchronized. If the valves are not synchronized, available control valve displacement is reduced, resulting in a corresponding reduction

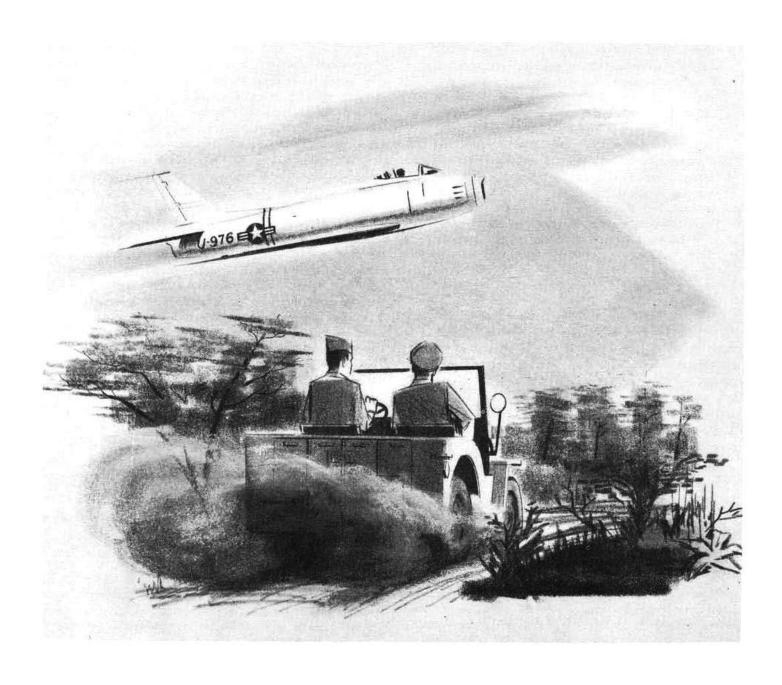
in maximum rate of control movement. This reduced rate would obviously restrict airplane response. The same effect would occur if restriction in hydraulic flow were caused, for example, by improper attachment of quick-disconnect fittings. Experience shows that this reduction in rate of control movement can mislead the pilot and at the same time escape detection by maintenance personnel. Whether the pilot encounters or notices the malfunction depends upon individual technique and whether the pilot desires to move the controls at a rate faster than the malfunction would permit. It is during take-off and landing that full stick deflection is most often necessary. Should the stick fail to move at the normal rate, the pilot may apply greater than normal pressure and gain the impression that he has full stick deflection. Because of the short time involved and the surprise element, the pilot may have an erroneous impression of how far the stick moved. Since a ground check will show that full stick deflection occurs (ignoring the fact that it can be moved only at a slower than normal rate), the nature of the malfunction remains undetected. Another pilot using a slower technique and not having occasion to move the stick at rapid rates will not encounter the malfunction. During nose wheel liftoff on take-off, during misjudged and consequently late flare-out on landing, and in the technique of "feeling for the runway," a pilot may assume he is getting the desired stick deflection, whereas restriction of hydraulic fluid flow for any of the reasons mentioned may actually be limiting the rate and consequently the amount of immediate stick deflection. These examples are based on use of the horizontal stabilizer, but other difficulties could also result from similar malfunctions affecting aileron control. It is important to check rate of control movement prior to flight. If the rate is slower than normal, based on experience in other F-86H Airplanes, malfunction of the flight control system, as previously described, should be suspected.

LANDING GEAR.

If the landing gear unsafe warning light should come on during flight, indicating an unsafe landing gear condition, airspeed should be reduced to below the gear-down limit airspeed before an attempt is made to correct the unsafe condition. This is necessary to prevent air loads from damaging the landing gear doors. When airspeed is below the gear-down limit airspeed, cycle landing gear down and up. If the warning light remains on after the gear is cycled several times, land as soon as possible.

Section VIII CREW DUTIES

Not applicable





Except for some repetition necessary for emphasis or continuity of thought, this section contains only those procedures that differ from, or are in addition to, the normal operating procedures in Section II.

INSTRUMENT FLIGHT PROCEDURES

Under absolutely no circumstances except military necessity should this airplane be flown entirely by reference to flight instruments unless the pilot is a qualified instrument pilot and a holder of AF Form 8A (green) or AF Form 8 (white) instrument certificate. The pilot should be thoroughly familiar with existing Air Force regulations, Technical Orders, and other publications applicable to all-weather operation. Special attention should be given to the fuel planning phase of the preflight planning of IFR flights. As certain phases of instrument flying may require delays in departures and additional time for letdown procedures, which are often made at low altitudes, the endurance factor is critical. Therefore, it is necessary to plan your flight accurately, with special attention to traffic density and types of approaches at your destination. The effect of a go-around on fuel reserve (because of missedapproach or traffic control emergencies) must be considered. This airplane has satisfactory stability while being flown on instruments, and its flight handling characteristics during all-weather operation are satisfactory. Flight instruments provided for basic instrument flying and radio navigation enable the pilot to make low-frequency range, automatic direction finding (ADF), manual direction finding (MDF), and ground-controlled approach (GCA) type instrument approaches.

BEFORE ENTERING AIRPLANE.

Remove pitot cover.

ON ENTERING AIRPLANE.

- 1. Have external power source connected.
- 2. Map case: Radio Facility Charts, Pilot's Handbooks—Jet, and other necessary publications and charts available in the cockpit.

- 3. Check pitot heater operation with crew chief.
- Check rate-of-climb indicator at zero.
- Check attitude gyro or vertical gyro indicator for erection and retraction of "OFF" indicator flag. For quick erection during scramble operations, cage and uncage attitude gyro 30 seconds after power is turned on.
- 6. Check slaved gyro magnetic compass for stabilization of needle and check for 180-degree ambiguity against stand-by compass 3 to 4 minutes after power is turned on.
- 7. Check command radio with tower, and check approach control, ground-controlled intercept (GCI), and GCA channels.
- 8. Check radio compass for frequency alignment, antenna reception, manual loop rotation, and ADF operation.
- 9. Tune radio compass low-frequency range, or homer that serves field of departure, identify it, and turn function switch to COMP.

AFTER STARTING ENGINE.

