FLIGHT MANUAL

USAF SERIES WB-66D AIRCRAFT

THIS PUBLICATION INCOMPLETE WITHOUT T.O. 1B-66(W)D-1A

THIS REISSUE REPLACES SAFETY OF FLIGHT SUPPLEMENTS —1U, 1CG AND 1CJ. SEE BASIC INDEX T.O. 0-1-1 AND WEEKLY INDEX T.O. 0-1-1A FOR CURRENT STATUS OF SAFETY OF FLIGHT SUPPLEMENTS.

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1 SEPTEMBER 1958

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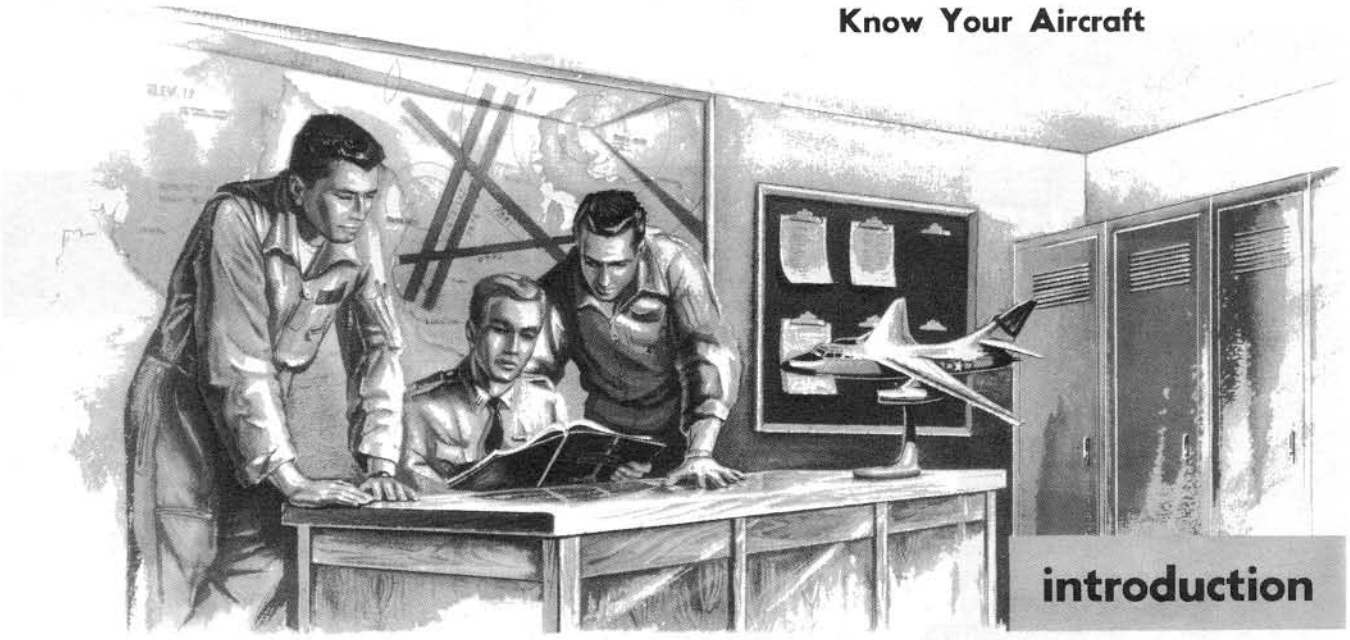
Know Your Aircraft



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SCOPE. This handbook contains all the information necessary for safe and efficient operation of the WB-66C aircraft. These instructions do not teach basic flight principles, but are designed to provide you with a general knowledge of the aircraft, its flight characteristics, and specific normal and emergency operating procedures. Your flying experience is recognized, and elementary instructions have been avoided.

SOUND JUDGMENT. The instructions in this handbook are designed to provide for the needs of a crew inexperienced in the operation of this aircraft. This book provides the best possible operating instructions under most circumstances, but 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 is not specifically covered in the Flight Handbook.

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

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

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

PERSONAL COPIES, TABS, AND BINDERS. *Each flight crew member, except those attached to an administrative base, is entitled to have a personal copy of the Flight Handbook.* Air Force Regulation 5-13 specifically makes that provision. Flexible, loose leaf tabs and binders have been provided to hold your personal copy of the Flight Handbook. These good-looking, simulated-leather binders will make it much easier for you

to revise your handbook as well as to keep it in good shape. These tabs and binders are secured through your local contracting officer.

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

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 10 days. You can determine the status of Safety of Flight Supplements by referring to the Index of Technical Publications (T.O. 0-1-1) and the Weekly Supplemental Index (T.O. 0-1-1A). This is the only way you can determine whether a supplement has been rescinded. The title page of the Flight 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. It is critically important that you remain constantly aware of the status of all supplements — you must comply with all existing supplements but there is no point in restricting the operation of your aircraft by complying with a supplemental that has been replaced or rescinded. 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 connotation will be applied to these items:

WARNING — Injury to personnel

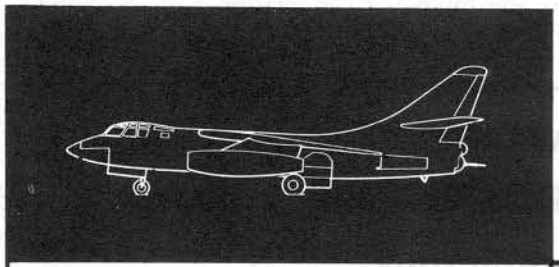
CAUTION — Damage to equipment

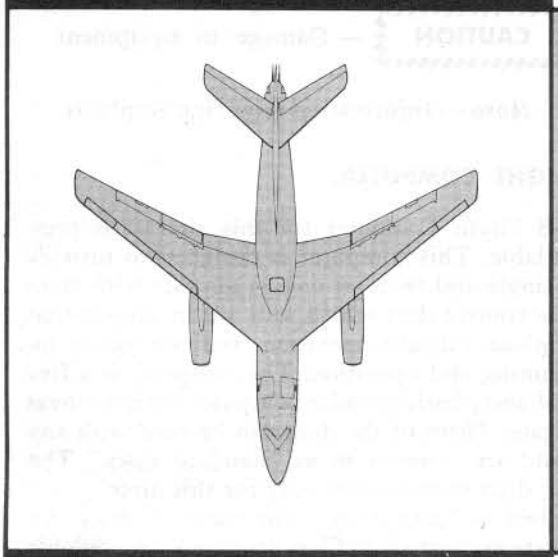
Note — Information requiring emphasis

MB-8 FLIGHT COMPUTER.

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

COMMENTS AND QUESTIONS. *Comments and questions regarding any phase of the Flight Handbook program are invited and should be addressed to the attention of ARDC Engineering Representative, WCLOD-31F, Norton Air Force Base, California.*

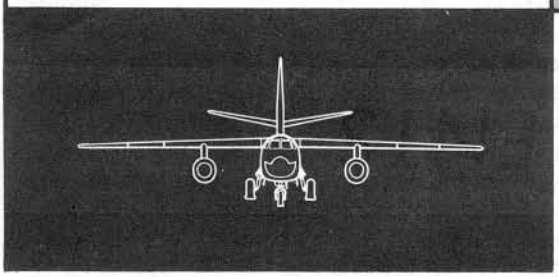




the

WB-66D

aircraft



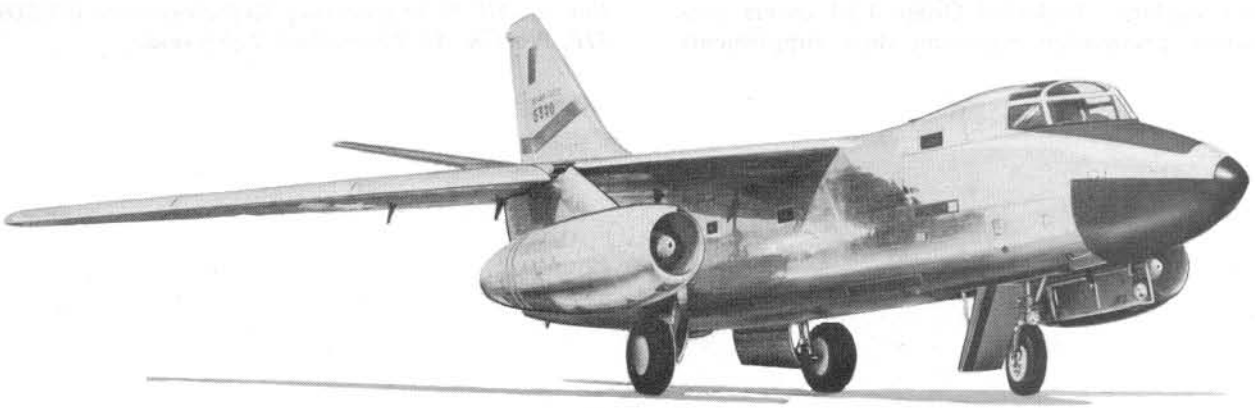


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Figure i-1

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THE AIRCRAFT.

The Air Force model WB-66D aircraft, manufactured by Douglas Aircraft Company, Inc., is a land based, medium class, all-weather, electronic weather data collecting aircraft designed for long range flight at subsonic speeds up to an altitude of 45,000 feet. The tactical mission of the aircraft is to accurately predict meteorological conditions over a large area. The aircraft has a five-man crew: a pilot, navigator, gunner, and two weather observers.

SPECIAL FEATURES.

The aircraft is an all-metal, high-wing monoplane with swept wings and empennage and an unusually large vertical suface. Two underslung nacelles, supported by pylons, house two axial-flow turbo-jet engines which are clean and free due to the use of an air bleed system. It is equipped with a tricycle landing gear with a steerable nose wheel, and is designed for take-off with or without the use of ATO. The aircraft has speed brakes (one on either side of the aft fuselage section), an adjustable horizontal stabilizer, and aerodynamically actuated leading edge wing slats. Provisions are made for the installation of external fuel tanks or chaff dispensing pods supported by pylons, one under each wing. The aircraft is provided with a removable tail cone section which allows complete interchangeability of the MD-1A fire control system components with chaff dispensing units. For general arrangement of the aircraft, see figure 1-1.

For the Main Difference Table, see T.O. 1B-66(W)D-1A.

AIRCRAFT DIMENSIONS.

The principal dimensions of the aircraft are:

Length	75 feet 2 inches.
Span	72 feet 6 inches.
Height	23 feet 7 inches.
Wing Sweep Back	35 degrees 9 minutes.

See Minimum Turning Radius, figure 2-5.

AIRCRAFT GROSS WEIGHT.

The aircraft is designed for the 75,000 pound gross weight class. For complete weight information, refer to *Section V and the Handbook of Weight and Balance Data, T.O. 1-1B-40.*

COMPARTMENTS.

The various compartments of the aircraft are shown in figure 1-2.

FLIGHT COMPARTMENT.

The flight compartment provides accommodations for a crew of three *(4, 5, and 6, figure 1-1).* This pressurized area *(figure 1-3)* has accommodations for the pilot, the gunner seated immediately behind the pilot, and the navigator seated to the right of the gunner.

WEATHER OBSERVERS' COMPARTMENT.

The weather compartment provides accommodations for two weather observers *(25, figure 1-1).* This pressurized area *(figure 1-2)* provides a seating arrangement for weather observer 1 and observer 2 at the forward stations.

MOVEMENT OF FLIGHT PERSONNEL.

Movement of flight personnel is restricted to the flight compartment and weather compartment when these compartments are pressurized. When the flight compartment is unpressurized, access to the crawlway is possible *(figure 1-2).*

Note

Normal operation of the weather compartment crawlway access door prevents it from being opened whenever one or both engines are operating and the main weather compartment entrance door is locked in the CLOSED position. The access door can be forced open, but not without damage to the door seal.

ENGINES.

Two turbo-jet AF J71-A-13 engines *(figure 1-3)* provide power for the aircraft. Each engine is equipped with an air-driven starter and consists essentially of a multistage, axial-flow compressor; ten cylindrical, through-flow combustion chambers; and a multistage turbine. The compressor is a sixteen-wheel rotor enclosed by a four-piece casing. The hub of the rotor is spline-coupled to the forward end of the turbine shaft. The forward frame, attached to the front of the compressor case, is the compressor air inlet housing and accessories drive housing. The constant speed transmission is mounted on the front cover of the forward frame. All other engine-driven accessories are mounted on the radial drive on the bottom of the forward frame. The combustion section consists of ten inner chambers enclosed in a case which is the outer combustion chamber. A three stage turbine nozzle directs combustion gases against the blades of the three turbine wheels to effect rotation. The exhaust section consists of the variable exhaust nozzle, shroud and hydraulic nozzle actuators. Each engine is rated to deliver maximum thrust at sea level static conditions when operating at 100.7 per cent power output (6175 rpm). See Section VII for additional information regarding the engines and their systems.

ENGINE FUEL SYSTEM.

The engine fuel system *(figure 1-11)* is comprised of the following major components: two fuel pumps, a fuel control unit, a fuel filter, a fuel flow transmitter,

an oil to fuel heat exchanger, fuel nozzles, and a drip valve. Fuel from the aircraft supply is routed through the fuel strainer and enters the engine fuel pumps, where its pressure is raised. From the pumps, fuel is delivered through the filter to the fuel control. Regulated fuel from the control passes through the heat exchanger to the fuel nozzles. Bypass lines are included to return fuel from the control to the fuel pumps. The pumps also include a centrifugal boost element to permit fuel pump operation under lower than atmospheric inlet fuel pressure, as required for operation, in case of failure of a boost pump. The fuel filter has replaceable elements and an integral bypass valve. The fuel nozzle is a single-line duplex unit containing a valve, primary and secondary flow passages, and a filter screen. When the engine is started, fuel flows through the dual nozzle screen, bypasses the valve, and is sprayed into the combustion chamber through the primary flow passage. When the fuel pressure reaches a preset value, the valve automatically opens and fuel passes through the valve and is sprayed through the secondary flow passage into the combustion chamber.

ENGINE FUEL CONTROL.

The engine fuel control provides automatic control of the fuel flow to the engine by sensing rpm, inlet compressor pressure and temperature. According to the governor setting, as determined by throttle position, th engine fuel control provides constant speed regardless of changes in air density, and during critical rpm indirectly controls compressor bleeds to avoid the compressor stall area. In addition, the engine fuel control prevents the engine from overspeeding beyond the maximum governed speed, minimizes the possibility of flame-out during deceleration and provides correct metering of fuel for starting.

THROTTLES AND THROTTLE LOCK LEVER.

The engine throttles *(13 and 14, figure 1-5),* located on the control pedestal, are equipped with a friction-type throttle lock lever. The throttles mechanically operate the fuel control (through linkage) to control engine rpm, thrust, and exhaust gas temperature.

VARIABLE EXHAUST NOZZLE.

The variable exhaust nozzle is attached to the rear flange of the turbine case assembly. An inner cone is positioned within this exhaust nozzle assembly by four struts, two of which carry turbine cooling air. A shroud assembly surrounds the exhaust nozzle and provides air channels for cooling the variable exhaust nozzle units. The shroud also connects the actuating cylinders to the nozzle segments to regulate the nozzle area. The variable exhaust nozzle is controlled by throttle position, which in turn repositions the servo-valve actuator by an interlink between the fuel control and the servo-valve actuator, at speeds in excess of 88 per cent rpm. A followup cable assembly connected to the variable exhaust nozzle and the servo-valve actuator is used to stabilize the position of the variable exhaust nozzle. *(See Section VII for variable nozzle actuating system.)*

ENGINE ELECTRONIC OVERTEMPERATURE CONTROL.

The engine electronic overtemperature control consists of the following major components: an amplifier; a servo-valve actuator motor; a potentiometer; and thermocouples. This control utilizes 115-volt a-c electrical power and hydraulic system pressure to perform its functions. The engine amplifier receives a signal from the engine thermocouple and compares this signal to a fixed signal representing the maximum exhaust gas temperature. If the exhaust gas temperature limit is exceeded, the amplifier causes the servo-valve actuator motor to reposition the servo-valve, which in turn repositions the variable exhaust nozzle to return the temperature to the maximum allowable. During overtemperature corrections, the potentiometer acts to stabilize the variable exhaust nozzle to prevent hunting.

Note

On the J71-A-13 engine, the amplifier also controls the exhaust gas temperature when the throttle is in the position to obtain TAKE-OFF thrust.

ENGINE AIR INTAKE SCREENS.

The engines are equipped with retractable air intake screens, installed in the inlet duct assembly of each engine, which prevent foreign particles from entering and damaging the engines. The screens are electrically controlled by a switch located at the pilot's station, and hydraulically actuated by the engine hydraulic system.

ENGINE AIR INTAKE SCREENS SWITCH.

A 3-position engine air intake screens switch *(9, figure 1-6)* is located on the engine start panel on the pilot's right console. The switch is placarded EXTEND, RETRACT, and AUTO. In the EXTEND position, the switch energizes a 28-volt d-c circuit to actuate the screen valve solenoid which directs hydraulic fluid from the engine hydraulic system to extend the screens. In the RETRACT position, electrical power is removed from the spring-loaded solenoid, causing the screens to retract. In the AUTO position, the screens will be extended automatically when the landing gear is down and locked, and will retract automatically when the landing gear starts to retract.

IGNITION.

Two d-c ignition units energize the igniter plugs in No. 4 and No. 8 combustion chambers. Ignition is continuous only during starting. The ignition circuit is energized when the momentary-type start switch is actuated or when the ignition switch is placed in the

(Continued on Page 1-7)

1. IFR (AIR REFUELING) PROBE LIGHT
2. BATTERY
3. LIQUID CONTAINER (THERMOS)
4. PILOT'S SEAT
5. NAVIGATOR'S SEAT
6. GUNNER'S SEAT
7. GROUND REFUELING CONTROL PANEL
8. FORWARD FUSELAGE FUEL TANK COMPARTMENT
9. ENGINE NACELLE
10. WING SLATS
11. AILERON
12. SPOILER
13. WING FLAPS
14. AFT FUSELAGE FUEL TANK COMPARTMENT
15. AFT ELECTRONIC EQUIPMENT
16. GUN TURRET
17. AMMUNITION CHUTE
18. AMMUNITION BOXES
19. ACCESS AND AMMUNITION LOADING DOOR
20. DRAG CHUTE CONTAINER
21. SPEED BRAKE
22. AFT EQUIPMENT COMPARTMENT ACCESS DOOR
23. EXTERNAL AIR SOURCE RECEPTACLE (RIGHT SIDE EACH NACELLE)
24. WEATHER COMPARTMENT ENTRANCE DOOR
25. WEATHER COMPARTMENT CREW SEAT (TYPICAL)
26. AILERON HYDRAULIC SYSTEM RESERVOIR
27. RUDDER – ELEVATOR HYDRAULIC SYSTEM RESERVOIR
28. SPOILER ACCUMULATOR
29. UTILITY HYDRAULIC SYSTEM RESERVOIR
30. HYDAULIC CONTROL VALVES
31. FORWARD ELECTRONIC EQUIPMENT
32. FLIGHT COMPARTMENT ENTRANCE DOOR
33. EXTERNAL POWER RECEPTACLES
34. TAXI LIGHT
35. NOSE WHEEL STEERING AND BRAKE ACCUMULATOR
36. BRAKE AND NOSE WHEEL STEERING ACCUMULATOR INDICATOR AND AIR BRAKE PRESSURE INDICATOR
37. EMERGENCY AIR BOTTLE FOR BRAKES
38. LANDING LIGHT
39. PITOT TUBE
40. EXTERNAL WING TANKS

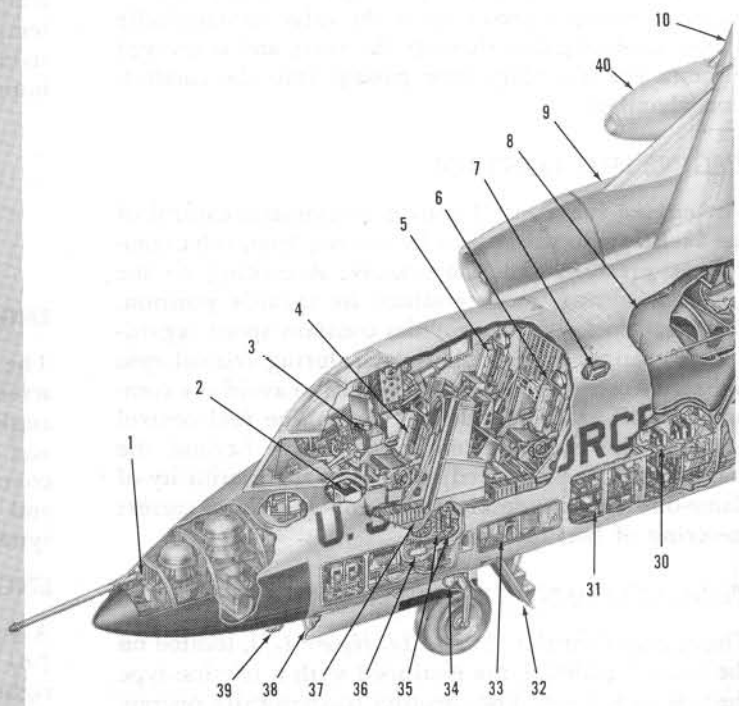

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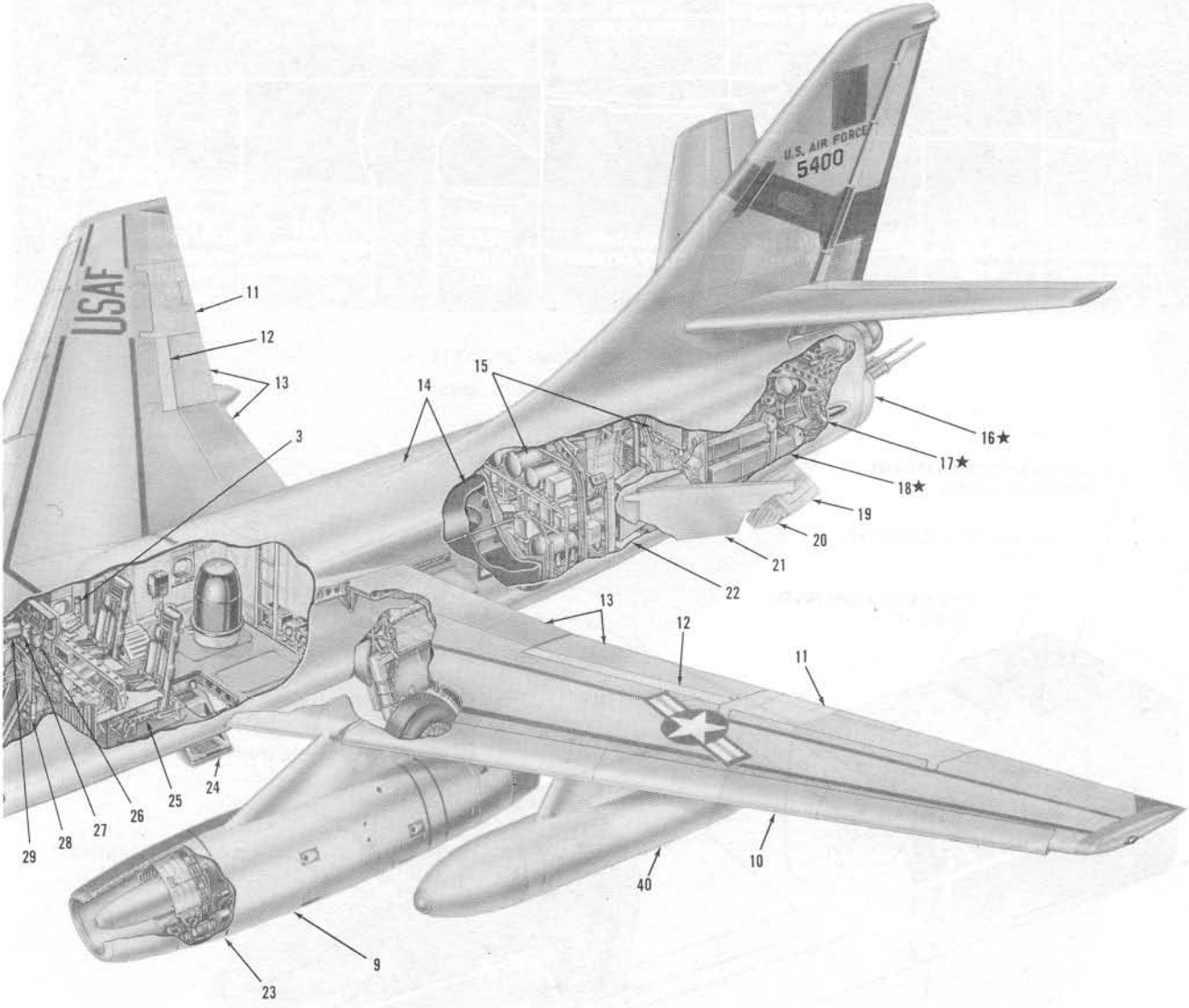
Figure 1-1 (Sheet 1 of 2)



★ Removed on aircraft with the removable ECM tail cone installed.

General Arrangement

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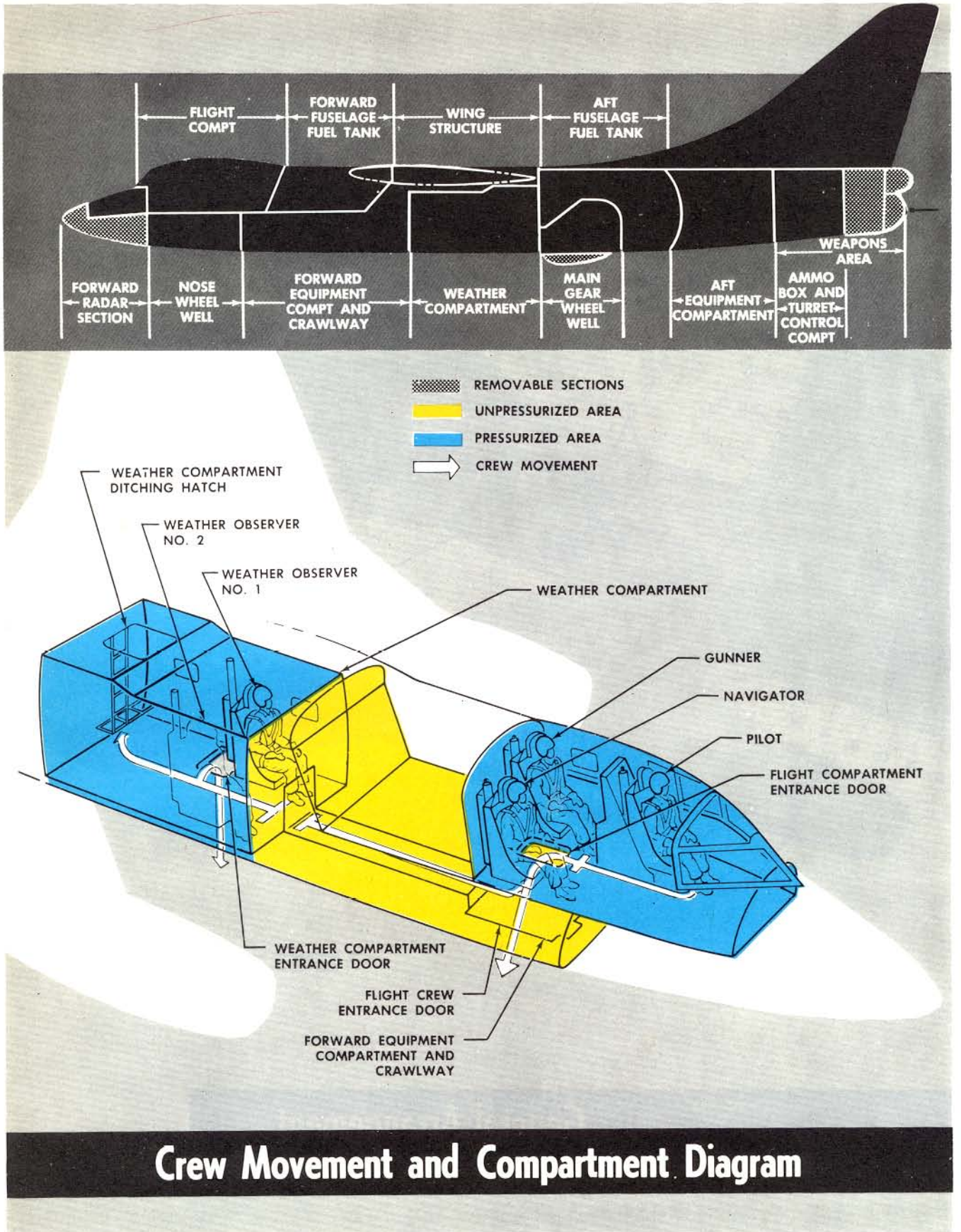
Figure 1-1 (Sheet 2 of 2)



Crew Movement and Compartment Diagram

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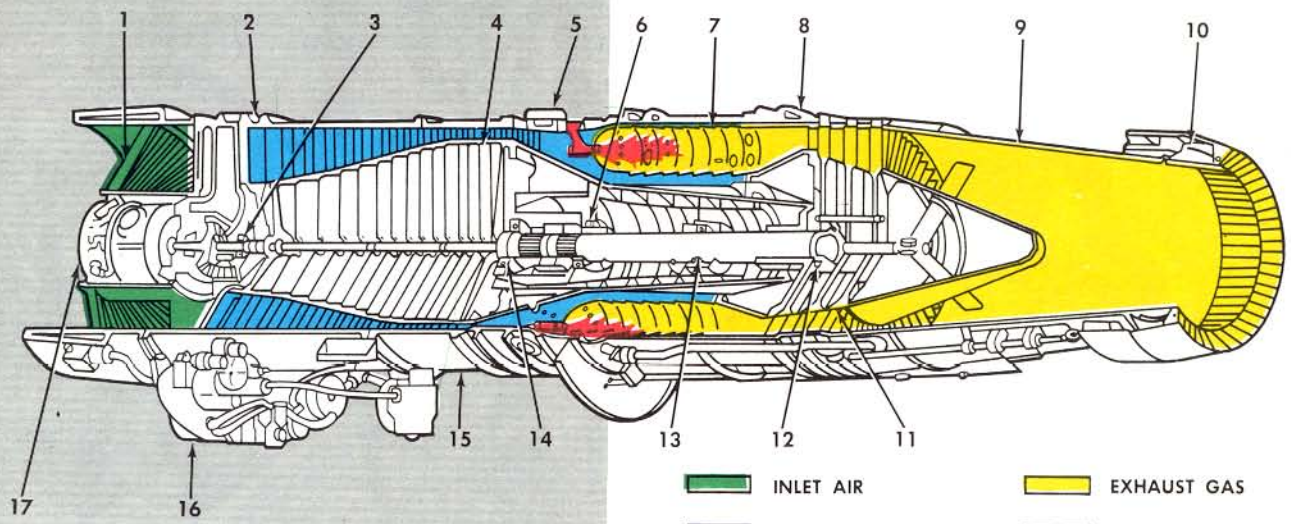
Figure 1-2

The Engine



1. INLET SCREENS
2. FORWARD FRAME
3. FORWARD COMPRESSOR BEARING
4. COMPRESSOR ROTOR
5. MIDFRAME
6. FORWARD TURBINE BEARING
7. COMBUSTION CHAMBER
8. BURNER SUPPORT
9. EXHAUST ASSEMBLY
10. VARIABLE EXHAUST NOZZLE
11. TURBINE ROTOR
12. REAR TURBINE BEARING
13. DAMPENER BEARING
14. REAR COMPRESSOR BEARING
15. COMPRESSOR CASE
16. RADIAL DRIVE
17. CONSTANT SPEED DRIVE UNIT

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Figure 1-3

(Continued from Page 1-3)

AIR START position. A 28-volt d-c ignition timer is installed in the engine start system to limit each attempted start to 3 minutes when utilizing the NORMAL position. The ignition circuit is opened automatically when engine speed reaches approximately 41 per cent rpm.

IGNITION SWITCHES.

Two ignition switches *(9, figure 1-6)*, one for each engine, are located on the engine start panel on the pilot's right console. These switches have three positions: NORMAL, MOTOR, and AIR START. The NORMAL position is used for normal engine starts; the MOTOR position of the switch is used while motoring the engine to drain raw fuel or for engine purging without ignition; and the AIR START position of the switch is used in flight to make a windmilling start.

STARTER.

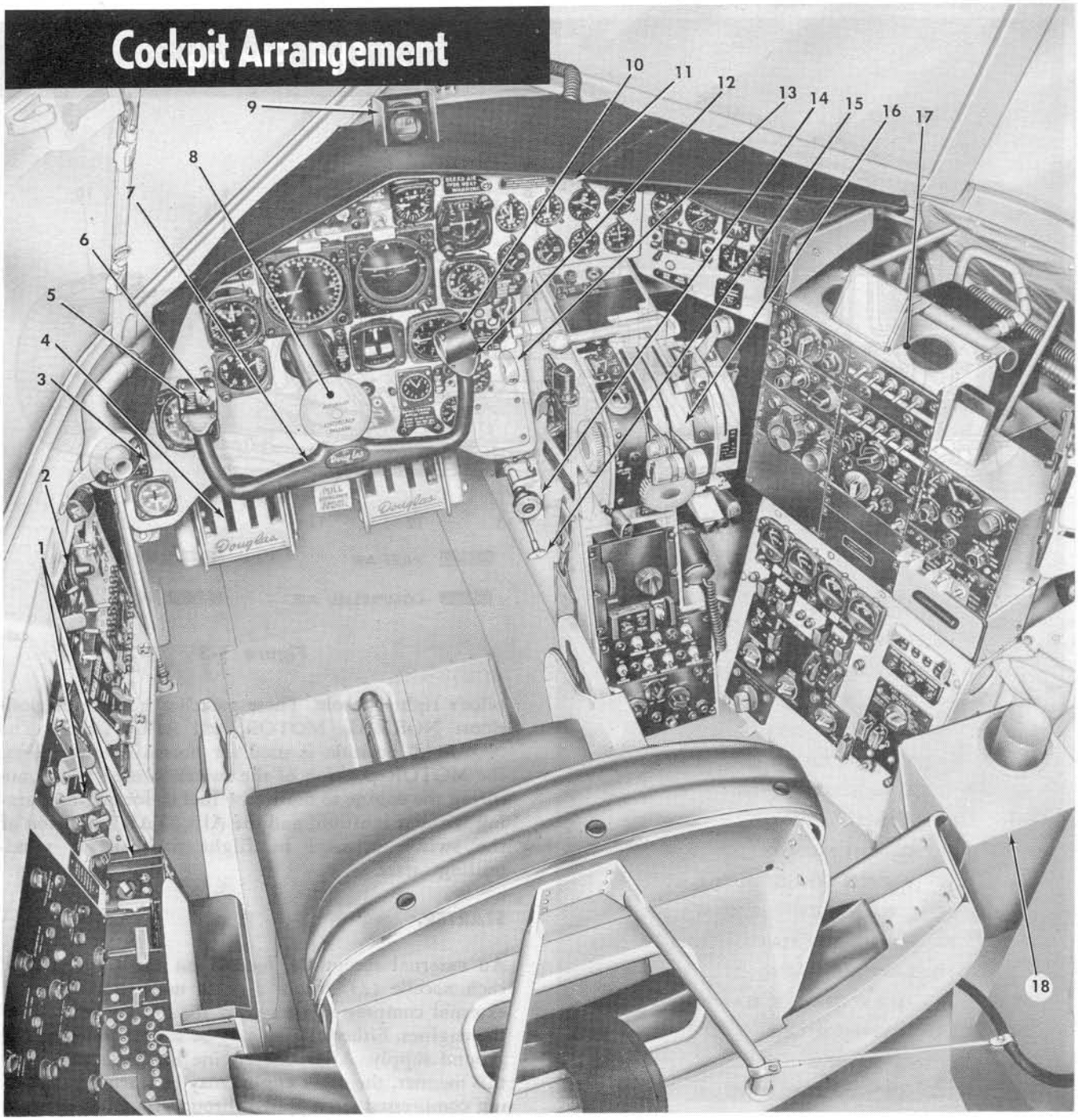
An external receptacle, located on the right side of each nacelle *(23, figure 1-1)*, is used to connect an external compressed air supply for ground starting of the engines. Either engine may be started by using the ground supply. After one engine has been started in this manner, the other engine may be started by utilizing compressed air supplied through the high pressure bleed air manifold system of the operating engine. In-flight engine starts may also be made by using high pressure engine bleed air.

MASTER ENGINE SWITCHES.

Two guarded ON-OFF master engine switches *(5 and 9, figure 1-5)*, one for each engine, are located on the top side of the control pedestal. The ON position of each master switch energizes its respective 28-volt d-c circuits to the start switch and other controls and opens the fuel firewall shutoff valve, provided the fire control handle is in. The OFF position of the switch

(Continued on Page 1-13)

Cockpit Arrangement



1. PILOT'S LEFT CONSOLE
2. LEFT FORWARD CONSOLE
3. NOSE WHEEL STEERING RANGE SELECTOR HANDLE
4. RUDDER PEDAL
5. HORIZONTAL STABILIZER TRIM CONTROL
6. AUTOPILOT ELECTRICAL RELEASE SWITCH
7. CONTROL WHEEL
8. AUTOPILOT EMERGENCY RELEASE SWITCH
9. MAGNETIC COMPASS
10. INTERPHONE AND RADIO COMMUNICATIONS SWITCH
11. MAIN INSTRUMENT PANEL
12. ROGER BUTTON
13. LANDING GEAR LEVER
14. PARKING BRAKE HANDLE
15. PILOT'S FOOT WARMER CONTROL HANDLE
16. CONTROL PEDESTAL
17. PILOT'S RIGHT CONSOLE
18. DATA AND THERMOS CASE

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Figure 1-4

Control Pedestal

1. LANDING GEAR ANTI-RETRACTION LATCH
2. ATO ARMING SWITCH
3. ATO WARNING LIGHT
4. ATO JETTISON SWITCH
5. LEFT MASTER ENGINE SWITCH
6. RUDDER TRIM KNOB
7. SURFACE LOCK CONTROL LEVER
8. THROTTLE LOCK
9. RIGHT MASTER ENGINE SWITCH
10. DRAG CHUTE CONTROL LEVER
11. HORIZONTAL STABILIZER TRIM CONTROL KNOB
12. ATO FIRING SWITCH
13. RIGHT THROTTLE
14. LEFT THROTTLE
15. SPEED BRAKE SWITCH
16. AILERON TRIM KNOB
17. WING FLAP HANDLE
18. EMERGENCY AIR BRAKE HANDLE
19. AUTOPILOT CONTROLLER
20. AUTOPILOT FUNCTION SELECTOR
21. INSTRUMENT LIGHT SWITCHES
22. LANDING LIGHT SWITCH
23. EXTERNAL STORES JETTISON SWITCH
24. EMERGENCY ALARM SWITCH
25. TAKE-OFF AND LANDING CHECK LIST
26. PILOT'S CHECK LIST

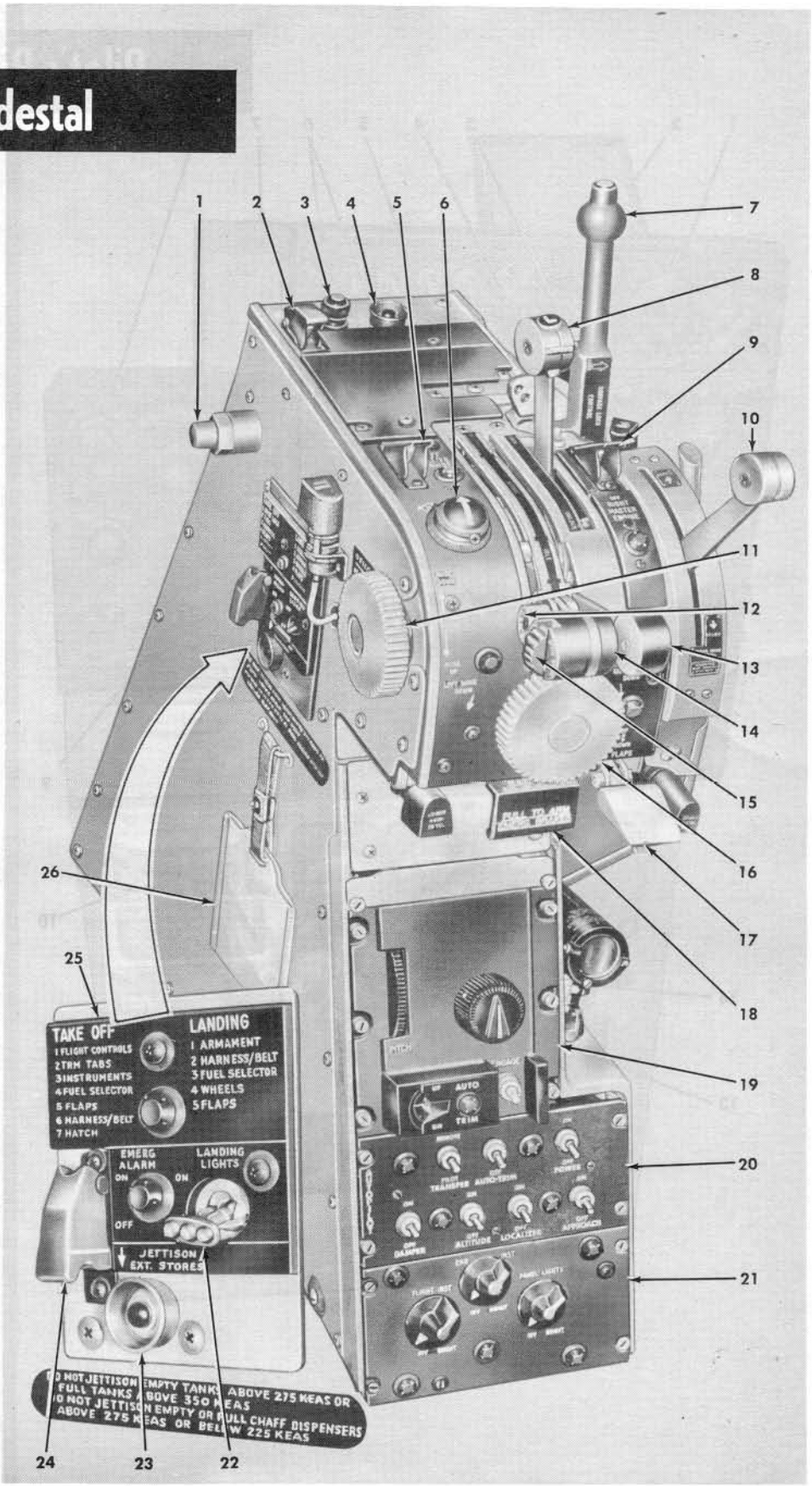

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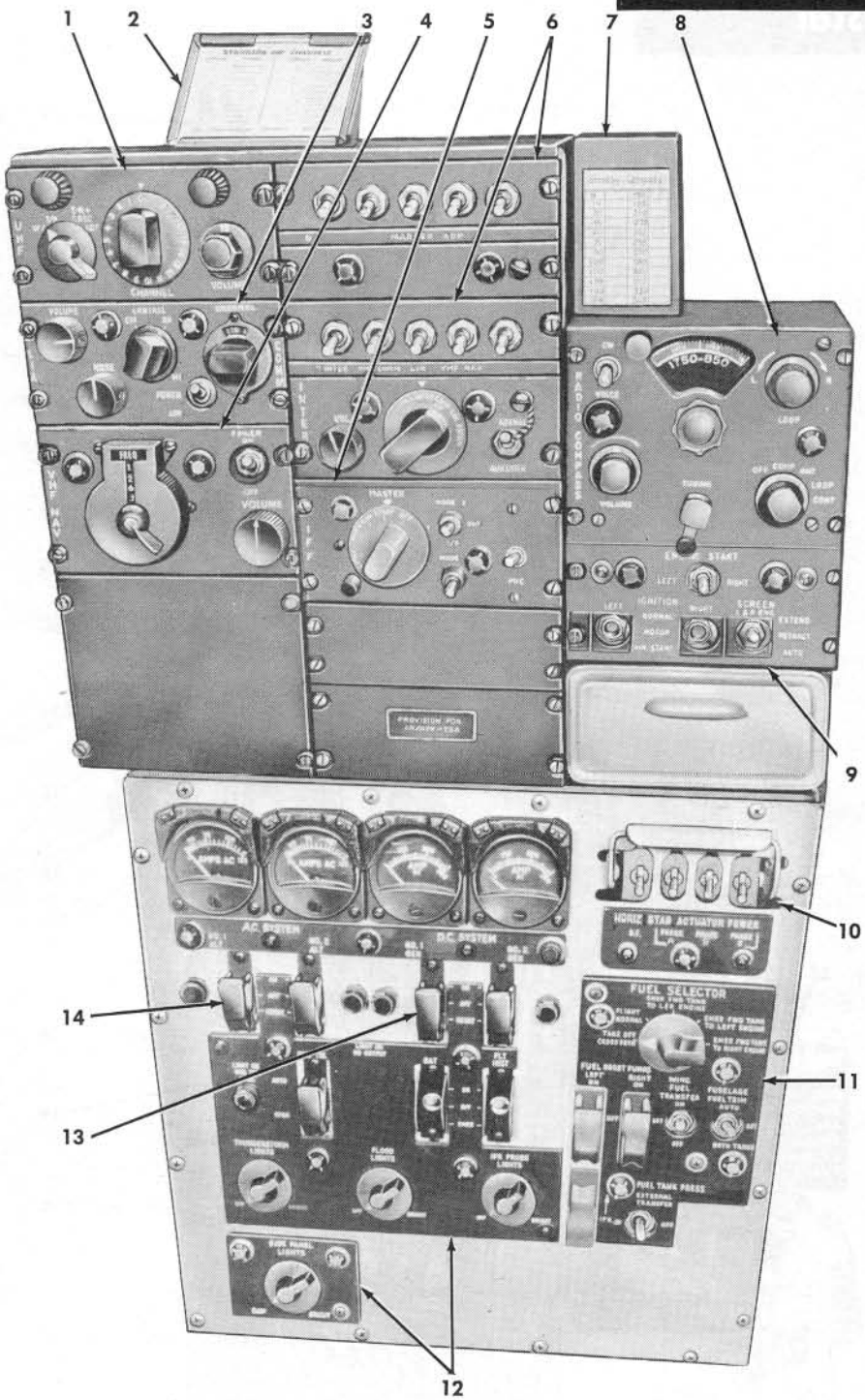
Figure 1-5

Pilot's Right Console



1. UHF CONTROL PANEL
2. UHF RADIO FREQUENCY CARD HOLDER
3. LIAISON CONTROL PANEL
4. VHF NAV CONTROL PANEL
5. IFF RADAR CONTROL PANEL
6. INTERPHONE CONTROL PANEL
7. STANDBY COMPASS CORRECTION CARD HOLDER
8. RADIO COMPASS (ADF) CONTROL PANEL
9. ENGINE START PANEL
10. HORIZONTAL STABILIZER ACTUATOR POWER CIRCUIT BREAKER SWITCH PANEL
11. FUEL SELECTOR PANEL
12. LIGHT CONTROL PANEL
13. D-C SYSTEM CONTROL PANEL
14. A-C SYSTEM CONTROL PANEL

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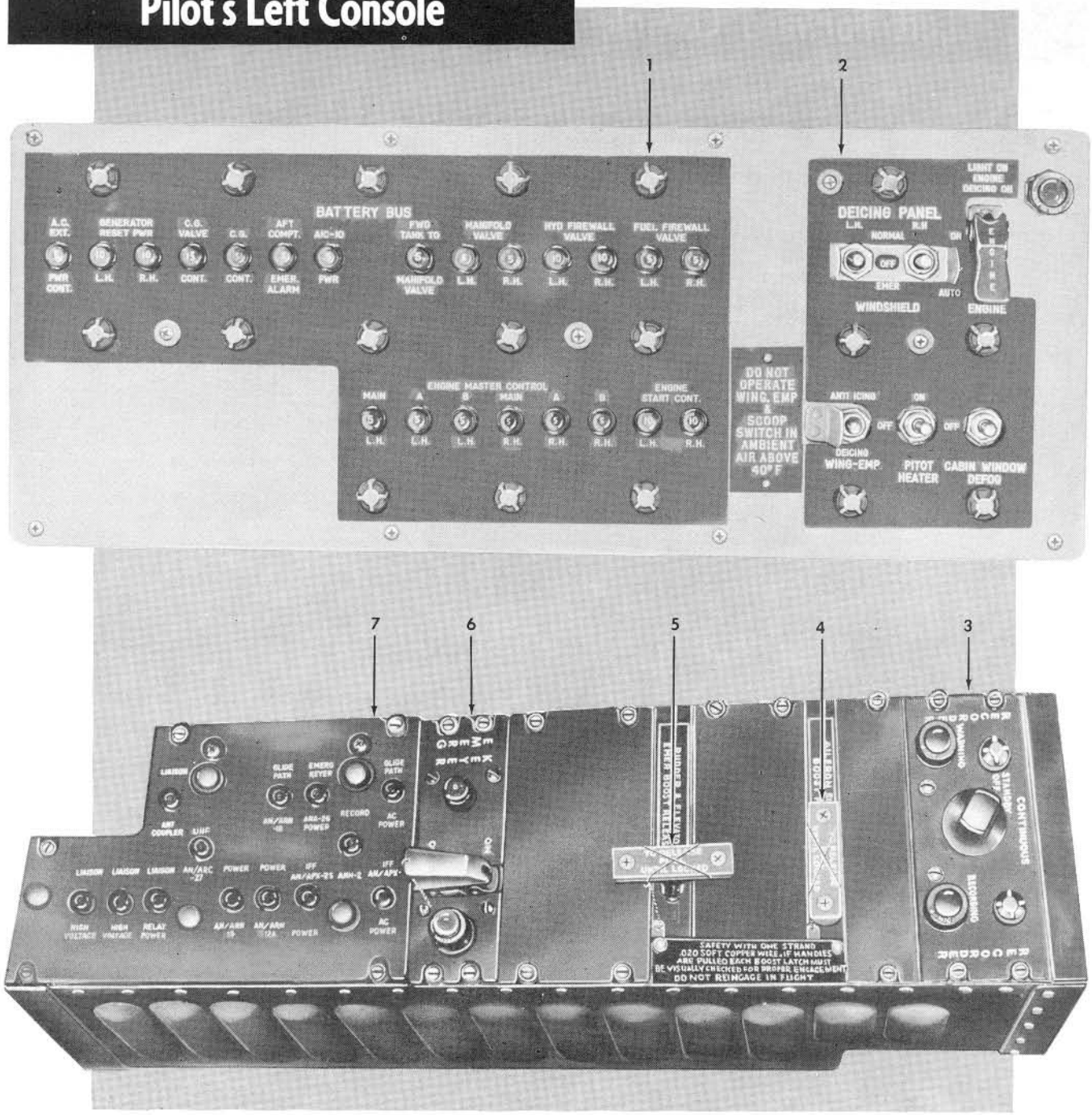
Figure 1-6

Pilot's Left Console



1. BATTERY BUS CIRCUIT BREAKER PANEL
2. DE-ICING CONTROL PANEL
3. INTERPHONE RECORDER CONTROL PANEL
4. AILERON BOOST MANUAL RELEASE
5. RUDDER-ELEVATOR BOOST MANUAL RELEASE
6. EMERGENCY KEYER
7. PILOT'S RADIO CIRCUIT BREAKER PANEL

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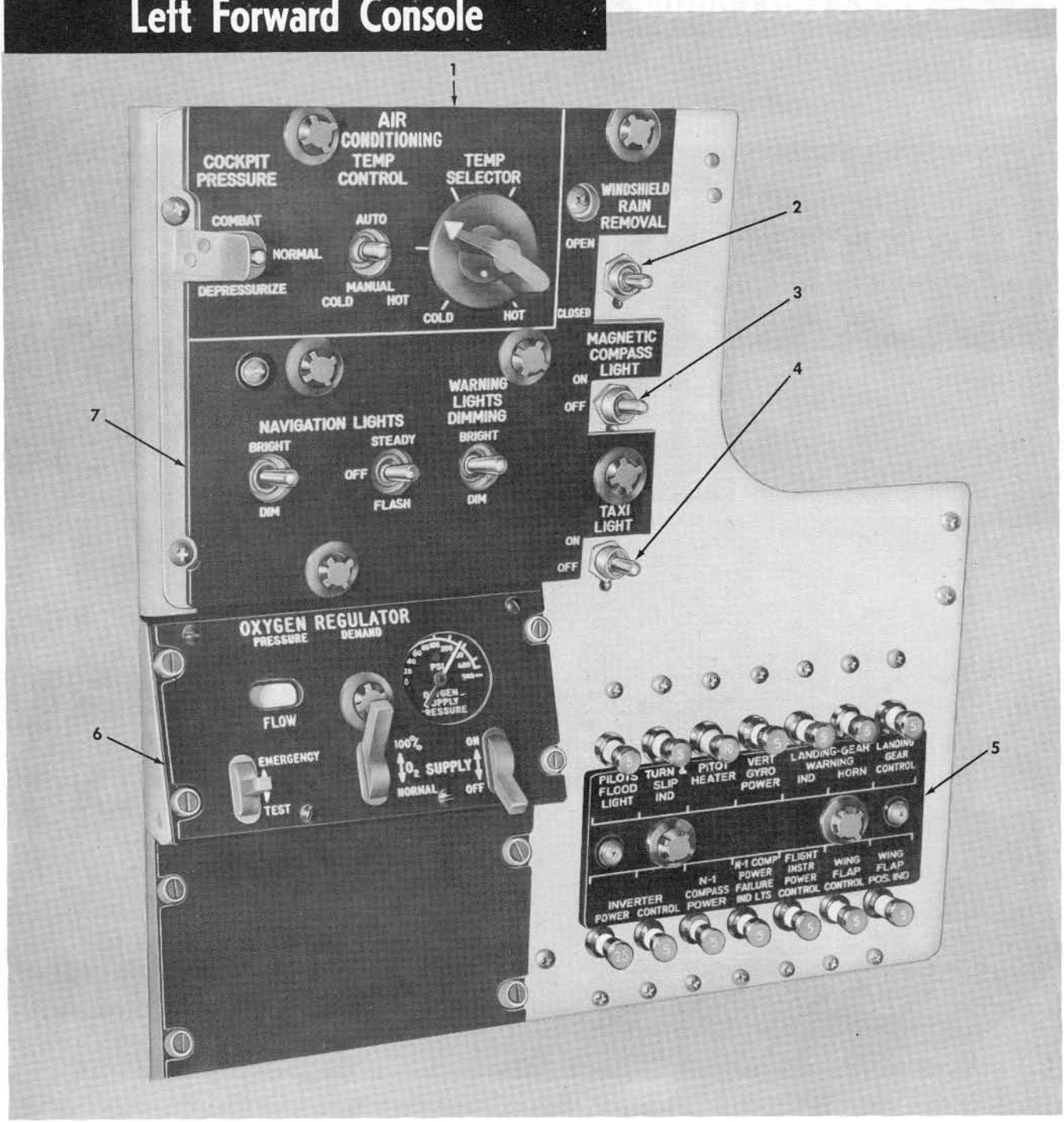
Figure 1-7

Left Forward Console



1. AIR CONDITIONING CONTROL PANEL
2. WINDSHIELD RAIN REMOVAL SWITCH
3. MAGNETIC COMPASS LIGHT SWITCH
4. TAXI LIGHT SWITCH
5. EMERGENCY BUS CIRCUIT BREAKER PANEL
6. PRESSURE DEMAND OXYGEN REGULATOR PANEL
7. NAVIGATION LIGHT PANEL

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Figure 1-8

(Continued from Page 1-7)

deenergizes the circuits to the start switch and other controls and closes the fuel firewall shutoff valve. These switches must be in the ON position prior to starting the engines.

STARTER SWITCH.

A 3-position momentary-type start switch *(9, figure 1-6)* is located on the engine panel on the pilot's right console. The switch is placarded ENGINE START, LEFT, and RIGHT. This switch is spring-loaded to the OFF (centered) position. With the ignition switch in NORMAL, positioning the start switch in either the LEFT or RIGHT position energizes a 28-volt d-c circuit which actuates the air shutoff valve solenoid, admits air to the starter, and energizes the drip valve solenoid and the ignition circuit for the respective engine.

ENGINE INSTRUMENTS.

EXHAUST TEMPERATURE INDICATORS.

Two engine exhaust temperature indicators, one for each engine, are located on the main instrument panel *(15, figure 1-9)*. They indicate exhaust temperature in degrees centigrade by means of thermocouples which are located around the exhaust nozzle.

TACHOMETERS.

Two tachometers *(5, figure 1-9)*, one for each engine, show readings in PER CENT RPM and are located on the main instrument panel.

OIL PRESSURE INDICATORS.

Two 28-volt, 400 cycle, a-c powered oil pressure indicators *(6, figure 1-9)*, one for each engine, calibrated in psi, are located on the main instrument panel.

FUEL FLOW INDICATORS.

Two 28-volt a-c powered fuel flow indicators *(16, figure 1-9)*, one for each engine, are located on the main instrument panel. Each indicator is calibrated to show fuel flow in pounds per hour.

Note

The engine instruments are positioned on the main instrument panel to give the pilot a normal operating indication at the nine o'clock position.

ASSIST TAKE-OFF SYSTEM.

Provisions are installed for the mounting of six ATO units on each side of the fuselage between the main landing wheel doors and the speed brakes *(21, figure 1-1)*. The necessary controls are provided for the arming, firing, and jettisoning of the 12 ATO units. Each unit is capable of delivering 1000 pounds thrust for approximately 15 seconds. Refer to Section II for operation of the assist take-off system and to Appendix I for ATO Firing Speeds.

ATO ARMING SWITCH.

A guarded ATO arming switch, located on the control pedestal *(2, figure 1-5)*, completes a 28-volt d-c circuit to arm the firing switch when moved to the ON position.

ATO WARNING LIGHT.

A 28-volt d-c press-to-test red warning light, located adjacent to the ATO arming switch on the control pedestal *(3, figure 1-5)*, will glow continuously when the ATO system is armed.

ATO FIRING SWITCH.

The ATO firing switch is a shielded pushbutton switch, located on the left throttle lever *(12, figure 1-5)*. When depressed, this switch completes a 28-volt d-c circuit through relays to energize the ATO ignitor and fire the ATO charges, provided the ATO arming switch is in the ON position. There is no protective circuit in either the ATO arming or fire control to close the speed brakes in the event they are inadvertently left in the OPEN position during ATO take-off.

ATO JETTISON SWITCH.

The shielded pushbutton ATO jettison switch is placarded PUSH TO JETTISON BOTTLES and is located on the control pedestal *(4, figure 1-5)*. This switch completes a 28-volt d-c circuit which energizes the solenoid-actuated ATO jettison control valve for hydraulic jettisoning of the ATO units *(figure 1-16)*. A time delay circuit is installed to keep the jettison control valve energized for approximately twenty-five seconds after the cockpit control switch has been released.

CAUTION

Check that the speed brakes are closed, by positioning the speed brakes switch to CLOSE, prior to jettisoning the ATO bottles.

ATO JETTISON CONTROL VALVE MANUAL OVERRIDE.

The ATO jettison control valve manual override consists of a manually operated plunger in the end of the solenoid-actuated ATO jettison control valve located on the emergency hydraulic control panel *(figure 1-18)* on the left side of the crawlway. The plunger is pushed manually to actuate the ATO jettison control valve in the event of failure of the normally electrically actuated solenoid. The plunger must be held in the PUSH TO DROP position until all bottles are released. The manual override plunger is placarded JATO-PUSH TO DROP and is spring loaded to return to the OFF position.

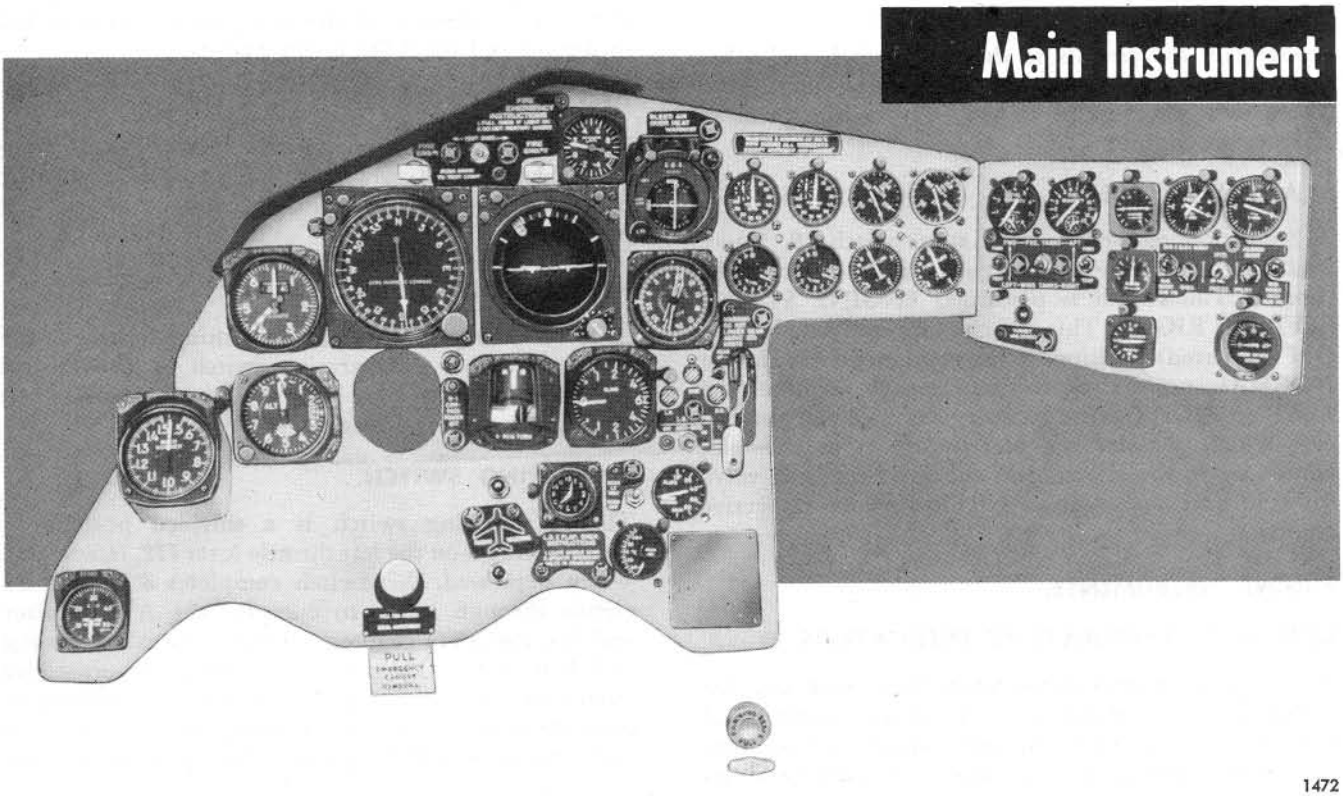

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Figure 1-9 (Sheet 1 of 2)

OIL SUPPLY SYSTEM.

An independent oil supply system for each engine is provided to supply the engine with oil from an integral tank located in each engine *(3, and 12, figure 1-24)*. Each tank has a usable capacity of 5.5 US gallons. Operation of the oil system is automatic and no controls are provided. Oil specification and filler points are shown in figure 1-24. See Section VII for Engine Oil System Operation.

FUEL SUPPLY SYSTEM.

The aircraft fuel supply system *(figure 1-10)* consists of two integral wing tanks, two self-sealing fuselage tanks, and two external droppable tanks (if installed). The aft fuselage tank is the main tank, and normally supplies fuel for the engines. The continuous-flow fuel system employs electrically driven transfer pumps in the wing tanks to force the fuel under pressure from the wing tanks, through the transfer line check valves, to the wing fuel transfer valve, from which it is directed to the aft fuselage tank through the fuel line connecting the forward and aft fuselage tanks.

The fuel is transferred from the forward tank to the aft tank by the forward tank boost pump. The flow is automatically controlled through the aft tank inlet control valve by the CG control system. The CG control system also controls the wing fuel transfer. Two submerged 115/200-volt a-c driven centrifugal boost pumps, located in the aft section of the aft fuselage tank, force the fuel under pressure through separate lines from the aft tank, through a check valve and an electrically operated shutoff valve to the fuel cross-feed line, to the two cross-feed electrically operated shutoff valves, and to the electrically operated fuel firewall shutoff valves of both engines.

A single-point ground refueling system permits refueling of the aircraft (except for the external droppable tanks). A ground refueling control panel *(figure 4-27)*, located on the right side of the fuselage below the leading edge of the wing, contains switches to manage the aircraft system as required for refueling. Provisions for an air refueling system are also installed to permit refueling of the aircraft during flight. See the paragraphs on Air Refueling System and Single Point Refueling System, Section IV. For usable fuel and tank capacities, see figure 1-12. For fuel specification and servicing points, see figure 1-24. (Refer to Section VII for additional information on the fuel system).

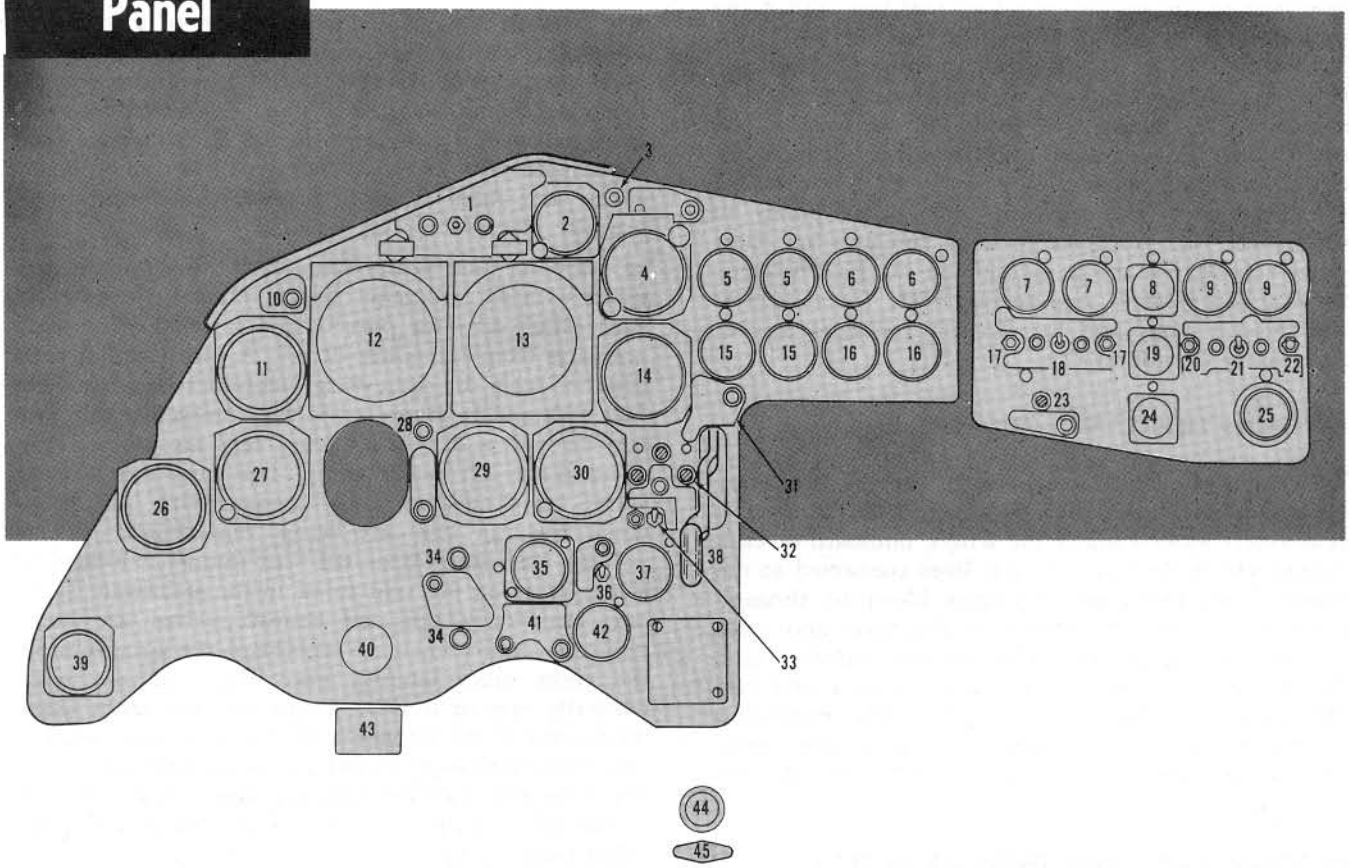
Note

The fuel firewall shutoff valves are opened when the master engine switches are placed in the ON position and the engine fire control handles are IN; the OFF position of the master engine switches closes the valves. See the paragraph on Master Engine Switches and Engine Fire Control Handles, this Section.

EMERGENCY FUEL SYSTEM.

In the event that fuel cannot be supplied from the aft fuselage tank, it may be supplied from the forward fuselage tank for emergency operation of the engines

Panel



1. FIRE CONTROL PANEL
2. ACCELEROMETER
3. BLEED AIR OVERHEAT WARNING LIGHT
4. COURSE INDICATOR (LOCALIZER AND GLIDE SLOPE)
5. TACHOMETER
6. ENGINE OIL SYSTEM PRESSURE INDICATOR
7. FUEL QUANTITY INDICATOR
8. AILERON TRIM POSITION INDICATOR
9. HYDRAULIC SYSTEM PRESSURE INDICATOR
10. PILOT'S RADIO CALL NUMBER
11. AIRSPEED INDICATOR
12. DIRECTIONAL INDICATOR (COMPASS REPEATER)
13. ATTITUDE INDICATOR
14. RADIO MAGNETIC INDICATOR
15. ENGINE EXHAUST TEMPERATURE INDICATOR
16. FUEL FLOW INDICATOR
17. FUEL QUANTITY PRESS TO TEST SWITCHES
18. FUEL QUANTITY SELECTOR SWITCH
19. RUDDER TRIM POSITION INDICATOR
20. RUDDER BOOST PRESSURE INDICATOR LIGHT (AMBER)
21. HYDRAULIC BOOST PRESSURE INDICATOR SELECTOR SWITCH
22. RUDDER BOOST PRESSURE WARNING LIGHT (RED)
23. TURRET UNLOCK INDICATOR
24. HORIZONTAL STABILIZER (ELEVATOR) TRIM POSITION INDICATOR
25. OXYGEN QUANTITY INDICATOR
26. MACHMETER
27. ALTIMETER
28. COMPASS POWER-OFF WARNING LIGHT
29. TURN-AND-SLIP INDICATOR
30. VERTICAL VELOCITY INDICATOR
31. LANDING GEAR WARNING PLACARD
32. LANDING GEAR POSITION INDICATOR (3 TYPICAL)
33. ANTI-SKID SYSTEM SWITCH AND INDICATOR LIGHT
34. RADAR WARNING INDICATOR
35. CLOCK
36. LANDING GEAR LIGHT TEST AND HORN CUTOFF SWITCH
37. FLAP POSITION INDICATOR
38. LANDING GEAR LEVER
39. PRESSURE ALTITUDE INDICATOR
40. RUDDER PEDAL ADJUSTMENT RELEASE KNOB
41. LANDING GEAR AND WING FLAP EMERGENCY INSTRUCTIONS
42. FREE AIR TEMPERATURE INDICATOR
43. EMERGENCY CANOPY HATCH REMOVAL HANDLE
44. PARKING BRAKE HANDLE (MOUNTED ON SIDE OF CONTROL PEDESTAL)
45. PILOT'S FOOT WARMER CONTROL HANDLE

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Figure 1-9 (Sheet 2 of 2)

through the fuel line connecting the forward fuselage tank to the engine cross-feed fuel line. When the fuel selector switch is placed in the EMER. FWD. TANK TO L. & R. ENGINE position, the shutoff valve in the line from the forward tank and the two shutoff valves in the cross-feed line are opened, the two shutoff valves in the lines from the aft tank are closed, and both boost pumps in the aft tank are shut off, permitting the forward tank boost pump to supply the fuel from the forward fuselage fuel tank *(figure 1-10)*. See the paragraph on the Fuel Selector Switch, this Section. See Section VIII for Fuel System Management and Section III for Fuel System Emergency Operation.

EXTERNAL FUEL TANKS (STORES).

Two external droppable fuel tanks (stores), supported by pylons and racks, may be attached to the aircraft at adapters located under the wings, outboard of each engine nacelle *(figure 2-2)*. Air lines connected to the external fuel tanks supply engine bleed air through pressure regulators to pressurize the tanks and force the fuel through check valves in the transfer lines, through the wing tank inlet control valves, and into the respective wing tanks *(figure 1-10)*. Provisions are also made for the attachment of chaff dispensing pods to the pylons when the external fuel tanks are not used.

EXTERNAL FUEL TANK PRESSURE SWITCH.

The external fuel tank pressure switch, located on the fuel selector panel *(11, figure 1-6)* on the pilot's right console, is placarded TRANSFER and OFF. When placed in the TRANSFER position, the switch completes a 28-volt d-c circuit to energize the solenoid-actuated shutoff valves which admit pressurized air to the external (droppable) tanks through the pylon pressure regulators and close the tank vent line. In addition, the TRANSFER position completes a 28-volt d-c circuit to open the wing vent shutoff valve and the vent shutoff valve in the horizontal stabilizer and closes both pressure regulator shutoff valves that supply air to the external fuel tank pressure system. In the OFF position, the solenoid-actuated shutoff valves are positioned so that the pressurized air is shut off and the external (droppable) tanks are vented to the atmosphere. The OFF position also closes the wing vent and shutoff valves and returns the external tank pressure system to normal.

EXTERNAL STORES JETTISON SWITCH.

A shielded pushbutton-type external tanks (stores) jettison switch *(23, figure 1-5)*, placarded JETTISON EXT. STORES, is located on the left side of the control pedestal. This switch, when depressed, completes a 28-volt d-c circuit to actuate the explosive-operated ejector rack in each pylon and jettison the external fuel tanks (stores).

VENT SYSTEM.

The fuselage tank vent system consists of a vent line, connecting the forward and aft fuselage tanks, which leads to a vent relief valve located in the tip of the right horizontal stabilizer. The vent relief valve is set to maintain a pressure of ¾ psi. Each fuselage tank is provided with an emergency vent line and an emergency vent relief valve to prevent the internal tank pressure from exceeding 3 psi.

In the wing tank vent system, each wing tank is provided with an emergency vent line and an emergency vent relief valve to prevent the internal wing tank pressures from exceeding 12 psi. A vent line has been installed from the right wing fuel tank to the left wing fuel tank and is connected to the emergency vent system through a 28 volt d-c wing vent shutoff valve located in the left center wing. The wing vent shutoff valve, when energized, will depressurize both wing tanks through the left wing vent relief. A 28-volt d-c electrically operated vent shutoff is located in a line bridging the vent relief in the stabilizer. These two electrically operated shutoff valves are automatically closed when the weight of the aircraft is off the right main landing gear oleo, and are automatically opened to depressurize the fuel tanks when the weight of the aircraft is on the right main landing gear oleo. Both vent shutoff valves automatically open when the external fuel tank pressure switch is placed in the TRANSFER position, or when the air refueling (IFR) switch is up.

HIGH-LEVEL FLOAT VALVES.

High-level float valves are installed in the four internal tanks. During refueling or transfer of fuel, the high-level float valve will, when a tank is full, automatically close the respective control valve to prevent undue pressure in the tank and possible overflow of fuel from the tank.

FUEL SELECTOR SWITCH.

A 5-position rotary fuel selector switch located on the fuel selector panel *(11, figure 1-6)*, on the pilot's right console, energizes a 28-volt d-c circuit which controls the fuel shutoff valve in the line from the forward tank, the shutoff valves in the cross-feed line, the shutoff valves in the lines from the aft tank, and a 115-volt a-c circuit which controls one boost pump in the forward fuselage tank and two boost pumps in the aft fuselage tank *(figure 1-10)* as follows:

Switch Position	*Fuel Shutoff Valve Position*
TAKEOFF & CROSSFEED —	Both cross-feed shutoff valves open. Forward tank to manifold valve closed. Left and right boost shutoff valve open. (Fuel to both engines from either aft tank boost pump.)

Switch Position	*Fuel Shutoff Valve Position*
FLIGHT NORMAL —	Both cross-feed shutoff valves closed. Forward tank to manifold valve closed. Left and right boost shutoff valves open. (Each aft tank boost pump supplying one engine separately).
EMER FWD TANK TO L & R ENGINE —	Forward tank to manifold shutoff valve open. Left cross-feed shutoff valve open. Right cross-feed shutoff valve open. Right and left boost shutoff valves closed. (Both engines are supplied fuel from the forward tank boost pump.)
EMER FWD TANK TO LEFT ENG —	Forward tank to manifold shutoff valve open. Left cross-feed shutoff valve open. Right cross-feed shutoff valve closed. Right boost shutoff valve open. Left boost shutoff valve closed. (Left engine is supplied fuel from the forward tank boost pump.)
EMER FWD TANK TO RIGHT ENGINE —	Forward tank to manifold shutoff valve open. Right cross-feed shutoff valve open. Left cross-feed shutoff valve closed. Left boost shutoff valve open. Right boost shutoff valve closed. (Right engine is supplied fuel from the forward tank boost pump.)

Note

All three emergency positions of the fuel selector switch automatically close the CG valve.

See Section III for Fuel System Emergency Operation and Section VIII for Fuel System Management.

FUEL BOOST PUMP SWITCHES.

Two guarded fuel boost pump switches are located on the fuel selector panel *(11, figure 1-6)* on the pilot's right console and have the positions ON-OFF. Placing either switch in the ON (guarded) position energizes a 115/200-volt a-c circuit to operate the respective boost pump in the aft fuselage fuel tank to force fuel under pressure to the engines. The fuel boost pumps are also controlled by the fuel selector switch. One or both boost pumps are turned off automatically when the fuel selector switch is positioned to any of the three emergency forward tank positions. There is no flight compartment switch for the forward fuselage fuel tank boost pump; its operation corresponds to the position of the pilot's fuel control switches. See the paragraph on the Fuel Selector Switch and Fuselage Fuel Trim Switch, this Section.

CAUTION

Do not use the guard to turn on the switches because it is possible to have the guard closed and the switches in the OFF position.

WING FUEL TRANSFER SWITCH.

A 2-position wing fuel transfer switch, placarded ON-OFF, is located on the fuel selector panel *(11, figure 1-6)* on the pilot's right console. This switch, when placed in the ON position, completes 28-volt d-c circuits to open the wing fuel transfer valve, deenergize (close) the CG valve, and turn off the forward tank boost pump, and actuates a 200-volt a-c circuit to operate the fuel transfer pumps located in each wing tank *(figure 1-10)*.

Note

Wing fuel transfer to the aft fuselage tank is controlled by the automatic feature of the CG system only when the wing fuel transfer switch is in the ON position and the fuselage fuel trim switch is in the AUTO position. In the event of CG system malfunction, causing the aft fuel tank inlet control valve to close, fuel may be transferred from the wing tanks by placing the fuselage fuel trim switch in either the BOTH TANKS or the AFT position.

FUSELAGE FUEL TRIM SWITCH.

A 3-position fuselage fuel trim switch, located on the fuel selector panel *(11, figure 1-6)* on the pilot's right console, is placarded AUTO, AFT, and BOTH TANKS. When the switch is positioned to either AUTO or BOTH TANKS, 28-volt battery circuits are energized to open the CG valve and turn on the forward tank boost pump, provided the fuel selector switch is positioned to either TAKE OFF & CROSS FEED or FLIGHT NORMAL. The forward tank boost pump energizes the forward tank high level float solenoids. Only in the AUTO position is the aft tank inlet control valve opened or closed by the cg system to maintain the fuel weight relationship between the forward and aft tanks. With the fuselage fuel trim switch in the AFT position, the circuits are deenergized to close the CG valve and turn off the forward tank boost pump. The CG valve is closed, regardless of the position of any other switch, when the wing fuel transfer switch is positioned to ON or when the fuel selector switch is positioned to any one of the three

(Continued on Page 1-20)

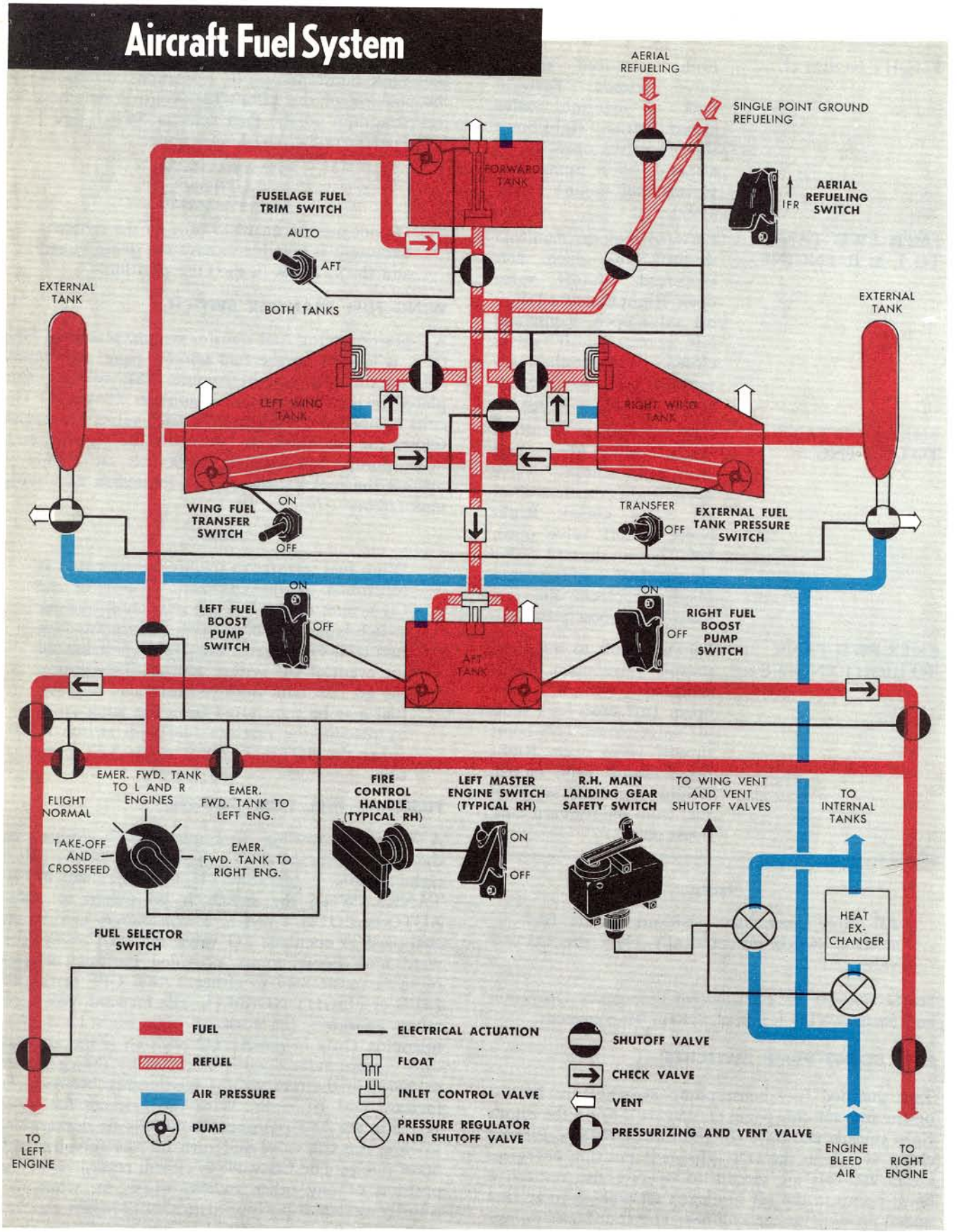

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Figure 1-10

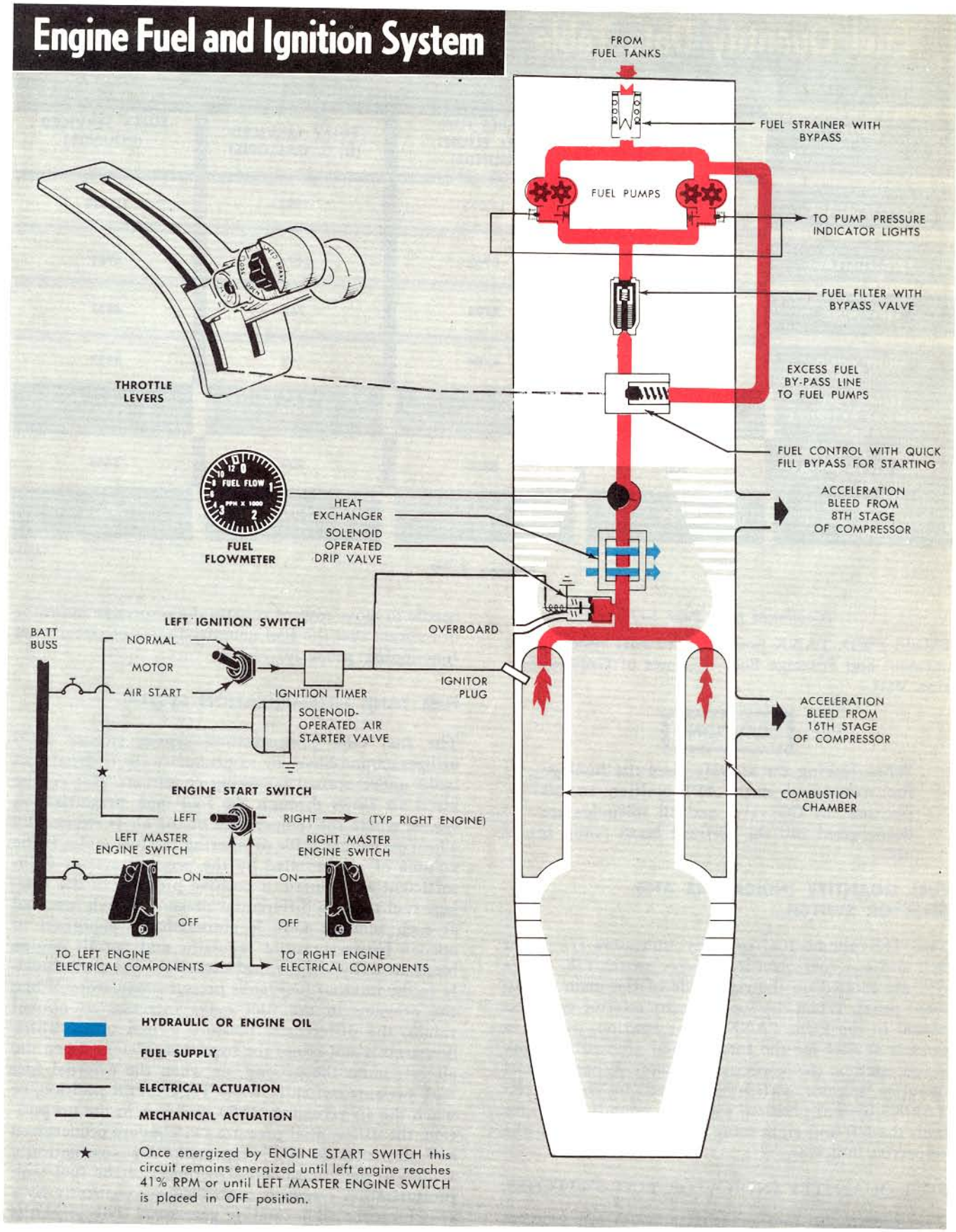
Engine Fuel and Ignition System
FROM FUEL TANKS
FUEL STRAINER WITH BYPASS
FUEL PUMPS
TO PUMP PRESSURE INDICATOR LIGHTS
FUEL FILTER WITH BYPASS VALVE
EXCESS FUEL BY-PASS LINE TO FUEL PUMPS
FUEL CONTROL WITH QUICK FILL BYPASS FOR STARTING
ACCELERATION BLEED FROM 8TH STAGE OF COMPRESSOR
ACCELERATION BLEED FROM 16TH STAGE OF COMPRESSOR
COMBUSTION CHAMBER
THROTTLE LEVERS
FUEL FLOW
PPH X 1000
FUEL FLOWMETER
HEAT EXCHANGER
SOLENOID OPERATED DRIP VALVE
OVERBOARD
IGNITOR PLUG
LEFT IGNITION SWITCH
BATT BUSS
NORMAL
MOTOR
AIR START
IGNITION TIMER
SOLENOID-OPERATED AIR STARTER VALVE
ENGINE START SWITCH
LEFT
RIGHT
(TYP RIGHT ENGINE)
LEFT MASTER ENGINE SWITCH
RIGHT MASTER ENGINE SWITCH
ON
OFF
TO LEFT ENGINE ELECTRICAL COMPONENTS
TO RIGHT ENGINE ELECTRICAL COMPONENTS
HYDRAULIC OR ENGINE OIL
FUEL SUPPLY
ELECTRICAL ACTUATION
MECHANICAL ACTUATION
★ Once energized by ENGINE START SWITCH this circuit remains energized until left engine reaches 41% RPM or until LEFT MASTER ENGINE SWITCH is placed in OFF position.
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Figure 1-11

Fuel Quantity Data Table

BASED ON TEST DATA AS OF: 11-9-55

FUEL AT 6.5 LB/GAL (BASED ON STANDARD DAY CONDITIONS)

TANK	USABLE FUEL LEVEL FLIGHT (U. S. GALLONS)	USABLE FUEL LEVEL FLIGHT (POUNDS)	FULLY SERVICED (U. S. GALLONS)	FULLY SERVICED (POUNDS)
AFT FUSELAGE	1842	11,973	1852	12,038
FWD FUSELAGE	1071	6962	1074	6981
LEFT WING	736	4784	742	4823
RIGHT WING	736	4784	742	4823
TOTAL FUEL (WITHOUT EXTERNAL TANKS)	4385	28,503	4410	28,665
EXTERNAL (DROPPABLE) TANKS (2 TANKS AT 450 GAL EACH	900	5850	902	5863
TOTAL FUEL (WITH EXTERNAL TANKS)	5285	34,353	5312	34,528

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Figure 1-12

(Continued from Page 1-17)

EMER. FWD. TANK positions. See Fuel System Management and Fuselage Fuel — Center of Gravity, Section VIII.

CAUTION

When leaving the aircraft place the fuselage fuel trim switch in the AFT position. In this position the CG valve and all solenoids are deenergized and the forward boost pump is off.

FUEL QUANTITY INDICATORS AND SELECTOR SWITCH.

Two 115-volt a-c fuel quantity indicators *(7, figure 1-9)* and one fuel quantity selector switch *(18, figure 1-9)* are located on the right side of the main instrument panel. When the fuel quantity selector switch is placed in the FUS. TANKS (up) position, weight in pounds of fuel for the forward and aft fuselage tank is indicated on the respective indicator. When the fuel quantity selector switch is placed in the WING TANKS (down) position, weight in pounds of fuel for both the left and right wing tanks is indicated on the respective indicator.

FUEL QUANTITY INDICATOR TEST SWITCHES.

Two press-to-test fuel quantity indicator test switches *(17, figure 1-9)*, one located below each fuel quantity indicator, when pressed, will cause the fuel indicator needle to move toward zero on the respective indicator to indicate that the fuel quantity indicator circuits are functioning properly.

FUEL TANK PRESSURIZATION SYSTEM.

The fuel tank pressurization system *(figure 1-10)* utilizes engine bleed air to pressurize the internal fuel tanks under normal operating conditions. Hot engine bleed air flows through the fuel tank pressurization system where the temperature of the air is reduced by a heat exchanger prior to entering the fuel tanks. If the volume of air supplied by the pressure system is insufficient to maintain a positive pressure in the fuselage fuel tanks, a differential pressure switch installed at each fuselage tank is automatically energized to open a bypass pressure regulator and permit engine bleed air to bypass the heat exchanger and flow directly to the internal fuel tanks pressure regulators. When the pressure in the fuel tanks increases to normal values, the differential pressure switch opens which deenergizes and closes the bypass regulator. When the aircraft is on the ground, or when the external fuel tank pressure switch is in the TRANSFER position, or when the air refueling (IFR) switch is in the up position, the differential pressure switches are deenergized and the fuselage and wing tanks are automatically vented to the atmosphere. Operation of the fuel tank pressurization system is controlled automatically by a switch on the right landing gear strut. This switch is actuated to energize the system when the aircraft is airborne.

ELECTRICAL POWER SUPPLY SYSTEM.

The electrical power supply system includes a single-wire, 28-volt d-c system, using the aircraft structure as a ground return and a 115/200-volt, 3-phase, 400-cycle, 3-wire a-c system, with the aircraft structure being used as a ground return. Both a-c and d-c systems are necessary to provide the required electrical power supply for operation of the aircraft, its systems, and related electronic equipment. To insure a continued power supply, two d-c engine-driven generators and two a-c engine-driven alternators are provided (one on each engine). In the event of a generator or alternator malfunction or engine failure, the single operating generator and alternator will be capable of supplying the entire a-c and d-c power requirements. A storage battery and inverter are also provided as an emergency source of d-c and a-c power to supply essential equipment in case of complete failure of the alternators and/or generators. Electrical power is distributed to the various units by bus bars and feeder cables. Circuit protection is provided by fuses or circuit breakers *(figure 1-15)*. External power receptacles are provided *(33, figure 1-1)* to connect a-c and d-c ground power sources to the aircraft circuits while the aircraft is on the ground and the engines are not operating.

D-C POWER SUPPLY.

D-c power is supplied by two 28-volt, 300-ampere generators, one on the accessory drive of each engine. The output of the generators is delivered to the d-c buses through regulating and control units to supply the various items of equipment requiring 28-volt d-c power for operation *(figure 1-13)*. When external d-c power is connected, the aircraft d-c bus system is automatically energized. A 24-volt, 36-ampere-hour storage battery is installed to provide a standby source of d-c power. The battery is connected directly to the battery bus and to the emergency bus through a relay actuated by the battery switch. When a d-c external power supply source is not available for starting the engines, the starter controls for either engine are energized from the battery bus. A blocking rectifier prevents equipment connected to the main d-c bus from being operated by the battery, but will allow the battery to be charged from the main d-c bus to assure a fully charged battery for emergency operation *(figure 1-13)*.

BATTERY RELAY SWITCH.

A 3-position guarded battery relay switch (BAT.) is mounted on the d-c system control panel on the pilot's right console *(13, figure 1-6)*. The battery relay switch positions are ON, OFF, and EMER. The ON position of the switch energizes a relay which connects the battery bus to the main d-c bus to provide 28-volt d-c power to the battery bus, and also connects the battery to the main d-c bus for charging. The OFF position of the switch deenergizes a relay which disconnects the battery bus and battery from the main d-c bus; however, the battery bus is still energized by the battery. The EMER. position connects the emergency bus to the battery *(figure 1-13)*. For normal operation, the battery relay switch should be in the ON position. The emergency bus supplies power for the inverters, turn-and-slip indicator, pitot heater, pilot's floodlight, landing gear warning light, and landing gear warning horn, and also provides power for the N-1 compass system and K-4 vertical gyro system (B-1A attitude indicator) when the flight instrument power switch is in the EMER. position.

D-C GENERATOR SWITCHES AND WARNING LIGHTS.

Two guarded 3-position, d-c generator switches are mounted on the d-c system control panel *(13, figure 1-6)* on the pilot's right console. The generator switch positions are placarded ON, OFF, and RESET. The ON and OFF positions are conventional in operation; the spring-loaded RESET position is used for resetting a tripped field control relay. When a generator is off the bus, the warning light for the respective generator will illuminate if the switch is in the ON position and the main bus is energized. The warning lights are placarded LT. ON NO OUTPUT.

D-C AMMETERS.

Two d-c system ammeters, one for each generator, are located on the d-c system ammeter control panel *(13, figure 1-6)* on the pilot's right console. The ammeters are calibrated from 0 to 300 amperes and will indicate the output of the generators when the engines are running and the d-c generator switches are ON.

FLIGHT INSTRUMENT POWER SWITCH.

The flight instrument power switch, located on the a-c and d-c system control panel *(figure 1-6)*, on the pilot's right console, is a 3-position guarded switch with ON, OFF and EMER. positions. With the switch in the ON position, a 28-volt d-c relay is energized to provide 115-volt 3-phase power through the transformer for operation of the flight instruments. In the event of an a-c system failure, the EMER. position of the switch will start the inverter and connect the inverter output to supply the K-4 vertical gyro system and the N-1 compass system.

A-C POWER SUPPLY.