- 1. Check operation of main and alternate inverters.
- 2. Check generator.
- 3. Set clock with tower time check.
- 4. Set altimeter. Note error against field elevation to be taken into consideration when resetting altimeter during flight.

Note

If altimeter error is in excess of 75 feet, do not accept airplane for IFR operation.

TAXIING.

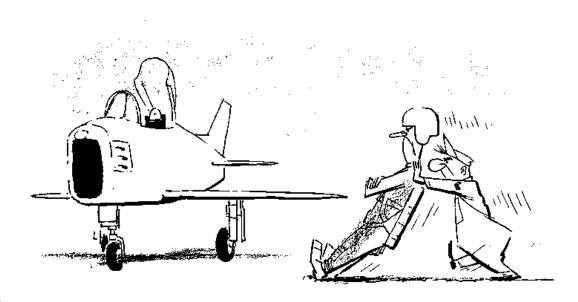
- 1. Check turn-and-bank indicator for deflection of turn needle during turns.
- Check radio compass for relative bearing to selected station during various taxi operations.
- 3. Check slaved gyro magnetic compass for actual changes of headings on taxi ways against instrument indications.
- 4. Pitot heater switch ON, if necessary, prior to rolling into take-off position.



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

BEFORE INSTRUMENT TAKE-OFF.

- 1. Line up visually with centerline of runway.
- 2. Rotate slaved gyro magnetic compass course index until runway heading is aligned with top of dial.
- 3. Adjust attitude gyro reference airplane for level indication by aligning it with index on each side of instrument face.
- 4. Windshield rain and ice removal (anti-icing) switch ON if icing is expected.
- Windshield and canopy defrost handle INC, as needed.
 - 6. Wing flap lever bown.
 - 7. Hold brakes and advance power.



INSTRUMENT TAKE-OFF.

- 1. Recheck all instruments, and release brakes.
- 2. Maintain runway heading with nose wheel steering until rudder becomes effective (at about 60 knots IAS).
 - 3. Take off at normal VFR speed.
- 4. As airplane breaks ground, immediately establish an initial climb attitude on attitude indicator at a rate of 500 fpm.

WARNING

A slight amount of pitch error in the indication of the MM-2 attitude indicator will result from accelerations or decelerations. It will appear 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 will be most noticeable at the time the airplane breaks ground during the take-off run. At this time, a climb indication error of about 11/2 horizon bar widths will normally be noticed; however, the exact amount of error will depend upon the acceleration and elapsed time of each individual take-off. The erection system will automatically remove the error after the acceleration ceases.

Landing gear handle UP as soon as altimeter indicates a gain of altitude.

INSTRUMENT CLIMB.

- 1. Maintain 160 knots IAS until a 1500 fpm climb is established, and then retract flaps.
- 2. Holding a 1500 fpm rate of climb, accelerate to best VFR climbing speed.
- 3. Do not turn until 500-foot altitude above terrain is reached.
 - 4. Limit angle of bank in turns to 30 degrees.
- 5. Maintain a careful watch for tail-pipe temperature rise for indications of intake duct icing while flying in visible moisture.

DURING INSTRUMENT CRUISING FLIGHT.

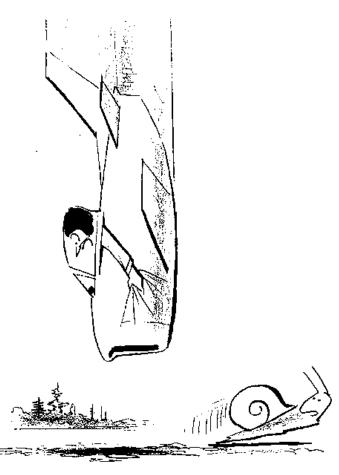
The airplane has satisfactory handling characteristics throughout its normal speed range and can be flown with ease if properly trimmed and controlled primarily by reference to the attitude gyro. At higher speeds, it becomes increasingly more difficult to maintain longitudinal (pitch) control with resultant gains and losses in altitude. During maneuvers at these speeds, use of the horizontal stabilizer for nose-up or nose-down corrections should be kept at a minimum. Otherwise, overcontrolling will result, with subsequent altitude changes of as much as 800 or 1000 feet.

RADIO-NAVIGATION EQUIPMENT.

The AN/ARN-6 radio compass is the only radio equipment provided for en route radio navigation. Because this equipment is highly susceptible to precipitation and electrical static, its reliability at high altitudes is considerably reduced by thin overcasts, haze, and dust. For this reason, the automatic operation of the radio compass should not be relied on entirely to establish fixes. The signals of the station should be audited at all times to ascertain station passage and that the station is still transmitting. With the function switch turned to the ANT. position, the antenna of the radio compass serves as a normal low-frequency receiver. Use of the loop provides better reception during extreme static conditions. Flights should be thoroughly planned, and elapsed flight time between compulsory check points should be plotted against the estimated times, to maintain constant watch on the progress of the flight.

DESCENT.

Descent can be accomplished without difficulty at speeds up to the limiting Mach number and/or airspeed



Warning

It is imperative during descents that altimeter be accurately read, with particular attention given to the 1000-foot and 10,000-foot indexes.

JET PENETRATION WITH INSTRUMENT APPROACH

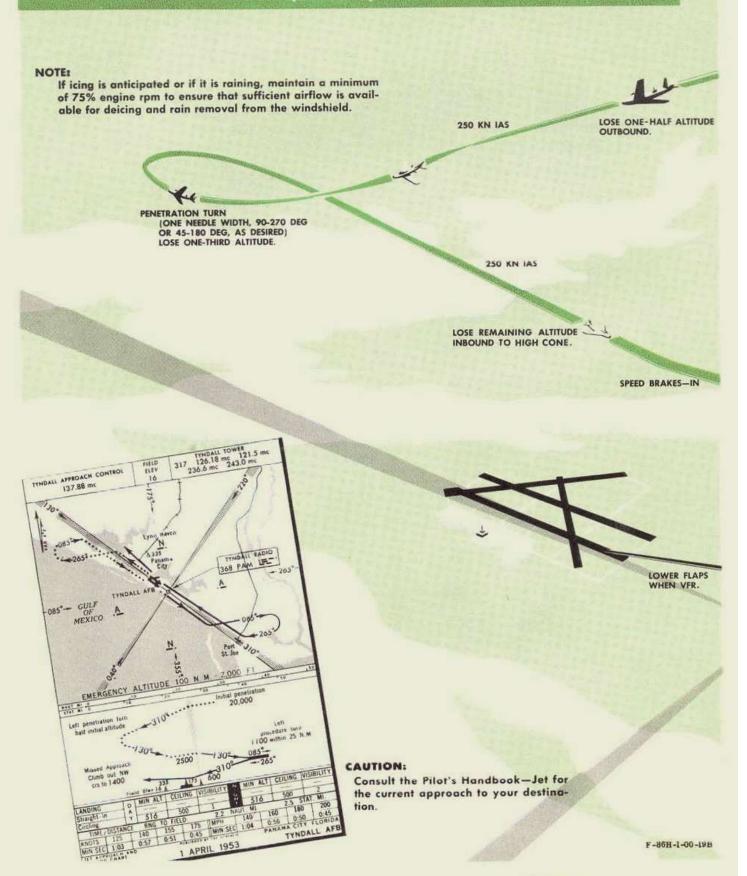


Figure 9-1

PENETRATION CONE SPEED BRAKE—OUT GEAR AND FLAPS—UP

NOTE

- Use power as required to maintain desired rate of descent at the speeds indicated.
- For minimum terrain coverage, lower gear and flaps at penetration cone (below gear-andflaps-down limit speed); then maintain 195 knots IAS through penetration turn.



MAINTAIN SPEED AND PENETRATION ALTITUDE TO THE RANGE STATION.

NOTE:

- Maintain altitudes assigned by ATC in preference to JAL chart altitudes.
- Use standard terminology to advise controller of positions and maneuvers in the pattern.

HIGH CONE (COMMENCE LOW-FREQUENCY RANGE APPROACH.)

NOTE: Raise gear and flaps if lowered at penetration cone.

190-200 KN IAS

ONE MIN OUTBOUND (MAX 2 MIN)

ONE MIN, 15 SEC

(MAX 2 MIN)

160 KN IAS

GEAR-DOWN

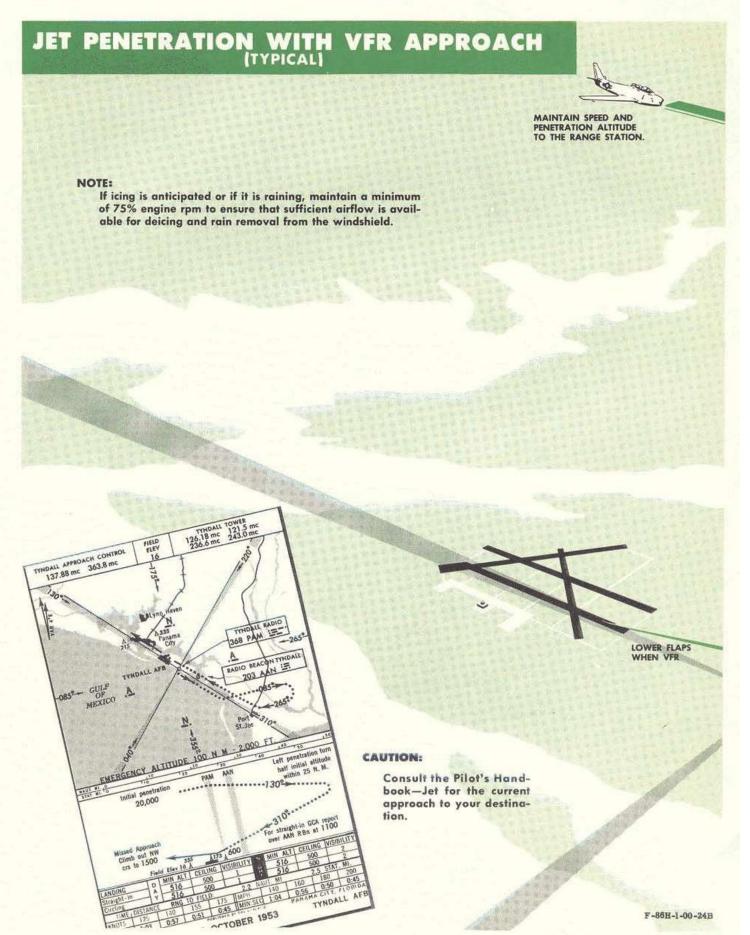


Figure 9-2

PENETRATION CONE SPEED BRAKES—OUT GEAR AND FLAPS—UP NOTE NOTE: Use power as required to maintain 1. Maintain altitudes assigned by ATC in prefdesired rate of descent at the speeds erence to JAL chart altitudes. indicated. 2. Use standard terminology to advise con-· For minimum terrain coverage, lower gear and flaps at penetration cone (below gear-and-flaps-down limit troller of positions and maneuvers in the approach. speed); then maintain 195 knots IAS through penetration turn. 250 KN IAS LOSE ONE-HALF ALTITUDE OUTBOUND. PENETRATION TURN LOSE ONE-THIRD ALTITUDE (ONE-NEEDLE-WIDTH TURN), 90 DEG METHOD. 250 KN IAS LOW CONE 160 KN IAS GEAR-DOWN SPEED BRAKES-IN

of the airplane. It is not recommended that descents at high Mach number be continued below 10,000 feet because of the very steep angle and high rate of descent. Instrument descent can be made with or without speed brakes extended. However, to limit the airspeed and distance covered at high rates of descent, use of speed brakes is recommended.

Note

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

In medium to heavy rain, forward visibility will be almost completely obscured. By moving the windshield rain and ice removal (anti-icing) switch to ON, the airflow over the windshield is enough to improve vision if a minimum engine rpm of 75% is maintained. If rain is still encountered as power is reduced for landing, vision through the windshield side panels may be necessary during touchdown and roll-out.

Note

Turn off windshield rain and ice removal (anti-icing) system after landing, to prevent windshield cracking.

RECOMMENDED PROCEDURE:

For typical descents, proceed as follows:

- 1. Speed brake switch OUT. (Return switch to neutral position after speed brakes are fully extended.)
 - 2. Throttle IDLE.