A-c power is furnished by two 40-kva alternators *(figure 1-14)*, connected to a constant-speed hydraulic drive unit and mounted on the forward accessory drive pad of each engine. The output frequency of each alternator is held at 400 (± 2) cps by means of a governor which controls the torque of the drive unit. Excitation for the alternator is provided by an integral exciter, which is a small d-c generator mounted on the same shaft as the alternator rotor. Excitation is controlled by a voltage regulator which controls the output voltage of the alternator by regulating the amount of field current in the exciter unit. Since excitation of the alternators is automatically controlled, no controls for

(Continued on Page 1-24)

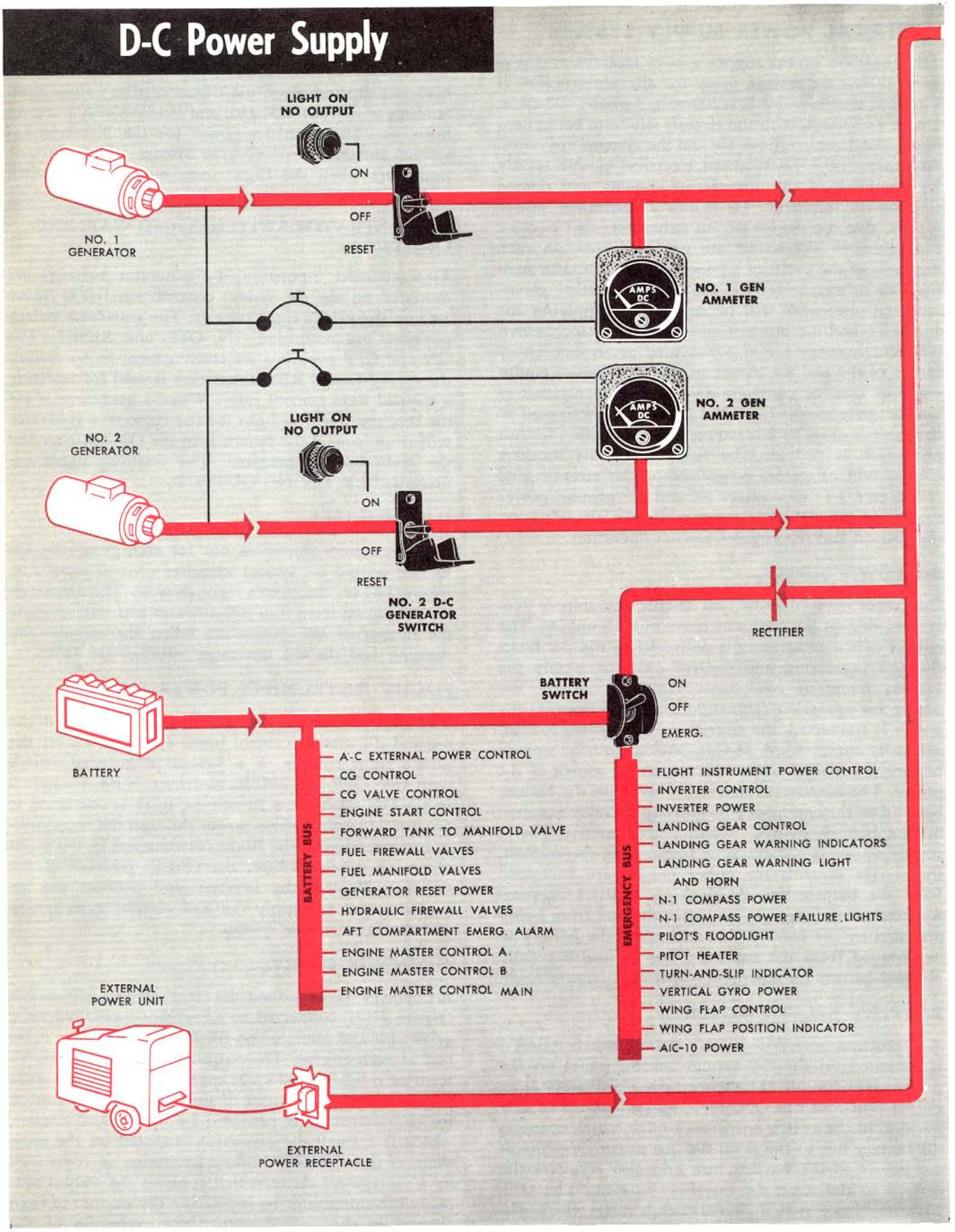

Figure 1-13 (Sheet 1 of 2)

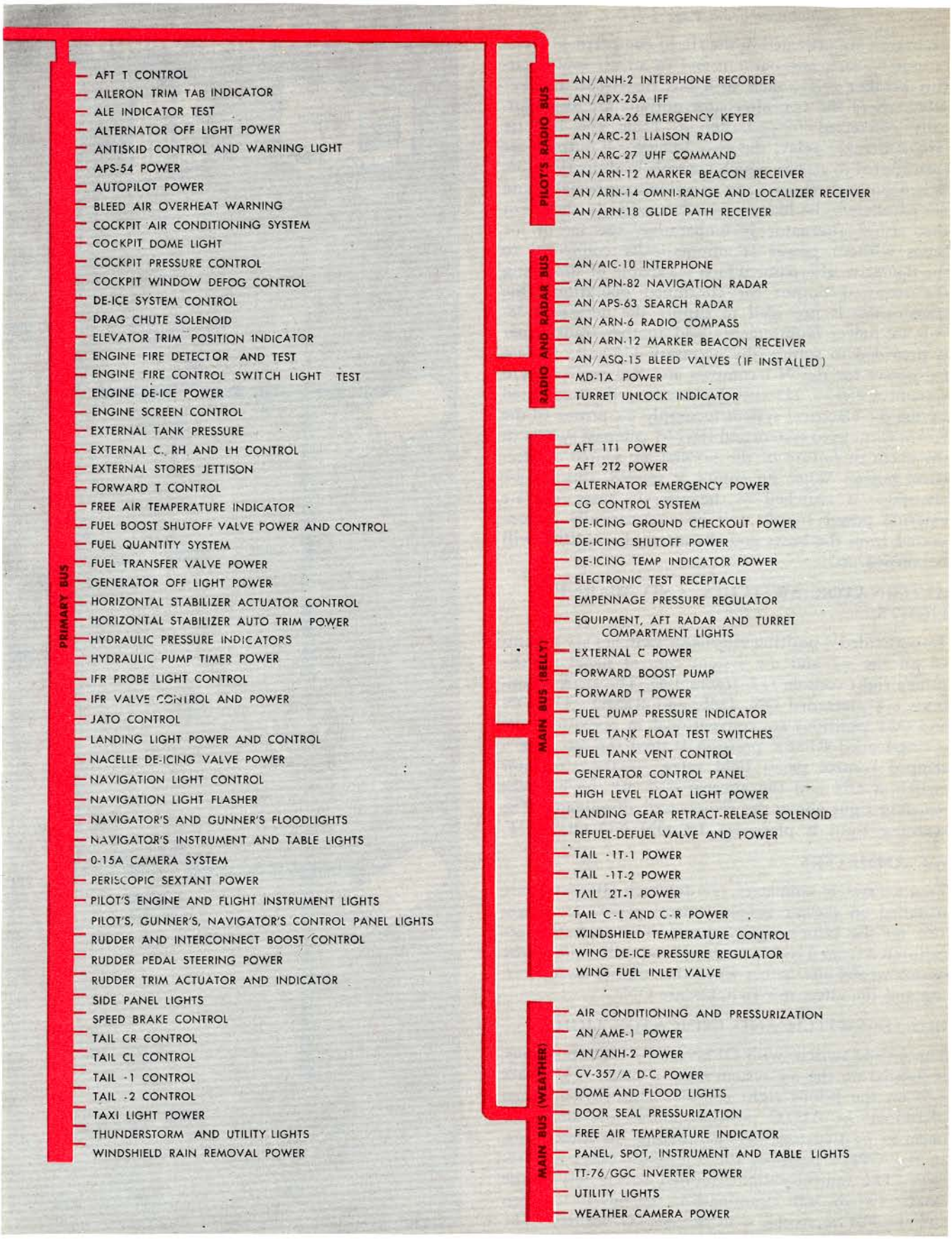

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Figure 1-13 (Sheet 2 of 2)

(Continued from Page 1-21)

excitation are provided in the flight compartment. The output of each alternator is fed to an alternator circuit breaker relay, then to a bus tie circuit breaker relay where the two alternator outputs are automatically connected for paralleling. From the bus tie circuit breaker relay, the two 3-phase a-c outputs are each routed to a relay which controls load distribution. When both alternators are functioning normally and are paralleled, the load is shared equally. In the event that either alternator is inoperative, the set of a-c buses without power is automatically connected to the operative alternator which is capable of supplying the required output for continued operation. One transformer is provided to supply the necessary 28-volt a-c power requirements, and another transformer is provided to supply the necessary 115-volt, 3-phase a-c power for the N-1 compass and K-4 vertical gyro system. A 250 va, 115-volt, 3-phase inverter is operated by the d-c electrical system to supply a-c power to the K-4 vertical gyro system and the N-1 compass system in the event of failure of the normal a-c source of electrical power. When an engine is started, and the a-c alternator is switched to the aircraft buses, the a-c external power supply will be automatically disconnected from the buses and the affected amplifier will be turned on.

ALTERNATOR SWITCHES AND WARNING LIGHTS.

Two guarded 3-position alternator switches are mounted on the a-c and d-c system control panel on the pilot's right console *(13, figure 1-6)*. The switch positions are placarded ON, OFF, and RESET. The ON and OFF positions are conventional in operation; the spring-loaded RESET position is used for resetting a tripped control panel field relay. If the alternator switch is ON and the alternator is off the bus, the warning light above the switch will illuminate. The warning light is placarded LT. ON NO OUTPUT.

A-C AMMETERS.

Two a-c system ammeters, one for each alternator, are installed on the a-c system control panel *(13, figure 1-6)* on the pilot's right console. The ammeters are calibrated from 0 to 125 amperes, and will indicate the output of the alternators when the engines are operating and the alternator switches are ON.

BUS-TIE SWITCH AND INDICATOR LIGHT.

The bus-tie switch, with OPEN and AUTO positions, is located on the a-c system control panel *(13, figure 1-6)* on the pilot's right console. This switch, when placed in the AUTO position, allows the alternator buses to be tied together, paralleling the alternators. In the OPEN position, the alternator buses are isolated. The indicator light, located to the left of the bus-tie switch, will illuminate if the bus tie is open and the bus-tie switch is in the AUTO position. The warning light is placarded LT. ON BUS TIE OPEN.

(Continued on Page 1-31)

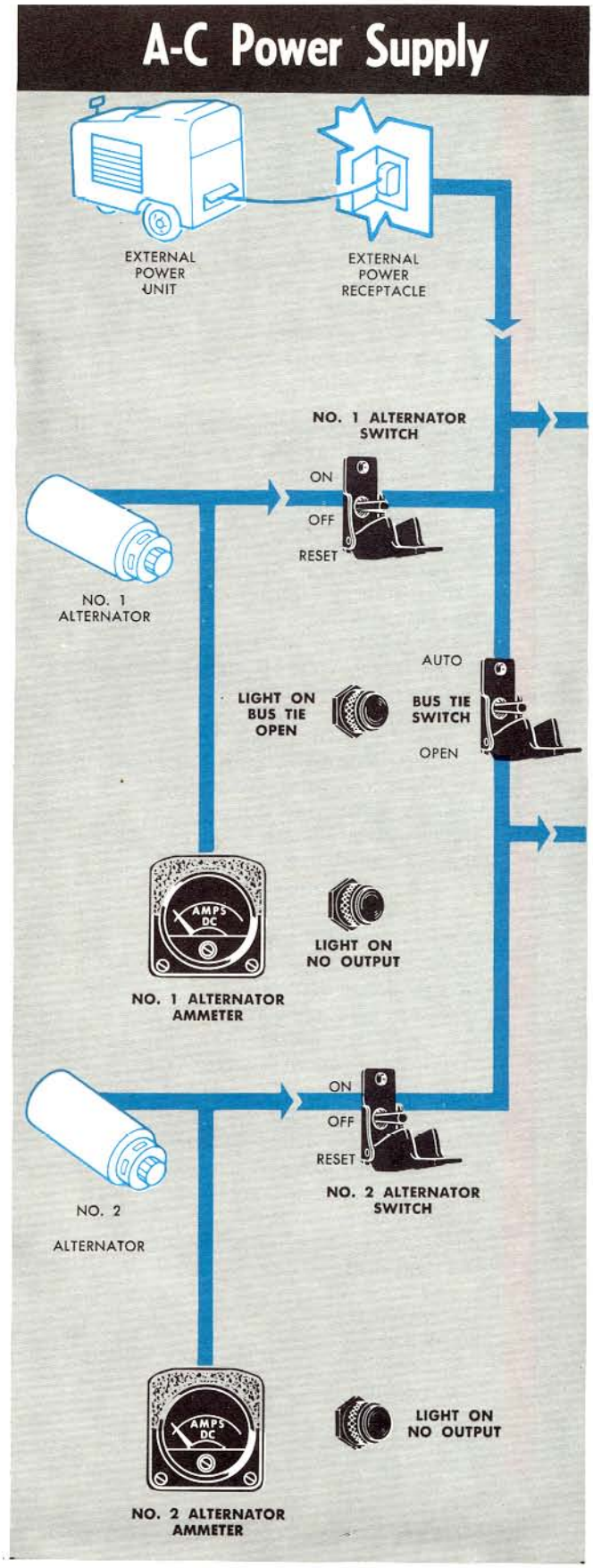

Figure 1-14 (Sheet 1 of 2)

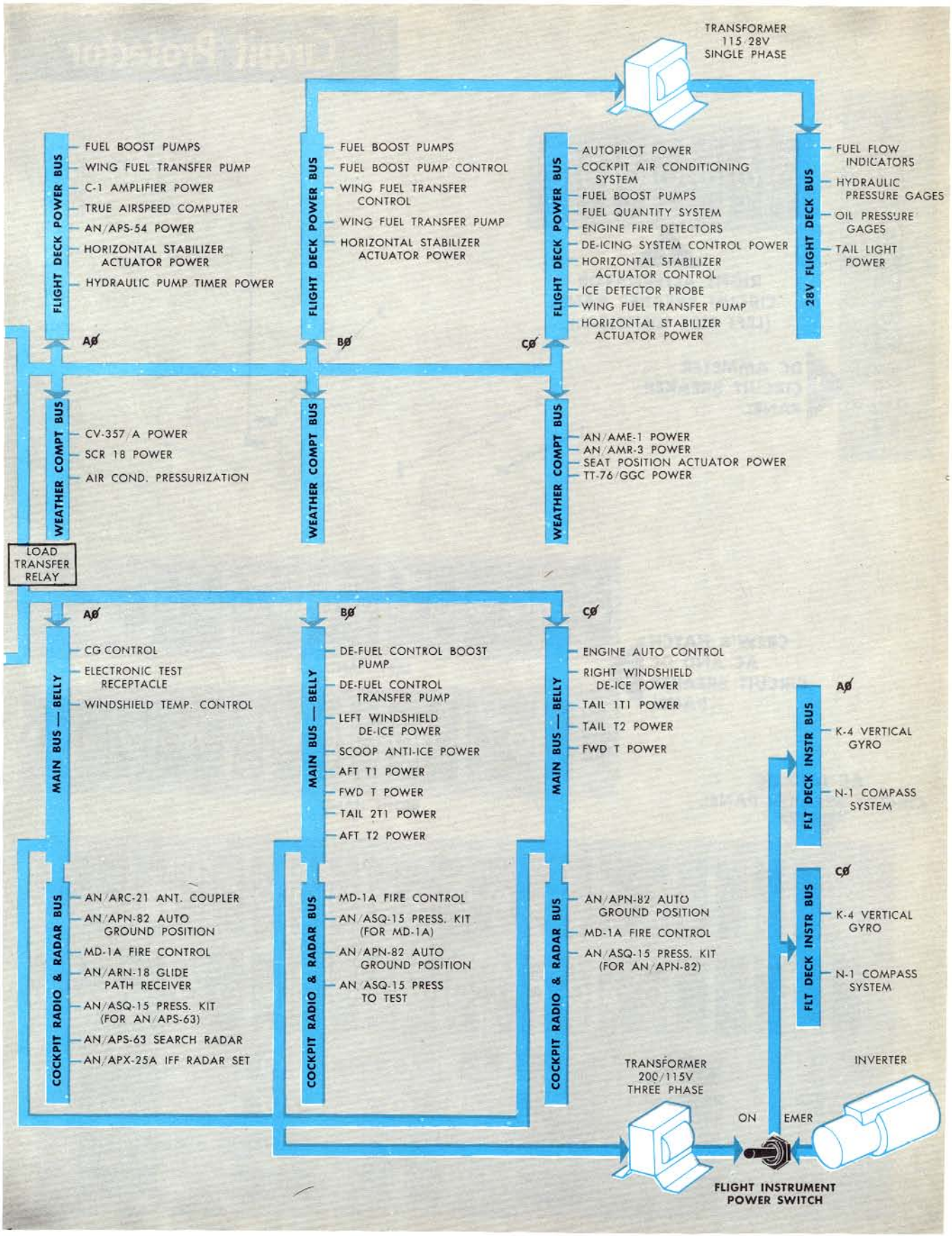

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Figure 1-14 (Sheet 2 of 2)

Circuit Protector

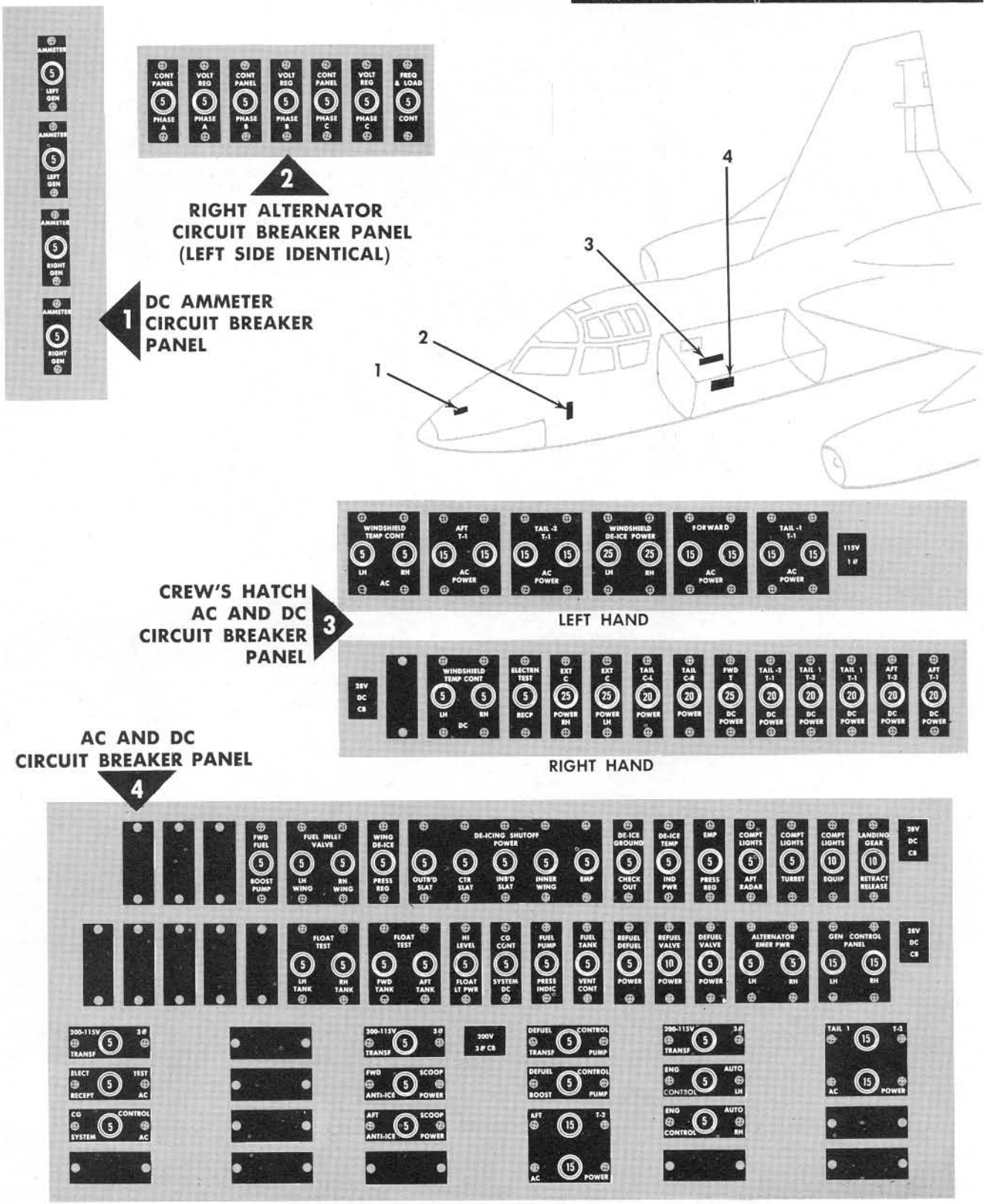

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Figure 1-15 (Sheet 1 of 5)

Circuit Protector

RADIO AND RADAR AC CIRCUIT BREAKER PANEL

1

PRESS EQUIP 10 ASQ-15 MD-1A
PRESS EQUIP 10 ASQ-15 APS-63
PRESS EQUIP 10 ASQ-15 APN-82

MD-1A 10 POWER PHASE A
MD-1A 25 POWER PHASE A
MD-1A 25 POWER PHASE B
MD-1A 25 POWER PHASE B

APS-63 10 POWER PHASE A
APS-63 20 POWER PHASE A
MD-1A 5 POWER PHASE C
MD-1A 25 POWER PHASE C

APN-82 5 POWER PHASE B
APN-82 10 POWER PHASE C

APN-82 15 POWER PHASE A
APN-82 10 POWER PHASE A
APN-82 5 POWER PHASE A
APN-82 5 POWER PHASE C
GPI

GUNNER'S MAIN CIRCUIT BREAKER PANEL

2

35 MD-1A POWER
10 MD-1A POWER
5 MD-1A UNLOCK WARNING
5 A1C-10 POWER
5 APN-82 POWER
10 APN-82 POWER
5 ARN-12 TEST
10 ADF ARN-6 POWER
20 APS-63 POWER
† 5 ASQ-15 BLEED VALVES
5 ADF ARN-6 CONTROL
5 ASQ-15 PRESS TO TEST
5 ARC-21 ANT COUPLER

† Some Aircraft

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Figure 1-15 (Sheet 2 of 5)

Panels - Typical

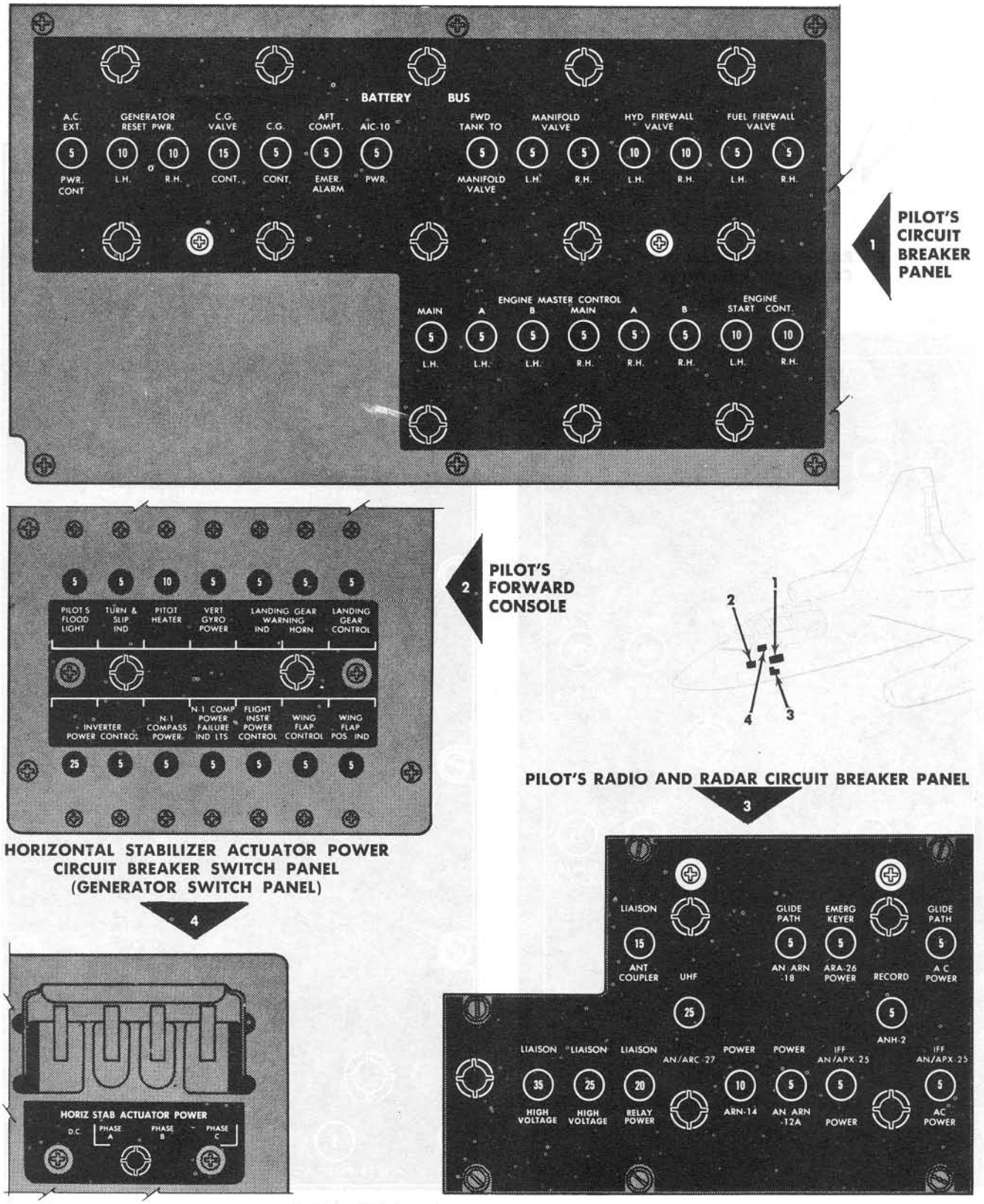

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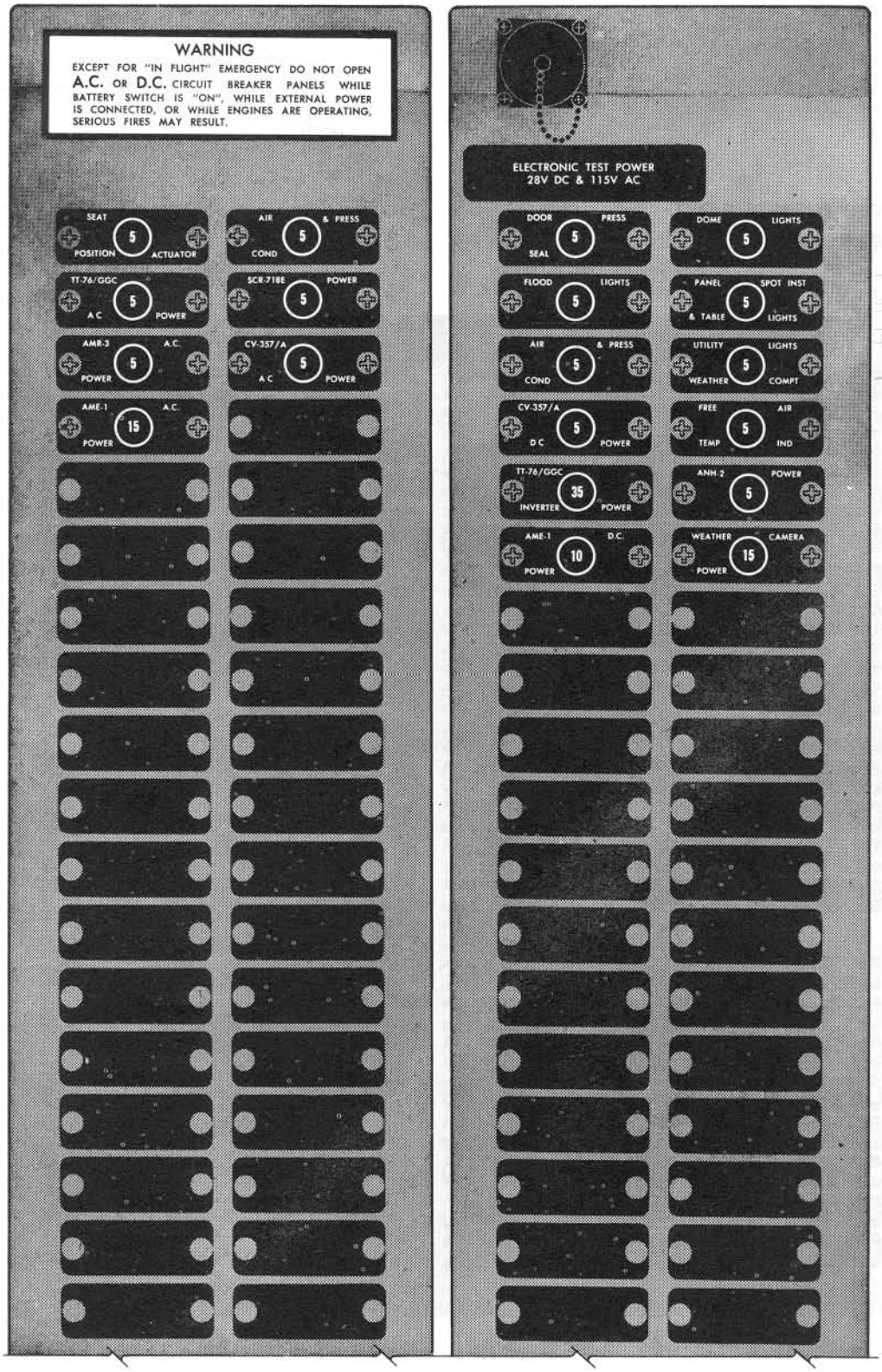
Figure 1-15 (Sheet 3 of 5)

Circuit Protector Panel



WEATHER COMPARTMENT AC AND DC CIRCUIT BREAKER PANEL

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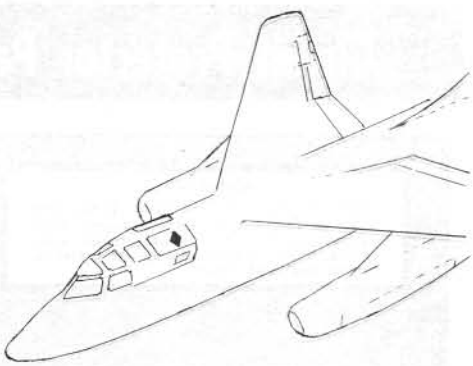
Figure 1-15 (Sheet 4 of 5)

Panels - Typical



COCKPIT CIRCUIT BREAKER PANEL

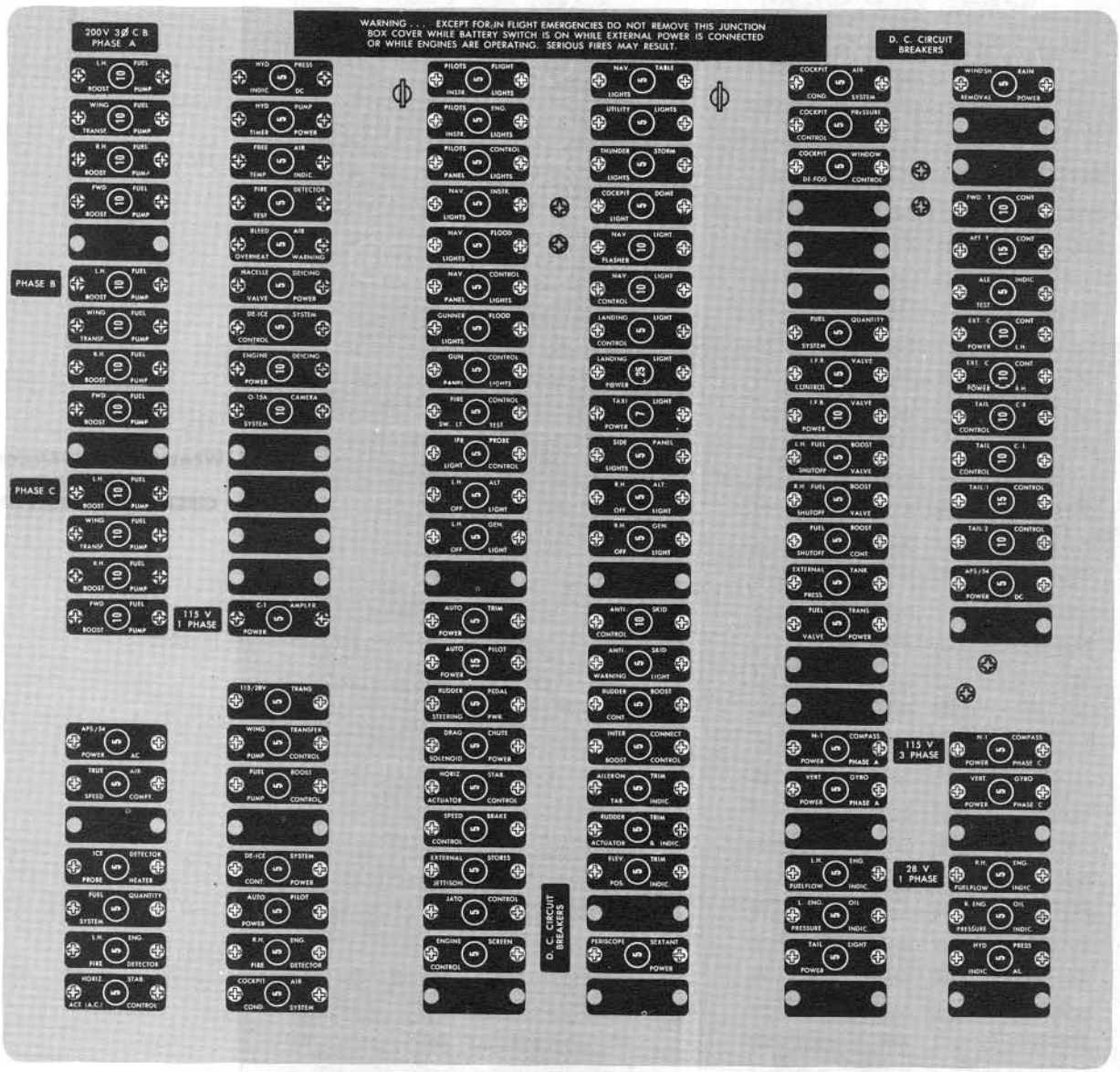


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Figure 1-15 (Sheet 5 of 5)

(Continued from Page 1-24)

Note

The load transfer relay will function with the bus-tie switch in either the OPEN or AUTO position.

HYDRAULIC POWER SUPPLY SYSTEM.

The hydraulic power supply system *(figures 1-16 and 1-18)* is a 300-psi hydraulic system consiting of four engine-driven hydraulic pumps (two on each engine), three hydraulic fluid reservoirs, three accumulators, one hand-operated pump, relief valves, solenoid-operated control valves, and mechanically operated control valves. The various hydraulic actuating units in the aircraft are powered by one or more of the four hydraulic systems. In addition to those units that are actuated solely by hydraulic pressure, the aileron, rudder and elevator mechanisms are equipped with hydraulic actuating cylinders to boost the effect of the mechanical control force. The rudder and elevator boost cylinders and control valves are heated automatically by engine bleed air to insure normal operation in the event of low temperatures. The four hydraulic systems of the aircraft are: a utility installation, an emergency installation, an aileron boost-spoiler control installation, and a rudder-elevator boost control installation.

Each of the hydraulic systems is served by its own engine-driven hydraulic pump and, in general, its own hydraulic lines. A solenoid-operated shutoff valve interconnects the utility and the emergency hydraulic systems, and a similar valve interconnects the rudder-elevator boost hydraulic system with the aileron boost-spoiler hydraulic system. These valves are automatically controlled by the rpm of the engines and will close when the speed of both engines exceeds approximately 3000 (49%) rpm. It is only above these speeds that all systems are separated. If either engine fire control handle is pulled, the systems are immediately interconnected regardless of the speed of the engines. Since the hydraulic pumps are engine driven, pressure in any hydraulic system will be available only while the engines are operating. The emergency hydraulic system 10-gpm pump and the aileron boost-spoiler hydraulic system 6gpm pump are mounted on the left engine; the utility system 10-gpm pump and the rudder-elevator boost hydraulic system 6-gmp pump are mounted on the right engine. These pumps supply hydraulic fluid on demand; that is, the pumps will maintain system pressure of 2850 to 3000 psi for fluid demands from zero to the rated output of the pump. As the demand on the pump falls to zero, the pump moves to a zero flow position maintaining a system pressure of 3000 psi. As the demand is put on the pump, it will assume a flow position to supply the required hydraulic fluid. During a cruise, solenoids on the utility and emergency system hydraulic pumps hold the pumps in zero flow position and permit the systems to depressurize.

Three hydraulic fluid reservoirs are installed for the use of the systems. The utility system hydraulic reservoir also feeds the emergency hydraulic system from a reserve area in the tank. The rudder-elevator boost reservoir and the aileron boost-spoiler reservoir are served by a common filler point; however, each system reservoir independently supplies its operating units. Fluid flow to the actuating units of the utility hydraulic system is controlled by solenoid-operated control valves, whereas the flow to the boost system units is directed by mechanically operated valves located at the various boost cylinders. The three hydraulic reservoirs are pressurized by means of engine bleed air from the air conditioning system to permit normal hydraulic operation at extreme altitudes. A piston-type hydraulic pressure accumulator is installed in the nose steering system, parking brake system, and spoiler system. The nose wheel steering accumulator keeps a supply of hydraulic fluid under pressure available to the return side of the steering cylinders; the parking brake accumulator supplies a reserve volume of hydraulic fluid under pressure for holding the brakes in the parked position; the spoiler accumulator maintains pressure for spoiler holddown. See figure 1-24 for specifications of hydraulic fluid. Refer to Sections III and VII for further description and operation of the hydraulic power supply system.

HYDRAULIC SYSTEM PRESSURE INDICATORS AND SELECTOR SWITCH.

Two 115/200-volt a-c actuated hydraulic system pressure indicators calibrated in psi are located on the main instrument panel *(9, figure 1-9)*, and provide pressure indication for each hydraulic system.

A 2-position 28-volt d-c selector switch located below the hydraulic system pressure indicators *(21, figure 1-9)*, is placarded RUD & ELEV BOOST, AILERON BOOST, and EMER-UTILITY. In the UP position, system pressure is indicated on the right indicator for the aileron boost system; pressure is indicated on the left indicator for the rudder and elevator boost system. In the DOWN position, system pressure is indicated on the left indicator for the emergency system; pressure is indicated on the right indicator for the utility system.

Note

In the event of d-c system power failure, the selector switch will fail to the RUD & ELEV BOOST & AILERON BOOST (up) position.

RUDDER BOOST HYDRAULIC PRESSURE INDICATOR AND WARNING LIGHT.

One amber indicator light *(20, figure 1-9)* and one red warning light *(22, figure 1-9)*, located on the main instrument panel, are press-to-test lights and have the following placarded positions: RUDDER BOOST 1500 PSI and RUDDER BOOST OVER 1500 PSI.

(Continued on Page 1-34)

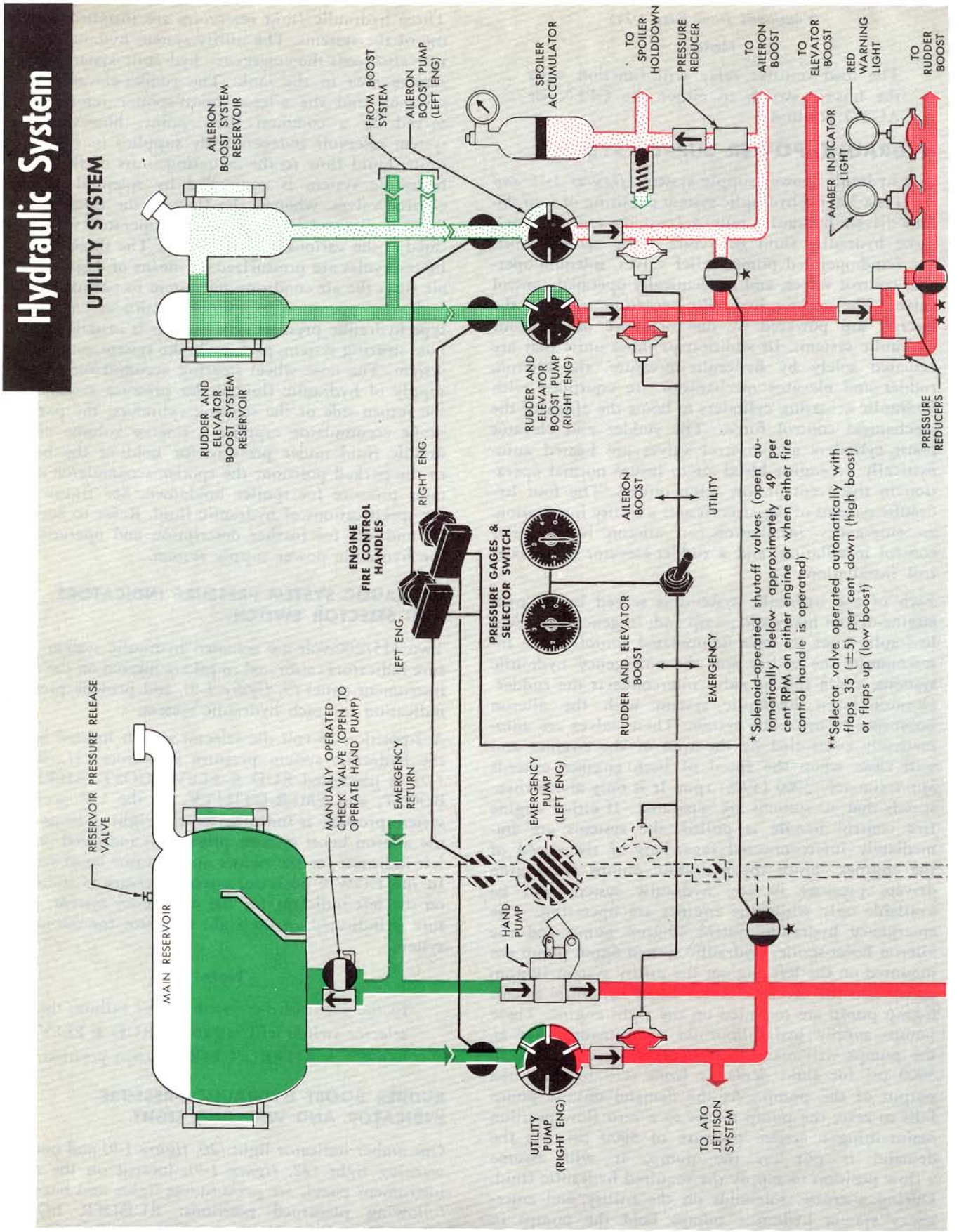

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Figure 1-16 (Sheet 1 of 3)

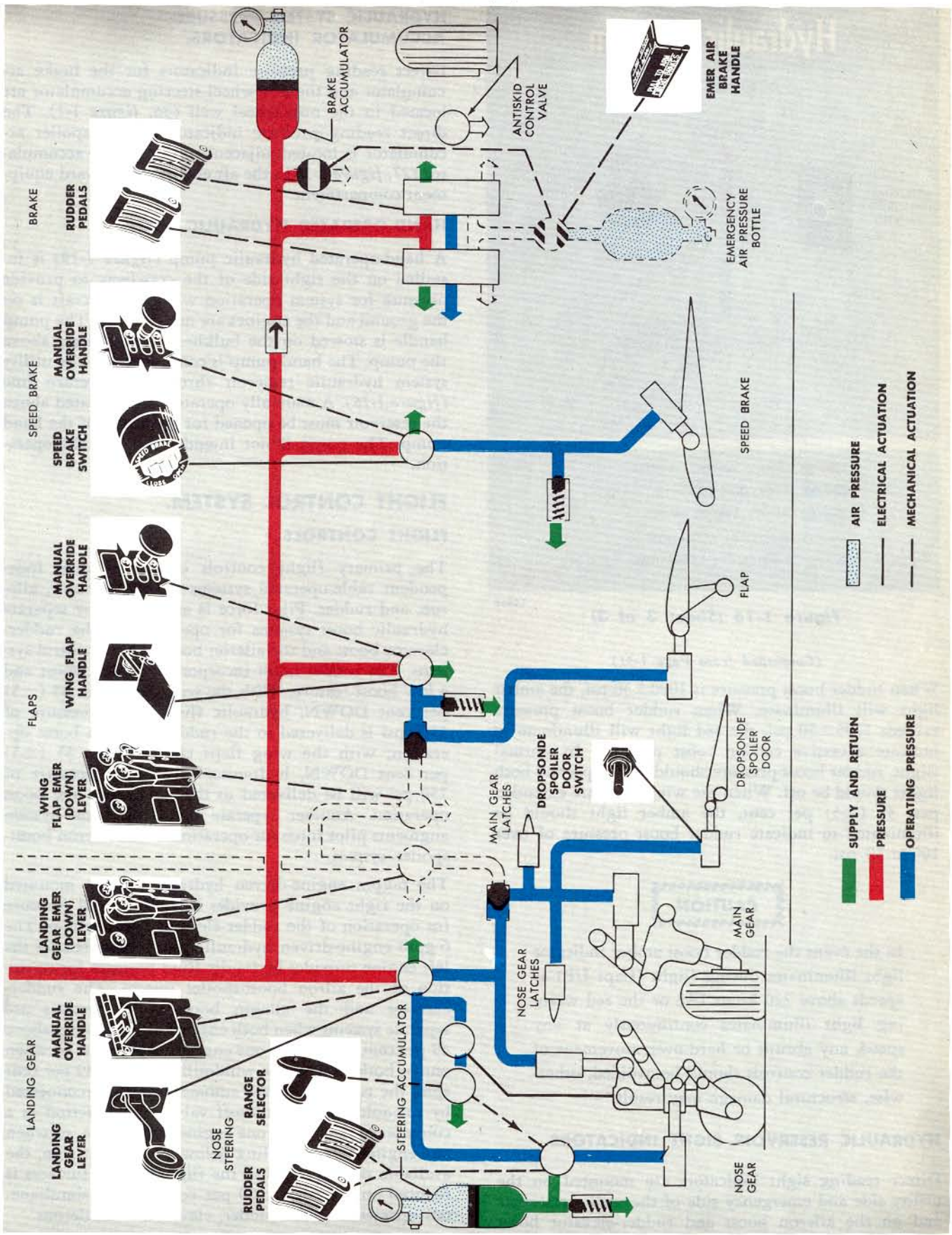

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Figure 1-16 (Sheet 2 of 3)

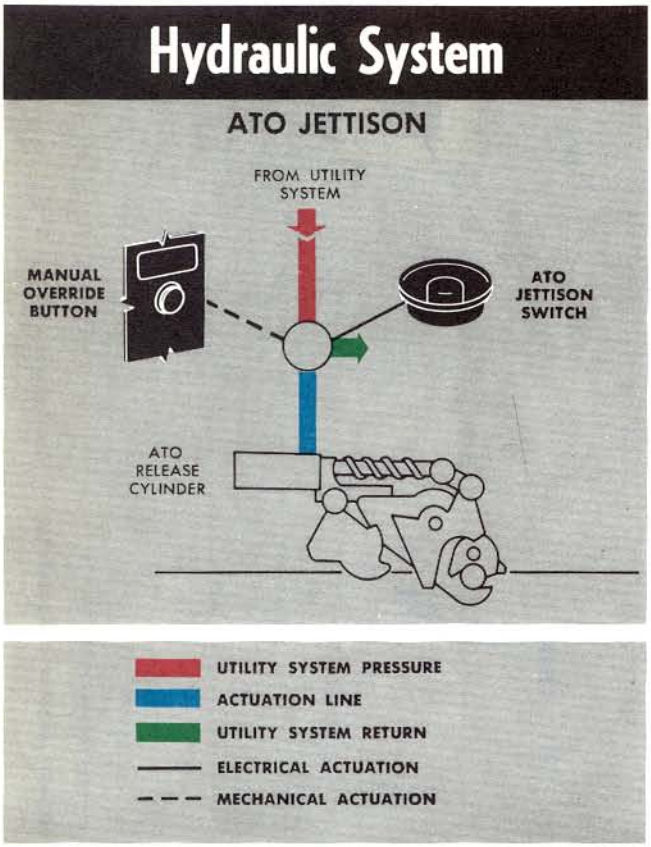

Figure 1-16 (Sheet 3 of 3)

(Continued from Page 1-31)

When rudder boost pressure is 1000±30 psi, the amber light will illuminate. When rudder boost pressure exceeds 1795±50 psi, the red light will illuminate to indicate excessive rudder boost pressure. In normal flight, rudder boost pressure should be 750 psi and both lights should be off. When the wing flaps are extended past 35 (±5) per cent, the amber light should be illuminated to indicate rudder boost pressure of over 1000±30 psi.

CAUTION

In the event the rudder boost amber indicator light illuminates during flight (flaps UP) at speeds above 220 knots IAS or the red warning light illuminates continuously at any speed, any abrupt or hard-over movement of the rudder controls should be avoided, otherwise, structural damage may result.

HYDRAULIC RESERVOIR SIGHT INDICATORS.

Direct reading sight indicators are mounted on the utility side and emergency side of the utility reservoir and on the aileron boost and rudder-elevator boost reservoirs *(26, 28, and 29, figure 1-1)*, located in the aft end of the forward equipment compartment.

HYDRAULIC SYSTEM PRESSURE ACCUMULATOR INDICATORS.

Direct reading pressure indicators for the brake accumulator and the nosewheel steering accumulator are located in the nose-wheel well *(36, figure 1-1)*. The direct reading pressure indicator for the spoiler accumulator is located adjacent to the spoiler accumulator *(27, figure 1-1)* in the aft end of the forward equipment compartment.

HAND-OPERATED HYDRAULIC PUMP.

A hand-operated hydraulic pump *(figure 1-19)* is installed on the right side of the crawlway to provide pressure for system operation when the aircraft is on the ground and the engines are not running. The pump handle is stowed on the bulkhead immediately above the pump. The hand pump is connected into the utility system hydraulic reservoir through the return line *(figure 1-16)*. A manually operated valve located above the reservoir must be opened for operation of the hand pump. The pump is not intended for inflight operation.

FLIGHT CONTROL SYSTEM.

FLIGHT CONTROLS.

The primary flight controls consist of dual independent cable-operated systems for the elevator, aileron, and rudder. Pilot force is augmented by separate hydraulic boost systems for operation of the rudder-elevator boost and the aileron boost-spoiler control systems. The rudder boost incorporates a high boost and a low boost feature. With the wing flaps past 35 (±5) per cent DOWN, hydraulic fluid under pressure of 1500 psi is delivered to the rudder for high boost operation; with the wing flaps UP or above 35 (±5) per cent DOWN, hydraulic fluid under pressure of 750 psi will be delivered to the rudder for low boost operation. Another separate hydraulic boost system augments pilot force for operation of the aileron boost-spoiler system.

The 6-gpm engine-driven hydraulic pump, mounted on the right engine provides hydraulic fluid pressure for operation of the rudder-elevator boost system. The 6-gpm engine-driven hydraulic pump mounted on the left engine provides hydraulic fluid pressure for operation of the ailron boost-spoiler system. The rudder-elevator and the aileron boost-spoiler systems are separate systems when both engines are operating above 49 per cent rpm. With one engine inoperative, or when one or both engines are windmilling below 49 per cent rpm, the two systems are automatically interconnected by solenoid-operated shutoff valves and function as a common system. With one engine inoperative, or when one engine is windmilling below 49 per cent rpm, the available rate of travel of the flight control surfaces is reduced approximately 30 per cent, during simultaneous operation of the rudder, elevator, and ailerons.

The spoiler system is employed to increase the effectiveness of the ailerons. Spoiler control is accomplished

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Figure 1-17

by the hydraulic cylinders and valves at each surface, which are operated by the actuating cable system connected to the main aileron flight control system. Horizontal stabilizer trim is accomplished by changing the angle of incidence of the horizontal stabilizer stabilizer with an electrical actuator controlled by switches located at the pilot's station.

RUDDER CONTROLS.

The rudder is mechanically controlled by a set of hinged rudder pedals *(4, figure 1-4)* of the conventional suspended type incorporating toe brakes. The rudder pedals also control nose wheel steering. See the paragraph on the Nose Wheel Steering System, this section. The pedals can be adjusted forward and aft by pulling the release knob *(40, figure 1-9)* located on the main instrument panel immediately below the control column. A bungee positions the pedals to the full aft position; the pedals can be adjusted to any desired position and then relocked by allowing the knob to return to its normal forward position. Uneven adjustment of the rudder pedals is impossible because the entire assembly moves forward or aft.

RUDDER TRIM KNOB.

The rudder trim tab is controlled for trimming purposes by a knob located on the control pedestal *(6, figure 1-5)*. Movement of the knob to the right or left electrically operates the 28-volt d-c rudder trim actuator and momentarily shuts off the yaw damper.

RUDDER TRIM POSITION INDICATOR.

A 28-volt d-c rudder trim position indicator, marked in degrees of travel from the neutral position of 0 to 20 LEFT and 20 RIGHT, is mounted on the main instrument panel *(19, figure 1-9)*.

CONTROL COLUMN AND WHEEL.

A single control column and wheel *(7, figure 1-4)*, mounted forward of the pilot's seat, provides control of the ailerons and elevators. The push-pull column is of the conventional type, incorporating a wheel for lateral control, while longitudinal control is maintained by forward or aft movement of the column. Four electrical switches are installed on the control wheel; a slide-type switch for horizontal stabilizer trim actuation *(5, figure 1-4)*; a trigger-type 2-position switch for the interphone and radio communication *(10, figure 1-4)*; push-type switch for the autopilot electrical release *(6, figure 1-4)*, and an autopilot emergency release switch *(8, figure 1-4)* located in the center of the control wheel.

HORIZONTAL STABILIZER (ELEVATOR) TRIM CONTROL SWITCH AND KNOB.

Horizontal trim is accomplished by means of a switch located on the pilot's control wheel *(5, figure 1-4)*, and a knob located on the control pedestal *(11, figure 1-5)*. Both the switch and knob are placarded NOSE DOWN and NOSE UP. The 115-volt a-c trim switch, located on the pilot's control wheel, when moved from the spring-loaded NEUTRAL position, energizes an a-c driven motor which actuates a screw-type actuator to provide for horizontal stabilizer incidence change. The 28-volt d-c and 115-volt a-c trim knob located on the control pedestal, operates in the same manner as the trim switch on the pilot's control wheel, except

(Continued on Page 1-38)

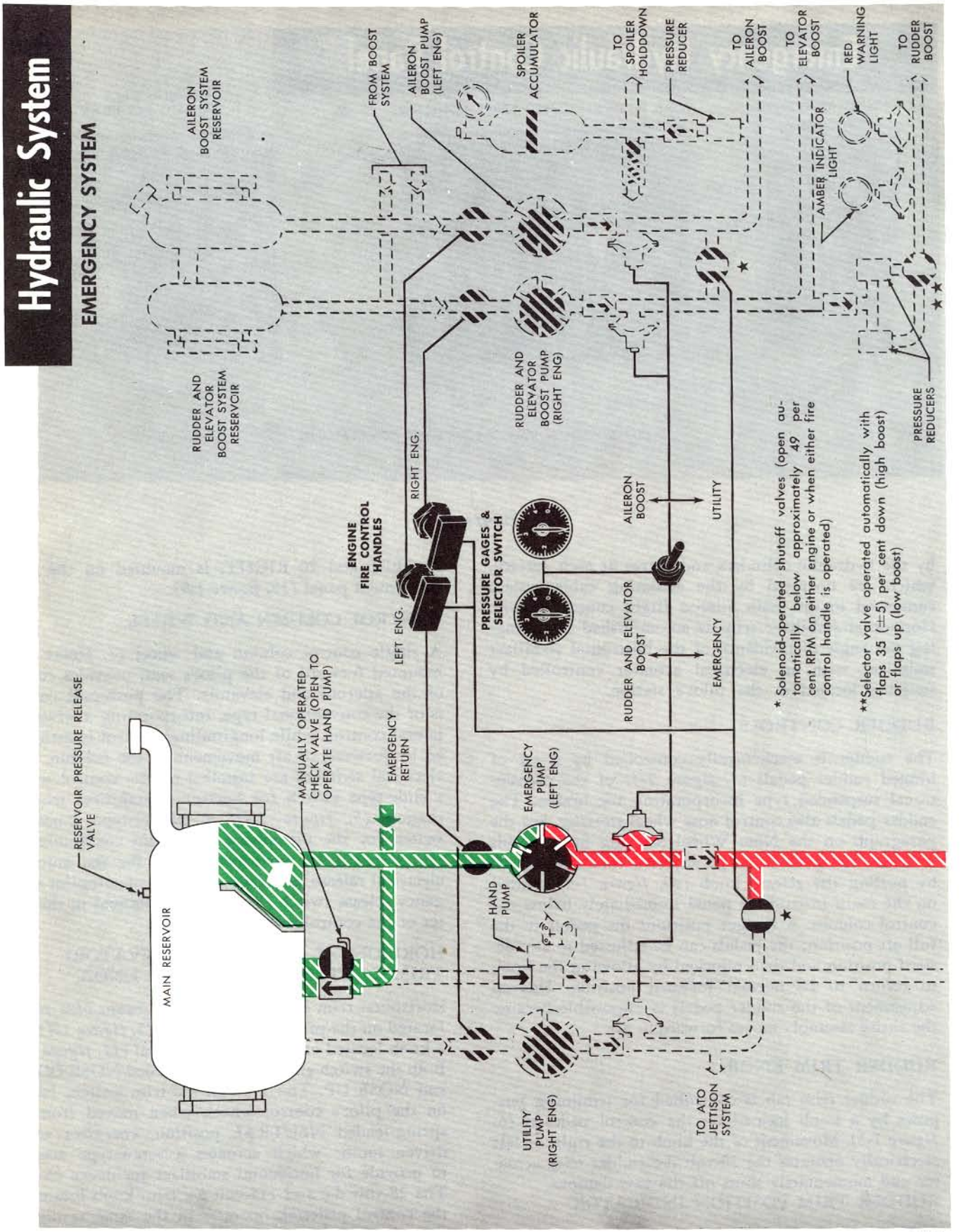

Figure 1-18 (Sheet 1 of 2)

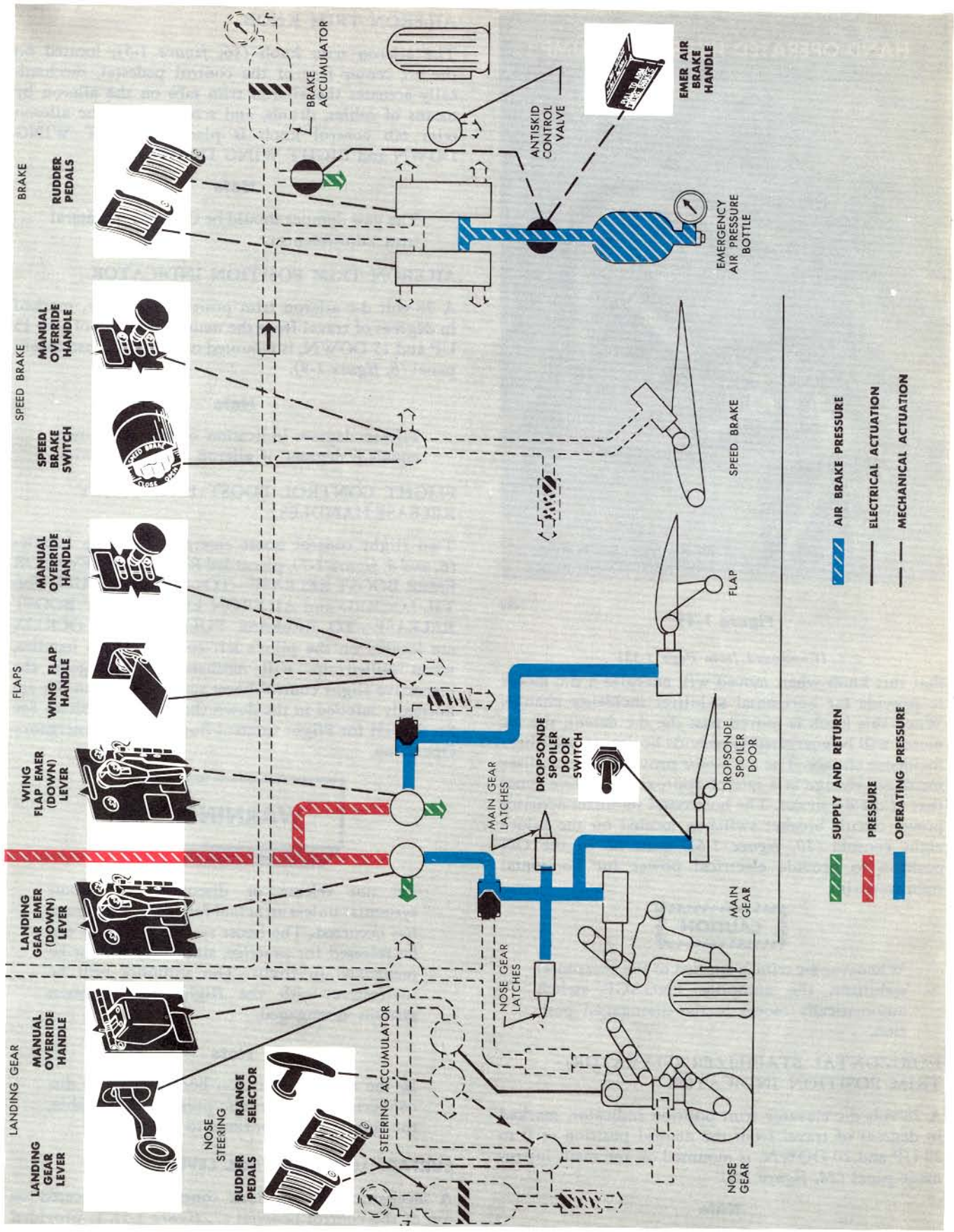

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Figure 1-18 (Sheet 2 of 2)

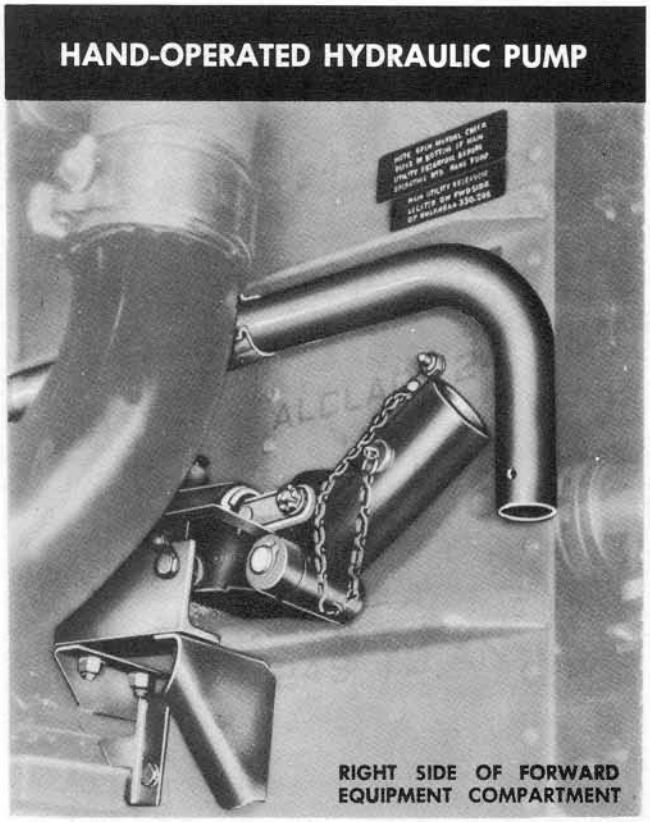

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Figure 1-19

(Continued from Page 1-35)

that this knob when moved will energize a d-c motor to provide for horizontal stabilizer incidence change. When this knob is moved past the d-c detent, the a-c motor will be energized to provide horizontal stabilizer incidence change. The a-c motor provides for stabilizer incidence change at a rate of approximately five times that of the d-c motor. The horizontal stabilizer actuator power circuit breaker switches, located on the pilot's right console *(10, figure 1-6)*, must be in the ON position to provide electrical power for horizontal stabilizer trim.

CAUTION

Whenever a-c trim is applied to the horizontal stabilizer, the autopilot ENGAGE switch automatically moves to the disengaged position.

HORIZONTAL STABILIZER (ELEVATOR) TRIM POSITION INDICATOR.

A 28-volt d-c elevator trim position indicator, marked in degrees of travel from the neutral position of 0 to 20 UP and 20 DOWN, is mounted on the main instrument panel *(24, figure 1-9)*.

Note

Horizontal stabilizer incidence travel is from 2 degrees UP to 10 degrees DOWN.

AILERON TRIM KNOB.

The aileron trim knob *(16, figure 1-5)*, located on the aft center face of the control pedestal, mechanically actuates the aileron trim tabs on the aileron by means of cables, drums, and screw jacks. The aileron trim tab control knob is placarded LEFT WING DOWN and RIGHT WING DOWN.

Note

The yaw damper should be OFF during lateral trim adjustments.

AILERON TRIM POSITION INDICATOR.

A 28-volt d-c aileron trim position indicator, marked in degrees of travel from the neutral position of 0 to 15 UP and 15 DOWN, is mounted on the main instrument panel *(8, figure 1-9)*.

Note

Fifteen degrees indication on the instrument equals 6 degrees of aileron trim tab motion.

FLIGHT CONTROL BOOST EMERGENCY RELEASE HANDLES.

Two flight control boost emergency release handles *(6, and 8, figure 1-7)*, placarded RUDDER-ELEVATOR EMER BOOST RELEASE—TO—RELEASE PULL UNTIL LOCKED and AILERON EMERGENCY BOOST RELEASE—TO RELEASE PULL UNTIL LOCKED, are located on the pilot's left consolc. Thesc handles, when pulled up, will mechanically disengage the respective flight control boost system. The handles are normally safetied in the down (boost on) positions. See Section III for Flight Control Boost System Emergency Operation.

WARNING

Do not release or disengage the boost system(s) unless an actual failure in the system has occurred. The boost system(s) should not be released for practice, since they cannot be reengaged in flight. The autopilot will be ineffective with the flight control boost systems disengaged.

Note

In the event the aileron boost system is disconnected and hydraulic pressure is available, the spoilers will continue to operate.

SURFACE LOCK CONTROL LEVER.

A mechanical surface lock control lever, located on top of the control pedestal *(7, figure 1-5)*, is provided to lock the control surfaces when the aircraft is parked. When the surface lock control is placed in the LOCK

(vertical) position, the control surfaces are locked in the NEUTRAL position. A throttle interlock is incorporated in the surface lock control mechanism to prevent movement of both throttles simultaneously beyond the 50 per cent rpm range position when the surface lock control is in the locked position. The control surfaces are unlocked by placing the control in the UNLOCK (horizontal) position. A latch operated by a pushbutton in the end of the surface lock control is installed to prevent inadvertent locking of the control surfaces.

WING FLAPS.

The single-slotted, hydraulically actuated, all-metal wing flaps *(13, figure 1-1)* are divided into inboard and outboard segments, which are supported by the wing trailing edge structure. The inboard segments extend spanwise from the sides of the fuselage to the engine pylons. The outboard segments extend from the pylons to the inboard ends of the ailerons. As pressure is applied to the hydraulic cylinder at each inboard segment, all segments extend from their faired position. Each inboard segment drives the respective outboard segment through mechanical linkage. To assure synchronization of the flaps from wing to wing, a cable bus system is incorporated, which prevents one side from leading the other. Should one side jam and the other attempt to extend or retract, the bus cables will limit asymmetry of the flaps to approximately 8 degrees. A pressure relief valve in the wing flap hydraulic system will permit the flaps to blow back at approximately 200 knots IAS or prevent them from being fully lowered at airspeeds in excess of approximately 184 knots IAS.

Note

No blow back feature is provided for the wing flaps when using the wing flap emergency system.

WING FLAP HANDLE.

A squeeze-type wing flap handle, located on the aft face of the control pedestal *(17, figure 1-5)*, energizes a 28-volt d-c circuit to the solenoid on the wing flap control valve, which directs hydraulic fluid pressure to the wing flap cylinders for actuation of the wing flaps up or down. The wing flap handle has the following positions: UP, STOP, and DOWN. The flaps may be positioned UP or DOWN and stopped at the desired setting by placing the handle in the STOP position.

Note

When the wing flaps are retracted, the handle should be left in the UP position in order to relieve hydraulic system pressure. The flaps will retract in approximately 15 seconds from 60% DOWN and approximately 25 seconds from 100% DOWN, during flight. The flaps will extend 100% DOWN in approximately 10 seconds, during flight at a speed of approximately 150 knots IAS.

WING FLAP POSITION INDICATOR.

A 28-volt d-c wing flap position indicator, calibrated in per cent extended, from UP to 100 per cent DOWN, is mounted on the main instrument panel *(37, figure 1-9)*. Also, there are two wing flap transmitters located in the left inboard wing section.

WING FLAP CONTROL VALVE MANUAL OVERRIDE.

The wing flap control valve manual override is located on the emergency hydraulic control panel *(figure 1-17)* on the left side of the crawlway. This manual override may be pushed or pulled to port the control valve to extend or retract the flaps in the event of failure of the electrical circuit. The control valve and manual override are spring-loaded to the neutral position. As a result, when the plunger is released to the neutral position, flap travel will stop immediately. The manual override is placarded – PUSH & HOLD – FLAPS DOWN and PULL & HOLD – FLAPS UP.

WING FLAP EMERGENCY VALVE CONTROL.

The wing flap emergency valve control, placarded EMER. WING FLAP, is located on the emergency hydraulic control panel *(figure 1-17)* on the left side of the crawlway. The FLAPS DOWN position of the valve control directs fluid pressure from the emergency hydraulic system to the down side of the wing flap actuating cylinders to extend the wing flaps 100 per cent DOWN.

Note

No provision is made for emergency wing flap retraction by use of the wing flap emergency valve control.

WING SLATS.

Wing slats *(10, figure 1-1)*, which extend spanwise from the engine pylons to the wing tips, are installed on the leading edge of the wings. The slats are in three sections to permit free operation with the wings deflected. In the closed position, the center and inboard sections conform to the wing contour, whereas the outboard sections remain open 5 degrees to provide longitudinal stability at high speeds. The slats are actuated automatically by aerodynamic forces.

SPEED BRAKES.

Hydraulically actuated, blowback-type speed brakes *(21, figure 1-1)* are installed on each side of the aft section of the fuselage to retard the speed of the aircraft. There are no restrictions on the use of the speed brakes. At 600 knots IAS at sea level, the speed brakes, when actuated, will open to approximately 10 degrees. The speed brake can be completely opened (45 de-

grees) at speeds up to 450 knots IAS at sea level. There are no intermediate positions between CLOSE and OPEN, except as limited by the aircraft.

Note

The speed brakes are not synchronized, and a momentary asymmetric condition may occure during opening and closing of the speed brakes.

SPEED BRAKE SWITCH.

A 3-position, slide-type speed brake switch, spring-loaded to the center (OFF) position, is located on the left throttle lever on the control pedestal *(15, figure 1-5)* and has the placarded positions OPEN and CLOSE. This switch, when moved to either position, energizes a 28-volt d-c circuit to the solenoid-actuated speed brake control valve to port hydraulic fluid pressure to open or close the speed brakes.

SPEED BRAKE INDICATOR.

No speed brake indicator is provided.

SPEED BRAKE CONTROL VALVE MANUAL OVERRIDE.

The solenoid-operated speed brake control valve, incorporating a manual override, is located on the emergency hydraulic control panel *(figure 1-17)* on the left side of the crawlway. This manual override may be pushed or pulled to port the control valve to close or open the speed brakes in the event of failure of the electrical circuit. This valve is a 2-position unit. When the override is pushed, the valve is ported to the brake out position and remains in this position until the override is pulled to the brake in position. The manual override is placarded PUSH – BRAKE OUT and PULL – BRAKE IN. See Section III for emergency operation of the speed brake.

LANDING GEAR SYSTEM.

A completely retractable tricycle landing gear consisting of two main gear, one mounted on each side of the fuselage aft of the center of gravity, and a nose gear mounted in the forward portion of the fuselage, is installed on the aircraft. Release of the down locks, extension and retraction of the nose and main gear, latching and unlatching of the nose and main gear doors, and opening and closing of the nose gear door are accomplished hydraulically. The latched nose gear door serves as an uplatch for the nose gear. The main gear is normally held in the retracted position by gravity when it reaches the over-center position and by the latched main gear door, which prevents the gear from extending during any flight maneuver that might tend to extend the gear. To permit gear extension in the event of failure of the utility hydraulic system, an emergency hydraulic system is installed to release the nose and main gear door latches and to extend the main gear. The nose gear extends by gravity. Separate hy-

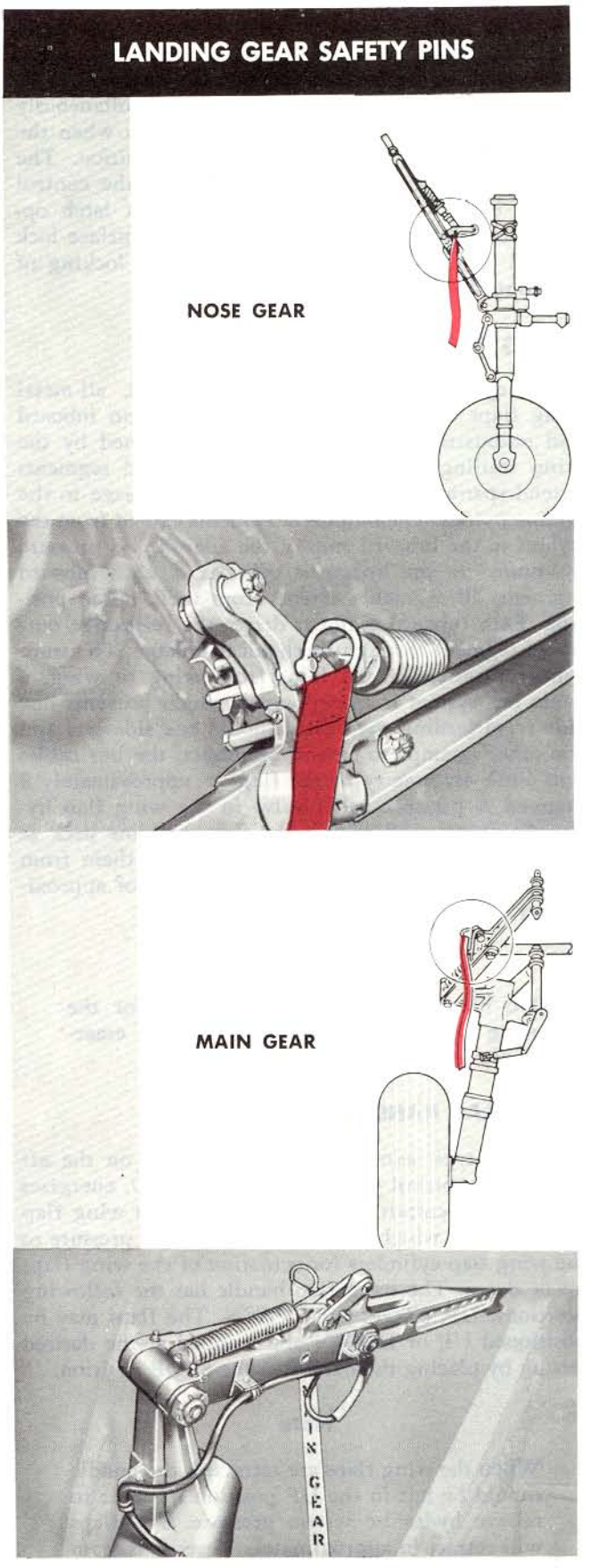


Figure 1-20

draulic lines are installed to the main gear actuating cylinder and the door latch cylinders for use with the emergency hydraulic system for gear down operation only. Landing gear safety pins are provided for ground installation *(figure 1-20)* and are stowed in the miscellaneous equipment container in the nose wheel well, when not in use.

LANDING GEAR LEVER.

The landing gear lever, located on the main instrument panel *(38, figure 1-9)*, controls a switch which energizes a 28-volt d-c solenoid-actuated hydraulic valve for the hydraulic operation of the landing gear. Placards GEAR UP and GEAR DOWN are located to the left of the lever. A solenoid-actuated anti-retraction latch is provided to prevent movement of the lever from the GEAR DOWN position to the GEAR UP position when the weight of the aircraft is on the landing gear.

Note

The landing gear will retract in approximately 10 seconds and extend in approximately 8 seconds, during flight.

LANDING GEAR POSITION INDICATORS.

Three landing gear position indicators, one for each gear, are located on the main instrument panel *(32, figure 1-9)* to indicate the position of each gear. When each gear is up and the door closed and latched, its respective indicator reads UP. When each gear is down and locked, a picture of a gear and wheel appears on the face of each indicator. When the landing gear doors are open and the gear is either retracting or extending, or is up and not locked, or down and not locked, or when 28-volt d-c power is not supplied, regardless of the position of the gear, a striped marker is shown in each indicator.

LANDING GEAR WARNING LIGHT AND TEST SWITCH.

A red 28-volt d-c landing gear warning light, located in the landing gear control lever knob *(38, figure 1-9)*, illuminates when the landing gear is in any position other than latched up or locked down, or when the throttles are retarded and the landing gear is in any position other than down and locked. A 3-position switch *(36, figure 1-9)*, spring-loaded to the center OFF position, is mounted on the main instrument panel to provide a means of checking operation of the landing gear warning light. The GEAR LT TEST position of the switch is for testing the landing gear warning light, and the HORN OFF position silences the warning horn.

LANDING GEAR WARNING HORN AND HORN CUTOFF.

A 28-volt d-c warning horn, mounted on the aft side of the pilot's seat structure, automatically sounds when either or both throttles are retarded and the gear is in any position other than full down and locked. Placing the test switch *(36, figure 1-9)*, located on the main instrument panel, in the HORN OFF position silences the horn by means of a relay in the horn circuit.

LANDING GEAR ANTI-RETRACTION LATCH AND MANUAL RELEASE.

The landing gear anti-retraction latch *(1, figure 1-5)*, located on the control pedestal, consists of a solenoid plunger spring-loaded to the OUT position to block the travel of the landing gear control lever. When the weight of the aircraft is off the landing gear, an electrical circuit is completed which energizes and depresses the solenoid latch to allow the landing gear lever to be raised to the GEAR UP position. Manual release of the anti-retraction latch is accomplished by depressing the solenoid plunger.

LANDING GEAR CONTROL VALVE MANUAL OVERRIDE.

The landing gear control valve manual override is located on the emergency hydraulic control panel on the left side of the crawlway *(figure 1-17)*. This manual override may be manually pushed or pulled to port the control valve and lower or retract the landing gear in the event of failure of the electrical circuit. When the override is manually operated, the landing gear will remain in its selected position until the override is again manually operated to the other position. The manual override is placarded — PUSH TO LOWER — PULL TO RETRACT.

WARNING

This manual override overrides the antiretraction latch.

LANDING GEAR EMERGENCY VALVE CONTROL.

The landing gear emergency valve control, placarded EMER. LDG. GEAR, is located on the emergency hydraulic control panel on the left side of the crawlway *(figure 1-17)*. The GEAR DOWN position of the control directs fluid pressure from the emergency hydraulic system to the gear down line and unlatches the latches on the main gear and nose gear doors. The hydraulic pressure extends the main gear, and the nose gear extends by free-fall. (See Section III for emergency operation of the landing gear.)

Note

No provision is made for emergency landing gear retraction by use of the landing gear emergency valve control.

NOSE WHEEL STEERING SYSTEM.

The hydraulically operated nose wheel steering system is controlled by a steering control valve which is actu-

ated mechanically, through linkage, by movement of the rudder pedals. The system incorporates a steering selector valve (positioned by a control at the pilot's station) to vary the ratio of nose wheel steering to rudder pedal travel. Hydraulic fluid pressure for operation of the nose wheel steering system is available from the main landing gear down line when the nose gear shock strut is compressed and the nose wheel steering selector handle is in the TAKE-OFF & LANDING or TAXI position. The hydraulic fluid pressure is directed from the steering selector valve to the shift cylinder and to the clutch engaging cylinder to actuate the nose wheel steering valve to provide nose wheel steering.

NOSE WHEEL STEERING RANGE SELECTOR HANDLE.

The nose wheel steering range selector handle *(3, figure 1-4)*, located to the left of the pilot's main instrument panel, mechanically positions the shift selector valve which routes hydraulic fluid, under pressure, to the clutch assembly and the shift cylinder. The handle has three positions: DISENGAGE, TAKE-OFF & LANDING, and TAXI. When the handle is placed in the DISENGAGE position, the selector valve cuts off hydraulic pressure to the nose wheel steering system and the nose wheel will trail and caster. When the handle is placed in the TAKE-OFF & LANDING position, the selector valve routes hydraulic fluid pressure to the shift cylinder and the clutch engaging cylinder to provide nose wheel steering of approximately 10 degrees left or right of neutral (20 degrees turning). When the handle is placed in the TAXI position, the selector valve routes hydraulic fluid pressure to the shift cylinder and the clutch engaging cylinder to provide nose wheel steering of 62 degrees left or right of neutral. (See Section III for brake emergency operations.)

Note

The nose wheel must be approximately centered before shifting from TAKE-OFF & LANDING to TAXI position.

Note

The nose wheel steering range selector handle must be turned fully counterclockwise to disengage steering; and clockwise to the up position to engage the TAKE-OFF AND LANDING. The handle must be turned fully clockwise to engage TAXI steering. The arrow indication on the selector handle indicates which steering selector is engaged.

BRAKE SYSTEM.

The utility hydraulic system is used to supply hydraulic pressure for the operation of the rotor disc-type brakes, installed in each main gear wheel, for constant or differential braking *(figure 1-16)*. In addition, an emergency air brake system provides air pressure to operate the brakes in the event of complete hydraulic failure. An antiskid automatic brake control system is incorporated into the hydraulic brake system to prevent the brakes from locking should excessive hydraulic brake pressure be applied. This system permits the use of maximum braking, and incorporates fail-safe provisions that will automatically revert the brake system to normal braking in the event of anti-skid system failure. A switch is provided at the pilot's station to turn the anti-skid system ON or OFF.

HYDRAULIC BRAKE CONTROLS.

The hydraulic brakes are actuated by toe pressure applied to the hinged rudder pedals *(4, figure 1-4)*, the pressure applied to the brakes being in proportion to the pressure applied to the brake pedals, which are linked to the power brake control valves. When the pedals are depressed, the valves are actuated and admit fluid pressure through the lines to the individual brakes.

ANTISKID SWITCH AND INDICATOR LIGHT.

An ON-OFF antiskid switch *(33, figure 1-9)* is located on the main instrument panel. When the switch is placed in the ON position, a 28-volt d-c circuit and the detector units are energized to actuate the antiskid system to prevent locking of the brakes. In the OFF position, the circuit and detector units are deenergized and the antiskid system is inoperative. An amber indicator light *(33, figure 1-9)*, placarded OUT, is located immediately to the left of the antiskid switch on the main instrument panel. This light will illuminate in the event of antiskid system failure, or when the antiskid system switch has been placed in the OFF position, thereby giving an indication at all times.

PARKING BRAKE HANDLE.

The main wheel brakes can be locked for parking purposes by using the brake handle located immediately below the main instrument panel *(45, figure 1-9)*. To set the parking brakes, depress the brake pedals, pull back the parking brake handle, and release the brake pedals. To release the parking brakes, depress the brake pedals.

EMERGENCY AIR BRAKE HANDLE.

The emergency air brake handle, located on the aft face of the control pedestal *(18, figure 1-5)*, is placarded PULL TO ARM – EMERG. BRAKES. After being armed, the brakes operate with air pressure in the same manner as with hydraulic pressure. See Section III for emergency air brake operation.

EMERGENCY AIR BRAKE PRESSURE INDICATOR.

An emergency air brake pressure indicator is installed in the nose wheel well *(36, figure 1-1)* for ground inspection and servicing. The indicator should indicate within normal limits shown by the green arc on the instrument.

DRAG CHUTE.

A 24-foot ring slot-type drag chute is mounted on the turret compartment access door *(19, figure 1-1)*. The drag chute provides a means of applying decelerating forces during the initial phase of the landing roll. A drag chute electrical interlock is installed to prevent accidental release of the drag chute before the nose wheel touchdown. A control lever is provided at the pilot's station for deployment and jettisoning of the drag chute.

CAUTION

Deployment of the drag chute is possible during flight, or prior to nose wheel touchdown, when a pull in excess of 50 pounds is exerted on the drag chute lever to overpower the electrical interlock.

DRAG CHUTE CONTROL LEVER.

A 2-position drag chute control lever, located on the control pedestal to the right of the throttle levers *(10, figure 1-5)*, is cable-connected to the drag chute mechanism for deployment and jettisoning of the drag chute. The drag chute control lever is placarded DEPLOY and JETTISON and is normally stowed in the JETTISON position. When the drag chute control lever is placed in the DEPLOY (aft) position, the drag chute doors are opened mechanically by a spring-loaded mechanism and the drag chute is deployed. When the drag chute control lever is returned to the JETTISON (forward) position (after deployment), the drag chute is jettisoned.

INSTRUMENTS.

All quantity and pressure indicators, gyroscopic instruments, temperature indicators, position indicators, and the free air temperature indicator, are energized by the aircraft electrical system. The K-4 vertical gyro system, and the N-1 compass system, normally operated by the 115-volt a-c system, can, in the event of an a-c power supply failure, be connected to the battery-operated inverter by use of the flight instrument power switch located on the d-c system control panel *(13, figure 1-6)* on the pilot's right console.

WARNING

The OFF flag on the attitude indicator will appear in case of a complete a-c or d-c power failure. However, a slight reduction in a-c or d-c power, or failure of certain electrical components within the system, will not cause the OFF flag to appear, even though the system is not functioning properly. Therefore, it is possible that a malfunction of the attitude indicator may be determined only by checking it with the slaved gyro magnetic compass and the turn-and-slip indicator.

Note

In the event of failure of the left alternator, the OFF flag on the attitude indicator may appear due to momentary loss of power during load transfer to the right alternator. Under this condition the OFF flag should disappear within 2 to 3 minutes.

AIRSPEED INDICATOR-PILOT'S.

The pilot's airspeed indicator *(11, figure 1-9)* provides a continuous indication of both the actual indicated airspeed and the maximum safe speed at which the aircraft may be flown. This is accomplished by the incorporation of two pointers. The narrow white pointer is conventional in operation and indicates the actual IAS of the aircraft. The wide barber pole pointer indicates the maximum safe indicated airspeed and is set (at the time of installation) to the design Mach Number of the aircraft. The maximum safe airspeed (barber pole) pointer is sensitive to changes in pressure; therefore, the maximum safe indicated airspeed is always shown regardless of altitude.

Note

The navigator's, gunner's, and the weather observer's airspeed indicators indicate TAS, and may be at variance with the pilot's airspeed indicator, which registers IAS.

PITOT STATIC SYSTEM.

Ram air pressure to operate the airspeed indicators, a machmeter, an autopilot airspeed compensator, and a true airspeed computer is provided by the pitot tube *(39, figure 1-1)*. Static pressure is supplied from the flight instrument static ports, located on the left and right side of the forward nose section, for three altimeters, a vertical velocity indicator, a machmeter, and two airspeed indicators. The autopilot static ports, located just forward of the flight instrument static ports, supply a true airspeed computer, an autopilot airspeed compensator, an autopilot altitude compensator, and an autopilot altitude control. A separate static source is provided for the fuel tank pressurization components.

ACCELEROMETER.

The accelerometer mounted on the main instrument panel *(2, figure 1-9)*, is a direct reading instrument, and measures vertical accelerations in the range of minus 5 to plus 12 units. Three pointers are used: one main pointer for indicating instantaneous acceleration and two auxiliary pointers, one for indicating maximum positive acceleration and one for indicating maximum negative acceleration. A reset knob mounted on the face of the accelerometer is provided for resetting the auxiliary pointers for return into alignment with the main pointer.

ALTIMETER.

The pressure altimeters installed at the pilot's and navigator's stations, and in the weather compartment instrument panel, incorporates a flag-type indicator on the face of the instrument to provide warning when the aircraft enters altitudes below 16,000 feet.

EMERGENCY EQUIPMENT.

WEATHER COMPARTMENT ENTRANCE DOOR JETTISON HANDLE.

A yellow T-handle located under a spring loaded access door on the floor right of weather observer No. 1 and placarded "This door is not recommended for bailout," is used to jettison the weather compartment entrance door. The access door must be opened, the yellow T handle pulled up and aft; this action disengages the hinge pins and the door is blown free by the slip stream.

Note

The weather compartment entrance door may be used for dumping equipment overboard during emergency conditions.

ENGINE FIRE CONTROL SYSTEM.

Note

The aircraft has no engine fire extinguishing system.

ENGINE FIRE CONTROL HANDLES.

Two engine fire control handles, one for each engine, are located on the fire control panel *(1, figure 1-9)* on the main instrument panel. Either handle, when pulled, will complete a 28-volt d-c circuit, which will close its respective firewall shutoff valves, cutting off the supply of fuel and hydraulic fluid to that engine, and will open the hydraulic boost interconnect control circuit allowing the interconnect valves to open. This interconnects the systems so as to maintain hydraulic pressure on the systems normally served by the engine which has been shut down.

ENGINE FIRE WARNING SYSTEM.

The engine fire warning system is a continuous loop-type detector. One detector is used in each nacelle. The continuous loop is employed to provide continued detector operation in case the loop is cut in any one place. The fire warning lights and fire control handles for shutting off the supply of fuel and hydraulic fluid are located at the pilot's station.

ENGINE FIRE WARNING LIGHTS AND TEST SWITCH.

Two red test fire warning lights, one for each engine, are located in the engine fire control handles *(1, figure 1-9)*, and are illuminated when energized by the fire detectors.The lights may be tested by pushing the engine fire control handles all the way in. When pressure is released, the handles will spring out approximately ⅛ inch and the lights will go off. A momentary contact test switch for testing the fire detector system is located on the main instrument panel adjacent to the engine fire control handles. This switch, when deflected to the left or right, energizes a 115 volt a-c circuit in the respective engine fire warning system and causes the warning light to illuminate momentarily, if the system is functioning properly.

WEATHER COMPARTMENT EMERGENCY ALARM SYSTEM.

An emergency alarm system, controlled by an emergency alarm switch *(24, figure 1-5)* on the pilot's control pedestal is installed in the weather compartment to alert the weather observers in case of an inflight emergency.

WEATHER COMPARTMENT EMERGENCY ALARM SWITCH.

A guarded emergency alarm switch, placarded ON-OFF, is located on the pilot's control pedestal *(24, figure 1-5)*. Placing the switch in the ON position energizes a 28-volt circuit connected to the battery bus, to ring the emergency alarm bell and turn on the emergency warning light, if installed.

WEATHER COMPARTMENT EMERGENCY ALARM BELL.

An emergency alarm bell is located in the weather compartment *(figure 3-9)*. The alarm bell can be used, with prearranged signals, to alert the weather observers in the event of an inflight emergency.

WEATHER COMPARTMENT EMERGENCY WARNING LIGHT.

On aircraft with T.O. 1B-66-752 accomplished, a red warning light *(figure 3-9)* is installed in the weather compartment to give the weather observers a visual indication of an inflight emergency. Since the emergency warning light is connected to the emergency alarm bell circuit, the warning light and alarm bell will give a simultaneous indication of an inflight emergency.

EMERGENCY DITCHING LADDER.

An emergency ditching ladder has been installed in the weather compartment. The ladder is located on the centerline of the aircraft, and is attached to the aft bulkhead in the weather compartment.

HAND FIRE EXTINGUISHERS.

One hand fire extinguisher is installed in the flight compartment aft of the pilot's seat structure, and one on the left side of the weather compartment at the entrance door *(figure 3-9)*. The minimum pressure for the fire extinguisher is 150 psi.

WARNING

Repeated or prolonged exposure to high concentrations of Bromochloromethane (CB) or decomposition products should be avoided. CB is a narcotic agent of moderate intensity but of prolonged duration. It is considered to be less toxic than carbon tetrachloride, methyl bromide, or the usual products of combustion. In other words, it is safer to use than previous fire extinguishing agents. However, normal precautions should be taken including the use of 100% oxygen when available.

FIRST AID KITS.

One aeronautic first aid kit is installed in the flight compartment on the navigator's forward console and one on the left side of the weather compartment at the entrance door *(figure 3-9)*.

BATTLE SPLINT AND DRESSING KITS.

One battle splint and dressing kit is stowed on the right side of the crawlway, near the flight crew entrance door, and one is stowed on the left side of the weather compartment, near the compartment entrance door *(figure 3-9)*.

BLOOD PLASMA KITS.

One blood plasma kit is mounted behind the pilot's right console, and one is mounted on the left side of the weather compartment, aft of the compartment entrance door *(figure 3-9)*.

FIREMAN'S AXES.

One fireman's small hand axe is mounted in a scabbard on the right side of the pilot's control pedestal, and one is mounted on the left side of the weather compartment adjacent to the compartment entrance door *(figure 3-9)*.

EMERGENCY KNIVES.

One emergency knife in a scabbard is mounted on the right side of the pilot's control pedestal, and one is mounted on the left side of the weather compartment, above the compartment entrance door *(figure 3-9)*.

LIFE RAFTS.

Provision is made in each crew member's seat for a one-man life raft and survival kit, which attach to the parachute harness.

WARNING

The A-5 seat cushion should not be left in the seat if the C-2A life raft is being carried. The combined use of the two items will increase the possibility of injury in the event of seat ejection or crash landing. If additional height in the seat is needed, a solid filler block may be used in conjunction with the C-2A pack, provided that the combined thickness does not exceed 5 inches.

CREW ENTRANCE DOORS.

The flight compartment and weather compartment entrance doors can be manually jettisoned in the event of an emergency requiring an alternate bail-out if encountered. See figure 3-7 for operation of the jettisoning controls for the flight compartment.

CANOPY HATCHES.

FLIGHT COMPARTMENT.

Individual jettisonable hatches *(figure 3-4)* are installed in the canopy above each crew member's station in the flight compartment. Each jettisonable hatch is provided with a separate gas-fired unlatching mechanism and is unlatched by means of powder charges in the unlatching cylinders. As the hatches are jettisoned, safety pins in the seat catapult initiators are pulled automatically, and the initiators are armed. These safety pins prevent the seats from being inadvertently ejected through the hatches. Jettisoning of the hatches is controlled, individually, by the right pre-ejection lever on each crew seat. Emergency jettisoning of all three hatches simultaneously may be accomplished by operation of the emergency canopy removal handle located at the pilot's station.

CANOPY HATCH CONTROLS FLIGHT COMPARTMENT.

RIGHT PRE-EJECTION LEVER (SEAT CONTROL).

A pre-ejection lever *(1, figure 1-21)* is located on the right armrest of each crew member's seat. When this lever is pulled up, the initiator is fired, actuating the unlatching cylinders and the respective hatch is jettisoned.

CANOPY HATCH MANUAL UNLATCH LEVER.

A jettisonable canopy hatch manual unlatch lever *(figure 1-22)*, located on the inboard forward side of each hatch, is provided to unlatch the hatch to permit partial opening for ventilating purposes, during ground operation. The latches are released by downward movement of the manual unlatch lever. Each hatch is equipped with a support arm to hold the hatch in the open position. These arms are attached to and stowed on the hatch door by means of a clip when not in use. Safety cables which limit the hatch opening for ventilation must be installed prior to opening the hatch, to prevent opening beyond safe limits and inadvertently arming the seat catapult initiators. The manual unlatch levers may also be used

as an emergency means of jettisoning the hatches in the event of an inflight emergency *(see figure 3-6).*

EMERGENCY CANOPY HATCH REMOVAL HANDLE.

An emergency canopy hatch removal handle *(44, figure 1-10),* located below the main instrument panel at the pilot's station, is placarded PULL-EMERGENCY CANOPY REMOVAL. This handle is provided to permit the unlatching of all three hatches simultaneously. A ground safety pin is provided for the emergency canopy hatch removal handle, to prevent inadvertent operation of the handle when the aircraft is on the ground.

WARNING

The emergency canopy hatch removal handle must not be actuated while the flight compartment is pressurized. A sudden depressurization could result in injury to the flight crew.

Note

If the emergency canopy hatch removal handle is pulled when the aircraft is in a static condition, the hatches must be removed manually.

EXTERNAL EMERGENCY CANOPY HATCH REMOVAL HANDLE.

Two external emergency canopy hatch removal handles *(figure 3-5),* one on the left side of the fuselage adjacent to the gunner's station, the other on the right side adjacent to the navigator's station, when pulled out will fire the unlatching cylinders to unlatch all three hatches to provide access to the flight compartment for ground rescue.

PILOT'S SEAT.

The pilot's seat is equipped with controls for vertical adjustment and fore and aft adjustment. A separate control is provided to release the aft position lock. The seat *(figure 1-21)* is provided with two controls for locking the shoulder harness, one for normal use and the other for use during seat ejection. The seat is also provided with ejection controls for use in the event that it becomes necessary to abandon the aircraft during flight. The ejection carriage of the seat rides on rails, and the seat is catapulted by means of a powder charge in the seat ejection catapult. The seat is equipped with an automatic-opening lap safety belt. An ejection control ground safety pin is provided to prevent inadvertent operation of the control when the aircraft is on the ground *(2, figure 1-21).* For Ejection Seat Operation, see figure 3-6. For the navigator's, gunner's, and weather compartment seat controls, see Section IV.

PILOT'S SEAT CONTROLS.

AFT LOCK RELEASE LEVER.

An aft lock release lever *(9, figure 1-21)* on the aft left side of the pilot's seat, when pulled up, will release the latch which is engaged when the seat is in the full aft position, to permit seat adjustment.

FORE AND AFT ADJUSTMENT LEVER.

A fore and aft adjustment lever *(10, figure 1-21)* on the left forward side of the pilot's seat, when pulled up, will mechanically unlock the fore and aft adjust lock and permit forward and aft adjustment of the seat after the seat has been unlatched from the aft position.

VERTICAL ADJUSTMENT HANDLE.

A vertical adjustment handle *(4, figure 1-21)* on the forward edge of the pilot's seat, when pulled up mechanically unlocks the vertical adjustment lock and permits vertical adjustment of the seat to the desired height.

NORMAL SHOULDER HARNESS INERTIA REEL LOCKING LEVER.

A normal shoulder harness inertia reel locking lever *(8, figure 1-21)* is located on the left forward side of the pilot's seat. Forward movement of the lever to the LOCKED position mechanically locks (through linkage) the inertia reel.

PILOT'S SEAT EJECTION CONTROLS.

LEFT PRE-EJECTION LEVER.

The left pre-ejection lever on the left armrest, when pulled up, will lock the shoulder harness inertia reel for seat ejection.

RIGHT PRE-EJECTION LEVER.