Note

In steep dives during high rates of descent with idle power and speed brakes out, the horizon bar of the attitude gyro rises to a very high position, making accurate determination of pitch angle very difficult. The airspeed indicator becomes very important in limiting the pitch angle under these conditions.

3. In turns, limit angle of bank to 30 degrees.

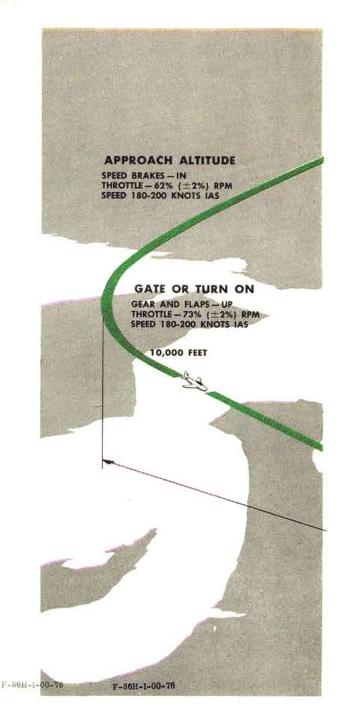


Descending turns with high rates of descent become progressively more difficult as bank angle is increased.

INSTRUMENT LETDOWNS.

JET PENETRATIONS.

Jet penetrations have been set up to provide a highspeed and high-rate-of-descent letdown from cruising altitude to a point where a VFR approach or an instrument approach (such as GCA, low-frequency range, or



ILS) can be made. Penetration procedures for specific fields are given on JAL (jet approach and landing) charts. The Pilot's Handbook—Jet, in two parts, for the eastern and western United States, has the JAL charts for all fields where jet penetration procedures have been established. Figure 9-1 shows a typical jet penetration with instrument approach, which is accomplished by beginning a letdown at the penetration cone (cruising altitude) on the heading specified in the JAL chart. The initial phase of the penetration is set up to avoid interference with altitudes occupied by other airplanes. After the high cone is crossed, a conventional instrument approach is begun. A typical penetration with

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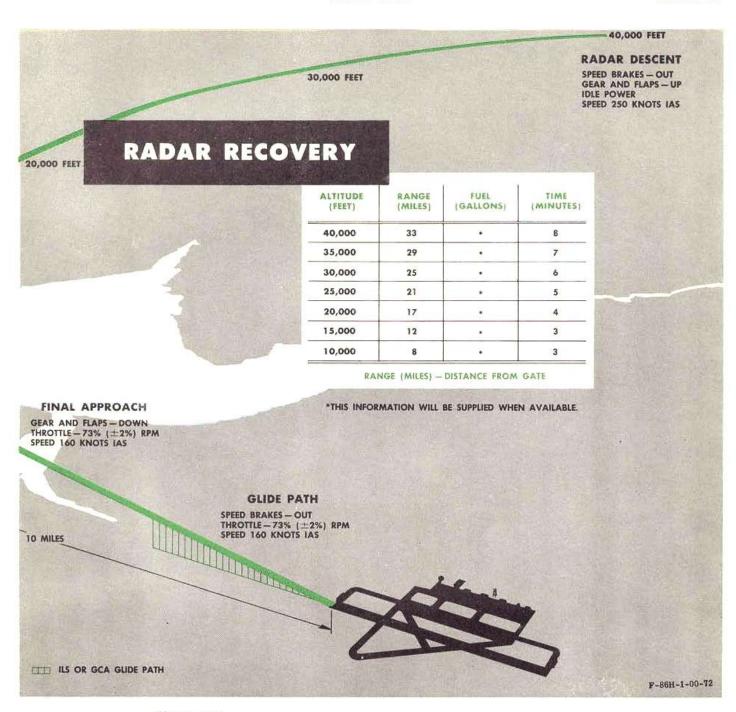


Figure 9-3

VFR approach is shown in figure 9-2. In such penetrations, if you are not VFR at low cone altitude, an instrument approach must be made. The conditions set up in the JAL charts should be given careful consideration during flight planning. Availability of GCA, alternates, and operational problems in high density traffic areas should be analyzed.

LOW-FREQUENCY RANGE APPROACHES.

The low-frequency range approach procedure may be used in conjunction with a jet penetration procedure. JAL charts specify the combined procedures where applicable. A close inspection of the JAL charts reveals that though the altitudes for range approaches are usually the same as shown in the Flight Handbook the

pattern is often abbreviated or altered in some way for jet airplanes.

RADAR RECOVERY.

Radar letdowns with GCA landings are optimum for conserving fuel under instrument conditions. For a typical letdown, see figure 9-3.

GROUND-CONTROLLED APPROACH.

The airplane has satisfactory handling qualities during GCA. On a normal GCA glide path, the airplane is in its approximate landing attitude, and only small control movement is required for the touchdown. For time required to complete standard ground-controlled approach, see figure 9-4.

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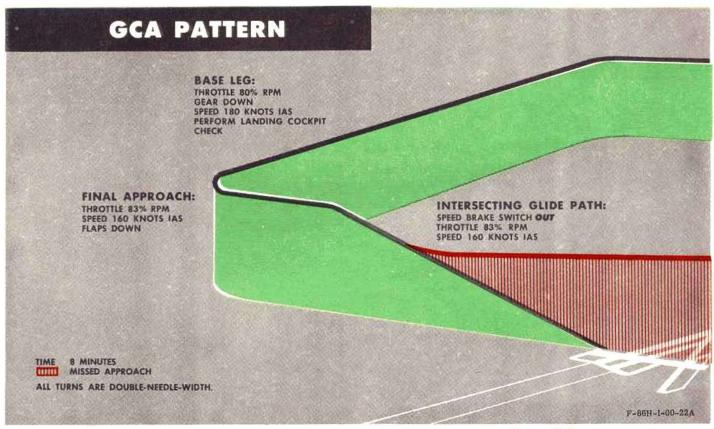


Figure 9-4

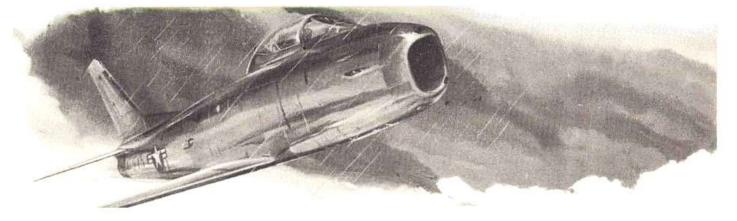
Note

Double-needle-width (3-degree-per-second) rates of turn should be made in the GCA pattern.

MISSED-APPROACH.

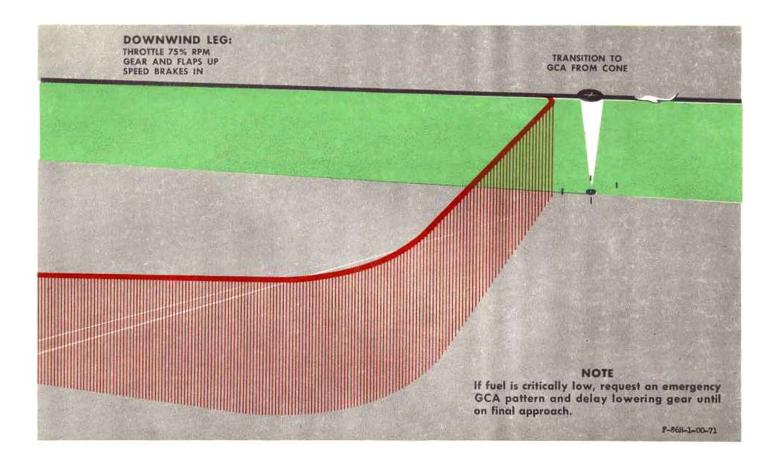
In case of missed approach, follow this procedure for go-around:

- 1. Throttle 100% rpm.
- Speed brake switch IN. (Return switch to neutral position after speed brakes are fully retracted.)
 - 3. Landing gear handle UP.
- Wing flap lever UP (after reaching 160 knots IAS).



ICE AND RAIN

Ice normally adheres to the windshield, the leading edges of the airfoils, and the forward portion of the drop tanks. Altitude should be changed immediately upon the first sign of ice accumulation. The resultant drag and weight increases associated with icing act to reduce the airspeed and to increase the power requirements with consequent reductions in range. Icing of the engine air intake area is an ever-present possibility during operation in weather with temperatures near the freezing point. A reduction in fuel pressure and



rpm with a loss of thrust (no mechanical difficulties present) can indicate engine icing. A major rise in tail-pipe temperature with a decrease in thrust is one of the normal indications of engine icing on this type of engine.

WARNING

Engine anti-icing is not effective below 95% engine rpm. Therefore, if you are in an area where icing is probable, maintain a minimum of 95% engine rpm, if possible, to prevent icing of the engine air intake area. If ice begins to form in the engine air intake area, indicated by a rise in exhaust temperature and loss of thrust, the throttle should be retarded immediately and an effort made to leave the icing area, because once ice begins to form, low air-speed and high engine rpm are most conducive to engine icing.

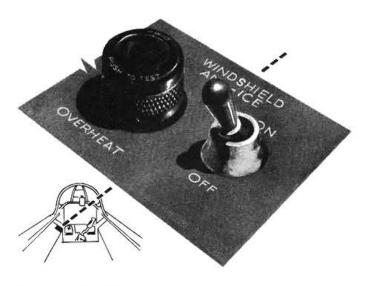
During take-offs into fog or low clouds, when temperatures are at or near freezing, the engine could be subject to icing. Climb should be made at higher than normal indicated airspeeds as an additional precaution. The high-speed performance capabilities of the airplane may be utilized in preventing icing formations on the flight surfaces. Flight speeds above .85 Mach

number ordinarily provide protection for the flight surfaces in all but extreme icing conditions. Avoid atmospheric icing conditions whenever feasible. It is recognized that the most proficient weather service cannot always predict accurately just when or where icing may be encountered. However, many areas of probable icing conditions can be avoided by careful flight planning that utilizes available weather information. If possible, avoid take-offs when the temperature is between -10°C (14°F) and 5°C (41°F) if fog is present or dew point is within 4°C (39°F) of outside air temperature. These are conditions under which engine icing can occur without wing icing.

If outside air temperature is in the range of 0°C (32°F) to 5°C (41°F), the speed of the airplane should be maintained at 250 knots IAS or above to prevent inlet duct icing.

If icing conditions are encountered at freezing atmospheric temperatures, immediate action should be taken as follows:

- Change altitude rapidly by climb or descent in layer clouds, or vary course as appropriate to avoid cloud formations.
- Reduce airspeed to 250 knots to minimize rate of ice build-up.
- Maintain close watch of exhaust temperature, and reduce engine rpm as necessary to prevent excessive exhaust temperature.



LANDING IN RAIN.

On early airplanes,* the windshield anti-icing system airflow is capable of providing windshield and side panel clearance in a medium rain condition. A minimum power setting of 75% engine rpm is necessary for ample clearance. When the windshield overheat light illuminates, reduce engine power setting to reduce anti-icing airflow over the windshield, or place the cockpit pressure switch at RAM DUMP position. If these measures cannot be taken and windshield clearance is required, the anti-icing system should be left on. On most airplanes,† the windshield rain and ice removal system will provide ample windshield and side panel clearance in most rain conditions. The system is designed to maintain temperature of the jet airflow over the windshield and side panels within the design limits automatically. Therefore, the system may be left on as long as necessary to improve vision. The system does not include an overheat warning light.

For detailed procedures on removal of ice and rain from the windshield, refer to "Defrosting and Rain and Ice Removal Systems" in Section IV.

*F-86H-1 Airplanes AF52-1975 through -1990 †F-86H-1 Airplane AF52-1991 and all subsequent airplanes



TURBULENCE AND THUNDERSTORMS



Flight through a thunderstorm should be avoided if at all possible. Thunderstorm flying demands considerable instrument experience and should be intentionally undertaken only by well-qualified pilots. However, many routine flight operations require a certain amount of thunderstorm flying, since it is not always possible to avoid storm areas. At night, it is often impossible to detect individual storms and find the in-between clear areas. A pilot using modern equipment and possessing a combination of proper experience, common sense, and instrument flying proficiency can safely fly thunderstorms.