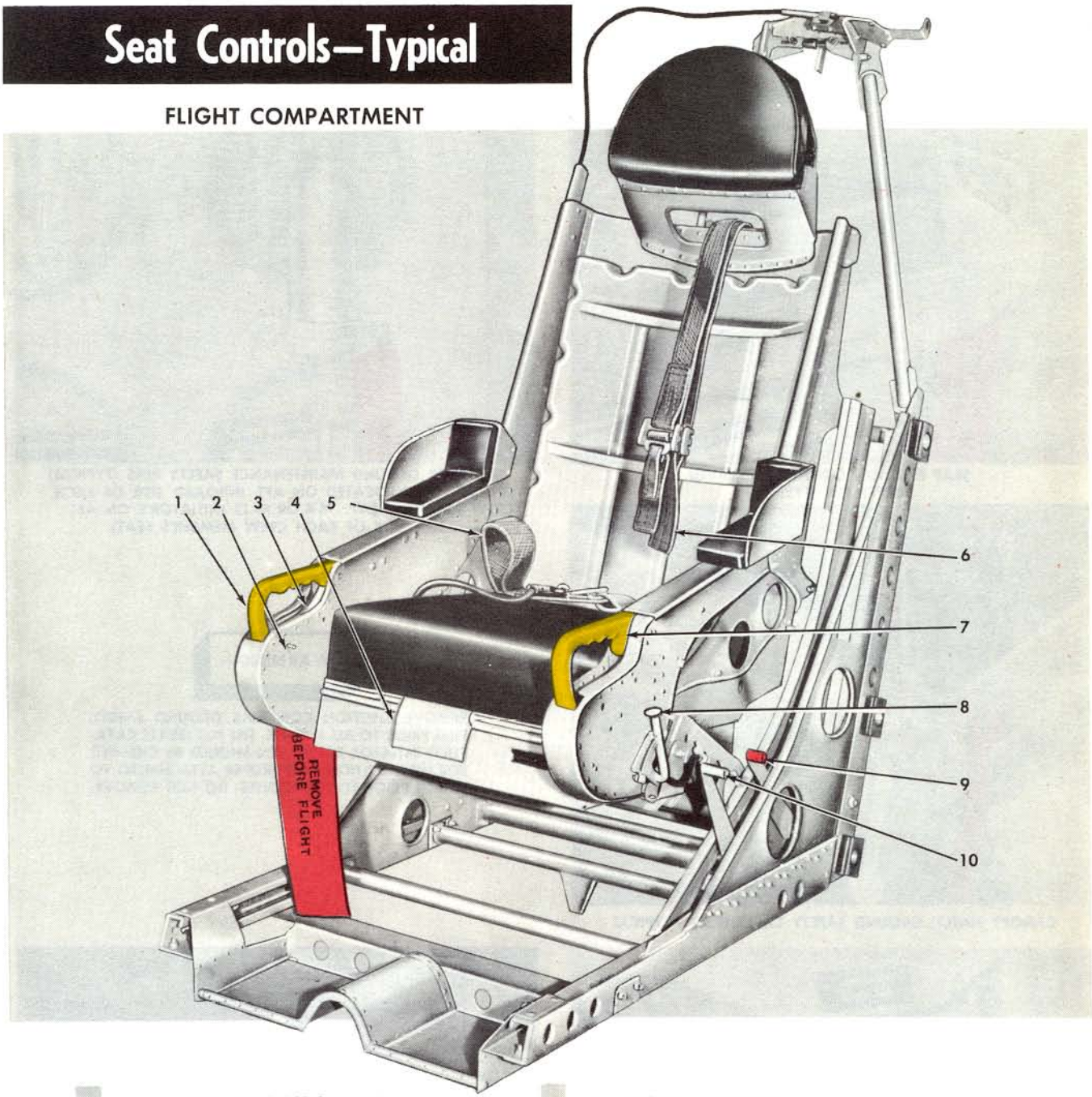
The pilot's pre-ejection lever *(7, figure 1-21)* is mounted on the right armrest. Upward movement of this lever fires the initiators to jettison the pilot's hatch, disengage and stow the control column, move the pilot's seat aft to ejection position, and raise the seat ejection trigger into operating position.

SEAT EJECTION TRIGGER.

The seat ejection trigger is moved into operating position when the right pre-ejection lever is pulled up. When the trigger is squeezed, the seat catapult initiator is actuated which fires the seat catapult and the seat is ejected.

Seat Controls—Typical

FLIGHT COMPARTMENT

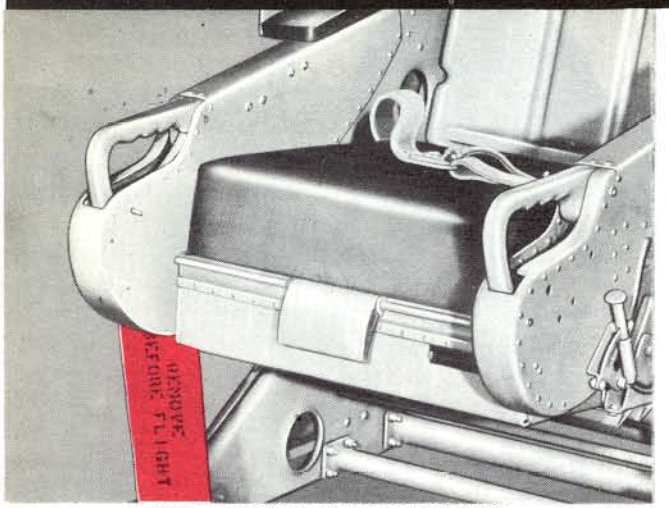


1. RIGHT PRE-EJECTION LEVER
2. EJECTION CONTROLS GROUND SAFETY PIN
3. SEAT EJECTION TRIGGER
4. VERTICAL ADJUSTMENT HANDLE (PILOT'S AND NAVIGATOR'S SEATS ONLY)
5. AUTOMATIC-OPENING SAFETY BELT
6. SHOULDER HARNESS
7. LEFT PRE-EJECTION LEVER
8. NORMAL SHOULDER HARNESS INERTIA REEL-LOCKING LEVER
9. AFT LOCK RELEASE LEVER (PILOT'S AND NAVIGATOR'S SEATS ONLY)
10. FORE AND AFT ADJUSTMENT LEVER (PILOT'S AND NAVIGATOR'S SEATS ONLY)

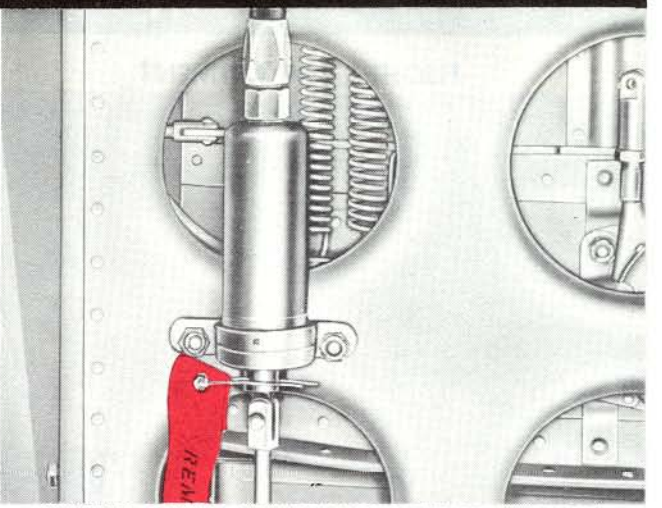
1490B

Figure 1-21

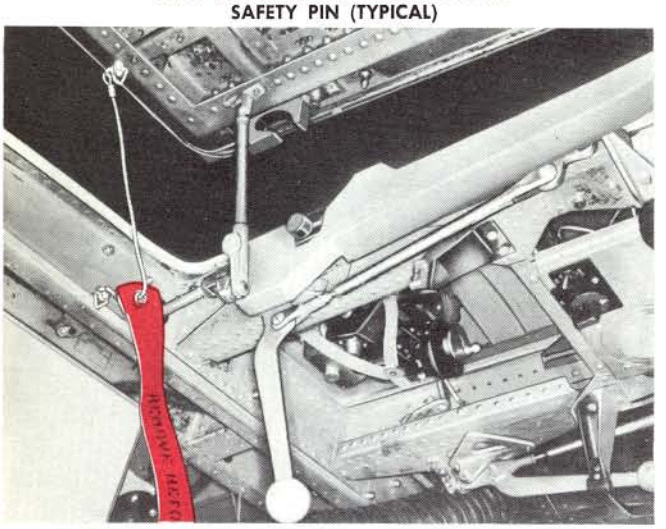
Ejection Controls Ground Safety Pins—Flight Compartment



SEAT EJECTION CONTROLS GROUND SAFETY PIN (TYPICAL)



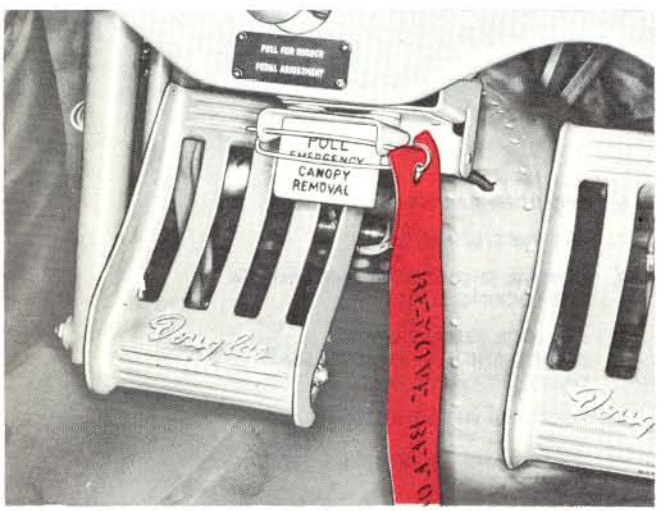
INITIATOR GROUND MAINTENANCE SAFETY PINS (TYPICAL) (T-8 INITIATOR LOCATED ON AFT INBOARD SIDE OF EACH CREW MEMBER'S SEAT. M-4 OR M-12 INITIATOR'S ON AFT LEFT SIDE OF EACH CREW MEMBER'S SEAT).



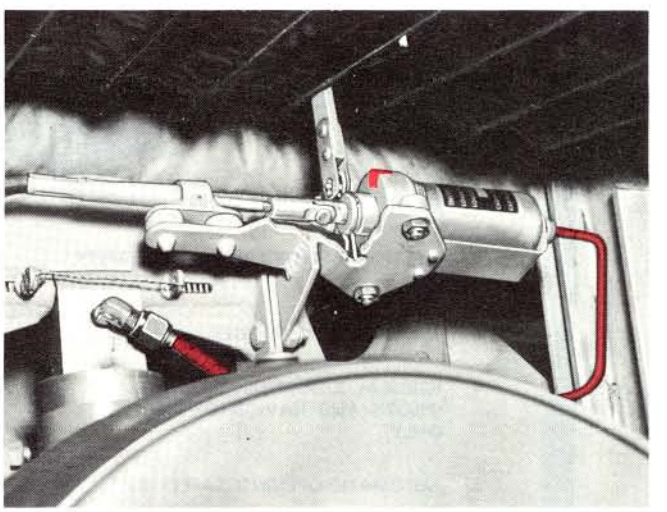
CANOPY HATCH GROUND SAFETY CABLE (PIN) — TYPICAL

WARNING

REMOVE EJECTION CONTROLS GROUND SAFETY PINS PRIOR TO ALL FLIGHTS. THE M-3 (SEATS CATAPULT) INTIATOR SAFETY PIN SHOULD BE CHECKED FOR INSTALLATION AND PROPER ATTACHMENT TO HATCH PRIOR TO ALL FLIGHTS. DO NOT REMOVE.



EMERGENCY CANOPY HATCH REMOVAL HANDLE GROUND SAFETY PIN



M-3 (SEAT CATAPULT) INITIATOR SAFETY PIN (TYPICAL) (TOP OF EACH CREW SEAT STRUCTURE)

1491B

Figure 1-22

EJECTION CONTROLS GROUND SAFETY PINS

The following ground safety pins are provided to prevent inadvertent hatch or seat ejection during ground operation. Each pin is identified by a red streamer which is placarded REMOVE BEFORE FLIGHT.

SEAT EJECTION CONTROLS GROUND SAFETY PINS.

A seat ejection controls ground safety pin *(2, figure 1-21)* is provided for the right pre-ejection lever on each flight crew member's seat (to be removed or replaced by the flight crew). Removal of the pin is accomplished by depressing the spring lock and pulling the pin.

EMERGENCY CANOPY REMOVAL HANDLE GROUND SAFETY PIN.

An emergency canopy removal handle ground safety pin *(figure 1-22)* is provided for the emergency removal handle, located immediately below the main instrument panel (to be removed or replaced by the pilot). Removal of the pin is accomplished by depressing the spring lock and pulling the pin.

CANOPY HATCH GROUND SAFETY CABLE PINS.

Canopy hatch ground safety cables *(figure 1-22)* are provided for each flight crew member's hatch (to be removed or replaced by the flight crew). The cable (when installed) is located on the forward side of each hatch door and is attached to the hatch door and the canopy enclosure by means of spring-locked pins. The purpose of this cable is to prevent opening of the hatches beyond safe limits, during ground operation, and to prevent inadvertent arming of the hatch thruster mechanism.

T-8 OR M-12 INITIATOR GROUND MAINTENANCE SAFETY PINS.

A safety pin may be installed in the T-8 and M-12 initiators by maintenance personnel. The T-8 initiator is located on the aft inboard of each flight crew seat, and the M-12 initiator, on the aft left side of each flight crew seat. These safety pins are used when performing maintenance work on the seats. Each flight crew member should make certain that these safety pins have been removed prior to flight.

WARNING

Remove the ejection controls ground safety pins prior to all flights to insure operation of the seat ejection system in the event of an inflight emergency. If these pins are installed, the maintenance personnel should be consulted regarding the status of the ejection system before occupying the ejection seat.

M-3 (SEAT CATAPULT) INITIATOR SAFETY PINS.

The M-3 (seat catapult) initiator, located on the top of each crew seat structure, incorporates a safety pin which is automatically removed when the respective hatch is jettisoned. These safety pins are provided to prevent ejection of the seats before the hatches are jettisoned, and should be checked by each flight crew member for proper installation and attachment to the canopy, prior to flight.

AUTOMATIC OPENING SAFETY BELT.

High speed, high altitude aircraft have made conventional modes of escape from the aircraft obsolete. As a result, various ejection systems have been tried to provide the safest and most effective escape from an aircraft in times of emergency. Many automatic devices have been designed into these systems, one of them being the automatic opening safety belt. The purpose of the automatic opening safety belt is to extend the maximum and minimum altitudes that escape with ejection seats can be made safe. In a high altitude bailout (above 15,000 feet), the automatic opening parachute prevents deployment of the parachute at an altitude where the oxygen supply is insufficient for a safe descent. In a low altitude bailout use of the automatic opening safety belt and the automatic opening parachute greatly reduce the time required for separation from the seat and deployment of the parachute. The automatic safety belt has been throughly tested. and is completely reliable and far faster than physical reactions.

WARNING

Under no circumstances should the automatic opening safety belt be manually opened prior to ejection, regardless of altitude.

The escape operation using the automatic feature is not on'y faster, since with the use of the M-12 initiator safety belt release time has been reduced to 1 second after ejection; but is also safer, and protects the crew member from severe injury during high speed ejection due to deceleration forces. Since the deceleration of a crew member alone is considerably greater than that of a crew member and seat combined, immediate separation would result if the belt were manually opened prior to ejection. This could cause inadvertent opening of the parachute due to the pack being blown open, and high opening shock of the parachute could cause fatal injuries.

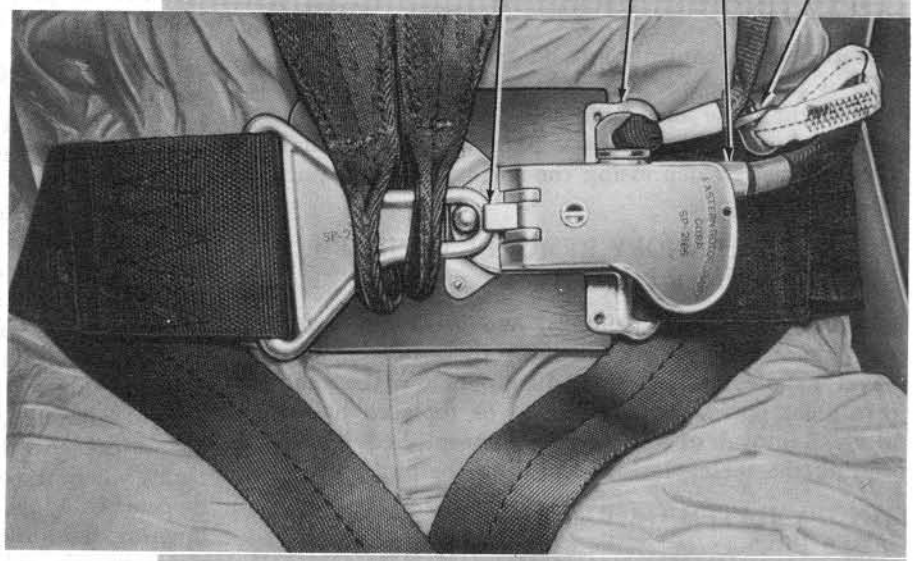
MA-6 AUTOMATIC-OPENING SAFETY BELT.

The aircraft has been equipped with the MA-6 type automatic-opening safety belt *(figure 1-23)*. For normal use, the belt may be opened manually by merely pull-

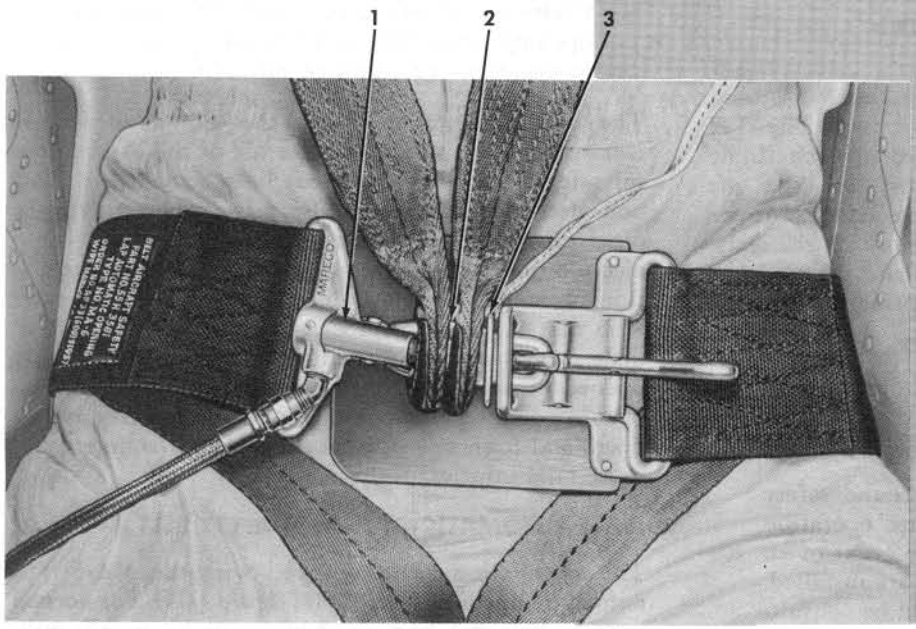
(Continued on Page 1-52)

Automatic-Opening Seat Belt

MA-3 TYPE



1. LATCH
2. LANYARD KEY
3. AUTOMATIC RELEASE
4. SPARE KEY



MA-6 TYPE

1. AUTOMATIC RELEASE
2. SWIVEL LINK
3. LANYARD RING

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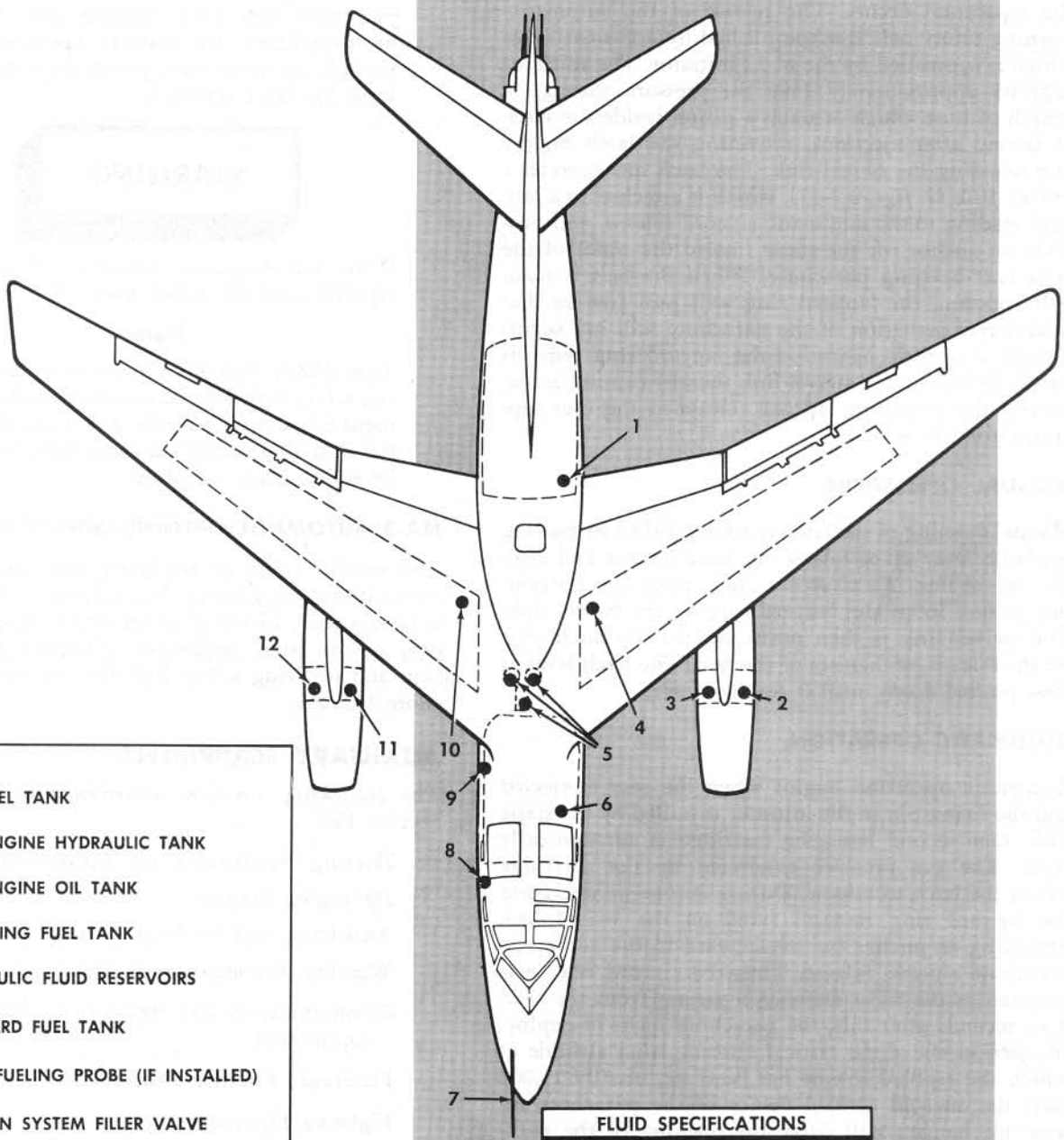
Figure 1-23

Servicing Diagram



1. AFT FUEL TANK
2. LEFT ENGINE HYDRAULIC TANK
3. LEFT ENGINE OIL TANK
4. LEFT WING FUEL TANK
5. HYDRAULIC FLUID RESERVOIRS
6. FORWARD FUEL TANK
7. AIR REFUELING PROBE (IF INSTALLED)
8. OXYGEN SYSTEM FILLER VALVE
9. SINGLE-POINT REFUELING ADAPTER
10. RIGHT WING FUEL TANK
11. RIGHT ENGINE HYDRAULIC TANK
12. RIGHT ENGINE OIL TANK

FLUID SPECIFICATIONS	
RECOMMENDED	
FUEL	JP-4, MIL-F-5624B ALTERNATE MIL-F-5572 (ANY GRADE AVAILABLE)
OXYGEN (LIQUID)	BB-0-925
OIL	MIL-L-7808
HYDRAULIC	MIL-0-5606

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Figure 1-24

(Continued from Page 1-49)

ing the latch lever. During ejection the belt is automatic, and will open 1 second after the seat leaves the aircraft, thus separating the crew member from the seat. When an automatic-opening parachute is used, it is actuated at this time by the lanyard which is anchored to the swivel link causing it to pull when the separation occurs. The release of the automatic-opening safety belt is accomplished by a gas cartridge which is controlled by the M-12 initiator. The initiator supplies approximately 1500 psi pressure through a length of hose which actuates a piston inside the latch (1 second after ejection), retracting the latch tongue and releasing the swivel link. The latch incorporates a swivel link *(2, figure 1-23)*, which is attached to a lanyard leading to the automatic ripcord release, and provides an anchor for the static line to the timer of the automatic-opening parachute. When the belt is manually opened, the lanyard ring will pull free so that inadvertent actuation of the parachute will not occur. During automatic operation the lanyard ring remains firmly locked on the swivel link thereby causing actuation of the parachute ripcord release as the user separates from the seat.

MANUAL OPERATION.

Manual opening of the latch is accomplished by pulling the latch lever up to release the latch tongue and eject the swivel link. To close and lock, place the restraining harness loops and lanyard ring on the swivel link. The swivel link is then positioned in the latch post on the release mechanism of the belt. The latch lever is then pushed down until it reaches a stop.

AUTOMATIC OPERATION.

Automatic operation begins when the seat is ejected and the firing pin in the initiator is pulled by the static line. One second later the cartridge is automatically fired. The gas pressure generated by the cartridge causes the latch to release. During automatic operation the lanyard ring remains fixed on the swivel link providing an anchor for the lanyard to the automatic parachute ripcord release. Thus the ripcord release is actuated as the crew member separates from the seat. Two seconds after this, the parachute starts to deploy. In ejection above the critical altitude (that altitude at which the ripcord release has been set, usually 15,000 feet) the aneroid control device of the parachute release mechanism will delay the opening of the parachute, until the crew member free-falls to the critical altitude. Two seconds later the parachute will deploy.

WARNING

When using an automatic-opening parachute, make certain the lanyard is attached to the MA-6 swivel link *(3, figure 1-23)* as it is possible to lock the swivel link without the lanyard ring being inserted in the latch.

Note

Manual operation of the system can override the automatic features of the system at any time. It is possible to manually open the belt even though initiator action has started. The parachute automatic features may likewise be overridden by manual operation even though the automatic parachute ripcord release has been actuated.

WARNING

If the belt is opened manually, the parachute ripcord must be pulled manually.

Note

Type MA-1, MA-4, or MA-5 automatic-opening safety belts may be installed when replacement is necessary, and the MA-3 and MA-6 are not available. Information on these types will be added when available.

MA-3 AUTOMATIC-OPENING SAFETY BELT.

The aircraft could be equipped with the MA-3 type automatic-opening safety belt *(figure 1-23)*. This belt is functionally identical to the MA-6 type and differs only in the latch mechanism, eliminating the swivel link and utilizing a key link for attaching the parachute lanyard.

AUXILIARY EQUIPMENT.

The following auxiliary equipment is described in Section IV:

Heating, Ventilating and Pressurization Systems.

Defogging System.

Anti-Icing and De-Icing System.

Weather Reconnaissance Equipment.

Communication and Associated Electronic Equipment.

Electronic Counter-Measures.

Lighting Equipment.

Autopilot System.

Navigation Equipment.

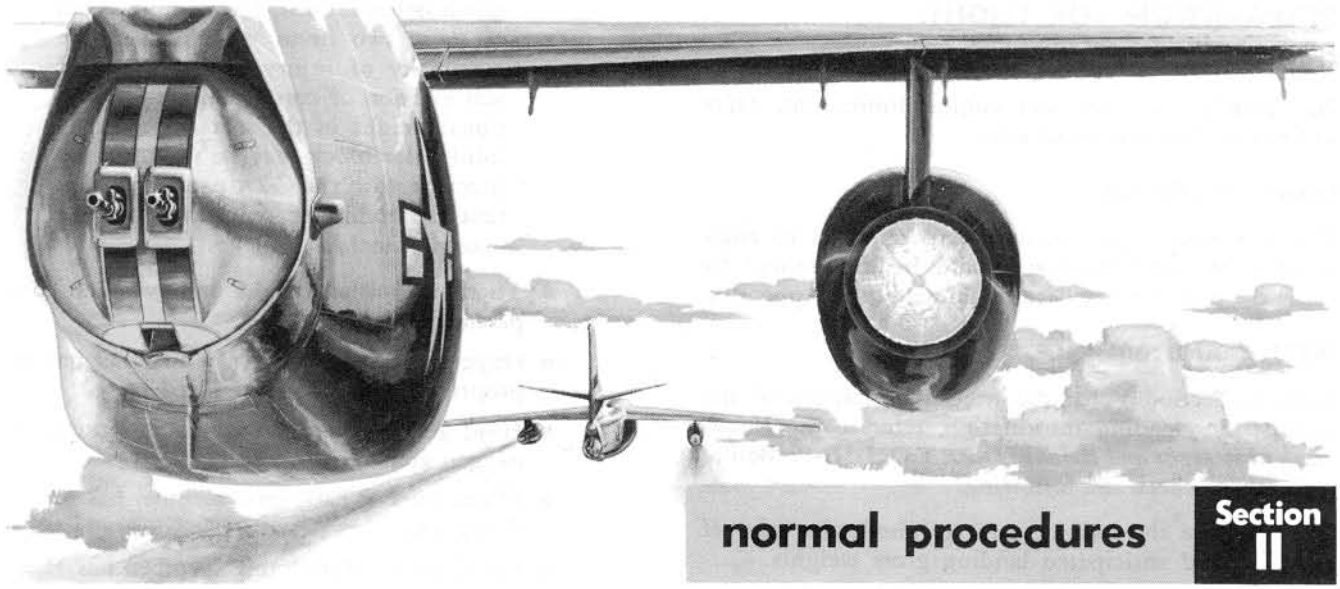
Gunnery Equipment.

Air Refueling System.

Single Point Ground Refueling System.

Oxygen System.

Miscellaneous Equipment.



normal procedures

Section II

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PREPARATION FOR FLIGHT.

FLIGHT RESTRICTIONS.

For detailed aircraft and engine limitations, refer to Section V of this handbook.

FLIGHT PLANNING.

Flight planning performance data required to complete a proposed mission should be determined by using the performance data contained in the Appendix.

WEIGHT AND BALANCE.

Refer to Section V for the weight limitations of the aircraft. For loading information, refer to the *Handbook of Weight and Balance Data, T.O. 1-1B-40.* Before each flight, check the following:

- Use the load adjuster to check the take-off and anticipated landing gross weights.
- Make certain that the weight and balance clearance (DD Form 365F) is satisfactory.
- Make certain that the grade of fuel, oil, and any special equipment carried, are suited to the mission to be performed.

CAUTION

Use of tail cone chaff (maximum capacity) may result in balance conditions exceeding the aft center of gravity (CG) limit on certain ECM missions. When this condition exists, it is recommended that the amount of tail cone chaff be reduced sufficiently to bring the CG within the established aircraft balance limits.

ENTRANCE.

Entrance to the aircraft is gained from the underside of the fuselage, aft of the nose gear *(figure 2-1).*

PREFLIGHT CHECKS.

CREW INSPECTION AND PERSONAL EQUIPMENT CHECK.

1. Crew inspection and personal equipment — Checked.
   - Parachutes — Check and adjust as required.
   - Survival kits and one man life rafts — one for each crew member aboard.

WARNING

The A-5 or MC-1 seat cushion should not be left in the seat if the C-2A life raft is being carried. The combined use of these two items will increase the possibility of injury in the event of seat ejection or crash landing. If additional height in the seat is needed, a solid filler block may be used in conjunction with the C-2A pack, provided that the combined thickness does not exceed 5 inches.

   - Thermos bottles (flight and weather compartments) — Filled.
   - Oxygen masks — Each crew member has appropriate mask, properly fitted.
   - Head gear — Each crew member has proper oxygen attachments.
   - Flight suits — Each crew member has proper flying suit.
   - Flashlights — Each crew member has flashlight in working condition.

BEFORE EXTERIOR INSPECTION.

It will be the responsibility of the pilot to insure that a Before Exterior Inspection and an Exterior Inspection are accomplished before each flight.

Note

The Before Exterior Inspection and Exterior Inspection procedures outlined in this section are predicated on the assumption that maintenance personnel have completed all the requirements of the *Handbook of Inspection Requirements, T.O. 1B-66B-6,* for PREFLIGHT or THRUFLIGHT; therefore duplicate inspections and operational checks of systems by air crew members have been eliminated, except certain items required in the interest of FLYING SAFETY.

Before performing an Exterior Inspection, make certain that the following steps have been accomplished:

1. DD Form 781 — Check to determine the status of the aircraft.
2. Battery — Connected and checked.
3. Seat ejection controls ground safety pins (flight and weather compartments) — Installed.
4. Canopy hatch ground safety cable pins (flight compartment) — Installed.
5. Emergency canopy hatch removal handle ground safety pin (flight compartment) — Installed.
6. Publications — Complete.
7. De-icing control panel switches — OFF.
8. Brakes — Bleed hydraulic pressure.

Note

In order to obtain an accurate check of the parking brake accumulator

pressure (air charge), it is necessary to bleed off any hydraulic pressure prior to the accumulator pressure check.

9. Landing gear lever — DOWN.
10. Surface lock control lever — LOCKED.
11. Master engine switch — OFF.
12. Throttles — OFF (locked).
13. Engine ignition switches — NORMAL.
14. Inverter — Emergency operation checked, switches OFF.

Note

Observe that the emergency inverter and essential flight instruments are operating properly.

15. Emergency alarm bell (and warning light, if installed) — Checked.
16. Hand fire extinguisher (flight and weather compartments) — Check indicators for proper charge.
17. Portable oxygen bottle (flight and weather compartments) — Check indicators for proper charge "in the green."

WEATHER COMPARTMENT (FLIGHTS WITH COMPARTMENT UNOCCUPIED).

1. Emergency ditching hatch — CLOSED and LOCKED.

CAUTION

In the event a flight is to be made with the weather compartment unoccupied, the pilot should perform the following check on the weather compartment ditching hatch. The emergency ditching hatch latching handle must be completely over-center and resting securely in the LOCKED position. Any movement toward the unlocked position will cause the hatch to be in the CLOSED position, but unlocked. When locking the hatch, the handle should be moved firmly over-center and should snap into the LOCKED position with an audible click. An inspection window on the underside of the hatch provides a positive inspection method from inside the compartment to insure that the locking spider is correctly over-center and against its stop. A flashlight should be used in making this inspection of the locking spider.

2. Seats and belts — Secure, seat ejection controls ground safety pins installed.
3. Pressurization switches — PRESSURIZE.
4. Air conditioning switch — NORMAL.

Note

In the event a bleed air start is to be made, the pilot should instruct a ground crew member to place the weather compartment air conditioning switch to RAM.

WARNING

After the start is made, the switch should then be placed in the NORMAL position.

5. Oxygen regulators — OFF.
6. Entrance door — CLOSED and LOCKED.

Note

The weather compartment entrance door latching mechanism is a two-position latch (INTERMEDIATE AND LOCKED). In the INTERMEDIATE position the door may be closed, but unlocked and the microswitch disengaged. In this position the door seal will not pressurize.

EXTERIOR INSPECTION.

Refer to figure 2-2 for Exterior Inspection.

INTERIOR INSPECTION (ALL FLIGHT).

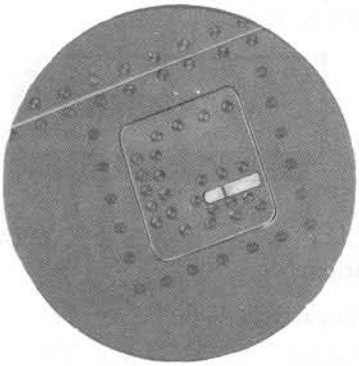
CRAWLWAY.

1. External a-c and d-c power — Connected and operation.
2. Crawlway compartment light switch — Checked ON, set as required.
3. Interphone cord — CONNECTED, stowed in bag.
4. Rudder-elevator boost manual check valve — CLOSED (out of clip).
5. Main hydraulic reservoir manual check valve — CLOSED (out of clip).
6. Main hydraulic reservoir — Proper fluid level (observe placarded instructions on reservoir for determining proper fluid level).
7. Spoiler accumulator pressure indicator — Within limits.
8. Aileron boost-spoiler reservoir — Proper fluid level (observe placarded instructions on reservoir for determining proper fluid level).

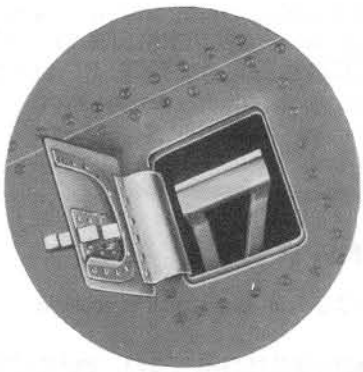
(Continued on Page 2-6)

Entrance To Aircraft

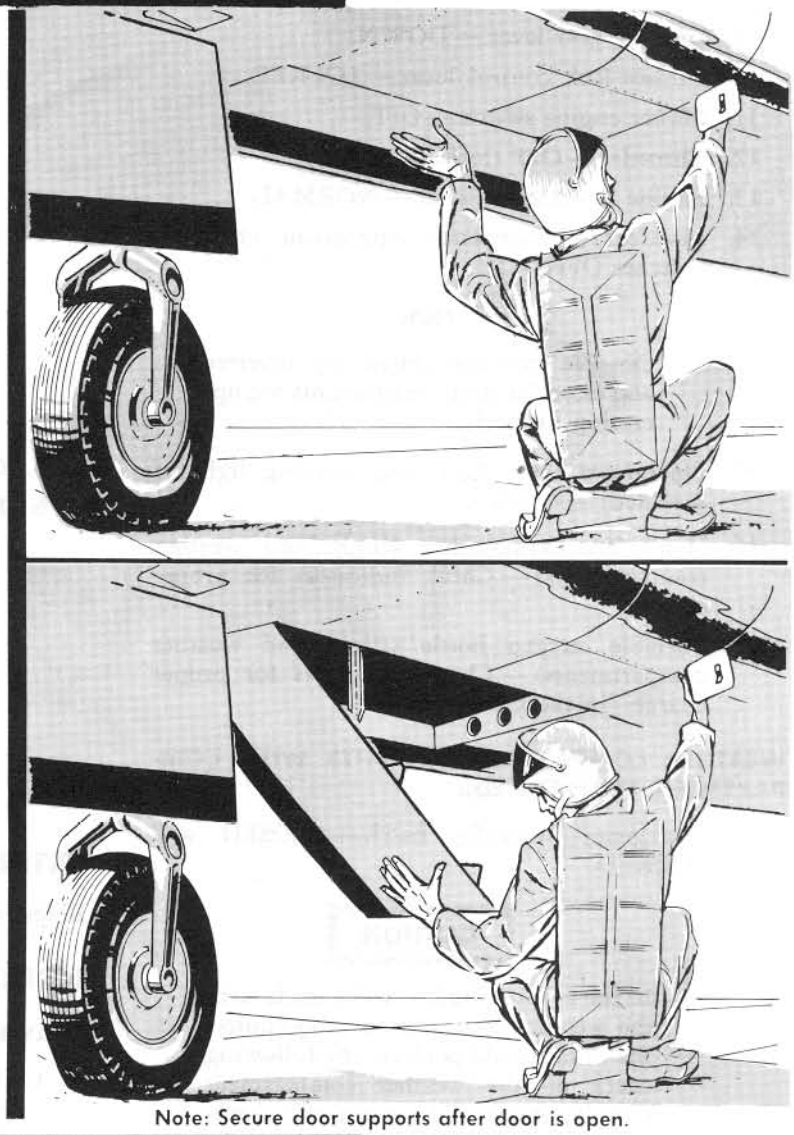
FLIGHT COMPARTMENT



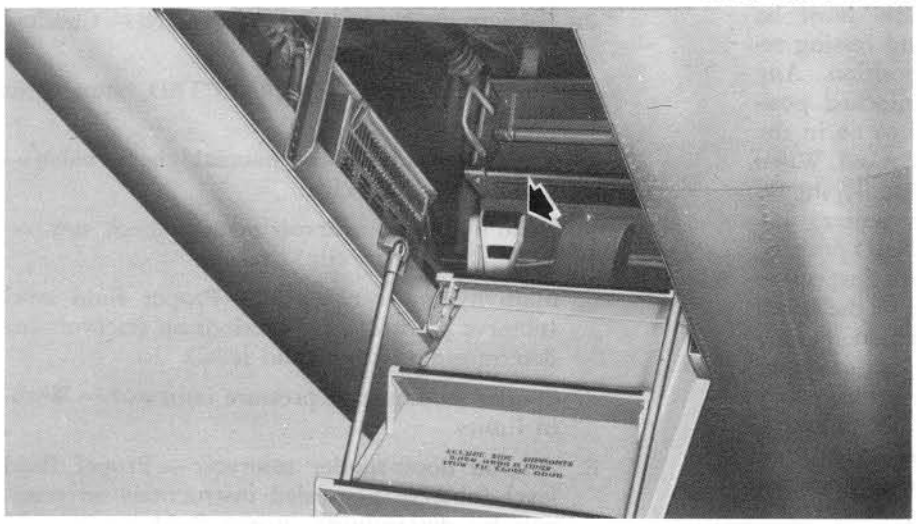
OPEN ACCESS DOOR



PULL HANDLE TO RELEASE DOOR



Note: Secure door supports after door is open.



TO CLOSE DOOR, AFTER ENTERING AIRCRAFT, STOW DOOR SUPPORTS THEN DEPRESS FOOT PEDAL (INDICATED)

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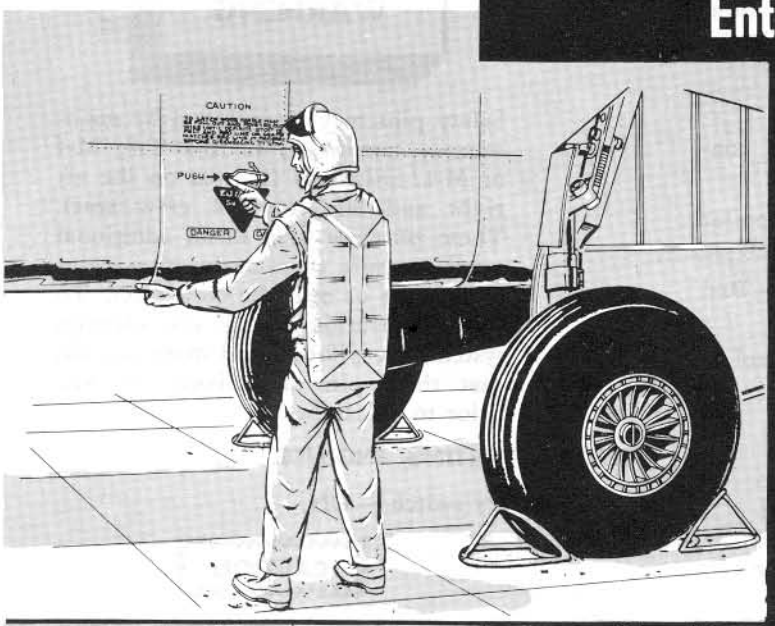
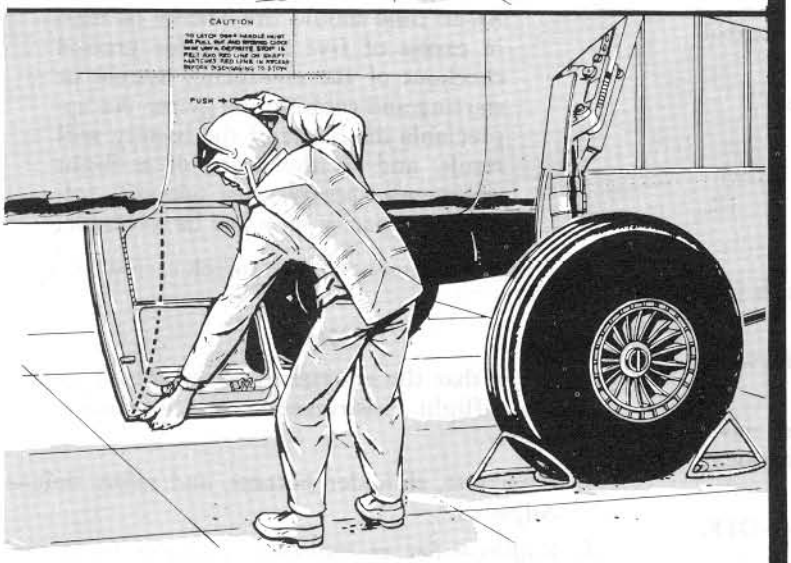
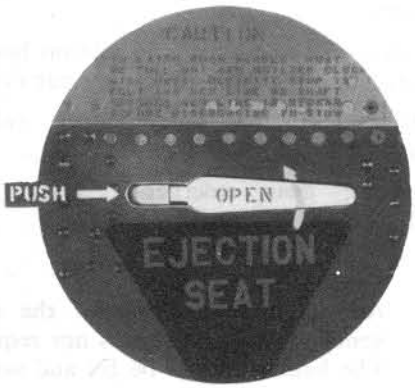
Figure 2-1 (Sheet 1 of 2)

Entrance To Aircraft

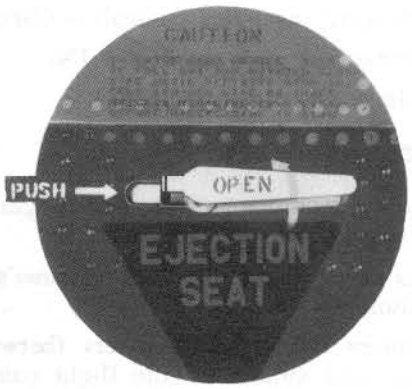




WEATHER COMPARTMENT



PUSH AS INDICATED TO RELEASE HANDLE



TURN HANDLE TO RELEASE DOOR

SECURE DOOR SUPPORT TO FORWARD SIDE OF ENTRANCE AS SHOWN

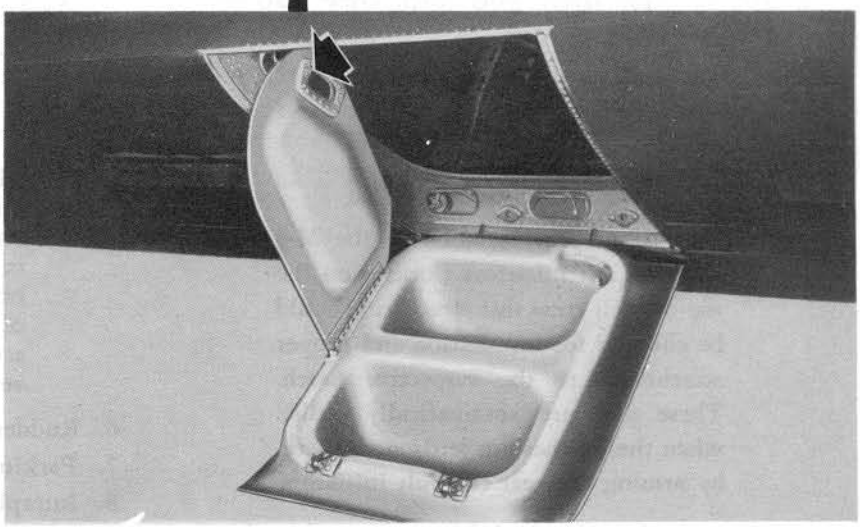


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Figure 2-1 (Sheet 2 of 2)

(Continued from Page 2-3)

9. Rudder-elevator boost reservoir — Proper fluid level (observe placarded instructions on reservoir for determining proper fluid level).
10. Aileron boost disconnect — ENGAGED.
11. Hydraulic cylinders and lines — General condition.
12. Rudder-elevator boost and aileron boost-spoiler interconnect valve — Red flag out (visible).
13. Utility-emergency interconnect valve — Red flag out (visible).
14. Landing gear emergency valve control — NEUTRAL (safetied).

Note

An operational check of the emergency airbrake system is not required. The handle should be IN and safetied at all times, except when needed for emergency braking.

15. Wing flap emergency hydraulic valve control handle — NEUTRAL (safetied).
16. Emergency over-ride controls — Checked.
17. Alternator circuit breakers — IN.
18. Main bus circuit breakers — IN.

FLIGHT COMPARTMENT.

1. Manual cockpit pressure control (gunner's forward console) — PRESSURIZED.
2. Auxiliary circuit breakers (gunner's forward console) — IN.
3. Primary bus circuit breakers (between navigator and gunner on the flight compartment aft bulkhead) — IN.
4. N-1 compass latitude correction pointer — OFF.
5. M-3 initiator safety pins (each crew seat) — Properly installed.

WARNING

The safety pins installed in the M-3 seat catapult initiators (located on the top of each crew seat structure) should be checked for installation and proper attachment to the respective hatch. These pins are automatically pulled when the hatches are jettisoned, thereby arming the seat catapult initiators.

6. T-8 and M-4 (M-12) initiator ground maintenance safety pins — REMOVED.

WARNING

Safety pins may be installed by maintenance personnel, in the T-8, M-4 or M-12 initiators (located on the aft right and left sides of crew seat). These pins are used as an additional safety measure when performing maintenance on or near the crew seats. To insure operation of the seat ejection system, the pilot should make certain that these pins have been removed prior to all flights.

BEFORE STARTING ENGINES.

1. Battery switch — ON.

CAUTION

At no time should the battery be used in excess of five minutes for ground checkout of the emergency system or starting and running the gyros. An appreciable discharge of the battery will result, and in the event of a flight emergency shortly after take-off, full battery capacity may not be available.

2. Flight instrument power switch — EMER, then ON.

Note

Observe that the emergency inverter and essential flight instruments are operating properly.

3. Parachute, shoulder harness, and safety belt — Adjusted.
4. Radios — Set as required (perform functional check).
5. Seat — Adjusted and locked.

CAUTION

The pilot and navigator should determine that the fore and aft adjustment lever is positively engaged and locked in the desired position prior to take-off. This will minimize the possibility of seat fore and aft movement during acceleration and deceleration maneuvers.

6. Rudder pedals — Adjusted.
7. Parking brake — Set.
8. Interphone, oxygen, emergency alarm bell, (and warning light, if installed) — Crew reports.

(Continued on Page 2-15)

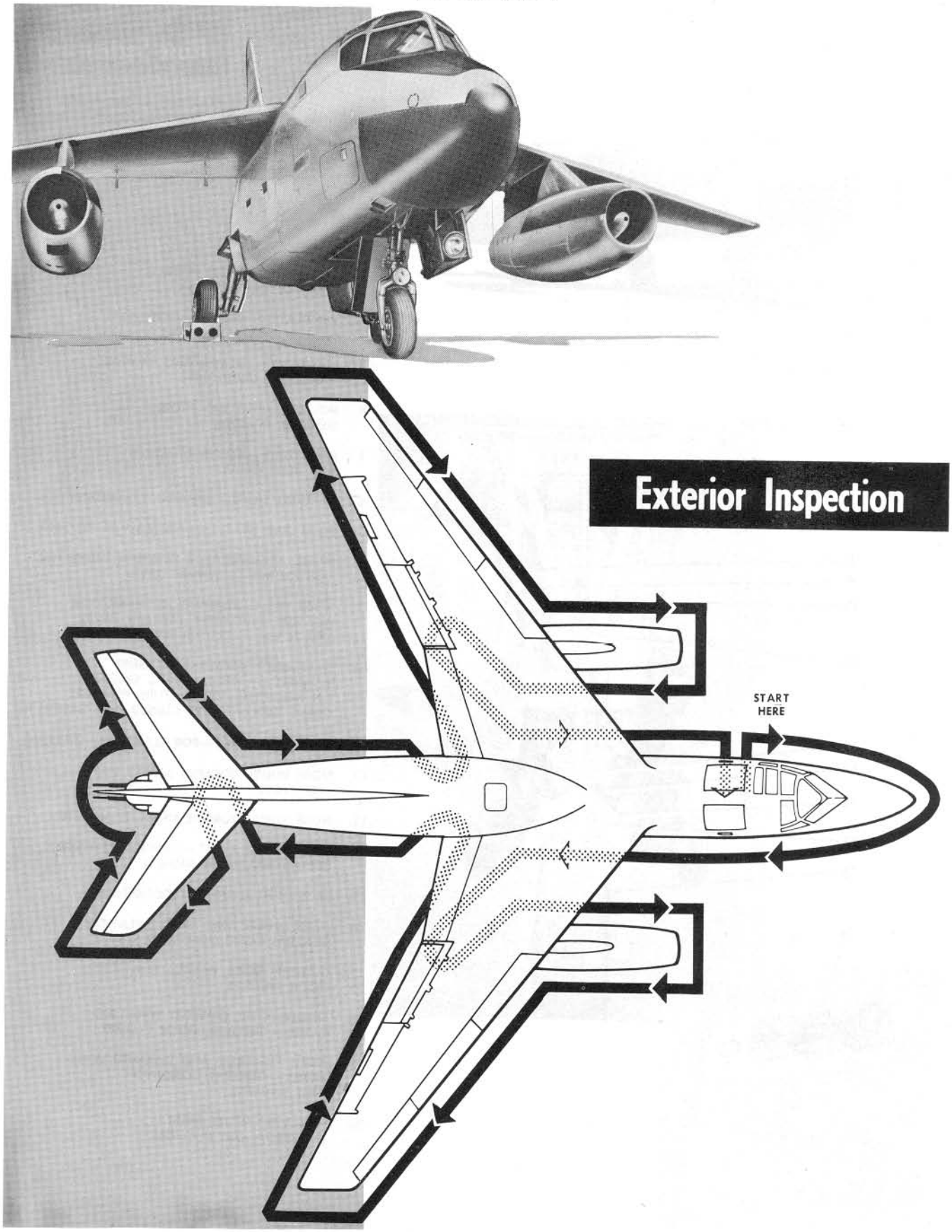
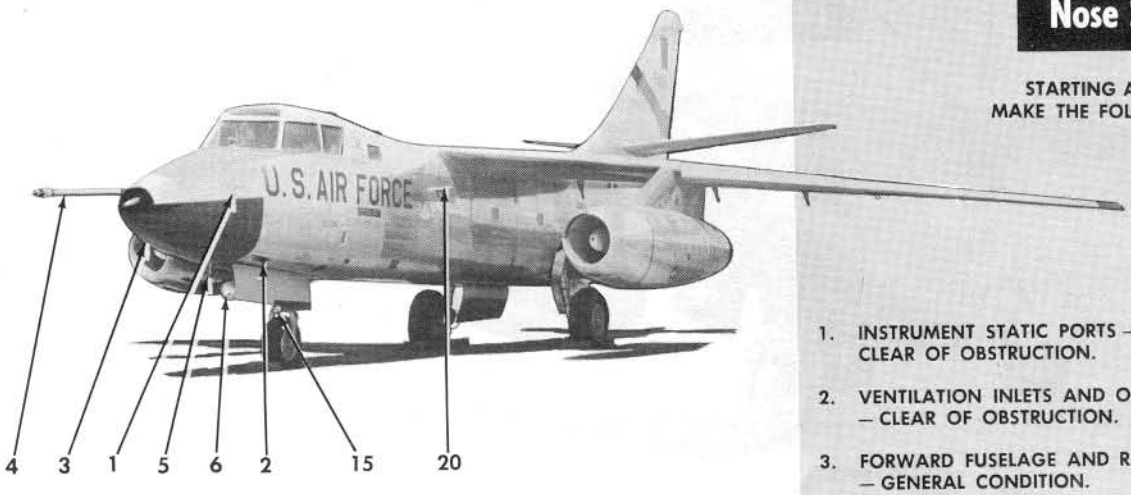


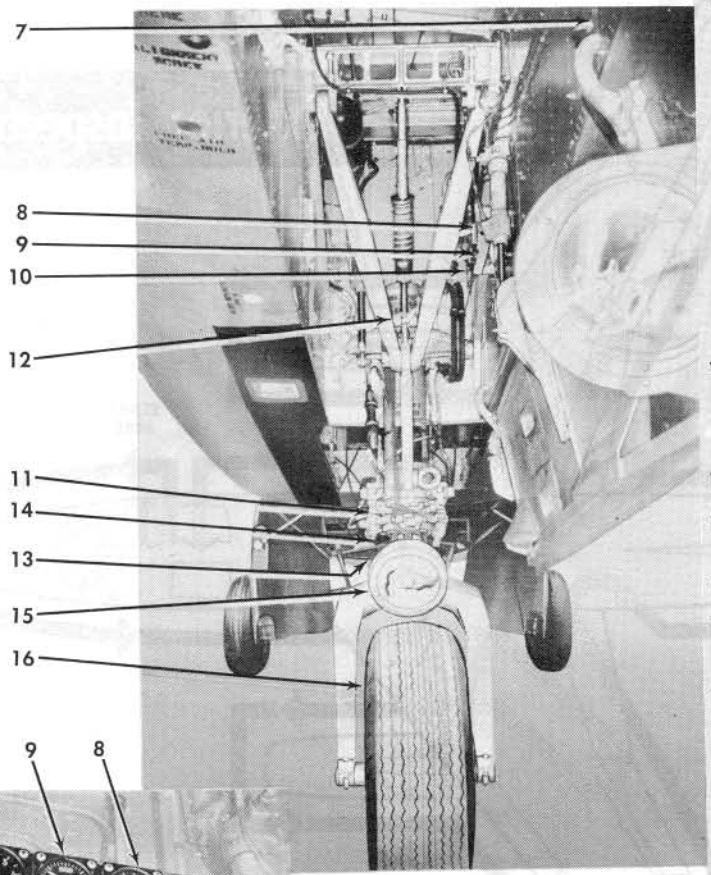
Figure 2-2 (Sheet 1 of 8)

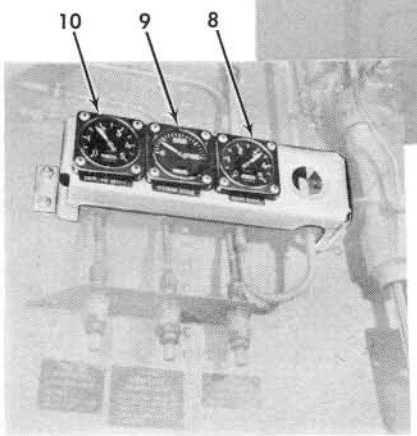
1498B

Nose Section and

STARTING AT THE NOSE, MAKE THE FOLLOWING CHECKS:







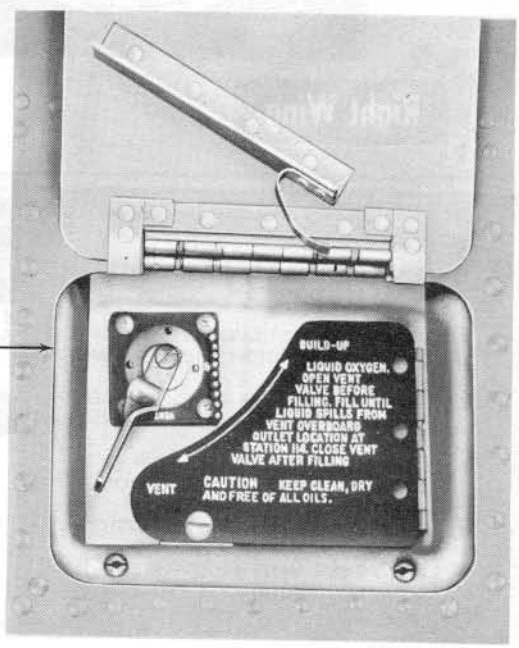
1. INSTRUMENT STATIC PORTS – CLEAR OF OBSTRUCTION.
2. VENTILATION INLETS AND OUTLETS – CLEAR OF OBSTRUCTION.
3. FORWARD FUSELAGE AND RADOME – GENERAL CONDITION.
4. INFLIGHT REFUELING PROBE – GENERAL CONDITION.
5. PITOT TUBE – COVER REMOVED AND TUBE CLEAR.
6. LANDING LIGHT – GENERAL CONDITION.
7. PITOT AND STATIC DRAIN VALVES – CLOSED.
8. BRAKE ACCUMULATOR PRESSURE INDICATOR (300 PSI MIN.) – WITHIN LIMITS.
9. NOSE WHEEL STEERING ACCUMULATOR PRESSURE INDICATOR – WITHIN LIMITS (DRAIN VALVE CLOSED AND SAFETIED).
10. EMERGENCY AIRBRAKE PRESSURE INDICATOR – WITHIN LIMITS SPECIFIED ON ADJACENT TEMPERATURE/PRESSURE CURVE (DRAIN VALVE CLOSED AND SAFETIED).
11. HYDRAULIC LINES – FOR LEAKS AND CHAFING.
12. NOSE WHEEL GROUND SAFETY PIN – IN PLACE.
13. NOSE WHEEL TORQUE LINK – CONNECTED.
14. NOSE WHEEL STRUT – PROPER EXTENSION (APPROXIMATELY 6 INCHES).
15. TAXI LIGHT – GENERAL CONDITION.
16. NOSE WHEEL AND TIRE – INFLATION, GENERAL CONDITION, AND SLIPPAGE.
17. OXYGEN FILLER VALVE – BUILT UP, DOOR SECURED.
18. SINGLE POINT GROUND REFUELING PANEL – CHECKED, DOOR CLOSED.
19. RIGHT FUSELAGE AND INBOARD WING PANEL – GENERAL CONDITION. (NOT SHOWN)
20. FUEL VENT RELIEF MAST – FREE FROM OBSTRUCTION.

1499B

Figure 2-2 (Sheet 2 of 8)

Forward Fuselage

Exterior Inspection



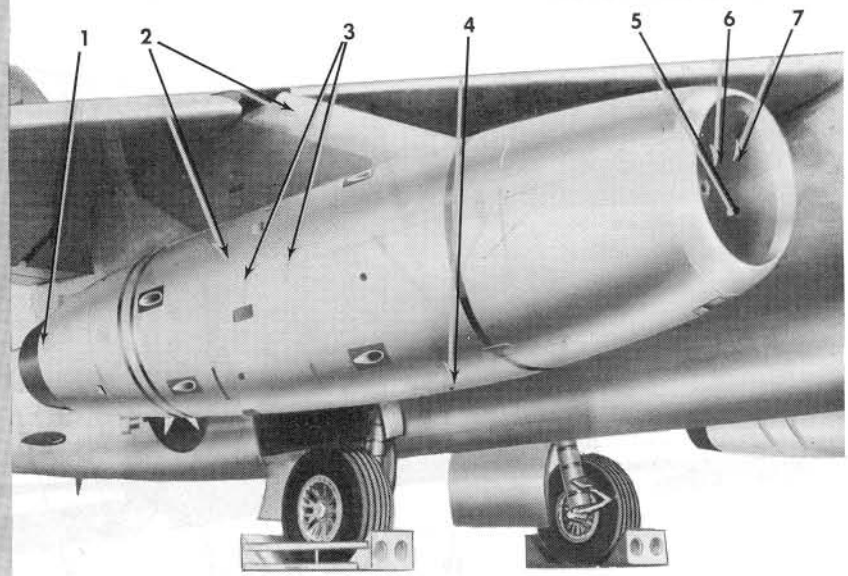
2374B

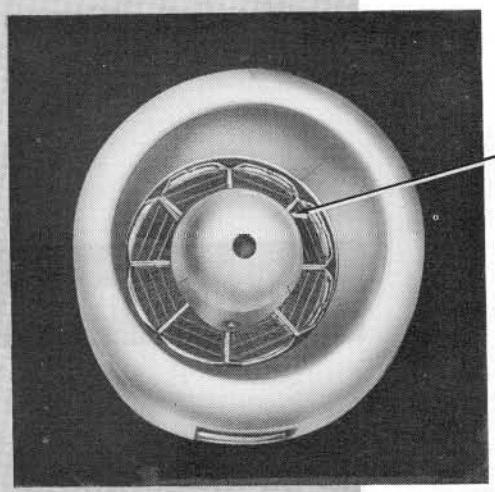
Figure 2-2 (Sheet 3 of 8)

Exterior

Right Engine and Nacelle

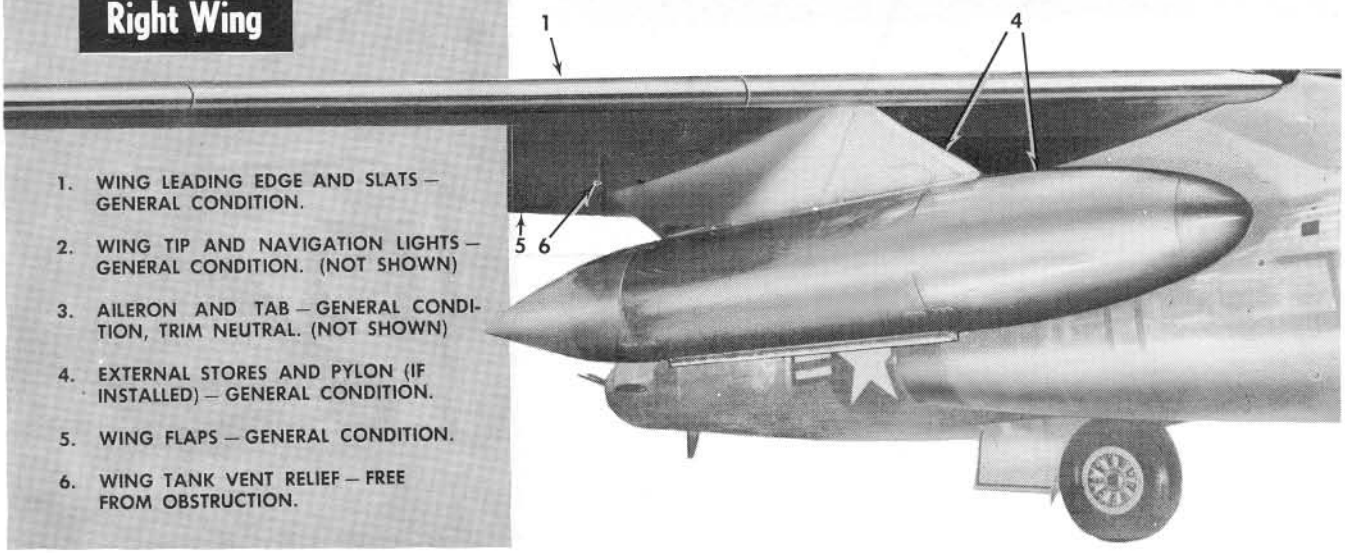
1. TAILPIPE AND TURBINE – CRACKS, DENTS, AND WRINKLES.
2. NACELLE AND PYLON – GENERAL CONDITION.
3. NACELLE DOOR LOCKS – SECURE.
4. DRAINS AND DRAIN VALVE – FREE OF OBSTRUCTION.
5. ENGINE INLET AREA – FREE OF FOREIGN OBJECTS.
6. CONSTANT SPEED DRIVE UNIT – CHECK FOR EVIDENCE OF LEAKS.
7. ENGINE SCREENS, GUIDE VANES, COMPRESSOR – GENERAL CONDITION.





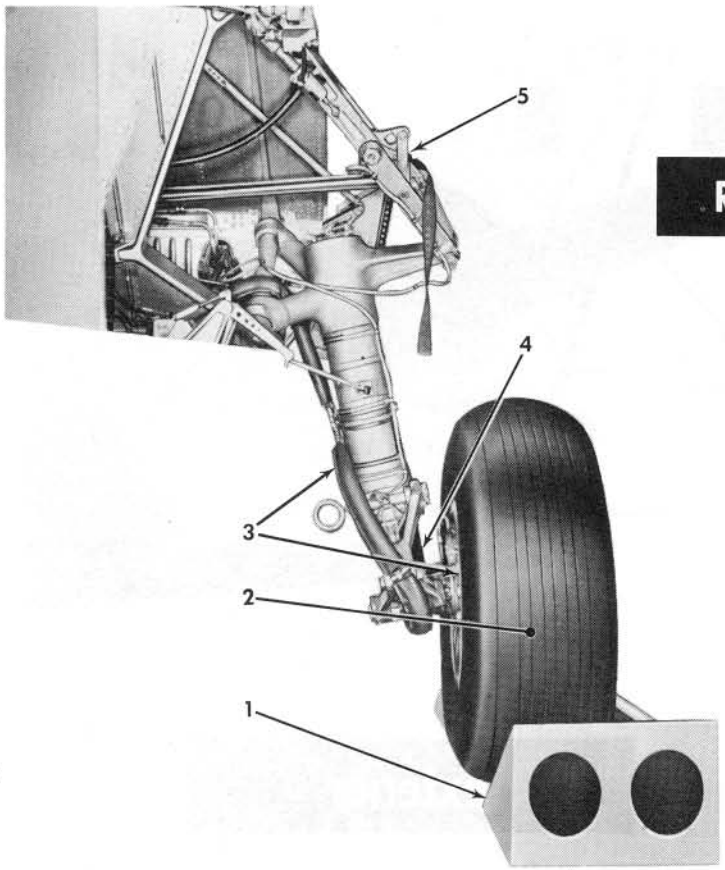
Right Wing

1. WING LEADING EDGE AND SLATS – GENERAL CONDITION.
2. WING TIP AND NAVIGATION LIGHTS – GENERAL CONDITION. (NOT SHOWN)
3. AILERON AND TAB – GENERAL CONDITION, TRIM NEUTRAL. (NOT SHOWN)
4. EXTERNAL STORES AND PYLON (IF INSTALLED) – GENERAL CONDITION.
5. WING FLAPS – GENERAL CONDITION.
6. WING TANK VENT RELIEF – FREE FROM OBSTRUCTION.



1500B

Figure 2-2 (Sheet 4 of 8)



Right Main Gear and Center Fuselage

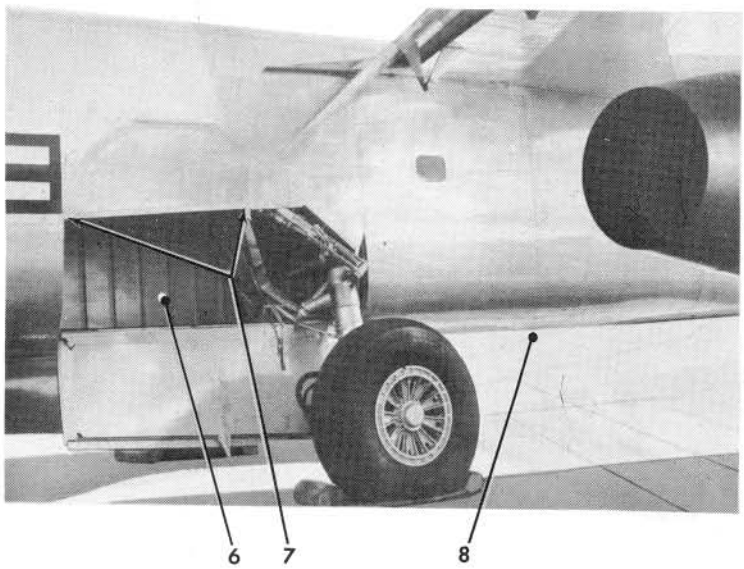
1. CHOCKS – IN PLACE.
2. MAIN WHEEL AND TIRE – GENERAL CONDITION, INFLATED, AND SLIPPAGE.
3. BRAKE AND HYDRAULIC LINES – GENERAL CONDITION, RETURN SPRING IN PLACE, BRAKE BACKING PLATE LOCK PIN PROPERLY POSITIONED.

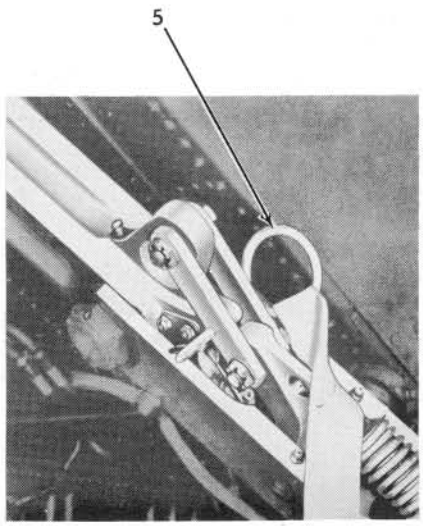
CAUTION

MAKE CERTAIN THAT THE BRAKE BACKING PLATE LOCK PIN IS IN THE LOCKED POSITION (TOWARD THE WHEEL HUB). OTHERWISE A LOCKED WHEEL BRAKE MAY RESULT.

4. MAIN GEAR STRUT – PROPER EXTENSION (APPROXIMATELY 7 INCHES).
5. MAIN GEAR SAFETY PIN – IN PLACE.
6. WHEEL WELL AREA – GENERAL CONDITION, EVIDENCE OF HYDRAULIC LEAKS.
7. UPPER MAIN GEAR DOOR LOCKS – LOCKED.
8. CENTER AND UNDERSIDE OF FUSELAGE – GENERAL CONDITION, ACCESS DOORS CLOSED AND LOCKED.

Inspection



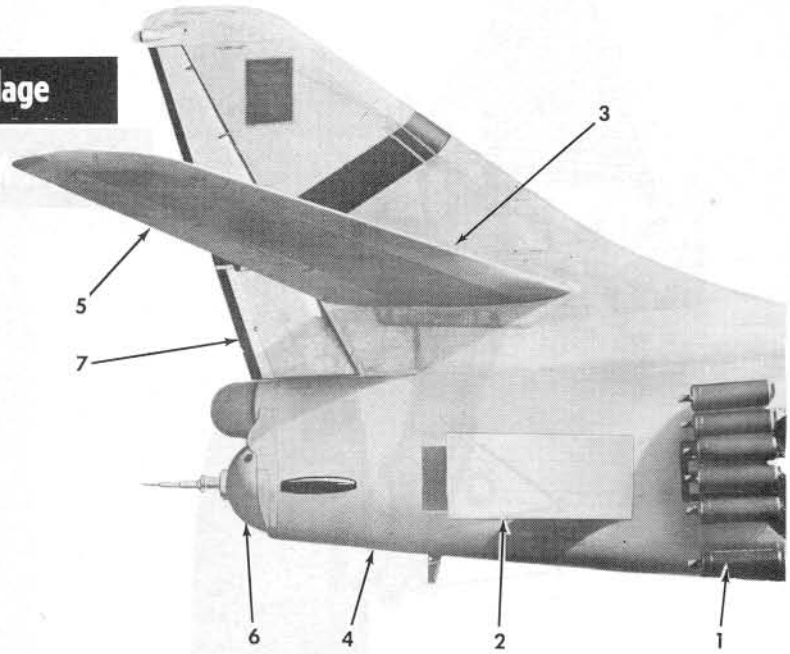


1501B

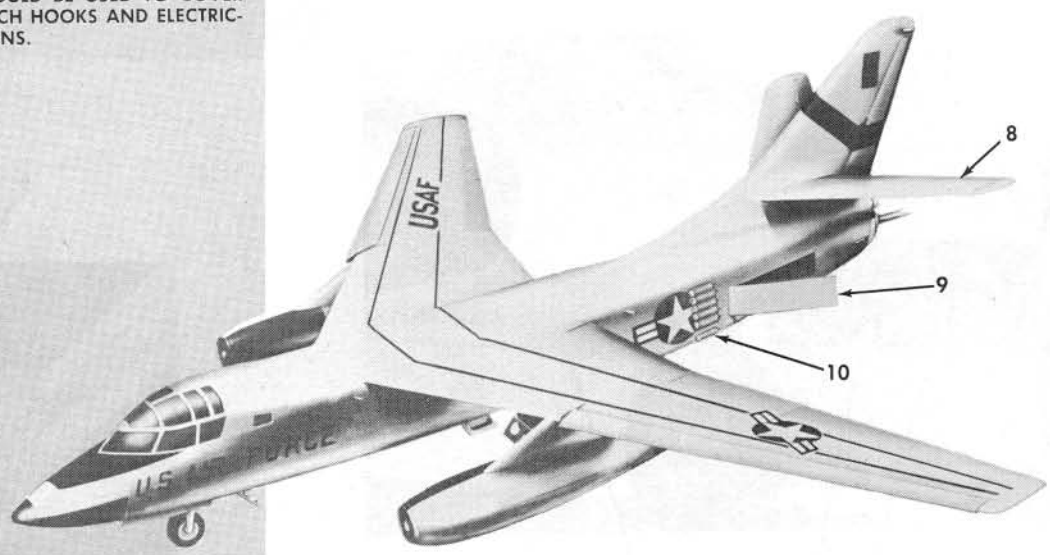
Figure 2-2 (Sheet 5 of 8)

Empennage and Aft Fuselage

1. ATO ATTACHMENTS(RIGHT) — GENERAL CONDITION. IF THE ATO BOTTLES ARE NOT INSTALLED, AN ADHESIVE PLASTIC FILM TAPE SHOULD BE USED TO COVER THE ATO ATTACH HOOKS AND ELECTRICAL CONNECTIONS.
2. SPEED BRAKE(RIGHT) — GENERAL CONDITION, EVIDENCE OF HYDRAULIC LEAKS.
3. RUDDER BOOST DISCONNECT-ENGAGED.
4. DRAG CHUTE-RISER MECHANISM PROPERLY POSITIONED, DOOR CLOSED, INDICES ALIGNED.
5. HORIZONTAL STABILIZER AND ELEVATOR(RIGHT) — NEUTRAL, GENERAL CONDITION.
6. GUN TURRET — GENERAL CONDITION, GUNS STOWED.
7. VERTICAL STABILIZER AND RUDDER — RUDDER TRIM NEUTRAL, GENERAL CONDITION.
8. HORIZONTAL STABILIZER AND ELEVATOR(LEFT) — NEUTRAL, GENERAL CONDITION.
9. SPEED BRAKE(LEFT) — GENERAL CONDITION, EVIDENCE OF HYDRAULIC LEAKS.
10. ATO ATTACHMENTS(LEFT) — GENERAL CONDITION. IF THE ATO BOTTLES ARE NOT INSTALLED, AN ADHESIVE PLASTIC FILM TAPE SHOULD BE USED TO COVER THE ATO ATTACH HOOKS AND ELECTRICAL CONNECTIONS.



Exterior



1502B

Figure 2-2 (Sheet 6 of 8)

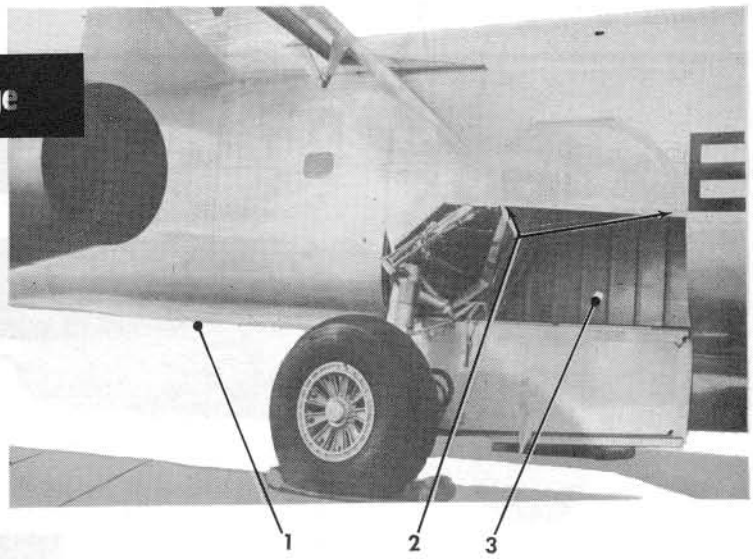
Left Main Gear and Center Fuselage

1. CENTER AND UNDERSIDE OF FUSELAGE — GENERAL CONDITION, ACCESS DOORS — CLOSED AND LOCKED.
2. UPPER MAIN GEAR DOOR LOCKS — LOCKED.
3. WHEEL WELL AREA — GENERAL CONDITION, NO EVIDENCE OF HYDRAULIC LEAKS.
4. MAIN GEAR SAFETY PIN — IN PLACE.
5. MAIN GEAR STRUT — PROPER EXTENSION (APPROXIMATELY 7 INCHES).
6. BRAKE AND HYDRAULIC LINES — GENERAL CONDITION, RETURN SPRING IN PLACE, BRAKE BACKING PLATE LOCK PIN PROPERLY POSITIONED.

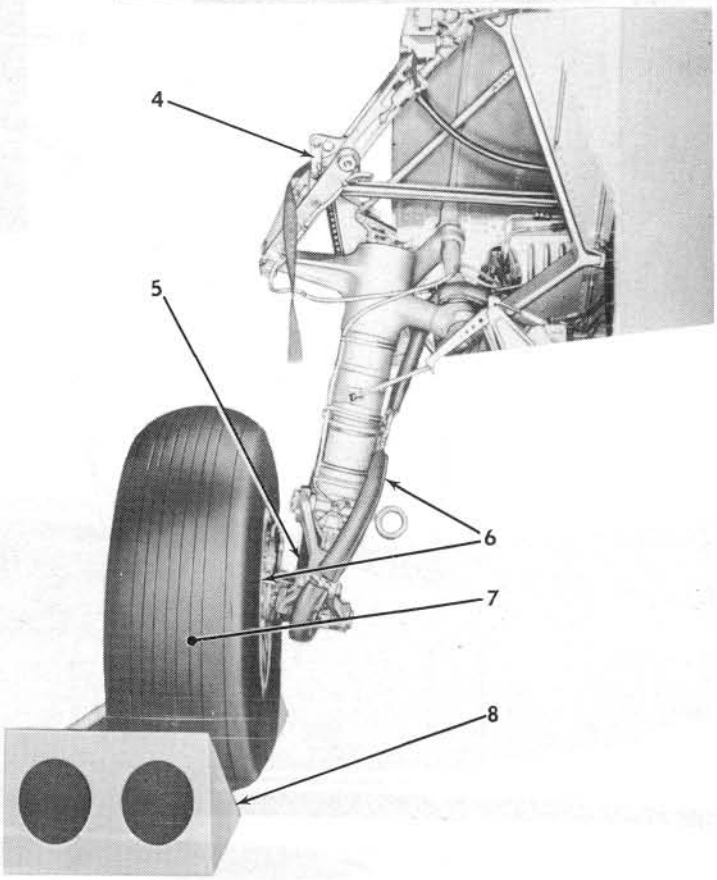
CAUTION

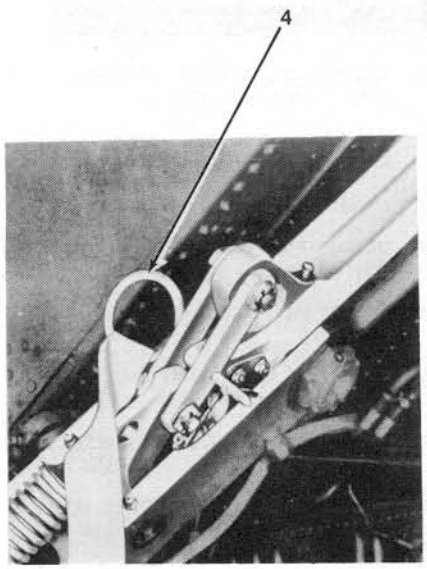
MAKE CERTAIN THAT THE BRAKE BACKING PLATE LOCK PIN IS IN THE LOCKED POSITION (TOWARD THE WHEEL HUB). OTHERWISE A LOCKED WHEEL BRAKE MAY RESULT.

7. MAIN WHEEL AND TIRE — GENERAL CONDITION, INFLATED, AND SLIPPAGE.
8. CHOCKS — IN PLACE.



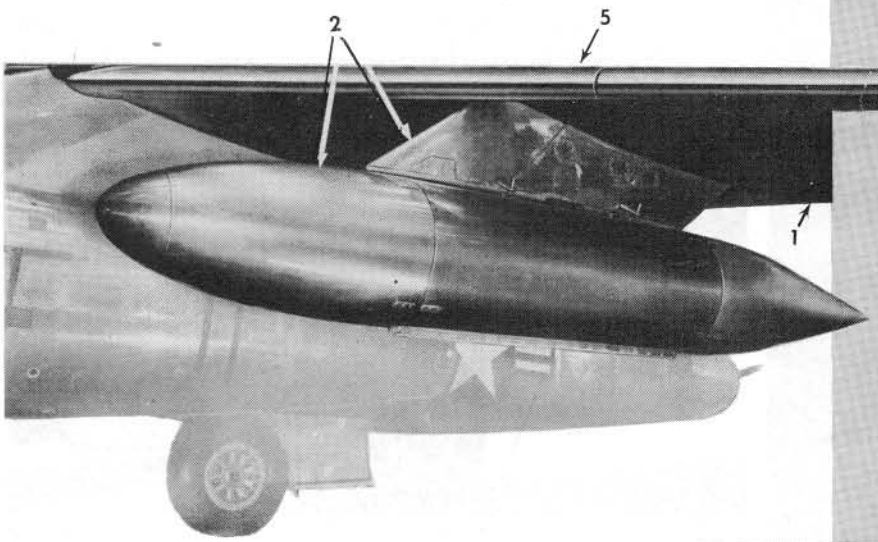
Inspection





2418B

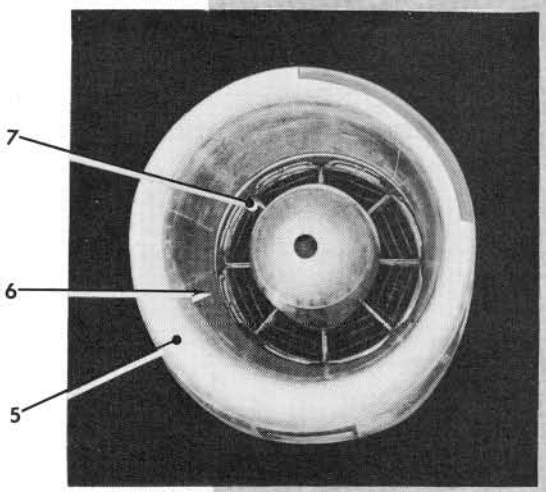
Figure 2-2 (Sheet 7 of 8)



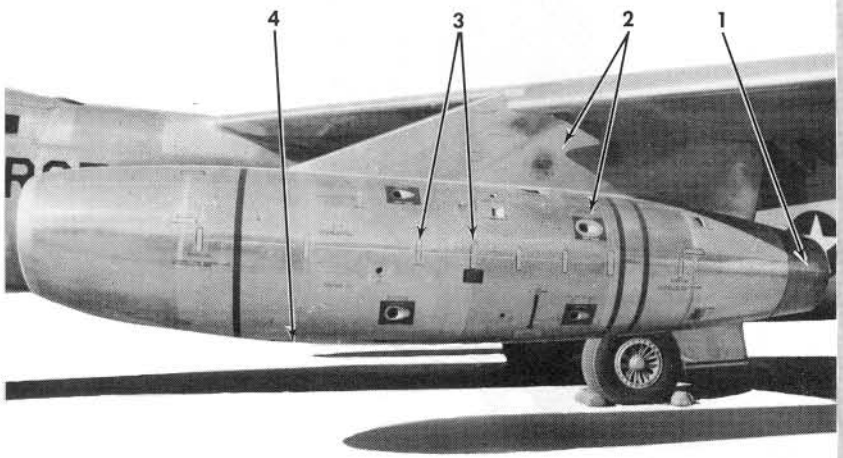
Left Wing

1. WING FLAPS – GENERAL CONDITION.
2. EXTERNAL STORES AND PYLON (IF INSTALLED) – GENERAL CONDITION.
3. AILERON AND TAB – GENERAL CONDITION, TRIM NEUTRAL. (NOT SHOWN)
4. WING TIP AND NAVIGATION LIGHTS – GENERAL CONDITION. (NOT SHOWN)
5. WING LEADING EDGE AND SLATS – GENERAL CONDITION.

Exterior Inspection



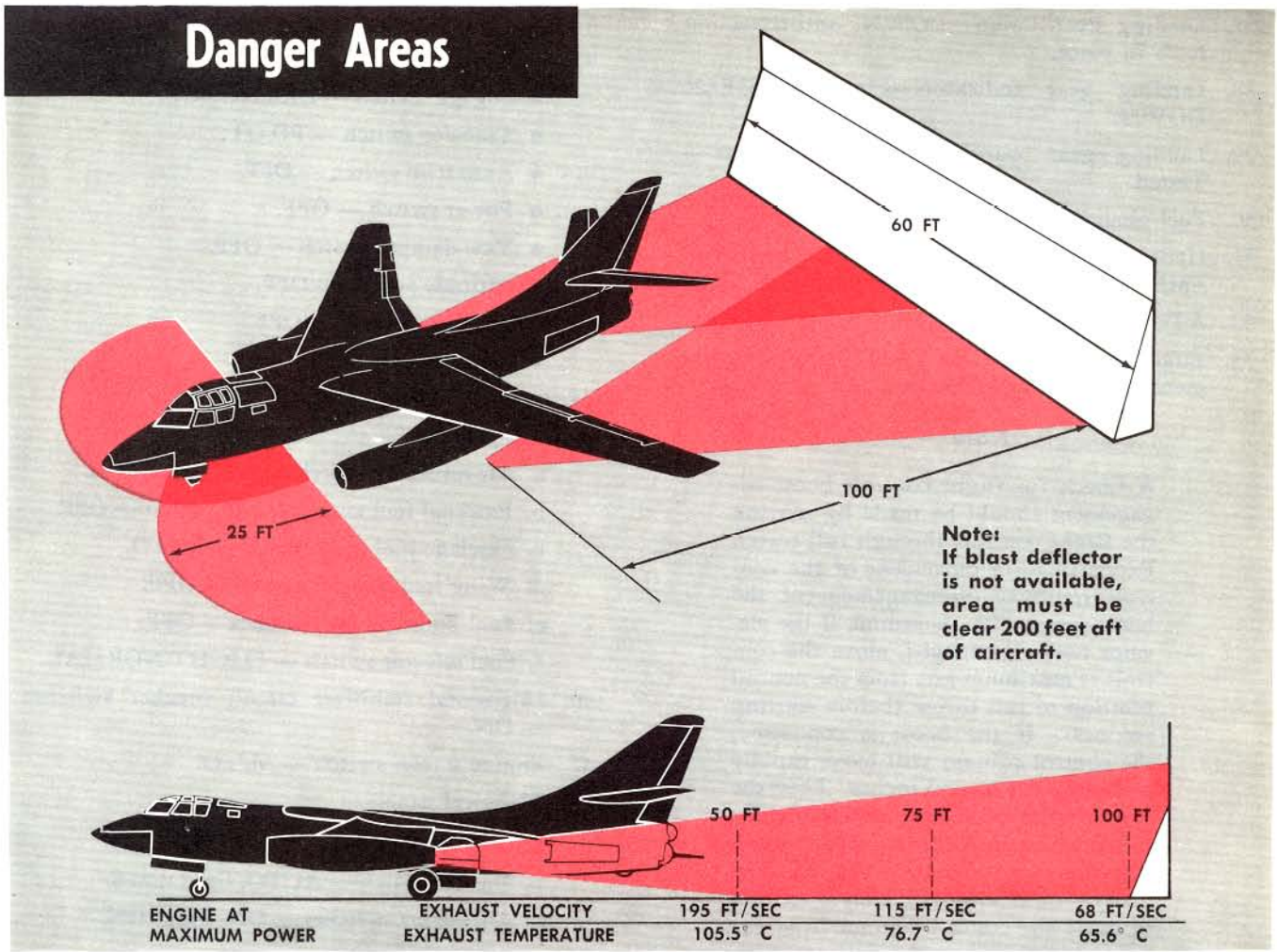
Left Engine and Nacelle



1. TAILPIPE AND TURBINE – CRACKS, DENTS, AND WRINKLES.
2. NACELLE AND PYLON – GENERAL CONDITION.
3. NACELLE DOOR LOCKS – SECURE.
4. DRAINS AND DRAIN VALVE – FREE OF OBSTRUCTION.
5. ENGINE INLET AREA – FREE OF FOREIGN OBJECTS.
6. CONSTANT SPEED DRIVE UNIT – CHECK FOR EVIDENCE OF LEAKS.
7. ENGINE SCREENS, GUIDE VANES, COMPRESSOR – GENERAL CONDITION.
8. LEFT FUSELAGE AND INBOARD WING PANEL. (NOT SHOWN)

2363B

Figure 2-2 (Sheet 8 of 8)



1503B

Figure 2-3

(Continued from Page 2-6)

9. Radio circuit breakers — IN.
10. AN/ARA-26 emergency keyer — OFF.
11. Flight controls boost manual release handles (pilot's lower left console) — DOWN and safetied.
12. AN/ANH-2 wire recorder — As required.
13. Battery bus circuit breakers (pilot's left console) — IN.
14. Pitot heat — Checked, then OFF.
15. De-icing panel switches — OFF.

Note

The AUTOMATIC feature of the engine ANTI-ICING system is inoperative.

WARNING

The engine automatic anti-icing system has been disconnected. To de-ice the engine place the engine ANTI-ICING switch in the ON position.

16. Air conditioning panel switches:
    - Cockpit pressure — DEPRESSURIZED.
    - Cockpit temperature control — AUTO.
17. Rain removal switch — CLOSED.
18. Navigation lights switch — Set as required.
19. Magnetic compass light switch — Set as required.
20. Taxi light — Check and OFF.
21. Emergency bus circuit breakers (pilot's left forward console) — IN.
22. Nose wheel steering range selector handle — DISENGAGED.
23. Engine fire control handles — IN.
24. Engine fire warning lights — PRESS-TO-TEST.
25. Main instrument panel — Lights and indicators checked.
26. Anti-skid switch — ON, light checked.

27. Landing gear lever — DOWN, anti-retraction latch in place.
28. Landing gear indicators — Indicates GEAR DOWN.
29. Landing gear warning horn and lights — Tested.
30. Fuel quantity, and indicators — Checked.
31. Hydraulic pressure gage selector switch — EMER-UTILITY (down position).
32. ATO arming switch — OFF.
33. Flight controls — UNLOCKED, boost engagement and movement checked.

Note

A Check for flight controls boost engagement should be made by moving the flight controls through full travel. Excessive force movement of the controls indicates disengagement of the boost system. To determine if the elevator boost is engaged, move the controls at maximum rate from the neutral position to full throw (before starting engines). If the boost is connected, the control column will move rapidly and easily for several inches. Then the rate of deflection will noticeably decrease while the force required to move the control will increase. It will normally require approximately 3 seconds to move the control column from the neutral position to the full aft position. If the elevator boost is disconnected, the control column may be easily and rapidly moved through its limits; requiring approximately 0.7 seconds from neutral to the full aft position at a maximum rate. The preceding check will give positive indication of a complete boost disconnect; however, it will not indicate that the locking mechanism is in the dead center or near dead center position.

34. Landing light — OFF.
35. Master engine switches — OFF.
36. Drag chute control lever — FORWARD (detent), safetied.
37. Throttles — OFF and LOCKED.
38. Rudder trim — Run rudder trim through full travel, then set at zero.
39. Aileron trim — Run aileron trim through full travel, then set at zero.
40. Wing flap handle — UP, then NEUTRAL position.
41. Emergency airbrake handle — IN, and safetied.
42. Autopilot turn control — DETENT.
43. Autopilot panel switches:
    - Engage switch — DISENGAGE.
    - Transfer switch — PILOT.
    - Auto trim switch — OFF.
    - Power switch — OFF.
    - Yaw damper switch — OFF.
    - Altitude switch — OFF.
    - Localizer switch — OFF.
    - Approach switch — OFF.
44. Interior lights — OFF.
45. Fuel panel:
    a. Air refueling switch — OFF, (guarded).
    b. External fuel tank pressure switch — OFF.
    c. Fuselage fuel trim switch — AUTO.
    d. Wing fuel transfer switch — OFF.
    e. Fuel boost pump switches — OFF.
    f. Fuel selector switch — FLIGHT NORMAL.
46. Horizontal stabilizer circuit breaker switches — ON.
47. Engine screen switch — AUTO.
48. Electrical panel:
    a. Generator switches — ON, lights ON.
    b. Bus-tie switch — AUTO, light tested.
    c. Alternator switches — ON, lights ON.
49. IFF — STANDY.
50. Radios — Checked, set as required.
51. Altimeter — Set.

INTERIOR INSPECTION (NIGHT FLIGHTS).

In addition to the preceding checks, perform the following for night operations:

1. Interior lighting — Check operation, then
2. Air refueling (IFR) probe light rheostat — Check operation, then OFF.
3. Navigation lights — Check operation with ground crew, then ON.
4. Warning lights dimming switch — Check operation, then set as required.
5. Magnetic (standby) compass light — Check operation, then ON.
6. Taxi light — Check operation, then OFF.
7. Landing light — Check operation, then OFF.

STARTING ENGINES.

It is recommended that the right engine be started first. Start engines as follows:

1. External air — Check with ground controller that ground air supply unit is operating at maximum pressure.
2. Area clear to start — CLEAR for starting engines, fire guard posted. (For graphic presentation of danger area see *figure 2-3.)*
3. Master engine switches — ON.
4. Fuel boost pump switches — ON.
5. Engine ignition switches — Check in NORMAL position.

Note

The ignition system is energized when the starter switch is actuated and the master engine switch is ON.

CAUTION

Because of the harmful effects associated with a *hot start* always make certain that the ignition switch is in the NORMAL position when making a ground start. Failure to do so may result in an attempted start without ignition and can allow raw fuel to accumulate in the combustion case, the turbine section, and the exhaust system of the engine. In event of a *hot start,* the engine must come to a complete stop to permit all the raw fuel to drain from the engine. The engine must then be purged by motoring with the ignition in the MOTOR position and with the throttle in the OFF position for approximately 25 seconds. The engine must come to a complete stop and 3 minutes must elapse before a second start is attempted. Should a third attempt be necessary, 23 minutes must then elapse. A *hot start* is a start during which the exhaust gas temperature exceeds the starting limits shown in Section V. Record each such start in DD Form 781.

Note

On indication of a hot start the EGT may be controlled through metering the fuel flow, by movement of the throttle toward the OFF position.

6. Engine start switch — Position to desired engine, hold for a maximum of 2 seconds (ignition circuit will be energized for a 3-minute period).

CAUTION

The engine should not be started if the EGT is in excess of 150°C. If the EGT is in excess of 150° C, as a result of previous engine operation, the engine may be motored (without ignition) to hasten cooling.

CAUTION

Start and run up engines with the aircraft on a clean hard surface to prevent foreign material from entering the compressor. Make certain that personnel are clear of intake and exhaust areas.

WARNING

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

1. Before starting engines, all crew members will don oxygen masks, connect hoses, and place the diluter lever in 100%.
2. Whenever contamination is suspected, 100% will be used during ground operation and take-off.
3. When contamination is no longer suspected, place the diluter lever in the NORMAL position as soon as possible, in order to conserve the oxygen supply for flight.

CAUTION

Upon initiation of engine cranking, check the oil pressure gage for an immediate indication of oil pressure. If there is no pressure, shut down and investigate.

7. Throttle — When the engine speed reaches 11% rpm, advance the throttle to IDLE.

CAUTION

Instruct the ground controller to report excessive fuel drainage from the engine starting. In event of excessive drainage discontinue the start immediately.

CAUTION

If there is no increase in exhaust gas temperature within 10 seconds after opening the throttle, immediately return the throttle to the OFF position; place the engine ignition switch to MOTOR (for approximately 25 seconds); then position the master engine switch to OFF, and allow the engine to coast to a complete stop. Three minutes must then elapse before a second start is attempted.