Throttle setting and pitch attitude are the keys to proper flight technique in turbulent air. The throttle and pitch attitude required for desired penetration airspeed should be established before you enter the storm. This throttle setting and pitch attitude, if maintained throughout the storm, must result in a constant airspeed, regardless of any false readings of the airspeed indicator. Specific instructions for preparing to enter a storm and flying in it are given in the following paragraphs.

BEFORE TAKE-OFF.

Note the following precautions:

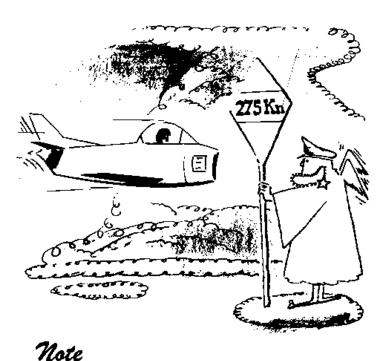
1. Make a thorough analysis of the general weather situation to determine thunderstorm areas, and prepare a flight plan which will avoid thunderstorm areas whenever possible.

2. Be sure to check proper operation of all flight instruments, navigation equipment, pitot heater, instrument panel lights, and deicing equipment before undertaking any instrument flight or attempting flight into thunderstorm areas.

APPROACHING THE STORM.

It is imperative that you prepare the airplane before entering a zone of turbulent air. If the storm cannot be seen, its nearness can be detected by radio crash static. Prepare the airplane as follows:

1. Adjust throttle as necessary to obtain a comfortable penetration speed.



A comfortable penetration speed for entering a zone of turbulent air is 275 knots IAS.

- 2. Pitot heater switch on.
- 3. Safety belt rightened. Shoulder harness locked.
- 4. Turn off any radio equipment rendered useless by static.
- 5. At night, turn cockpit lights and thunderstorm lights full bright to minimize blinding effect of lightning.

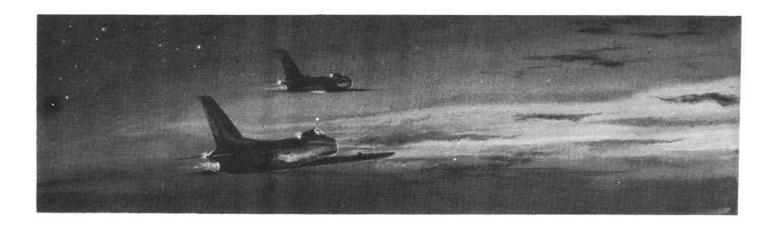


Do not lower landing gear or wing flaps, as they decrease the aerodynamic efficiency of the airplane.

IN THE STORM.

When in the thunderstorm, follow these instructions:

- 1. Maintain throttle setting and pitch attitude (established before entering) throughout the storm. Hold these constant, and your airspeed will be constant, regardless of the airspeed indicator.
 - 2. Devote all attention to flying the airplane.
- Expect turbulence, precipitation, and lightning. Don't allow these conditions to cause undue concern.
- Maintain attitude. Concentrate principally on remaining level by reference to the attitude gyro.
- Maintain original heading. Do not make any turns unless absolutely necessary.
- 6. Don't chase the airspeed indicator, since doing so will result in extreme airplane attitudes. Should a sudden gust be encountered while airplane is in a nosehigh attitude, a stall might easily result.
- 7. Use as little longitudinal control as possible to maintain your attitude in order to minimize the stresses imposed on the airplane.
- 8. The altimeter may be unreliable in thunderstorms because of differential barometric pressure within the storm. A gain or loss of several thousand feet may be expected. Make allowance for this error in determining the minimum safe altitude.



NIGHT FLYING

There are no specific techniques for flying this airplane at night which differ from those required for daylight operation.



COLD-WEATHER PROCEDURES

Icing conditions are covered under "Ice and Rain." While still a factor for successful cold-weather operation, generally cold-weather postflight preparation is not as critical in a jet-powered airplane as in a reciprocating-engine airplane, because there is no need for oil dilution, etc. In order to hasten preflight inspection and ensure satisfactory operation for the next flight, normal operating procedures outlined in Section II should be adhered to, with the following additions and exceptions:

BEFORE ENTERING AIRPLANE.

- Check that all protective covers and dust plugs have been removed.
- Check that airplane, including surfaces, controls, ducts, shock struts, drains, etc, has been cleared of all snow, frost, and ice.

WARNING

The collection of snow, frost, and ice on airplane surfaces constitutes one of the major flight hazards in low-temperature operation and will result in the loss of lift and in treacherous stalling characteristics.

3. Inspect lower portion of engine compressor section for evidence of ice formation on forward stator and rotor blades. If accumulation of ice can be seen or is suspected in the area of the compressor or turbine sections, check engine for freedom of rotation.

Note

External heat must be applied to forward section of engine to remove ice. The engine should be started as soon as possible after heating, to prevent moisture from refreezing.

- 4. Make sure that oil system has been serviced with proper lubricant.
- 5. Check that fuel system has been serviced with proper fuel.

Note

JP-4 fuel (Specification MIL-F-5624), or gasoline (Specification MIL-F-5572) if JP-4 fuel is not available, should be used at all temperatures below -18°C (0°F) to provide satisfactory low-temperature engine starts.

6. Make sure that fuel filter deicing system alcohol tank has been filled if installed.

ON ENTERING AIRPLANE.

- 1. External power source connected.
- 2. Check flight controls for proper operation.
- 3. Make sure that canopy can be fully closed.
- 4. Check electrical and radio equipment.

STARTING ENGINE.

- 1. JP-4 fuel has good starting characteristics for low-temperature engine starts and permits normal starting procedures.
- 2. If there is no indication of oil pressure after 30 seconds of engine operation at idle, or if oil pressure drops to zero after a few minutes of ground operation, stop engine and investigate.

CAUTION

When switching from the emergency to the main fuel system after a start, engine surge will occur, the magnitude depending upon how cold engine oil temperature is. In cases where the airplane has stood for long periods at extremely low outside air temperatures, overspeed can result when the switch-over is made. Care should be taken to operate the engine on the emergency fuel system long enough to ensure safe operation on the main system before take-off. When switching over to the main fuel system, be prepared to immediately switch back to the emergency system if the engine surge is severe. Brakes will not hold the airplane on packed snow or ice, and if a violent surge occurs on switch-over, the airplane may move out of control.

WARM-UP AND GROUND CHECK.

Use firmly anchored wheel chocks for engine run-ups.

WARNING

Because of low outside air temperatures, the thrust developed at all engine speeds is noticeably greater than normal. Make sure airplane is tied down securely and wheels are chocked before attempting a full-power run-up.

- 1. Turn on cockpit heat, and canopy and windshield defrosting system, as required, immediately after engine starts.
- 2. Check flight controls, speed brakes, rudder trim tab, and aileron and horizontal tail trim for proper operation.

Note

Cycle flight controls four to six times on both the normal and alternate systems. Check hydraulic pressure and control reaction.

- Check wing flap operation.
- 4. Check operation of all instruments.

Caution

Make sure all instruments have warmed up sufficiently to ensure normal operation. Check flight instruments for



TAXIING.

- Avoid taxiing in deep snow, as taxiing and steering are extremely difficult and frozen brakes are likely to result.
- 2. Use only essential electrical equipment to preserve battery life while taxiing at low engine speeds.
- 3. Increase interval between airplanes while taxiing at subfreezing temperatures, to ensure safe stopping distance and to prevent icing of airplane surfaces by melted snow and ice in the jet blast of a preceding airplane.

4. Minimize taxi time to conserve fuel and reduce amount of ice fog generated by engine.

BEFORE TAKE-OFF.

- 1. Check that canopy is fully closed.
- 2. Make full power check if on a dry, clear runway; however, if take-off is started on ice or snow, make check during the initial part of the take-off roll. Do not attempt to hold the brakes while the engine is accelerating and the take-off roll is beginning, because you are likely to lose control of the airplane if one wheel begins to slide ahead of the other.
- 3. Turn pitot heater switch on just before moving into take-off position.

TAKE-OFF.

At low temperatures, excessive tail-pipe temperatures may result at high engine speeds and zero or low ramair pressures. Therefore, exhaust temperatures may be a limiting factor for take-off rpm during the first part of the take-off roll. Any reduction in engine speed necessary to reduce exhaust temperature to permissible limit will be more than compensated for by the thrust augmentation resulting from increased air density; e.g., 100 percent rated thrust is reached at 94% rpm at -18°C (0°F) and at 88% rpm at -54°C (-65°F). Refer to take-off distances charts in the Confidential Supplement, T. O. 1F-86H-1A.

AFTER TAKE-OFF.

- 1. After take-off from a wet snow- or slush-covered field, operate landing gear and wing flaps through several complete cycles to preclude their freezing in retracted position. (In cold weather, expect considerably slower landing gear operation due to stiffening of all lubricants.)
 - 2. Turn on gun heaters immediately after take-off.
- Check instruments. Many flight instruments may be unreliable at extremely low temperatures.

DURING FLIGHT.

- 1. Use cockpit heat, and canopy and windshield defrosting system as required.
 - 2. Operate fuel filter deicing system* as required.

Note

Since the deicing alcohol supply will last for only 3 minutes of deicing operation, make sure fuel filter ice warning light burns steadily

*F-86H-1 Airplanes AF52-1975 through -1983

before moving the deicing switch to DE-ICE. Use deicing system for 15 seconds at a time.

DESCENT.

Check engine operating temperatures during descents and in traffic pattern, as low temperatures are common at low altitudes because of frequent temperature inversions.

APPROACH.

- 1. Make normal pattern and landing, but allow for flatter glide because of thrust augmentation caused by extremely low surrounding air temperatures.
- 2. Turn off all unnecessary electrical equipment at least one minute before final approach, to reduce battery load when rpm is lowered and generator cuts out.
 - 3. Pump brake pedals several times.

AFTER LANDING.

1. If snow and ice tires are installed on airplane, apply brakes smoothly and steadily to the point just short of locking wheels; then release and apply brakes intermittently and carefully to keep treads from filling and glazing over.

Note

Best technique for obtaining minimum ground roll on slippery runways is to maintain a high angle of attack for as long as possible, keep the flaps fully down, and apply brakes only after the nose wheel touches the runway.

2. Pitot heater switch OFF.

STOPPING ENGINE.

The engine is stopped in the normal manner. If JP-4 fuel is used, it is unnecessary to drain the fuel tanks and lines.

BEFORE LEAVING AIRPLANE.

- 1. If it is not snowing or raining, leave canopy partly open to allow circulation within cockpit, to prevent canopy cracking from differential contraction, and to decrease windshield and canopy frosting.
- 2. Whenever possible, leave airplane parked with full fuel tanks. Every effort should be made during servicing to prevent moisture from entering fuel system.
- 3. Check that battery is removed when airplane is parked outside for any extended period of time or at temperatures below -29°C (-20°F) for more than 4 hours.



HOT-WEATHER AND DESERT PROCEDURES

In general, hot-weather and desert procedures differ from normal procedures mainly in that additional precautions must be taken to protect the airplane from damage due to high temperatures and sand and dust. Particular care should be taken to prevent the entrance of sand into the various airplane components and systems (engine, fuel system, pitot-static system, etc). All filters should be checked more often than under normal conditions. Units having plastic and rubber parts should be protected as much as possible from excessive temperatures. Tires should be checked frequently for signs of blistering, etc.

Note

Do not attempt a take-off in a sandstorm or dust storm. Park airplane cross-wind, and shut down engine.

BEFORE TAKE-OFF.

The emergency fuel regulator normally is set to give 100% rpm on a 100°F day and does not compensate for temperature changes. If the emergency fuel system is turned on at maximum rpm when temperature is above 100°F, the engine may overspeed. The following procedure is recommended for testing the emergency fuel system before take-off at excessively high outside air temperatures.

- 1. Run up engine to 100% rpm with fuel system selector switch in NORM position.
- 2. Move fuel system selector switch to TAKE OFF position and retard throttle to below 95% rpm.
- Check that amber emergency fuel-on indicator light goes on.
- 4. Advance throttle cautiously to stop, and check rpm against temperature as shown in figure 2-4. If rpm is within the prescribed limits, emergency system operation is satisfactory.