CAUTION

After the engine starts, the rpm must continually increase to IDLE (55%). During acceleration to IDLE, should the exhaust gas temperature exceed the maximum allowable for starting (as specified in Section V), immediately retard the throttle to OFF; position the master engine switch to OFF (to disengage the starter); and allow the engine to coast to a complete stop. (See Section VII for information on Compressor Stall.)

Note

Make certain that the throttles, when moved to the IDLE position, or above, ride firmly on the inside track of the slots. This will insure positive engagement with the stops at the IDLE position and preclude the possibility of moving the throttles to OFF during power reductions to IDLE.

8. Engine instruments (oil pressure, rpm, exhaust gas temperature, fuel flow) — Within limits.
9. Hydraulic pressure — Within limits.

Note

With the right engine operating, observe that the UTILITY, AILERON BOOST, and RUD. & ELEV. BOOST & ALT. EMER. pressure indicators show operating pressure. The EMER. pressure indicator should show operating pressure immediately upon start-the left engine.

10. Ground power and air — Disconnected.
11. Alternator warning light on operating engine — OFF.

Note

Check that the alternator and generator are operating properly, before starting the other engine.

12. Generator warning light on operating engine — OFF.

Note

Due to an unbalanced condition of the generators immediately after starting the left engine, the left generator warning light may indicate an inoperative generator. If this condition occurs, placing the right generator switch to the OFF position momentarily will throw the entire aircraft d-c load on the left generator and bring it into operation. The right generator switch should then be returned to the ON position.

13. Bus-tie light — ON.
14. Autopilot power switch — ON (for warm up).
15. Auto trim switch — ON.
16. Speed brakes — CLOSED.
17. Elevator trim switches (a-c and d-c) — Run horizontal stabilizer through full travel (both a-c and d-c), then set as required. (See *figure 2-6* for recommended trim setting for take off.)

Note

Check hydraulic crossover by moving flight controls (rudder, elevator, and ailerons). The controls should move freely and in the proper direction to indicate that the right engine hydraulic pumps are supplying the required hydraulic fluid pressure and that the interconnecting valves are operating properly.

18. Flaps — Checked 60% DOWN, high rudder boost amber indicator light ON.

CAUTION

The rudder boost red warning light should be out at all times; otherwise, excessive boost pressure is being delivered to the rudder and structural damage could result.

Start other engine, using the procedure outlined in preceding *steps 2, 6, 7, and 8.*

Note

The other engine may be started using bleed air from the operating engine,

which should be operating at approximately 80 per cent rpm to provide sufficient air pressure.

19. Alternator warning lights — OFF.
20. Generator warning lights — OFF.

Note

Check that both left and right alternators are operating properly before placing the bus-tie switch to the AUTO position.

21. Bus-tie light — OFF.
22. A-c load transfer relays:
    - Both alternator switches — ON.
      a. Both alternator warning lights — OFF.
      b. N-1 compass power off warning light — OFF.
      c. When test switch actuated to either test position, fire warning light — ON.
      d. Bus-tie light — OFF.
    - LH alternator switch — ON; RH alternator switch — OFF.
      a. Both alternator warning lights — OFF.
      b. N-1 compass power off warning light — Momentarily ON, then OFF.

Note

Light continuously ON indicates LH transfer relay stuck in the transfer position.

      c. When test switch actuated to either test position, fire warning light — ON.

Note

Light OFF indicates RH transfer relay stuck in primary position.

      d. Bus-tie — ON.
    - LH alternator switch — OFF; RH alternator switch — ON.
      a. Both alternator warning lights — OFF.
      b. N-1 compass power off warning light — Momentarily ON, then OFF.

Note

Light continuously ON indicates LH transfer relay stuck in primary position.

      c. When test switch actuated to either test position, fire warning light — ON.

Note

Light OFF indicates RH transfer relay stuck in transfer position.

      d. Bus-tie light — ON.

23. Fuel system — Check the fuel system for satisfactory operation with the fuel selector switch in the following positions:
    - TAKE-OFF & CROSSFEED
    - FLIGHT NORMAL
    - EMER. FWD. TANK TO L. & R. ENGINES
    - EMER. FWD TANK TO LEFT ENGINE
    - EMER. FWD. TANK TO LEFT ENGINE

Note

Tests have shown that fuel flow fluctuation will occur in approximately 5 seconds if a fuel shutoff valve fails to open to provide fuel to either operating engine.

24. Fuel selector switch — FLIGHT NORMAL.

ENGINE GROUND OPERATION.

ENGINE WARM-UP.

A warm-up period is not required for jet engines; however, when the engines have stabilized at IDLE rpm and all instruments read normal, the hydraulic accumulator pressure gages should be checked by the ground crew to determine that the pressure is within limits.

BEFORE TAXIING.

1. Cockpit pressure control switch — NORMAL.

Note

During ground operations, the flight compartment may be cooled more effectively (if required) by placing the cockpit pressure switch in the NORMAL position and opening the flight compartment entrance door.

2. Ground cooling — Disconnected.
3. Hydraulic system and flight controls—Checked.

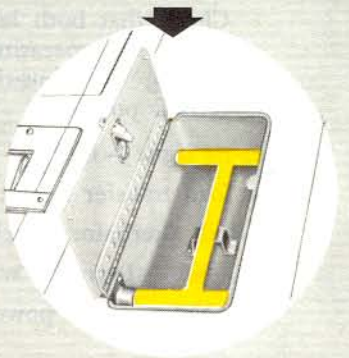
Note

With both engines operating at IDLE rpm, check that the hydraulic system is operating properly as follows: Move the ailerons through full travel, observe the AILERON BOOST pressure indicator for momentary pressure drop (ailerons and spoilers should move freely and in the proper direction); move the rudder and elevators through full travel, observe the RUD. & ELEV. BOOST pressure indicator for momentary pressure drop (rudder and elevators should move freely and in the

Weather Compartment Entrance Door

JETTISON HANDLE ACCESS DOOR

The entrance door can be jettisoned during flight by pulling UP AND AFT on the T handle located under the access door.



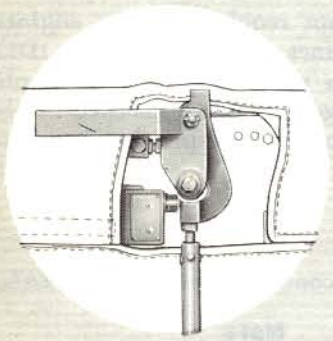
WEATHER COMPARTMENT CRAWLWAY ACCESS DOOR

WEATHER COMPARTMENT ENTRANCE DOOR CLOSED, DOOR SUPPORT STOWED, LATCHING HANDLE LATCHED

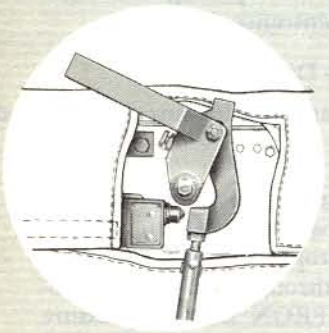
WARNING

The entrance door should not be used for alternate bailout. For alternate bail-out procedures see figure 3-8.

WEATHER COMPARTMENT ENTRANCE DOOR OPEN WITH DOOR SUPPORT SECURED



DOOR CLOSED AND LATCHED (LOCKED POSITION)



DOOR CLOSED BUT UNLATCHED (INTERMEDIATE POSITION)

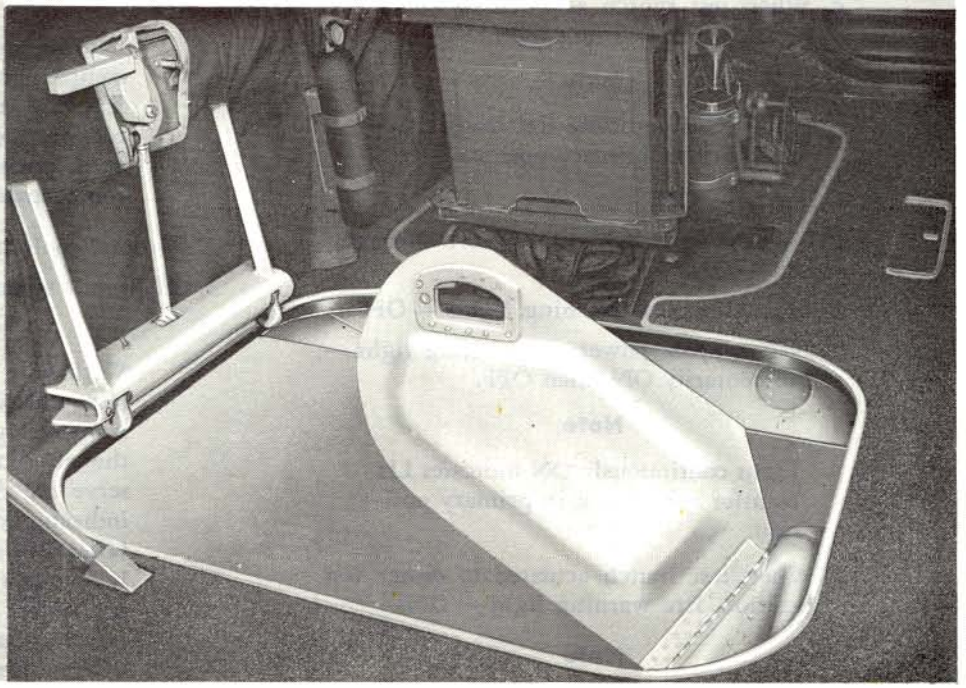


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Figure 2-4

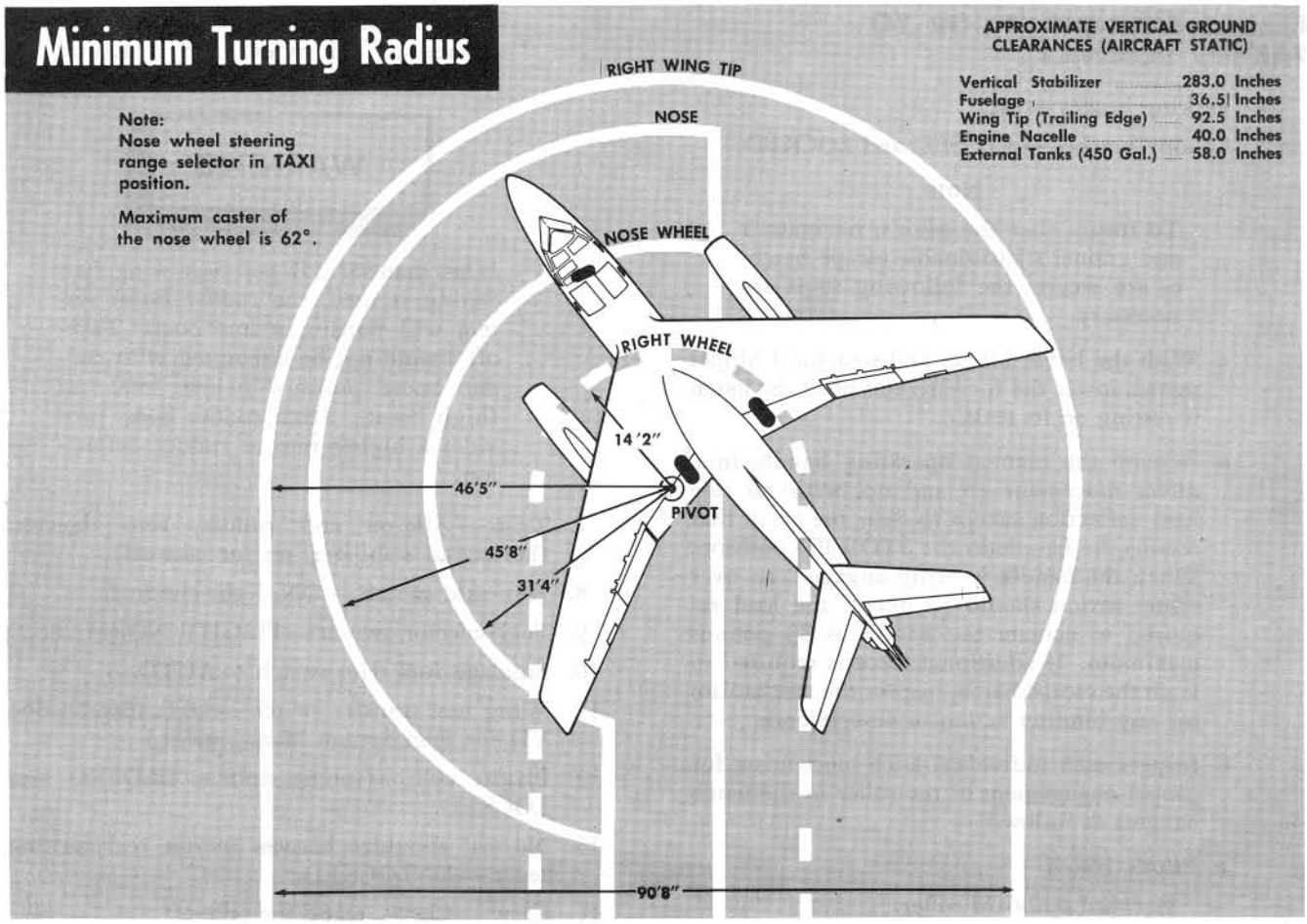

Figure 2-5

proper direction). Sluggish movement of the flight controls, or lack of hydraulic pressure, indicates a malfunction.

4. Hydraulic system pressure indicators — Within limits (check in both switch positions).
5. Perform functional check on the autopilot (Refer to Section IV).
6. Autopilot engage switch — DISENGAGED.
7. Yaw damper — OFF.
8. Turret unlocked indicator (main instrument panel) — NO.
9. Nose wheel steering range selector handle — TAXI (rudder pedals neutral before shifting to TAXI position).

CAUTION

To prevent possible damage to the nose gear assembly with the aircraft static, the nose wheel steering range selector handle should be in the DISENGAGE position during rudder pedal movement.

10. Nose wheel well hydraulic pressure indicators — Within limits.
11. Landing gear safety pins — Removed and stowed.
12. Fuel boost pump indicator lights — OFF.
13. Chocks — Removed.
14. External interphone cord — Stowed.
15. Aircraft entrance door — CLOSED and LOCKED.
16. Canopy — CLOSED and LOCKED, all stations.

TAXIING.

1. Brakes — Checked for proper operation (no grabbing or pulling right or left).
2. Nose wheel steering system — Check for proper operation during taxiing.
3. Flight instruments — Check for proper operation.

BEFORE TAKE-OFF (PRIOR TO TAKING RUNWAY).

1. Parking brakes — Set.
2. Canopy hatches — CLOSED and LOCKED.

Note

To insure that the pilot's, navigator's and gunner's jettisonable escape hatches are secure, the following steps are necessary.

- With the hatch hinges and structural hinges mated, lower the forward end until the hatch is resting on its seals.
- Actuate the manual operating handle in a direct movement aft and up, with no side load deflection except to clear the catch that retains the handle in the STOWED position. When the handle is being engaged, an over center action should be noted; the load required to actuate the handle is 33 pounds maximum. If additional force is required to latch the escape hatch, inspect the mechanism for any binding action or interference.
- Inspect each individual latch mechanism for proper engagement of the roller in the hatch hangers as follows:
- Pilot's Hatch

  Forward outboard roller.

  Forward inboard roller.

  Roller located above the handle.
- Navigator's and Gunner's Hatch

  Inboard roller located above the handle.

  Two outboard rollers.

Note

Inspection of the two outboard rollers in the navigator's and gunner's hatch mechanism may be difficult but can be accomplished by observing that portion of the roller which is visible above the cover.

3. Canopy hatch ground safety cable pins — Removed.
4. Emergency canopy removal handle ground safety pin — Removed.
5. Seat ejection controls ground safety pins — As required.
6. Flaps — 60% DOWN, high rudder boost amber indicator light ON.

CAUTION

The rudder boost red warning light should be out at all times; otherwise, excessive boost pressure is being delivered to the rudder and structural damage could result.

WARNING

If less than 35(±5) per cent wing flap setting is used, the rudder boost system will remain in low boost. Takeoff should not be attempted with rudder boost pressure below 1500 psi (high boost). High rudder boost provides a higher rate of rudder deflection.

7. Trim — Aileron and rudder, zero degrees; (horizontal stabilizer, set for take-off).
8. Anti-skid switch — ON, light checked.
9. Fuel selector switch — FLIGHT NORMAL.
10. Fuselage fuel trim switch — AUTO.
11. Wing fuel transfer switch — OFF. (See Section VII for Fuel System Management.)
12. Flight compartment door — CLOSED and LOCKED.
13. Normal shoulder harness inertia reel locking lever — UNLOCKED.
14. Crew — Check, ready for take-off.
15. Windshield anti-icing switches — NORMAL.

CAUTION

To insure adequate defogging, the windshield anti-icing switches must be left in the NORMAL position during all flights from take-off to landing. Ground operations (in the NORMAL position) should be limited to very short periods, to prevent damage to the windshield. Under no conditions should the EMERGENCY position be used during ground operations.

16. Anti-icing and de-icing switches — As required. (See Section IV for operation of the anti-icing and de-icing systems.)
17. Windshield rain removal switch — As required.
18. Performance data — In place.

LINE UP.

1. Parking brake — Set.
2. Nose wheel steering range selector handle — TAKE-OFF & LANDING.
3. Speed brakes — CLOSED.

CAUTION

Insure that the speed brakes and the turret access and ammunition loading door remains closed, when engines are operating above 80 per cent rpm, during all ground operations and engine run-ups. In addition, all engine ground run-up operations under these conditions will be held at a minimum.

4. Engine screens switch — RETRACT.
5. Throttles — TAKE-OFF thrust.
6. Engine instruments — Checked, within limits.
7. Hydraulic system pressures — Checked.

TAKE-OFF.

In order to determine optimum procedures and accurately predict the take-off performance for a normal take-off, the pilot must know:

Gross Weight

Pressure Altitude

Outside Air Temperature

Runway Length, Slope, and Condition

Wind Direction and Velocity

Existing wind velocities should then be resolved into cross-wind and runway components.

The actual take-off distance and the distance over a 50-foot height should be determined, using the applicable correction for runway component, wind velocity, and runway slope.

Then determine the Minimum Control Speed and compare it with the take-off speed. If it is higher than the take-off speed, check the possibility of increasing the take-off ground run. The increased take-off distance may be determined from the Velocity During Take-Off Ground Run chart, Appendix I.

Note

This increased take-off ground run, to meet the Minimum Control Speed requirements, should only be considered with low gross weights and at relatively low altitudes and temperature.

The Maximum Refusal Speed should then be determined for the runway available.

Note

Any take-off may be safely aborted before reaching Maximum Refusal Speed.

CAUTION

If, for any reason, the decision is made to abort the take-off the pilot should immediately retard the throttles, apply the brakes, and deploy the drag chute, if required.

STABILIZER TRIM SETTING

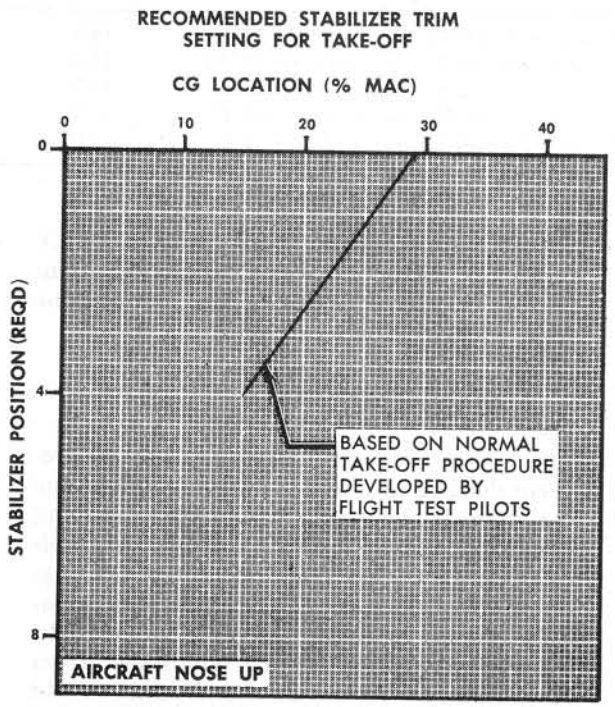

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Figure 2-6

The no-wind take-off distance should then be determined and the runway slope correction applied.

Using this distance and the given gross weight, the no-wind speed during the take-off ground run may be determined at any selected distance along the runway. After determining the no-wind line speed at the selected line speed distance, the runway component wind velocity should be applied to give the actual line speed.

WARNING

Wet or slippery runway conditions will *increase* the Distance to Stop and *decrease* the Maximum Refusal Speed. (See appendix).

See Take-Off Performance, Appendix I.

NORMAL TAKE-OFF.

In making a normal take-off the following procedures should be used:

Throttles — TAKE-OFF thrust. (See Exhaust Gas Temperature Limits, Section V.)

Compressor inlet temperature °F(C°)	*Acceleration time (Seconds)*
— 20 (—29°C) to + 99°(+37°C)	14.0
+100°(+38°C) to +104°(+40°C)	15.0
+105°(+41°C) to +109°(+43°C)	16.0
+110°(+44°C) to +199°(+48°C)	17.0
+120°(+49°C) to +124°(+51°C)	19.0

Note

Acceleration time for IDLE to MILITARY must not exceed 14 seconds at ambient temperatures above —18°C(0°F). For engine operating limits see Section V.

CAUTION

To insure adequate defogging, and to prevent damage to a cold-soaked windshield due to thermal shock the windshield anti-icing switches must be left in the NORMAL position on all flights, from take-off to landing. Ground operations (in the NORMAL position) should be limited to very short periods, to prevent damage to the windshield from overheating. Under no conditions should the EMERGENCY position be used during ground operations.

- RPM — Stabilized; exhaust gas temperature, oil pressure, and fuel flow, within limits.
- Hydraulic system pressure indicators — Within limits.
- Brakes — Released.
- Start take-off roll. Maintain directional control by the use of nose wheel steering and/or rudder.

Leave the nose wheel on the ground until take-off speeds are attained.

Lift the aircraft off the ground by a slight backward pressure on the control wheel. These take-off procedures should produce the results shown in the Take-Off Charts, Appendix I. For take-off emergencies, refer to Section III.

CROSS-WIND TAKE-OFF.

In making a cross-wind take-off use the same procedure as for Normal Take-Off. Use ailerons to keep wings level or upwind wing slightly low.

NIGHT TAKE-OFF.

In making a night take-off, use the same procedure as for Normal Take-Off. Interior lighting should be adjusted as desired.

MINIMUM RUN TAKE-OFF.

The minimum run take-off technique differs from the Normal Take-Off technique principally in the definition of lift-off speed and the speed at the 50-foot height. The lift-off speeds for the minimum run take-off are in the region of stall warning buffet of the take-off configuration of the aircraft.

OBSTACLE CLEARANCE TAKE-OFF.

For obstacle clearance take-off follow Normal Take-Off procedures, using the applicable airspeed to clear a 50-foot height. (See After Take-Off, this Section.)

ASSISTED TAKE-OFF.

Perform the following:

- ATO arming switch — ON (before start of take-off roll).

Note

The ATO warning light should be illuminated when the ATO arming switch is ON.

- ATO firing button — Push (at ATO cut-in speed). See ATO Cut-In Speed Chart, Appendix I.
- Take-off at the Normal Take-Off Speed, as determined from Appendix I.

Note

Except for the added thrust and subsequent shortening of the take-off roll when ATO is used, the technique is the same as for Normal Take-Off. These take-off procedures should produce the results shown in the ATO Cut-In Speed Charts, Appendix I.

- ATO — Jettison over safe area.

CAUTION

To avoid possible damage to the aircraft structure and the ATO support mechanism, it is recommended that the ATO units be jettisoned at a speed of approximately 300 knots IAS. See ATO Jettison Limitations, Section V.

CAUTION

Check that the speed brakes are CLOSED before jettisoning the ATO bottles, by positioning the speed brakes switch to CLOSE.

AFTER TAKE-OFF (CLIMB).

Accelerate during climb after take-off in order to clear a 50-foot height. (Wing flaps 60% DOWN.) When aircraft is definitely airborn:

1. Landing gear lever — UP. Wing flap handle — UP (at or above 120% of stall speed, and accelerate to best climb speed).

Note

The wing flap handle should remain in the UP position to depressurize the hydraulic system.

CAUTION

Do not apply abrupt or hardover movement of the rudder controls with rudder boost (1500 psi) at speeds in excess of 200 knots IAS; otherwise, structural damage may result.

2. Hydraulic system pressure indicator selector switch — UP position (for indication of rudder-elevator and aileron boost-spoiler system pressures).

The best power for climb depends on the performance required. Refer to the Climb Charts, Appendix I for recommended airspeeds, estimated rate of climb, and fuel consumption.

CRUISE CHECK.

During the cruise the following procedure should be used:

- Throttles — NORMAL (cruise power). Refer to Appendix I for desired cruise control.
- Fuel selector switch — FLIGHT NORMAL.
- Wing fuel transfer switch — As required. (See Section VII for Fuel System Management.)
- External fuel tank pressure switch — TRANSFER (if external (droppable) tanks are installed). See Section VII for Fuel System Management.
- Wing fuel transfer switch — OFF (after wing tank fuel transfer has been completed).
- Utility and emergency hydraulic pressure indication — Check for pressure drop to indicate that the utility and emergency hydraulic pumps are feathered.

Note

The utility and emergency hydraulic pressure indicator should indicate a drop in pressure approximately 10 to 15 minutes after the landing gear and flaps are UP and the ATO bottles have been jettisoned.

- Hydraulic system pressure indicator selector switch — UP.

Note

Leave the hydraulic system pressure indicator selector switch in the UP position, during cruise, to provide pressure indication for the rudder-elevator and aileron boost-spoiler systems.

- Monitor the CG position and flight control boost system pressure during flight.

Note

The fuel quantity indicator selector switch should be maintained in the FUS. TANKS position except for momentary checking of wing tank fuel quantity.

FLIGHT CHARACTERISTICS.

See Section VI for information concerning flight characteristics.

DESCENT.

Note

In order to minimize the formation of frost or fog at altitude or during a rapid descent, keep the flight compartment temperature at the highest maximum consistent with crew comfort.

CAUTION

Maintain not less than 80 per cent engine rpm during descent. Negative pressure within the fuselage fuel cells may cause possible structural damage to the fuselage and/or fuel cells at less than 80% rpm.

For descent, proceed as follows:

1. Altimeter — Set.
2. Fuel quantity — Checked.

Note

After checking the fuel quantity, leave the fuel quantity indicator selector switch in the FUS. TANKS (UP) position.

WARNING

The aircraft must be in a normal flight attitude in order to obtain an accurate indication from the fuel quantity indicating system. Fuel quantity indications will be erratic after a significant change in aircraft flight attitude or in a sustained climb or descent.

3. Windshield anti-icing switches — Checked in NORMAL position.

4. Cabin window defog switch — As required.
5. Anti-icing and de-icing switch — As required.

Note

If icing conditions exist when flying at altitudes of 3000 feet or below, and airspeeds of 200 knots IAS or below, position the anti-icing and de-icing switch to ANTI-ICING. When the engine anti-icing switch is in AUTO, the engine anti-icing system is automatically shut off when the aircraft is on the ground. This is to prevent damage to the engines from over-heating.

Note

The AUTO feature of the engine anti-icing system is inoperative.

6. Air refueling switch — OFF, (guarded).
7. External fuel tank pressure switch — OFF.

Note

A rapid descent with rates as high as 45,000 feet per minute can be obtained with this aircraft, if required.

BEFORE LANDING.

1. Landing data — Computed.
2. Engine screens switch — Check RETRACT.
3. Fuel selector switch — FLIGHT NORMAL.
4. Hydraulic pressure indicator selector switch — DOWN.

Note

Leave the hydraulic pressure indicator selector switch in the DOWN position for UTILITY and EMERGENCY system pressure indication.

5. Autopilot — DISENGAGED.
6. Yaw damper — OFF.
7. Anti-skid switch — ON, amber light OFF.
8. Nose wheel steering range selector handle — TAKE-OFF & LANDING.
9. Navigator, gunner, and weather observers — Ready for landing.
10. Landing gear — DOWN and LOCKED. (Maximum gear down speed — 250 knots IAS.) Check the landing gear position indicators, on the main instrument panel, for GEAR DOWN, and locked indication.
11. Wing flaps — 100% DOWN. See Allowable Flap Deflection Vs Speed, Section V.

Note

Check that the rudder boost amber indicator light is illuminated, indicating that high rudder boost pressure is being supplied to the rudder. Check that the red warning light is out.

WARNING

In the event the rudder boost red warning light illuminates above 200 knots, any abrupt or hardover rudder movement should be avoided; otherwise, structural damage may result due to excessive rudder boost pressure.

12. Hydraulic pressures — Checked, within limits.
13. Guns — Stowed.

Note

The turret unlocked indicator, located on the main instrument panel, will indicate YES, if the guns are *not* stowed when the landing gear is extended.

TRAFFIC PATTERN CHECKS.

See figure 2-7 for Landing Pattern. For weight and CG limitations, see Section V. Use power and speed brakes as required to maintain airspeeds as shown in the Landing Pattern *(figure 2-7)*.

LANDING.

In order to determine optimum procedures and accurately predict the landing performance, the pilot must know the following:

Runway Length

Runway Condition

Runway Elevation

Runway Ambient Temperature

Runway Wind Conditions

Aircraft Gross Landing Weight

With these data known, the pilot may determine the minimum landing distance required (refer to the landing performance data, Appendix I). The landing distance required, as determined from the Appendix data, should be composed to the available runway length. Only in cases where the landing distance required equals the available field length, should a minimum run landing be made. When the available runway length is greater than the calculated minimum landing distance, as determined from the Appendix, the aircraft can be stopped with less than maximum braking;

thereby, minimizing the brake heat dissipation problem. (Refer to Section VI for additional landing technique information).

NORMAL LANDING.

- Use power as required to maintain a minimum approach speed of 120 per cent of stall speed for the weight configuration being shown. Establish a technique as shown in the Landing Pattern *(figure 2-7)* in order to produce the results shown in the Landing Distance Chart, Appendix I. With the speed brakes OPEN, power should be used as required to maintain the desired approach speeds and rate of descent. Speed brakes should be OPEN at touchdown to assist in deceleration during the landing roll. Touchdown should be made at 110 per cent of stall speed for the weight being flown. Maintain directional control after touchdown, by means of the rudder and nose wheel steering.
- Drag chute — DEPLOY. (See Section V for Drag Chute Limitations.)

CAUTION

Do not deploy the drag chute at speeds in excess of 150 knots IAS. Deploy only after the nose wheel is on the runway.

CAUTION

Actuation of the speed brakes during ground operations, with the engines at IDLE, may cause momentary loss of nose wheel steering and braking due to the lack of sufficient hydraulic fluid pressure.

- Brakes — Use brakes as required to slow aircraft for turn-off or stop.

WARNING

To prevent damage to the wheel and brake installations, due to the dragging of brakes, the following restrictions must be observed:

- Taxi speed shall not exceed 25 knots.
- No more than one full stop landing (with brakes) or full stop from a highspeed taxi run (with brakes) will be made within a 2-hour period. Aborted take-offs will be considered as a full stop landing.
- The drag chute will be utilized for all full stop landings, whenever possible.

In the event of a full stop landing at high gross weights (over 63,000 lb.) the aircraft will be operated in accordance with the following procedures:

- Taxi the aircraft clear of the runway, shut down the engines, and remain parked for a minimum of 20 minutes to allow the brakes to cool.
- Do not set the parking brake during the 20-minute cooling period.

Note

Do not taxi the aircraft into crowded parking areas when the brakes have been overheated.

- Visually inspect the landing gear from the entrance door of the aircraft. If the brakes are smoking, call for fire equipment and evacuate the aircraft immediately. All personnel should stay at least 100 feet from the aircraft, avoiding any area to either side of the main landing gear.

Note

The parking brakes should be set if the aircraft is to be evacuated.

CROSS-WIND LANDING.

In making a cross-wind landing, use the same procedure as in a normal landing *(figure 2-7)*, with the following additions:

Make a longer approach than normal to allow sufficient time to establish a course that will result in a ground track parallel to the runway.

Lower nose wheel to the runway as soon as possible after touchdown and use nose wheel steering to maintain a straight track down the runway. Use ailerons cautiously to keep wings level or the upwind wing slightly low.

Refer to Section VI for additional information regarding Cross-Wind Landing, and to the Cross-Wind Landing Chart, Appendix I.

MINIMUM RUN LANDING.

Make a normal approach with the following additions:

- Speed brakes — OPEN.
- Retard throttles to IDLE (55%) when landing is assured.
- Nose gear — On runway immediately.
- Drag chute — DEPLOY.
- Brakes — Use brakes as required.

(Continued on Page 2-30)

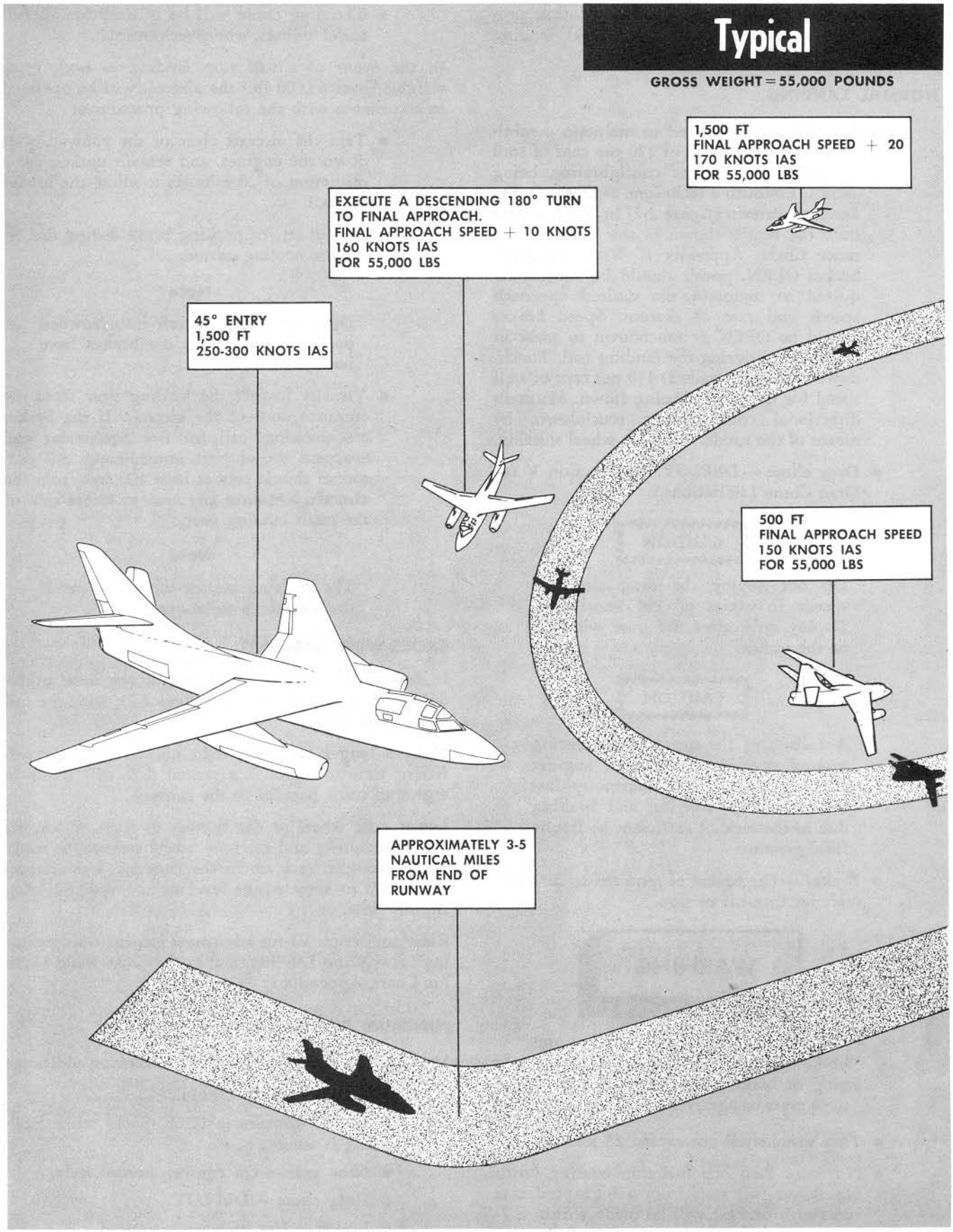

Figure 2-7 (Sheet 1 of 2)

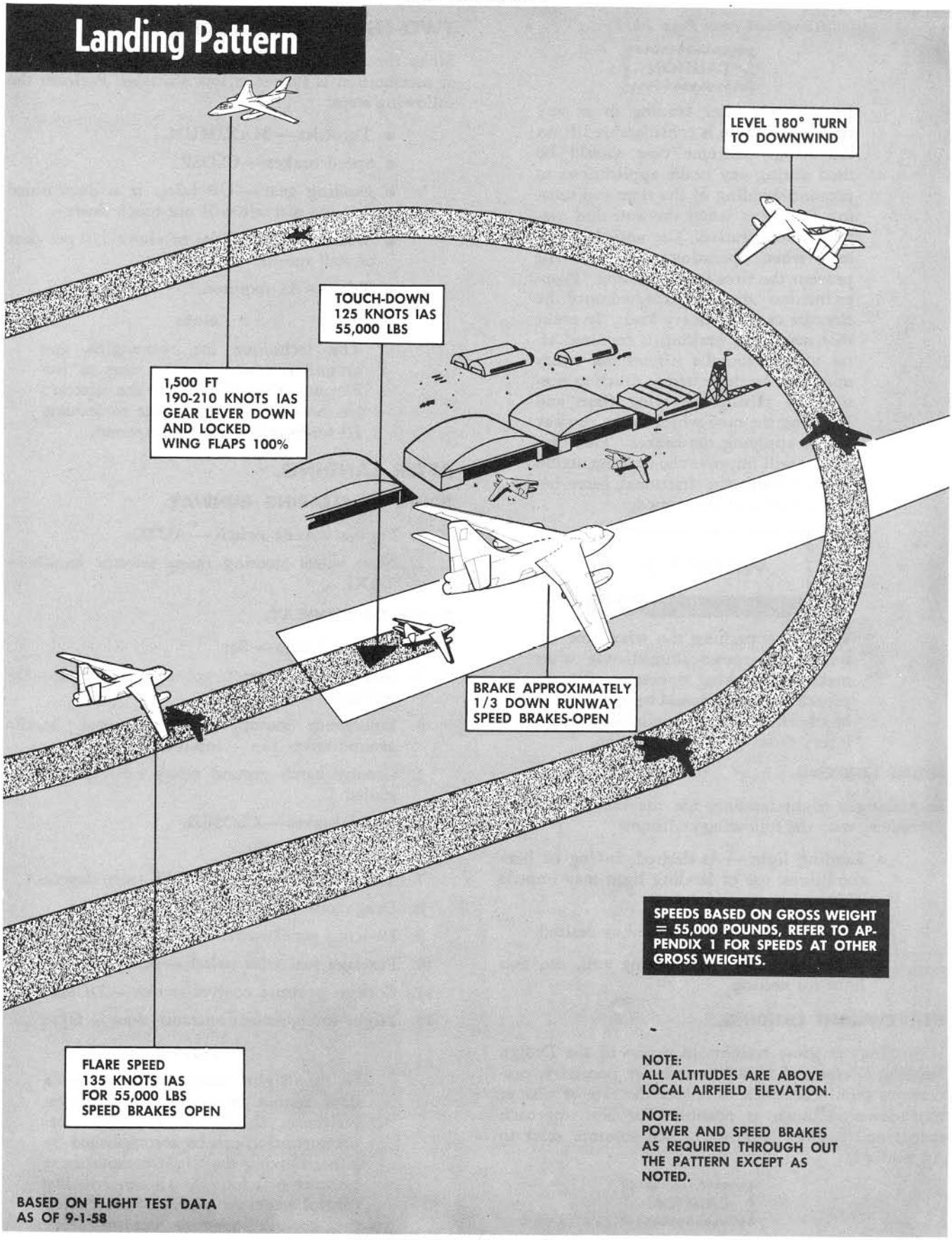

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Figure 2-7 (Sheet 2 of 2)

(Continued from Page 2-27)

CAUTION

Immediately after landing or at any time when there is considerable lift on the wings, extreme care should be used during any brake applications to prevent skidding of the tires and causing flat spots when the anti-skid system is inoperative. The anti-skid system, when operating properly, will prevent the tires from skidding. Proper traction cannot be expected until the tires are carrying heavy loads. In event that maximum braking is required after touchdown, the lift on the wings must first be decreased as much as possible by raising the wing flaps and lowering the nose wheel to the runway before applying the brakes. This procedure will improve the braking action by increasing the frictional force between tires and the runway.

WARNING

When approaching the wheel for inspection purposes immediately after maximum braking operation, the approach direction should be in the plane of wheel rotation to minimize personal injury from possible explosion.

NIGHT LANDING.

In making a night landing, use the normal landing procedure, with the following additions:

- Landing light — As desired. In fog or haze conditions, use of landing light may impede vision.
- Interior lighting — Adjusted as desired.
- After completion of landing roll, use taxi light for taxiing.

HEAVYWEIGHT LANDING.

If landings at gross weights in excess of the Design Landing Weight of 55,000 pounds are necessary, precautions should be taken to reduce the rate of sink at touchdown as much as possible. For best approach speeds and runway length required to stop, refer to Appendix I.

CAUTION

Touchdown at excessive air speeds may result in porpoising.

TWO-ENGINE GO-AROUND.

Make the decision to go-around as early as possible, as acceleration is slower at low altitudes. Perform the following steps:

- Throttles — MAXIMUM.
- Speed brakes — CLOSE.
- Landing gear — UP (after it is determined that the aircraft will not touch down).
- Wing flaps — UP (at or above 120 per cent of stall speed).
- Trim — As required.

Note

The technique for two-engine go-around is essentially the same as for Normal Take-Off, after the aircraft has been retrimmed. Refer to Section III for Single-Engine Go-Around.

AFTER LANDING.

PRIOR TO CLEARING RUNWAY.

1. Engine screens switch — AUTO.
2. Nose wheel steering range selector handle — TAXI.

CLEAR OF RUNWAY.

1. Parking brake — Set.
2. Seat ejection controls ground safety pins — Installed.
3. Emergency canopy hatch removal handle ground safety pin — Installed.
4. Canopy hatch ground safety cable pins — Installed.
5. Speed brakes — CLOSED.
6. Wing flaps — UP.
7. Trim indicator — NEUTRAL (zero degrees).
8. Drag chute — JETTISON.
9. De-icing panel switches — OFF.
10. Fuselage fuel trim switch — AFT.
11. Cockpit pressure control switch — DUMP.
12. Flight compartment entrance door — OPEN.

Note

If the flight compartment entrance door cannot be opened, cabin pressurization should be suspected. Depressurization can be accomplished by either moving the flight compartment pressure switch on the air conditioning control panel to DEPRESSURIZE, or the cockpit pressure control lever on the gunner's forward console to DUMP.

CAUTION

Do not open the canopy hatches until the flight compartment entrance door is opened, this will prevent damage which could result from rapid depressurization of the flight compartment.

13. Weather compartment — Check list completed.

ENGINE SHUTDOWN.

1. Parking braker — Set.
2. Nose wheel steering range selector handle — DISENGAGED.
3. AN/ANH-2 recorder — OFF.
4. Navigation lights — OFF.
5. Cockpit pressure switch — DEPRESSURIZED.
6. Taxi light — OFF.
7. Anti-skid switch — OFF.
8. Landing light switch — OFF.
9. Autopilot panel switches:
   - Engage switch — OFF.
   - Transfer switch — PILOT.
   - Auto trim switch — OFF.
   - Power switch — OFF.
   - Damper switch — OFF.
   - Altitude switch — OFF.
   - Localizer switch — OFF.
   - Approach switch — OFF.
10. Radio — OFF.
11. IFF — OFF.
12. Throttles — OFF and locked.

Note

Before shutdown, with the engines operating at IDLE, instruct the ground crew to open the manual fuel drain valves (on both engines) to drain the excess fuel from the engines. This will minimize the possibility of an engine fire caused by the accumulation of fuel in the engine.

CAUTION

When the engines have stopped, place the throttle lock in the full LOCKED position to prevent inadvertent opening of the throttles.

WARNING

Stay clear of the engine exhaust area for at least 15 minutes after engine shutdown and at all times when smoke vapors issue from the tail pipe. Danger exists to personnel because of the possibility of explosion of accumulated fuel vapors.

BEFORE LEAVING AIRCRAFT.

1. Fuel boost pump switches — OFF.
2. Flight instrument power switch — OFF.
3. Battery switch — OFF.
4. Master engine switches — OFF.
5. Engine fire control handle — Out.
6. Flight controls — Locked.
7. Parking brake — Off.
8. Interior lights — OFF.
9. Battery — DISCONNECTED.
10. Landing gear ground safety pins — Installed.
11. Oxygen build-up and vent handle — VENT.

Note

Experience indicates that the valve being placed in the VENT position when not in use will avoid excessive loss and/or leakage in the system.

12. DD Form 781 — Completed.

CONDENSED CHECK LIST.

Pages 2-33 through 2-48 comprise the Condensed Check List and may be removed from this manual.

AIR REFUELING CONDENSED CHECK LIST.

Pages 2-49 and 2-50 comprise the Air Refueling Condensed Check List and may be removed from this manual.

PILOT'S CONDENSED CHECK LIST

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TAKE-OFF AND LANDING DATA

RUNWAY DATA								
Press Alt	Elevation	Gradient	Length	Temperature	Wind	Minimum EGT		

TAKE-OFF DATA		
Line Speed	Ft	
Line Speed Tolerance	Kts	
ATO Fire Speed	Kts	
Refusal Speed	W/Chute	Kts
	W/O Chute	Kts
Take Off Speed	Kts	
Take Off Distance	Ft	
Minimum Velocity for Zero Rate of Climb: Gear Down, 60% Flaps		

LANDING DATA – IMMEDIATE LANDING AFTER T.O.		
Approach Speed	Kts	
Flare Speed	Kts	
Touchdown Speed	Kts	
Landing Distance W/Chute	Ft	
Landing Distance W/O Chute	Ft	

LANDING DATA – AFTER COMPLETED MISSION		
Flt Duration:	Est Gross Weight:	
Approach Speed	Kts	
Flare Speed	Kts	
Touchdown Speed	Kts	
Landing Distance W/Chute	Ft	
Landing Distance W/O Chute	Ft	

AIRCRAFT DATA		
1. Operating Weight		
Fuel Weight	2. Fwd Fuselage	
	3. Aft Fuselage	
	4. Lt Wing	
	5. Rt Wing	
	6. External	
	7. Total Fuel Weight	
8. Total (1 + 7)		
9. Ammo Weight		
10. Chaff Weight		
11. ATO Nr Bottles		
12. Aircraft Gross Weight		
13. Starting Fuel, Taxi and Acceleration Allowance (–)		
14. Adjusted T.O. Weight		

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WB-66D CONDENSED CHECK LIST

PREFLIGHT CHECKS.

CREW INSPECTION AND PERSONAL EQUIPMENT CHECK.

1. Crew inspection and personal equipment — Checked.

BEFORE EXTERIOR INSPECTION.

1. DD Form 781 — Checked.
2. Battery — Connected and checked.
3. Seat ejection pins (all stations) — Installed.
4. Canopy safety cables (all station) — Installed.
5. Emergency canopy removal pin — Installed.
6. Publications — Complete.
7. De-icing panel switches — OFF.
8. Brakes — Bled.
9. Gear lever — DOWN.
10. Controls — LOCKED.
11. Master engine switches — OFF.
12. Throttles — OFF and locked.
13. Engine ignition switches — NORMAL.
14. Inverter — Emergency operation checked, switches OFF.
15. Alarm bell (and warning light, if installed) — Checked.
16. Hand fire extinguisher — Checked.
17. Portable oxygen bottle — Checked.

WEATHER COMPARTMENT (FLIGHTS WITH COMPARTMENT UNOCCUPIED).

1. Upper access door — LOCKED and safetied.
2. Seats and belts — Secure, ejection pins installed.
3. Pressurization switch — pressurize.

WB-66D CONDENSED CHECK LIST (CONTINUED)

4. Air conditioning switch — NORMAL.
5. Oxygen regulators — OFF.
6. Entrance door — CLOSED and LOCKED.

EXTERIOR INSPECTION.

NOSE SECTION AND FORWARD FUSELAGE.

1. Instrument static ports — Clear.
2. Ventilation inlets and outlets — Clear.
3. Forward fuselage and radome — Checked.
4. Refueling probe — Checked.
5. Pitot tube — Cover removed and tube clear.
6. Landing light — Checked.
7. Pitot and static drain valves — Closed.
8. Brake accumulator pressure (300 psi min.) — Within limits.
9. Steering accumulator pressure — Within limits.
10. Emergency airbrake pressure — Within limits.
11. Hydraulic lines — Checked.
12. Nose wheel pin — Installed.
13. Nose wheel torque link — Connected.
14. Nose wheel strut — Checked.
15. Taxi light — Checked.
16. Nose wheel and tire — Checked.
17. Oxygen filler valve — BUILD UP, door secure.
18. Refueling panel — Checked, door secure.
19. Right fuselage and inboard wing panel — Checked.
20. Fuel vent relief mast — Clear.

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WB-66D CONDENSED CHECK LIST (CONTINUED)

RIGHT ENGINE AND NACELLE.

1. Tail pipe and turbine — Checked.
2. Nacelle and pylon — Checked.
3. Nacelle door locks — Secure.
4. Drains and drain valve — Checked, door secure.
5. Engine inlet area — Checked.
6. Constant speed drive unit — Checked.
7. Engine screens, guide vanes, compressor — Checked.

RIGHT WING.

1. Wing leading edge and slats — Checked.
2. Wing tip and navigation lights — Checked.
3. Aileron and tab — Checked.
4. External stores and pylon — Checked.
5. Flaps — Checked.
6. Wing tank vent relief — Clear.

RIGHT MAIN GEAR AND CENTER FUSELAGE.

1. Chocks — In place.
2. Main wheel and tire — Checked.
3. Brake and hydraulic lines — Checked.
4. Main gear strut — Checked.
5. Main gear pin — Installed.
6. Wheel well area — Checked.
7. Upper main gear door locks — LOCKED.
8. Center and underside of fuselage — Checked, doors secure.

WB-66D CONDENSED CHECK LIST (CONTINUED)

EMPENNAGE AND AFT FUSELAGE.

1. ATO attachments (right) — Checked.
2. Speed brake (right) — Checked.
3. Rudder boost disconnect — ENGAGED.
4. Drag chute (risers, door closed, indices aligned) — Checked.
5. Horizontal stabilizer and elevator (right) — Checked.
6. Gun turret — Checked, guns stowed.
7. Vertical stabilizer and rudder — Checked.
8. Horizontal stabilizer and elevator (left) — Checked.
9. Speed brake (left) — Checked.
10. ATO attachments (left) — Checked.

LEFT MAIN GEAR AND CENTER FUSELAGE.

1. Center and underside of fuselage — Checked.
2. Upper main gear door locks — LOCKED.
3. Wheel well area — Checked.
4. Main gear pin — Installed.
5. Main gear strut — Checked.
6. Brakes and hydraulic lines — Checked.
7. Main wheel and tire — Checked.
8. Chocks — In place.

LEFT WING.

1. Wing tank vent relief — Clear.
2. Flaps — Checked.
3. External stores and pylon — Checked.
4. Aileron and trim tab — Checked.
5. Wing tip and navigation lights — Checked.
6. Wing leading edge and slats — Checked.

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WB-66D CONDENSED CHECK LIST (CONTINUED)

LEFT ENGINE AND NACELLE.

1. Tail pipe and turbine — Checked.
2. Nacelle and pylon — Checked.
3. Nacelle door locks — Secure.
4. Drains and drain valve — Checked, door secure.
5. Engine inlet area — Checked.
6. Constant speed drive unit — Checked.
7. Engine screens, guide vanes, compressor — Checked.
8. Left fuselage and inboard wing panel — Checked.

INTERIOR INSPECTION (ALL FLIGHTS).

CRAWLWAY.

1. External a-c and d-c — Operating.
2. Crawlway compartment light switch — Set.
3. Interphone cord — Connected, stowed in bag.
4. Rudder-elevator boost manual check valve — CLOSED.
5. Main reservoir manual check valve — CLOSED.
6. Main hydraulic reservoir — Proper fluid level.
7. Spoiler accumulator pressure indicator — Within limits.
8. Aileron boost-spoiler reservoir — Proper fluid.
9. Rudder-elevator boost reservoir — Proper fluid level.
10. Aileron boost disconnect — ENGAGED.
11. Hydraulic cylinders and lines — Checked.
12. Control boost interconnect — Red flag out.
13. Utility-emergency interconnect — Red flag out.
14. Gear emergency valve — NEUTRAL, safetied.
15. Flap emergency valve — NEUTRAL, safetied.

WB-66D CONDENSED CHECK LIST (CONTINUED)

16. Over-ride controls — Checked.
17. Alternator circuit breakers — IN.
18. Main bus circuit breakers — IN.

FLIGHT COMPARTMENT.

1. Manual cockpit pressure control — PRESSURIZED.
2. Auxiliary circuit breakers — IN.
3. Primary bus circuit breakers — IN.
4. N-1 compass latitude correction pointer — OFF.
5. M-3 initiator pins — Installed.
6. T-8 and M-4 (M-12) initiator pins —Removed.

BEFORE STARTING ENGINES.

1. Battery switch — ON.
2. Flight instrument switch — ON.
3. Parachute, shoulder harness, and safety belt — Adjusted.
4. Radios — ON.
5. Seat — Adjusted and locked.
6. Rudder pedals — Adjusted.
7. Parking brake — Set.
8. Interphone, oxygen, alarm bell (and emergency warning lights if installed) — Crew reports.
9. Radio circuit breakers — IN.
10. Emergency keyer — OFF.
11. Boost release handles — Down and safetied.
12. Recorder — As required.
13. Battery bus circuit breakers — IN.
14. Pitot heat — Checked.

WB-66D CONDENSED CHECK LIST (CONTINUED)

15. De-icing panel switches — OFF.
16. Air conditioning panel — DEPRESSURIZED, AUTO, set.
17. Rain removal switch — CLOSED.
18. Navigation lights — Set.
19. Magnetic compass light — Set.
20. Taxi light — OFF.
21. Emergency bus circuit breakers — IN.
22. Steering selector — DISENGAGED.
23. Fire control handles — IN, lights checked.
24. Fire test circuit — Checked.
25. Instrument panel — Lights and indicators checked.
26. Anti-skid switch — ON, light checked.
27. Gear lever — DOWN, anti-retraction latch in place.
28. Gear indicators — GEAR DOWN.
29. Gear warning horn and light — Tested.
30. Fuel quantity — Checked.
31. Hydraulic selector — Switch DOWN.
32. ATO arming switch — OFF.
33. Flight controls — UNLOCKED, boost engagement and movement checked.
34. Landing light — OFF.
35. Master engine switches — OFF.
36. Drag chute lever — Safetied forward.
37. Throttles — OFF and LOCKED.
38. Rudder trim — Checked, set at zero.
39. Aileron trim — Checked, set at zero.
40. Wing flap handle — UP.
41. Emergency airbrake handle — IN, safetied.

WB-66D CONDENSED CHECK LIST (CONTINUED)

42. Autopilot turn control — DETENT.
43. Autopilot panel — All switches DOWN.
44. Interior lights — OFF.
45. Fuel panel — Check.
    a. Air refueling switch — OFF.
    b. External fuel transfer switch — OFF.
    c. Fuselage fuel trim switch — AUTO.
    d. Wing fuel transfer switch — OFF.
    e. Fuel boost pump switches — OFF.
    f. Fuel selector switch — FLIGHT NORMAL.
46. Horizontal stabilizer circuit breaker switches — ON.
47. Engine screens switch — AUTO.
48. Electrical panel —
    a. Generator switches — ON, lights ON.
    b. Bus tie switch — AUTO, light tested.
    c. Alternator switches — ON, lights ON.
49. IFF — STANDBY.
50. Radios — Checked, set as required.
51. Altimeter — Set.

INTERIOR INSPECTION (NIGHT FLIGHTS).

In addition to the preceding checks, perform the following for night operations:

1. Interior lighting — As required.
2. Air refueling probe light — Checked.
3. Navigation lights — ON.
4. Warning lights dimming switch — Checked.

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WB-66D CONDENSED CHECK LIST (CONTINUED)

5. Magnetic compass light — ON.
6. Taxi light — Checked.
7. Landing light — Checked.

STARTING ENGINES.

1. External air — Maximum pressure.
2. Clear to start — CLEAR, fire guard posted.
3. Master engine switches — ON.
4. Fuel boost pump switches — ON.
5. Engine ignition switches — NORMAL.
6. Engine start switch — Position to desired engine.
7. Throttle — IDLE, at 11% RPM.
8. Engine instruments (oil pressure, rpm, EGT, fuel flow) — Checked.
9. Hydraulic pressures — Checked.
10. Ground power and air — Disconnected.
11. Alternator light — OFF.
12. Generator light — OFF.
13. Bus tie light — ON.
14. Autopilot power switch — ON.
15. Auto trim switch — ON.
16. Speed brakes — CLOSED.
17. Elevator trim — Checked full travel, set for take-off.
18. Flaps — Checked 60%, amber light ON.

Start other engine, using the procedure outlined in *steps 2, 6, 7, 8,* preceding.

19. Alternator lights — OFF.
20. Generator lights — OFF.
21. Bus tie light — OFF.

WB-66D CONDENSED CHECK LIST (CONTINUED)

22. A-c load transfer relays — Checked.
23. Fuel system — Checked.
24. Fuel selector — FLIGHT NORMAL.

BEFORE TAXIING.

1. Cockpit pressure switch — NORMAL.
2. Ground cooling — Disconnected.
3. Hydraulic systems and flight controls — Checked.
4. Pressure indicators — Checked.
5. Functional check of the autopilot — Completed.
6. Autopilot engage switch — DISENGAGED.
7. Yaw damper — OFF.
8. Turret indicator — Reads NO.
9. Steering selector — TAXI.
10. Nose wheel well hydraulic pressure indicators — Within limits.
11. Gear pins — Removed and stowed.
12. Fuel pump lights — OFF.
13. Chocks — Removed.
14. External interphone cord — Stowed.
15. Aircraft entrance door — CLOSED and LOCKED.
16. Canopy — CLOSED and LOCKED all stations.

TAXIING.

1. Brakes — Checked.
2. Nose wheel steering — Checked.
3. Flight instruments — Checked.

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WB-66D CONDENSED CHECK LIST (CONTINUED)

BEFORE TAKE-OFF (PRIOR TO TAKING RUNWAY).

1. Parking brake — Set.
2. Canopy hatches — CLOSED and LOCKED.
3. Canopy safety cables — REMOVED.
4. Emergency canopy removal pin — REMOVED.
5. Seat ejection pins — As required.
6. Flaps — 60% DOWN, amber light ON.
7. Trim — Aileron and rudder — 0 Degrees; Horizontal stabilizer — Set for take-off.
8. Anti-skid switch — ON, light checked.
9. Fuel selector switch — FLIGHT NORMAL.
10. Fuel trim switch — AUTO.
11. Wing fuel transfer switch — OFF.
12. Flight compartment door — CLOSED and LOCKED.
13. Shoulder harness — UNLOCKED.
14. Crew — Ready for take-off.
15. Windshield anti-icing switches — NORMAL.
16. Anti-icing and de-icing switches — As required.
17. Rain removal switch — As required.
18. Performance data — In place.

LINE UP.

1. Parking brake — Set.
2. Steering selector — TAKE-OFF and LANDING.
3. Speed brakes — CLOSED.
4. Engine screens — RETRACT.
5. Throttles — Take-off power.
6. Engine instruments — Checked.
7. Hydraulic pressures — Checked.

WB-66D CONDENSED CHECK LIST (CONTINUED)

AFTER TAKE-OFF — CLIMB.

1. Gear and flaps — UP.
2. Hydraulic selector switch — UP.

DESCENT.

1. Altimeter — Set.
2. Fuel quantity — Checked.
3. Windshield anti-icing switches — Checked.
4. Defog switch — As required.
5. Anti-icing and de-icing switches — As required.
6. Air refueling switch — OFF.
7. External pressure switch — OFF.

BEFORE LANDING.

1. Landing data — Computed.
2. Engine screens — RETRACT.
3. Fuel selector — FLIGHT NORMAL.
4. Hydraulic selector switch — DOWN.
5. Autopilot — DISENGAGED.
6. Yaw damper — OFF.
7. Anti-skid switch — ON, amber light OFF.
8. Steering selector — TAKE-OFF AND LANDING.
9. Crew — Ready for landing.
10. Gear — DOWN and LOCKED.
11. Flaps — 100% DOWN, amber light ON.
12. Hydraulic pressures — Checked.
13. Guns — Stowed.

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WB-66D CONDENSED CHECK LIST (CONTINUED)

AFTER LANDING.

PRIOR TO CLEARING RUNWAY.

1. Engine screens switch — AUTO.
2. Steering selector — TAXI.

CLEAR OF RUNWAY.

1. Parking brake — Set.
2. Seat ejection pins — Installed.
3. Emergency canopy removal pin — Installed.
4. Canopy hatch cables — Installed.
5. Speed brakes — CLOSED.
6. Flaps — UP.
7. Trim — NEUTRAL.
8. Drag Chute — JETTISON.
9. De-icing panel — Switches OFF.
10. Fuel trim switch — AFT.
11. Cockpit pressure control — DUMP.
12. Flight compartment entrance door — OPEN.
13. Weather compartment — Check list completed.

ENGINE SHUTDOWN.

1. Parking brake — Set.
2. Steering selector — DISENGAGED.
3. Recorder — OFF.
4. Navigation lights — OFF.
5. Cockpit pressure switch — DEPRESSURIZED.
6. Taxi light — OFF.

WB-66D CONDENSED CHECK LIST (CONTINUED)

7. Anti-skid switch — OFF.
8. Landing light switch — OFF.
9. Autopilot panel — All switches DOWN.
10. Radios — OFF.
11. IFF — OFF.
12. Throttles — OFF and LOCKED.

BEFORE LEAVING AIRCRAFT.

1. Boost pump switches — OFF.
2. Instrument power switch — OFF.
3. Battery switch — OFF.
4. Master engine switches — OFF.
5. Fire control handles — OUT.
6. Controls — LOCKED.
7. Parking brake — OFF.
8. Interior lights — OFF.
9. Battery — DISCONNECTED.
10. Gear pins — Installed.
11. Oxygen filler valve — VENT.
12. DD Form 781 — Completed.

AIR REFUELING CONDENSED CHECK LIST

RENDEZVOUS AND PREDESCENT.

1. Radios — As required.
2. Altimeter — Set.
3. Descent range — Computed.

PRE-CONTACT.

1. Fuel quantity indicator selector switch — UP.
2. Air refueling circuit breakers — IN.
3. Air refueling probe light — As required.
4. Air refueling switch — IFR.
5. External fuel tank pressure switch — OFF.
6. Wing fuel transfer switch — OFF.
7. Fuel selector switch — TAKE-OFF & CROSSFEED. (FLIGHT NORMAL if forward tanks is empty).
8. Wing flaps — 20 to 30% DOWN.
9. Unnecessary electrical equipment — OFF.
10. Fuselage fuel trim switch — BOTH TANKS.
11. Checklist — Complete.

POST REFUELING.

1. Wing flaps — UP.
2. Air refueling probe light — OFF.
3. Air refueling switch — OFF.
4. External fuel tank pressure switch — As required.
5. Fuselage fuel trim switch — AUTO.
6. Wing fuel transfer switch — As required.

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AIR REFUELING CONDENSED CHECK LIST (Continued)

7. Fuel selector switch — FLIGHT NORMAL.
8. Fuel quantity indicator switch — UP.
9. Altimeter — Reset.
10. Checklist — Complete.

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emergency procedures

Section III

1509B

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ENGINE FAILURE.

Engine flame-out, compressor stall, or malfunctions of various types could occur as a result of improper techniques or as a result of a malfunction of engine components. When conditions permit, an inflight engine (air) start can be accomplished. A failure of the engine fuel control system is usually indicated by the engine instruments. Inflight engine starts should not be attempted when the cause of engine failure can be determined as a mechanical failure within the engine proper.

See the paragraphs on Engine Failure During Flight and Engine Restart Inflight, this Section, and Compressor Stall, Flame-Out, and Engine Fuel Control, Section VII.

ENGINE FAILURE DURING TAKE-OFF.

In the event an engine failure occurs, sufficient control is available to maintain directional control of the aircraft. Refer to the Minimum Control Speed Chart, Appendix 1. The most critical condition would be engine failure after lift-off speed is reached on take-off. Under this condition, ability to maintain flight may be marginal. Prior to each take-off, the pilot must determine the zero rate of climb speed for the take-off gross weight and configuration. The possibility of an engine failure during the take-off run influences the take-off procedure and should in all cases be considered. The flight characteristics of the aircraft with one engine inoperative are calculated to be satisfactory. See Appendix I for Maximum Refusal Speeds.

ENGINE FAILURE DURING TAKE-OFF BEFORE LEAVING GROUND.

If a complete engine failure occurs before leaving the ground, or if take-off is aborted for any other reason, perform the following:

1. Both throttles — IDLE immediately.
2. Drag chute — DEPLOYED.
3. Brakes — Maximum depression, as required.
4. Inoperative engine throttle — OFF.

CAUTION

Do not jettison external tanks. (Jettisoning external tanks would create a fire hazard.)

CAUTION

Do not operate the speed brakes during ground operations with the engines at IDLE. This may cause momentary loss of nose wheel steering and braking due to the lack of sufficient hydraulic fluid pressure.

If unable to stop on prepared surface and terrain and conditions permit, perform the following:

5. Other throttle — OFF.
6. Flight compartment hatches — Jettison by means of the emergency canopy removal handle below the instrument panel.
7. Landing gear lever — GEAR UP. (Manually depress antiretraction latch depending on conditions.)
8. Fire control handles — Pull out.
9. Weather compartment ditching hatch — Remove after aircraft comes to rest.

CAUTION

If possible, replace seat ejection controls ground safety pins after aircraft comes to rest, to prevent inadvertent operation of the seat ejection controls.

ENGINE FAILURE DURING TAKE-OFF AFTER LEAVING GROUND.

If an engine fails immediately after take-off, climb performance is marginal until the gear is raised. IF SAFE SINGLE-ENGINE SPEED is reached, sufficient control is available to maintain directional control of the aircraft after an engine failure. Maintain airspeed and directional control and perform the following:

1. Landing gear lever — Retract immediately.
2. Wing flaps — UP, at or above the speed of 50 foot height. (See Take-Off Speed Chart, Appendix I.)
3. External stores — JETTISON.

Perform *steps 4 through 9* on the affected engine.

4. Throttle — OFF.
5. Master engine switch — OFF.
6. Fire control handle — Pull out.
7. Boost pump switch — OFF.
8. Alternator switch — OFF.
9. Generator switch — OFF.
10. Alert crew.

CAUTION

Stay above minimum velocity for single engine zero rate of climb and accelerate to desired airspeed; (See Zero Rate of Climb Chart, Appendix I).

ENGINE FAILURE DURING FLIGHT.

Refer to Appendix I for cruise control with one engine operating.

If an engine is to be shut down because of malfunction and it is not imperative to shut down immediately, investigate the cause of malfunction. If the cause of malfunction cannot be determined or it is determined it is not safe to continue operation of the affected engine, perform the following steps:

1. Throttle — TAKE-OFF (thrust), on operating engine.

Note

For the J71-A-13 engine there are no restrictions on throttle movement.

2. Reduce drag — As required, (speed brakes, landing gear).

Perform *steps 3 through 8* on the affected engine.

3. Throttle — OFF.
4. Master engine switch — OFF.
5. Fire control handle — Pull out.
6. Fuel boost pump switches — As required.
7. Alternator switch — OFF.
8. Generator switch — OFF.
9. Fuel selector switch — As required.
10. Alert crew.

ENGINE RESTART INFLIGHT.

WINDMILLING ENGINE START.

CAUTION

The windmilling inflight engine start procedure should be utilized for all inflight engine starts, when possible, particularly above 35 per cent engine rpm. Damage to the starter may occur when attempting bleed air starts above 35 per cent engine rpm.

In the event of a flame out *(see Section VII)*, proceed as follows:

1. Throttle — OFF.
2. Master engine switch — ON.
3. Fire control handle — Push in.
4. Fuel boost pump switches — ON.
5. Fuel selector switches — As required.

Note

Before attempting an air start, attain an airspeed for the altitude being flown as shown on Table I.

TABLE 1

AIR STARTING LIMITS

Altitude Feet	*Indicated Air Speed Knots*
10,000	225-535
20,000	225-460
30,000	225-380
40,000	250

Note

Air starts have been accomplished as high as 35,000 feet; however, an altitude of 20,000 or below is recommended for air starts.

6. Rpm — 13% to 23%.
7. Ignition switch — AIR START.

Note

The ignition cycle and drip valve operate in the same manner as for NORMAL start. If the starter has disengaged allow the engine to decelerate to 15% before re-engaging the starter.

8. Throttle — IDLE.
9. Engine instruments (oil pressure, rpm, EGT and fuel flow) — Within limits.

WARNING

If the engine does not start within 30 seconds, retard the throttle to the OFF position and place the ignition switch in the MOTOR position. Place the aircraft in a nose-high attitude in order to drain excess fuel, and repeat starting attempt.

10. Ignition switch — NORMAL.

BLEED AIR ENGINE START.

1. Throttle: Advance and watch for engine speed and exhaust for temperature increase. If no increase is noted, immediately retard the throttle to the OFF position and place the master engine switch in the OFF position for a minimum of 3 seconds.
2. Master engine switch — ON.
3. Fire control handle — Push in.
4. Fuel boost pump switches — ON.
5. Fuel selector switch — As required.
6. Engine ignition switch — NORMAL.
7. Engine start switch — RIGHT or LEFT engine as required.
8. Throttle — When the engine speed reaches 11 per cent advance the throttle to IDLE.
9. Engine instruments (oil pressure, rpm, EGT and fuel flow) — Within limits.

MAXIMUM GLIDE

The maximum gliding ratio (gear and flaps up), engines windmilling, is approximately 14 to 1 at low altitudes. For speeds and weight to maintain maximum gliding ratio, see the Maximum Glide chart, figure 3-3.

VELOCITY FOR SINGLE ENGINE MAXIMUM RATE OF CLIMB

MILITARY THRUST
SEA LEVEL

MODEL WB-66D

ENGINES: (2) J-71-A-13

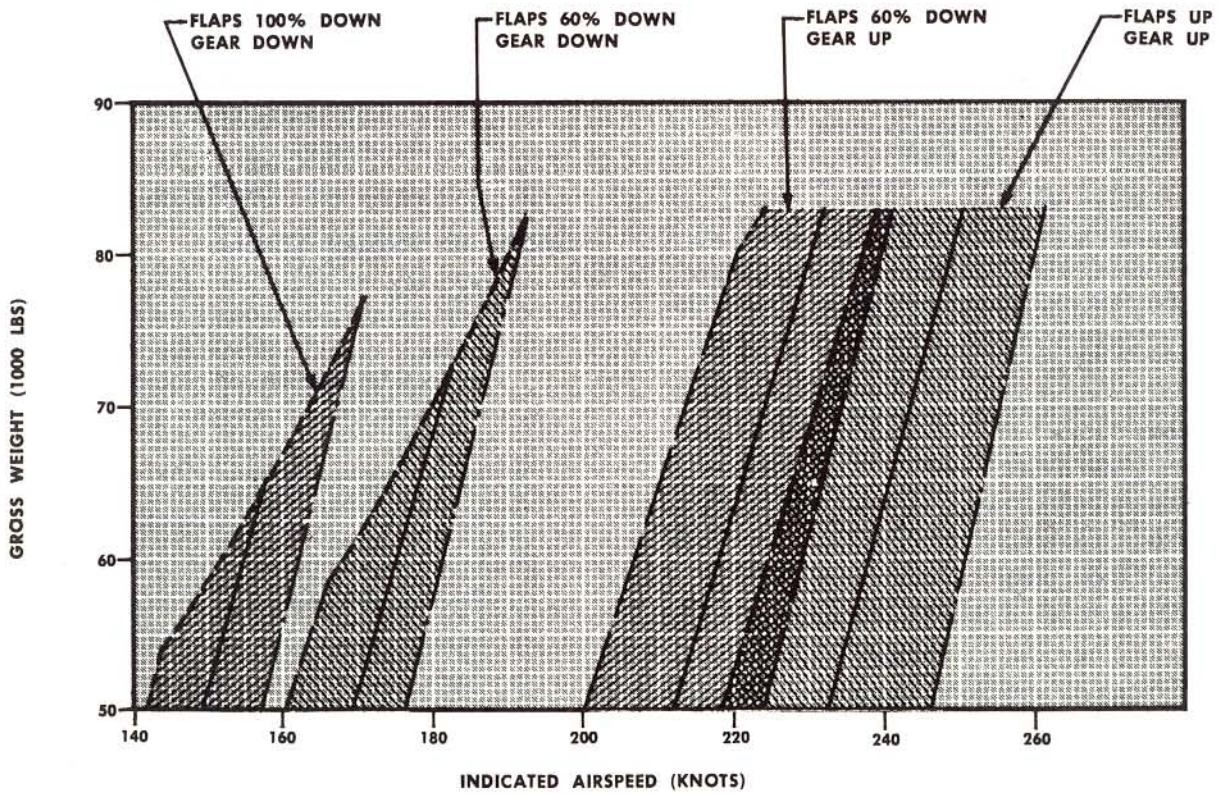
——— STANDARD ATMOSPHERE (59° F)

— — — 120° F

— — — 0° F

— — — — — — ZERO RATE OF CLIMB

Note:
Reduce speed 2 knots for each 1000 feet increase in altitude.



DATA BASIS: FLIGHT TEST

DATA AS OF: 1-1-58

2373B

Figure 3-1

VELOCITY FOR SINGLE-ENGINE MAXIMUM RATE OF CLIMB.

A velocity for Single-Engine Maximum Rate of Climb Chart *(figure 3-1)* has been provided to give the speed for best climb performance with one engine inoperative.

SINGLE ENGINE GO AROUND.

- Throttle on good engine — TAKE-OFF (thrust).
- Speed brakes — CLOSED.
- Landing gear lever — GEAR UP.
- Flaps — UP (at speed at 50 foot height). (See Take-Off Speed Chart Appendix I, also see Single Engine Landing Pattern *figure 3-2.)*

CAUTION

Go-around decisions, especially those regarding single engine go-arounds should be made as early as possible, since jet acceleration time is considerable longer at low altitudes. (Refer to Minimum Velocity for Single-Engine Zero Rate of Climb Charts, Appendix I).

WARNING

If necessary use altitude to gain required minimum velocity for zero rate of climb. Caution should be exercised in avoiding a nose attitude during go-around procedures as the aircraft can quickly end up on the *back side* of the power curve.

WARNING

If, in making a single engine go-around the test switch on the landing gear warning horn has been positioned to the HORN OFF position, advancing the throttle on the good engine will not re-arm the circuit. Both throttles must be advanced to re-arm the circuit.

LANDING WITH ONE ENGINE INOPERATIVE.

Make an approach slightly higher than during normal landing approach. Maintain safe single-engine speed for the weight being flown (See Zero Rate Of Climb chart Appendix I).

CAUTION

An inflight engine start should not be attempted unless it has been determined it is reasonably safe to do so.

1510B

WARNING

If landing at gross weights in excess of the design landing weight is necessary, precautions should be taken to reduce the rate of sink at touchdown as much as possible, remembering that with high gross weight and higher touchdown speed, the landing roll will be considerably increased.

Landing gear and wing flaps DOWN, when landing is assured; speed brakes as required.

CAUTION

Operation of the speed brakes during ground operations, with the engines at IDLE, may cause momentary loss of nose wheel steering and braking, due to lack of sufficient hydraulic fluid pressure.

LANDING WITH BOTH ENGINES INOPERATIVE.

Landing with both engines inoperative is not recommended.

PRACTICE MANEUVERS WITH ONE ENGINE INOPERATIVE.

For practice maneuvers with one engine inoperative, a gross weight within the normal landing weight

(Continued on Page 3-8)

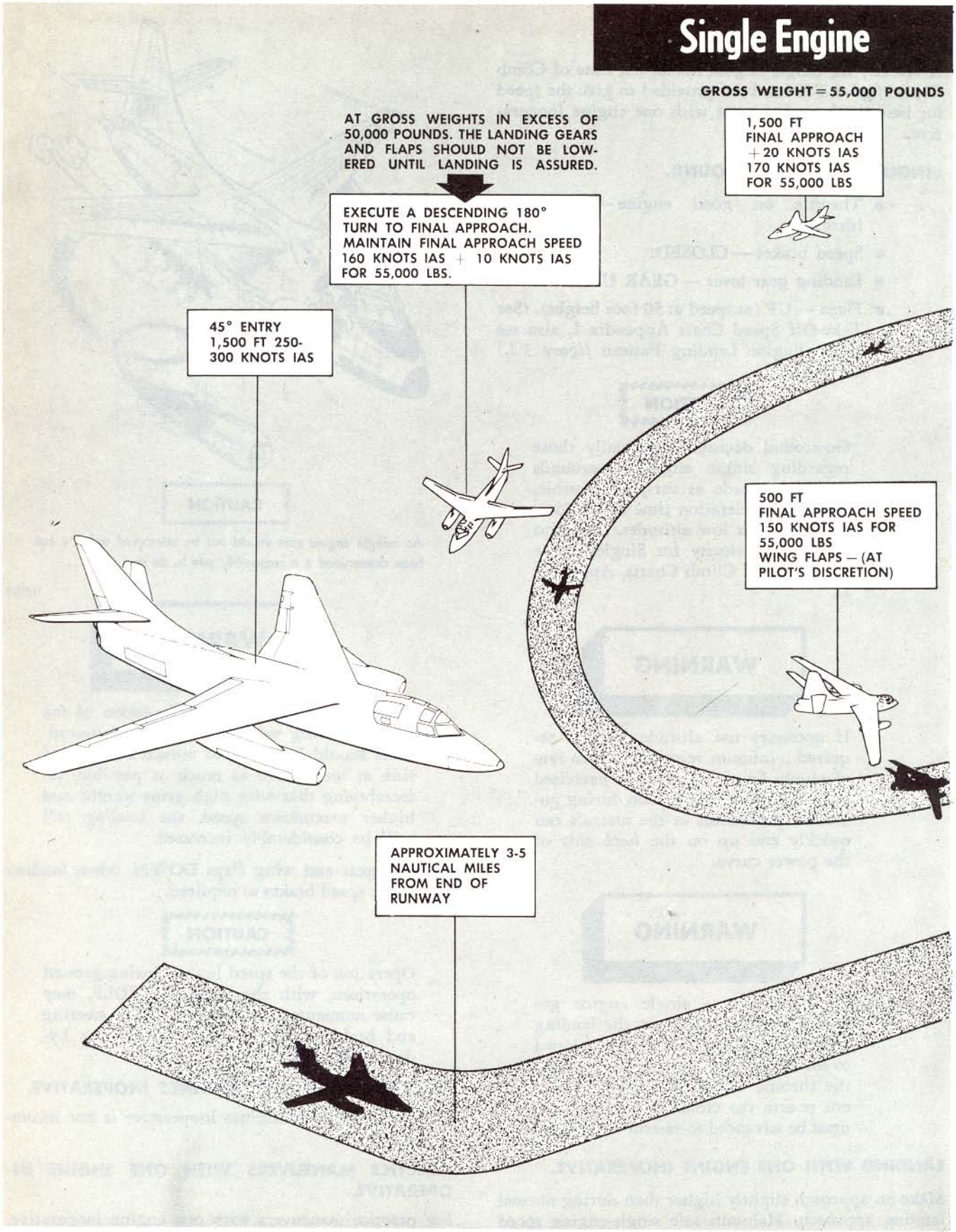


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Figure 3-2 (Sheet 1 of 2)

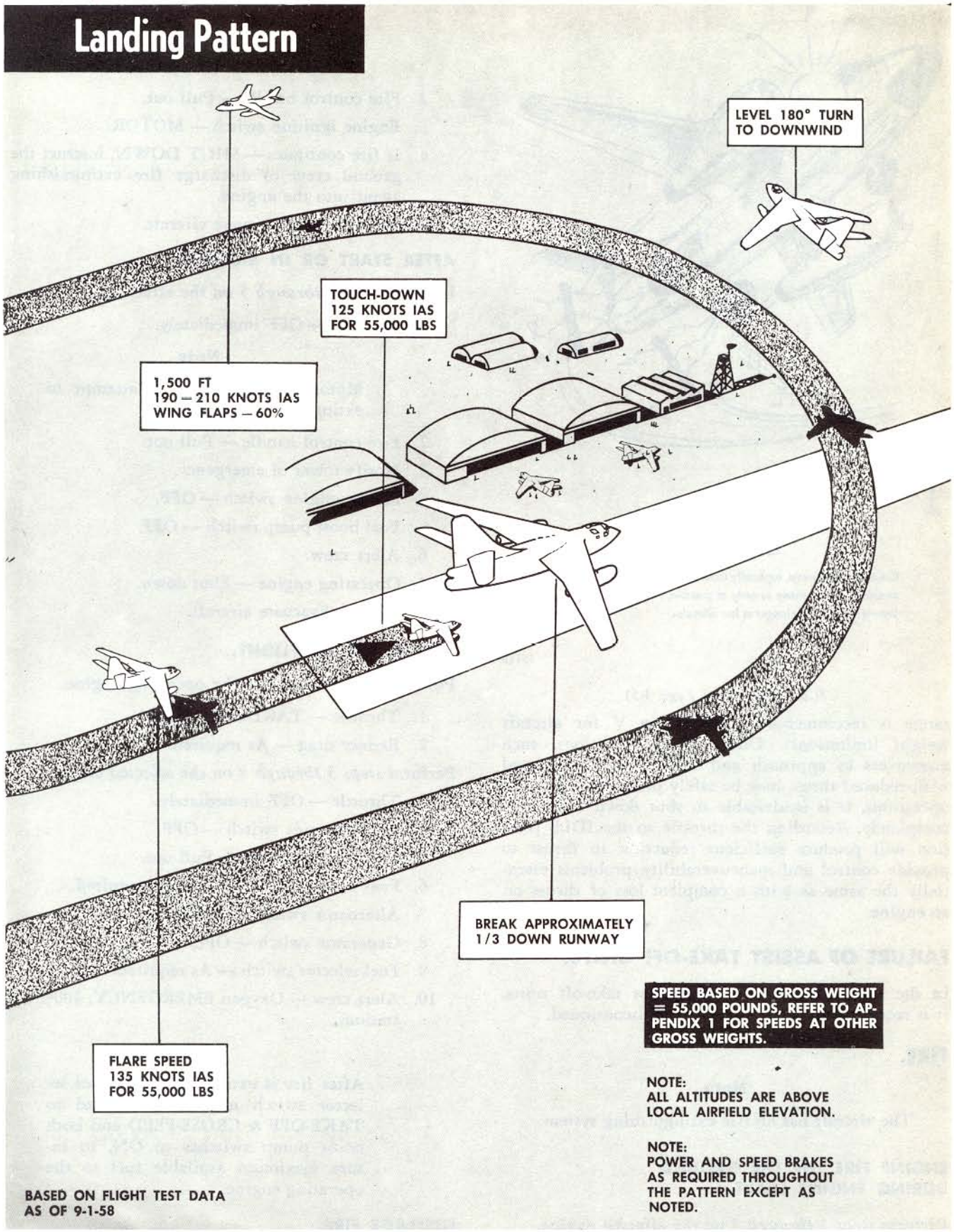

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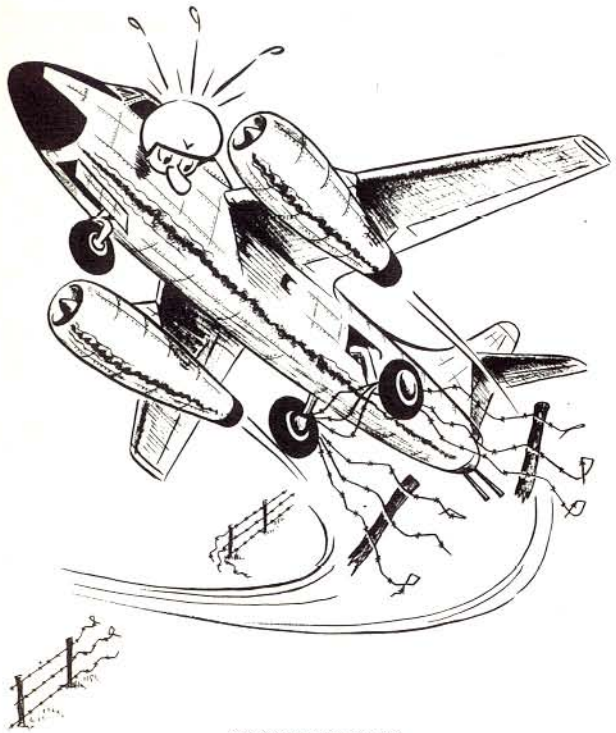
Figure 3-2 (Sheet 2 of 2)



CAUTION

Go-around decisions, especially those regarding single-engine go-arounds, shall be made as early as possible, since jet acceleration time is considerably longer at low altitudes.

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(Continued from Page 3-5)

range is recommended (see Section V for aircraft weight limitations). Under these conditions, such maneuvers as approach and landing and go-around with reduced thrust may be safely practiced. For these operations, it is inadvisable to shut down an engine completely. Retarding the throttle to the IDLE position will produce sufficient reduction in thrust to provide control and maneuverability problems essentially the same as with a complete loss of thrust on an engine.

FAILURE OF ASSIST TAKE-OFF UNITS.

In the event of failure of the assist take-off units, it is recommended that take-off be discontinued.

FIRE.

Note

The aircraft has no fire extinguishing system.

ENGINE FIRE ON THE GROUND DURING ENGINE START.

Perform *steps 1 through 3* on the affected engine.

1. Throttle — OFF, immediately.

Note

Motor the engine in an attempt to extinguish the fire.

2. Fire control handle — Pull out.
3. Engine ignition switch — MOTOR.
4. If fire continues — SHUT DOWN, instruct the ground crew to discharge fire extinguishing agent into the engine.
5. Alert crew — Evacuate aircraft.

AFTER START OR IN MOTION.

Perform *steps 1 through 5* on the affected engine.

1. Throttle — OFF immediately.

Note

Motor the engine in an attempt to extinguish the fire.

2. Fire control handle — Pull out.
3. Notify tower of emergency.
4. Master engine switch — OFF.
5. Fuel boost pump switch — OFF.
6. Alert crew.
7. Operating engine — Shut down.
8. Crew — Evacuate aircraft.

ENGINE FIRE IN FLIGHT.

Perform the following on the operating engine.

1. Throttle — TAKE-OFF (thrust).
2. Reduce drag — As required.

Perform *steps 3 through 8* on the affected engine.

3. Throttle — OFF immediately.
4. Master engine switch — OFF.
5. Fire control handle — Pull out.
6. Fuel boost pump switch — As required.
7. Alternator switch — OFF.
8. Generator switch — OFF.
9. Fuel selector switch — As required.
10. Alert crew — Oxygen EMERGENCY, 100% all stations.

Note

After fire is extinguished, the fuel selector switch may be positioned to TAKE-OFF & CROSS-FEED and both boost pump switches to ON, to insure maximum available fuel to the operating engine.

FUSELAGE FIRE.

In the event of fuselage fire, proceed as follows:

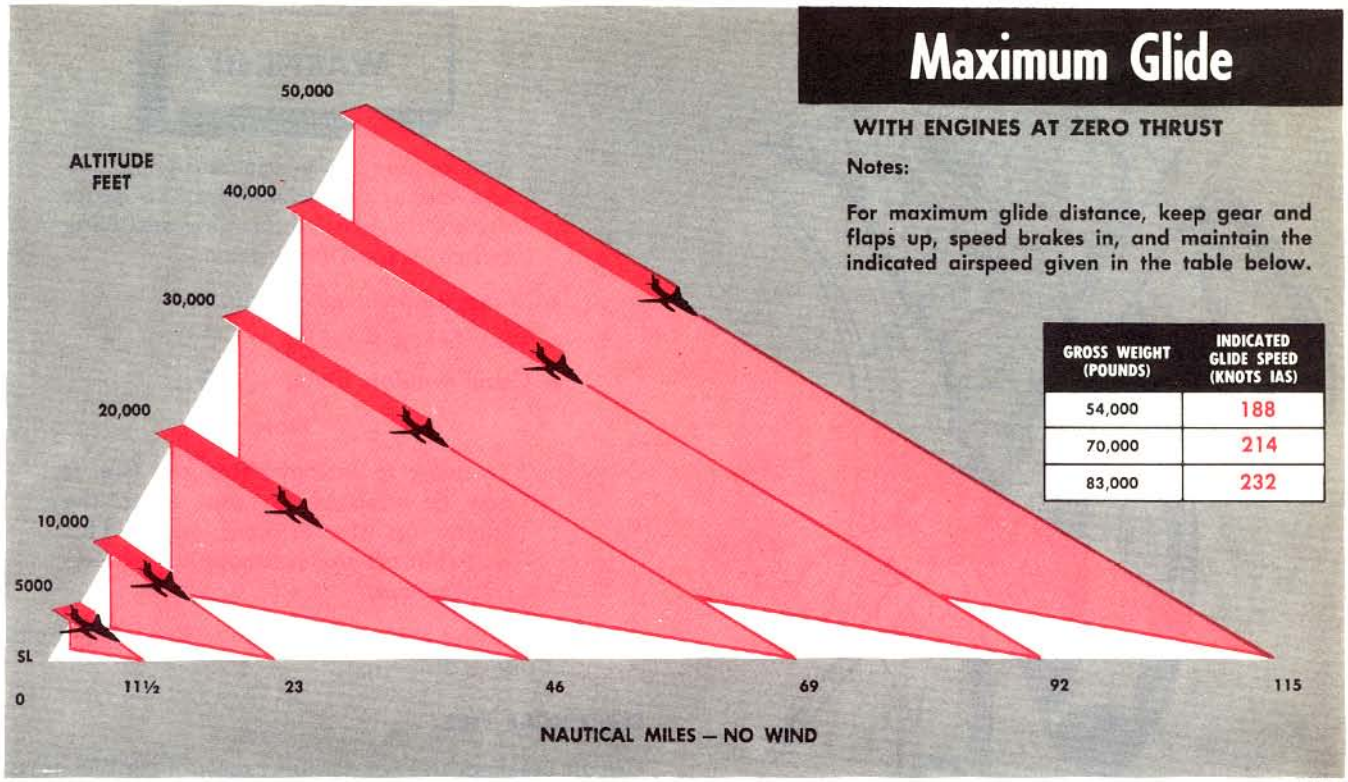

Figure 3-3

1. Alert crew — Oxygen EMERGENCY, 100% all stations.
2. Determine the source and isolate.
3. Cockpit pressure switch — DEPRESSURIZE.
4. Cockpit pressure control — DUMP (if the cockpit fails to depressurize electrically).
5. Crew member operate hand fire extinguisher.

WARNING

Repeated or prolonged exposure to high concentrations of Bromochloromethane (CB) or decomposition products should be avoided. CB is a narcotic agent of moderate intensity but of prolonged duration. It is considered to be less toxic than carbon tetrachloride, methyl bromide, or the usual products of combustion. In other words, it is safer to use than previous fire extinguishing agents. However, normal precautions should be taken including the use of oxygen when available.

6. De-icing panel switches:
   - Windshield de-ice LH, RH — OFF.
   - Engine de-ice — OFF.

Note

The AUTOMATIC feature of the engine ANTI-ICING system in operative.

WARNING

The engine automatic anti-icing system has been disconnected. To de-ice the engine place the engine anti-icing switch in the ON position.

   - Wing, empennage — OFF.
   - Pitot heater — OFF.
   - Cabin window defog — OFF.
7. Weather compartment master air conditioning switch — RAM.

WARNING

Do not increase ventilation until fire is extinguished. Continue use of 100% oxygen as a protection against fumes.

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Note

Weather observer No. 2 — Weather compartment pressure control-DEPRESSURIZED (if compartment fails to depressurize electrically).

WING FIRE.

If a fire occurs in the wing during flight, proceed as follows:

1. Alert crew — Oxygen EMERGENCY, 100% all stations.
2. Turn off all electrical equipment in the affected wing.
3. De-icing panel switches:
   - Windshield de-ice LH, RH — OFF.
   - Engine de-ice — OFF.

Note

The AUTOMATIC feature of the engine ANTI-ICING system is inoperative.

WARNING

The engine automatic anti-icing system has been disconnected. To de-ice the engine place the engine anti-icing switch in the ON position.

- Wing, empennage — OFF.
- Pitot heater — OFF.
- Cabin window defog — OFF.

Note

To assist in extinguishing the fire, it may be advisable to shut down the engine on the affected wing. This will shut off the fuel supply and electrical power.

4. Determine extent of damage — Continue flight at pilot's discretion.

ELECTRICAL FIRE.

Circuit breakers and fuses protect most of the electrical circuits to minimize the probability of electrical fires; however, if an electrical fire occurs in flight, perform the following:

1. Alert crew — Oxygen EMERGENCY, 100% all stations.
2. Determine and isolate source — TURN OFF affected equipment.

If fire persists perform the following:

3. Cockpit pressure switch — DEPRESSURIZE.
4. Battery switch — EMERGENCY.
5. Flight instrument power switch — EMERGENCY.
6. Alternator switch — OFF.

WARNING

Shutting off the a-c power will render the boost pumps inoperative, which will affect engine operation above approximately 18,000 feet.

7. Generator switch — OFF.

Note

Place the battery switch and flight instrument power switch in EMER to provide power to the flight instrument if required.

8. Crew member operate hand fire extinguisher.

9. Weather compartment master air conditioning switch — RAM.

Note

Weather observer No. 2 — Weather compartment DEPRESSURIZED, (if compartment fails to depressurize electrically).

10. Determine extent of damage — Continue flight at pilot's discretion.

SMOKE AND FUMES ELIMINATION.

In the event of heavy smoke or toxic fume concentration in the flight compartment or weather compartment, perform the following:

1. Alert crew — Oxygen EMERGENCY, 100% all stations.
2. Cockpit pressure control — DUMP.
3. Cockpit pressure switch — DEPRESSURIZE.

Note

If smoke and fumes are not emanating from the cockpit outlets, it is advantageous to leave the cockpit pressure switch in either the COMBAT or NORMAL position (as desired) so that the refrigeration unit will remain in operation. This will provide a greater airflow, which will assist in dissipation of smoke and fumes.

4. Flight compartment entrance door — OPEN (if required).
5. Weather compartment master air conditioning switch — RAM.

Note

If smoke and fumes are not emanating from the weather compartment outlets, it is advantageous to leave the weather compartment master air conditioning switch in NORMAL position so that the refrigeration unit will remain in operation. This will provide a greater airflow, which will assist in dissipation of smoke and fumes.

6. Weather observer No. 2 — Weather compartment pressure control DEPRESSURIZED, (if compartment fails to depressurize electrically).
7. Descend to lower altitude if necessary.

BAIL-OUT.

Immediate action required.

1. Pull up left pre-ejection lever to LOCK shoulder harness.
2. Pull up right pre-ejection lever to jettison hatch.
3. Squeeze trigger in right pre-ejection lever to eject seat.

If time and condition permit.

1. Descend to 20,000 feet altitude or less and reduce airspeed to 450 knots IAS or less.
2. Depressurize flight compartment.
3. Personal equipment — Check.
4. At altitude, actuate bail out bottle.
5. Navigator and pilot manually move their seats AFT into ejection position and gunner stow control indicator.
6. Pilot-jettison all 3 hatches simultaneously by pulling the emergency canopy removal handle.
7. Perform ejection seat operation.

Note

Position IFF and emergency keyer to EMERGENCY. (Radio security permitting), also transmit continuously the estimated time and position of intended bail-out on all command and emergency frequencies (radio).

Recent study and analysis of escape techniques from aircraft by means of ejection seat have revealed that: (a) Ejection accomplished at airspeeds ranging from stall speed to 450 knots IAS results in relatively minor forces being exerted on the body thus reducing the injury hazard. (b) The crew member will undergo appreciable forces on the body when ejection is performed at airspeeds of 450 to 600 knots IAS, and escape is more hazardous than at lower airspeeds. (c) Above 600 knots IAS, ejection is extremely hazardous because of the forces on the body. (d) Ejection at low altitudes is facilitated by pulling the nose of the aircraft up above the horizon *(zoom up* maneuver*)*. The trajectory of the ejection seat is not perpendicular to the flight path of the aircraft, but rather, is a resultant of the aircraft velocity and upward velocity of the ejection seat. Since the ejection seat velocity is very small compared to the aircraft velocity, the ejection seat tends to follow a nearly horizontal path. A *Zoom Up* maneuver will result in an ejection seat trajectory more nearly vertical in relation to the aircraft flight path, thus effecting an increase in altitude. This gain in altitude will increase the time available for separation from the seat and deployment of the parachute. Flight tests accomplished thus far have indicated the following approximate differences between ejection altitude and the altitude at which full deployment of the parachute occurs. This data is based on use of an automatic safety belt and automatic parachute.

Flight Conditions	*Full Deployment Above or Below Ejection Altitude*
Level Flight 200 Knots IAS	100 to 150 Feet Below
6 Degrees Nose-Up 200 Knots IAS	20 to 70 Feet Below
12 Degrees Nose-Up 300 Knots IAS	10 Feet Below to 60 Feet Above

With nose-up attitude ejections, higher aircraft airspeeds will result in slight improvements in altitude of full parachute deployment relative to ejection altitude.

WARNING

For manual safety belt or manual parachute, full deployment will occur at a lower relative altitude.

Whenever circumstances permit, depressurize the flight and weather compartments and slow the aircraft down as much as possible prior to ejection. When ejecting at low altitudes (below 2000 feet) pull the nose of the aircraft above the horizon if at all possible.

MINIMUM SAFE UPWARD EJECTION ALTITUDES.

Manual safety belt and manual parachute	2000 FEET
Automatic safety belt and manual parachute	1000 FEET
Automatic safety belt and automatic parachute	500 FEET

MINIMUM SAFE DOWNWARD EJECTION ALTITUDES.