CAUTION

Be prepared to retard throttle immediately if engine speed should exceed 100% rpm. If engine overspeeds (104% rpm or more), shut down engine and do not fly the airplane, since engine overhaul will be necessary.

- Move fuel system selector switch to NORM position, to return to main fuel system operation. Check that amber emergency fuel-on indicator light goes out.
- Move fuel system selector switch to TAKE OFF.Check that green take-off switch on indicator light is on.

Note

- If airplane is based at a field where normal temperature range is above 100°F, the emergency regulator should be reset to give 100% rpm at the maximum outside air temperature.
- At high outside air temperatures, it may be necessary to have tail-pipe segments reset to avoid excessive exhaust temperatures at maximum rpm.
- On some -3E engines, sufficient tail-pipe segment adjustment may not be available; therefore, it may be necessary to retard the throttle to maintain exhaust temperature within limits.

TAKE-OFF.

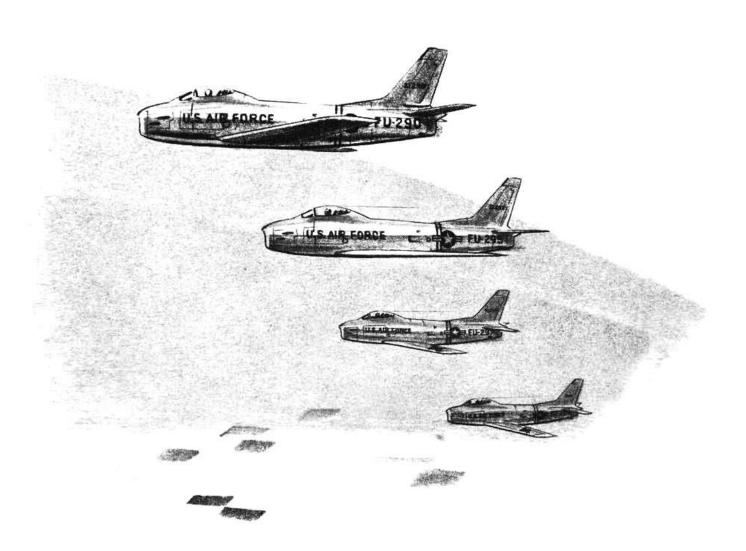
The increase in required take-off distances commonly associated with hot-weather operation of any airplane is even greater when the airplane is powered by a jet engine. Refer to take-off distances charts in the Confidential Supplement, T. O. 1F-86H-1A.

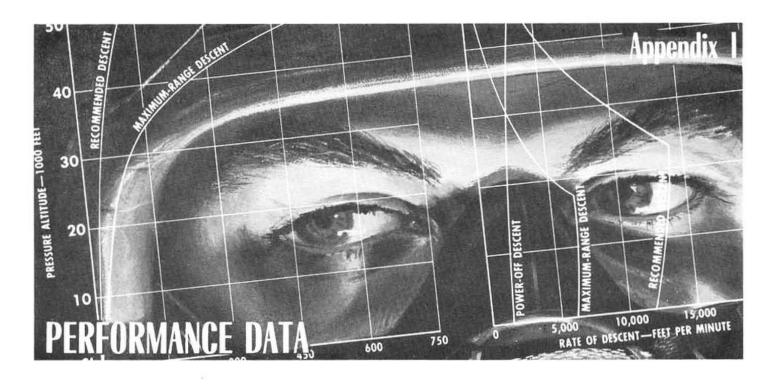
AFTER TAKE-OFF.

Follow normal flight procedures, being particularly careful to maintain a power setting that will keep exhaust temperature within its prescribed limits.

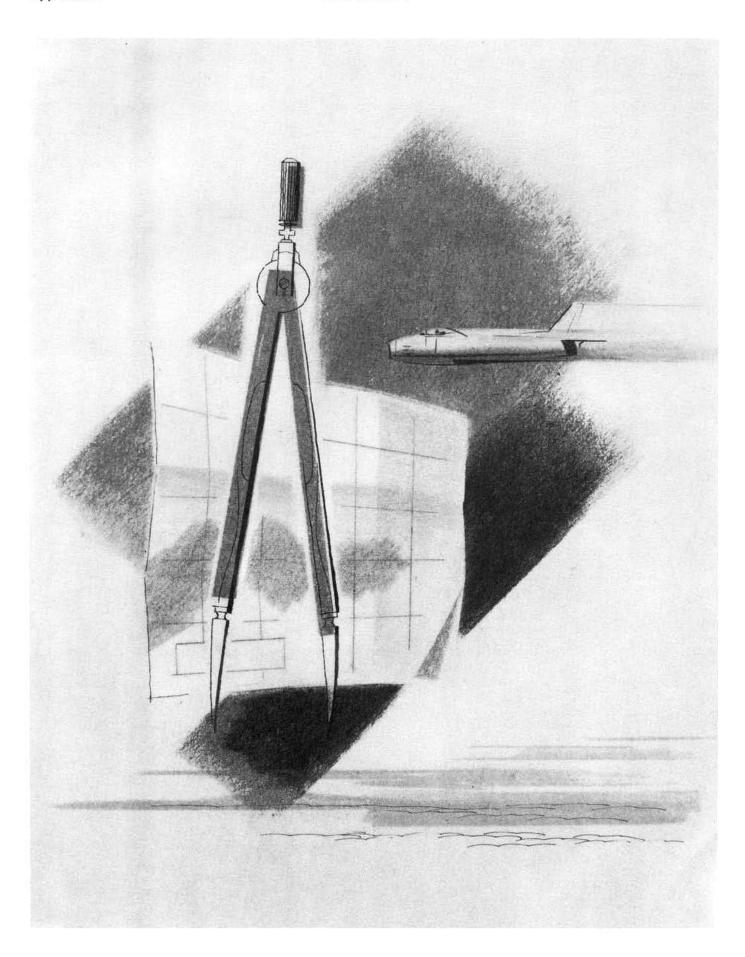
BEFORE LEAVING AIRPLANE.

- 1. If sand or dust is not blowing, leave canopy slightly open to permit air circulation within cockpit.
- 2. Make sure that protective covers are installed on pitot head, canopy, and intake and exhaust ducts.





Refer to Appendix I in the Confidential Supplement, T. O. 1F-86H-1A.





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