Manual safety belt and manual parachute	2300 FEET
Automatic safety belt and manual parachute	1300 FEET
Automatic safety belt and automatic parachute	800 FEET

WARNING

When ejection is necessary and a manual opening safety belt (nonautomatic type) is being used, the following procedure should be observed. When ejecting upward below 2000 feet, manually open the safety belt prior to ejection to allow pulling of the D-ring and rapid opening of the parachute after ejection. In a dive, particularly at high speeds, the safety belt should be manually opened at higher altitudes, even as high as 5000 feet under the most adverse conditions to facilitate rapid opening of the parachute. When ejecting at altitudes above 5000 feet, do not open the manual safety belt until after ejection.

WARNING

When ejection is necessary and an automatic opening safety belt is being used, do not manually open the automatic-opening safety belt prior to ejection at any altitude. Manually opening the automatic safety belt will eliminate the automatic opening feature of the automatic opening parachute, unless the crew member arms his parachute by pulling the arming knobs.

When the decision is made to abandon the aircraft, the pilot will give instructions to crew members over the interphone, in addition to the emergency alarm bell (and warning light, if installed) signals for the weather observers (time and conditions permitting). The following procedure should be executed at the time the pilot gives the order to abandon the aircraft:

- Position the IFF to EMERGENCY. (Radio security permitting.)
- Continuously transmit the estimated time and position of intended bail-out on all command and emergency frequencies (radio security permitting).

WARNING

Time and conditions permitting, the crew compartments should be depressurized prior to jettisoning the hatches and the speed of the aircraft should be reduced to 450 knots IAS or less, prior to ejection.

Note

It is recommended that, at the time the pilot gives the order to abandon the aircraft (conditions permitting), the pilot jettison all three flight compartment canopy hatches simultaneously by pulling the emergency canopy removal handle.

FLIGHT COMPARTMENT.

The navigator will eject first, the gunner second, and the pilot last. This procedure allows the pilot to retain control of the aircraft (conditions permitting) while the navigator, gunner, and weather observers eject. It also precludes the possibility of collision between any of the crew members during ejection.

WEATHER COMPARTMENT.

Weather observer No. 2 will eject first, weather observer No. 1 will report to the pilot over the interphone (if operative) that No. 2 observer has cleared the aircraft, then eject himself. This procedure precludes the possibility of collision between the weather compartment crew members and informs the pilot that all crew members have ejected.

Note

The steps shown in figure 3-6 must be executed for seat ejection.

ALTERNATE BAIL-OUT PROCEDURE.

For Alternate Bail-Out Procedure, see figures 3-7 and 3-8.

EMERGENCY STATIC LINE.

Two emergency static lines *(figure 3-9)*, one located in the flight compartment and one in the weather compartment, are installed for use with the alternate bail-out method of abandoning the aircraft for those crew members who cannot actuate their own ripcords *(figure 3-7 and figure 3-8)*. When required, this line is to be attached to the *D* ring of the parachute.

LANDING EMERGENCIES.

NOSE GEAR RETRACTED — MAIN GEAR DOWN.

After it has been determined that the nose wheel will not extend, retract the main gear and burn as much fuel as possible, and then make a wheels up landing. If the main gear will not retract, do not land — bail out.

ONE MAIN GEAR DOWN.

If only one main gear extends, retract the gear and make a wheels up landing. If the gear will not retract, do not attempt a landing: bail out.

WHEELS UP LANDING.

1. Jettison the external droppable tanks prior to landing attempt to reduce fire hazard.
2. External fuel tank pressure switch-TRANSFER (to depressurize wing and fuselage tanks).
3. Normal shoulder harness inertia reel-LOCKED (all crew members).

CAUTION

When the inertia reel is LOCKED, the crew member is prevented from bending forward. Therefore, all controls not readily accessible should be properly positioned for landing before the inertia reel is LOCKED.

4. If possible, the seat ejection controls ground safety pins should be replaced to prevent inadvertent operation of the seat controls during landing.
5. The three flight compartment canopy hatches should be jettisoned by the pilot, using the emergency canopy removal handle, just prior to touchdown, so that the hatches will not be jammed by crash damage. See figure 3-4 for Emergency Exit.

CAUTION

The flight compartment seat catapults will be armed when the hatches are jettisoned by use of the emergency canopy removal handle.

6. Accomplish as much of the engine shut down as possible, immediately prior to touchdown as outlined under Engine Failure, this Section.
7. The weather compartment emergency ditching hatch in the ceiling should be removed (condition permitting) before contact with the ground so the hatch will not be jammed by crash damage.

WARNING

Under no conditions will a weather observer be out of his seat prior to a WHEELS UP LANDING.

LANDING GEAR TIRE FAILURE.

If the nose wheel tire is flat at the time of landing, keep the nose wheel off the ground as long as possible. Do not let the nose wheel slam to the runway. Use minimum braking. If a main gear tire is flat at time of landing, lower the nose wheel as quickly as possible, in order to maintain a straight track. Use the same approach and landing pattern as in normal landing.

UNPREPARED RUNWAY LANDING.

Landing on an unprepared runway should be left to the pilot's discretion. A normal approach should be used for landing on a smooth hard surface. If the terrain is unsuitable and a landing has to be made, it should be made with the gear retracted.

EMERGENCY ENTRANCE.

See figure 3-5 for Emergency Entrances.

DITCHING.

In the event the decision to ditch the aircraft has been made, the following procedure is recommended:

Note

Ditching procedure outlined in this section is theoretical and is not based on actual flight tests.

Preparedness of the aircraft and the crew is essential to any successful emergency water landing. It is extremely important that an exact ditching procedure be worked out by the crew and that a simulated

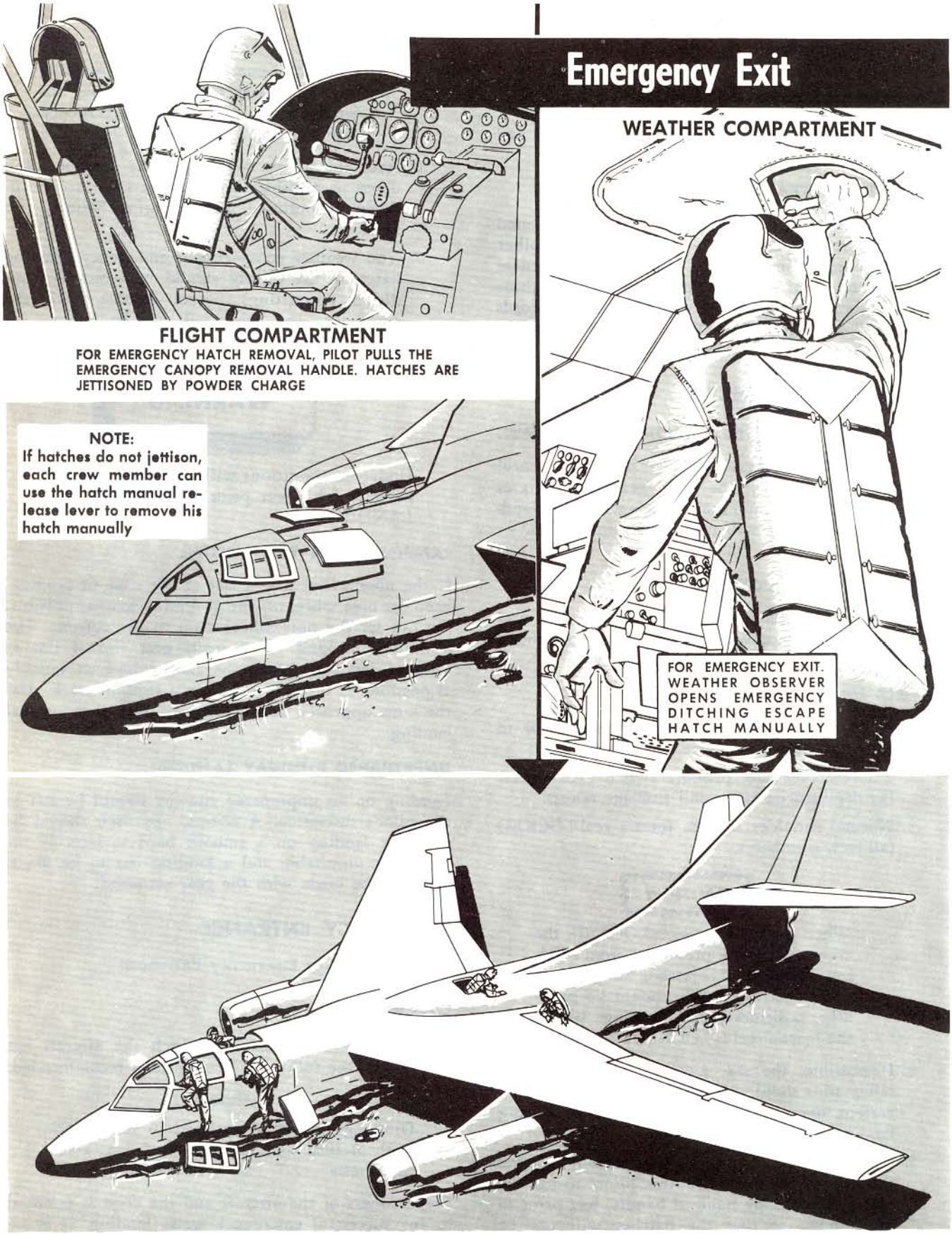
Emergency Exit
WEATHER COMPARTMENT
FLIGHT COMPARTMENT
FOR EMERGENCY HATCH REMOVAL, PILOT PULLS THE EMERGENCY CANOPY REMOVAL HANDLE. HATCHES ARE JETTISONED BY POWDER CHARGE
NOTE:
If hatches do not jettison, each crew member can use the hatch manual release lever to remove his hatch manually
FOR EMERGENCY EXIT. WEATHER OBSERVER OPENS EMERGENCY DITCHING ESCAPE HATCH MANUALLY
1515B

Figure 3-4

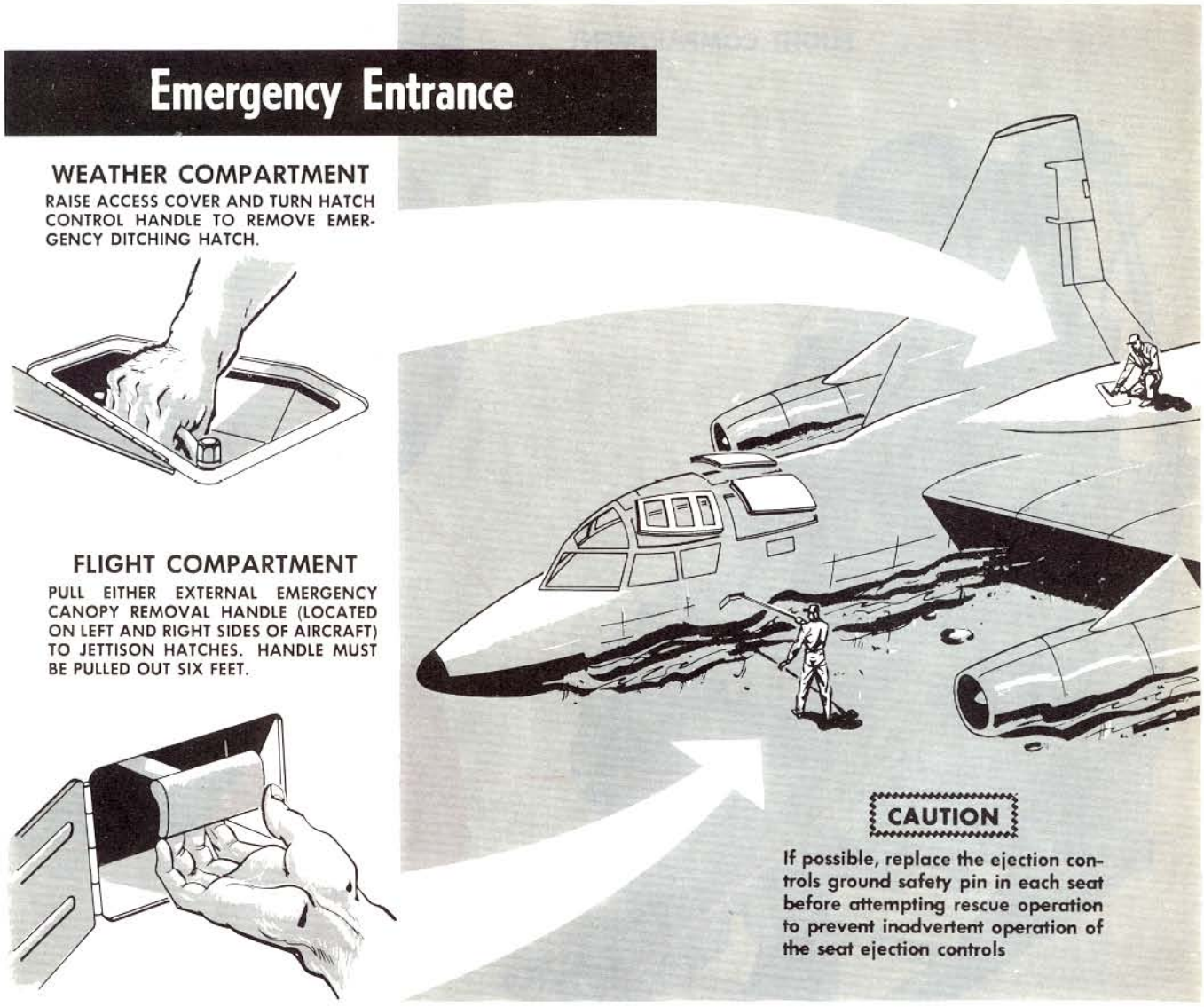

Figure 3-5

ditching be practiced at every opportunity. It is the responsibility of the aircraft commander to see that a thorough inspection of all emergency equipment be accomplished prior to every flight and that each crew member thoroughly understands the procedure to be followed in the event an emergency water landing becomes necessary. Each crew member should be assigned specific items of survival equipment to carry from the aircraft after ditching. This assignment should be covered in each preflight briefing.

PREPARATION FOR DITCHING.

Preparation for ditching should begin at the first indication of a possible water landing. Ditching while power is still available is advantageous in that the landing site can be selected and the most desirable approach may be established. It is highly desirable, however, to use up as much fuel as possible in order to reduce weight and aid flotation. The following is the recommended procedure for preparation of the aircraft and the crew:

1. Notify the crew immediately of the decision to ditch. The pilot will give *prepare for ditching* warning by a predetermined number of rings on the emergency bell (simultaneous visual warning by the emergency warning light, if installed) and verbal warning over the interphone.
2. Position the IFF and emergency keyer to EMERGENCY.
3. Transmit position and time on all available frequencies.
4. Seat ejection control ground safety pins — Installed.

(Continued on Page 3-22)

FLIGHT COMPARTMENT

Ejection

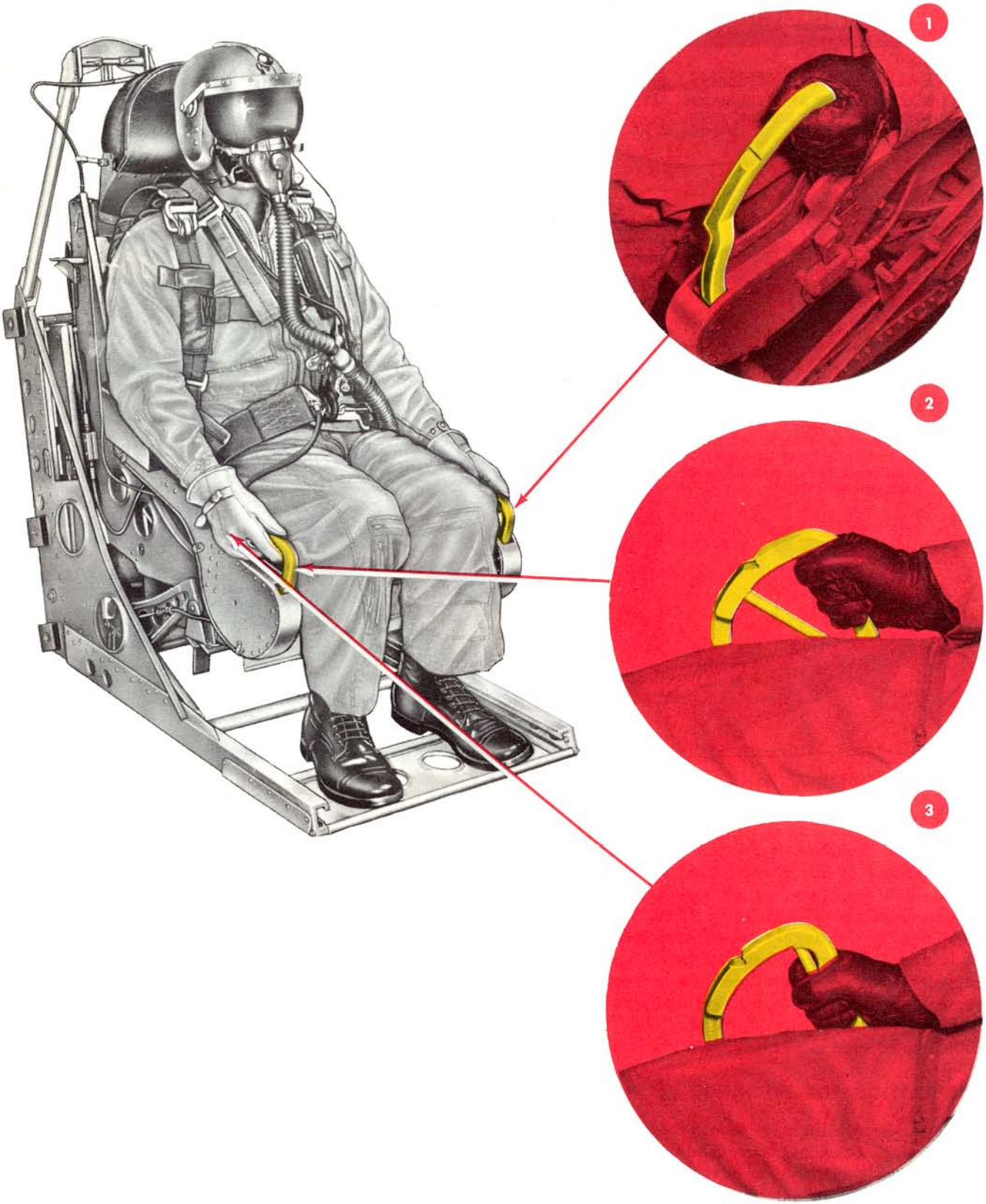

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Figure 3-6 (Sheet 1 of 4)

Seat Operation

IF TIME AND CONDITIONS PERMIT
(Per instructions from pilot)

STOW LOOSE EQUIPMENT.

DEPRESSURIZE FLIGHT COMPARTMENT.

DISCONNECT OXYGEN CLIP FROM SHOULDER HARNESS.

AT ALTITUDE, ACTUATE BAIL-OUT BOTTLE.

CHECK SURVIVAL GEAR.

CHECK SHOULDER HARNESS.

ADJUST SAFETY BELT FOR SNUG FIT AND CHECK AUTOMATIC PARACHUTE DEPLOYMENT CONTROL ATTACHED TO BUCKLE.

PULL HELMET VISOR DOWN.

DON GLOVES.

NOTE

Navigator and pilot may manually move their seats into the aft ejection position.

NOTE

Pilot-jettison all three hatches simultaneously by pulling the emergency canopy removal handle. This will preclude the possibility of a hatch colliding with a crew member during ejection.

STAND BY INTERPHONE FOR INSTRUCTIONS FROM PILOT

NOTE

If possible descend to 20,000 feet altitude or less and reduce airspeed to 450 knots or less.

WARNING

Do not exceed 450 knots IAS during ejection, to insure that the navigator and gunner clear the tail of the aircraft.

WARNING

The following minimum altitude (above the terrain) must be observed during upward ejection. With manual safety belt and manual parachute — 2000 feet. With automatic safety belt and manual parachute — 1000 feet. With automatic safety belt and automatic parachute — 500 feet.

NOTE

The M4 initiator will open the automatic lap safety belt 2 seconds after seat ejection and the M12 initiator will open the automatic lap safety belt 1 second after seat ejection.

1. PULL UP LEFT PRE-EJECTION LEVER . . . . .
   a. To lock shoulder harness.

2. PULL UP RIGHT PRE-EJECTION LEVER . . . . .
   a. To jettison hatch.

WARNING

In the event the hatches do not jettison, the pilot can pull the emergency canopy removal handle. If hatches still do not jettison, each crew member can use the hatch manual release lever to jettison his hatch manually.

3. SQUEEZE EJECTION TRIGGER . . . . . .
   a. Seat ejects.

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Figure 3-6 (Sheet 2 of 4)

WEATHER COMPARTMENT

Ejection

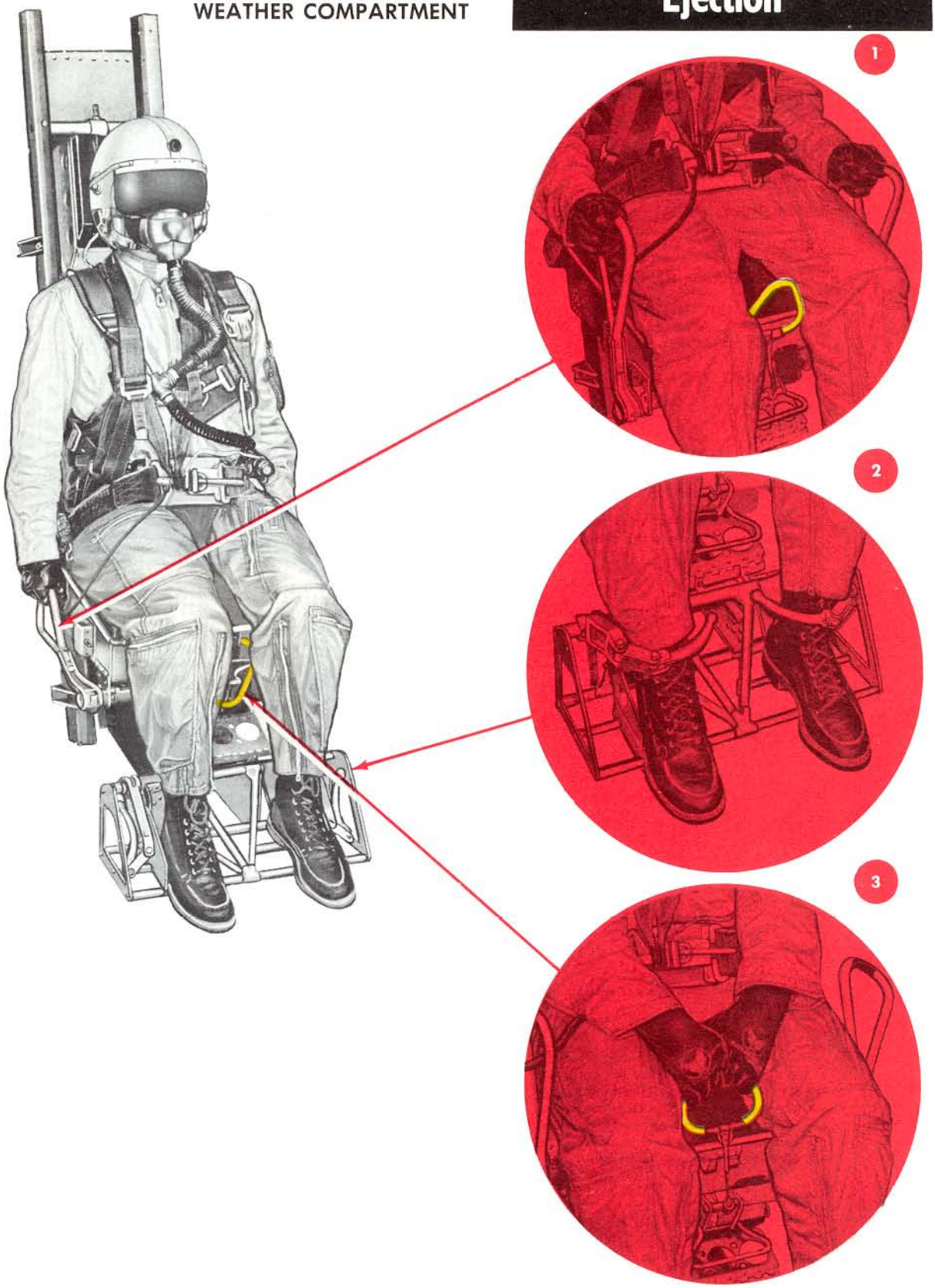

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Figure 3-6 (Sheet 3 of 4)

Seat Operation

IF TIME AND CONDITIONS PERMIT
(Per instructions from pilot)

STOW LOOSE EQUIPMENT.

DEPRESSURIZE WEATHER COMPARTMENT.

DISCONNECT OXYGEN CLIP FROM SHOULDER HARNESS.

AT ALTITUDE, ACTUATE BAIL-OUT BOTTLE.

CHECK SURVIVAL GEAR.

CHECK SHOULDER HARNESS.

ADJUST SAFETY BELT FOR SNUG FIT AND CHECK AUTOMATIC PARACHUTE DEPLOYMENT CONTROL ATTACHED TO BUCKLE.

PULL HELMET VISOR DOWN.

DON GLOVES.

STAND BY INTERPHONE FOR INSTRUCTIONS FROM PILOT

1 RAISE LEG GUARDS . . . . . .

WARNING

Preposition feet on foot rest in case ankle restraints release and snap while raising leg guards.

a. Locks shoulder harness.

b. Tightens crotch harness (if installed.)

c. Releases ankle restraints.

d. Positions D-ring.

2 KICK FEET INTO FOOT RESTS . . . . . .

a. Ankle restraints hold feet in place.

SIT ERECT WITH HEAD BACK AGAINST HEAD REST AND CHIN TUCKED IN.

NOTE

The M4 initiator will open the automatic lap safety belt 2 seconds after seat ejection and the M12 initiator will open the automatic lap safety belt 1 second after seat ejection.

3 PULL D-RING AND HOLD . . . . . .

a. Fires hatch thruster. Hatch jettisons.

b. Catapult initiator safety pin is removed.

c. Seat ejects.

NOTE

If possible descent to 20,000 feet altitude or less and reduce airspeed to 450 knots or less.

WARNING

The following minimum altitudes (above the terrain) must be observed during downward ejection. With manual safety belt and manual parachute — 2300 feet. With automatic-opening safety belt and manual parachute — 1300 feet. With automatic-opening safety belt and automatic-opening parachute — 800 feet.

CAUTION

IF PULLING THE D-RING DOES NOT JETTISON THE HATCH AND EJECT THE SEAT, THE PROCEDURES INDICATED BELOW SHOULD BE FOLLOWED:

1. RELEASE D-RING.
2. LOOSEN SHOULDER HARNESS AND LAP BELT.
3. LEAN OVER TO AISLE SIDE AND PULL YELLOW MANUAL HATCH ESCAPE RELEASE HANDLE LOCATED ON FLOOR.

a. Manually pulls pins and permits hatch to be blown away by the slip stream. The catapult initiator safety pin is removed by the jettisoning of the hatch. The seat is now ready for ejection. Seat will not eject until D-ring is pulled.

NOTE

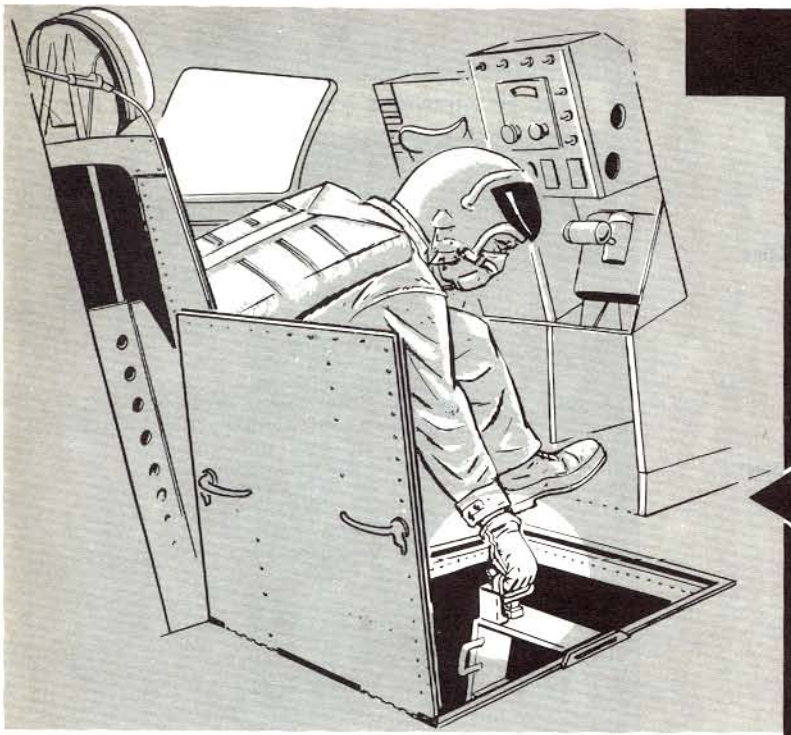
Lower seat to reach manual release handle if required.

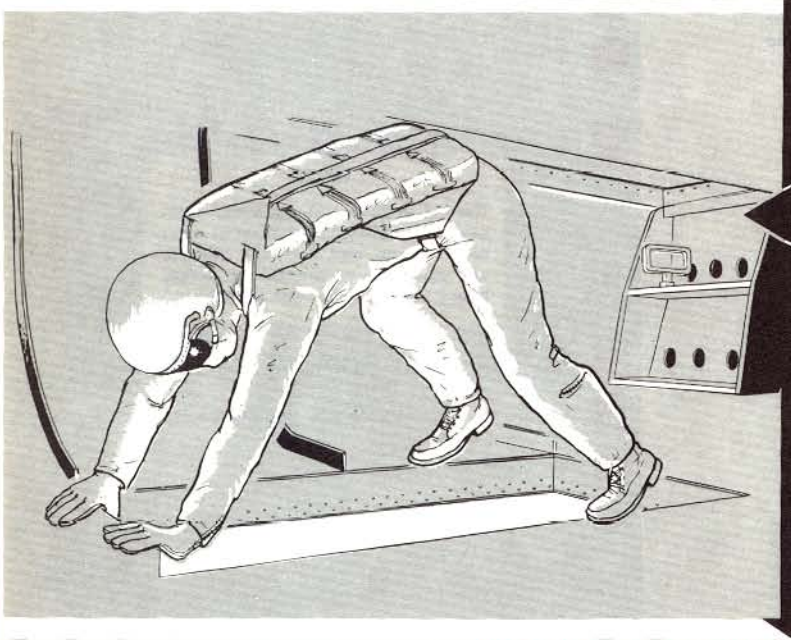
4. TIGHTEN SHOULDER HARNESS AND LAP BELT.
5. PULL D-RING.

a. Seat ejects.

1520B

Figure 3-6 (Sheet 4 of 4)





Alternate Bail-Out

FLIGHT COMPARTMENT

IMMEDIATE ACTION REQUIRED

1

GUNNER—DEPRESSURIZE THE FLIGHT COMPARTMENT

OPEN THE FLIGHT COMPARTMENT ENTRANCE DOOR.

JETTISON THE AIRCRAFT ENTRANCE DOOR BY PULLING THE EMERGENCY JETTISON HANDLE UPWARD.

NAVIGATOR—STOW THE NAVIGATOR'S SWINGING PANEL PRIOR TO LEAVING THE NAVIGATOR'S STATION.

2

BAIL OUT IN THE FOLLOWING ORDER:

1. GUNNER 2. NAVIGATOR 3. PILOT

WARNING

AFTER CLEARING THE AIRCRAFT, ACTUATE THE AUTOMATIC PARACHUTE BY PULLING THE AUTOMATIC RELEASE LANYARD.

WARNING

In event the automatic opening parachute fails to open 1 second after pulling the automatic release lanyard (below 15,000 feet altitude), deploy the parachute by pulling the manual release ("D" ring).

TIME AND CONDITIONS PERMITTING

1. Descend to an altitude of 20,000 feet or below and reduce airspeed to 450 knots or less.
2. At altitude, actuate bail-out bottle.
3. Depressurize the flight compartment.
4. Gunner — open flight compartment entrance door.
5. Gunner — Jettison aircraft entrance door by pulling the emergency jettison handle upward.
6. Bail out in the following order: Gunner — Navigator — Pilot.
7. After clearing the aircraft, actuate the automatic parachute by pulling the automatic release lanyard.

WARNING

In event the automatic opening parachute fails to open 1 second after pulling the automatic release lanyard (below 15,000 feet altitude), deploy the parachute by pulling the manual release ("D" ring)

1523B

Figure 3-7

Alternate Bail-Out

WEATHER COMPARTMENT

Note:
If an ejection seat fails to operate the weather observer can abandon the aircraft utilizing the hatch opening the other observer has ejected from. The following method is to be used if the situation arises.

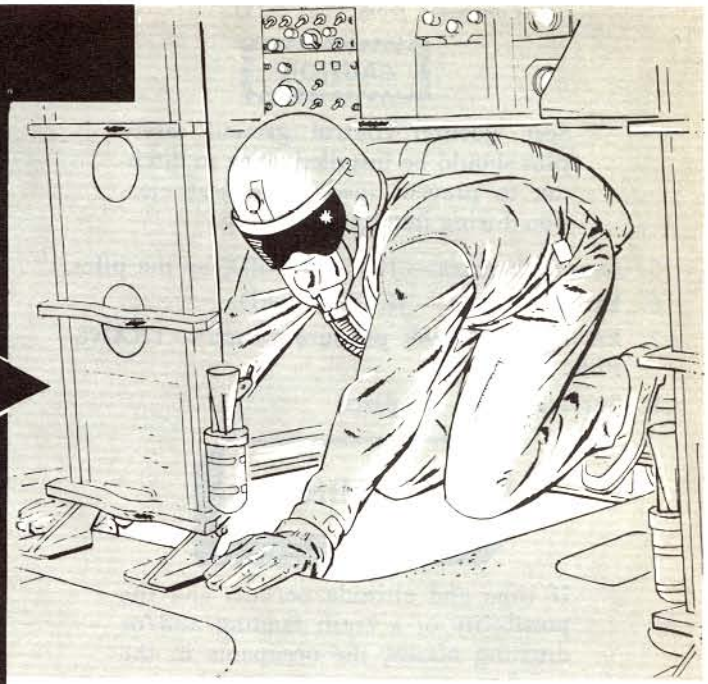
1. Notify the pilot that an alternate bailout is required. The aircraft should descend to an altitude of 20,000 feet or below and airspeed reduced to 260 KEAS or less.
2. Actuate bail-out bottle.
3. Assume position over jettisoned hatch as indicated.
4. Kick feet free from the leading edge of the opening, at the same time, pushing away from the aircraft with the arms.
5. After clearing the aircraft, actuate the automatic parachute by pulling the automatic release lanyard.

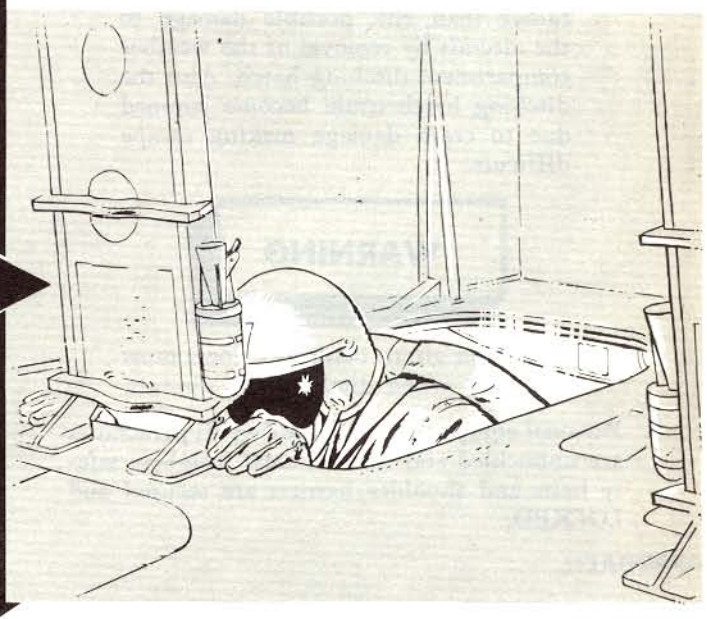
WARNING

In event the automatic opening parachute fails to open 1 second after pulling the automatic release lanyard (below 15,000 feet altitude), deploy the parachute by pulling the manual release ("D" ring).

WARNING

If a very low altitude or high speed bail-out is to be utilized to abandon the aircraft, attach the static line located behind the chief observer's ejection seat to the manual release ("D" ring). This will facilitate the observers' escape from the aircraft under these conditions.





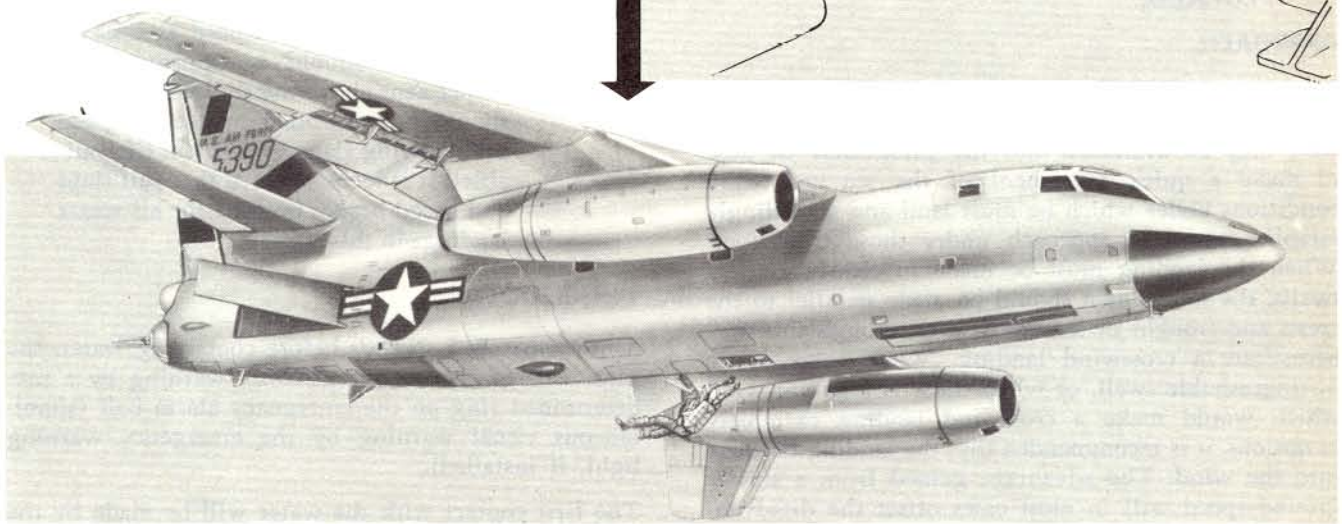


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Figure 3-8

(Continued from Page 3-15)

CAUTION

Seat ejection control ground safety pins should be installed prior to ditching to prevent inadvertent seat ejection during impact on landing.

5. Canopy hatches — JETTISONED, by the pilot.
6. External stores — JETTISONED.
7. External fuel tank pressure switch — TRANSFER.
8. Survival gear — In place.

WARNING

If time and altitude permits and the possibility of a crash landing and/or ditching occurs, the occupants in the weather compartment should eject rather than risk possible damage to the aircraft by removal of the weather compartment ditching hatch. Also the ditching hatch could become jammed due to crash damage making escape difficult.

WARNING

The lower aircraft entrance doors must be closed when ditching the aircraft.

9. Personal equipment — Check that all parachutes are unbuckled and that all crew members safety belts and shoulder harness are secured and LOCKED.

APPROACH.

The time available for establishing the approach will be determined by altitude and power available. Little time may be available, and the pilot must be able to make a quick assessment of the sea and wind conditions under which he must land and accordingly establish the best approach under those conditions. When the landing must be made in clearly defined swells, the touchdown should be made parallel to the crests and troughs of the swells even though this may necessitate a crosswind landing. When there is no distinguishable swell, or when there is a strong wind which would make a crosswind landing extremely hazardous, it is recommended that the landing be made into the wind. The advantage gained from a slower ground speed will in most cases offset the disadvantages of a possible head-on impact with a wave crest. When landing across large waves it is advisable to land on the falling side, or trough, if possible. If it is impossible to determine the prevailing wind and wave systems, it is recommended that the landing be made at the slowest airspeed possible.

LANDING.

The factors that affect a water landing are the same as those affecting a normal landing; however, tolerances are far more critical and must be closely maintained in order to hold to a minimum the extremely high impact forces and pressures encountered in a water landing. A rate of descent of a 100 feet per minute or less should be maintained until flare out. The attitude of the aircraft at the time of touchdown should be from 6 to 8 degrees nose high, with an indicated airspeed of 10 per cent above the power-off speed for the weight being flown.

WARNING

The rate of descent at touchdown is the most important variable that the pilot can control. Landing at a high rate of descent will result in very high impact pressures which are likely to cause diving and serious structural failures and a very short flotation time. 100-feet-per-minute rate of descent should be maintained under any circumstances if at all possible.

Note

It is generally best to land at as slow an air-speed as possible relative to the water. A low speed, however, must not be obtained at the expense of increasing the ditching attitude, and under no circumstances should the aircraft be stalled in. The airspeed at time of touchdown should be approximately 10 per cent above the stall speed. Speed should be controlled by use of speed brakes, wing flaps, and power (if available). It is recommended that full flaps and speed brakes be used for all water landings in this aircraft.

TOUCHDOWN.

Approximately 5 seconds before contacting water, the pilot will give *brace for ditching* warning by a predetermined ring on the emergency alarm bell (simultaneous visual warning by the emergency warning light, if installed).

The first contact with the water will be made by the tail section, resulting in a moderate to severe shock. This contact will be followed by a second contact

with more severe shock than the first, as the forward section of the fuselage settles into the water. To minimize the possibility of injury, each crew member must be securely strapped in his seat by insuring that his seat belt and shoulder harness are properly adjusted so as to limit movement during impact. The pilot should brace his feet evenly against the rudder pedals; the navigator and gunner should brace their feet on the foot guards provided on the crew seats. The weather observers should raise their leg guards and use the ankle restraints. These positions should be maintained until the aircraft has come to rest in the water. Deceleration will be rapid, particularly if the engine nacelles dig in. It is likely that the flight compartment will be at water level or awash when the aircraft comes to rest. The aircraft must be abandoned immediately, since flotation, depending on the extent of structural damage, may be limited to a matter of seconds. If circumstances permit, it is advisable to depart from the aircraft over the fuselage and across a wing in order to clear the immediate area as soon as possible.

Note

If the dinghy or survival kit is used, remove it from the seat, throw it out the top of the emergency ditching hatch prior to exiting through the emergency ditching hatch.

Note

Leave the dinghy lanyard connected to the Mae West to prevent loss of dinghy.

Note

After the aircraft has come to rest, the weather compartment occupants should release the seat belt, shoulder harness, and crotch harness. The occupants then should exit through the weather compartment ditching hatch, in the following order: weather observer No. 2 then observer No. 1.

EJECTION VS FORCED LANDING.

The pilot and crew should give consideration to the advantages of the use of seat ejection in preference to forced landings. If an emergency occurs over unknown terrain, or over terrain unsuited for a forced landing, seat ejection should be used.

WARNING

Do not manually open the automatic opening safety belt prior to ejection at any altitude. Opening of the safety belt, prior to ejection, could result in fatal injury, due to being thrown from the seat during uncontrollable or negative *G* maneuvers or separation from the seat at excessive speeds immediately after ejection.

FUEL SYSTEM EMERGENCY OPERATION.

BOOST PUMP FAILURE.

There is no way of determining that a boost pump has failed below an altitude of approximately 18,000 feet. Normal engine operation may be maintained up to this altitude with the fuel selector switch in the FLIGHT NORMAL position. If the fuel flow on one engine fluctuates (above 18,000 feet) and the fuel selector switch is in FLIGHT NORMAL, a failed boost pump is indicated, and the fuel selector switch should be immediately positioned to TAKE-OFF & CROSS-FEED. In the event of single boost pump failure, normal engine operation may be maintained at any altitude with the fuel selector switch in TAKE-OFF & CROSS-FEED. Failure of both boost pumps is indicated if the fuel flow on both engines fluctuates above 18,000 feet with the fuel selector switch in either FLIGHT NORMAL or TAKE-OFF & CROSS-FEED. If this occurs, reduce power and descent to a lower altitude (below 18,000 feet) in order to maintain normal engine operation. *(See figure 7-6* for Fuel Flow Diagram.)

FUSELAGE FUEL TRIM VALVE (CG CONTROL) FAILURE.

If the automatic feature of the fuselage CG control valve fails to maintain proper fuel load balance, and a nose-heavy condition exists, the fuselage fuel trim switch can be placed in the BOTH TANKS position (CG valve open) to allow unrestricted flow from the forward tank to the aft tank. If a tail-heavy condition exists, the fuselage fuel trim switch can be placed in the AFT (CG valve closed) position, and the engines will use fuel from the aft tank only.

WARNING

At any time the automatic CG control system malfunctions, immediate action should be taken to manually establish the CG within recommended limits. If this becomes impossible, a landing should be made as soon as practicable.

A failure of the fuselage fuel trim valve (CG control), in the closed position, could result in an increasing unbalance of the aircraft (nose heavy). This condition can be established by first positioning the fuel selector switch to EMER. FWD. TANK TO LEFT ENGINE or EMER. FWD. TANK TO RIGHT ENGINE. This allows one engine to draw fuel from the forward tank and the other engine to receive fuel from the aft tank

by the boost pump still operating. Should the unbalanced (forward CG) condition of the aircraft become extreme, the fuel selector switch can be placed in the EMER. FWD. TANK TO L & R ENGINE position. Fuel for engine operation is then drawn from the forward tank by both engine fuel pumps *(figure 7-6)*.

CAUTION

The fuselage fuel trim valve (CG control) is automatically closed when the fuel selector switch is placed in any emergency position.

Note

In the event of d-c power failure, the CG control valve will fail to the closed position, preventing the transfer of fuel to the aft tank.

ELECTRICAL POWER SYSTEM EMERGENCY OPERATION.

A-C SYSTEM FAILURE.

In the event of failure of the a-c electrical system, alternating current from the inverter is available for the emergency operation of the K-4 vertical gyro indicator and N-1 compass systems. Placing the flight ply, and connect the inverter output to the K-4 vertical gyro indicator and N-1 compass systems. See Section VII for Single Alternator Operation.

D-C SYSTEM FAILURE.

In the event of failure of the d-c electrical system, the battery switch should be placed in the EMER position to operate the equipment connected to the battery bus and emergency bus, as shown in figure 1-14. The battery, if fully charged, will supply the gyro flight instruments and the N-1 compass for a period of approximately ½ hour. The life of the battery will be dependent on the load requirements.

Note

If d-c power to the K-4 gyro is interrupted, avoid changes in aircraft attitude while the power is interrupted. Cross-check the B-1A indicator with the other flight instruments upon reapplication of d-c power. During preflight or loading, if a-c power is applied with d-c power, allow the gyro to erect. If power is interrupted, follow the preceding procedures.

Note

No lighting (except the pilot's floodlights) are available in the event of d-c system power failure. One dynamotor has been connected to the emergency power bus to allow the pilot, gunner and weather observer No. 2 use of the interphone system in the event of a d-c failure.

CAUTION

Only that equipment which is absolutely necessary to effect a safe landing should be operated when the battery is used as the electrical power source.

See Section VII for Single Generator Operation and Electrical System Trouble Shooting.

EFFECTS OF ELECTRICAL POWER FAILURE ON ENGINE PERFORMANCE.

COMPLETE A-C POWER SYSTEM FAILURE.

Complete failure of the a-c power system below an altitude of 18,000 feet causes no appreciable reduction in engine performance. Above 18,000 feet engine performance will be reduced because of fuel boost pump failure in the forward and aft fuselage fuel tanks. Due to reduced fuel flow, a flame out could occur at altitudes above 18,000 feet (as a result of fuel starvation). In the event of an a-c power failure proceed as follows:

- Reduce engine power (compatible with existing conditions).
- Descend to an altitude of 18,000 feet or below (to maintain maximum engine performance).

CAUTION

The amplifier of the engine electronic overtemperature control is inoperative when complete a-c power failure occurs.

COMPLETE D-C POWER SYSTEM FAILURE.

Complete failure of the d-c power supply system will seriously affect engine performance and will result in a loss of approximately 10 per cent thrust, per engine. The fuel consumption will increase to an abnormal rate and the EGT will rise approximately 100°C above normal. The engines will, in most cases, stabilize at these new abnormal conditions in approximately 15 seconds. Any attempt to retard the throttles to a setting below that position compatible with existing operation conditions may result in a compressor stall and flame-out.

WARNING

Sustained operation without d-c power will result in excessive exhaust gas temperatures and subsequent failure of the engine and nacelle components.

In the event of a complete d-c power system failure, proceed as follows: Maintain a throttle position com-

patible with or above the existing abnormal operating conditions of the engines. Make an emergency landing as quickly as possible.

WARNING

A complete power loss (flame-out) will result if the throttles are retarded below a position compatible with existing abnormal engine operating conditions accompanying a d-c power system failure. Engine speed may be reduced to 74% (4500 rpm) and increased again without difficulty. If the engine speed is reduced below 74% the throttle lever must be advanced very slowly to avoid surge. Avoid excessive movement of the throttles in order that the existing engine operation may be maintained.

ENGINE COMPONENT SETTINGS — DC POWER FAILURE.

COMPONENT	SETTING
Guide Vanes	High Speed Position
8th Stage Acceleration Bleed Valve	OPEN
16th Stage Acceleration Bleed Valve	CLOSED
Engine Screens	RETRACTED
Engine De-icing Valve	OPEN

ICE PROTECTION SYSTEMS FAILURE.

ENGINE ANTI-ICING SYSTEM FAILURE.

When, with the engine anti-icing switch in the AUTO/OFF position, visible ice collects on the inlet dome or on the inside edges of the engine nacelle, a complete failure of the engine anti-icing system may have occured. Because of the extreme vulnerability of an unprotected engine to icing conditions, immediate action to vacate the icing conditions is mandatory. Engine damage, or failure from ingestion or airflow restriction, can occur with as little as ½ inch of ice on the engine inlets. This amount can accumulate in less than 1 minute in a severe icing condition, if this condition occurs, declare an emergency and take immediate action to vacate the icing conditions. Normally, a change in altitude will provide the quickest route to clear air while minimizing the total ice accumulation. After reaching clear air, extend the engine screens to minimize ingestion damage and position the engine anti-icing switch ON. A high indicated airspeed of 350 knots IAS should be maintained if possible, with a minimum rpm required to maintain the desired flight condition. The remainder of the flight should be planned to avoid further icing encounters.

Note

The AUTOMATIC feature of the engine ANTI-ICING system is inoperative.

WARNING

The engine automatic anti-icing system has been disconnected. To de-ice the engine place the engine anti-icing switch in the ON position.

WARNING

Without engine ice protection, attempt an instrument letdown and low approach in icing conditions only as an emergency measure.

CAUTION

The lower rpm will reduce the amount of ice passing through the engine. If possible, avoid the high rmp — low airspeed configuration in icing conditions.

AIRCRAFT ANTI-ICING AND DE-ICING SYSTEM FAILURE.

The ice accumulations resulting from a failure of the aircraft anti-icing and de-icing system will cause increased drag, poor flight handling characteristics, and higher stalling speeds. However, the aircraft can be operated satisfactorily, with allowances made for these performances losses, with as much as 2 inches of ice accumulated on the leading edges of the wings. If visible ice collects and remains on any wing leading edge for an excessive period of time (longer than 5 minutes plus or minus 30 seconds, which is the normal cycle time for the de-icing mode of operation), and the wing and empennage anti-icing and de-icing switch is in the DE-ICING position, the de-icing mode of operation has failed. In this event, limited ice protection may be available in the anti-icing mode of operation. Check operation of the system in both the ANTI-ICING and DE-ICING positions of the wing and empennage anti-icing and de-icing switch. If possible, increase the airspeed to 350 knots IAS (250 knots IAS minimum) to reduce the rate of ice accumulation. Take evasive action to depart and avoid icing conditions. If a penetration and low approach are necessary in icing conditions, maintain a high indicated airspeed (250 to 350 knots IAS) to reduce the total ice accumulation, complete a minimum fuel landing pattern, and delay the final cockpit check until final approach.

WARNING

The recommended approach speeds, specified in Appendix I, should be increased 10 knots for each inch of ice accumulated on the leading edge of the wings.

CAUTION

In heavy to severe icing conditions, the wing and empennage anti-icing and de-icing switch should not be left in the ANTI-ICING position for extended periods of time. The water that impinges on the leading edges would normally be evaporated by the anti-icing system in light icing conditions. However, if the icing conditions are so severe that the water is not evaporated, the water that runs back from the leading edges will freeze on the wing, resulting in a loss of aerodynamic efficiency and a corresponding loss in performance and range. Runback ice can probably be first detected near the tips of the wings.

OVERHEAT WARNING.

If the over heat warning light illuminates during flight in "non-icing to slight icing condition," position the wing and empennage anti-icing and de-cing switch to OFF, and position the engine anti-icing switch to ON. The wing and empennage anti-icing switch may then be positioned intermittently to ANTI-ICING or DE-ICING, as required, to remove ice.

Note

The engine anti-icing switch should normally be in the AUTO/OFF position, except when icing conditions are encountered. The ANTI-ICING position of the wing and empennage switch may be used intermittently, as required, to remove ice.

In severe icing conditions, position the wing and empennage anti-icing and de-icing switch to DE-ICING and position the engine anti-icing switch to ON.

CAUTION

Bleed air supplied to the anti-icing and de-icing system at temperatures above 260°C (500°±10°F) may cause structural damage to the aircraft due to overheating.

Note

If an overheat warning occurs during flight, and if the cause is determined to be a failure of the heat exchanger bypass valve (in the open position), it may be possible to eliminate the overheat condition by power reduction to slow the aircraft to the following calculated airspeeds, or below:

Altitude	IAS (knots)
Sea level	415
10,000 feet	378
20,000 feet	321

Depending on gross weight, it is calculated that the power required to maintain airspeeds below those stated previously will produce bleed air temperatures below 260°C (500±10°F).

Note

To determine if one or both of the heat exchanger bypass valves have failed or are malfunctioning, proceed as follows: Reduce power, conditions permitting, on first one engine and then the other, in an attempt to extinguish the warning light. If the warning light continues to illuminate, follow the procedure outlined in paragraph 1 or 2, depending on icing conditions.

HYDRAULIC EMERGENCIES.

WARNING

During emergency operation of the landing gears, wing flaps, or speed brakes by use of the manual override, always pull the respective circuit breaker prior to operation of the manual override. This will prevent inadvertent retraction as a result of an electrical malfunction in the respective circuit.

HYDRAULIC BOOST SYSTEMS FAILURE.

In the event of simultaneous loss of both systems at altitude, it is highly probable that at least one system is intact and can be regained if the altitude is reduced. Simultaneous loss will occur under two circumstances: Battle damage resulting in the loss of both boost reservoirs or loss of reservoir pressurization. The following conditions are discussed to illustrate various types of system failure and the resulting action of the boost system. It should be remembered that both boost system reservoirs are supplied by the same air pressure regulator and because of reservoir interconnection both reservoirs are at the same pressure.

PIPING FAILURE OF A SUCTION LINE.

This is probably the most common failure which would result in partial or complete loss of pressurization. The type of failure will determine the extent

of pressure loss. If either the suction or return line is completely severed, complete loss of pressurization will occur and reservoir pressure will be atmospheric pressure. In this case it will be necessary to reduce the altitude to less than 5000 feet and move the controls slowly to maintain pressure on the remaining good system.

FAILURE OF THE UTILITY AND EMERGENCY SYSTEM.

In this case there will be no loss of boost reservoir pressure because the air supply is sufficient to provide full boost reservoir air pressure under this condition.

BOOST SYSTEM PRESSURE LINE FAILURE.

This is no doubt the most common failure to be expected, reservoir air pressure loss is usually not significant. The pump will supply .8 cubic feet of air per minute which is less than that supplied by the regulator. With the reservoir empty a connection exists from the return system to the pressure system through the system relief valve. If the line failure is between the pump and pressure line check valve no loss of reservoir pressure will be encountered. If the failure is down stream of the pressure line check valve the pressurizing air will flow through the relief valve to the pressure side of the system. In this case, the minimum reservoir pressure will be atmospheric plus 4 psi.

FAILURE OF THE OVERBOARD RELIEF VALVE TO CLOSE.

This will cause both the main and boost system reservoir air pressure to fail to approximately 3 to 5 psi above atmospheric pressure. This pressure differential is being created by the pressure required to unseat the check valve in the overboard relief line.

Note

If simultaneous loss of both hydraulic boost systems occurs at altitudes above 10,000 feet and flight conditions permit, do not disengage the boost systems. Immediately reduce altitude to less than 10,000 feet and check boost system indicators for indication of pressure. If system failure has been caused by loss of boost system reservoir air pressure a reduction in altitude will increase reservoir air pressure and the system will function normally.

LANDING GEAR EMERGENCY OPERATION.

If the landing gear fails to extend under normal condition proceeds as follows:

1. Reduce airspeed as much as practicable.
2. Leave the landing gear lever (at the pilot's station) in the DOWN position.
3. Wing flap handle — STOP position.
4. Pull the landing gear control circuit breaker, located on the emergency bus circuit breaker panel on the pilot's left forward console *(figure 1-8)*.
5. Send a crew member to the emergency hydraulic control panel *(figure 1-17)* to operate the landing gear manual override to the PUSH TO LOWER position.

If gear does not extend:

6. Instruct the crew member to position the landing gear emergency valve control handle *(figure 1-17)* to the GEAR DOWN position.

In the event that one main gear indicates UP and locked and the other main gear indicates DOWN and locked and hydraulic pressure is normal proceed as follows:

7. Landing gear control circuit breaker — IN.
8. Landing gear lever — GEAR UP.

After landing gear is down and locked.

9. Landing gear lever — GEAR DOWN.

MAIN GEAR DOOR SEQUENCE VALVE — EMERGENCY OPERATION.

In the event that one main gear indicates UP and locked and the other main gear indicates DOWN and locked and hydraulic pressure is normal proceed as follows:

1. Landing gear — Recycled, (one time).
2. Landing gear control circuit breaker, located on the emergency bus circuit breaker panel on the pilot's left console, PULL OUT *(figure 1-8)*.
3. Instruct the crew members to position the landing gear emergency valve control handle *(figure 1-17)* to the GEAR DOWN position.
4. Landing gear control circuit breaker — PUSH IN.
5. Landing gear lever — GEAR UP.

After the landing gear is down and locked.

6. Landing gear lever — GEAR DOWN.

WING FLAP EMERGENCY OPERATION.

If the wing flaps fail to extend under normal conditions, proceed as follows:

1. Leave the control handle (at the pilot's station) in the DOWN position.
2. Pull the wing flap control circuit breaker, located on the pilot's left forward console *(figure 1-8)*.
3. Send a crew member to the emergency hydraulic control panel *(figure 1-17)* to operate the wing flap manual override to the PUSH & HOLD-FLAP DOWN position.

If the wing flaps still fail to extend:

4. Instruct the crew member to position the emergency wing flap hydraulic valve control handle *(figure 1-17)* to the FLAPS DOWN position.

Note

Wing flaps retraction can also be accomplished by use of the manual override when positioned to FLAPS UP.

Note

During emergency operation of the wing flaps by use of the manual override, pull the wing flap control circuit breaker (located on the emergency bus circuit breaker panel) prior to operation of the manual override.

CAUTION

Do not exceed 184 knots IAS with the flaps in EMERGENCY DOWN, or structural damage may occur. The blowback feature does not apply to emergency system operation.

Note

There is no provision for emergency wing flap retraction by use of the emergency wing flap control.

Note

The flap system is designed to eliminate an undesirable high pressure condition on the retract hose at the flap cylinder. Failure of the retract cylinder hose could result, thereby leaving the flaps unable to retract and causing possible loss of the entire utility hydraulic system.

SPEED BRAKE EMERGENCY OPERATION.

In the event the speed brakes fail to function when the speed brake switch is actuated proceed as follows:

1. Place the wing flap handle, located at the pilot's station, in the STOP position, then actuate the speed brake switch momentarily to the OPEN or CLOSE position, as desired.

If the speed brakes do not operate:

2. Send a crew member to the emergency hydraulic control panel *(figure 1-17)* to operate the speed brake manual overside to the PUSH-BRAKE or PULL-BRAKE IN position, as desired.

Note

Except for the manual override, there is no emergency means for operation of the speed brakes.

Note

During emergency operation of the speed brakes by use of the manual override, pull the speed brake control circuit breaker (located between the navigator and gunner) prior to operation of the manual override.

NOSE WHEEL STEERING EMERGENCY OPERATION.

There are no provisions for emergency nose wheel steering; should system pressure be lost directional control can be maintained by applying differential braking and asymmetric power. However, if the nose wheel steering becomes inoperative, the nose wheel steering rage selector handle should not be placed in the DISENGAGE position; in this position to selector valve shuts off hydraulic pressure to the nose wheel steering system. Should pressure return to the system while in the DISENGAGE position there would be no indication that the system was once again in operation.

CAUTION

Do not attempt to taxi the aircraft when the nose wheel steering system is inoperative.

ATO JETTISON EMERGENCY.

If the ATO bottles fail to jettison by use of the ATO jettison switch *(figure 1-5)*, maintain an airspeed of approximately 300 knots IAS. Move the wing flap handle, located at the pilot's station, to the STOP position, and then actuate the ATO jettison switch momentarily. If the ATO bottles still fail to release, send a crew member to the emergency hydraulic control panel *(figure 1-17)* to operate the jettison manual override to the PUSH TO DROP position.

Note

The manual override must be held in the PUSH TO DROP position for a minimum of 30 seconds to insure release of the bottles.

HYDRAULIC EMERGENCY CHART.

A Hydraulic Emergency Chart *(figure 3-10)* has been provided for the pilot. This chart may be used for hydraulic system trouble shooting. It is conveniently located at the end of the setcion, so that it may be removed, if desired.

BRAKE EMERGENCY OPERATION.

With normal utility pressure:

1. Anti-skid switch — OFF.

If brakes fail to operate:

2. Anti-skid switch — ON, to arm emergency air-brakes.

3. Emergency airbrake handle — PULL TO ARM-EMERG BRAKES.

Without utility pressure:

1. Anti-skid switch — ON.

CAUTION

The anti-skid system is inoperative when the emergency airbrake system is used; however, the anti-skid switch should remain in the ON position. With the antiskid switch in the ON position, any utility hydraulic system pressure available to the brake valve is routed through a restrictor valve which reduces the flow rate at which the utility system fluid is bypassed to return. With the switch in the OFF position, any residual pressure in the utility system would not be available for limited operation of utility services, and hydraulic back pressure on the system may lock the wheel brakes.

2. Emergency air brake handle — PULL TO ARM-EMERG BRAKES.

Note

Actuation of the emergency airbrake handle, located on the control pedestal *(figure 1-5)*, to the PULL TO ARM-EMERG BRAKES position, ports air pressure to the air section of the hydraulic brake valve. Airbrake operation will be the same as hydraulic brake operation without antiskid. Sufficient air is stored to permit three brake applications.

Note

There is no cockpit indicator to indicate air pressure in the emergency airbrake system.

FLIGHT CONTROL BOOST SYSTEM EMERGENCY OPERATION.

ELEVATOR BOOST FAILURE DURING TAKE-OFF.

Horizontal stabilizer setting at take-off will depend upon the aircraft center of gravity. To determine whether or not the elevator boost is engaged, move the controls at maximum rate from neutral detent to full throw before engine start. If the boost is connected the control column will move more rapidly and easily for several inches, then the rate will noticeably decrease while force increases. It will normally take three seconds to move the control column neutral to full aft position. If the boost is disconnected the control column may be easily and rapidly moved through its limits, normally requiring only 7/10 of a second from neutral to full aft position at maximum rate. The above checks will give positive indication of complete disconnect but will not show if the locking mechanism is on the *dead center* or near *dead center* position. If the locking mechanism is only near, rather than on, *dead center*, the boost will not be locked on. A spring will hold the connection in place until a fairly heavy pilot force has been applied, at which time the stabilized boost will become disconnected. In some instances, this has resulted in a loss of boost during takeoff or ground taxi and on flights following maintenance work on the control system. If the elevator boost is found to be inoperative prior to maximum refusal speed, the take-off should be aborted. In the event the failure is not detected until after maximum refusal speed has been reached, and the stabilizer is in the recommended trim setting, the pilot may, by combined use of the high speed trim and high stick force, lift the nose wheel. The pilot who suddenly finds himself without boost assist at Vs, and immediately applies high nose up trim, requires a longer than normal take-off run in order to lift the nose wheel with less than 100 pounds force. In the most critical case of height, weight, and forward CG the increase in take-off run is approximately 700 feet. The recommended stabilizer setting shown in *figure 2-6* is the setting which has been found desirable for normal take-off procedure but it is not necessarily optimum for the case of boost failure.

WARNING

Do not release or disengage either boost system unless an actual failure in the system has occurred. The boost system(s) must not be released for practice, since they cannot be reengaged in flight.

Note

The autopilot will be ineffective with the flight controls boost systems disengaged.

The following procedure is recommended in the event of actual failure of the rudder-elevator boost and/or aileron-boost spoiler system:

1. Trim the aircraft to zero stick force by means of the high-speed (a-c) elevator trim switch on the control wheel prior to releasing the affected boost system (time and conditons permitting).
2. Pull up the affected emergency boost release handle to disengage the boost system.
3. Maintain longitudinal control of the aircraft by means of the high-speed (a-c) elevator trim switch on the control wheel.

(Continued on Page 3-32)

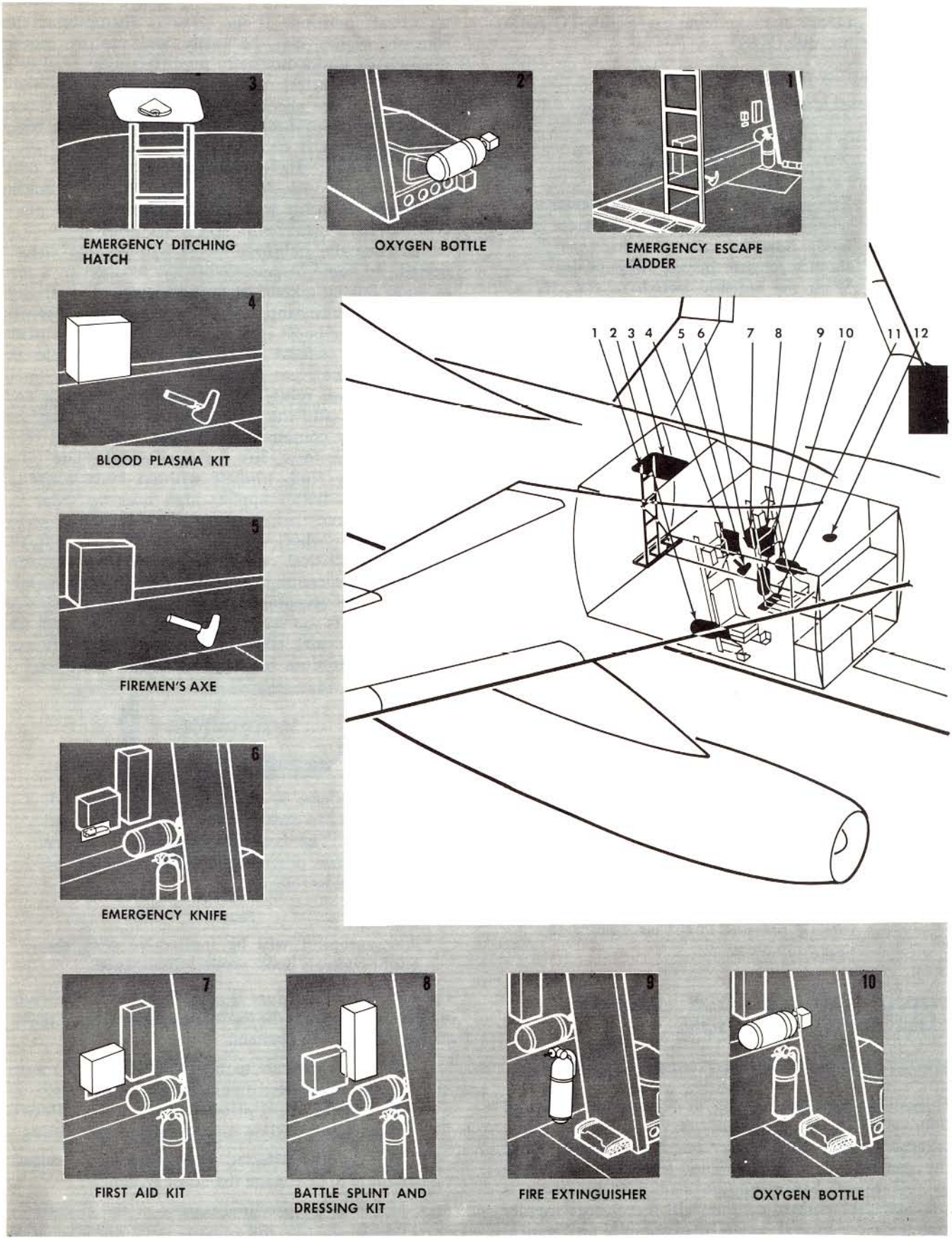

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Figure 3-9 (Sheet 1 of 2)

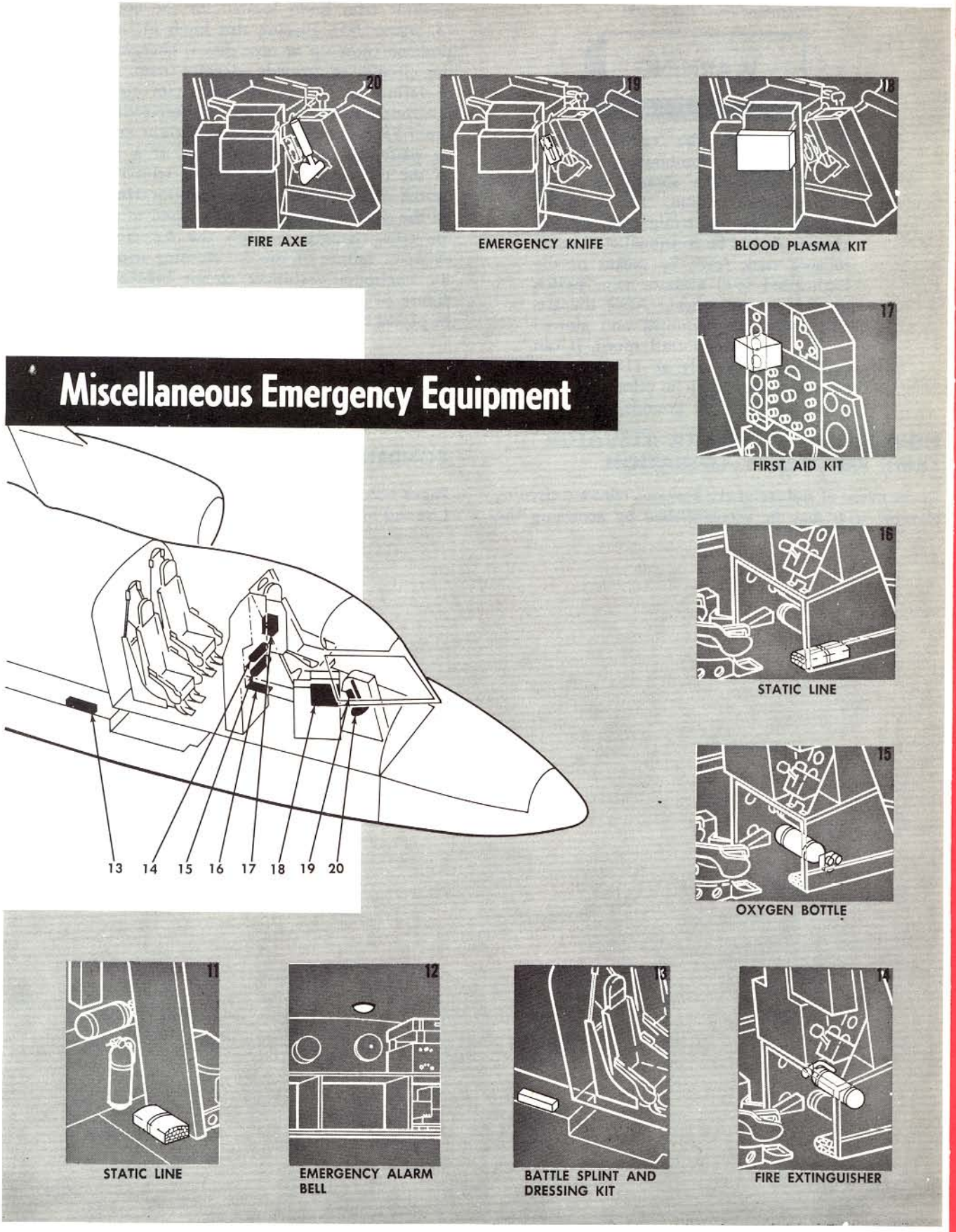

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Figure 3-9 (Sheet 2 of 2)

(Continued from Page 3-29)

WARNING

Landings with the rudder-elevator boost and/or aileron-boost spoiler system(s) inoperative should be made with extreme caution. The approach should be flat and straight in, and the aircraft should be continually trimmed to zero stick force by means of the high-speed (a-c) elevator trim switch on the control wheel. After the aircraft has been trimmed and slowed to 140 per cent of stall speed, it can be landed manually at 115 per cent of stall speed with a pilot effort of approximately 100 pounds.

HORIZONTAL STABILIZER (ELEVATOR TRIM) EMERGENCY OPERATION.

In the event of failure of the elevator trim a-c circuits, elevator trim may be accomplished by actuating the elevator trim knob located on the control pedestal *(5, figure 1-5)*. Placing this knob in the first detent position (nose up or nose down) energizes the 28-volt d-c circuits to provide elevator trim. In the event of failure of the a-c elevator trim circuits, the a-c horizontal stabilizer circuit breaker switches *(10, figure 1-7)*, located on the pilot's right console, should be placed in the OFF position. If a failure occurs in the d-c circuits, the elevator trim switch located on the control wheel, or the elevator trim knob located on the control pedestal, may be used to provide elevator trim changes through the a-c circuits. In the event of failure of the d-c elevator trim circuits, the d-c horizontal stabilizer circuit breaker switch *(10, figure 1-7)*, located on the pilot's right console, should be placed in the OFF position.

MISCELLANEOUS EMERGENCY EQUIPMENT.

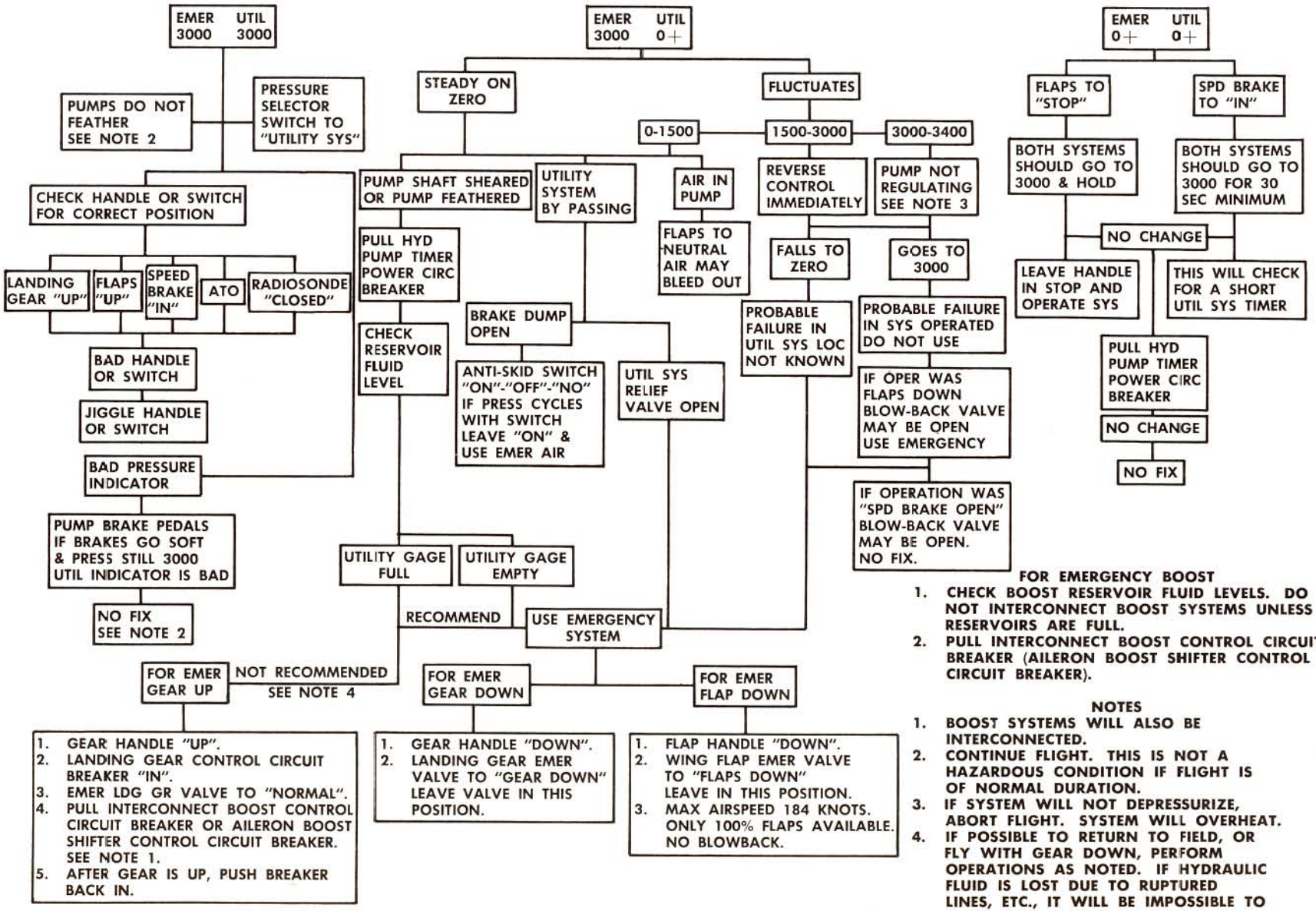
See figure 3-9, for location of miscellaneous emergency equipment.

CONDENSED CHECK LIST.

Pages 3-35 through 3-42 comprise the Condensed Check List and may be removed from this manual.

HYDRAULIC EMERGENCY CHART

IF OPERATION DOES NOT START OR IS INCOMPLETE



FOR EMERGENCY BOOST

1. CHECK BOOST RESERVOIR FLUID LEVELS. DO NOT INTERCONNECT BOOST SYSTEMS UNLESS RESERVOIRS ARE FULL.
2. PULL INTERCONNECT BOOST CONTROL CIRCUIT BREAKER (AILERON BOOST SHIFTER CONTROL CIRCUIT BREAKER).

NOTES

1. BOOST SYSTEMS WILL ALSO BE INTERCONNECTED.
2. CONTINUE FLIGHT. THIS IS NOT A HAZARDOUS CONDITION IF FLIGHT IS OF NORMAL DURATION.
3. IF SYSTEM WILL NOT DEPRESSURIZE, ABORT FLIGHT. SYSTEM WILL OVERHEAT.
4. IF POSSIBLE TO RETURN TO FIELD, OR FLY WITH GEAR DOWN, PERFORM OPERATIONS AS NOTED. IF HYDRAULIC FLUID IS LOST DUE TO RUPTURED LINES, ETC., IT WILL BE IMPOSSIBLE TO LOWER GEAR OR FLAPS.

Figure 3-10

WB-66-D CONDENSED CHECK LIST

ENGINE FAILURE.

ENGINE FAILURE DURING TAKE-OFF BEFORE LEAVING GROUND.

1. Throttles — IDLE.
2. Drag chute — DEPLOYED.
3. Brakes — As required.
4. Inoperative engine — Throttle OFF.

If not able to stop on prepared surface and terrain and conditions permit perform the following:

5. Other throttle — OFF.
6. Canopy hatches — JETTISON.
7. Landing gear lever — UP.
8. Fire control handles — Pull out.
9. Weather compartment ditching hatch — Remove after aircraft comes to rest.

ENGINE FAILURE DURING TAKE-OFF AFTER LEAVING GROUND.

1. Landing gear lever — UP immediately.
2. Flaps — UP at speed at 50 foot height.
3. External stores — JETTISON.

Perform steps 4 through 9 on the affected engine.

4. Throttle — OFF.
5. Master engine switch — OFF.
6. Fire control handle — PULL OUT.
7. Boost pump switch — OFF.
8. Alternator switch — OFF.
9. Generator switch — OFF.
10. Alert crew.

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WB-66-D CONDENSED CHECK LIST (Continued)

ENGINE FAILURE DURING FLIGHT.

1. Throttle — TAKE-OFF (on the operating engine).
2. Reduce drag — As required.

Perform steps 3 through 8 on the affected engine.

3. Throttle — OFF.
4. Master engine switch — OFF.
5. Fire control handle — Pull out.
6. Boost pump switches — As required.
7. Alternator switch — OFF.
8. Generator switch — OFF.
9. Fuel selector switch — As required.
10. Alert crew.

ENGINE RESTART INFLIGHT.

WINDMILLING ENGINE START.

1. Throttle — OFF.
2. Master engine switch — ON.
3. Fire control handle — Push in.
4. Boost pump switches — ON.
5. Fuel selector switch — As required.
6. Rpm — 13 to 23%.
7. Ignition switch — AIR START.
8. Throttle — IDLE.
9. Engine instruments — Within limits.
10. Ignition switch — NORMAL.

BLEED AIR ENGINE START.

1. Throttle — OFF.
2. Master engine switch — ON.

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WB-66-D CONDENSED CHECK LIST (Continued)

3. Fire control handle — Push in.
4. Boost pump switches — ON.
5. Fuel selector switch — As required.
6. Ignition switch — NORMAL.
7. Engine start switch — Right or left engine (as required).
8. Throttle — IDLE at 11% rpm.
9. Engine instruments — Within limits.

FIRE.

ENGINE FIRE ON THE GROUND DURING ENGINE START.

Perform steps 1 through 3 on the affected engine.

1. Throttle — OFF.
2. Fire control handle — Pull out.
3. Ignition switch — MOTOR.
4. If fire continues — SHUT DOWN.
5. Alert crew — Evacuate aircraft.

AFTER START OR IN MOTION.

Perform steps 1 through 5 on the affected engine.

1. Throttle — OFF.
2. Fire control handle — Pull out.
3. Notify tower.
4. Master engine switch — OFF.
5. Boost pump switch — OFF.
6. Alert crew.
7. Operating engine — SHUT DOWN.
8. Crew — Evacuate aircraft.

WB-66-D CONDENSED CHECK LIST (Continued)

ENGINE FIRE IN FLIGHT.

1. Throttle — TAKE-OFF.
2. Reduce drag — As required.

Perform steps 3 through 8 on the affected engine.

3. Throttle — OFF.
4. Master engine switch — OFF.
5. Fire control handle — Pull out.
6. Boost pump switch — As required.
7. Alternator switch — OFF.
8. Generator switch — OFF.
9. Fuel selector switch — As required.
10. Alert crew — Oxygen EMERGENCY, 100% all stations.

FUSELAGE FIRE.

1. Alert crew — Oxygen EMERGENCY, 100% all stations.
2. Determine source and isolate.
3. Cockpit pressure switch — DEPRESSURIZE.
4. Cockpit pressure control — DUMP.
5. Fire extinguisher — As required.
6. De-icing panel switches — As required.
7. Weather compartment air conditioning switch — RAM.

WING FIRE.

1. Alert crew — Oxygen EMERGENCY, 100% all stations.
2. Electrical equipment in affected wing — OFF.
3. De-icing panel switches — As required.
4. Determine damage — Continue flight at pilot's discretion.

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WB-66-D CONDENSED CHECK LIST (Continued)

ELECTRICAL FIRES.

1. Alert crew — Oxygen EMERGENCY, 100% all stations.
2. Isolate source — Turn OFF affected equipment.

If fire persists perform the following:

3. Cockpit pressure switch — DEPRESSURIZE.
4. Battery switch — EMERGENCY.
5. Flight instrument power switch — EMERGENCY.
6. Alternator switches — OFF.
7. Generator switches — OFF.
8. Fire extinguisher — As required.
9. Weather compartment master air conditioning switch — RAM.
10. Determine damage — Continue flight at pilot's discretion.

SMOKE AND FUME ELIMINATION.

1. Alert crew — Oxygen EMERGENCY, 100% all stations.
2. Cockpit pressure control — DUMP.
3. Cockpit pressure switch — DEPRESSURIZE.
4. Flight compartment entrance door — OPEN.
5. Weather compartment master air conditioning switch — RAM.
6. Descend to lower altitude if necessary.

BAIL OUT.

Immediate action required.

1. Pull up left pre-ejection lever to LOCK shoulder harness.
2. Pull up right pre-ejection lever to jettison hatch.
3. Squeeze trigger in right pre-ejection lever to eject seat.

If time and conditions permit.

1. Descend to 20,000 feet altitude or less, and reduce air speed to 450 knots IAS or less.

WB-66-D CONDENSED CHECK LIST (Continued)

2. Depressurize flight compartment.
3. Personal equipment check.
4. At altitude, actuate bail-out bottle.
5. Navigator and pilot manually move their seats AFT into ejection position and gunner stow control indicator.
6. Pilot-Jettison all 3 hatches simultaneously by pulling the emergency canopy removal handle.
7. Perform ejection seat operation.

LANDING EMERGENCIES.

WHEELS UP LANDING.

1. External stores — JETTISON.
2. External fuel tank pressure switch — TRANSFER.
3. Shoulder harness — LOCKED.
4. Seat ejection pins — INSTALLED.
5. Canopy hatches — Jettisoned by pilot.
6. Engines — Shutdown if time permits.
7. Weather compartment ditching hatch — Remove after aircraft comes to rest.

DITCHING.

PREPARATION FOR DITCHING.

1. Alert crew.
2. IFF and emergency keyer — EMERGENCY.
3. Transmit position and time on all available frequencies.
4. Seat ejection pins — Installed.
5. Canopy hatches — Jettisoned by pilot.
6. External stores — JETTISONED.

WB-66-D CONDENSED CHECK LIST (Continued)

7. External fuel tank pressure switch — TRANSFER.
8. Survival gear — In place.
9. Personal equipment — Checked, shoulder harness LOCKED.

HYDRAULIC EMERGENCIES.

LANDING GEAR EMERGENCY OPERATION.

1. Airspeed — Reduced.
2. Landing gear lever — DOWN.
3. Wing flap handle — STOP.
4. Landing gear control circuit breaker — OUT.
5. Landing gear manual override — PUSH TO LOWER.

If gear still does not extend.

6. Landing gear emergency handle — DOWN.

In the event that one main gear indicated up and locked, and the other main gear indicated down and locked, proceed as follows:

7. Landing gear control circuit breaker — IN.
8. Landing gear lever — UP.

After gear is down and locked.

9. Landing gear lever — DOWN.

MAIN GEAR DOOR SEQUENCE VALVE — EMERGENCY OPERATION.

In the event that one main gear indicates up and locked and the other main gear indicates down and locked and hydraulic pressure is normal proceed as follows:

1. Gear — Recycled.
2. Landing gear control circuit breaker — PULL OUT.
3. Landing gear emergency handle — GEAR DOWN.
4. Landing gear control circuit breaker — IN.

WB-66-D CONDENSED CHECK LIST (Continued)

5. Landing gear lever — UP.

After gear is down and locked.

6. Landing gear lever — DOWN.

WING FLAP EMERGENCY OPERATION.

1. Flap handle — DOWN.
2. Flap control circuit breaker — PULLED.
3. Flap manual override control — PUSH and HOLD.

If flaps do not extend.

4. Flap emergency handle — DOWN.

SPEED BRAKE EMERGENCY OPERATION.

1. Wing flap handle — STOP position, operate speed brake switch.

If speed brakes still do not operate.

2. Speed brake manual override control — PUSH or PULL as required.

BRAKE EMERGENCY OPERATION.

With normal utility pressure.

1. Anti-skid switch — OFF.

If brakes fail to operate.

2. Anti-skid switch — ON.
3. Emergency airbrake handle — PULL TO ARM.

Without utility pressure.

1. Anti-skid switch — ON.
2. Air brake handle — PULL TO ARM.

FLIGHT CONTROL SYSTEM EMERGENCY OPERATION.

1. Trim zero stick forces.
2. Boost release handle — PULL OUT.
3. Pitch attitude — Maintain with a-c trim.

description and operation of auxiliary equipment

Section IV

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HEATING, VENTILATING AND PRESSURIZATION SYSTEMS.

The aircraft is equipped with a heating and ventilating system *(figure 4-1)* which provides the flight compartment and the weather compartment with heated or cooled air. The nose radome and the forward and aft equipment compartments are cooled by ram air under all flight conditions. The weather compartment and flight compartment heating and ventilating systems are operated independently and provide automatic or manual temperature control. Electrical power for operation of the heating and ventilating system is supplied by both the d-c and a-c power supply systems.

The flight compartment and weather compartment pressurization systems *(figure 4-1)* utilize air supplied by the heating and ventilating system. The pressure at which either compartment is to be maintained is determined by the position of the control switches and is maintained by pressure regulators. The regulators (one for each compartment system) maintain pressure by controlling the discharge of conditioned air from the compartments. If the differential pressure in either compartment exceeds 5.35 psi, the respective compartment safety valve opens automatically and bleeds the excess pressure overboard.

CAUTION

If the flight compartment door cannot be opened, cabin pressurization should be suspected. Depressurization can be accomplished by either moving the cockpit pressure switch on the air conditioning panel to DEPRESSURIZE or the cockpit pressure control on the gunner's forward console to DUMP.

FLIGHT COMPARTMENT TEMPERATURE CONTROLS.

Note

The flight compartment pressure switch incorporates the function of an air-conditioning master switch, and must be placed in either the COMBAT or NORMAL position for operation of the flight compartment heating, ventilating, and pressurization systems.

FLIGHT COMPARTMENT TEMPERATURE CONTROL SWITCH.

The flight compartment temperature control switch is mounted on the air conditioning control panel *(1, figure 1-8)* on the pilot's left forward console. This switch has three placarded positions: AUTO, HOT, and COLD. In the AUTO position, the temperature sensing elements maintain the flight compartment temperature at the setting selected on the temperature selector rheostat. The center position of the switch cuts the temperature sensing elements out of the circuit, and the system continues to operate at the last setting. The switch must be held in the spring-loaded HOT or COLD manual position to operate the hot air bypass valve for hot or cold airflow into the flight compartment as desired. Approximately 12 seconds are required to position the bypass valve from full closed (cold) to full open (hot), or vice versa.

FLIGHT COMPARTMENT TEMPERATURE SELECTOR RHEOSTAT.

The flight compartment temperature selector rheostat, mounted on the air conditioning control panel *(1, figure 1-8)* on the pilot's left forward console, is used to select a desired flight compartment temperature from COLD to HOT. This rheostat determines the temperature at which the flight compartment will be maintained, provided the temperature control switch is in the AUTO position.

Note

During small changes in temperature settings, an immediate temperature change will not be noted. The temperature change will be gradual to prevent overshooting the selected temperature.

PILOT'S FOOTWARMER CONTROL HANDLE.

A pilot's footwarmer control handle (45, figure 1-9) is located on the left side of the control pedestal immediately below the main instrument panel. The control handle is a mechanical push-pull type that ports air from the cockpit conditioned air duct to the pilot's feet. The control is unlocked by turning the handle in a counterclockwise direction. When the desired amount of airflow is obtained, the control may be locked in any intermediate position by turning the handle in a clockwise direction.

WEATHER COMPARTMENT TEMPERATURE CONTROLS.

WEATHER COMPARTMENT MASTER AIR CONDITIONING SWITCH.

A 2-position master air conditioning switch located on the air conditioning control panel on the No. 2 observer's side panel, has NORMAL and RAM AIR placarded positions. In the NORMAL position, a flow-limiting and shutoff valve opens to supply engine bleed air for heating, ventilating, and pressurization of the weather compartment. In the RAM AIR position, engine bleed air supplied to the weather compartment is shut off and the compartment is ventilated by ram air. The master switch must be placed in the NORMAL position for operation of the heating, ventilating, and pressurization systems.

WEATHER COMPARTMENT TEMPERATURE CONTROL SWITCH.

The weather compartment temperature control switch is mounted on the air conditioning control panel on

(Continued on Page 4-6)

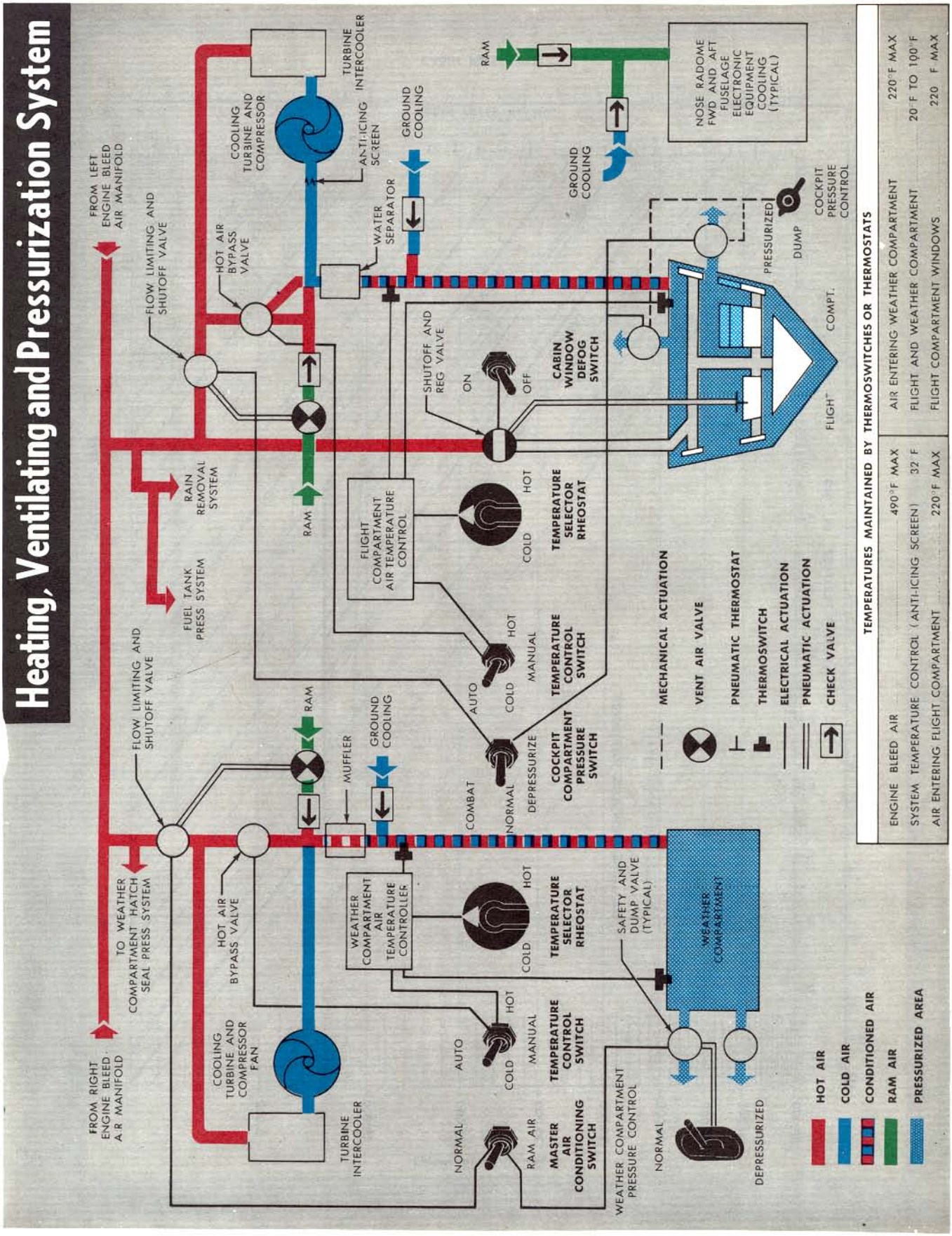
Heating, Ventilating and Pressurization System
FROM LEFT ENGINE BLEED AIR MANIFOLD
FLOW LIMITING AND SHUTOFF VALVE
HOT AIR BYPASS VALVE
COOLING TURBINE AND COMPRESSOR
TURBINE INTERCOOLER
ANTI-ICING SCREEN
GROUND COOLING
WATER SEPARATOR
RAM
NOSE RADOME FWD AND AFT FUSELAGE ELECTRONIC EQUIPMENT COOLING (TYPICAL)
GROUND COOLING
PRESSURIZED
DUMP
COCKPIT PRESSURE CONTROL
COMPT.
FLIGHT
SHUTOFF AND REG VALVE
ON
OFF
CABIN WINDOW DEFOG SWITCH
RAIN REMOVAL SYSTEM
FUEL TANK PRESS SYSTEM
FLIGHT COMPARTMENT AIR TEMPERATURE CONTROL
HOT
COLD
TEMPERATURE SELECTOR RHEOSTAT
HOT
MANUAL
AUTO
COLD
TEMPERATURE CONTROL SWITCH
RAM
GROUND COOLING
MUFFLER
FLOW LIMITING AND SHUTOFF VALVE
COMBAT
NORMAL
DEPRESSURIZE
COCKPIT COMPARTMENT PRESSURE SWITCH
MECHANICAL ACTUATION
VENT AIR VALVE
PNEUMATIC THERMOSTAT
THERMOSWITCH
ELECTRICAL ACTUATION
PNEUMATIC ACTUATION
CHECK VALVE
TEMPERATURES MAINTAINED BY THERMOSWITCHES OR THERMOSTATS
ENGINE BLEED AIR 490°F MAX
SYSTEM TEMPERATURE CONTROL (ANTI-ICING SCREEN) 32°F
AIR ENTERING FLIGHT COMPARTMENT 220°F MAX
AIR ENTERING WEATHER COMPARTMENT 220°F MAX
FLIGHT AND WEATHER COMPARTMENT 20°F TO 100°F
FLIGHT COMPARTMENT WINDOWS 220 F MAX
TO WEATHER COMPARTMENT HATCH SEAL PRESS SYSTEM
HOT AIR BYPASS VALVE
WEATHER COMPARTMENT AIR TEMPERATURE CONTROLLER
HOT
COLD
TEMPERATURE SELECTOR RHEOSTAT
SAFETY AND DUMP VALVE (TYPICAL)
WEATHER COMPARTMENT
FROM RIGHT ENGINE BLEED AIR MANIFOLD
COOLING TURBINE AND COMPRESSOR FAN
TURBINE INTERCOOLER
NORMAL
AUTO
HOT
COLD
MANUAL
TEMPERATURE CONTROL SWITCH
RAM AIR
MASTER AIR CONDITIONING SWITCH
WEATHER COMPARTMENT PRESSURE CONTROL
NORMAL
DEPRESSURIZED
HOT AIR
COLD AIR
CONDITIONED AIR
RAM AIR
PRESSURIZED AREA
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Figure 4-1

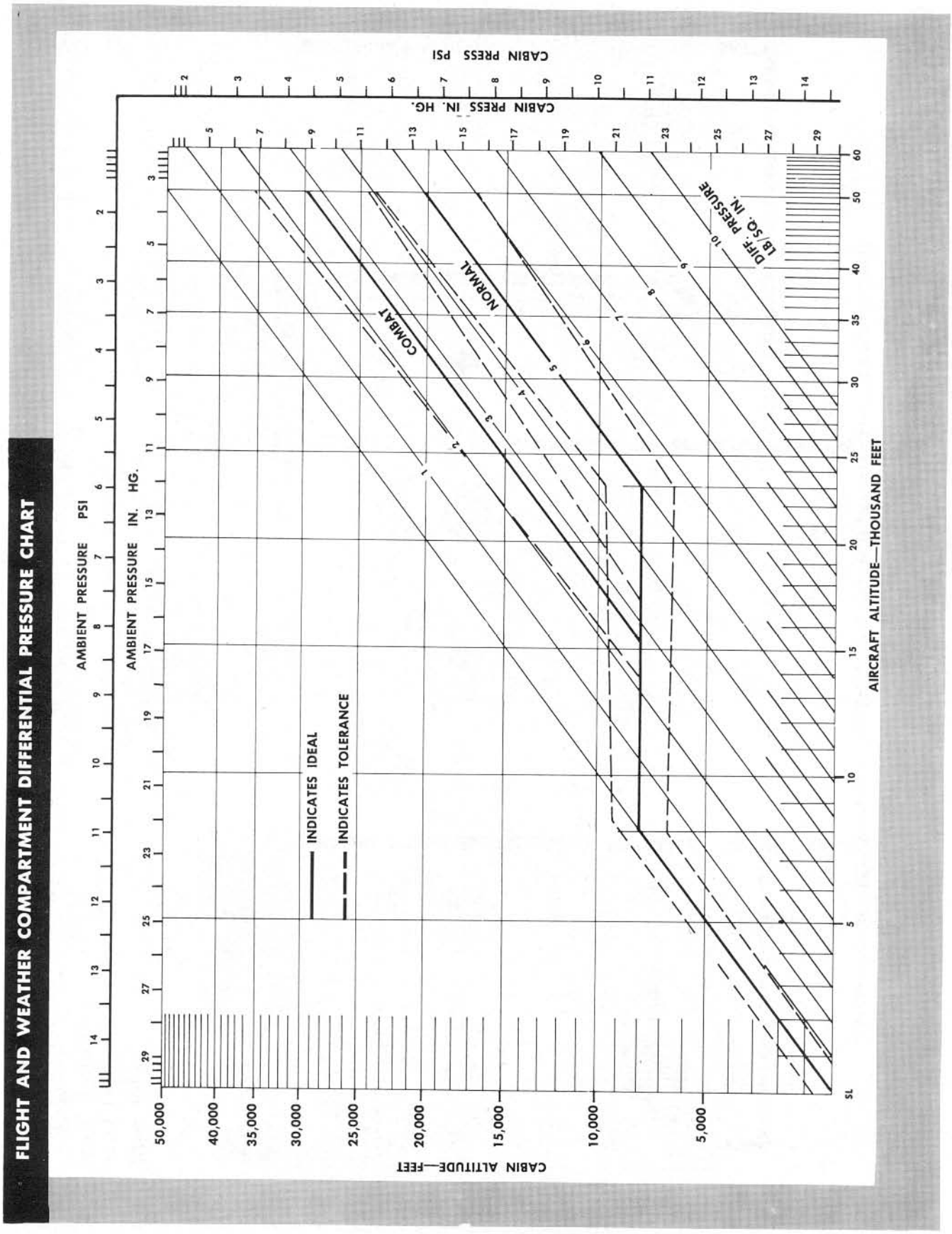

Figure 4-2

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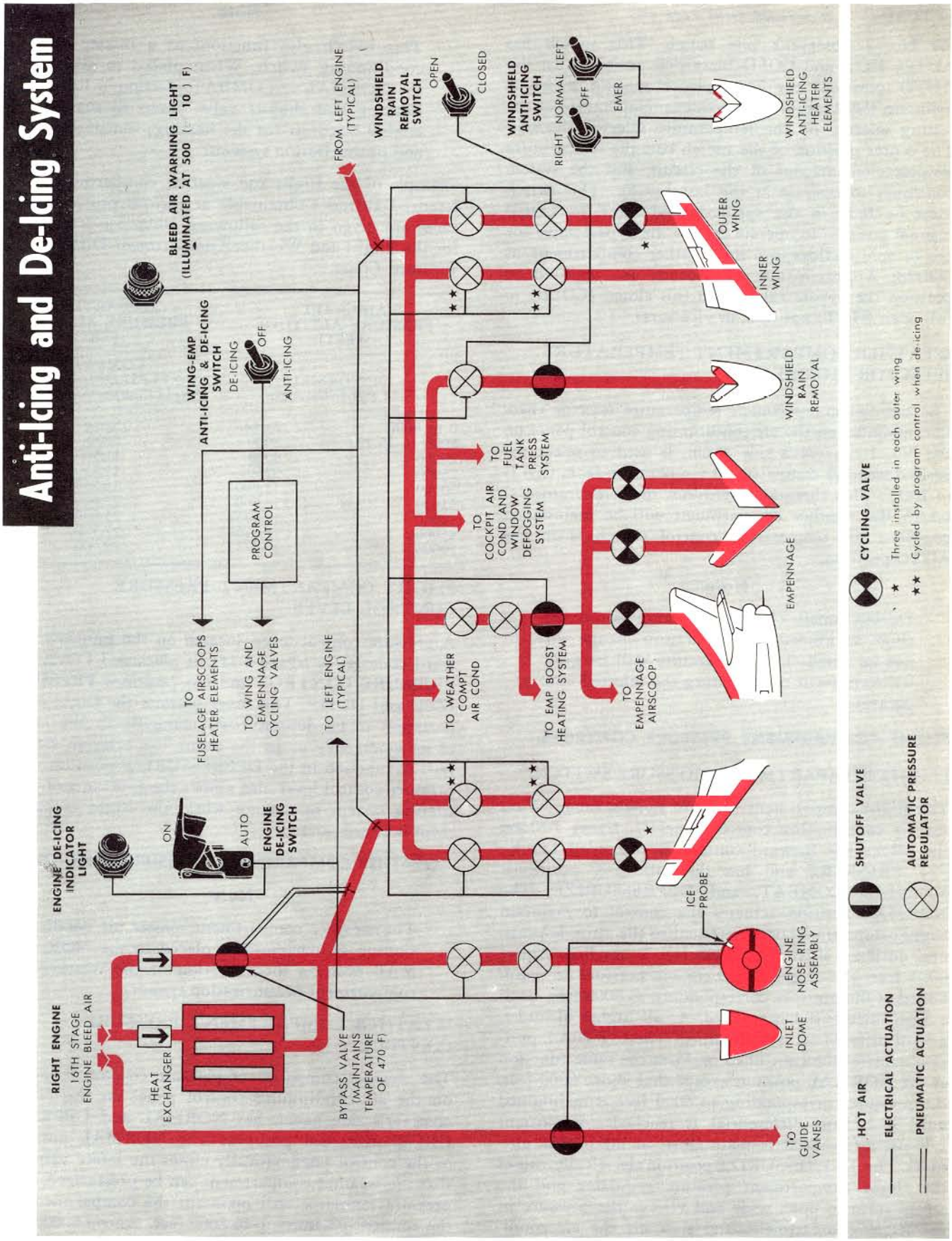

1527B

Figure 4-3

(Continued from Page 4-2)

the No. 2 observer's side panel. This switch has AUTO, HOT and COLD placarded positions. In the AUTO position, the temperature sensing elements maintain the weather compartment temperature at the setting selected on the temperature selector rheostat. The center position of the switch cuts the temperature sensing elements out of the circuit, and the system continues to operate at the last setting. The switch must be held in the spring-loaded HOT or COLD manual position to operate the hot air bypass valve for hot or cold airflow into the weather compartment, as desired. Approximately 12 seconds are required to position the bypass valve from full closed (COLD) to full open (HOT) position, or vice versa.

WEATHER COMPARTMENT TEMPERATURE SELECTOR RHEOSTAT.

The weather compartment temperature selector rheostat, mounted on the air conditioning control panel on the No. 1 observer's side panel, is used to select the desired weather compartment temperature from COLD to HOT. This rheostat determines the temperature at which the weather compartment will be maintained provided the temperature control switch is in the AUTO position.

Note

During small changes in temperature settings, an immediate temperature change will not be noted. The temperature will be gradual to prevent overshooting the selected temperature.

FLIGHT COMPARTMENT PRESSURE CONTROLS.

FLIGHT COMPARTMENT PRESSURE SWITCH.

The flight compartment pressure switch, mounted on the air conditioning control panel *(1, figure 1-8)* on the pilot's left forward console, is placarded COCKPIT PRESSURE and has the following positions: NORMAL, COMBAT, and DEPRESSURIZE. The NORMAL position actuates the control to maintain flight compartment pressure equal to the altitude pressure, until an altitude of 8000 feet is reached. Above 8000 feet, the flight compartment pressure is maintained at the pressure corresponding to 8000 feet, until a 5-psi differential is reached. At all higher altitudes, a 5-psi differential is maintained. The COMBAT position actuates the control to perform the same function as the NORMAL position except that above 8000 feet, the pressure corresponding to 8000 feet is maintained until a 2.75-psi differential is reached. A constant 2.75-psi differential is maintained at all higher altitudes. The DEPRESSURIZE position electrically causes the flight compartment pressure regulator and the safety valve to open wide and relieve the pressure in the flight compartment, and shut off the air conditioning system. Ram air will then automatically be supplied to the flight compartment for ventilation.

Note

This switch also functions as a master air conditioning switch. When placed in either the NORMAL or COMBAT position, a flow-limiting and shutoff valve opens to supply engine bleed air for the heating, ventilating, and pressurization systems.

Example of the flight and weather compartment differential altitudes obtainable at various pressure altitudes are given in the following table. See *figure 4-2* for the Flight and Weather Compartment Differential Pressure Chart.

AIRCRAFT PRESSURE ALTITUDE (FEET)	COMPARTMENT PRESSURE ALTITUDE (FEET)	
	NORMAL *5 PSI Differential*	COMBAT *2.75 PSI Differential (Flight Compartment Only)*
0 to 8000	Same	Same
8000 to 15,400	8000	8000
20000	8000	11,500
25000	9250	15,250
30000	12,000	18,750
35000	14,500	22,000
40000	16,625	25,000
45000	18,625	27,500
50000	20,375	29,500

FLIGHT COMPARTMENT PRESSURE CONTROL LEVER.

A pressure control lever, located on the gunner's forward console *(3, figure 4-11)*, is placarded COCKPIT PRESSURE CONTROL and has positions PRESSURIZED and DUMP. This lever permits the flight compartment to be depressurized manually in the event of an emergency or in the event the pressure switch fails to function in the DEPRESSURIZE position. The pressure control lever also allows the heating and ventilating system to operate while the flight compartment is depressurized.

WEATHER COMPARTMENT PRESSURE CONTROLS.

Note

The weather compartment master air conditioning switch must be placed in the NORMAL position for operation of the weather compartment pressurization system.

WEATHER COMPARTMENT PRESSURE CONTROL.

The weather compartment pressure control, mounted on the air conditoning control panel on the No. 2 observer's side panel, has NORMAL and DEPRESSURIZE placarded positons. The NORMAL position of the control pneumatically closes the safety valve so that the weather compartment can be pressurized. The pressure regulator will maintain the compartment at the ambient pressure up to 8000 feet. Above 8000 feet, the compartment pressure altitude remains at 8000 feet until a 5-psi differential is reached. A constant

5-psi differential between compartment pressure and ambient pressure is maintained at all higher levels. The DEPRESSURIZE position pneumatically opens the safety valve to depressurize the weather compartment.

HEATING, VENTILATING, AND PRESSURIZATION SYSTEMS — NORMAL OPERATION.

FLIGHT COMPARTMENT.

The flight compartment air conditioning system and pressurization system can be set for normal operation as follows:

1. Pressure control lever (gunner's station) — PRESSURIZED.
2. Cabin window defog switch — OFF.
3. Pressure switch — NORMAL or COMBAT, as desired.
4. Temperature control switch — AUTO.
5. Temperature selector rheostat — Set as desired.

WEATHER COMPARTMENT

The weather compartment air conditioning and pressurization systems can be set for normal operation as follows:

1. Master air conditioning switch — NORMAL.
2. Pressure control — NORMAL.
3. Temperature control switch — AUTO.
4. Temperature selector rheostat — set as desired.

HEATING, VENTILATING, AND PRESSURIZATION SYSTEMS — EMERGENCY OPERATION.

FLIGHT COMPARTMENT.

In the event of failure of the flight compartment automatic temperature control, perform the following:

1. Temperature control switch — Off (centered). Control temperature by depressing the switch to the manual HOT or COLD position, as desired.
2. Cabin window defog switch — As required.

If it becomes necessary to depressurize the flight compartment in an emergency (such as inadequate airflow, fog, or for rapid smoke dissipation), proceed as follows:

1. Pressure switch — DEPRESSURIZE.
2. Pressure control lever (gunner's station) — DEPRESSURIZE, if necessary.

WEATHER COMPARTMENT.

In the event of failure of the weather compartment automatic temperature control, perform the following:

1. Temperature control switch — Off (centered). Control temperature by depressing the switch to the manual HOT or COLD position, as desired.

If it becomes necessary to depressurize the weather compartment in an emergency (such as inadequate airflow, fog, or for rapid smoke dissipation), proceed as follows:

1. Master air conditioning switch — RAM.
2. Pressure control — DEPRESSURIZE, if necessary.

DEFOGGING SYSTEM.

FLIGHT COMPARTMENT WINDOW DEFOGGING SYSTEM.

The flight compartment side panel and overhead center panel windows are defogged by jetting part of the conditioned air supplied to the flight compartment across the surface of the windows or between the panes of the double windows *(figure 4-1)*. Under most defogging conditions, the conditioned air will keep the windows clear. Severe fog is removed from the windows by placing the cabin window defog switch on the de-icing control panel *(2, figure 1-7)* in the ON position to supply additional hot air to the windows.

CABIN WINDOW DEFOG SWITCH.

The cabin window defog switch, mounted on the de-icing control panel *(2, figure 1-7)* on the pilot's left console, has the placarded positions ON and OFF. The ON position energizes a 28-volt d-c circuit to a solenoid valve to open and supply additional hot air at the window openings. The defogging air is regulated by the thermostatic control to maintain a temperature of 88°C (190°F) at the bottom of the windows.

ANTI-ICING AND DE-ICING SYSTEMS.

ENGINE ANTI-ICING SYSTEM.

An automatic anti-icing system is provided for the inlet dome, guide vanes, and nose ring assembly of each engine *(figure 4-3)*. When icing conditions are encountered, and ice forms on the detector (located on the inlet duct of each engine) the static pressure is decreased causing valves to open to admit hot engine bleed air to the engine anti-cing system and simultaneously causes the engine anti-icing indicator light (at the pilot's station) to illuminate. Heating elements within each detector are turned on automatically to de-ice the detector once ice has formed. The detector in each nacelle cycles through its icing and de-icing periods individually to provide continuous operation of the engine anti-icing system. A switch is provided at the pilot's station to place the engine anti-icing system in automatic operation or to place the system in continuous operaion by over-riding the sensing detector control. An indicator light at the pilot's station is illuminated when hot air is supplied to the engine anti-icing system.

WARNING

The engine automatic anti-icing system and indicator light have been disconnected. To de-ice the engine, place the de-icing switch in the ON position.

ENGINE ANTI-ICING SWITCH.

A guarded 2-position, engine anti-icing switch, mounted on the de-icing control panel *(2, figure 1-7)*, is placarded ON and AUTO. When the guard is closed, the switch is in the AUTO position, allowing the anti-icing of the engine inlet domes, guide vanes, and nose ring assemblies to be controlled automatically by the ice sensing probes. The ON position of the switch cuts the sensing probes out of the 28-volt d-c circuit and opens the valves to provide a continuous supply of hot air for anti-icing of the inlet dome, guide vanes, and nose ring assemblies.

CAUTION

The anti-icing switch must be in the OFF position during take-off, or loss of power will result.

WARNING

To prevent damage to the engines from overheat, the automatic anti-icing system for the engines is electrically disengaged when the aircraft is on the ground. If icing of the engines should occur during ground operation, place the engine anti-icing switch on the de-icing control panel *(2, figure 1-7)* in the ON position. When the engines are stopped, or after take-off, place the engine anti-icing switch in the ON position. Care must be taken when using the ON position, since hot air will be supplied to the inlet dome, guide vanes, and nose ring assemblies, continuously, whether the aircraft is in icing conditions or not.

ENGINE ANTI-ICING INDICATOR LIGHT.

A 28-volt d-c press-to-test indicator light is mounted above the engine anti-icing switch on the de-icing control panel *(2, figure 1-7)*. When the inlet dome, guide vanes, and nose ring assemblies are being supplied with hot air from the anti-icing system, the light will be illuminated. The indicator light will also illuminate, and remain illuminated, when the engine anti-icing switch is placed in the ON position. In addition, this indicator light serves as a warning to the pilot that other anti-icing and de-icing systems should be turned on, if icing conditions warrant.

WINDSHIELD ANTI-ICING AND DEFOGGING SYSTEM.

Ice, snow, or fog is removed or prevented from forming on the front windshields by an electrical anti-icing and defogging system, using heater elements imbedded in each of the windshield panels *(figure 4-3)*. A-c power is provided for the operation of the windshield anti-icing and defogging system. Windshield heater power is controlled by switches at the pilot's station.

Note

The front and rear triangle portions of the windshield are not heated. Therefore, ice may form on these portions. However, this build-up is not considered hazardous to flight.

WINDSHIELD ANTI-ICING AND DEFOGGING SWITCHES.

Two windshield anti-cing and defogging switches (one for each windshield) are located on the de-icing control panel *(2, figure 1-7)*, and have the following placarded positions: NORMAL, OFF, and EMERGENCY. When either switch is placed in the NORMAL position, a 28-volt d-c circuit actuates relays to provide a-c power for operation of the front windshields heater elements. Under most conditions of fog, ice, or snow, the NORMAL position will be sufficient to keep the front windshields clear.

CAUTION

To insure adequate defogging, the windshield anti-icing and defogging switches must be left in the NORMAL position for all flights from take-off to landing.

CAUTION

Ground operations (in the NORMAL position) should be limited to very short periods to prevent damage to the windshield. Under no conditions should the EMERGENCY position be used during ground operations.

The EMERGENCY position of the windshield switches should be used only when the NORMAL position is not capable of keeping the windshield clear.

CAUTION

The NORMAL position must always be used for warm-up, prior to switching to the EMERGENCY position.

AIRCRAFT ANTI-ICING AND DE-ICING SYSTEM.

The leading edges of the wings, engine pylons, and empennage are de-iced or anti-iced, and the empennage airscoop, is anti-iced by hot engine bleed air *(figure 4-3)*. The bleed air is ducted through the distribution system to primary and secondary pressure regulators which automatically regulate the pressure of the hot air being supplied to the various sections. Normally de-icing is used; however, in case the de-icing system malfunctions and fails to provide adequate ice protection, anti-icing may be used. A switch is provided at the pilot's station to select either de-icing or anti-icing for the wings, engine pylons, and empennage. For de-icing, the outer wings and empennage are divided into sections, and by means of cycling valves, are arranged to cycle by program control, so that normally, only one section is being de-iced at a time. Cycling operation for the inner wing sections and engine pylons is provided by the primary pressure regulator valve (one for each inner wing section), which is opened or closed by the program control to perform the same function as the cycling valves in the outer wing sections. An overheat switch is installed in each section to prevent overheating of the aircraft surface. When the surface temperature exceeds approximately 60°C (140°F), the overheat switch causes the supply of hot air to that section to be shut off, even though the cycle time is only partially elapsed. The de-icing function of the system is dependent upon the program control. This control is connected to a temperature sensing element in one of the ram airscoops and to the true airspeed computer. As the airspeed and ram air temperature vary, the program control causes the heating time for each section to vary accordingly. When the ram air temperature is above 3.4°C (26°F), and de-icing operation is selected, anti-icing will be automatically provided for the wings, engine pylons, and empennage.

When anti-icing is used, the program control is bypassed and a continuous supply of hot bleed air is provided to all sections. During anti-icing, the overheat switches in each section will cause the system to shut off if any one section is overheated.

The empennage airscoop is anti-iced by a continuous supply of engine bleed air when either de-icing or anti-icing operation is selected. The pitot masts and fuselage airscoops are anti-iced by heater elements embedded in each installation. A switch is provided at the pilot's station to turn on the pitot heater. The heating elements in the fuselage scoops are automatically turned on when either de-icing or anti-icing operation is selected.

WING AND EMPENNAGE ANTI-ICING AND DE-ICING SWITCH.

The wing and empennage, anti-cing and de-icing switch, located on the de-icing control panel *(2, figure 1-7)*, has the placarded positions ANTI-ICING, OFF, and DE-ICING. This switch, when positioned to either ANTI-ICING or DE-ICING, closes the circuits to supply the necessary 28-volt d-c and 115-volt a-c power for automatic anti-icing and de-icing operation. In the DE-ICING position, the wings, engine pylons and empennage are de-iced and the wing tip radomes and empennage airscoop are anti-iced. In addition, the ANTI-ICING or DE-ICING positions of the switch energize the heater elements in the fuselage airscoops.

WARNING

The wing and empennage anti-icing and de-icing switch must be turned OFF when operating in ambient temperatures above 4.4 C (40 F).

BLEED AIR OVERHEAT WARNING LIGHT.

A 28-volt d-c press-to-test bleed air overheat warning light is located on the main instrument panel *(3, figure 1-9)*. A sensing element, located in the bleed air supply duct downstream of the bypass valve *(figure 4-3)*, will cause the light to illuminate if the bleed air temperature is above 500° (±10°)F.

CAUTION

The illumination of the bleed air overheat warning light for a momentary period is not of sufficient duration to cause structural overheat; however, if the warning light remains illuminated, a malfunction of the bypass valve is indicated. Continuous operation of the anti-icing and de-icing system with the warning light illuminated, may cause structural overheat damage.

PITOT HEATER SWITCH.

The pitot tube is heated by a 28-volt d-c heater element when the pitot heater switch, located on the de-icing control panel *(2, figure 1-7)*, is placed in the ON position. Power is available from the generator under normal operation, or the battery bus during emergency operation.

WINDSHIELD RAIN REMOVAL SYSTEM.

The windshield rain removal system utilizes hot engine bleed air to clear rain from the pilot's windshield *(figure 4-1)*. The hot air is routed through a pressure regulator and shutoff control valve to the windshield. A switch is provided at the pilot's station for rain removal control.

Note

The windshield rain removal system is inoperative, except on aircraft modified by T.O. 1B-66-765.

Table of Communication and Associated Electronics Equipment

TYPE	DESIGNATION	USE	OPERATOR	RANGE	LOCATION OF CONTROLS
UHF Command Radio	AN/ARC-27	Two-way voice communication	Pilot	Line of sight 200 nautical miles	Pilot's right console
Liaison Radio	AN/ARC-21	Two-way voice communication	Pilot	Up to 2500 nautical miles	Weather Observer position No. 2 (Can set special frequencies)
Teletype and Converter	TT-76/GGC CV-357/A	Two-way teletype communication	Weather Observer No. 2	Up to 2500 nautical miles	Weather Observer position No. 2
Instrument Approach	AN/ARN-18	Glide slope ILAS Landing	Pilot	15 nautical miles	Pilot's right console
OMNI Range VHF	AN/ARN-14	Navigation and localizer	Pilot	Line of sight 200 nautical miles	Pilot's right console
Marker Beacon	AN/ARN-12	Reception of location marker beacon signals from instrument approach stations	Pilot	Over beacon up to 30,000 feet elevation	Main instrument panel
Radar Set	AN/APS-63	Navigation search	Navigator	Line of sight (200 nautical miles for navigational search)	Navigator's forward console — lower
Pressurization Kit	AN/ASQ-15	Pressurization circuit control	Gunner	Not applicable	Gunner's left console
Interphone	AN/AIC-10	Intercrew communication	All crew members	Not applicable	Control panel at each crew member's station
Emergency Keyer	AN/ARA-26	In case of emergency, automatically channels and operates command transmitter	Pilot	Up to 2500 nautical miles	Pilot's left console
Radio Altimeter	SCR-718E	Absolute altitude indications	Weather Observer No. 1	Line of sight 40,000 feet elevation over land or water	Weather Observer position No. 1
Recorder	AN/ANH-2	Sound recording	All personnel	Not applicable	Weather Observer position No. 2 and Pilot
Navigation Radar	AN/APN-82	Automatic aircraft ground position indicator	Navigator	Not applicable	Navigator's forward console — lower
Radio Compass ADF	AN/ARN-6	Navigation	Pilot	Up to 1000 nautical miles (Depends on power output of ground station)	Pilot's right console

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Figure 4-4

WINDSHIELD RAIN REMOVAL SWITCH.

The windshield rain removal switch *(2, figure 1-7)*, located on the pilot's left forward console, has the placarded positions, OPEN and CLOSED. When the switch is placed in the OPEN position, a 28-volt d-c circuit is energized to open the solenoid-operated shutoff valve and admit hot engine bleed air through the nozzle to the windshield, and to simultaneously shut off electrical power to the left windshield anti-icing system. When the switch is placed in the CLOSED position, electrical power is restored to the left windshield anti-icing system, the shutoff valve is closed, and the system is inoperative.

ANTI-ICING AND DE-ICING SYSTEMS — NORMAL OPERATION.

1. Wing and empennage, anti-icing and de-icing switch — DE-ICING.

Note

When ambient temperatures are above 3.5°C (26°F), anti-icing is automatically provided, regardless of whether the wing and empennage anti-icing switch is in the ANTI-ICING or DE-ICING position.

2. Engine anti-icing switch — As required.
3. Windshield anti-icing and defogging switches — NORMAL.

CAUTION

In the event the bleed air overheat warning light illuminates during flight and remains illuminated, reduce power (conditions permitting) first on one engine and then the other, in order to lower bleed air temperatures (warning light out). If the warning light continues to burn, turn OFF the wing and empennage anti-icing and de-icing switch and position the engine anti-icing switch to AUTO. If actual icing is encountered and operation of the anti-icing and de-icing system is necessary, place the wing and empennage anti-icing and de-icing switch in the ANTI-ICING position and operate for short intervals of time, as required, for removal of ice. If possible, change altitude or course and fly out of icing conditions.

COMMUNICATION AND ASSOCIATED ELECTRONIC EQUIPMENT.

TT-76/GGC TELETYPEWRITER.

The TT-76/GGC teletypewriter, control panel and AN/ARC-21 radio controls are located at the number 2 weather observer's station *(figure 4-16)*. The teletypewriter utilizes the AN/ARC-21 Liaison radio for two-way communication from airplane to airplane and from airplane to ground. The unit is capable of transmitting or receiving 60 words per minute utilizing the CV-357/A converter and AN/ARC-21 radio. Provisions are made for storage of chad, prepared tape, and waste tape. For reception, the equipment provides the best teletype signal when not subjected to interference and the irregularities common to radio transmission. It will, however, give accurate conversion up to the point where the noise level is approximately equal to or greater than the signal. The temperature limit for proper operation is from 0°C to 55.6°C and the altitude rating for the unit is 15,000 feet.

ENERGIZING PROCEDURES.

1. Apply power to the system.
2. Preset the channel control on the C-451/ARC-21 control panel to the authorized frequency *(4, figure 4-19)*.
3. Permit the AN/ARC-21 radio to tune, then place the function selector switch to FSK *(8, figure 4-19)*.
4. Position the power switch on the CV-357/A converter to ON, *(4, figure 4-16)* and allow a two minute warmup period.

Note

The power switch on the CV-357/A converter should be left in the ON position since the converter is turned off and on as a function of the AN/-ARC-21 radio.

5. After the initial warmup period, tune the CV-357/A converter, *(4, figure 4-16)* position the tune-operate switch to OPERATE, and the AFC switch to ON.

Note

Approximately 10 minutes is required for the equipment to warmup.

6. Position the motor, light, and power switches on the TT-76/GGC teletypewriter to ON (1, *figure 4-17)*.

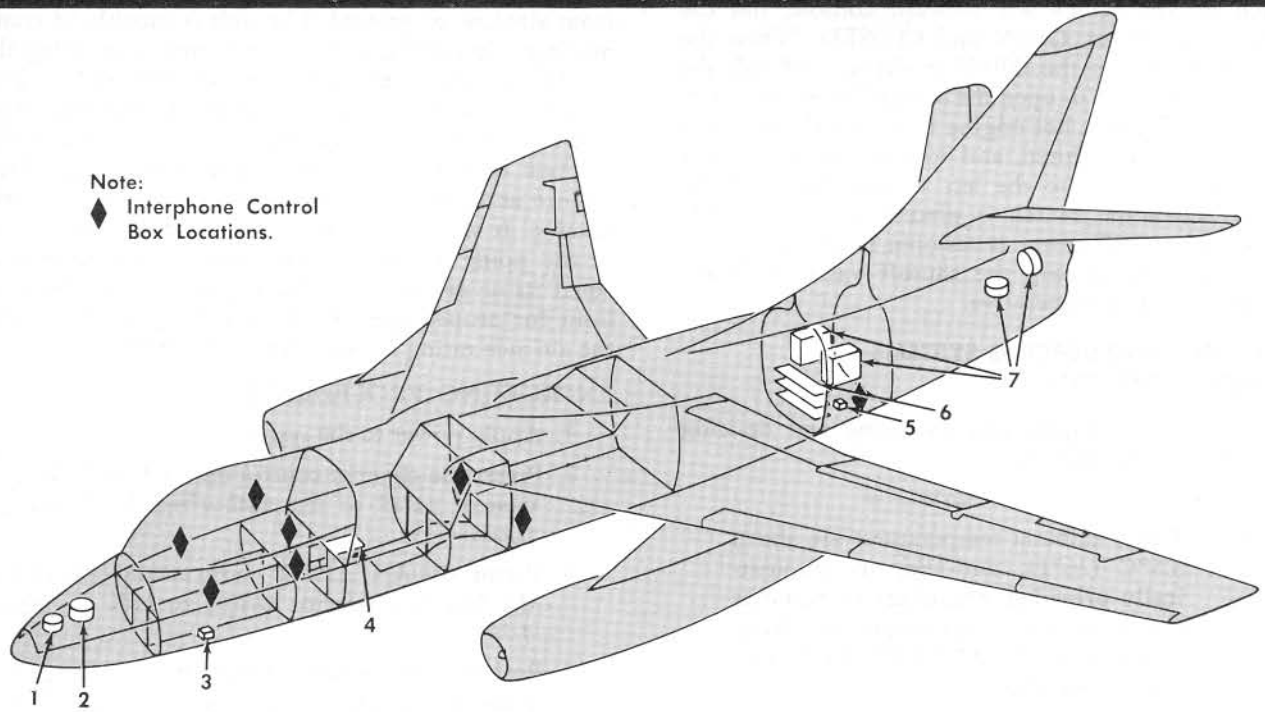
Note

The equipment is in the standby condition and additional warmup periods are not necessary.

TO TRANSMIT.

1. Position the transmit-receive switch *(2, figure 4-16)* on the FSK control panel to TRANSMIT.
2. Position the selector switch on the TT-76/GGC teletypewriter to number 1 *(5, figure 4-17)*.
3. Position the keyboard lock switch to SEND *(3, figure 4-17)*.

Communication and Associated Electronic Equipment



1. AN/APS-63 MODULATOR
2. AN/APS-63 RECEIVER-TRANSMITTER
3. AN/ARN-18 RECEIVER
4. RACK INSTALLATION-EQUIPMENT AN/ARN-6 RECEIVER
5. EMERGENCY KEYER
6. RACK INSTALLATION-EQUIPMENT AN/ARN-12 RECEIVER AN/ARC-21 RECEIVER-TRANSMITTER AN/ARC-27 RECEIVER-TRANSMITTER
7. MD-1A FIRE CONTROL RADAR INSTALLATION

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Figure 4-5

4. Type the desired message on the keyboard. No record will be made of the message.

TO RECEIVE TRANSMISSIONS.

1. Position the transmit-receiver switch on the FSK control panel to RECEIVE *(2, figure 4-16)*.
2. Position the selector switch on the TT-76/GGC teletypewriter to NUMBER 1 *(5, figure 4-17)*.
3. Position the keyboard lock switch to LOCK *(3, figure 4-17)*.

TO PREPARE TAPE

1. Position the selector switch on the TT-76/GGC teletypewriter to number 2 or 3 *(5, figure 4-17)*.

Note

With the selector switch positioned in number 2, tape may be prepared while a message is being transmitted by the tape transmitter.

2. Position the keyboard switch to SEND *(3, figure 4-17)*.

TO TRANSMIT PREPARED MESSAGE.

1. Position the selector switch on the TT-76/GGC teletypewriter to number 1 or 2 *(5, figure 4-17)*.
2. Position the keyboard lock switch to LOCK *(3, figure 4-17)*.
3. Position the start-stop lever on the tape transmitter to START *(11, figure 4-17)*.

Note

The tight-tape lever will stop the operation of the transmitter if the loop of tape between the perforator and transmitter becomes short enough to lift the tight-tape lever from its down position *(10, figure 4-17)*.

DEENERGIZING PROCEDURES.

1. Position the motor, light and power switches to OFF *(1, figure 4-17)*.
2. Position the AN/ARC-21 function selector switch out of FSK operation *(8, figure 4-19)*.
3. All power is removed from the set.

KEYBOARD CONTROLS.

The following chart lists the various controls and switches used in the operation of teletypewriter set TT-76/GGC (Figure 4-17). The operator must become familiar with the location and funcation of each control before attempting to operate the set.

CONTROL	LOCATION	FUNCTION
Power switch	In left side of keyboard guard arssembly.	ON position connects a-c input to set. OFF position disconnects a-c input to set.
Motor switch	In left side of keyboard guard assembly.	ON position connects a-c power to the motor. OFF position disconnects a-c power to the motor.
Break switch	In right side of the keyboard guard assembly.	Push-button switch. When it is depressed, opens, signal circuit. When released, closes signal line circuit.
Keyboard switch	In right side of keyboard guard assembly.	SEND position permits keyboard transmission. LOCK position prevents keyboard transmission.
End-of-line indicator	In left panel of keyboard guard assembly.	Lights to indicate that the end of a standard line of typing is near. Carriage return signal extinguishes the lamp.
Light switch	In left side of keyboard guard assembly.	ON position lights the copy light. OFF position extinguishes the copy light.
Manual tape feedout lever	Center above keyboard.	Allows tape feeding when no messages are being received.
Back-space lever	Below type wheel.	Permits manual back-spacing of tape to correct errors in tape.
CAR RET key	Extreme right of the middle row of keys.	Returns character counter zero. Returns carriage on page printing machine in circuit to the left margin.
Line feed key	Second key from the right in the bottom of keys.	Causes page-printing machines in the circuit to feed paper.

WARNING DEVICES

The following devices are used to alert the operator to certain operating conditions *(figure 4-17)*.

CONTROL	LOCATION	FUNCTION
End-of-line indicator	In the left side of the keyboard guard.	Warns the operator that the end of a line of typing is near.
Character counter	Above the top row of keys.	Indicates the number of code groups perforated in the tape since the CAR RET key was last depressed.
Tape-out buzzer	Behind the tape reel.	Indicates diminishing supply of tape.
Signal bell	Mounted on the tape printing and punching mechanism.	Signals the operator. Bell will ring when the machine is in the figures position and the S code group is received or sent.

TAPE TRANSMITTER CONTROLS

The following chart lists the controls and switches used to operate the tape transmitter *(figure 4-17)*.

CONTROL	LOCATION	FUNCTION
Start-stop lever	In left front side of the tape transmitter cover.	START position allows a message to be transmitted from the tape transmitter. STOP position stops transmission from the tape transmitter. FEED RETRACT position depresses fed pins and permits a tape to be inserted into the tape transmitter.
Tight-tape lever	In front of the tape transmitter.	When tape becomes tight, lever stops transmission. Slack in tape allows unit to transmit.
End-of-tape lever	Under tape cover.	When the end of the tape is reached, the lever is permitted to rise and stop the tape transmitter.
Selector switch	In right side of keyboard guard assembly.	1. TD SEND TR SEND RECEIVE: Arranges the set to send to the converter from the tape transmitter and keyboard transmitter and receive from the converter on the reperforator. 2. TD SEND LOCAL PUNCH: Permits transmission from the tape transmitter while a local message is being prepared on the keyboard transmitter and the reperforator. 3. LOCAL REPUNCH: Places the tape transmitter, keyboard transmitter and the receiving portion of the reperforator in series with each other electrically for local preparation of tape or for local testing of the set.

CV-357/A FREQUENCY SHIFT CONVERTER.

The CV-357/A frequency shift converter is specifically designed for use with the AN/ARC-21 liaison radio *(4, figure 4-16)*. The purpose of the converter is to change radio frequency signals of the frequency shift keyed (FSK) type from the receiving portion of AN/ARC-21 radio into direct current pulses to properly operate the teletypewriter and change the information pulses from the teletypewriter into frequency shifted signals to properly actuate the transmitter portion of the AN/ARC-21 radio. Little attention of the operation is required during operation after the equipment has warmed up (warm up time is approximately 10 minutes). The tuning monitor gives continuous visible monitoring of the discrimination output. The neon ON indicator, operating from the +200 volt supply, gives a continuous indication of the B power supply for the tubes.

AN/ARC-21 LIAISON RADIO.

The AN/ARC-21 liaison radio provides long range CW, Voice and Teletypewriter communication from airplane to airplane and airplane to ground. The liaison radio operates over a frequency range of 2 to 23.9995 megacycles with any 20 of 44,000 preset channels available for use. Receiver and transmitter tuning is fully automatic. The liaison radio master control panel is located at the number 2 weather observer's station *(figure 4-19)* with a subpanel located at the pilot's station.

TAKE CONTROL KNOB

A two-position ON-OFF rotary knob, one at the liaison radio master control panel and one on the liaison radio subpanel, is used to turn the equipment on, and also to secure control of the equipment. When the *take* control knob on one panel is placed in the ON position, the radio is energized and control is acquired at that panel. Turning the *take* control knob on the other panel to the ON position will then secure control at that panel; the *take* control knob on the panel initially controlling the radio will automatically cycle to the OFF position. Placing the *take* control knob on the operator's panel in the OFF position deenergizes the liaison radio *(2, figure 4-19)*.

VOLUME CONTROL KNOB

Volume control knobs on both the master and subcontrol panels provide a means for adjusting the audio output from the liaison radio to the interphone system during voice operation and receiver sensitivity during CW operation *(1, figure 4-19)*.

CHANNEL SELECTOR CONTROL KNOB

Channel selector knobs are located on both the master and subcontrol panels. This switch has channel positions numbered from 1 to 20 providing selection of any of the preset channel frequencies *(5, figure 4-19)*.

POWER SWITCH

A two-position switch marked POWER is located on both the master and subcontrol panels. This switch has HI-LOW positions and provides a means of selecting the transmitter power output in a 1-to 1 proportion. HI position will normally be used when maximum range is desired, while the LO position is used when shorter range transmissions are desired *(6, figure 4-19)*.

NOISE CONTROL KNOB

A knob marked NOISE is located on both the master and subcontrol panels. The knob allows adjustment of the background noise level of the receiver during voice operation. The knob should be adjusted for best reception of voice signals *(7, figure 4-19)*.

PRESETTING DRUMS

Two presetting drums located in the master control panel provide means for manually presetting the frequency of each channel as selected by the channel selector switch. Each drum is protected by a hinged cover. A special tool for the presetting operation is stowed inside the top cover. A card mounted on the face of the top drum cover is used to record frequency values of each channel as the presetting operation is accomplished *(4, figure 4-19)*.

CONTINUOUS WAVE CONTROL KNOB.

A CW control knob on the master control panel is used to adjust the CW beat frequency *(3, figure 4-19)*.

LIAISON OPERATION SELECTOR KNOB.

A rotary-type selector knob located on the master control panel has CW SHARP — CW BROAD — VOICE — FSK positions and is used to select the type of liaison radio operation desired. CW SHARP position provides CW operation with a narrow band width to increase intelligibility of signals. CW BROAD provides CW operation with a 7 kilocycle band width for general operation. The VOICE position allows voice transmission and reception of the liaison radio. FSK position is used for operation of the teletypewriter and frequency shift converter CV-357/A *(8, figure 4-19)*.

NORMAL OPERATION OF LIAISON RADIO/VOICE COMMUNICATIONS.

The master control panel has control necessary for all types of liaison radio operation while the subcontrol panel has only those controls necessary for voice communication. Liaison radio voice communication can be accomplished on either control panel by the following procedure.

1. Place the interphone selector switch in LIA position to receive and transmit liaison radio signals.
2. Place the *take* control knob ON.
3. Turn the channel selector knob to the channel of be shown by the middle figure in the selector window.

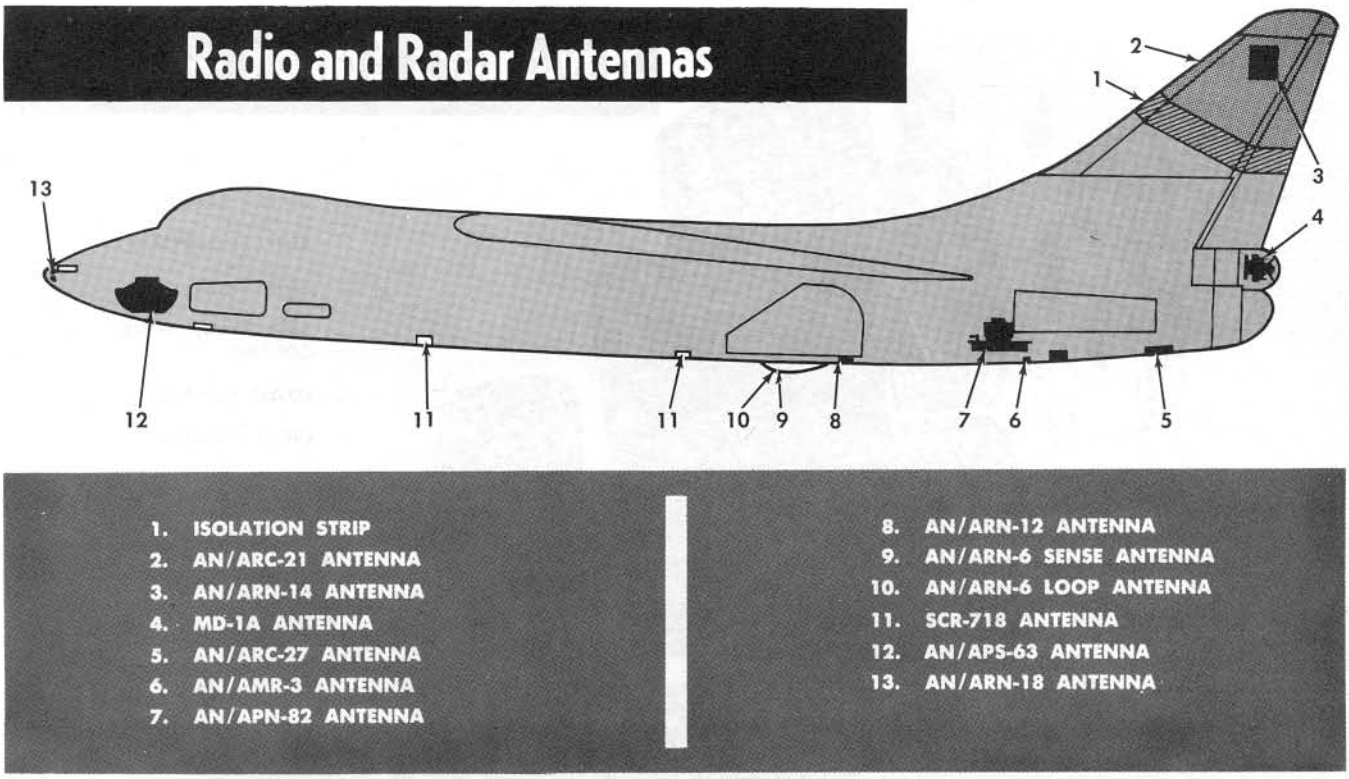


Figure 4-6

4. Rotate the liaison operation selector knob on the C-451 ARC-21 to VOICE.

5. Place the power switch in HI or LOW depending on desired range of transmission.

6. Depress the mike switch to transmit and release to receive. Adjust the volume control for proper audio level and the noise control for a slight background noise in absence of signals. A sidetone will be heard in the headset when talking if the transmitter is on the air.

7. To transfer control of the radio from one panel to the other, turn the *take* control knob on the inoperative panel to ON. The *take* control knob on the panel originally controlling the equipment will automatically cycle to OFF.

8. Turn the equipment off by rotating the *take* control knob on the operative panel to OFF.

EMERGENCY OPERATION OF LIAISON RADIO.

If the frequency selection cycle is not completed in the normal time interval, causing the *take* control knob to return to OFF position, a second try preferably on another channel is recommended. If tuning is normal return to the previously selected channel. Malfunctions within the equipment are indicated by the *take* control knob moving to the OFF position. If damage to the equipment is less important than getting the message through, transmission or reception can be resumed by holding the knob in the ON position. If no sidetone is heard when attempting to transmit, the transmitter is not on the air.

Note

A 40-second period is required after turning on the equipment before the radio is ready for operation. The first 30-seconds allow for tube warmup and the remaining 10-seconds allow for automatic tuning. If automatic tuning is not accomplished in the normal 40-seconds period, the *take* control knob will go to the OFF position and must be returned to the ON position.

Note

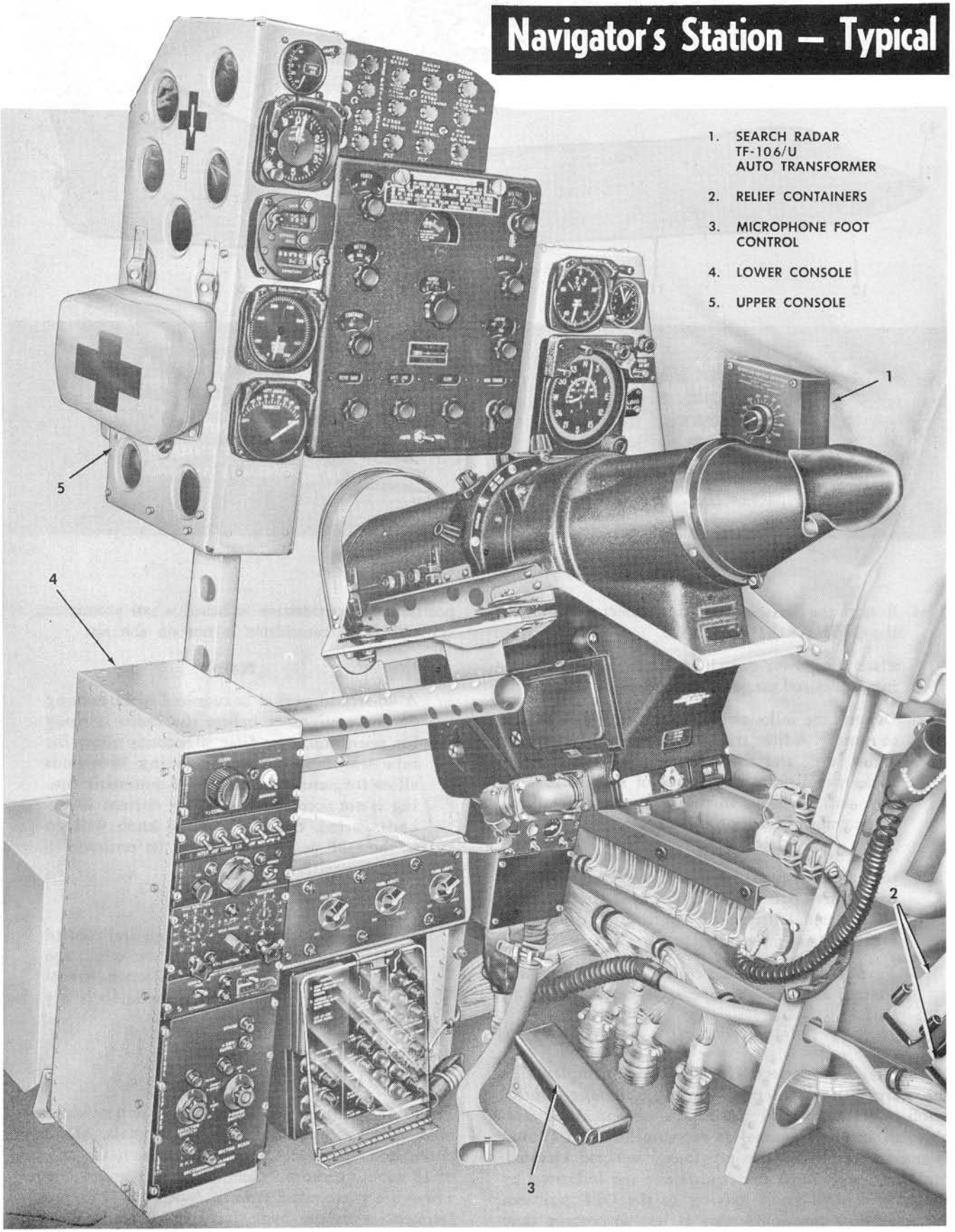
When the equipment is operating and control is changed from one panel to the other, the equipment will repeat the 40-second-warning cycle if the channel selector knob is not properly detented.

AN/ARC-27 UHF COMMAND TRANSMITTER-RECEIVER.

The UHF command transmitter-receiver provides transmission and reception of AM radio signals, ADF operation, and 1020-cycle tone transmission on any one of 18 communications channels, and a guard channel. These are preselected from a choice of 1750 possible frequencies in the bank from 225.0 to 399.9 megacycles.

(Continued on Page 4-21)

Navigator's Station — Typical

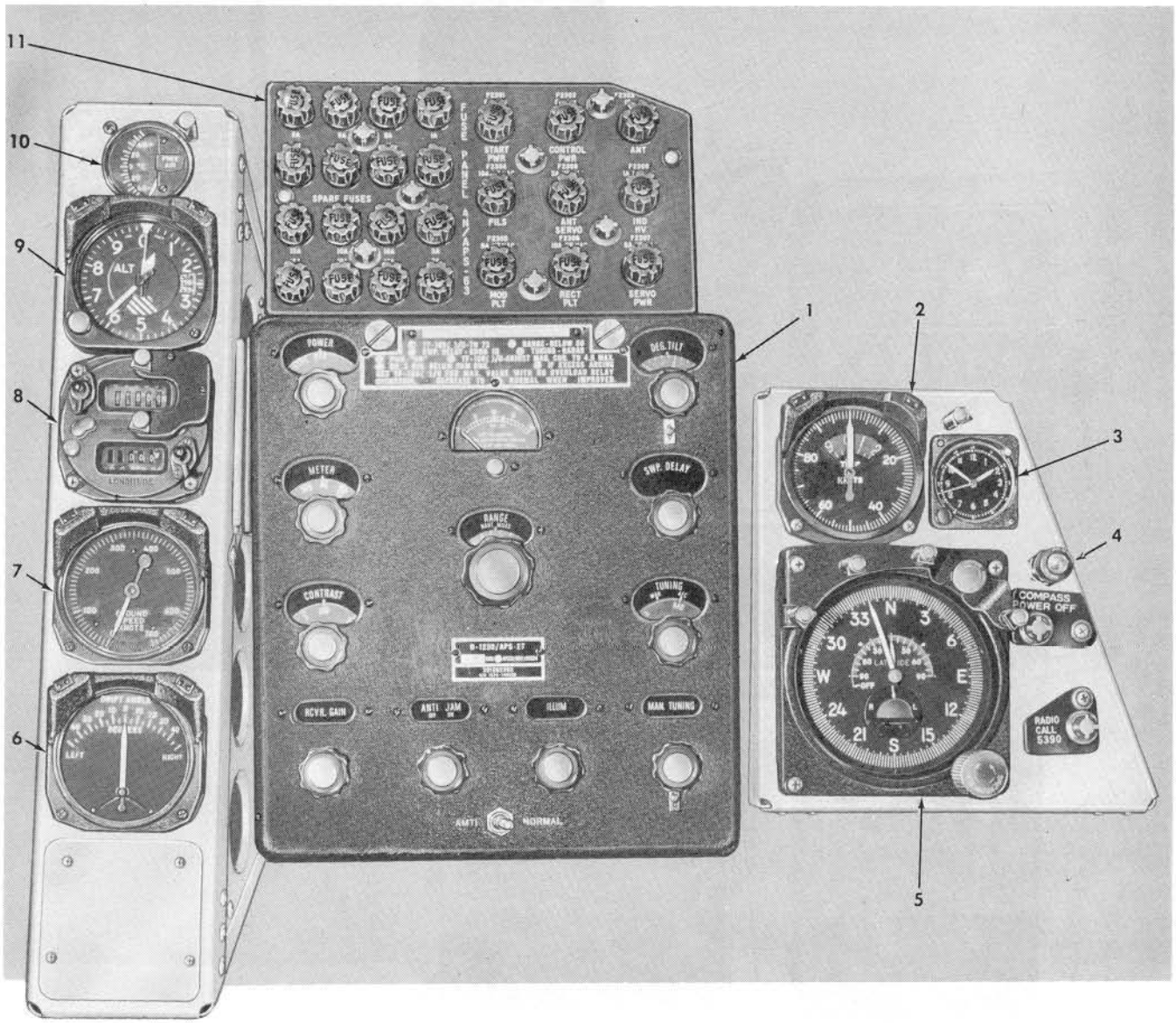


1529B

Figure 4-7

Forward Console – Upper

NAVIGATOR'S STATION



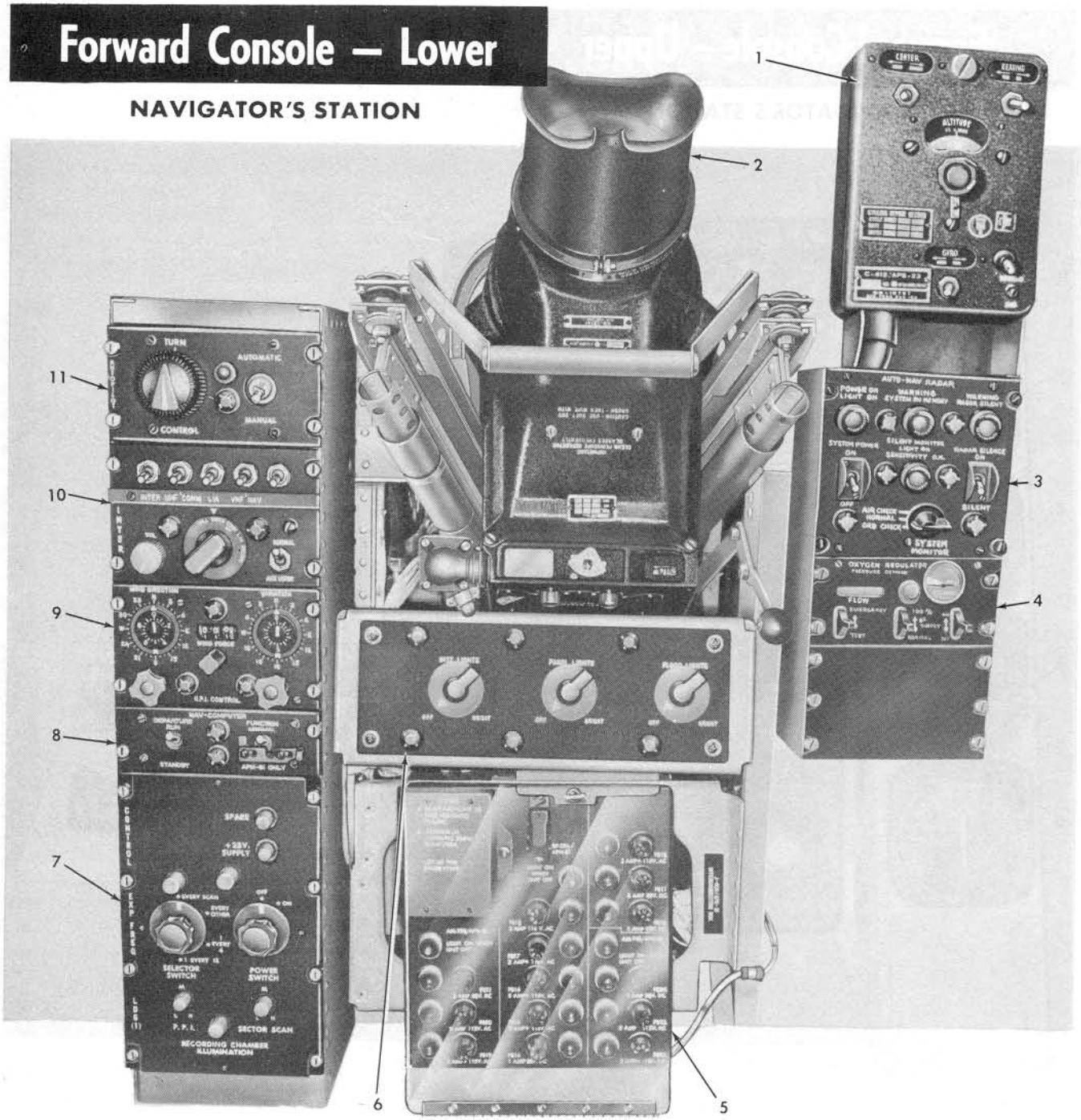
1. SEARCH RADAR CONTROL PANEL (C-1230/APS-27)
2. TRUE AIRSPEED INDICATOR
3. CLOCK
4. N-1 COMPASS POWER WARNING LIGHT
5. N-1 COMPASS MASTER INDICATOR
6. DRIFT ANGLE INDICATOR (ID-342/APN-81)
7. GROUND SPEED INDICATOR (ID-341/APN-81)
8. GROUND POSITION INDICATOR (ID-389/APN-81)
9. ALTIMETER
10. FREE AIR TEMPERATURE INDICATOR
11. SEARCH RADAR FUSE PANEL

1530B

Figure 4-8

Forward Console — Lower

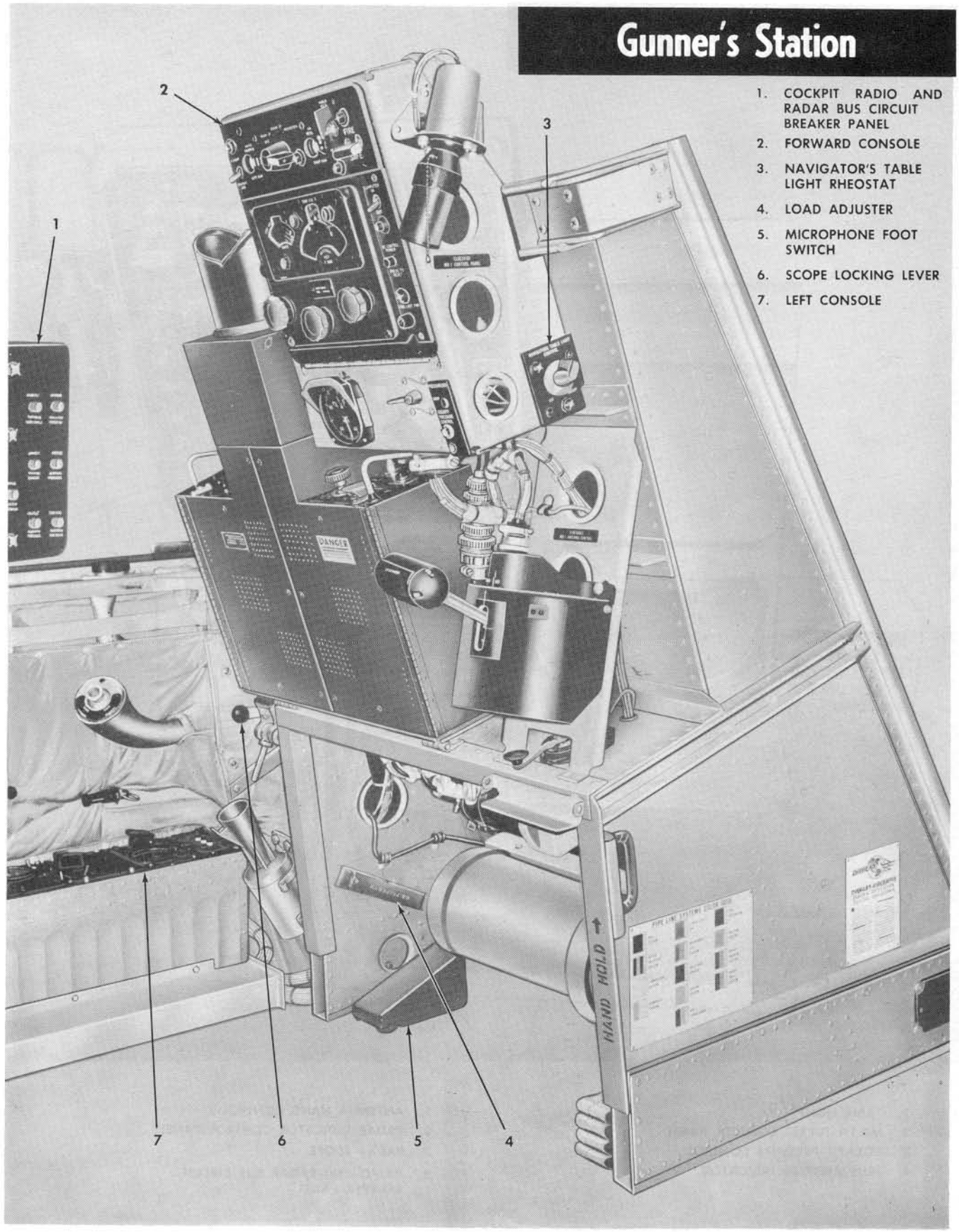
NAVIGATOR'S STATION



1. SEARCH RADAR CONTROL PANEL (C-412/APS-23)
2. SEARCH RADAR INDICATOR (IP-235/APS-27)
3. AUTO NAVIGATION RADAR CONTROL PANEL (C-1416/APN-81)
4. PRESSURE DEMAND OXYGEN REGULATOR PANEL
5. NAVIGATION RADAR INTERCONNECTING BOX (J-608/APN-81)
6. LIGHT CONTROL PANEL
7. EXPOSURE FREQUENCY CONTROL PANEL (LD-6)
8. NAVIGATION COMPUTER CONTROL PANEL (C-1196/APN-81)
9. GROUND POSITION INDICATOR (G.P.I.) CONTROL PANEL (C-1316/ASN-6)
10. INTERPHONE CONTROL PANEL
11. AUTOPILOT REMOTE TURN CONTROL

1531B

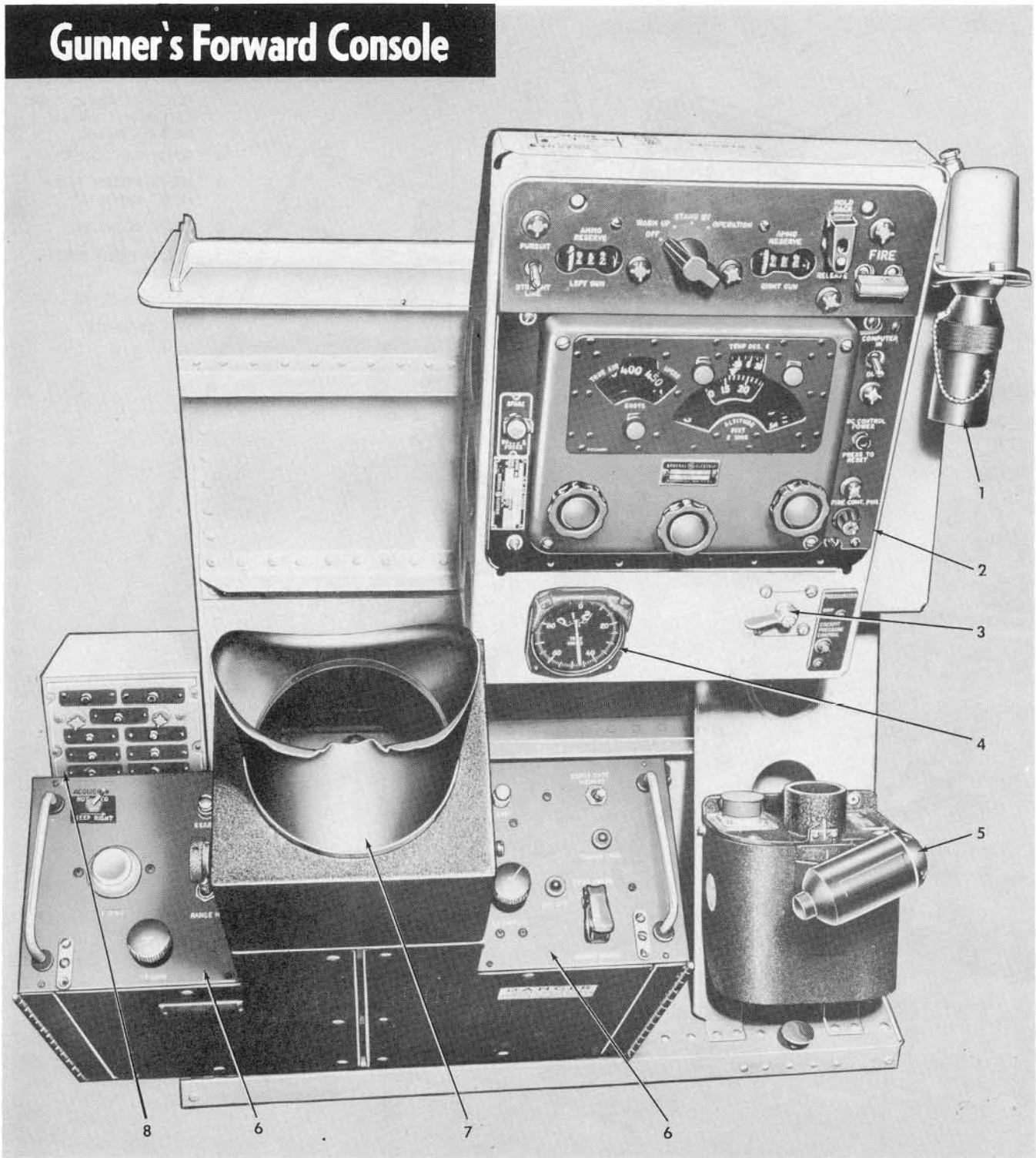
Figure 4-9



1532B

Figure 4-10

Gunner's Forward Console



1. TABLE LIGHT
2. MD-1A TURRET CONTROL PANEL
3. COCKPIT PRESSURE CONTROL
4. TRUE AIRSPEED INDICATOR
5. ANTENNA HAND CONTROL
6. RADAR INDICATOR CONTROL PANEL
7. RADAR SCOPE
8. RADIO AND RADAR BUS CIRCUIT BREAKER PANEL

1533B

Figure 4-11

Gunner's Left Console

1. AN/ASQ-15 PRESSURIZATION KIT CONTROL PANEL-APS-63
2. INTERPHONE CONTROL PANEL
3. PRESSURE DEMAND OXYGEN REGULATOR
4. AN/ASQ-15 PRESSURIZATION KIT CONTROL PANEL-MD-1A
5. AN/ASQ-15 PRESSURIZATION KIT CONTROL PANEL-APN-82
6. LIGHT CONTROL PANEL

(Continued from Page 4-15)

OPERATION.

This equipment is operated from the UHF control panel on the pilot's right console *(2, figure 1-6)*, as follows:

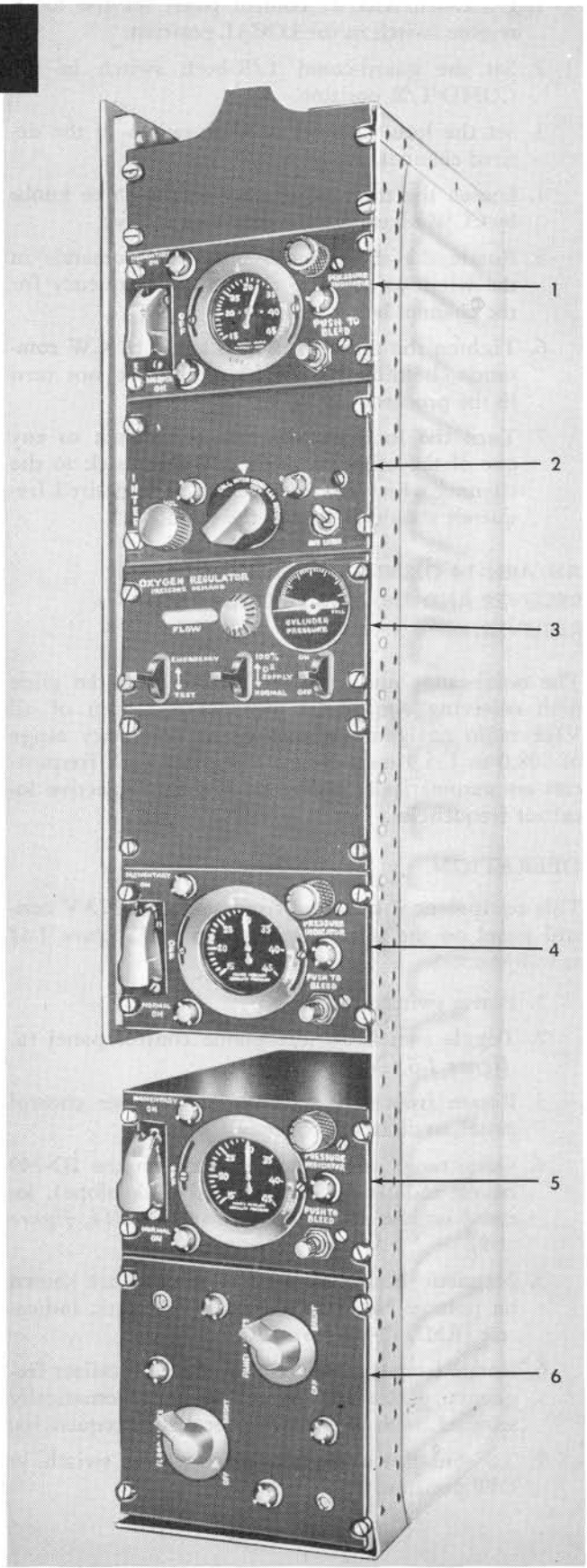
1. UHF control switch – T/R-T/R & G-REC.

Note

The T/R & G switch position adds a fixed tuned guard frequency receiver which may be monitored, together with the selected channel frequency. The ADF switch position is inoperative.

2. UHF command toggle switch on the interphone control panel *(6, figure 1-6)* on the pilot's right console – UHF COMM.
3. Rotate the channel selector switch on the UHF control panel to the desired channel and allow approximately 30 seconds for the radio to warm up. When the audio tone heard in the headset stops, the radio is ready for operation.
4. Adjust the volume control on the UHF control panel, with the interphone volume control set at mid-position for desired output of the incoming signal.
5. To transmit, place MIC selector switch on the interphone control panel in the UHF COMM position and press the MIC switch on the control wheel to COMM.
6. To shut down the set, turn the UHF control switch to OFF.

Channel frequencies may be preset on C-626/ARC-27 control panel in flight by weather operator Number 2 *(1, figure 4-16)*. The following procedure is to be followed in presetting these frequencies:



1534B

Figure 4-12

1. On C-626/ARC-27 control panel set the local-remote switch in the LOCAL position.
2. Set the guard-comd T/R-both switch in the COMD T/R position.
3. Set the local channel selector switch to the desired channel.
4. Loosen the three wing nuts on the three knobs by CCW rotation until they turn freely.
5. Rotate the three knobs until the numerals in the windows indicate the desired frequency for the channel being set.
6. Tighten the three wing nuts again by CW rotation, holding the knobs so they do not turn in the process.
7. Turn the local channel selector switch to any one of the other channels and then back to the channel which has been set up. The desired frequency should appear in the window.

AN/ARN-14 OMNI-RANGE AND LOCALIZER RECEIVER AND AN/ARN-18 GLIDE PATH RECEIVER.

The omni-range and localizer receiver and the glide path receiving equipment provides reception of all VHF radio navigational aids in the frequency range of 108.0 to 135.9 megacycles. The glide path frequencies are automatically paired with their respective localizer frequencies.

OPERATION.

This equipment is operated from the VHF NAV control panel on the pilot's right console *(4, figure 1-6)* as follows:

1. Power switch — ON.
2. Toggle switch on interphone control panel *(6, figure 1-6)* -VHF NAV.
3. Rotate frequency selector, on receiver control panel, to desired frequency.
4. Omni-range courses are selected on the ID-249 course indicator (localizer and glide slope), located on the main instrument panel *(4, figure 1-9)*.
5. Magnetic headings to omni stations are shown on pointer No. 2 on the radio magnetic indicator (RMI) *(14, figure 1-9)*.
6. Rotate frequency selector to desired localizer frequency; glide slope frequencies are automatically selected with the paired localizer frequencies.
7. To shut down the set, place power switch in OFF position.

Note

The receiver covers 108.0 mc to 135.9 mc in the VHF range and includes military and commercial communications (amplitude-modulated) channels.

AN/ARN-12 MARKER BEACON RECEIVER.

The marker beacon receiver has no controls, but operates automatically when power is supplied to the d-c bus. A marker beacon indicator light is located on the course indicator (localizer and glide slope) *(4, figure 1-9)*, and will illuminate when the aircraft is in the radiation pattern of 75-megacycle marker beacon transmitters. The marker beacon receiver also provides audio signals to the interphone system.

AN/APX-25A IFF.

See T.O. 1B-66(W)D-1A.

AN/AIC-10 INTERPHONE SYSTEM.

The power source for the AN/AIC-10 interphone system is the 28-volt d-c bus. Interphone control panels are located adjacent to each crew member's station in the flight compartment *(6, figure 1-7 and 10, figure 4-9 and 2, figure 4-12)* and adjacent to each weather observer's station in the weather compartment *(2, figure 4-15 and 6, figure 4-16)*. Each crew member's station is equipped with a jackbox for plugging in the headset microphone. Additional interphone jackboxes are located inside the aft equipment compartment, the crew entrance door, and the nose wheel well. One dynamotor is connected to the d-c emergency bus to provide power, in case of d-c failure, for interphone communication at the pilot's and gunner's stations, weather station No. 1 and at the crawlway.

Note

The circuit breaker placarded AIC-10 PWR is located on the battery bus circuit breaker panel. However, this circuit breaker does not receive power from the battery bus, since it is wired directly to the emergency bus.

NORMAL-AUX LISTEN SWITCH.

A NORMAL-AUX LISTEN switch, safetied in the NORMAL position, is located on each control panel. Placing the switch in the AUX LISTEN position provides emergency reception in case of control panel amplifier failure.

OPERATION.

The entire interphone system is automatically energized when the aircraft d-c power is on and the circuit breakers are closed. An interphone check at each crew station can be made with the NORMAL-AUX LISTEN switch in the NORMAL position. All crew station control panels should be tested for satisfactory communication between stations on the interphone channel. Operation of the CALL circuit may be checked by transmitting with the selector switch in the CALL position. All other stations will receive the signal regardless of the position of the respective selector switches.

Note

Placing the selector switch in the CALL position automatically turns the microphone on, except when a hand microphone is used. To use the hand microphone on CALL, the MIC switch must be closed.

The mixing toggle switches installed at all crew stations except the gunner's station, provide simultaneous reception of any and all signals selected. Mixing may be accomplished in any position of the selector switch except CALL. The NORMAL-AUX LISTEN toggle switch provides emergency reception in case of failure of the control panel amplifier. The volume control is not effective for sidetone signals, or when CALL is being received, or when the NORMAL-AUX LISTEN switch is in the AUX LISTEN position. The interphone control boxes located in the fuselage and the nosewheel well have only the CALL button, NORMAL-AUX LISTEN switch, and volume control. These switches and controls operate in the same manner as those at the crew stations.

Note

Microphone transmission is not possible when the NORMAL-AUX LISTEN switch is in the AUX LISTEN position.

EMERGENCY OPERATION.

In case of a complete d-c system failure, interphone communication at the pilot's station, gunner's station, weather station No. 1, and the crawlway station is provided by placing the battery switch in the EMER. position.

AN/ARA-26 EMERGENCY KEYER.

The emergency keyer is located on the pilot's left console *(6, figure 1-7)*, and is operated by lifting the red cover guard and placing the switch ON. The equipment may be tested by pressing the test light, which will illuminate if power is being supplied to the equipment. The light will also illuminate when the switch is turned ON. The emergency keyer operates with the CW portion of the HF liaison transmitter and receives power from the transmitter circuits. When in operation, the keyer applies power to the liaison transmitter, channels it to a preset frequency, and selects CW transmission. The keyer sends out, in International Morse Code, signals in the following sequence: SOS three times, the last four digits of the aircraft serial number three times and sends out six times a series of four second dashes spaced one second apart. The sequence will be repeated until the keyer is turned off. An additional code disc containing a series of the letter *D* (dah dit dit) is installed for activating the automatic alarm control. This additional disc has been installed in all units that have the letter *B* in ¼ inch high letters of either red paint or enamel stenciled upon the unit.

WARNING

Inadvertent operation of the emergency keyer should be avoided, and the control panel should be left in such a position that accidental transmission of distress signals cannot occur, as this constitutes a violation of international agreement.

SCR-718-E RADIO ALTIMETER.

Radio set SCR-718-E is a high altitude radio altimeter designed to determine the absolute altitude of the aircraft above the terrain. Controls for this equipment are installed in the weather compartment at the Number 1 weather observer's station *(4, figure 4-15)*. The aircraft 400 cycle a-c power supply is the primary power source for the equipment. The transmitter produces pulses occuring at definite intervals. These pulses are radiated earthward and upon reaching the surface of the earth are reflected back toward the aircraft. The reflected pulses are picked up by a receiving antenna and fed into the receiver section of the unit to be amplified and converted into a form usable by the indicator. The pulse is then applied to indicator I-152-E, which presents this pulse in the form of a small lobe on a circle, on the screen indicator. The screen of the indicator is calibrated so that all altitude readings are taken in feet *(figure 4-18)*.

CAUTION

If cabin pressure is lost, the low-voltage power supply in this equipment may arc-over at altitudes greater than 40,000 feet if it has not been specially treated. Therefore, under these conditions, the set should be turned OFF above 40,000 feet altitude.

Note

A blind spot of approximately 250 feet occurs at an altitude of 5000 feet and all multiples of 5000 feet including zero. A blind spot is a point where altitude cannot be determined accurately. *(See figure 4-18)*.

Note

The radio set SCR-718-E is accurate to within 50 feet at all altitudes up to its normal maximum range of 40,000 feet. By taking special precautions, the equipment is capable of operating at an altitude of up to 60,000 feet.

Note

Pulse jitter occurs when flying over rough terrain. Pulse jitter is a rapid variation in the amplitude of the altitude-indicating lobe

and intermittent appearance of extra lobes. (See figure 4-18.) When this occurs, read the lowest altitude lobe, because it is this lobe which indicates the highest point of terrain over which the aircraft is flying.

AN/ARN-6 RADIO COMPASS.

The AN ARN-6 radio compass enables the pilot or navigator to acquire bearing information (as seen on the indicator) on range or standard broadcast stations within the frequency range of the equipment. This equipment may also be used as a communications receiver to receive flight-information from ground control facilities. The equipment is operated from the radio compass control panel on the pilot's right console *(8, figure 1-6)*.

OPERATION.

1. Turn the function switch to ADF, and allow a 5-minute warm-up.
2. Rotate the band switch to the desired frequency band.
3. Turn the tuning crank to the desired station frequency.
4. Place the CW-VOICE switch in CW position. A 900-cycle tone will be heard along with the station modulation, allowing for more accurate tuning. After tuning, return the CW-VOICE switch to VOICE.
5. Adjust the volume control for desired headset level.
6. Check identifcation of the station being received.
7. Rotate the function switch to ADF (pointer No. 1 will then indicate magnetic heading to the station).

Note

The function switch has a LOOP position, for manual operation.

8. To shut down the set, turn the function selector switch to OFF.

AN/ANH-2 INTERPHONE SOUND RECORDER.

The interphone sound recorders are used in conjunction with the interphone system to provide the crew the opportunity to make direct recording of useful data on a magnetic wire. When the drive system of the recorder is operating, the green record lamp on the recorder control panel illuminates. The drive system of the recorder will not operate when the forward limit switch actuator of the magazine has closed, due to expiration of the 60-minute recording time. The removal of the magazine causes the drive system to stop. Audio input to the recorder is supplied by the interphone system, when the recorder selector switch is placed in the RECORD position. One recorder control panel is located on the pilot's left console *(3, figure 1-7)* and one at the Number 2 weather observer's station *7, figure 4-16)*. One spare magazine is stowed adjacent to the recorder behind the pilot's right console in the flight compartment, and one spare magazine is stowed behind the recorder in the weather compartment.

OPERATION.

1. Interphone and recorder circuit breakers — Pushed IN.
2. Recorder switch — STANDBY (allow one minute for warm-up).
3. NORMAL-AUX LISTEN switch — NORMAL.
4. Selector switch (any station) — RECORD.
5. Depress the microphone control switch. The green record light on the recorder control panel should illuminate and the recorder drive motor should operate. Sidetone from the recorder should be heard in the headset while the operator is recording.
6. The amber warning light on the recorder control panel should illuminate when there is approximately 5 minutes of recording time remaining on the magazine. The recorder drive motor should stop when the talk switch is released, or when the magazine reaches the end of the wire.
7. To remove the magazine, push the release lever on the recorder, located directly above the magazine, and pull the magazine out of its receptacle. To replace the magazine, make certain the magazine is properly centered in its receptacle to avoid breaking the wire, and firmly push the magazine into the opening until the locking snaps on both sides of the magazine firmly engage.

AN/ASQ-15 PRESSURIZING KIT.

The AN/ASQ-15 pressurizing kit is used to pressurize radar equipment to prevent arcing. Three pressurizing kits are used on the aircraft: one for the MD-1A fire control system, one for the AN/APN-82 navigation radar set, and one for the AN/APS-63 search radar. Each pressurizing kit consists of a dehydrator, an air compressor, a check valve, a pressure switch, and a control panel. The control panels are located on the gunner's left console *(1, 4, and 5, figure 4-12)*. Each pressure switch is adjusted to automatically control the system pressure when the radar pressure switch is in NORMAL ON position. The pressure switch is actuated at a pressure less than 1.5 inches of mercury below atmospheric pressure, causing the compressor to operate. This switch stops the compressor before the system pressure reaches 2.4 inches of mercury above atmospheric pressure. The pointer on the pressure indicator should remain within the green portion of the

range marker. The pressure indicator lamp on the control panel will glow when the compressor is operating. The pressure in the radar system being pressurized is indicated on the dial on the control panel and can be controlled manually by use of the radar pressure switch on the control panel. The MOMENTARY ON position will energize the compressor motor causing it to build up pressure. The PUSH TO BLEED switch can be used to bleed off excessive pressure. The OFF position on the switch will cut off power to the compressor, even though the pressure switch has been actuated.

AN/APN-82 NAVIGATION SYSTEM.

The AN/APN-82 navigation system is comprised of two systems: the AN/ASN-6 altitude and longitude computer set and the AN/APN-81 radar set. This equipment is powered by 28-volt, d-c power from the radio and radar bus and 115-volt, 3-phase, a-c power from the cockpit radio and radar bus.

The AN/APN-82 radar navigation system is designed to automatically and continuously establish the position of the aircraft over the earth's surface. The equipment is designed to operate at altitudes from 300 to 70,000 feet and at ground speeds from 70 to 700 knots. This information will be continuously computed from radar set ground returns through aircraft rolls of 15 degrees left and right, climb and dive attitudes of 13 degrees nose up and 11 degrees nose down. During aircraft maneuvers exceeding these limits the information is computed on the basis of the last information put into the computer before these limits were exceeded. This is the forced memory mode of operation.

The AN/APN-81 radar set in addition to ground speed also computes aircraft drift angle up to 25 degrees left or right. The AN/ASN-6 latitude and longitude computer set utilizes this ground speed and drift angle information supplied from the AN/APN-81 radar set along with accurate heading information from the N-1 compass system precise data transmitter to give continuous indication of aircraft latitude and longitude. Information displayed to the navigator consists of ground speed, drift angle, and present longitude and latitude.

In case of AN/APN-81 radar failure, computed winds (direction and velocity) may be manually put into the AN/ASN-6 (on the G.P.I. panel) to allow continued computation of aircraft present position latitude and longitude.

AUTO NAVIGATION RADAR CONTROL PANEL (C-1416).

The auto navigation radar control panel, placarded AUTO-NAV RADAR *(3, figure 4-9)*, is installed at the navigator's station. It provides the following control switches and indicator lights:

POWER ON (light)	A green light which indicates that power has been applied to the AN/APN-81 components.
SYSTEM POWER ON-OFF (switch)	Applies power to the AN/APN-81 radar system components.
WARNING SYSTEM ON-MEMORY (light)	Indicates that the AN/APN-81 system is in the memory, forced memory, or half memory mode of operation.
SYSTEM MONITOR (light)	A green light is used in connection with the system monitor switch during ground and air check of the AN/APN-81 radar set. It indicates acceptable signal-to-noise ratio at the input to the main loop mixer of the AM-758/APN-81 amplifier electronic control.
WARNING RADAR SILENT (light)	A red light indicates when the radar silence switch is in the SILENT position.
RADAR SILENCE (switch)	Removes the primary voltage from the high-voltage supply for the magnetron. It places the system in the forced memory mode of operation.
SYSTEM MONITOR (switch)	A three-position switch provides air or ground check of the AN/APN-81 radar. The AIR-CHECK position is used during flight, when the AN/APN-81 radar equipment is in the memory mode of operation, to check if a low signal is causing memory operation. A test signal is applied to the receiver from an internal check oscillator. The GROUND-CHECK position is used during ground check of the AN/APN-81 equipment. In this position, the AM-742/APN-81 amplifier electronic control and the CP-183/APN-82 computer frequency tracker function to give a ground speed (obtained from an internal-check oscillator signal) of 95±10 knots or multiple of 95±10 knots. The ground speed reading on the ID-341/APN-81 ground speed indicator serves as a rough check on the major components of the AN/APN-81 system.

NAVIGATION COMPUTER CONTROL PANEL (C-1196).

The navigation computer control panel *(8, figure 4-9)* is installed at the navigator's station. This unit provides a departure switch with positions RUN and STANDBY, which is used to start the present position latitude and longitude counters on the ID-389/ASN-6 indicator. It also provides a function switch with positions NORMAL and APN-81 ONLY which, when used in conjunction with the ground position indicator control panel controls, places the AN/APN-82 equipment in the "normal or APN-82" "ASN-6 only" or "AN/APN-81" mode of operation.

GROUND POSITION INDICATOR CONTROL PANEL (C-1316).

The ground position indicator control panel, placarded G.P.I. *(9, figure 4-9)*, is installed at the navigator's

station. The unit provides manual magnetic variation control, which is used to compensate the magnetic heading reference from the N-1 compass for magnetic variation. It also provides manual wind force and wind direction control to insert wind information into the CP-188/ASN-6 latitude and longitude computer. The wind force and wind direction dials indicate only the values which are being set in by manual control. The wind force and wind direction controls are used in the "ASN-6 only" mode. When the wind force control is below zero, a flag placarded GND SPD covers the wind force dial.

NAVIGATION RADAR INTERCONNECTING BOX (J-608).

The navigation radar interconnecting box *(5, figure 4-9)* is installed at the navigator's station. It provides fuses to protect the a-c and d-c supply to the AN/APN-81 radar set. The box also provides fuses in the a-c and d-c supply for the RT-274/APN-81 receiver-transmitter, the AM-758/APN-81 electronic control amplifier, and the AM-742/APN-81 electronic control amplifier. The box contains lights to indicate if power has been removed from any of these units due to an open interlock or high temperature.

DRIFT ANGLE INDICATOR (ID-342).

The drift angle indicator *(6, figure 4-8)* is installed at the navigator's station. It is a synchro repeater and is used to indicate left or right drift angles up to 25°. It receives the drift angle information from the CP-183/APN-82 computer frequency tracker.

GROUND SPEED INDICATOR (ID-341).

The ground speed indicator *(7, figure 4-8)* is installed at the navigator's station. It is a synchro repeater, and is used to indicate ground speeds of 0 to 700 knots. It receives ground speed information from the CP-183/APN-82 computer frequency tracker.

GROUND POSITION INDICATOR (ID-389).

The ground speed indicator *(8, figure 4-8)* is installed at the navigator's station. (An additional indicator is installed in the weather compartment.) The unit receives present latitude and longitude information from synchro transmitters in the CP-188/ASN-6 latitude and longitude computer. Synchro motors use this information to position the present latitude and longitude counters. The unit also provides for slewing counters to any desired latitude or longitude.

Calibration of the latitude and longitude dials for a navigation run departure may be accomplished by any of the following procedures as applicable:

LOW ALTITUDE DEPARTURE.

1. Computer departure switch — STANDBY.
2. APN-81 radar power switch — ON: Radar silence switch — TRANSMIT.
3. Set in precomputed magnetic variation.
4. Computer function switch — NORMAL.
5. Preset ID-389 latitude and longitude dials to the co-ordinates of the preselected departure point.
6. After take-off when aircraft is above 300 feet check that memory light goes out and ground speed and drift angle are being computed.
7. Pass over precomputed departure point at approximately 500 feet and when visually over departure point, put computer departure switch to RUN and record time.

OMNI DEPARTURE.

1. Computer departure switch — STANDBY.
2. Set in precomputed magnetic variation.
3. Computer function switch — NORMAL.
4. APN-81 radar power switch — ON; Radar silence switch — TRANSMIT.
5. ID-389 latitude and longitude counters — Set to co-ordinates of the OMNI station to be used as a departure point.
6. Set ARN-14 control to the frequency of departure point OMNI station.
7. Adjust ID-249 set knob to a heading at least 20 degrees left or right of computed departure heading.
8. When approaching OMNI station, home aircraft using No. 2 needle (ID-250) allowing for drift. Have pilot steer aircraft or use autopilot second station control.
9. Check that memory light is out and drift angle and ground speed is being computed.
10. When No. 2 needle reverses and localizer pointer passes through the bullseye (ID-249), put computer departure switch to RUN and record time.

RADAR DEPARTURE.

1. Computer departure switch — STANDBY.
2. APN-81 radar power switch — ON: Radar silence switch — TRANSMIT.
3. Set in precomputed magnetic variation.
4. Computer function switch — NORMAL.
5. Preset ID-389 latitude and longitude dials to the co-ordinates of the preselected departure point.
6. Utilizing normal bomb run procedures, steer aircraft over radar target departure point.
7. Using the shortest practical range, compute the time to travel in GROUND range (utilizing APN-81 ground speed) from the first visible range mark. Start this time when departure target passes under this range mark.

8. At expiration of this precomputed time, place computer departure switch to RUN and record time.

EMERGENCY NAVIGATION PROCEDURES.

EMERGENCY OPERATION WHEN THE APN-81 FAILS.

Switch to "ASN-6 only" mode (leave the function switch on the navigation computer control panel in the NORMAL position and place the wind force knob on the GPI control panel to the value of computed wind direction and velocity) until corrective action clears the difficulty.

Note

There is no heading information to the search radar when the APN-82 is turned OFF so if the search radar has to be operated in the "true bearing" mode and the APN-81 trouble does not affect heading information (oscillating drift angle indication, etc.), then leave the system in the "normal or APN-82" mode.

EMERGENCY OPERATION WHEN THE ASN-6 FAILS.

Switch to "APN-81 only" mode (place the function switch on the navigation computer control panel in the APN-81 ONLY position) until corrective action clears the difficulty.

Note

With the system in the "APN-81 only" mode, the heading information fed to the search radar will be magnetic heading instead of true heading, so that when the search radar is placed in the "true bearing" mode, the bearing will actually be magnetic bearing.

Note

If search radar has to be operated in the "true bearing" mode and the ASN-6 trouble does not affect heading information, then leave the system in the "normal or APN-82" mode.

TRANSMITTER SILENCING PROCEDURE.

Place the radar silence switch on the auto navigation radar control panel in the SILENT position.

Note

If the radar is silenced for any length of time, there is a possibility of a wind shift and/or airspeed change affecting system accuracy.

CORRECTIVE ACTION FOR SYSTEM FAILURES.

Note

Do not put the system monitor switch in the GROUND CHECK position in flight as this removes all computer inputs and installs erroneous information.

If the system memory light on the auto navigation radar control panel stays on for an unusual length of time, air check the APN-81.

1. Place the system monitor switch on the auto-navigation radar control panel in the AIR CHECK position and hold.
2. Within 2 minutes, the system monitor light should indicate green and the ground speed indicator should indicate 100 knots or multiples thereof.
3. If the GPI is being utilized, do not hold the system monitor switch in the AIR CHECK position any longer than required for ground speed to go to 100 knots after the system monitor light is ON. When this light is ON, erroneous ground speed information is being fed to the ASN-6.

Note

With the system monitor switch in the AIR CHECK position and the system memory light ON:

1. If the system monitor light comes ON and the ground speed does not go to 100 knots, the frequency tracker (CP-183/APN-82) or the wind amplifier (AM-742/APN-81) is probably defective.
2. If the system monitor light remains OFF, the receiver-transmitter (RT-274/APN-81) is probably defective.
3. If the system air checks properly, the memory condition might be caused by insufficient ground returns due to terrain and there is a good chance that the system will operate normally later in the flight.
4. If the system will not air check after three attempts, the receiver-transmitter (RT-274/APN-81) is probably defective. Place the radar silence switch on the auto navigation radar control panel in the SILENT position, to avoid damage to the RT-274/APN-81 unit.

If the APN-81 is in NORMAL (memory light OFF) but ground speed is erroneous:

1. Place the radar silence switch on the auto navigation radar control panel in the SILENT position for 10 seconds, then return it to TRANSMIT.
2. If the APN-81 still will not lock onto the ground speed, place the system power switch on the auto navigation radar control panel in the OFF position for 10 seconds and then return it to the ON position. Allow 8 minutes for system memory light to go ON. If the system is recycled a few times, there is a good chance it will lock on to the correct ground speed.

If a blown fuse indicating light on the navigation interconnecting box (J-608/APN-81) is ON, replace the applicable fuse.

If no lights on the auto navigation radar control panel are ON when the system power switch is in the ON position:

1. Check all APN-81 circuit breakers.
2. If the APN-81 circuit breakers are all IN, the emergency override switch on the navigation radar interconnecting box (J-608/APN-81) box can be placed in the OVERRIDE position to by-pass the under-frequency and under-voltage protective devices in the APN-81.

CAUTION

Since the APN-81 can be seriously damaged if this switch is used, the switch should be used only in case of extreme emergency.

If one or more of the three LIGHT ON WHEN UNIT OFF lamps on the APN-81 fuse box is lit, indicating that a thermal cut-off switch or interlock is open in one of the three pressurized units.

1. Leave the system power switch on the auto navigation radar control panel in the ON position. If over-heating is the cause of the difficulty, there is a good chance that the equipment will cool off and become operational later in the flight.
2. The emergency override switch on the APN-81 fuse box can be placed in the OVERRIDE position to by-pass the thermal and interlock protective devices.

CAUTION

Since the APN-81 can be seriously damaged if this switch is used, the switch should be used only in case of extreme emergency.

AN/APS-63 SEARCH RADAR SYSTEM.

Search radar set AN/APS-63 is an airborne radar system which operates in the X-band of the frequency spectrum. The equipment presents information on aircraft altitude; on heading with respect to landmarks or specific targets; on range of specific targets; and, in conjunction with the N-1 compass, it indicates target bearing and aircraft heading with respect to magnetic north. In conjunction with the variation control of the ground position indicator control panel (APN 81), target bearing and aircraft heading with respect to true north is indicated. All presentations are displayed on the azimuth and range indicator, by means of the PPI (plan position indicator) display system.

The azimuth of a particular echo or target signal is indicated by the angular displacement of the observed echo signal from a heading mark on the indicator screen. This heading mark may be relative magnetic or true stabilized depending on the mode selected. A full 360-degree area, or a specific azimuth sector, may be scanned by the radar system. When sector scanning is employed, any sector of the entire 360 degrees of azimuth may be viewed, the angular width of the area scanned being adjustable from 40 to 180 degrees. Due to the location of the antenna, echos or target signals will not appear in a sector of approximately 120° aft. During normal search operation, the position of the aircraft is at the center of the presentation displayed on the indicator screen, while for normal sector scan operation the position of the aircraft is at the apex of the sector. A DEPRESSED-CENTER control, used when the system is operating on short range sector scan (3 to 50 nautical miles), permits the apex of the sector to be shifted from the center to the bottom of the indicator screen, thus utilizing the full face of the indicator and effectively doubling the size of the presentation.

While the aircraft is in flight at high altitudes, a circular hole, or lack of targets, appears near the center of the indicator presentation. This is due to the absence of targets between the aircraft and the ground immediately below it. The radius of the blank spot is a measure of the approximate altitude, or vertical distance, of the aircraft above ground. The indicated ranges of the echo signals are the straight line distances from the aircraft to the observed targets; these distances are called slant ranges. Sufficient delay may be introduced into the sweep circuits by an altitude control to eliminate the blank spot and move the first ground return echo signal to the center of the indicator screen.

A SWEEP-DELAY control and its associated marker make it possible to select a particular target (at any range) and display it at, or close to, the center of the indicator screen as the starting point or origin of the PPI sweep trace. Under this condition, only those signals at ranges greater than the approximate selector point will appear on the indicator. The scanned area appearing on the screen may be varied from 5 to 200 nautical miles with the sweep delay control.

Search radar set AN/APS-63 comprises a radar set control, an auxiliary control unit, a receiver-transmitter, an azimuth and range indicator, a line balancing network, a synchronizer, a noise suppressor, a servo amplifier, a gyroscope, a modulator power supply, a rectifier power unit, an autotransformer, interconnecting and junction boxes, a directional coupler, an antenna assembly, and a camera attachment. An AN/APS-63 fuse panel is located at the navigator's station.

RADAR SET CONTROL (C-1230).

The radar set control *(1, figure 4-8)* is installed at the navigator's station.

CAUTION

To prevent gear breakage in the antenna tilt motor, the power switch should be placed in the ST BY position during the taxi, take-off, and landing procedures.

It provides the following controls:

POWER	A five-position switch to control the power distribution. The OFF position removes power from all components except the filter unit, switch box, electrical protector, and voltage regulator. The ST BY position applies power to filaments, gyroscope erection circuits, blowers, rectifier, time-delay relay, and antenna tilt control circuits. The SCAN OFF position applies high voltage to all electronic circuits (antenna azimuth drive motor is not energized). The SCAN SLOW position energizes the drive motor which rotates the antenna clockwise at 6 rpm. THE SCAN FAST position energizes the drive motor which rotates the antenna clockwise at 20 rpm.
RANGE	Determines operating range of the radar set and controls the pulse width and repetition frequency.
SWP DELAY	Permits selection of any point on the 5 to 200 mile sweep as the starting point of the sweep (pull out to move the starting point to the center of the scope).
CONTRAST	Provides a method of limiting the intensity of unwanted returns.
TUNING	A four-position switch to control tuning. The RAD MAN position switches control of radar local oscillator frequency from the afc circuit to MAN TUNING control. The RAD AFC position places the radar local oscillator frequency under the control of the afc circuit. The BEA MAN position switches control of beacon local oscillator frequency from the afc circuit to MAN TUNING. The BEA AFC position places beacon local oscillator frequency under control of the afc circuit.
DEG TILT	Varies antenna pillbox tilt angle.
METER	An 11-position selector switch. The XTAL position indicates current through receiver crystal or beacon afc crystal. The MAG position indicates magnetron filament current. The MOD HV position indicates output voltage of modulator HV rectifier. The AC position indicates the 115-volt, a-c supply voltage. The 26.5 position indicates the 26.5 volt, d-c supply voltage. The IND HV position indicates second anode voltage on the cathode-ray tube. The —300, —105, +150, +300, and +600 positions indicate output voltage for the respective rectifier and regulator circuits in the rectifier power unit.
ILLUM	Controls intensity of illumination on the control dials.
ANTI-JAM	Emphasizes target contours at expense of details.
RCVR GAIN	Controls gain (IF amplifier).
MAN TUNING	Permits manual tuning of radar or beacon local oscillators.

AUXILIARY CONTROL UNIT (C-412).

The auxiliary control unit *(1, figure 4-9)* is located at the navigator's station. It provides the following controls:

CENTER	NORM positions origin of sector scan at center of scope. The DEPRESS position moves origin of sector scan to bottom of scope.
BEARING	The TRUE position presents heading mark to show aircraft heading with respect to magnetic or true north (zero azimuth corresponds to magnetic or true north). The REL position presents heading mark to appear at zero azimuth. All targets appear relative to aircraft heading.
ALTITUDE	Controls delay of sweep start to eliminate the altitude hole from the presentation.
GYRO	The NORM position permits the gyroscope to erect normally. The TURN position removes gyro erection voltages so the gyro operates as a free running gyro in turns.
DEPRESS ZERO	Permits adjustment of vertical displacement of the sector apex during depressed center operation.

RECEIVER-TRANSMITTER (RT-286).

The receiver-transmitter is installed in the nose of the aircraft at station 40. The unit transmits the high power RF pulses to the antenna, and receives the RF target echoes from the antenna. The main chassis contains the magnetron, the local oscillators, mixer, IF amplifier and AFC unit.

RANGE AND AZIMUTH INDICATOR (IP-235).

The range and azimuth indicator *(2, figure 4-9)* is installed at the navigator's station. The indicator contains the cathode-ray tube which visually displays the target echoes or beacon signals and the heading mark and radar range marks. The unit provides the following controls:

BLACKLASH	Eliminates blurred images in sector scan due to lag of indicator servo chain.
SCALE ILLUM	Adjusts illumination intensity on indicator azimuth scale.
BRIL MARK	Adjusts intensity of range and heading marks.
NORM VID GAIN	Adjusts normal video signal input to indicator.
SECT AMP	Switches antenna from 360-degree rotation to sector scan.
SECT POS	Positions sector at any desired bearing during sector scan.
BIAS	Controls the bias on the cathode-ray tube.
VERT CTR	Positions sweep vertically by moving magnetic shunt of focusing magnet.
HORZ CTR	Positions sweep horizontally by moving magnetic shunt of focusing magnet.
FOCUS	Controls focus of indicator electron beam.

LINE BALANCING NETWORK (CU-365).

The line balancing network is installed in the flight compartment near the search radar indicator.

SYNCHRONIZER (SN-115).

The synchronizer is located on the right side of the aircraft just above the nose wheel well, between stations 76 and 100. The unit contains the necessary electronic components and circuits to: mix and amplify video signals and range marks, generate calibrated range marks on the indicator, trigger the sweep generator for delayed sweep functions, move the origin of the PPI sweep to the bottom of the screen, generate a sawtooth sweep wave form, and to supply information to the sweep coils of the indicator.

ELECTRICAL NOISE SUPPRESSOR (F-210).

The electrical noise suppressor is located on the equipment rack on the right side of the aircraft at station 204. The unit reduces undersirable ripple and transients in external supplies of 26.5 volts d-c and 115 volts a-c.

SERVO AMPLIFIER (AM-193A).

The servo amplifier is located on the equipment rack on the right side of the aircraft at station 204. The amplifier regulates the operation of the antenna in accordance with information received from other units of the radar system.

GYROSCOPE (GA-10041).

The gyroscope is installed either at the station 100 access compartment on the left side of the aircraft or at station 76 on the right side of the aircraft. The gyro develops roll and pitch error signals based on the relative motion of the aircraft.

MODULATOR (MD-196).

The modulator unit is located in the nose of the aircraft at station 30. The unit generates a high voltage pulse to modulate the magnetron oscillator in the receiver-transmitter and trigger the sweep circuits in the synchronizer.

RECTIFIER POWER UNIT (PP-259B).

The rectifier power unit is located on the equipment rack on the right side of the aircraft at station 204. The unit supplies regulated voltages to other components of the radar set.

VARIABLE AUTOTRANSFORMER (TF-106C/U).

The variable autotransformer *(1, figure 4-7)* is installed at the navigator's station on the right side of the aircraft. The unit permits the adjustment of the 115-volt primary power for the high voltage circuit in the radar modulator.

INTERCONNECTING BOX (J-543).

The interconnecting box is installed at station 283 on the right side of the aircraft. The unit interconnects components of the radar set and contains a relay panel. System fuses are located on the AN/APS-63 fuse panel at the navigator's station. The fuse holder cover on the J-543 interconnecting box must be wired and sealed shut and the instruction plate mounted with the warning text visible.

JUNCTION BOX (J-219A).

The junction box is installed at the navigator's station and interconnects the main indicator with the rest of the radar set.

DIRECTIONAL COUPLER (CU-137).

The directional coupler is installed between the wave guide and the receiver-transmitter in the nose of the aircraft. It forms a section of the wave guide transmission line between the receiver-transmitter and the antenna, and provides a means for measuring power output and receiver sensitivity.

ANTENNA ASSEMBLY (AS-360).

The antenna assembly is installed in the nose of the aircraft at station 37. The antenna radiates pulses

Table of Weather Reconnaissance Equipment

TYPE	DESIGNATION	USE	OPERATOR	RANGE	LOCATION OF CONTROLS
Radiosonde Dispensing Set	AN/AME-1	Radiosonde Ejector	Weather Observer No. 2	Not Applicable	Weather Observer Position No. 2
Radiosonde Receiver	AN/AMR-3	To receive and record data transmitted from the AN/AMT-6 radiosonde	Weather Observer No. 2	Line of Sight	Weather Observer Position No. 2
Weather Cameras	P-220	Cloud Photography	Weather Observer No. 1	Optical	Weather Observer Position No. 1

2296B

Figure 4-13

of high frequency energy, and receives the resultant echoes from any reflecting objects in their path.

INDICATOR VISOR (MX-753).

The indicator visor is mounted directly over the face of the indicator to shield the screen from extraneous light.

CAMERA ATTACHMENT (MX-1159).

The camera attachment is installed at the indicator, permitting the use of the 0-15 camera with the search radar equipment.

Note

For energizing and deenergizing procedures, see Navigator's Check List, Section VIII.

ELECTRONIC COUNTER-MEASURES EQUIPMENT.

AN/APS-54 RADAR RECEIVING SET.
See T.O. 1B-66(W)D-1A.

AN/ALE-1 CHAFF DISPENSING SET.
See T.O. 1B-66(W)D-1A.

AN/ALE-2 CHAFF DISPENSING SET.
See T.O. 1B-66(W)D-1A.

AN/ALT-6B, AN/ALT-7, and AN/ALT-8B ACTIVE ECM EQUIPMENT.

See T.O. 1B-66(W)D-1A.

WEATHER RECONNAISSANCE EQUIPMENT.

AN/AME-1 RADIOSONDE DISPENSING SET.

AN/AME-1 radiosonde dispensing set is an automatic, remotely operated, radiosonde dispenser capable of launching eight radiosondes (AN/AMT-6) without reloading *(figure 4-14)*. The radiosondes are ejected through a spoiler door located in the aft right hand section of the weather compartment. The spoiler door incorporates an automatic blow-back feature which will necessitate the airplane being flown below a predetermined airspeed before the radiosonde can be ejected (figure 4-22). It is designed to operate to an altitude of 60,000 feet, within a temperature range of —55° to 71°C (—66.9° to 159.8°F), and within a humidity range of 0 to 100 percent. Two sources of power are required to operate the dispensing set: 28 volt dc, to operate the control circuit; and 115 volt, 400 cps, single phase ac to operate the ejector drive, drum drive motors, and heaters.

The control panel for the AN/AME-1 is located at the Number 2 weather observer's station *(5, figure 4-16)*. It contains a power switch, door switch, heater switch, arm-reject switch, antenna switch, reset switch, eject switch, radiosonde position indicator, and indicator lights for the door, heaters, radiosonde arming and radiosonde in-place *(figure 4-21)*.

(Continued on Page 4-37)

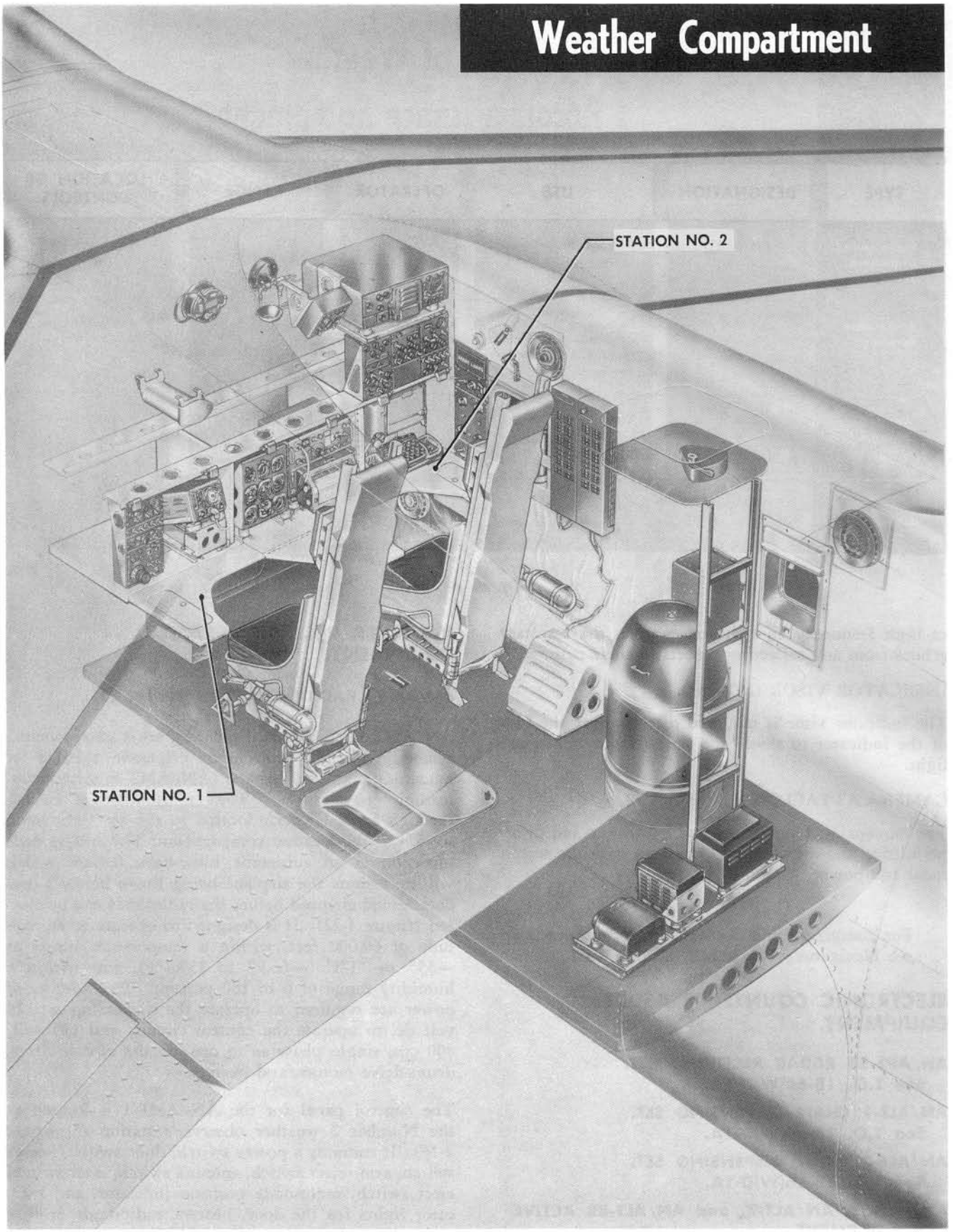
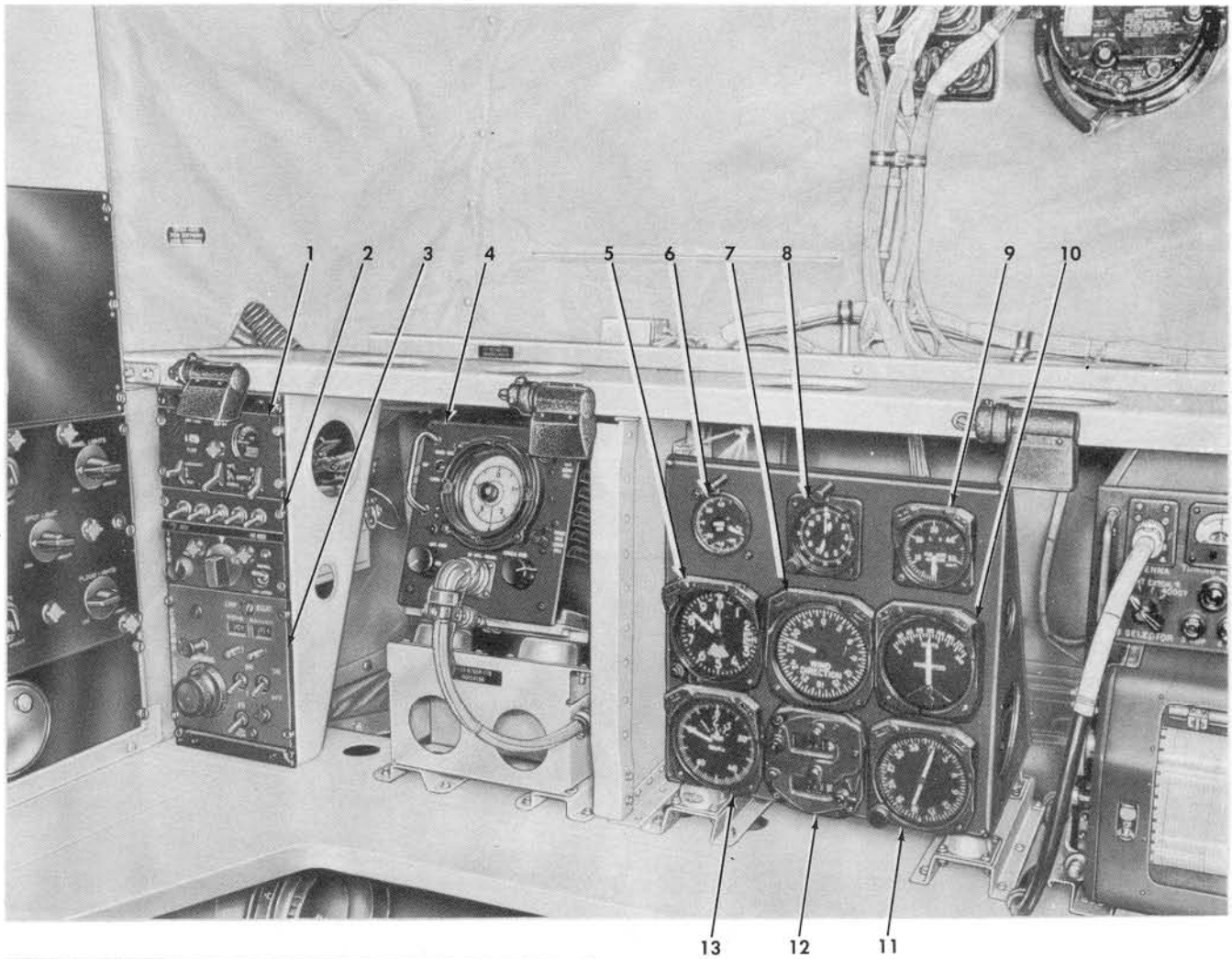
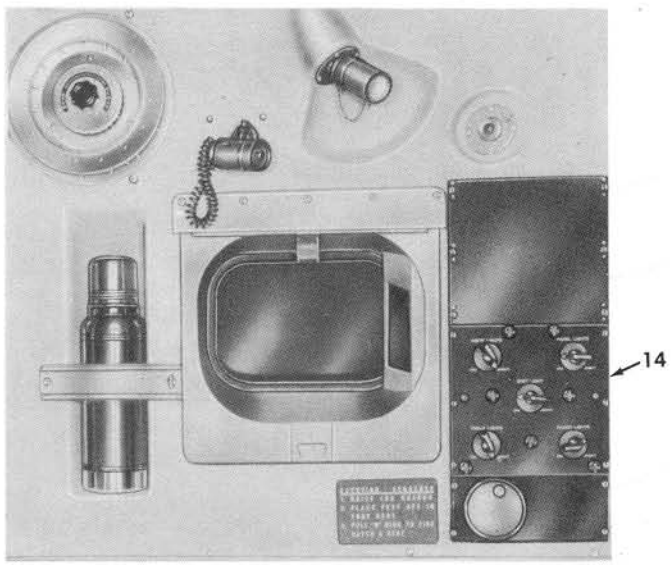


Figure 4-14

Weather Station No. 1 Typical





1. OXYGEN REGULATOR
2. INTERPHONE CONTROL PANEL
3. P-220 CAMERA CONTROLS
4. RADIO ALTIMETER
5. PRESSURE ALTIMETER
6. TEMPERATURE INDICATOR
7. WIND DIRECTION INDICATOR
8. CLOCK
9. CABIN PRESSURE INDICATOR
10. WIND SPEED INDICATOR
11. COMPASS REPEATER INDICATOR
12. GROUND POSITION INDICATOR
13. TRUE AIRSPEED INDICATOR
14. LIGHTING CONTROL PANEL

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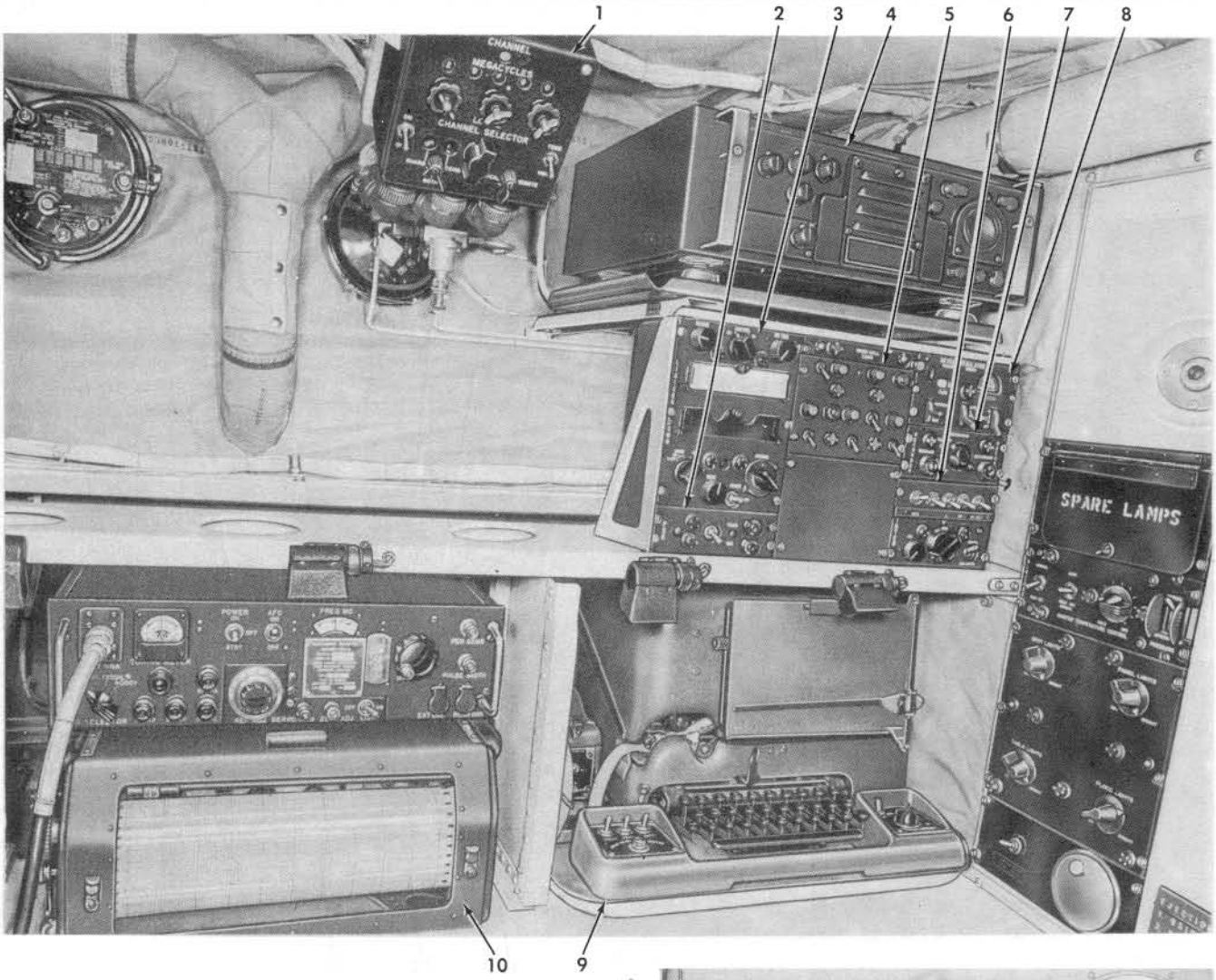
Figure 4-15

Weather Station No. 2 Typical



1. AN/ARC-27 RADIO CONTROLS
2. FSK CONTROL PANEL
3. AN/ARC-21 RADIO CONTROLS
4. CV-357/A FREQUENCY SHIFT CONVERTER
5. AN/AME-1 RADIOSONDE DISPENSER CONTROLS
6. INTERPHONE CONTROL PANEL
7. SOUND RECORDER CONTROL PANEL
8. OXYGEN REGULATOR
9. TT-76/GGC TELETYPEWRITER
10. AN/AMR-3 RADIOSONDE RECEPTOR
11. SPARE LAMPS
12. AIR CONDITIONING CONTROL PANEL
13. LIGHTING CONTROL PANEL
14. COMPARTMENT LIGHT SWITCH

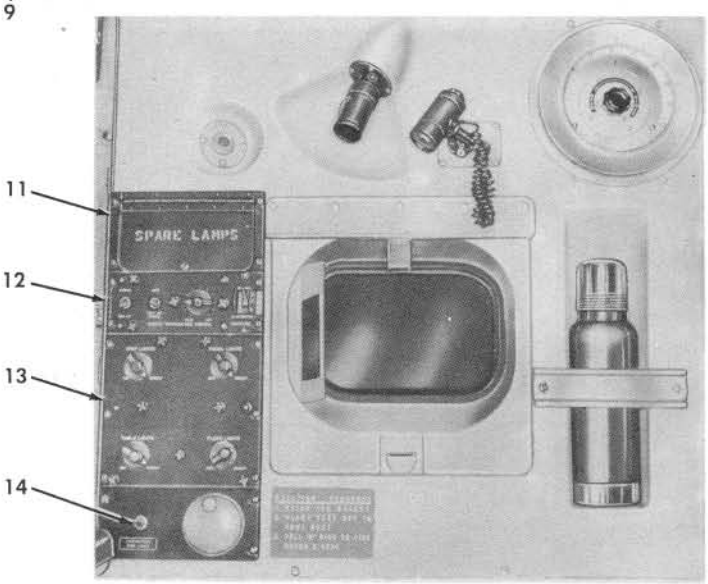


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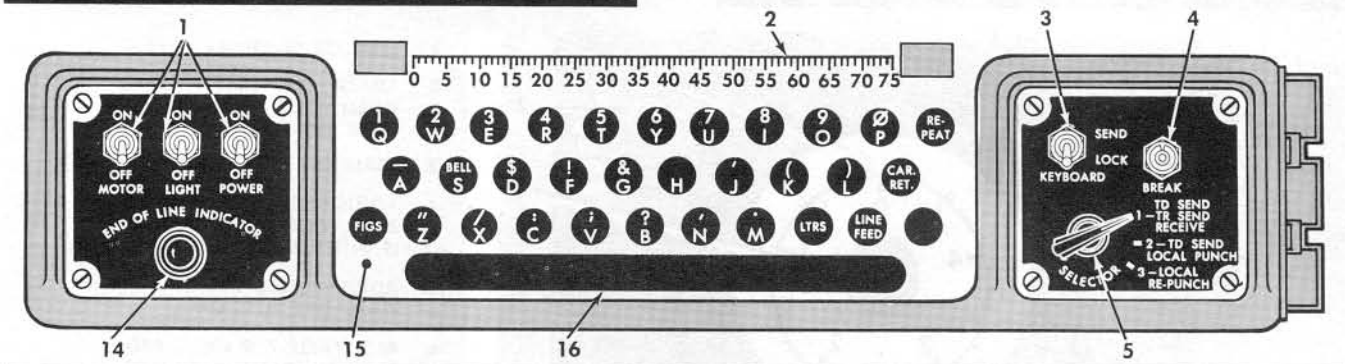
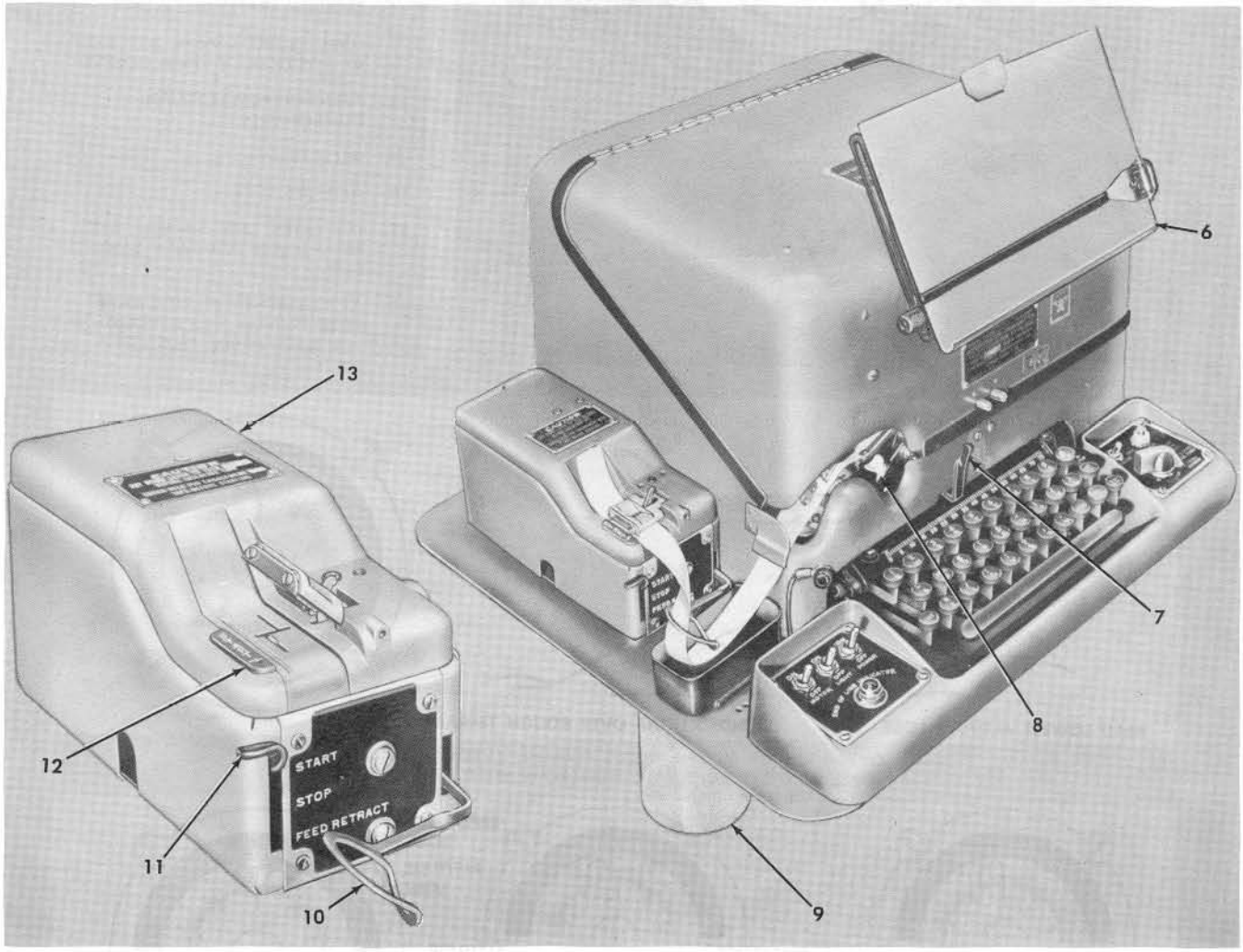
Figure 4-16

Teletypewriter





1. MOTOR, LIGHT, POWER SWITCHES
2. CHARACTER COUNTER
3. KEYBOARD SWITCH
4. BREAK SWITCH
5. SELECTOR SWITCH
6. COPY HOLDER
7. MANUAL TAPE FEED-OUT LEVER
8. BACK-SPACE LEVER
9. TAPE STORAGE
10. TIGHT-TAPE LEVER
11. START-STOP LEVER
12. START ARROW
13. TAPE TRANSMITTER
14. END OF LINE INDICATOR
15. KEYBOARD
16. SPACE BAR

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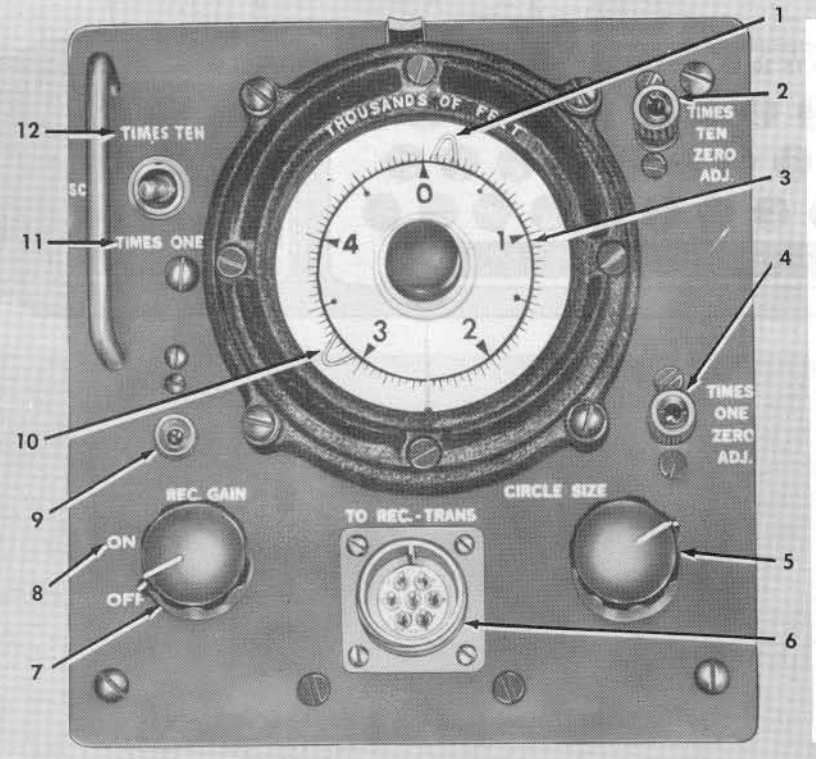
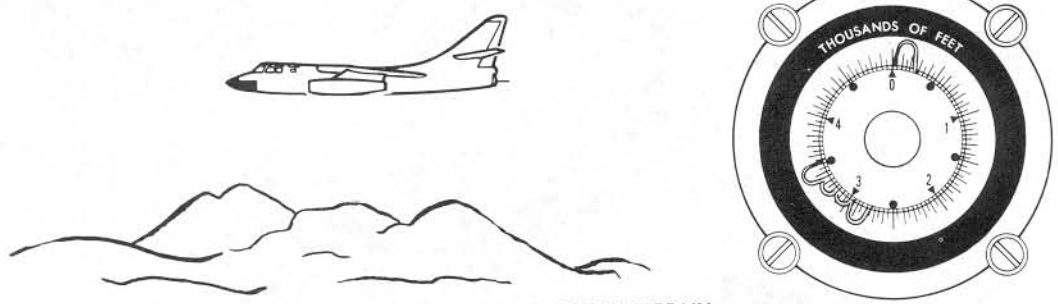
Figure 4-17

Radio Altimeter

SCR-718-E



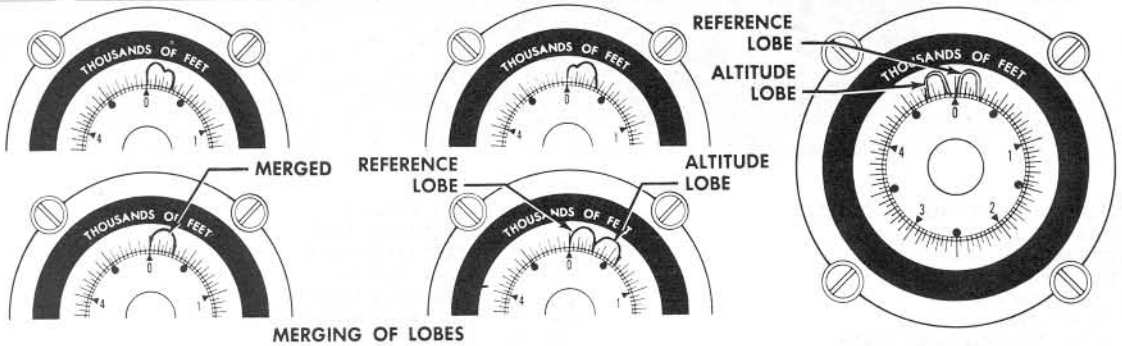
1. ZERO OR REFERENCE LOBE
2. ADJUST ZERO LOBE TO ZERO WHEN SCALE SWITCH IS IN TIMES TEN POSITION
3. SCALE ON INDICATOR FACE
4. ADJUST INDICATOR LOBE TO ZERO WHEN SCALE SWITCH IS IN TIMES ONE POSITION
5. ADJUST CIRCLE SIZE IN TIMES ONE POSITION
6. RECEPTACLE FOR CABLE FROM RECEIVER TRANSMITTER UNIT
7. LOBE HEIGHT CAN BE ADJUSTED BY POSITION OF GAIN CONTROL
8. TURNS ON POWER TO ALL COMPONENTS
9. PILOT LIGHT
10. ALTITUDE LOBE
11. INDICATOR LOBE TRAVELS ONE REVOLUTION FOR EACH 5000 FEET
12. IN THIS POSITION INDICATOR LOBE TRAVELS ONE REVOLUTION FOR EACH 50,000 FEET



READ LOWEST ALTITUDE LOBE

INDICATIONS OVER ROUGH TERRAIN

OVER HILLY OR MOUNTAINOUS TERRAIN SEVERAL ALTITUDE LOBES WILL APPEAR DUE TO NUMEROUS REFLECTIONS



MERGING OF LOBES

THE ALTITUDE LOBE AND REFERENCE PULSE WILL MERGE AT 5,000, 10,000 15,000, 20,000, ETC. (NOTICE: THIS IS TRUE ONLY WHEN THE SCALE SWITCH IS IN THE TIMES ONE POSITION).

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Figure 4-18

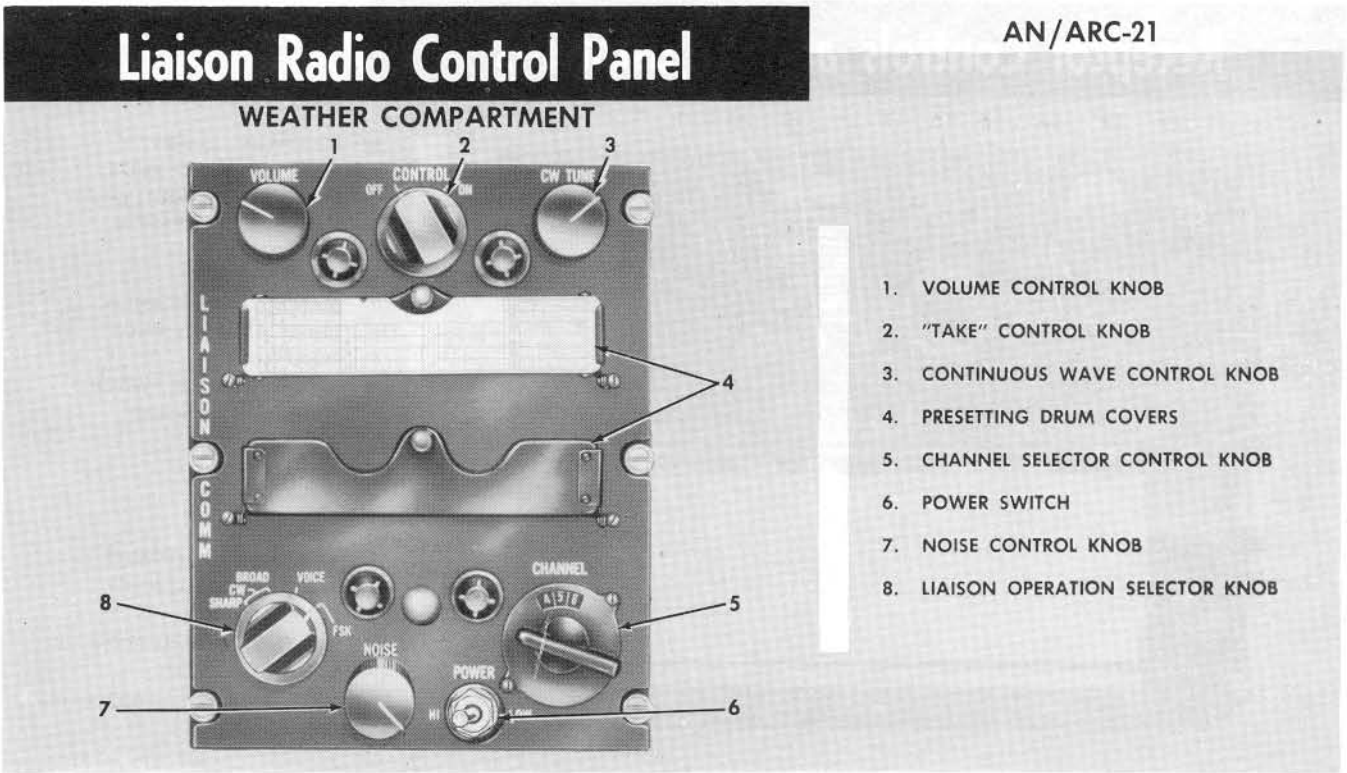

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Figure 4-19

(Continued from Page 4-31)

PRE-EJECTION CHECKOUT.

1. Position the power switch to ON *(2, figure 4-21).*

Note

The R/S in-place indicator light must come ON if the dispenser is fully loaded *(figure 4-21).*

2. Check the R/S position window *(4, figure 4-21).* If number appearing in the window does not agree with number of ejection tube in eject position, operate the RESET switch *(12, figure 4-21)* until the numbers do agree.
3. Position the heaters switch to ON *(8, figure 4-21).* The red light must come on indicating the heaters are operating *(7, figure 4-21).*
4. Position the door switch to OPEN *(11, figure 4-21).* The amber light must come on, indicating that door is open *(10, figure 4-21).*

EJECTION PROCEDURE.

1. Momentarily position the arm switch in ARM *(14, figure 4-21).* The green indicator light should come on after 45 seconds, indicating radiosonde is armed *(13, figure 4-21).*
2. Check for proper radiosonde signal. If the signal received from AN/AMR-3 *(figure 4-20)* is within calibration, the radiosonde is ready to eject. (If proper signal is not received accomplish reject procedures).
3. Press EJECT switch to eject radiosonde *(6, figure 4-21).*

Note

After ejection, the dispensing set will automatically index to the next position. Repeat *steps 1 thru 3* to eject the next radiosonde.

REJECT PROCEDURE.

1. Position the power switch OFF then ON.
2. Position the arm-reject switch to ARM, then immediately to REJECT and release. The power switch on the AN/AMT-6 will be moved to the OFF position and the AN/AME-1 will index to it's next position.
3. When the R/S IN PLACE indicator light is illuminated, the next radiosonde may be armed and tested as outlined above.

Note

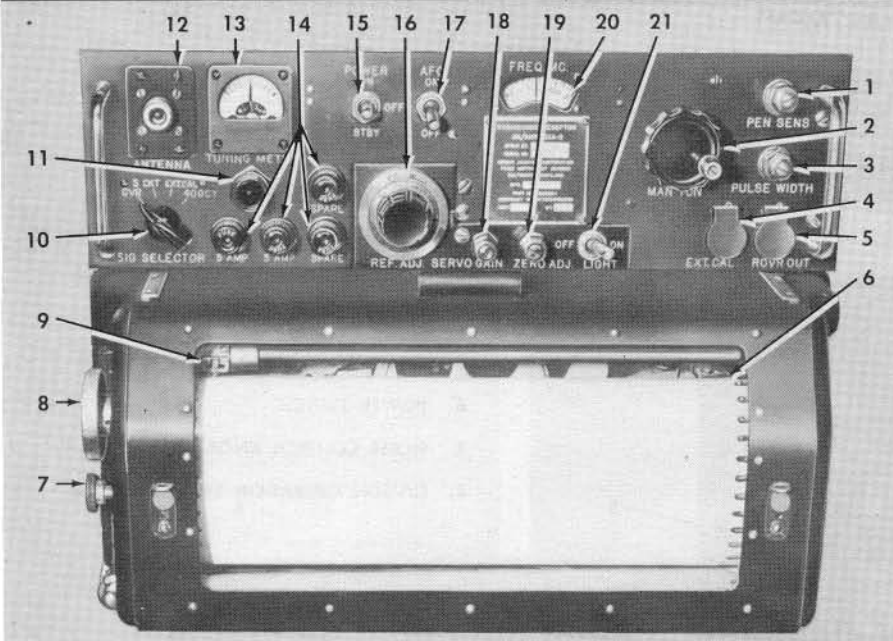
The radiosonde spoiler door should be closed between ejections to avoid unnecessary drag and severe local buffet.

LOADING PROCEDURE.

After the last radiosonde is ejected, the green R/S in-place indicator light will go off *(5, figure 4-21).* The dispensing set must be reloaded or turned off. To reload the dispensing set, proceed as follows:

Receptor Controls and Adjustments

AN/AMR-3



1. PENSTYLUS SENSITIVITY
2. MANUAL TUNING KNOB
3. PULSE WIDTH ADJUSTMENT
4. EXTERNAL CALIBRATION
5. RECEIVER OUT
6. CHART PAPER
7. MANUAL PIN LIFT KNOB
8. CHART ADVANCE KNOB
9. PENSTYLUS
10. SIGNAL SELECTOR SWITCH
11. TUNING METER KNOB
12. ANTENNA JACK
13. TUNING METER
14. FUSES
15. POWER SWITCH
16. REFERENCE ADJUSTMENT
17. AUTOMATIC FREQUENCY CALIBRATOR
18. SERVO GAIN ADJUSTMENT
19. ZERO ADJUSTMENT
20. FREQUENCY MEGACYCLE METER
21. LIGHT SWITCH

Figure 4-20

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Note

The weather compartment must be depressurized to reload the dispensing set.

1. Remove the upper chamber from the dispensing set.
2. Place a radiosonde in each of the accessible ejection tubes.
3. Position the power switch to ON *(2, figure 4-21).*
4. Press the load switch in the dispenser to index the eighth ejection tube into position where it can be loaded.
5. Load the remaining ejection tube.
6. Attach the lanyard snaps to the radiosonde detonator rings.
7. Replace the upper chamber and secure with wing nut.

SHUT DOWN PROCEDURES.

1. Position the door switch to CLOSED *(11, figure 4-21).*
2. Position the heaters switch to OFF *(8, figure 4-21).*
3. Position the power switch to OFF *(2, figure 4-21.)*

AN/AMR-3 RADIOSONDE RECEPTOR.

The AN/AMR-3 radiosonde receptor is designed to receive and record data transmissions from the AN/AMT-6 radiosonde *(figure 4-20).* The radiosonde signals, received by the receptor, consist of pulses of radio frequency energy. The frequency of repetition of these pulses is dependent on meteorological conditions. The received signal pulses will generally be a series of pulses at one audio rate followed by a series at a different audio rate. Each series will cause the receptor to print on the chart at a position determined by the audio rate of that particular series of pulses. These pulses may be evaluated from the permanent record to provide temperature, humidity, and pressure information.

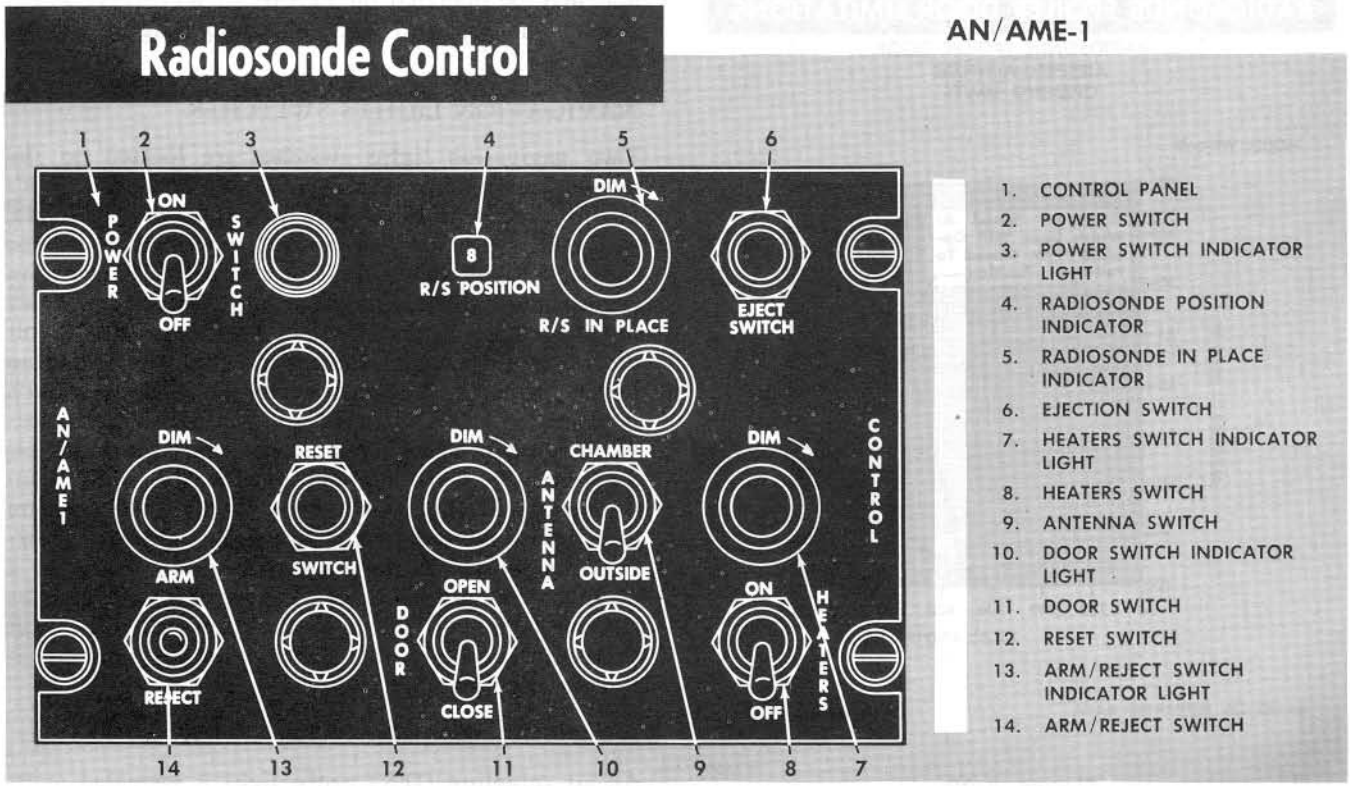
The control panel for the AN/AMR-3 is located at the number 2 weather observer's station *(figure 4-16).* To energize the AN/AMR-3 radiosonde receptor proceed as follows:

ENERGIZING PROCEDURES.

1. Position the power switch to STBY *(15, figure 4-20)* and allow 45 minutes for warmup.
2. Position the sig selector switch to S-CKT *(10, figure 4-20)* and turn the power switch ON *(15, figure 4-20).* The printing stylus should move to the 0 division on the chart.

Note

If the printing stylus does not positon on 0, adjust the ZERO ADJ potentiometer for 0 reading.



1549B

Figure 4-21

BEFORE RELEASE OF RADIOSONDE.

1. Position the sig selector switch to RCVR *(10,* figure 4-20) and the AFC switch to OFF *(17, figure 4-24).*
2. Set the FREQ MC dial to the approximate frequency *(20, figure 4-20).*
3. Position the arm-reject switch on the AN/AME-1 control panel to ARM *(13, figure 4-21).*
4. Tune the receptor to the incoming frequency, using the earphones for coarse tuning and the tuning meter for fine tuning.

RECORDING RADIOSONDE SIGNAL.

1. Eject the radiosonde.
2. Immediately after releasing the radiosonde, tune the MAN TUN knob to pick up the radiosonde signals *(2, Figure 4-20).*

Note

Use earphones for coarse tuning and the tuning meter for fine tuning.

3. After tuning is accomplished, position the AFC switch to ON *(17, figure 4-20)* and adjust the REF ADJ knob *(16, figure 4-20).* Allow the reference trace to print on the 95th divsion.

Note

Monitor the tuning meter to make sure the receiver is tuned throughout the drop *(13, figure 4-20).*

Note

If the tuning meter shows the receiver has become detuned, position the AFC to OFF and tune the receiver manually.

DEENERGIZING PROCEDURES.

1. When the radiosonde stops transmitting position the power switch to OFF *(15, figure 4-20).*
2. If another release is scheduled to be made within an hour leave the equipment in STANDBY and check to determine if there is enough chart paper for the next release.

CAUTION

Do not leave the power switch in the ON position since the chart motors will still be energized.

LIGHTING EQUIPMENT.

All lights, except the vertical stabilizer navigation and position lights, are wired to the 28-volt d-c power supply, through their respective circuit breakers and switches.

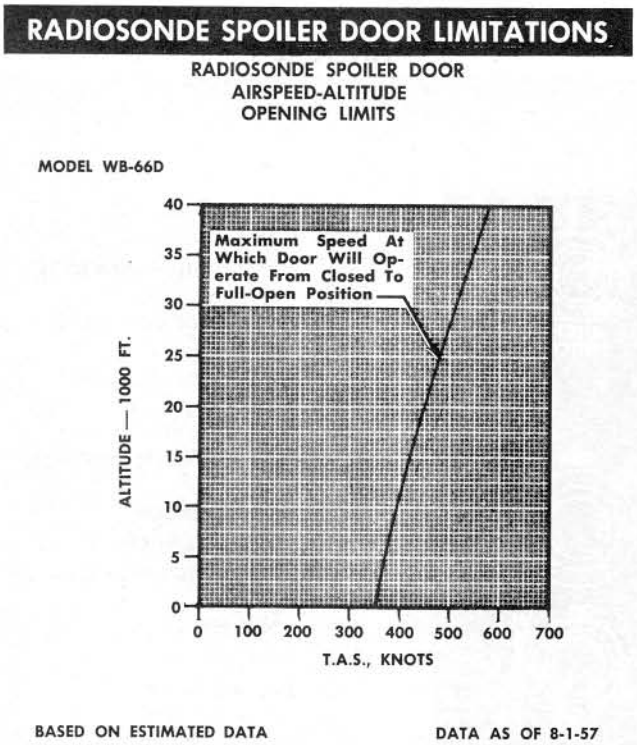


Figure 4-22

LANDING LIGHT.

The landing light *(38, figure 1-1)* is mounted on the nose gear door in such a manner that, when the door is open, the light is in the proper operating position. The landing light is inoperative when the nose door is closed.

LANDING LIGHT SWITCH.

The landing light switch *(22, figure 1-5)* located on the pilot's control pedestal, is placarded LANDING LIGHTS: ON-OFF. Placing the switch in the ON position energizes a 28-volt d-c circuit to turn on the landing light. Placing the switch in the OFF position deenergizes the circuit, and the landing light is off.

TAXI LIGHT.

A taxi light *(34, figure 1-1)* with wide angle illumination, is installed on the nose gear on some aircraft.

TAXI LIGHT SWITCH.

A taxi light switch *(4, figure 1-9)* located on the pilot's left forward console (if installed), is placarded TAXILIGHT: ON-OFF. Placing this switch in the ON position energizes a 28-volt d-c circuit to turn on the taxi light. The OFF position turns the taxi light off.

NAVIGATION LIGHTS.

Navigation lights are mounted on the top and bottom of the fuselage, the tail, and each wing tip pod. The tail and wing tip pod lights are of the flasher type, and may be operated on FLASH or STEADY, as desired. The top and bottom fuselage lights do not flash.

NAVIGATION LIGHTS SWITCHES.

Two navigation lights switches are located on the navigation light panel *(7, figure 1-9)*, on the pilot's left forward console. One switch, placarded BRIGHT — DIM, is provided to control the intensity of the lights. Placing this switch in the BRIGHT position permits the lights to operate at highest intensity. Placing this switch in the DIM position routes the 28-volt d-c current through resistors to dim the lights to lower intensity. The other navigation lights switch is placarded STEADY, OFF and FLASH. Placing this switch in the STEADY position energizes a 28-volt d-c circuit to turn on and operate the lights continuously. Placing this switch in the OFF position deenergizes the circuit and shuts the lights off. Placing this switch in the FLASH position energizes a 28-volt d-c circuit to the C-2 flasher unit which causes the wing and tail lights to flash on and off. With this switch in the FLASH position, the top and bottom fuselage lights are on steady.

AIR REFUELING (IFR) PROBE LIGHT.

An air refueling (IFR) probe light is provided to illuminate the probe for night air refueling operations.

AIR REFUELING (IFR) PROBE LIGHT RHEOSTAT.

The air refueling (IFR) probe light rheostat is located on the light control panel *(12, figure 1-6)* on the pilot's right console, and is placarded OFF—BRIGHT. Placing this rheostat in the OFF position deenergizes the 28-volt d-c circuit and the probe light is off. Moving the rheostat out of the OFF position energizes a 28-volt d-c circuit to turn on the probe light. The intensity of the light is determined by the position of the pointer between OFF and full BRIGHT.

PILOT'S CONTROL PANEL LIGHTS.

The pilot's control panel lights illuminate the various panels located at the pilot's station, except the right console. The intensity of these lights may be controlled by a rheostat located at the pilot's station.

PILOT'S CONTROL PANEL LIGHTS RHEOSTAT.

The pilot's control panel lights rheostat *(21, figure 1-5)* located on the aft lower face on the control pedestal, is placarded OFF — BRIGHT. Placing this rheostat in the OFF position deenergizes the circuit and the lights are OFF. Rotating the rheostat out of the OFF position energizes a 28-volt d-c circuit to turn on the lights. The intensity of the lights is determined by the position of the pointer between OFF and BRIGHT.

PILOT'S SIDE PANEL LIGHTS.

The pilot's side panel lights are provided to illuminate the pilot's right console. The intensity of these lights

is controlled by a rheostat located at the pilot's station.

PILOT'S SIDE PANEL LIGHTS RHEOSTAT.

The pilot's side panel lights rheostat *(12, figure 1-6)*, located on the pilot's right console, is placarded OFF — BRIGHT. This rheostat operates in the same manner as the pilot's control panel lights rheostat.

PILOT'S INSTRUMENT LIGHT.

The pilot's instrument lights system consists of individual lights mounted on the various instruments at the pilot's station.

PILOT'S INSTRUMENT LIGHTS RHEOSTATS.

Two pilot's instrument lights rheostats *(21, figure 1-5)* are located on the aft lower face of the control pedestal. One rheostat, placarded FLIGHT INST: OFF — BRIGHT, is provided to control the lighting for the flight instruments. The other rheostat, placarded ENG INST: OFF — BRIGHT, is provided to control the lighting for the engine instruments clock, landing gear indicators, flap position indicator, free air temperature indicator, and cabin pressure altitude indicator. These rheostats operate in the same manner as the pilot's control panel lights rheostat.

PILOT'S FLOODLIGHTS.

The pilot's floodlights system consists of light assemblies mounted on the left side of the pilot's station, the control pedestal, and the pilot's seat. The lights are controlled by a rheostat located at the pilot's station.

PILOT'S FLOODLIGHTS RHEOSTAT.

The pilot's floodlights rheostat located on the light control panel *(12, figure 1-6)* on the pilot's right console, is placarded FLOOD LIGHTS: OFF — BRIGHT. This rheostat operates in the same manner as the pilot's control panel lights rheostat.

THUNDERSTORM LIGHTS.

The thunderstorm lights system consists of two light assemblies, mounted at the pilot's station, which provide illumination of the cockpit, to prevent momentary loss of vision during flashes of lightning. These lights are controlled by a rheostat, located at the pilot's station.

THUNDERSTORM LIGHTS RHEOSTAT.

The thunderstorm lights rheostat located on the light control panel *(12, figure 1-6)* on the pilot's right console, is placarded THUNDERSTORM LIGHTS: OFF — BRIGHT. This rheostat operates in the same manner as the pilot's control panel lights rheostat.

WARNING LIGHTS DIMMING.

The warning lights dimming system incorporates resistors into the a-c and d-c warning lights circuit to effectively dim the following warning lights: generator warning lights (left and right), alternator warning lights (left and right), engine fire warning lights (left and right), landing gear warning light, bleed air overheat warning light, and AN/APS-54 warning lights.

Note

The flight instrument lights rheostat must be ON in order for the warning lights dimming switch to dim the above warning lights. When the flight instrument lights rheostat is OFF or when power is removed from the dimming system, the warning lights dimming relay locking circuit is deenergized and the warning lights will revert to full bright.

WARNING LIGHTS DIMMING SWITCH.

The 2-position warning lights dimming switch located on the navigation light panel *(7, figure 1-8)* on the pilot's left forward console, is placarded WARNING LIGHTS DIMMING: BRIGHT — DIM. This switch is spring loaded to the center (off) position. The switch actuates relays in such a manner that when the switch is momentarily depressed to the DIM position, relays are energized and a locking circuit is also actuated, so that when the switch is released, the relay will remain in the locked position, and the warning lights are dimmed. When the switch is placed in the BRIGHT position, the locking circuit is opened, the relay returns to the deenergized position, and the warning lights brighten to their highest intensity.

INTERIOR LIGHTS.

The interior lights system consists of three separate systems: the equipment compartment lights, aft radar compartment lights, and turret compartment lights. These lights are controlled by switches, located in the various compartments.

INTERIOR LIGHTS SWITCHES.

A 2-position ON-OFF interior lights switch is provided to control each compartment lights system separately. These switches are conveniently located in each compartment.

NAVIGATOR'S CONTROL PANEL LIGHTS.

The navigator's control panel lights serve to illuminate the various instruments located at the navigator's station. These lights are not visible as such, but cause the lettering on the various panels to appear as though the lights are behind the lettering by transmitting the light through lucite masks to the clear lettering. These lights are controlled by a rheostat located at the navigator's station.

NAVIGATOR'S CONTROL PANEL LIGHTS RHEOSTAT.

The navigator's control panel lights rheostat, located on the light control panel *(6, figure 4-9)*, on the navi-

gator's lower forward console, is placarded PANEL LIGHTS: OFF — BRIGHT. This rheostat, when placed in the OFF (detent) position, turns the navigator's control panel lights OFF. The rheostat operates in the same manner as the pilot's control panel lights rheostat.

NAVIGATOR'S AND GUNNER'S INSTRUMENT LIGHTS.

The navigator's and gunner's instrument lights consist of individual light assemblies mounted on the various instruments located at the navigator's and gunner's stations. These lights are controlled by a rheostat located at the navigator's station.

NAVIGATOR'S AND GUNNER'S INSTRUMENT LIGHT RHEOSTAT.

The navigator's and gunner's instrument lights rheostat, located on the light control panel *(6, figure 4-9)*, on the navigator's lower forward console, is placarded INST. LIGHT: OFF — BRIGHT. This rheostat, when placed in the OFF (detent) position, turns the navigator's and gunner's instrument lights OFF. The rheostat operates in the same manner as the pilot's control panel lights rheostat.

NAVIGATOR'S FLOODLIGHTS.

The navigator's floodlights consists of various light assemblies located at the navigator's station to provide additional illumination. These lights are controlled by a rheostat located at the navigator's station.

NAVIGATOR'S FLOODLIGHTS RHEOSTAT.

The navigator's floodlights rheostat, located on the light control panel *(6, figure 4-9)* on the navigator's lower forward console, is placarded FLOOD LIGHTS: OFF — BRIGHT. This rheostat operates in the same manner as the pilot's control panel lights rheostat.

NAVIGATOR'S TABLE LIGHT.

The navigator's table light *(3, figure 4-10)* is mounted on the right side of the gunner's forward console and provides illumination for the navigator's table. This light is controlled by a rheostat located on the gunner's forward console.

NAVIGATOR'S TABLE LIGHT RHEOSTAT.

The navigator's table light rheostat, located on the right lower side of the gunner's forward console, is placarded NAVIGATOR'S TABLE LIGHT CONTROL; OFF — BRIGHT. This rheostat operates in the same manner as the pilot's control panel rheostat.

GUNNER'S CONTROL PANEL LIGHTS.

The gunner's control panel lights serve to illuminate the various panels located at the gunner's station. These lights are controlled by a rheostat located at the gunner's left console.

GUNNER'S CONTROL PANEL LIGHTS RHEOSTAT.

The gunner's control panel lights rheostat, located on the light control panel *(6, figure 4-12)* on the gunner's left console, is placarded PANEL LIGHT: OFF — BRIGHT. This rheostat operates in the same manner as the pilot's control panel lights rheostat.

GUNNER'S FLOODLIGHTS.

The gunner's floodlights consist of various light assemblies, located at the gunner's station, which provide additional illumination. These lights are controlled by a rheostat located on the gunner's left console.

GUNNER'S FLOODLIGHTS RHEOSTAT.

The gunner's floodlights rheostat, located on the light control panel *(6, figure 4-12)* on the gunner's left console, is placarded FLOOD LIGHTS: OFF — BRIGHT. This rheostat operates in the same manner as the pilot's control panel lights rheostat.

FLIGHT COMPARTMENT DOME LIGHT.

The flight compartment dome light consists of a light assembly, comprising two lamp circuits for red and white lights. This light assembly is located approximately on the center line of the aircraft above the flight compartment entrance door.

FLIGHT COMPARTMENT DOME LIGHT SWITCH AND RHEOSTAT.

A 2-position flight compartment dome light switch, placarded RED — WHITE, and a rheostat, placarded OFF — BRIGHT, are located adjacent to the flight compartment dome light assembly. The switch selects red or white light; the rheostat turn the light on and off and controls the intensity.

UTILITY LIGHTS.

The utility lights consists of five light assemblies with integral rheostat for controlling the lights. The lights are located as follows: one near the left rear of the gunner's seat, one near the right arm of the navigator's seat, one on the pilot's control pedestal, and one located above each weather observer's window in the weather compartment.

WEATHER COMPARTMENT SPOT LIGHTS.

The weather compartment spot lights system consists of two spot lights located above the window to the left or right of each observer, respectively.

WEATHER COMPARTMENT SPOT LIGHTS RHEOSTAT.

A rheostat, placarded SPOT LIGHTS: DIM — BRIGHT, is mounted on each observer's light control panel and is used to vary the intensity of the spot light according to the position of the rheostat.

Oxygen Duration Table--Hours

20-LITER OXYGEN SYSTEM

OXYGEN DURATION HOURS
CREW MEMBERS (FIVE)
ONE TYPE MA-1 20-LITER
OXYGEN CONVERTER

CABIN ALTITUDE (FEET)	LITERS LIQUID OXYGEN					
	20	15	10	5	2.5	BELOW 2.5
35,000 AND ABOVE	21.23 21.23	15.92 15.92	10.62 10.62	5.31 5.31	2.65 2.65	EMERGENCY DESCEND TO ALTITUDE NOT REQUIRING OXYGEN
30,000	15.32 15.75	11.49 11.80	7.66 7.87	3.83 3.43	1.91 1.97	
25,000	11.82 14.88	8.86 11.16	5.91 7.44	2.95 3.72	1.48 1.86	
20,000	8.99 16.81	6.74 12.61	4.50 8.41	2.25 4.20	1.12 2.10	
15,000	7.21 20.39	5.40 15.30	3.60 10.20	1.80 5.10	.90 2.50	
10,000	5.79 20.39	4.34 15.30	2.90 10.20	1.45 5.10	.72 2.50	

RED FIGURES — DILUTER LEVER AT 100%
BLACK FIGURES— DILUTER LEVER AT NORMAL

1535

Figure 4-23

WEATHER COMPARTMENT FLOOD LIGHTS.

The weather compartment flood lights system consists of two light assemblies each containing three lamps, one mounted above each observer's seat.

WEATHER COMPARTMENT FLOOD LIGHTS RHEOSTAT.

A rheostat, placarded FLOOD LIGHTS: DIM — BRIGHT, is mounted on each observer's light control panel and is used to vary the intensity of the floodlights according to the position of the rheostat.

WEATHER COMPARTMENT INSTRUMENT LIGHTS.

The weather compartment instrument lights system consists of a number of light assemblies mounted in the various instrument panels.

WEATHER COMPARTMENT INSTRUMENT LIGHTS RHEOSTAT.

The lights in the instrument panels located at each observer's station are controlled by a rheostat, placarded INSTRUMENT LIGHTS: DIM — BRIGHT, located on each observer's light control panel. The rheostat is used to vary the intensity of the instrument lights.

WEATHER COMPARTMENT PANEL LIGHTS.

The weather compartment panel lights system consists of a number of light assemblies mounted in the various panels at the two compartment stations to illuminate the lettering on the masks.

WEATHER COMPARTMENT PANEL LIGHTS RHEOSTAT.

A rheostat, located at each observer's station on the light control panel is placarded PANEL LIGHTS: DIM — BRIGHT, is used to vary the intensity of the panel lights.

WEATHER COMPARTMENT TABLE LIGHTS.

The weather compartment table lights system consists of six light assemblies, three of which are mounted above each observer's table on the equipment racks. The table light assemblies are shaded to give maximum illumination at the table surfaces with a minimum reflection into the observer's eyes.

WEATHER COMPARTMENT TABLE LIGHTS RHEOSTAT.

A rheostat, placarded TABLE LIGHTS: DIM — BRIGHT, located on each observer's light control panel is used to vary the intensity of the table lights.

WEATHER COMPARTMENT DOME LIGHTS.

Three dome lights are installed in the weather compartment to illuminate the entrance hatch, the circuit breaker panel, and the aft equipment rack. The light assemblies are controlled by the switches (placarded COMPARTMENT DOME LIGHTS) mounted on the

side of the compartment above the entrance hatch and just below the No. 2 observer's light control panel.

OXYGEN SYSTEM.

A liquid oxygen system, incorporating a 20-liter 300-psi liquid oxygen converter, is installed. The liquid oxygen converter for the system converts liquid oxygen to gaseous oxygen at a rate sufficent to supply five crew members. Oxygen is distributed to each crew station when the crew member's mask is plugged into the oxygen supply quick-disconnect unit at his seat and the oxygen regulator supply toggle is in the ON positon. In the event of seat ejection, the quick-disconnect unit serves to disconnect the crew member from the oxygen system. See figure 4-23 for oxygen supply duration. Three portable MA-1 diluter-demand oxygen cylinders are provided; one in the flight compartment and two in the weather compartment *(figure 3-9)*. Three recharger outlets are provided, one adjacent to each cylinder location.

PRESSURE DEMAND OXYGEN REGULATOR.

Five type MD-1 automatic, pressure breathing, diluter-demand oxygen regulators are installed, one at each crew member's station *(6, figure 1-8)*.

OXYGEN REGULATOR SUPPLY LEVER.

The ON-OFF oxygen regulator supply lever is located on the oxygen regulator panel at each crew station *(6, figure 1-8)*.

WARNING

When not in use, all oxygen regulator supply levers, except for the pilot's station, must be in the OFF positon to prevent bleeding of oxygen from the system.

OXYGEN REGULATOR DILUTER LEVER.

An oxygen regulator diluter lever, located on each oxygen regulator panel *(6, figure 1-8)*, is placarded NORMAL and 100%. The diluter lever may be moved to 100% for emergency operation.

OXYGEN REGULATOR EMERGENCY TOGGLE.

The oxygen regulator emergency toggle, located on each oxygen regulator panel *(6, figure 1-8)*, is placarded EMERGENCY and TEST. Manually depressing the toggle to TEST will pressurize the mask to insure sufficient pressure for a leakage check; for emergency operation, movement of the toggle to EMERGENCY will increase the demand oxygen supply pressure.

OXYGEN SYSTEM INDICATORS.

OXYGEN PRESSURE AND FLOW INDICATORS.

Oxygen pressure and flow indicators are located on each oxygen regulator panel *(6, figure 1-8)* to indicate the oxygen flow pressure in psi when the oxygen supply is turned ON.

Note

The pressure indicator does not indicate the quantity of liquid oxygen in the converter.

OXYGEN QUANTITY INDICATOR.

An oxygen quantity indicator, placarded QUANTITY LITERS, is located on the main instrument panel *(25, figure 1-9)* and indicates the oxygen supply available.

Note

The oxygen system should be fully charged prior to all flights.

OXYGEN SYSTEM PREFLIGHT CHECK.

Each crew member should preflight his oxygen equipment as follows:

1. Regulator and Hose Connections.
   a. Alligator clip (clothing clamp) in proper working conditon.
   b. If the loop-type connector is used, connect the attachment strap on the mask male connector to the parachute chest strap by routing the connector strap under the chest strap as close to the chest strap snap as possible, up behind the chest strap, down in front of the chest strap, around again; then snap it to the connector.

WARNING

It is imperative that the connector tie-down strap on the mask male connector not be single looped around the parachute chest strap or attached to the chest strap snap. Failure to double loop the connector tie-down strap around the parachute chest strap will result in the tie-down strap slipping into the chest strap snap and inadvertently opening the snap during bail-out.

   c. Connect the mask-to-regulator tubing female disconnect to the mask male connector; listen for the click and see that the sealing gasket is only half exposed.

d. Attach the alligator clip to the end of the mask male connector strap.

2. MD-1 Regulator Check.

a. Check the regulator outward leakage by using the following blowback test: Remove mask and blow gently into the end of the oxygen regulator hose as during normal exhalation. (Blowing hard may tend to seal a leaky diluter air valve.) Resistance to blowing indicates that the demand diaphragm, the diluter air valve, and the mask-to-regulator tubing are satisfactory; little or no resistance to blowing indicates that one of the components is faulty.

Note

Conduct the blowback test on all demand regulators twice, once with the diluter valve at the NORMAL position and again at the 100% position.

b. With the regulator supply lever ON, the oxygen mask connected to the regulator, and the diluter lever in 100% position, conduct the following check while breathing normally:

(1) Observe the blinker for proper operation.

(2) Deflect the emergency toggle to EMERGENCY. A positive pressure should be applied to the mask. Return the emergency toggle to center position.

(3) Deflect the emergency toggle to TEST. A positive pressure should be applied to the mask. Hold your breath to determine whether there is leakage around the mask. Release the emergency toggle lever; positive pressure should cease.

(4) Return the diluter lever to NORMAL.

c. Return the oxygen supply lever to OFF, using approximately 20 pound-inches of torque to insure that the supply valve is completely closed. Then push the emergency toggle lever in momentarily to reset the indicator to a zero reading.

Note

If pressure builds up after several minutes, the oxygen supply valve is not fully closed. This condition will cause oxygen to flow from the regulator begins to meter oxygen.

OXYGEN SYSTEM NORMAL OPERATION.

1. Oxygen regulator supply lever — ON.
2. Oxygen regulator dilutor lever — NORMAL.
3. Momentarily depress the oxygen regulator emergency toggle to TEST to check the mask for leaks.
4. Check oxygen pressure and flow indicator.

OXYGEN SYSTEM EMERGENCY OPERATION.

1. Oxygen regulator supply lever — ON.
2. Oxygen regulator diluter lever — 100%.
3. Momentarily depress the oxygen regulator emergency toggle to TEST check the mask for leaks.
4. Move the emergency toggle lever to the EMERGENCY position to increase the demand oxygen supply pressure.
5. Check the oxygen pressure and flow indicator.

AUTOPILOT SYSTEM.

The MA-4 autopilot is a gyroscopically controlled, electrically actuated system which automatically operates the flight control systems to maintain any desired compass heading and a normal stabilized altitude. In addition, the system provides constant altitude control, coordinated turn control, automatic elevator trim compensation, localizer, and automatic approach control for instrument landing operation. Power is supplied to the autopilot equipment by the aircraft 28-volt d-c and 115-volt a-c systems.

Note

After electric power is supplied to the autopilot, it will take approximately 1½ minutes for the gyros to complete the erection process. It is impossible to engage the autopilot or the yaw damper, unless the system has been energized and is completely ready for automatic operation.

The system contains interlocks and disengagement devices for the prevention of improper engagement or control action of the autopilot. Displacement and torque limits on the elevator servo output are provided to automatically prevent control action from exceeding the structural limtations of the aircraft, when the action is due to autopilot control. The autopilot provides stabilized flight control at any airspeed or altitude; or by utilizing the rudder only, the autopilot can be used as a yaw-damping device to increase directional stability while flying the aircraft manually. It can be engaged with the flight control systems, when the aircraft is within pitch maneuvering limits and within ±29 degrees of roll and may be disengaged in any flight altitude. The electrical controls for manual operation of the autopilot in maneuvering and trimming the aircraft are grouped on the autopilot control panel *(figure 4-24)*. A remote

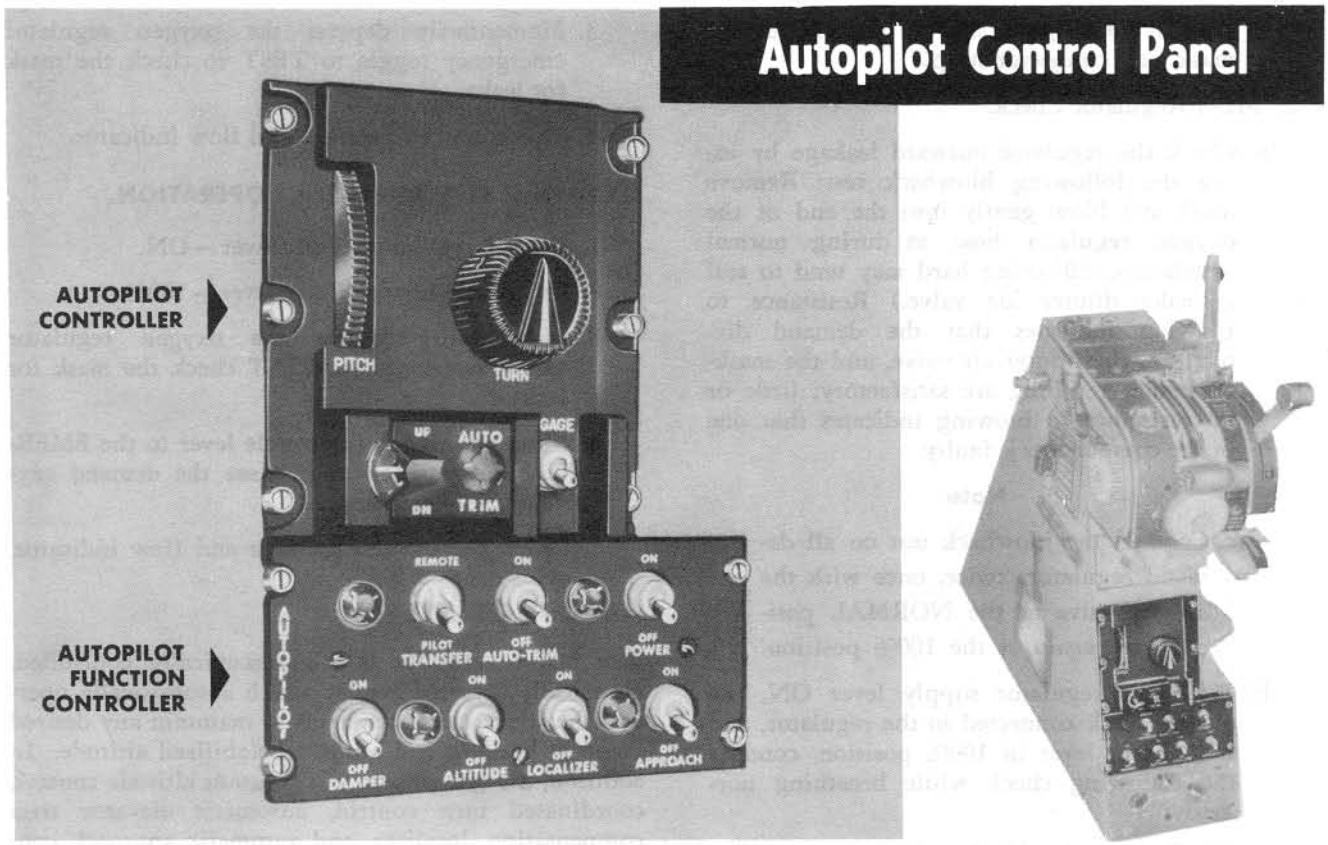


Figure 4-24

turn control *(figure 4-25)*, for use by the navigator, is installed at the navigator's station; it may be overridden by the pilot.

Note

The autopilot will be ineffective if either flight control boost system is disengaged.

Note

In the event of failure of the right alternator, the autopilot will automatically disengage due to momentary loss of power during load transfer to the left alternator. The autopilot may be reengaged immediately.

MANEUVERING LIMITS.

The autopilot, when engaged, is capable of maneuvering the aircraft through the following ranges:

1. Coordinated turns — bank angles to 60 degrees.
2. Pitch angles — plus 32 degrees and minus 26 degrees, from horizontal.

ENGAGE SWITCH.

The engage switch, located on the autopilot control panel *(figure 4-24)* is a toggle switch, spring loaded to the disengaged positon. This switch will be solenoid held in the ENGAGE positon when the power switch is ON and the autopilot is ready for engagement. If incorrect values of a-c or d-c power are supplied to the system, the switch will not remain in the ENGAGE position. When the autopilot is disengaged by means of the release button on the pilot's control wheel, the power switch, the elevator a-c trim control switches, or any malfunction of the system, the engage switch will return to the disengaged positon.

AUTOPILOT CONTROLLER.

The autopilot controller, located on the autopilot control panel *(figure 4-24)* provides a turn-and-pitch control for maneuvering the aircraft with the autopilot engaged.

TURN CONTROL.

The turn control has a detent at the center positon. Rotation of the turn control out of detent switches turns off the directional control and switches on a circuit for accomplishing coordinated turns by rotation of the control knob. The turn control signal is derived from a potentiometer connected to the turn control. The turn control must be in the detent position for operation of the yaw damper when the autopilot is disengaged.

PITCH CONTROL.

The pitch control wheel provides a means for manually adjusting the aircraft pitch attitude after the

autopilot has been engaged. The elevator synchronizer automatically synchronizes the pitch axis of the autopilot when it is engaged. Rotating the pitch control wheel forward results in a nose-down attitude; rotating the wheel aft produces a nose-up attitude.

AUTOPILOT FUNCTION SELECTOR.

The autopilot function selector located on the autopilot control panel *(figure 4-24),* contains the following seven autopilot control switches.

POWER SWITCH.

The power switch is an ON-OFF toggle switch which controls the power to the electronic units of the autopilot system.

DAMPER SWITCH.

The damper switch is an ON-OFF toggle switch which electrically energizes the yaw axis channel and engages the rudder servo to make corrections to stabilize the aircraft. The damper may be used when the autopilot is disengaged, if the power switch is ON and the turn control is in the detent positon.

AUTO TRIM SWITCH.

The auto trim switch energizes the automatic trim circuit of the horizontal stabilizer actuator when the autopilot is engaged. The auto trim circuit, through horizontal stabilizer adjustment, reduces to a minimum the out-of-trim conditions produced by steady-state change in trim introduced by changes in airspeed, angle of attack, and load conditions, thus reducing unbalanced stick force upon disengagement of the autopilot.

ALTITUDE SWITCH.

The altitude switch is an ON-OFF toggle switch which electrically energizes a circuit in the autopilot system, to maintain the aircraft at the barometric pressure altitude at which the altitude control is engaged. The altitude control is designed to operate over a pressure altitude range of −100 to +65,000 feet. If ON, the altitude switch will drop to the OFF positon when the autopilot engage switch is placed in the disengaged position, and/or, when the approach switch is placed ON.

LOCALIZER SWITCH.

The localizer switch is an ON-OFF toggle switch which, when in the ON position, causes the autopilot to respond to AN/ARN-14 omni-range localizer signals. The switch provides for the engagement and disengagement of the localizer coupler. This switch (solenoid held in the ON position), when turned on and the autopilot is engaged, may be manually turned off at any time, and will automatically spring back to the OFF position when the approach toggle switch is turned ON, or, when the autopilot is disengaged. The turn controls are inoperative when the localizer switch is actuated.

APPROACH SWITCH.

The approach switch is an ON-OFF toggle switch which, when in the ON position, causes the autopilot to respond to AN/ARN-18 approach signals. The altitude switch and the localizer switch will automatically return to OFF position when the approach switch is placed ON. The approach switch provides for the engagement of the approach portion of the localizer coupler and the glide path coupler. This switch, when turned ON, is solenoid locked in the ON position when the autopilot is engaged. The approach switch cannot be turned OFF while the autopilot is engaged; however, the switch will automatically spring back to the OFF position when the autopilot is disengaged. The turn controls are inoperative when the approach switch is actuated.

WARNING

Engagement of the approach switch before reaching the glide slope (indicated by the horizontal needle approaching the zero dot position) will result in an abrupt pitch-up as the aircraft climbs to intercept the glide slope.

This equipment is powered by 28-volt d-c power supplied from the pilot's radio and radar bus.

Allow at least one minute for the set to warm up before turning the channel selector switch, to preclude damage to the equipment.

The automatic approach should not be continued beyond the following specified distances:

Runway Length feet	5000	6000	7000	8000 or more
Minimum Altitude Above Terrain. feet	*500*	*420*	*330*	*250*
Minimum Range From End of Runway For Automatic Control (miles)	1.6	1.4	1.2	1.0

TRANSFER SWITCH.

The transfer switch, with placarded positions PILOT-REMOTE, is a solenoid held toggle switch. The purpose of the switch is to transfer manual turn control to the remote station (navigator's station). The pilot's turn control and the navigator's turn control must be in detent position before transfer of control can take place. The solenoid-holding circuits of the

Figure 4-25

switch may be interrupted at will by the pilot to transfer control from the navigator to the pilot by moving the pilot's turn control out of detent.

Note

The navigator's remote turn control cannot override the pilot's turn control.

NAVIGATOR'S AUTOPILOT REMOTE TURN CONTROL.

The navigator's autopilot remote turn control, located at the navigator's station *(figure 4-25)*, provides a means additional to, and remote from, the autopilot controller, for maneuvering the aircraft in coordinated turns in conjunction with the autopilot. The remote turn control has a detent at the center position and operates in the same manner as the turn control on the controller *(figure 4-24)*.

MANUAL-AUTOMATIC SWITCH.

The manual-automatic switch, on the remote turn control panel at the navigator's station, is not connected and does not function.

AUTOPILOT RELEASE SWITCH.

The autopilot release switch, located on the pilot's control wheel *(8, figure 1-4)*, when depressed, will instantly electrically disengage the autopilot engage switch, the altitude switch, the localizer switch and the approach switch. The remote turn control, if in use at the time, will automatically be inoperative. After use of the release switch, the autopilot may be reengaged by placing the engage switch in the ENGAGE position.

AUTOPILOT EMERGENCY RELEASE SWITCH.

The autopilot emergency release switch, located in the center of the pilot's control wheel *(8, figure 1-4)*, is placarded AUTOPILOT EMERGENCY RELEASE. When depressed, this switch electrically disengages the autopilot engage switch, the altitude switch, the localizer switch, and the approach switch. The remote turn control, if in use at the time, will automatically be inoperative. After actuating the emergency release switch, the autopilot may be reengaged by placing the engage switch in the ENGAGE position.

AUTOPILOT INDICATORS.

TRIM INDICATOR.

A 28-volt d-c pitch trim indicator (AUTO TRIM) is installed on the autopilot control panel *(figure 4-24)*, to give an indication that horizontal stabilizer trim correction is required. The trim indicator provides continuous trim indication. The indicator indicates the direction of required trim, but not the amount. Automatic trim may be overridden by either the elevator trim switch on the control wheel, or on the control pedestal.

CAUTION

Check the indicator for out-of-trim condition prior to engaging or disengaging the autopilot.

REMOTE TURN CONTROL INDICATOR LIGHT. A green indicator light, located on the navigator's autopilot remote turn control panel *(figure 4-25)*, will illuminate when the remote station has control.

AUTOPILOT OPERATION (FUNCTIONAL CHECK).

PRIOR TO TAKE-OFF.

1. Place the power switch in the ON position and allow a 2½ minute warm-up period.
2. Place the damper switch ON and check operation by applying right and left rudder pedal pressure. Turn yaw damper switch OFF.
3. Place the engage switch in the ENGAGE position and rotate the turn control knob to the right and left; check and observe controls for proper functioning and control surface action, and return the knob to the detent position.
4. Rotate the pitch control wheel for up and down elevator action, and check for proper action of the control column.
5. With the turn control in detent, place the transfer switch in the REMOTE positon; check the green light indicating that the remote station has authority, and instruct the navigator to operate his remote turn control to the right and left; check control action, and return the control knob to detent position. Rotate the pilot's turn control out of detent and see that the remote switch automatically drops to PILOT position, and, that the green light goes out on the remote controller.

6. Place the altitude and localizer switches ON. Place the approach switch ON and see that the altitude and localizer switches automatically drop to the OFF positions. Press the autopilot release switch on the control wheel and check for automatic disengagement of the approach switch.

TAKE-OFF.

Align the aircraft with the runway and set the directional indicator to the runway heading.

AFTER TAKE-OFF AND DURING CLIMB.

1. Trim the aircraft for desired rate of climb, and after a safe altitude has been attained, place the autopilot engage switch in the ENGAGE position. Use the pitch control knob as required to establish best rate of climb.
2. Use the autopilot turn control to establish desired heading.

CRUISE.

1. After desired cruising altitude is reached, level off by means of the pitch control knob and place the altitude switch in the ON position. The aircraft will maintain the constant barometric pressure altitude at which the altitude switch is engaged.

Note

With the IFR probe installed, transient disturbances may occur in the static pressure source used for altitude control. Such disturbances will result in mild porpoising during level flight and erratic elevator action at large bank angles.

2. When required, place the transfer switch in the REMOTE position to transfer autopilot turn control authority to the navigator. Before transfer can be made, the turn control on the pilot's controller unit and the turn control on the navigator's control unit must be in the center (detent) position. The turn control can be returned to the pilot by placing the remote switch in the PILOT position, or by turning the pilot's turn control out of detent.

OPERATION OF AUTOMATIC APPROACH EQUIPMENT.

1. Turn ON the omni-range and localizer receiver (AN/ARN-14 and set the frequency selector switch to the specified frequency (channel).
2. Set the course selector, on the course indicator (localizer and glide slope), to the approach heading to be used.
3. With the autopilot engaged, maneuver the aircraft (by means of the turn control) so as to intercept the localizer course 10 to 14 miles out, according to standard ILS procedure.

Note

The allowable intercept angle is 45 degrees to the localizer course at a distance of approximately 10 to 14 miles from the runway.

4. When stabilized at altitude, engage the altitude control by placing the altitude control switch to the ON position.

Note

Check that both OFF flags on the course indicator disappear.

5. As the aircraft approaches the localizer course (indicated by the vertical needle, on the course indicator, leaving the extreme deflection position and moving towards center), engage the localizer mode by placing the localizer switch to the ON position. The aircraft will then automatically turn toward, and bracket, the localizer.

Note

Normally, the bank angle should not exceed 30 degrees. Should this bank angle be exceeded, disengage the autopilot and continue the approachr manually.

6. As the aircraft apporaches the glide slope (indicated by the horizontal needle, on the course indicator, approaching the upper edge of the center circle), engage the approach mode by placing the approach switch in the ON position.

Note

The altitude and localizer switches will automatically move to the OFF position when the approach switch is placed ON.

Note

A 2½ degree nose-down attitude is automatically induced when the approach switch is placed ON.

Note

After the approach switch is turned ON the bank angle should not exceed 10 degrees and should decrease as the runway is approached. The localizer and glide slope needles should not exceed one dot deflection.

7. On establishing visual contact, press either electrical release button (located on the control wheel) to disengage the autopilot.

Note

When either release button is pressed, the engage switch will move to the DISENGAGE position and the approach switch will move to the OFF position.

CAUTION

Be prepared to immediately correct the pitch attitude after the autopilot is released.

8. Complete the flare-out and landing manually.

CAUTION

The autopilot is not designed for use as an automatic landing system. It is intended only to place the aircraft in a position from which a manual flare-out and landing can be accomplished. The automatic approach should not be continued beyond a distance of approximately ½ mile from the end of the runway or below an altitude of 200 feet above the terrain.

Note

The autopilot must be disengaged to release the solenoid-locked approach switch. Disengage the autopilot by depressing the electrical release switch on the control wheel.

NAVIGATION EQUIPMENT.

N-1 COMPASS SYSTEM.

The N-1 compass system is a remote indicating magnetic slaved, directional gyro stabilized compass system, specifically designed for airborne use in all latitudes. The system is comprised of the following major components; master indicator, repeater indicator, servo loops, directional gyro, and C-2 remote compass transmitter. It may be operated as a magnetic slaved compass or as a directional indicator (gyro) to provide an accurate directional reference and control when used within its design scope. In addition to its use as a compass system, it also provides an azimuth reference signal for the directional control of the autopilot and directional reference for the radio magnetic indicator (RMI), AN/ARN-14, AN/APN-82, and the AN/APS-63 equipment. The system is primarily designed as a directional reference system. Manual selection of the reference system may be made by rotating the altitude correction control knob on the master indicator *(5, figure 4-8)*. When the latitude correction pointer is positioned (by the knob on the face of the master indicator) to OFF, the system is in magnetic slaved operation. When the pointer is set at any latitude, the system is in directional indicator (gyro) operation. The operation of the system for either magnetic slaved or directional indicator (gyro) operation is accomplished by the amplification of signals in the amplifier and by their coordination and dissemination in the master indicator. The coordination of the signals may be traced through two power amplifying loops, one of which is the correction servo loop and the other the azimuth servo loop. They work together in such a way that the N-1 compass system is corrected for total gyro drift when in magnetic slaved operation, and for apparent gyro drift (precession) when in directional indicator (gyro) operation. The correction servo loop is controlled by the signal from the C-2 remote compass transmitter when the N-1 compass system is in magnetic slaved operation. The purpose of this loop is to correct the azimuth reference signal (from the directional gyro) to both the autopilot and the azimuth servo loop. The azimuth servo loop is controlled by both the output of the correction servo and the azimuth reference signal from the directional gyro. The purpose of the azimuth servo loop is to transmit signals to auxiliary equipment such as the autopilot, radar and repeater indicators, to position the master indicator heading pointer and to control the followup to the correction servo input signal. Both the correction servo and the azimuth servo loops work together to provide the desired intelligence. The azimuth signal from the directional gyro is fed to the synchro of the autopilot and to the azimuth servo loop. The correction for the gyro drift is made through the correction servo loop by the C-2 remote compass transmitter when the N-1 compass system is in magnetic slaved operation and by the latitude corrector when in directional indicator (gyro) operation (see Section VII for Principle of Operation and Section VIII for Preflight Checks).

Note

Operating as a magnetic slaved compass, the N-1 compass system may be used in any locality except in regions near the magnetic poles, or in other areas where severe magnetic distortion occurs. During operation as a directional indicator (gyro), the N-1 compass system functions in any latitude, but is especially useful where the magnetic field is weak or distorted as the system is removed from the influence of the earth's magnetism.

Note

The gyro motor of the slaving control should reach synchronous speed within 10 minutes and the motor of the directional gyro within 15 minutes. However, the system is usable as a directional reference after 5 minutes of warm-up time.

MASTER INDICATOR.

The master indicator *(5, figure 4-8)*, located at the navigator's station, provides control of the N-1 compass system. The indicator comprises the following major components; latitude correction knob, synchronizer knob, annunciator, latitude correction pointer, latitude correction scale, and the heading pointer.

REPEATER INDICATORS.

Two repeater indicators are located as follows: one on the main instrument panel *(12, figure 1-9)* at the pilot's station; one in the weather compartment instrument panel *(11, figure 4-15)*. This instrument at the pilot's station incorporates an adjustable azimuth scale, controlled by a knob located on the face of the instrument, and a heading pointer which is slaved to the master indicator. The adjustable azimuth scale can be rotated (by the knob on the face of the instrument). This allows the pilot to set the desired heading to be flown on the top index of the instrument. The heading pointer will always follow the adjustable azimuth scale so that the heading pointer always indicates the magnetic heading of the aircraft regardless of the adjustable azimuth scale setting.

N-1 COMPASS SYSTEM POWER OFF WARNING LIGHTS.

Two 28-volt d-c N-1 compass system power off warning lights are provided. One light is located on the pilot's main instrument panel *(28, figure 1-9)* and one light is located adjacent to the N-1 compass master indicator *(4, figure 4-8)*. These lights will illuminate in the event of N-1 compass system power failure.

NORMAL OPERATION – MAGNETIC SLAVED.

1. N-1 compass power off warning light – OFF.

Note

Allow 10 minutes for warm-up.

2. Synchronize master indicator (see SectionVIII).
3. Check master indicator heading against some known heading reference (such as runway heading, etc) for approximate agreement of magnetic heading.

Note

During magnetic slaved operation the following procedures should be observed:

a. Check that the correction servo indicator is rotating.

b. The annunciator pointer may oscillate *R* (right) and *L* (left) as a result of yaw of the aircraft. This indicates proper operation of the corrective servo.

c. Do not attempt to synchronize the system during, or immediately after a turn.

NORMAL OPERATION-DIRECTIONAL INDICATOR (GYRO).

1. Set latitude correction pointer on latitude of aircraft's position.
2. Check correction servo indicator for correct rotation. The indicator rotates clockwise in north latitudes and counterclockwise in south latitudes.
3. Set master indicator heading pointer to desired gyro heading.

Note

During directional indicator (gyro) operation the following procedures should be observed:

a. The latitude correction pointer should indicate plus or minus 1 degree of the aircraft's position at all times.

b. The latitude correction pointer should be changed to mid-latitude for each 2 degrees change in latitude.

c. Observe that the correction servo indicator is rotating to indicate proper operation of the correction servo, clockwise for north latitudes and counter-clockwise for south latitudes.

PERISCOPIC SEXTANT (PROVISIONS).

The aircraft has been equipped with a periscopic sextant mount for use by the navigator. The mount is installed on the canopy structure between the navigator's and gunner's hatches.

MD-1A FIRE CONTROL SYSTEM.

The fire control system is a radar-directed, remote-controlled turret system, employing a computing system to solve fire control problems. The radar set used in the fire control system performs two basic functions in the defense of the aircraft. It acts as an early-warning radar system and a gun-laying radar system. The radar equipment performs its early-warning function when placed in automatic search operation by the gunner. It then constantly searches a predetermined area aft of the aircraft for other aircraft. When an aircraft enters this area it appears as a spot on the "B" scope of the control-indictor, which is mounted at the gunner's station. The gunner identifies the aircraft as friend or foe by IFF responder equipment. This IFF equipment is not a part of the fire control system, but works in conjunction with it. When the aircraft is identified as an enemy, the gunner can continue to allow the radar to search, if the enemy is at long range, or he can cause the radar equipment to "lock on" and

automatically track the enemy aircraft. The radar equipment performs its gun-laying functions when placed in automatic track operation by the gunner. In this mode of operation, the radar equipment will keep the antenna centered on the target and the rest of the fire control system will cause the turret to follow the movement of the antenna. While the radar equipment is tracking a target, the range, azimuth, and elevation position signals of the target, in conjunction with altitude, airspeed, and temperature signals (from the handset), are fed to the computing equipment. The computing equipment uses these signals to calculate the amount of azimuth and elevation correction necessary to allow for various factors which affect the flight of the projectiles (such as windage and gravity drop) and, also, for turret movement. Corrected target position signals are transferred to the turret drive equipment. The corrected target position signals supplied to the turret drive equipment cause the turret to move into alignment with the antenna, plus or minus the corrections of the computing equipment. The turret is now positioned so that the line-of-fire is directed where it will hit the target. The turret-mounted guns will fire when the firing button is pressed by the gunner. While the radar equipment is in track operation, the antenna and the turret will continue to automatically follow the movements of the target until it is destroyed or moves out of the radar protected area. If the target is destroyed, the gunner may return the system to automatic search operation by pressing the SEARCH button on the control-indicator. If the target moves out of the radar protected area, causing the antenna to go into a limit, the antenna will automatically start searching. During search operation, the turret is held in the stowed position (130 degrees azimuth, zero degrees elevation). The turret is equipped with two dynamically mounted M24-A1 20-mm cannons. The ammunition is fired by d-c electrical power.

TURRET RADAR SYSTEM.

The radar equipment generates high powered radio frequency pulses which are transmitted to a directional antenna and radiated out into space in a narrow beam. Whenever a target is struck by the radar beam, some of the transmitted pulses will be reflected back to the antenna and fed to the receiving circuits of the radar. (The radar equipment employs a switching device that allows the use of a single antenna for both transmitting and receiving.) The time interval between radiated pulses is long enough to permit the reflected energy, or echo, to return to the antenna from targets within the desired range limit. Since radio frequency energy travels at a constant rate of speed, the time required for the transmitted pulse to reach the target and be reflected back to the antenna is directly proportional to the target range. There are three modes of radar operation: automatic search, hand control, and automatic track.

SCOPE ANNOTATION DURING AUTOMATIC SEARCH.

Vertical sweep — 0 to 8000 yards (jizzle ½ inch wide).

Motion of sweep — Horizontal movement, left to right, then right to left (3-second cycles).

Range gate — Not present in search.

Target indications — Should appear on an average of every 3 seconds for each target encountered, except when the target is in the antenna lap-over area. TARGET light (indicator panel) — Illuminates each time a target is encountered.

UP light — Illuminates when vertical sweep is moving to the right and the antenna position is above plus 16 degrees.

DOWN light — Illuminates when the vertical sweep is moving to the left and the antenna position is below minus 18 degrees.

SCOPE ANNOTATION DURING HAND CONTROL.

Vertical sweep — Extends from 0 to 8000 yards (jizzle 5/16 inch wide).

Motion of sweep — Horizontal movement in accordance with movement of antenna control handle.

Range gate — Sweeps from bottom to top of vertical trace until on target. Remains "locked-on" when action switch is released.

Target indications — Appear on vertical trace when antenna is directed at target and remains when antenna is "locked-on."

Target light (indicator panel) — Illuminates when antenna is directed at target and remains illuminated when antenna is "locked-on."

UP light — Illuminates when antenna is raised above plus 16 degrees.

DOWN light — Illuminates when antenna is lowered below minus 18 degrees.

SCOPE ANNOTATION DURING AUTOMATIC TRACK.

Vertical sweep — Extends from 0 to 8000 yards (jizzle 5/16 inch wide).

Motion of sweep — Moves horizontally as target moves.

Range gate — Centered on target (moves up or down as target moves in range).

Target indication on vertical trace — Remains during track.

TARGET light (indicator panel) — Remains illuminated while on target.

UP light — Illuminates when target is above plus 16 degrees.

Camera Controls

P-220 CAMERAS

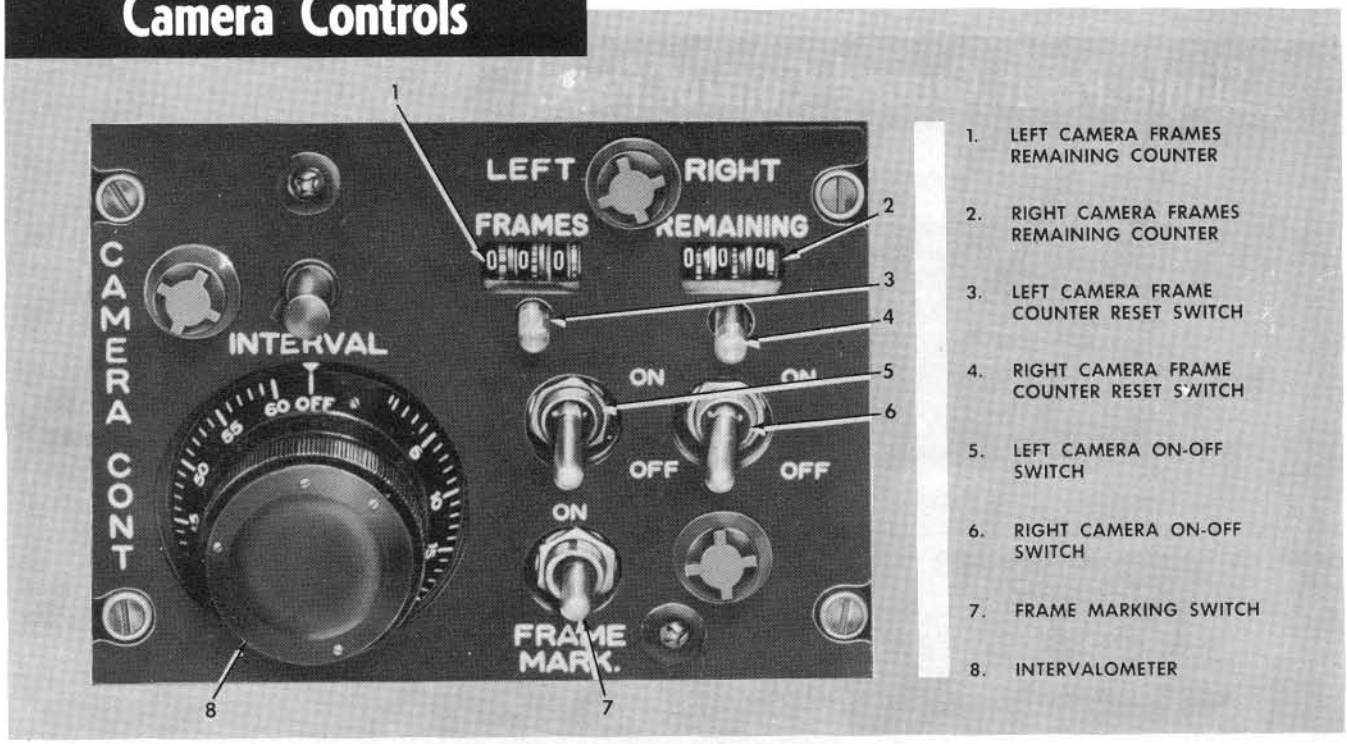


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Figure 4-26

DOWN light — Illuminates when target is below minus 18 degrees.

Rounds (ammunition) counters (left and right gun) — Rotates as guns fire.

CAMERA SYSTEMS.

P-220 CAMERAS.

Two P-220 sequential weather cameras are installed to record pertinent weather data. The P-220 cameras are installed in the forward fuselage access doors on the right and left side of the airplane. The optical axes of the two cameras are oriented 90° from the line of flight and 21° down from the fuselage reference plane. Each of the two camera installations includes: one P-220 camera with a 50 foot film magazine and an automatic exposure control unit. Space is provided for the installation of a 100 foot capacity film magazine.

The camera control panel located at weather observer's number 1 position *(3, figure 4-15 and figure 4-26)* includes: an intervalometer, type B-9A for determining the interval between exposures (from 1 to 60 seconds), individual camera ON-OFF switches, counters indicating frames remaining in each magazine and a frame marking switch which marks the film in either or both cameras when the cameras are in operation.

To set either camera in operation, it is necessary only to turn the camera ON-OFF switch to ON and set the intervalometer for the desired interval. Exposure control is fully automatic in three steps (bright-hazy-dull). The frame marking switch may be used as desired to mark frames of special interest.

0-15A CAMERA.

An 0-15A camera is installed to record images appearing on the radar indicator at the navigator's station. The components consist of a C-1A camera unit installed on the radar indicator, a C-1B film magazine accommodating 100 feet of 35-mm film attached to the camera unit, and an LD-6 exposure frequency control panel at the navigator's station *(7, figure 4-9)* for operation of the system. The camera automatically photographs the images displayed on the radar screen and the information displayed in a data-recording chamber. Data is recorded with each exposure to identify it and aid its evaluation so that a complete and permanent record is compiled.

AIR REFUELING SYSTEM.

A complete air refueling system is installed in the aircraft *(figure 1-10)*. The system includes the necessary piping and control valves and provisions for the ready attachment of the air refueling probe. Air refueling can be accomplished at an average rate of 600 gallons per minute. Switches are provided at the pilot's station for operation of the system. An air refueling probe light is provided in the upper nose section for illumination of the probe during night air refueling operation. Refer to Section VII for Air Refueling Procedure.

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Figure 4-27

AIR REFUELING (IFR) SWITCH.

A 2-position air refueling switch, placarded IFR, is located on the fuel selector panel on the pilot's right console *(11, figure 1-6)*. The switch is guarded in the down (off) position. When the guard is raised and the switch is placed in the up (on) position, a 28-volt d-c circuit is energized to open the refueling shutoff valves for refueling operation. The switch, also, because of its override control will cause the following: stop the forward fuselage fuel tank boost pump, deenergize the forward fuselage fuel tank high level float solenoids, stop the flow of tank pressurization air into all internal fuel tanks, and depressurize all internal fuel tanks. When the switch is placed in the down (guarded) position, its override control is off and the refueling shutoff valves are closed to discontinue air refueling operation. The IFR switch has no control over the CG valve. The CG valve is controlled only by the fuselage fuel trim switch during IFR operation.

AIR REFUELING (IFR) PROBE LIGHT RHEOSTAT.

The air refueling probe light rheostat, located on the light control panel on the pilot's right console panel *12, figure 1-6),* has OFF and BRIGHT positions. When the rheostat is moved from the OFF position toward the BRIGHT position, a 28-volt d-c circuit is energized to turn on the probe light. The intensity of the light is determined by the position of the rheostat between OFF and full BRIGHT. When the rheostat is in the OFF position, the circuit is deenergized to turn off the probe light.

SINGLE-POINT GROUND REFUELING SYSTEM.

A single-point ground refueling system permits complete refueling of the aircraft (except for the droppable tanks) at an average rate of 600 gallons per minute. A ground refueling adapter, located on the lower right side of the fuselage below the leading edge of the wing, opens mechanically when the ground refueling nozzle is engaged. A ground refueling control panel *(figure 4-27),* located adjacent to the ground refueling adapter, contains switches to manage the refueling system. With proper switch positioning on the ground control panel, the internal tanks may be refueled either simultaneously or selectively when fuel is supplied to the refueling adapter. An automatic high level shutoff system is provided in each tank to prevent overfilling. Single-point ground defueling, through the same adapter used for ground refueling, can be accomplished by proper positioning of switches on the ground control panel. All defueling is accomplished from the fuselage aft tank

by means of the two boost pumps. Defueling of the fuselage forward tank and wing tanks necessitates an initial transfer to the fuselage aft tank. A d-c external power supply is required for ground refueling and defueling.

GROUND REFUELING PROCEDURE.

When the ground jack has been plugged into the receptacle on the ground refueling panel and contact has been made between the ground fuel supply and the refueling adapter, proceed as follows:

1. Place the fuselage fuel trim switch in the AFT position and the fuel selector switch in the TAKE-OFF & CROSS FEED or FLIGHT NORMAL position.
2. Place the refuel-defuel switch on the ground control panel in the REFUEL position.
3. Place the precheck control switch to the PRECHECK position.
4. Place the four inlet valve control precheck switches on the ground control panel in the PRIMARY position.
5. Operate the ground refueling equipment to provide fuel under 20 psi pressure to the aircraft fuel system. The primary ground control panel amber indicator lights should illuminate and there should be no fuel flow into the aircraft.
6. Place the four inlet valve control precheck switches in the REFUEL (center) position. The amber indicator lights should go out and the fuel should start flowing.
7. Place the four inlet valve control precheck switches to the SECONDARY position. The secondary ground control panel amber indicator lights should illuminate and there should be no further fuel flow into the aircraft.
8. Place the precheck control switch in the REFUEL position. The primary indicator lights for the aft and forward fuel tank should illuminate and all secondary indicator lights should remain illuminated.

WARNING

If any one of the 8 inlet valve control precheck switch lights fails to illuminate in either primary or secondary position, press the press-to-test lights to determine if the malfunction is within the light assembly; if the light illuminates when pressed-to-test the aircraft is considered unsafe for flying until the cause of the malfunction is located and corrected.

9. Place the four inlet valve control precheck switches and the precheck control switch in the REFUEL (center) position. The amber indicator lights should go out and the fuel should start flowing.

Note

After completing the pre-check of the fuel system, fuel may be delivered to the aircraft at pressures up to 50 psi.

CAUTION

At completion of refueling the precheck control switch and inlet valve control precheck switches must be left in the REFUEL position for flight operation.

10. When refueling is complete, as indicated by all 8 indicator lights illuminating, place the refuel-defuel switch in the center position, and leave the four inlet valve control precheck switches in the REFUEL position.
11. Remove the ground refueling source and ground jack from the aircraft.

GROUND DEFUELING PROCEDURE.

When the ground jack has been plugged into the receptacle on the ground refueling panel and contact has been made between the ground fuel supply and the refueling adapter, proceed as follows:

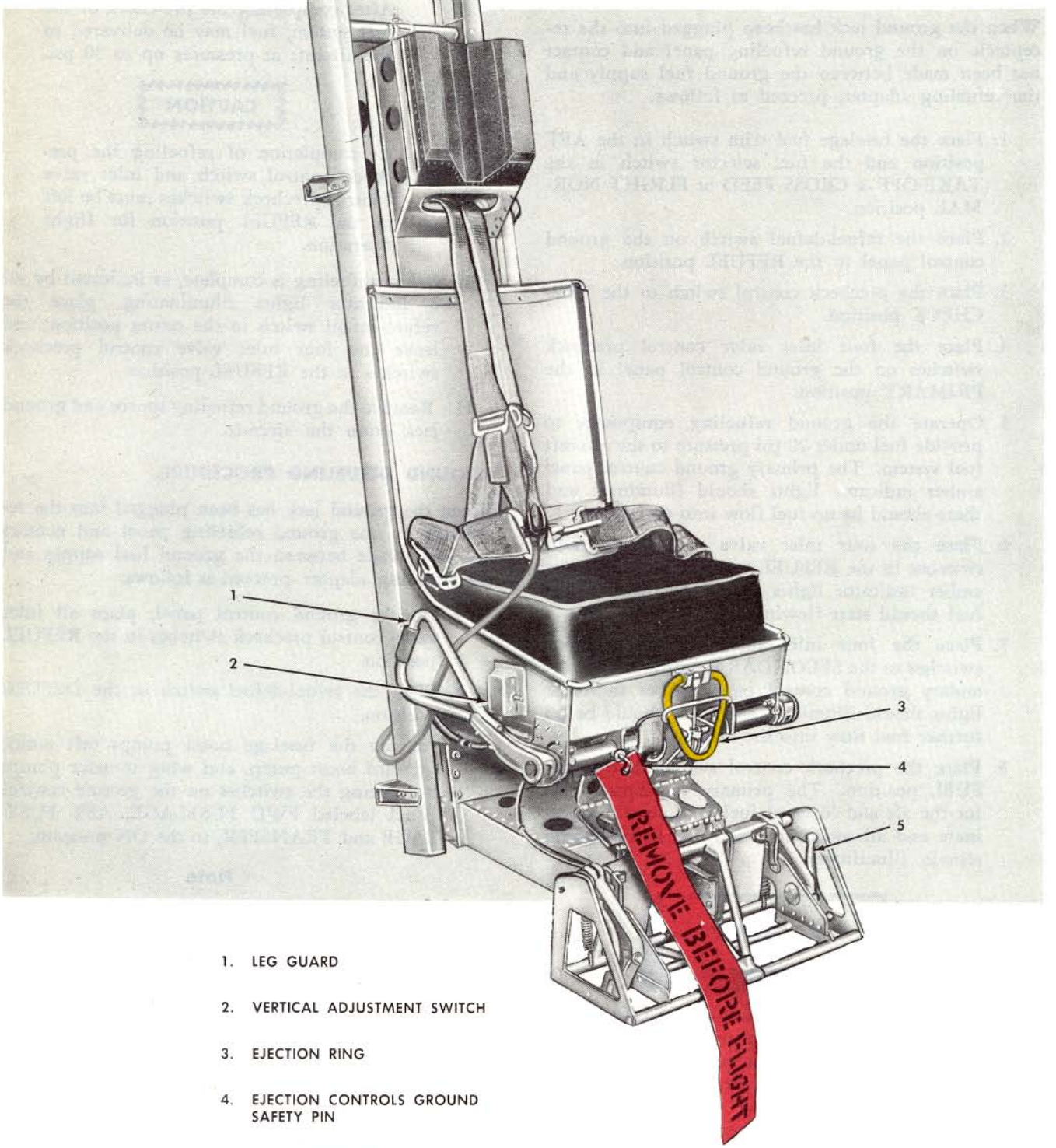
1. On the ground control panel, place all inlet valve control precheck switches in the REFUEL position.
2. Place the refuel-defuel switch in the DEFUEL position.
3. Actuate the fuselage boost pumps (aft tank), forward boost pump, and wing transfer pumps by placing the switches on the ground control panel labeled FWD FUSELAGE, AFT FUSELAGE and TRANSFER, to the ON position.

Note

When the forward fuselage fuel pump switch is turned ON, the forward tank float valve solenoids are energized. This causes the forward tank inlet control valve to remain closed.

4. When the wing tanks are empty, the transfer pump switch on the ground control panel must be placed in the OFF position.
5. When the forward tank is empty, the forward fuselage fuel pump switches on the ground control panel must be placed in the OFF position.
6. When defueling is complete, place the aft fuselage fuel pump switch to the OFF position.

Weather Observer's Seat—Typical



1. LEG GUARD
2. VERTICAL ADJUSTMENT SWITCH
3. EJECTION RING
4. EJECTION CONTROLS GROUND SAFETY PIN
5. ANKLE RESTRAINT

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Figure 4-28

7. Place the refuel-defuel switch in the center position.
8. Remove the ground refueling source and ground jack from the aircraft.

MISCELLANEOUS EQUIPMENT.

NAVIGATOR'S SEAT.

The navigator's seat is equipped with controls for vertical and fore and aft adjustments. A separate control is provided to release the aft position lock. The seat *(figure 1-21)* is provided with two controls for locking the shoulder harness, one for normal use and the other for use during seat ejection. The seat is also provided with controls for jettisoning the canopy hatch and for seat ejection. The ejection carriage of the seat rides on rails, and powder charges are used in the seat ejection catapult to accomplish seat ejection. The seat is equipped with an automatic-opening lap safety belt. See figure 3-6 for Ejection Seat Operation. See figure 1-21 for Seat Controls.

NAVIGATOR'S SEAT CONTROLS.

AFT LOCK RELEASE LEVER.

An aft lock release lever *(9, figure 1-21)* on the aft left side of the navigator's seat, when pulled up, will release the latch which is engaged if the seat is in the full aft position, to permit seat adjustment.

FORE AND AFT ADJUSTMENT LEVER.

A fore and aft adjustment lever *(10, figure 1-21)* on the left forward side of the navigator's seat, when pulled up, will permit fore and aft adjustment of the seat, after the seat has been unlatched from the aft position.

VERTICAL ADJUSTMENT HANDLE.

A vertical adjustment handle *(4, figure 1-21)* on the forward edge of the navigator's seat, when pulled up, will permit vertical adjustment of the seat to the desired height.

NORMAL SHOULDER HARNESS INERTIA

REEL LOCKING LEVER.

A normal shoulder harness inertia reel locking lever *(8, figure 1-21)* is located on the left forward side of the navigator's seat. Forward movement of the lever will lock the inertia reel; aft movement will UNLOCK the inertia reel.

NAVIGATOR'S SEAT EJECTION CONTROLS.

LEFT PRE-EJECTION LEVER.

The navigator's left pre-ejection lever *(7, figure 1-21)* mounted on the left armrest, when pulled up, will lock the shoulder harness inertia reel for seat ejection.

RIGHT PRE-EJECTION LEVER.

The right pre-ejection lever *(1, figure 1-21)* is mounted on the right armrest. Upward movement of the lever fires the initiators to jettison the hatch, move the navigator's seat aft to ejection position, and raise the seat ejection trigger into operating position.

SEAT EJECTION TRIGGER.

The seat ejection trigger *(3, figure 1-21)* is moved into operating position when the right pre-ejection lever is pulled up. When the trigger is squeezed, the seat catapult is fired and the seat is ejected.

GUNNER'S SEAT.

The gunner's seat has no provisions for adjustment. The seat *(figure 1-21)* is provided with two controls for locking the shoulder harness, one for normal use and the other for use during seat ejection. The seat is also provided with controls for jettisoning the canopy hatch and for seat ejection. The ejection carriage of the seat rides on rails, and powder charges are used in the seat ejection catapult to accomplish seat ejection. The seat is equipped with an automatic-opening lap safety belt. See figure 3-6 for Ejection Seat Operation. With the exception of stowing the gunsight and seat adjustment, the gunner's seat and ejection controls function in the same manner as the navigator's.

WEATHER OBSERVERS' SEATS.

Each weather observer's seat *(figure 4-28)* is equipped with a control for vertical adjustment. The seats are identical and are provided with two shoulder harness inertia reel locking controls, one for normal use and the other for use during seat ejection. The seats are also provided with a control for jettisoning the escape hatch and for seat ejection, in the event it becomes necessary to abandon the aircraft during flight. The ejection carriage of the seat rides on rails, and powder charges are used in the seat ejection catapult to accomplish seat ejection. Each seat is equipped with an automatic-opening lap safety belt. See figure 3-6 for Ejection Seat Operation.

WEATHER OBSERVER'S SEAT CONTROLS.

VERTICAL ADJUSTMENT SWITCH.

A spring-loaded vertical adjustment switch is located on the right side of the seat bucket on each weather observer's seat *(2, figure 4-28)*. When the switch is pulled up, a 115-volt a-c motor is energized to raise the seat. When the switch is pushed down, the motor is energized to lower the seat. The switch should be released to turn off the motor when the seat reaches the desired height. The seat provides 4 inches of vertical adjustment and is capable of being ejected at any vertically adjusted position.

NORMAL SHOULDER HARNESS INERTIA REEL LOCKING LEVER.

A normal shoulder harness inertia reel locking lever is located on the left forward side of each weather observer's seat. Forward movement of the lever will lock the inertia reel; aft movement will unlock the inertia reel.

WEATHER OBSERVER'S SEAT EJECTION CONTROLS.

LEG GUARD LEVERS.

Two leg guards, one on either side of each weather observer's seat *(1, figure 4-28)*, when raised to a vertical position, will lock the shoulder harness inertial reel, unlock the ankle restraint mechanisms, and position the ejection ring for operation. The leg guards are interconnected, so that both leg guards will be raised simultaneously when either leg guard lever is raised.

ANKLE RESTRAINTS.

Two ankle restraint mechanisms *(5, figure 4-28)* are mounted at the bottom of each weather observer's seat for locking the ankles in the foot rests prior to seat ejection. When the leg guards are raised, the ankle restraint mechanisms are unlocked. The operator's foot must be kicked aft in the foot rest to release the ankle restraints and secure the ankles in the foot rests. The feet are released from the ankle restraints after ejection, when the occupant leaves the seat.

EJECTION RING.

The ejection D-ring *(3, figure 4-28)*, located on the forward edge of each weather observer's seat, is moved into operating position when the leg guards are raised. When the ejection ring is pulled upward, the initiator is fired to jettison the escape hatch. As the hatch is jettisoned, a safety pin is pulled from the catapult initiator. With continued pull on the ejection ring, the seat catapult initiator is fired and the seat is ejected.

EJECTION SEAT CHAFF DISPENSING UNIT.

Some aircraft have been equipped with automatic chaff dispensing units installed on the ejection seat of each crewman. The staff dispensing unit is attached to the lower portion of the ejection seat and contains approximately one pound of chaff. The chaff is discharged immediately upon ejection from the aircraft and enables a radar receiving set to obtain a fix on the location of ejection from the aircraft, thereby facilitating rescue of the ejected crewman.

SEAT EJECTION GROUND SAFETY PINS (WEATHER COMPARTMENT).

The following seat ejection ground safety pins are provided for each weather seat to prevent inadvertent hatch firing and/or seat ejection during ground operation. Each pin is identified by a red streamer which is placarded REMOVE BEFORE FLIGHT.

SEAT EJECTION CONTROLS MAINTENANCE SAFETY PINS

A seat ejection controls ground safety pin *(4, figure 4-28)* is provided for the leg guard torque tube on the front of each weather seat (to be removed or replaced by each weather observer). Removal of the pin is accomplished by pulling.

SEAT LAP BELT INITIATOR MAINTENANCE. SAFETY PINS.

A safety pin may be installed by mainteance personnel in the lap belt intiator, located on the left side of each weather seat, when performing maintenance work on the seat. Each weather observer should make certain that these safety pins have been removed prior to each flight.

ESCAPE HATCH INITIATOR MAINTENANCE SAFETY PINS.

A safety pin may be installed by maintenance personnel in the escape hatch initiator, located on the left side of each weather seat, when performing maintenance work on the seat or escape hatch. Each weather observer should make certain that these safety pins have been removed prior to each flight.

OPTICAL VIEWER.

On some aircraft an optical viewer has been installed for use by the weather observers. The viewer may be utilized to scan various activities outside the aircraft that are not readily visible to the observers during flight. When the viewer is positioned on the weather compartment window, the observer can see approximately 80° in any direction from the axis of the viewer. The viewer container is located on the weather compartment ceiling, immediately above the number 1 weather observer's station.

SUN SHADES.

Sun shades are installed for the use of the pilot.

BLACKOUT CURTAINS.

Blackout curtains are installed on the flight compartment canopy to separate the pilot area from the rest of the crew. Blackout curtains are also installed for the side windows in the flight compartment and in the weather compartment.

LOAD ADJUSTER.

A load adjuster for checking weight and balance data is located at the gunner's station.

SPARE BULB CONTAINER.

A spare bulb container is installed at each flight crew station, and one in the weather compartment at the No. 2 weather observer's station.

DRINKING LIQUID CONTAINER.

One 1-quart liquid container is located in a receptacle in the pilot's data case, and one is located adjacent to each weather observer's side window *(3, figure 1-1)*.

CREW RELIEF PROVISIONS.

Three removable relief container assemblies are stowed in the flight compartment; the pilot's and navigator's containers are stowed at the navigator's station, and the gunner's container is stowed at the gunner's station. Two removable containers for the weather observers are stowed in the weather compartment inboard of each ejection seat rail.

AIRCRAFT CHECK LIST HOLDER.

An aircraft check list holder is installed in the flight compartment on the lower left side of the control pedestal.

AIRCRAFT DATA CASE AND FLIGHT REPORT HOLDER.

An aircraft data case and flight report holder is installed on the right side of the flight compartment aft of the pilot's right console *(16, figure 1-4)*.

WEATHER COMPARTMENT DATA CASE.

A data case is located below the window at each weather observer's station.

MAP HOLDER.

Holders for the stowage of folder maps are installed adjacent to the pilot's and navigator's stations.

ASH TRAYS.

Five removable ash trays are installed, one at each crew member's station.

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INTRODUCTION.

This section includes the engine and aircraft limitations that must be observed during normal operation. Notice must be taken of the instrument limit markings *(figure 5-1)*, which form a part of these limitations and must be referred to, since these limitations are not necessarily repeated in the text.

MINIMUM CREW REQUIREMENTS.

Minimum crew requirement to fly normal, nontactical missions is a pilot and one other qualified crew member. The other crew member will be required to operate the emergency hydraulic control valves in the crawlway in the event of an emergency. Other crew members, as required, will be added at the discretion of the Commanding Officer.

INSTRUMENT MARKINGS.

Most limit markings for the aircraft are shown in figure 5-1. For limit markings on the pilot's airspeed indicator, accelerometer, and machmeter, see T.O. 1B-66(W)D-1A.

Note

The limitations marked on the instruments apply to inflight conditions. They are not intended to indicate ground operating limits.

ENGINE LIMITATIONS.

NORMAL FUEL GRADE OPERATING LIMITS.

The normal operating limits, with engines burning JP-4 fuel, are as follows:

CAUTION

Whenever the throttle lever has been moved to the OFF position after an engine run, the engine must be allowed to come to a complete stop before attempting another start. This allows the manifold drip valve to open and drain any unburned fuel from the manifold and the combustion chambers.

ENGINE OPERATING TIME LIMITS.

Speed	*Throttle Position*	*Time Limits*	*Operating Conditions*
**100.7% (6175 rpm)	TAKE-OFF	5 Minutes	Maximum
***99.5% (6100 rpm)	MILITARY	30 Minutes	Military
*	*NORMAL	None	Continuous

* Airspeed and throttle positions which give 532°C (990°F) exhaust gas temperature.

** Take-off (thrust) is 5 minutes duration, for use during take-off which gives a 671°C (1240°F) exhaust gas temperature.

***Maximum time limit for 99.5 is 30 minutes.

Note

Maximum engine life is obtained at an EGT of 532°C (990°F) or below.

ENGINE SPEED LIMITS.

Inspect engine if speed momentarily exceeds 105.7%

Inspect engine if stabilized speed exceeds 103.7%

Reset engine fuel control if stabilized speed exceeds 102.7%

Normal ground setting .....100.7 (±0.5)%

Ground idle setting .....55(+1.3 —0.4)%

Note

With the throttles locked in the TAKE-OFF position, a variation of ±2 per cent indicated engine speed is permissible during take-off, climb or dive. However, in no case should the above engine speed limits be exceeded. In the event the above limits are exceeded, throttle back to within limits and record in DD Form 781, so that adjustment may be made later, on the ground.

ACCELERATION TIME LIMITS.

From	*To*	*Time*	*Conditions*
IDLE	MILITARY	10 sec.	Flight; 150 knots IAS; sea level to 6000 feet.
IDLE	MAXIMUM THRUST AVAILABLE	15 sec.	Flight; 150 knots IAS; 6000 feet and above.
IDLE	MILITARY	14 sec.	Static; sea level; ambient temperature above — 18°C(10°F).
IDLE	TAKE-OFF	15 sec.	Static; sea level; ambient temperature above — 18°C(10°F).

Note

The engine should decelerate from maximum thrust to IDLE in 15 seconds under static sea level conditions.

EXHAUST GAS TEMPERATURE LIMITS.

In order to obtain TAKE-OFF thrust, a minimum of 665°C and a maximum of 671°C exhaust gas temperature must be observed at 100.7 percent engine rpm at all ambient temperatures.

Note

Due to the wide tolerance (instrument error), it is not possible to accurately determine actual EGT. Therefore, with calculated rpm and fuel flow, it is acceptable to take off at TAKE-OFF thrust with a minimum static indicated EGT of 660°C to a maximum of 680°C.

Note

MILITARY power is obtained in flight by advancing the throttles to 99.5% RPM. It is not necessary to check the engine temperature against the ambient temperature when operating under MILITARY power conditions.

Note

MILITARY thrust will be obtained by setting the throttle at the 80° point on the engine fuel control quadrant.

Note

In flight, if the EGT difference between the two engines exceeds 20°C (68°F), check the engines on the ground prior to the next flight. EGT's under 671°C (1240°F) may be ignored.

The engine should produce the following MILITARY EGT temperature for 99.5% engine RPM at the ambient temperature shown:

TABLE I

Ambient Temperature		*Minimum EGT*		*Maximum EGT (Actual)*	
°C	°F	°C	°F	°C	°F
38	100	639	1182	643	1190
32	90	632	1170	643	1190
27	80	625	1156	643	1190
21	70	618	1144	643	1190
16	60	611	1141	643	1190
10	50	605	1121	643	1190
4	40	598	1108	643	1190
— 1	30	592	1102	643	1190
— 7	20	587	1089	643	1190
—12	10	583	1080	643	1190
—18	0	578	1072	643	1190

Note

Due to the wide tolerance (instrument error), it is not possible to accurately determine actual EGT. Therefore, with calculated rpm and fuel flow, it is acceptable to take off with a static indicated EGT from the minimum values specified above, to a maximum at 648°C(1199°F).

STEADY STATE (STABILIZED) TEMPERATURE LIMITS.

The maximum steady state (stabilized) temperature should never exceed 671°C (1240°F) at 99.5 per cent speed (6100 rpm) in flight. The limit for operation at 100.7 per cent speed (6175 rpm) is 671°C (1240°F) for five minutes during take off. Record each overtemperature, its duration, and possible cause in the DD Form 781. The allowable EGT variance between engines is 20°C (36°F) at MILITARY rated thrust and symmetrical thrust. This variance is due to the wide tolerances of existing instruments, inlet airflow distortion, flame pattern distortion, and circumferential variations in EGT.

ENGINE OVERTEMPERATURE TIME LIMITS.

If the engine is operated for the following periods of time within the temperature limits shown, the appropriate action noted must be taken:

Exhuast Gas Temperature	*Record Duration in DD Form 781 (After)*	*Maximum Allowable Accumulated Time (Per Engine)*
671° to 730°C (1240° to 1346°F)	30 seconds	10 minutes
730° to 790°C (1346° to 1454°F)	15 seconds	3 minutes
790° to 855°C (1454° to 1571°F)	5 seconds	1 minute
855° to 925°C (1571° to 1697°F)	Any time	15 seconds
Over 925°C (1697°F)	Any time	Any time

Note

When the maximum allowable accumulated time per engine is exceeded, the engine must be inspected to determine advisability of removal.

AIRSPEED LIMITATIONS.

EJECTION SPEED LIMITATION.

The indicated airspeed (IAS) must not exceed 450 knots in order to clear the tail of the aircraft during ejection from the navigator's and gunner's stations.

AIRSPEED LIMITATIONS — FLUTTER.
See T.O. 1B-66(W)D-1A.

AIRSPEED LIMITATIONS — AIR CONDITIONING.
See T.O. 1B-66(W)D-1A.

DESIGN MAXIMUM FLIGHT SPEEDS.
(ALL GROSS WEIGHTS.)
See T.O. 1B-66(W)D-1A.

MAXIMUM FLIGHT SPEED VS ALTITUDE.

(ALL GROSS WEIGHTS — CLEAN CONFIGURATION.)
See T.O. 1B-66(W)D-1A.

EXTERNAL FUEL TANKS JETTISON LIMITATIONS.

To avoid possible damage to the aircraft, the following restrictions must be observed when jettisoning the external (droppable) fuel tanks:

EMPTY TANKS
MINIMUM — 200 KNOTS EAS

(Continued on Page 5-7)

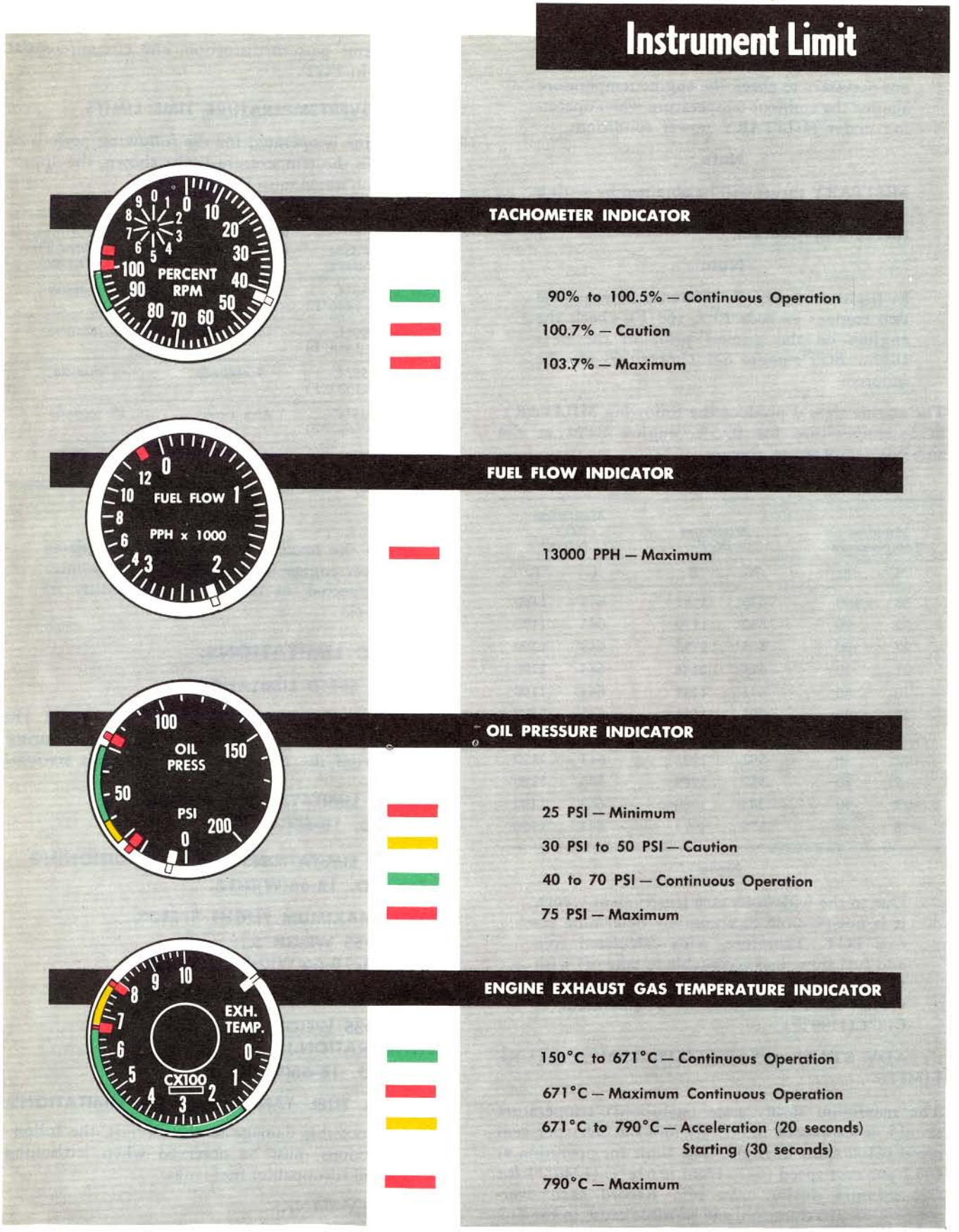

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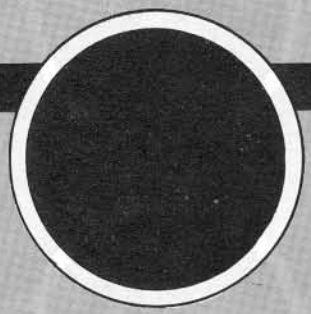
Figure 5-1 (Sheet 1 of 3)

Markings

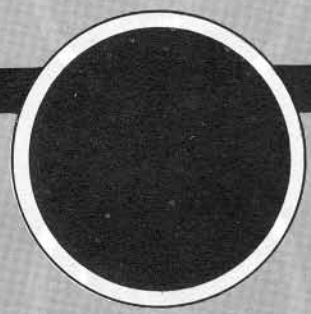
AIRSPEED INDICATOR (PILOT'S)

SEE T.O. 1B-66(W)D-1A



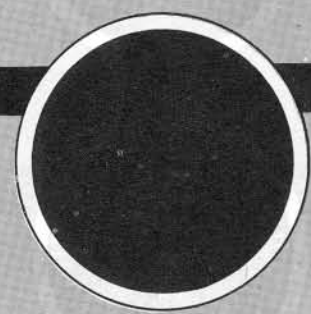
MACHMETER

SEE T.O. 1B-66(W)D-1A



ACCELEROMETER

SEE T.O. 1B-66(W)D-1A



AIRSPEED INDICATOR (NAVIGATOR'S AND GUNNER'S)

No markings are required.

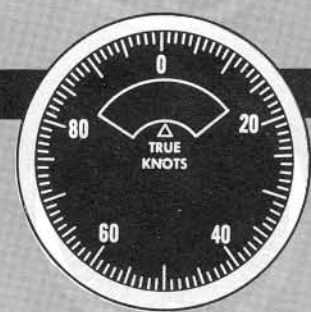


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Figure 5-1 (Sheet 2 of 3)

Instrument Limit Markings

NOSE WHEEL STEERING ACCUMULATOR PRESSURE INDICATOR

- 70 PSI Minimum
- 70 to 250 PSI Caution
- 250 to 350 PSI Continuous Operation

SPOILER ACCUMULATOR PRESSURE INDICATOR

- 975 PSI Minimum
- 975 to 1450 PSI Caution
- 1450 to 1850 PSI Continuous Operation
- 1850 PSI Maximum

AIR BRAKE ACCUMULATOR PRESSURE INDICATOR

- 2800 PSI Minimum
- 2800 to 3100 PSI Continuous Operation
- 3100 PSI Maximum

HYDRAULIC BRAKE ACCUMULATOR PRESSURE INDICATOR

- 300 PSI Minimum
- 300 to 3000 PSI Continuous Operation
- 3000 PSI Maximum

HYDRAULIC PRESSURE INDICATOR

- 2500 to 2900 PSI Caution
- 2900 to 3100 PSI Continuous Operation
- 3400 PSI Maximum

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Figure 5-1 (Sheet 3 of 3)

(Continued from Page 5-3)

OPTIMUM – 250 KNOTS EAS
(LEVEL FLIGHT)
MAXIMUM – 275 KNOTS EAS

FULL TANKS
OPTIMUM – 250 KNOTS EAS
(LEVEL FLIGHT)
MAXIMUM – 350 KNOTS EAS

Note

Full fuel tanks may be jettisoned at any speed below 350 knots EAS (flaps UP or DOWN).

CAUTION

Do not jettison external (droppable) tanks with partial fuel except in an emergency, because partially full tanks when jettisoned may damage the wing and/or tank pylon.

ATO LIMITATIONS.

When ATO bottles are installed on the aircraft, the maximum load factor allowable is 2 g's. Maximum flight speed with ATO bottles installed is 425 knots. Any operation in excess of these limitations can result in damage to the attaching mechanism which may not allow proper jettisoning of the bottles.

ATO JETTISON LIMITATION.

ATO rub strips have been installed to prevent scratching and denting of the aft fuselage skin. Maximum airspeed for safe separation of the ATO units during jettisoning is 300 knots IAS. For the cleanest separation, airspeeds as close to 300 knots IAS should be maintained.

ATO RELEASE SEQUENCE.

Means have been provided in the ATO jettison system for jettisoning the expended units in sequence with an interval of approximately one second between the release of each unit. Units will be released from both sides concurrently so that a total elapsed time of 5 to 10 seconds will be required for the jettisoning operation. The ATO jettison cockpit control is a momentary contact switch. A time delay circuit installed to keep the jettison control valve energized for approximately twenty-five seconds after the cockpit control switch has been released. This will permit the pilot to release the control switch and insure that the pressure remains on the system long enough to complete the release of all twelve bottles.

DRAG CHUTE LIMITATIONS.

Deployment of the drag chute is restricted to speeds up to 150 knots IAS after the aircraft is in a three point landing roll on the ground. There is a shear pin provided in the mechanism to prevent excessive loads from being transmitted to the fuselage structure. Shear pin failure will occur around 170 knots IAS.

WARNING

Do not deploy the drag chute while in flight. Loss of aircraft may result.

PROHIBITED MANEUVERS.

The aircraft is restricted to normal flight maneuvers. Acrobatic flight that exceeds maneuvering flight limitations is prohibited (see Acceleration Limitations Chart, this section).

ACCELERATION LIMITATIONS.

See T.O. 1B-66(W)D-1A.

MANEUVERING FLIGHT LIMITATIONS.

ALLOWABLE FLAP DEFLECTION VS SPEED.

See T.O. 1B-66(W)D-1A.

ELEVATOR CONTROL.

In performing any quick pull-ups or nose down maneuvers, reduce the elevator forces as quickly as possible to minimize the *dwell* period. This precaution will avoid developing excessive aircraft load factors that cannot be corrected or stopped by pilot action. All normal maneuvers performed within the maneuvering envelopes will not exceed the structural capabilities of the aircraft. The high rate horizontal stabilizer incidence actuator switch, located on the control wheel, is provided for rapid trim changes at any speed. Extreme caution should be exercised when using this switch at high speeds, because the airplane load factor change lags the incidence change and excessive load factors can be obtained before pilot corrective action can take effect.

AILERON CONTROL.

The aileron control system has a built-in safety feature, a boost cut-off limitation. The pilot effort is assisted up to a given value at which point any additional pilot effort will be unassisted and at a very low mechanical advantage. With this feature, the pilot can apply maximum aileron control for any flight condition up to the allowable rolling pull-out load factors. The boost cut-off limitations are such that excessive loads cannot be developed on the aileron or outer wing even with maximum pilot effort applied to the control wheel.

RUDDER CONTROL.

The rudder control system has the same built-in boost cut-off feature as the aileron control system. The boost

cut-off limitation is such that with maximum pilot effort on the rudder control pedals, critical vertical fin loads cannot be exceeded. Caution should be exercised when returning the rudder back to neutral from an abrupt application, so that reverse control will not be applied. Reversed rudder can develop vertical fin loads in excess of design with the possibility of permanent structural deformation. Abrupt constant *fish tailing* of the airplane must be avoided.

CENTER OF GRAVITY (CG) AND GROSS WEIGHT LIMITATIONS CHART.

See T.O. 1B-66(W)D-1A.

DIVE ANGLE LIMITATIONS CHART.

See T.O. 1B-66(W)D-1A.

AIRCRAFT WEIGHT LIMITATIONS.

	Weight	*Maximum Sinking Speed*
Maximum gross weight	83,000 pounds	
Design gross weight	75,000 pounds	
Maximum take-off and landing weight	83,000 pounds	300 fpm
Normal landing weight	55,000 pounds	540 fpm

Note

For specific weight information, refer to the *Handbook of Weight and Balance Data, T.O. 1-1B-40.*

FUEL LOADING.

At gross weights up to 68,000 pounds (wing zero fuel weight), *the fuel may be carried in the fuselage fuel tanks* (capacity of fuselage tanks is 18,935 pounds) to avoid excessive wing stress. At gross weights in excess of 68,000 pounds, *additional fuel must be carried in the wing fuel tanks* (wing tank capacity is 9568 pounds), or in the external tanks (external tank capacity is 5850 pounds).

flight characteristics

Section VI

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FLIGHT CHARACTERISTICS.

TAKE-OFF.

As in other jet-type aircraft, the aircraft should be held (with the brakes) until TAKE-OFF thrust is applied to the engines and the EGT, rpm, and fuel flow have reached at least minimum values for take-off. Once the brakes are released, directional control is easily maintained by the use of nose wheel steering and rudder, the rudder becoming effective at approximately 60 knots IAS.

NORMAL TAKE-OFF.

Following the release of the brakes, the take-off acceleration should be made in the taxi attitude, as maximum acceleration occurs in this attitude. The nose wheel should not be lifted off the runway until approximately 10 knots below lift-off speed. The nose wheel should be lifted off so that the aircraft will just reach take-off attitude at the same time that lift-off speed is attained. Premature lifting of the nose wheel to the angle of attack for take-off can increase the aerodynamic drag of the aircraft (in the take-off configuration) as much as 100 per cent, which will reduce the acceleration and significantly extend the ground roll. On the other hand, delaying the nose wheel lift-off too long will preclude reaching the take-off attitude at the lift-off speed and the ground roll will be increased. (Refer to the Take-Off Chart, Appendix I.) It should be noted that the take-off speeds contained in the Appendix are based on flight test recommendation. The speeds for normal take-off technique are above the stall warning buffet speed for the take-off configuration, while the short field technique take-off speeds are in the speed range where stall warning buffet will occur. Expediting the retraction of the gear also results in greater safety because of increased single-engine climb capability. Minimum control speed considerations affect take-off distances only at relatively low gross weights and low temperatures. In the event the minimum control speed is higher than the lift-off speed, the ground roll should be extended until the minimum control speed is reached. (Refer to the Minimum Control Speed Chart, Appendix I.) With an aft CG, the aircraft has a tendency to *pitch-up* slightly as it becomes airborne; however, this tendency is minimized if the above technique is used.

WARNING

In the event the line speed is below the allowable tolerance the take-off should be aborted before reaching the maximum refusal speed.

CROSS-WIND TAKE-OFF.

As the speed of the aircraft increases, the wings should be maintained level by use of ailerons. Contrary to the normal characteristics of most conventional aircraft, the WB-66D has a tendency, during crosswinds, to turn downwind rather than weather-vane. As a result, it is considered advantageous to lower the upwing slightly, through the use of aileron. Take-off in crosswinds in excess of 20 knots at 90 degrees should be attempted with caution. (Refer to the Effective Wind During Take-Off Chart, Appendix I.)

MINIMUM RUN TAKE OFF.

The minimum run take-off technique differs from the normal take-off technique principally in the definition of lift-off speed and the speed at the 50-foot height. The lift-off speeds for the minimum run take-off are in the region of stall warning buffet for the take-off configuration of the aircraft. (Refer to the Take-Off speed Chart, Appendix I.)

OBSTACLE CLEARANCE TAKE-OFF.

For obstacle clearance take-off, follow the normal take-off technique, using the applicable airspeed to clear a 50-foot height. (Refer to the Take-Off Chart, Appendix I.)

ASSISTED TAKE-OFF.

Except for the added thrust and subsequent shortening of the take-off roll when JATO is used, the technique for assisted take-off is the same as normal take-off, except that the MAXIMUM refusal speed with JATO is the JATO firing speed. In event the JATO units fail to fire, the normal operating procedure is to abort the take-off. It should be noted that, in this case, the take-off may be safely aborted at any speed before reaching the normal unassisted take-off maximum refusal speed. (Refer to the ATO Speed Chart, Appendix I.)

CLIMB CHARACTERISTICS.

No unusual characteristics should be experienced during climb. Adequate rudder control is available to handle the loss of one engine with the remaining engine operating at MAXIMUM power. It is recommended that the climb schedule be entered at an altitude of 5000 feet. (Refer to Climb Performance Data, Appendix I.)

SINGLE-ENGINE CONTROL.

The aircraft has excellent single-engine control characteristics (see Minimum Control Speed Chart, Appendix I). An abrupt engine failure at the minimum control speeds specified in Appendix I would be difficult to control due to the pilot reaction time and aircraft response. Corrective rudder applied 1 second after engine failure would be required to restrict the resulting side-slip and bank angle to moderate values.

Response to instantaneous engine failure would not be so critical at 15 to 20 knots above to the specified MINIMUM CONTROL SPEED.

LANDING.

Consistently good landings may be made with ease in this aircraft using normal landing techniques. The aircraft is readily adaptable to existing landing patterns. For an overhead pattern, an initial speed of 250 knots IAS is recommended. The wing flaps may be extended to 50 per cent DOWN at 210 knots IAS and to full DOWN at 184 knots IAS. If a wide pattern is used, the speed brakes should be retracted after the break and then extended again on the final approach, remaining OPEN after touchdown to aid deceleration. To prevent dragging of the tail skid, the touchdown speed should be no slower than the first stall warning buffet speed. Minimum run landings are accomplished by lowering the nose wheel to the runway immediately after touchdown, deploying the drag chute and raising the wing flaps. Immediate application of the brakes is then possible, maximum effective braking being insured by the antiskid system.

WARNING

In the event of failure of the antiskid system, the brakes should be applied cautiously. A skidding tire is difficult to detect and careless application of the brakes without antiskid will in all probability result in a blown tire.

Note

Landings with one external (droppable) tank empty and the other external (droppable) tank full may be accomplished without difficulty.

CROSS-WIND LANDING.

Cross-wind landings are best accomplished using the *wing-down* technique. Above 20 knots cross-wind gradient, the aircraft should touch down approximately 5 to 10 knots above the first stall warning buffet speed. During cross-wind landings it is recommended that the lift on the wings be decreased as much as possible, by raising the wing flaps, immediately after touchdown.

MANEUVERING FLIGHT.

The combination of light control forces and good response results in a highly maneuverable aircraft. Generally, the control forces increase linerally with deflection. (See paragraph on Flight Controls, this section.) However, under accelerated flight the elevator forces begin to level off as the aircraft approaches a stall condition. If the load factor is increased beyond this point, the aircraft will begin to buffet and an additional increase in load factor will result in either a *pitch-up* or heavy buffet, depending on Mach number and CG location. At high Mach numbers with an aft CG, there will be a marked *pitch-up* at the stall. However, at lower Mach numbers heavy airframe buffet will limit the load factor to the extent that *pitch-up* is not encountered. In a forward CG condition, the aircraft remains stable up to the stall throughout the entire speed range of the aircraft. During maneuvering flight in the high Mach buffet region, with an aft CG, caution should be exercised in applying abrupt increases in load factor, since the high Mach buffet tends to mask out the stall warning buffet and the pilot may inadvertently cause the aircraft to *pitch-up*. This condition is not considered serious, as the *pitch-up* is generally mild and may be corrected by releasing back pressure on the control column.

HIGH MACH FLIGHT.

See T.O. 1B-66(W)D-1A.

STALLS.

Stall characteristics of this aircraft are typical of swept wing aircraft which have a higher angle of attack at the point of stall than straight wing aircraft. There is no severe rolling or yawing tendency, and positive control is available throughout the stall and during recovery. The aircraft has excellent stall warning characteristics at all altitudes; therefore, unintentional stalls should be easily avoidable. Entry into the stall speed range is indicated by a medium to heavy airframe buffet; the intensity depending upon the configuration and *G*-load imposed. Unaccelerated stalls (stalls at 1*G*) in the approach and landing configuration (gear and flaps full DOWN) are preceded by the stall warning buffet approximately 8 knots before the actual stall, while the stall warning buffet in the clean configuration (gear and flaps UP) precedes the actual stall by approximately 20 knots. Once the stall warning occurs, the buffet level increases as the airspeed is decreased to the point of full stall. The aircraft responds well to all controls throughout the approach to the stall. At the actual stall the nose drops through straight with little or no tendency to roll-off; however, if the aircraft is in a slight yaw condition a mild roll-off, in the direction of the yaw, will occur. If the stall is continued, the aircraft has a slight *pitch-up* tendency. Stall recovery is accomplished by releasing back pressure on the control column. (See Minimum Speed Chart, Appendix I.)

WARNING

Full stalls or dwelling in the heavy stall buffet region is not recommended, as this will result in a longitudinal oscillation of increasing amplitude.

SPINS.

Intentional spins are prohibited. However, in the event of an unintentional spin, the following recovery procedure is recommended:

1. Retard the throttle to IDLE.
2. Retract the landing gear and flaps and close the speed brakes.
3. Push forward on the control column until the nose of the aircraft is below the horizon to gain sufficient flying speed. If necessary, adjust the stabilizer trim to *0* degrees. After obtaining a nose down attitude, neutralizes the control column.
4. Apply full rudder opposite to the direction of spin rotation. The rudder should be applied at a slow rate, requiring 2 to 3 seconds to obtain full deflection.
5. Neutralize the aileron.
6. Neutralize the rudder immediately as soon as rotation ceases.
7. Recover to normal-flight attitude.
8. Check the engines for stall condition and the alternators for proper operation.

FLIGHT CONTROLS.

The aircraft incorporates a hydraulically boosted flight control system with an elevator and aileron boost ratio of 25 to 1 and rudder boost ratio of 15 to 1. Rudder control is good during the take-off phase, becoming effective at approximately 60 knots IAS. During high speed flight, as the airspeed increases the control forces increases only slightly and the effectiveness remains generally unchanged, except as described in the paragraph on High Mach Flight. Lateral control is completely adequate during the entire speed range of the aircraft. The rudder control incorporates a variable boost system, with high rudder boost and low rudder boost. High rudder boost provides a higher rate of travel and greater deflection of the rudder for a given amount of pilot effort, and is designed for use at lower airspeeds during take-off and landings. The high rudder boost is automatically cut off when the wing flaps are retracted to prevent structural damage to the rudder in the higher speed ranges. With the exception of the limit load factors resulting from elevator deflection, there are no speed restrictions in the use of the elevator. (See Acceleration Limitations Chart, Section V.)

WARNING

Boost-off flight is possible; however, landing without boost should be accomplished with caution. Normal maneuvering during landing with boost-off requires up to 100 pounds stick force if the CG is within limits.

YAW DAMPER.

Because of the swept wing design, the dynamic directional stability of the WB-66D is low. This is especially noticeable at high altitudes in the clean configuration and at low altitudes in the approach configuration. In addition to supplying dynamic directional stability augmentation, the yaw damper coordinates the aircraft so that it is a two-control aircraft, with the yaw damper engaged. To permit side-slipping, the rudder pedals are equipped with force sensors, which bias the yaw damper to a new neutral rudder position. Any corrective rudder action is applied with respect to this new neutral position. Since the force sensors are at the pedals, the normal force and friction characteristics of the rudder system are masked. Therefore, an apparent breakout force and force gradient are built into the force sensor system. Because of this, intentional side-slips with the yaw damper ON are difficult to stabilize, since the pilot has tendency to over-control. The present break-out force with the yaw damper engaged is approximately 20 pounds. Because of the difficulty of rudder control, use of the yaw damper during take-off and landing is not recommended at this time. The yaw damper is very useful and desirable at high altitudes as it provides lateral direction stability during straight and level flight and during coordinated turns. The tendency of the pilot may be to assist the yaw damper during lateral directional oscillations. This pilot effort is conisdered undesirable in that the normal pilot reaction time is slower than that of the yaw damper.

Note

In case of a hard-over failure in the yaw damper, a pedal force of approximately 95 pounds is required to override the rudder servo.

SPEED BRAKES.

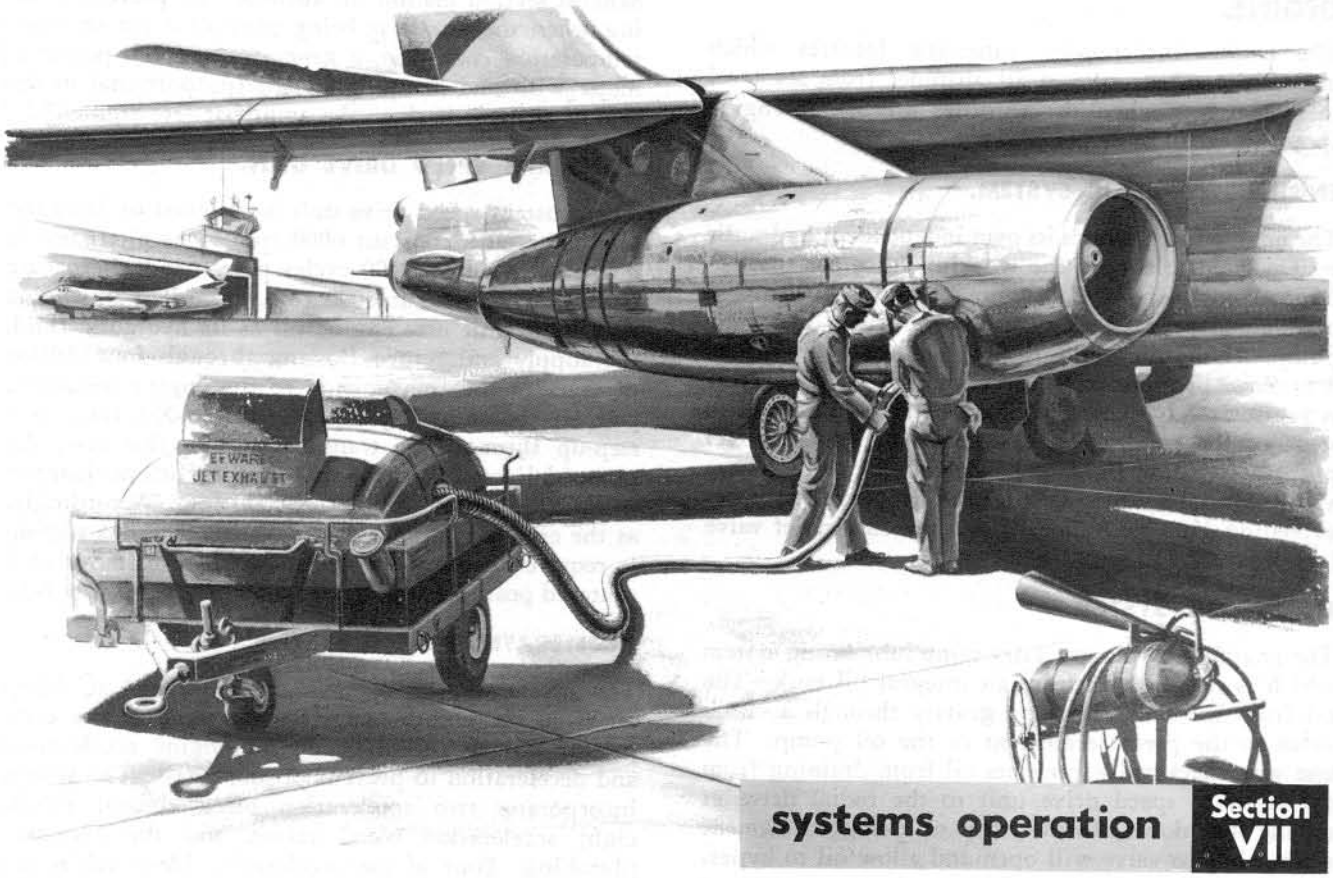
Generally, the speed brakes are an effective means of decelerating the aircraft. There is no airspeed restriction in the operation of the speed brakes. Because of the blowback feature, the speed brakes will not fully extend at speeds above 450 knots IAS, and as a consequence, the effectiveness decreases slightly above this speed. At speeds between 250 to 500 knots IAS, the aircraft tends to *pitch-up* slightly during speed brake extension; however, it is easily controllable. At speeds above 500 knots IAS, there is little or no *pitch-up* tendency. At speeds below 250 knots IAS, the effectiveness of the speed brakes is greatly reduced. The speed brakes are not synchronized and a momentary asymmetric condition could result because of one speed brake opening before the other. When this occurs, a slight yawing of the aircraft will result but is easily controllable. A mild airframe buffet is evidenced with the speed brakes full open.

WARNING

The speed brakes have priority on utility system hydraulic pressure during actuation. Therefore, the rate of operation of the landing gear, wing flaps, and nose wheel steering will be affected accordingly.

DIVING.

Do not exceed values shown on the Operating Flight Strength Diagram, Dive Recovery Chart, and Dive Angle Limitations Chart, T.O. 1B-66(W)D-1A.



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ENGINE.

The engine incorporates automatic features which maintain constant rpm at all altitudes from sea level to 60,000 feet when the throttles are set at engine speeds in excess of 87 per cent rpm.

ENGINE HYDRAULIC SYSTEM.

The engine incorporates its own independent hydraulic system, used to supply the working force for the different components. A system pressure of 3000 psi is maintained by a piston-type engine driven hydraulic pump. Hydraulic fluid is supplied to the pump at 3 to 5 psi pressure from the reservoir. The reservoir is pressurized by means of bleed air from the eleventh stage of the compressor. The reservoir has a swivel pick-up to allow fluid to be delivered to the system at all altitudes. System pressure is presented from exceeding 3500 psi by means of a pressure relief valve *(see figure 7-1).*

ENGINE OIL SYSTEM.

The engine incorporates a dry sump lubricating system which is supplied oil from an integral oil tank. The oil from the tank flows by gravity through a check valve to the pressure element of the oil pump. The one way check valve prevents oil from draining from the constant speed drive unit to the radial drive at engine shut down. In the event of a clogged element a filter bypass valve will open and allow oil to bypass the filter. Pressurized oil leaving the pump returns to the bottom strut through the radial drive housing. The function block also receives return pressurized oil from the constant speed drive unit. The quantity of oil flowing to each point of lubrication is controlled by the size of the nozzle tip orifice. Two screens in the aft frame lines provide extra protection for the tips and lubricated parts *(see figure 7-2).*

VARIABLE EXHAUST NOZZLE ACTUATING SYSTEM.

With a predetermined range the exhaust nozzle area of the engine is infinitely variable. By properly scheduling the nozzle area vs throttle position (rpm) it is possible to have the engine operate with the best nozzle area for each power setting. The shroud is hydraulically actuated fore and aft, or it moves, the nozzle segments will be moved to vary the nozzle area. The aft ends of the four shroud actuating cylinders are connected directly to the hydraulic system, and are always at system pressure (3000 psi). By maintaining the pressure relationship, the nozzle can be held in any position within its range of travel. The servo actuator override valve has the task of directing system pressure as long as the engine rpm is below 87 per cent. This prevents the nozzle from closing even though the throttle may be fully advanced. Over temperature protection is provided above 87 per cent rpm (the nozzle is full-open below 87 per cent rpm). The reversible motor is controlled by the electronic amplifier by means of thermocoupler located in the exhaust section behind the turbine. To prevent hunting when the nozzle is being controlled for an over-temperature condition, a generator and the potentiometer will send damping signals (proportional to the rate of change) back to the amplifier *(see figure 7-3).*

CONSTANT SPEED DRIVE UNIT.

The constant speed drive unit is designed to drive the alternators at a constant 6000 rpm. The alternator is designed to deliver 400 cycles per second alternating current at a constant 6000 rmp, regardless of engine rpm. The unit uses engine oil as its hydraulic fluid, the supply and return flowing through four drilled passages in the transmission to the engine mounting pad. If the engine rpm is less than 6000, there is a step-up through the transmission. In this case, the pump delivers oil to the motor in sufficient quantity to turn the motor wobbler at 6000 rpm. Accordingly, as the engine rpm increases toward, 6000, less step-up is required causing the pump wobbler to move to a centered position to decrease its output *(see figure 7-4).*

ACCELERATION BLEED SYSTEM.

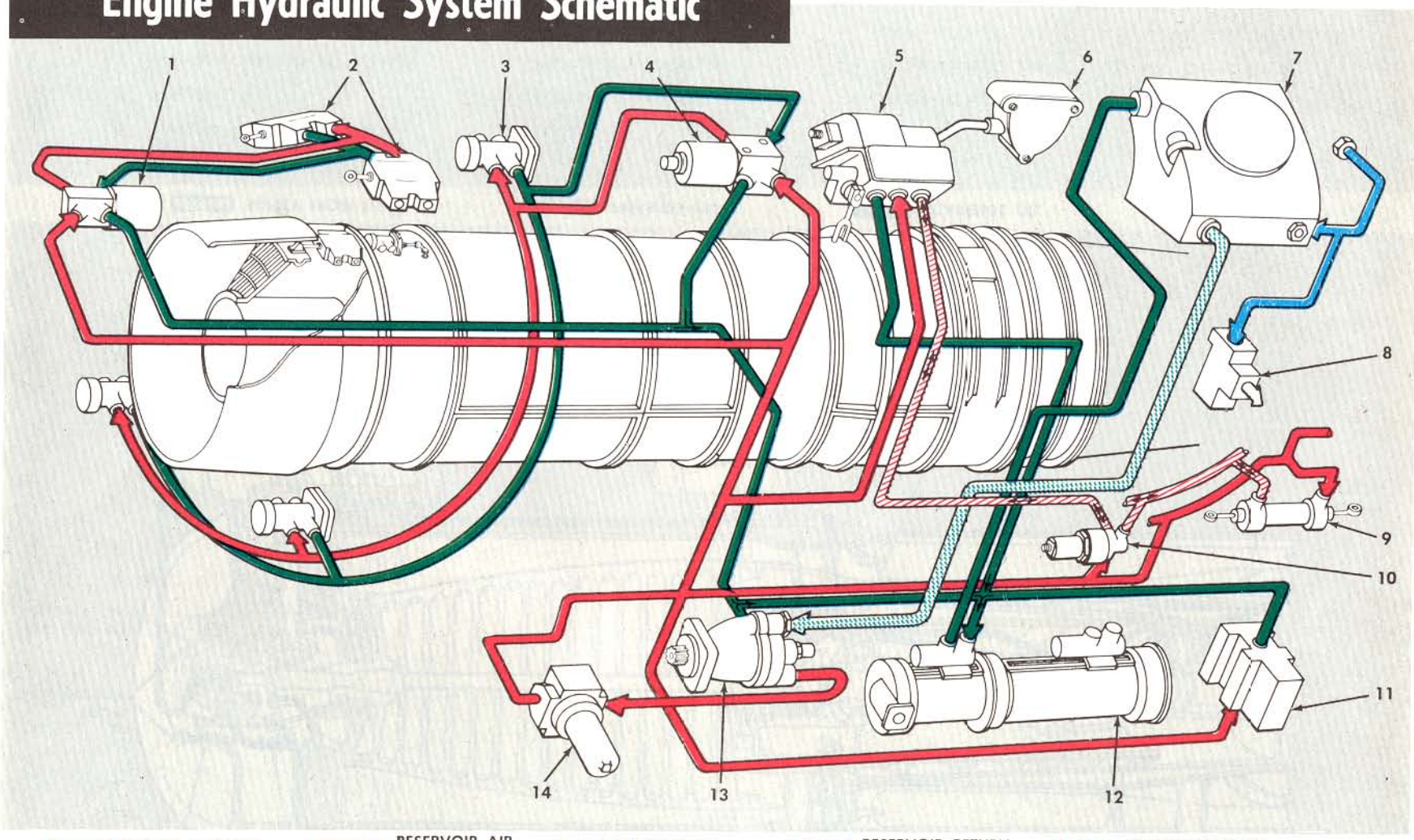
The acceleration bleed system is utilized to bleed air from the eighth and sixteenth stage of the compressor during certain stages of engine acceleration and deceleration to prevent pressure stall. The system incorporates two acceleration bleed control valves, eight acceleration bleed valves, and the necessary plumbing. Four of the acceleration bleed valves are equally spaced and attached to the compressor at the eighth stage and the other four are located around the outer combustion case at the sixteenth stage. The four acceleration bleed valves at either location are interconnected by the actuating pressure and vent lines. Each acceleration bleed selector valve directs compressor discharge air pressure, taken from the mid-frame by means of a probe assembly, to the bleed valves at all times during engine operation. The position of the acceleration bleed selector valve determines which side of the bleed valve piston is pressurized. Energizing and de-energizing the bleed selector valves are accomplished by the action of the engine speed sensitive control which makes and breaks the electrical circuits at designated engine RPM's. When the 8th stage selector valve is de-energized, compressor discharge air is directed to the opening side of the bleed valve actuating pistons. When the 8th stage selector valve is energized, the four bleed valves close. The 16th stage selector valve, when de-energized, directs pressure air to close these bleed valves. Energizing the 16th stage selector valve opens the 16th stage bleed valves. The side of the bleed valve piston, which is not being pressurized, is vented through the selector valve to the atmosphere.

RAPID ACCELERATION.

If necessary, the throttles can be advanced rapidly to full MAXIMUM (OPEN) position for rapid engine

(Continued on Page 7-7)

Engine Hydraulic System Schematic



1. RETRACTABLE SCREEN SELECTOR VALVE
2. RETRACTABLE SCREEN ACTUATORS (8)
3. GUIDE VANE ACTUATORS (3)
4. GUIDE VANE SELECTOR VALVE
5. EXHAUST NOZZLE SERVO VALVE ACTUATOR
6. AREA DAMPENING POTENTIOMETER
7. HYDRAULIC RESERVOIR
8. HYDRAULIC RESERVOIR REGULATOR VALVE
9. NOZZLE ACTUATING CYLINDERS (4)
10. ACTUATOR OVERRIDE VALVE
11. HYDRAULIC PRESSURE RELIEF VALVE
12. HEAT EXCHANGER
13. HYDRAULIC PUMP
14. MAIN HYDRAULIC FILTER

Figure 7-1

1886

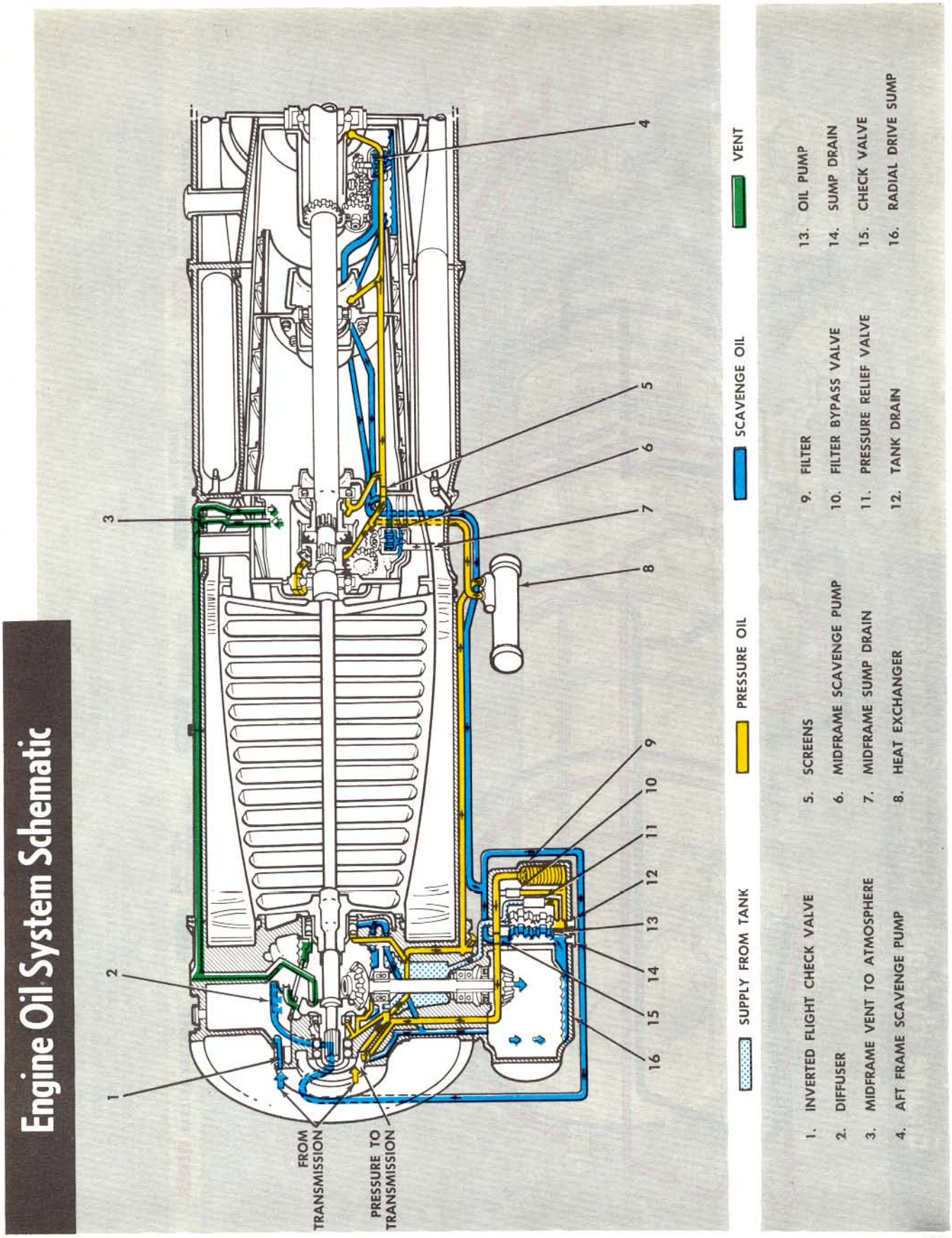


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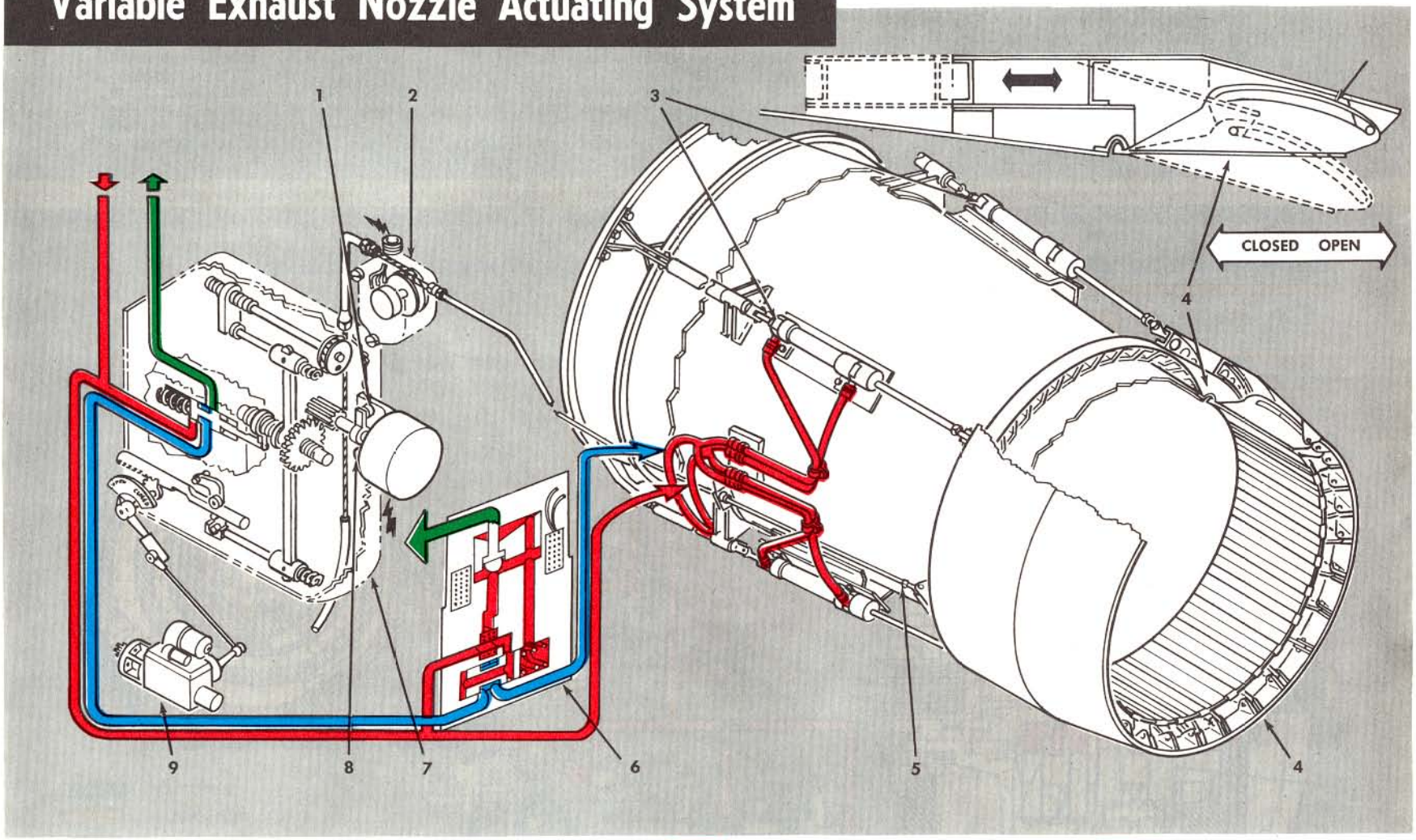
Figure 7-2

Variable Exhaust Nozzle Actuating System



1. UNDER TEMPERATURE STOP
2. POTENTIOMETER
3. SHROUD ACTUATORS
4. NOZZLE SEGMENT
5. FOLLOWUP ROD CABLE
6. SERVO ACTUATOR OVERRIDE VALVE
7. SERVO VALVE ACTUATOR
8. OVER TEMPERATURE STOP
9. FUEL CONTROL

1888

Figure 7-3

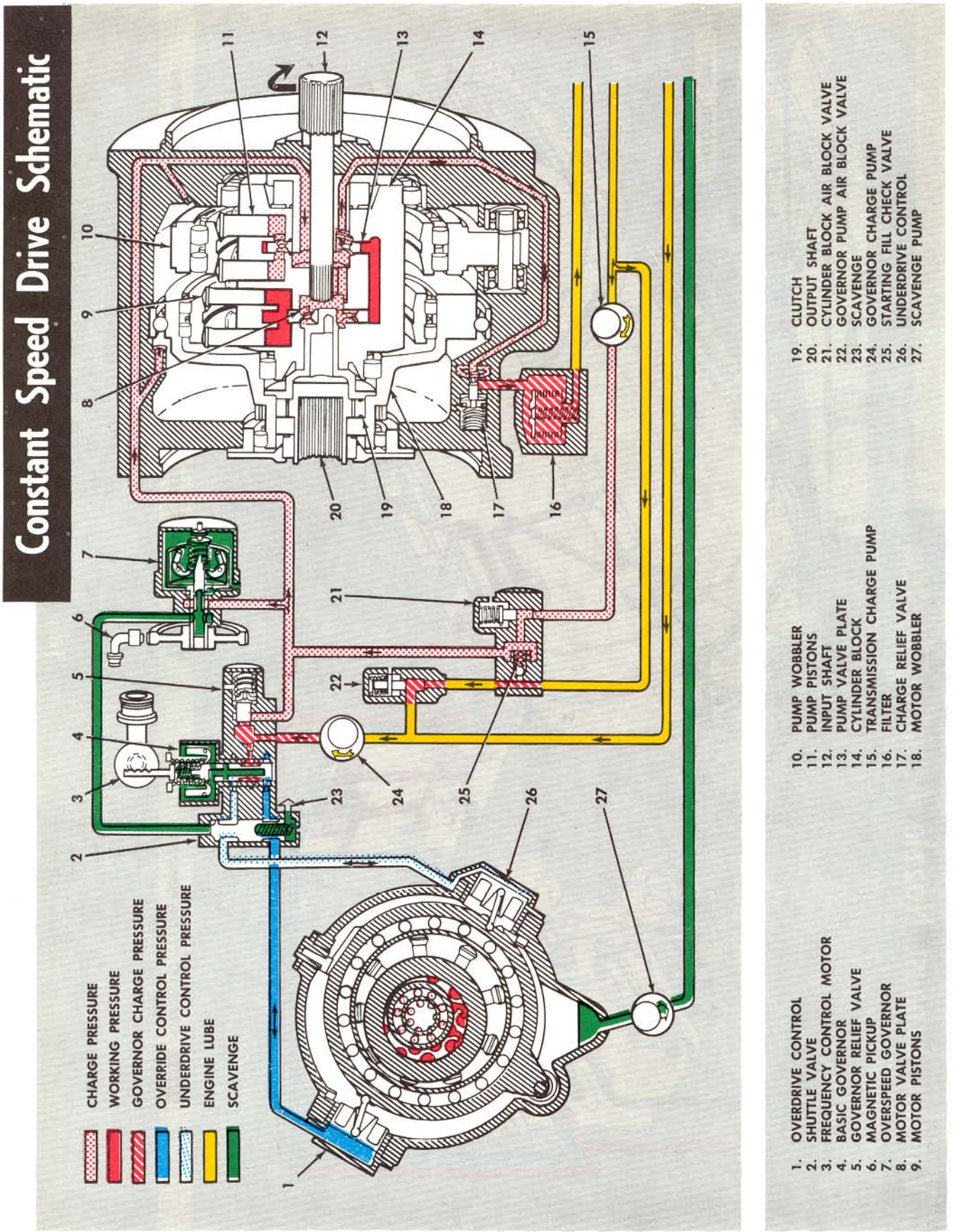

Constant Speed Drive Schematic
CHARGE PRESSURE
WORKING PRESSURE
GOVERNOR CHARGE PRESSURE
OVERRIDE CONTROL PRESSURE
UNDERDRIVE CONTROL PRESSURE
ENGINE LUBE
SCAVENGE
1. OVERDRIVE CONTROL
2. SHUTTLE VALVE
3. FREQUENCY CONTROL MOTOR
4. BASIC GOVERNOR
5. GOVERNOR RELIEF VALVE
6. MAGNETIC PICKUP
7. OVERSPEED GOVERNOR
8. MOTOR VALVE PLATE
9. MOTOR PISTONS
10. PUMP WOBBLER
11. PUMP PISTONS
12. INPUT SHAFT
13. PUMP VALVE PLATE
14. CYLINDER BLOCK
15. TRANSMISSION CHARGE PUMP
16. FILTER
17. CHARGE RELIEF VALVE
18. MOTOR WOBBLER
19. CLUTCH
20. OUTPUT SHAFT
21. CYLINDER BLOCK AIR BLOCK VALVE
22. GOVERNOR PUMP AIR BLOCK VALVE
23. SCAVENGE
24. GOVERNOR CHARGE PUMP
25. STARTING FILL CHECK VALVE
26. UNDERDRIVE CONTROL
27. SCAVENGE PUMP
1889

Figure 7-4

(Continued from Page 7-2)

acceleration to 100.7 per cent rpm for (5) minutes. The engine automatic fuel control will sense the engine inlet temperature and pressure, and engine rpm to provide the fuel flow required by the engine.

EXHAUST TEMPERATURE VARIATION.

Exhaust temperature is affected by airspeed, altitude, and outside air temperature. With constant rpm, exhaust temperature generally decreases with an increase in altitude, and increases with greater airspeed and higher ambient temperatures. These factors can cause variable exhaust temperatures at any given rpm. There is no direct control for regulating exhaust temperature; however, exhaust temperature can be indirectly controlled by throttle settings.

MAXIMUM FLIGHT OPERATING TEMPERATURES.

The electronic overtemperature control amplifier will normally limit the maximum exhaust gas temperature to 671°C (1240°F); however, in the event of a malfunctioning amplifier, the maximum exhaust gas temperature should be limited to 671°C (1240°F) by retarding the throttles.

If the maximum allowable flight operating temperatures (Section V) are exceeded 5° to 10°C (9° to 18°F), retard throttle to maintain maximum steady-state temperatures. Enter condition in DD Form 781 (old Form 1) so that adjustment may be made later on the ground.

FLAME-OUT.

Flame-outs are indicated by a loss in thrust, loss in rpm, and drop in exhaust temperature and fuel flow. If flame-out is believed to have occurred, advance the respective throttle and check for engine speed and exhaust temperature increase. If no increase is noted, immediately retard throttle to OFF. In the event of a flame-out, an air start can be attempted. Refer to Section III for Inflight Engine Start.

COMPRESSOR STALL.

Compressor stall is not considered to be a problem in regard to the AF Type J71-A-13 engine because of 8th stage acceleration bleeds and of the addition of the 16th stage bleeds. However, in order that the pilot may recognize a compressor stall, if encountered, the following information is provided:

Various types of compressor stalls can occur as a result of an unbalance between fuel flow and engine air flow; however, the J71-A-13 engine is relatively stall-free during normal operation. A partial stall is usually indicated by a momentary surging of the engine, and a slight decrease in rpm without any appreciable change in exhaust temperature. During flight, a violent noise may also accompany a partial stall. If a partial stall condition is encountered during ground operation or during flight, immediately retard the respective throttle to a lower rpm setting to eliminate the stall. The throttle may then be advanced smoothly and gradually to NORMAL or MILITARY, as required. A complete compressor stall is indicated by exhaust temperature continuing to rise as the throttle is advanced, rpm increasing and suddenly decreasing, or, failure of rpm to respond to throttle movement. During flight, the first indication that a complete compressor stall may have occurred will be a loss in thrust. Continued operation of the engine in a stalled condition will result in overtemperatures, fire warning indication, damage to the turbine section, and subsequent engine failure. If a complete compressor stall is encountered, the throttle should be immediately retarded to the OFF position. If a complete compressor stall is indicated during ground operation, another start must not be attempted until the engine has been checked. In the event a complete compressor stall is encountered during flight, an air start can be attempted. See the paragraphs on Inflight Engine Start, Section III.

CAUTION

An air start should not be attempted if the fire warning light is illuminated. If the fire warning light illuminates momentarily, and then goes out, an air start can be attempted. If the fire warning light does not go out, a fire in the turbine section is indicated, and the engine shutdown procedure should be completed as outlined under Engine Fire In Flight, Section III.

ENGINE ICING.

At airspeeds below approximately 250 knots IAS and at high power settings (as in climb or go-around), the compressor force is greater than the ram force; as a result, the intake air is pulled rather than rammed into the engine inlet. This action causes a decrease in air temperature. Under these conditions, air at ambient temperature above freezing may be reduced to sub-freezing temperatures as it enters the engine. Free moisture in the air may become supercooled and could cause engine icing while no external surface icing would be evident. The maximum inlet air temperature drop that may occur on the J71-A-13 engine is approximately 5°C (9°F). The greatest temperature drop occurs at high rpm on the ground and decreases with decreasing engine rpm and increasing airspeed. Ice formation in the engine inlet restricts the airflow which causes a loss of thrust and a rapid rise in exhaust gas temperature. As the airflow decreases, the fuel air ratio increases, which in turn raises the temperature of the gases entering the turbine. The fuel control attempts to correct any loss of engine rpm by adding more fuel, which aggravates the condition. Complete turbine failure from extreme overtemperatures may occur in a matter of seconds after ice builds up in the engine inlet. Even with the screens retracted, serious blocking of the air passages between the

guide vanes and struts can still occur in approximately 4 minutes or less. The conditions under which engine icing may occur without evidence of external icing (visible on wings) is when the temperature is between −10° to +5°C (14° to 41°F) and fog is present, or the dewpoint is within 4°C (or 7°F) of the ambient temperature. When operating under these conditions, the following action should be taken:

1. Engine anti-icing switch — ON.
2. Engine screens switch — AUTO (REACT during take-off and landing).
3. If possible, maintain 250 knots IAS or above.
4. Constantly monitor the exhaust gas temperature indicators.
5. If exhaust gas temperature rise is indicated, reduce power to maintain exhaust temperatures within limits (see Section V).

FUEL SYSTEM.

Refer to Section 1 for a complete description of the Fuel System, related control switches, valves, gages, and indicators; to figure 7-5 for detailed schematic diagrams. Primarily, the fuel flow schedule is from the wing tanks and forward tank to the aft fuselage tank to the engines. By placing the fuselage fuel trim switch to AUTO or BOTH TANKS position the forward boost pump is turned on and the forward tank high level float solenoids are energized. The fuel boost pump switches should be in the ON position to give adequate fuel pressure to the engines during take-off and landings and operation above 18,000 feet. The fuselage fuel trim switch must be placed in the AUTO positon to actuate the CG control system to automatically schedule fuel flow from the forward fuselage tank to the aft fuselage tank to maintain a balanced fuel load. The BOTH TANKS position has the identical operation with the exception that the automatic CG control system is overridden. This results in the aft tank control valve remaining open. In this position the fuel flow must be monitored by the pilot.

With the fuselage fuel trim switch in the AFT position, the forward tank boost pump is turned off, and the forward and aft tank high level float solenoids are de-energized; in this switch position the CG valve is closed. This permits control of a nose heavy fuel loading condition during in-flight refueling. The AFT position of the fuselage fuel trim switch can also be used to stop the operation of the forward tank boost pump after forward tank fuel has been used. By placing the wing fuel transfer switch in the ON position, the CG valve is closed, the forward tank high level floats are de-energized and the forward pump is off. This overrides the operation of the fuselage fuel trim switch listed above. The aft tank inlet control valve is controlled by the CG control system with the fuselage fuel trim switch in the AUTO position. With the fuel selector switch in any emergency position — EMER FWD TANK TO LEFT AND RIGHT ENG, EMER FWD TANK TO LEFT ENG, or EMER FWD TANK TO RIGHT ENG. — the forward tank pump is turned on, the forward tank high level float solenoids are energized, the forward tank to manifold valve is open and the CG valve is closed. This overrides the control of the fuselage fuel trim switch.

WARNING

Except during in-flight refueling, with the fuselage fuel trim switch in the BOTH TANKS position, and the fuel selector switch in TAKEOFF AND CROSSFEED or FLIGHT NORMAL, a rapid flow of fuel from the forward to the aft tank (without CG control) will occur. This will result in a tail heavy CG condition.

Note

Wing fuel transfer is to the aft fuselage tank only.

FUEL SYSTEM MANAGEMENT.

During taxi, take-off, and climb, place the fuel selector switch in the FLIGHT NORMAL position. After reaching cruising altitude or after the fuel weight in the forward fuselage tank drops to approximately 3900 pounds, place the wing fuel transfer switch in the ON position. When the wing fuel transfer switch is in the ON position, and the fuselage fuel trim switch is in the AUTO position, the circuit connecting the CG control and the high-level float switch in the aft fuselage tank is armed to prevent an unbalanced CG condition during fuel transfer. During fuel transfer, when the fuel level in the aft fuselage tank approaches the level where the aft fuel CG limit is reached, the high-level foat switch is energized to close the aft tank inlet control valve, preventing transfer of fuel. When sufficient fuel is used from the aft tank, the high-level float solenoid is deenergized and the aft tank inlet control valve is opened to resume transfer operation.

The circuit connecting the CG control system to the high-level float solenoid in the aft tank passes through the fuselage fuel trim switch. When the fuselage fuel trim switch is in the AUTO position, this circuit is closed. In any other position of the fuselage fuel trim switch (BOTH TANKS and AFT), the circuit is opened to allow wing transfer without CG control. Therefore, in the event of failure of the CG control system, wing fuel transfer is possible; however, during this operation wing fuel transfer must be monitored (by means of the fuel quantity indicators) and controlled by placing the wing fuel transfer switch to ON or OFF, as required, to prevent an unbalanced CG condition.

(Continued on Page 7-16)

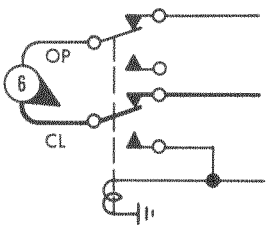
Aircraft Fuel System—Detail Schematic

KEY FOR FLIGHT FUEL CONTROL SYSTEM AND GROUND REFUELING CONTROL SYSTEM

(FP)	FORWARD PRIMARY INDICATOR LIGHT
(FS)	FORWARD SECONDARY INDICATOR LIGHT
(AP)	AFT PRIMARY INDICATOR LIGHT
(AS)	AFT SECONDARY INDICATOR LIGHT
(LP)	LEFT PRIMARY INDICATOR LIGHT
(LS)	LEFT SECONDARY INDICATOR LIGHT
(RP)	RIGHT PRIMARY INDICATOR LIGHT
(RS)	RIGHT SECONDARY INDICATOR LIGHT
OP	OPEN
CL	CLOSE
	ENGINE FUEL FLOW
	FWD TO AFT TANK FUEL FLOW
	PRESSURE SWITCH
★	SEE GROUND REFUELING CONTROL SYSTEM

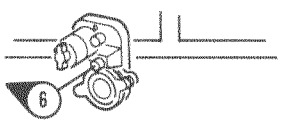
Circuits between valves and their control relays are indicated by a circled number with an attached pointer.

Example:



FWD TANK TO MANIFOLD VALVE CONTROL RELAY

FWD TANK TO MANIFOLD VALVE



The circuit lines are shown in two widths. Wide lines are energized, used circuits. Narrow lines are not energized or are dead-end energized (not used) circuits. The above example shows that valve number 6 (forward tank manifold valve control relay) has the closed circuit energized.

The wide dash line between the CG amplifier and the aft tank high level float indicates an intermittent signal which activates the aft tank inlet control valve.

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Figure 7-5 (Sheet 1 of 5)

Aircraft Fuel System

FLIGHT FUEL CONTROL SYSTEM

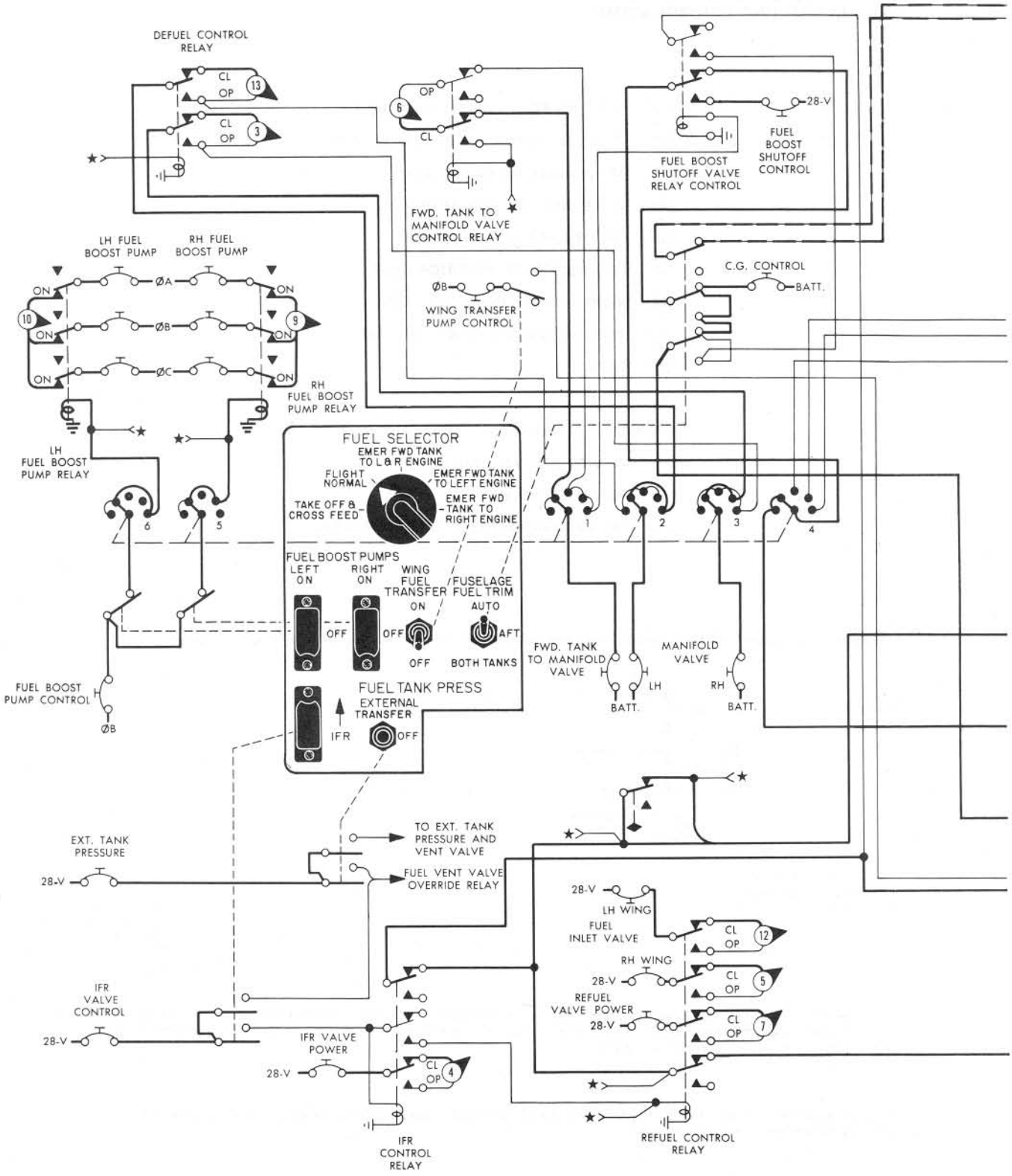

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Figure 7-5 (Sheet 2 of 5)

—Detail Schematic

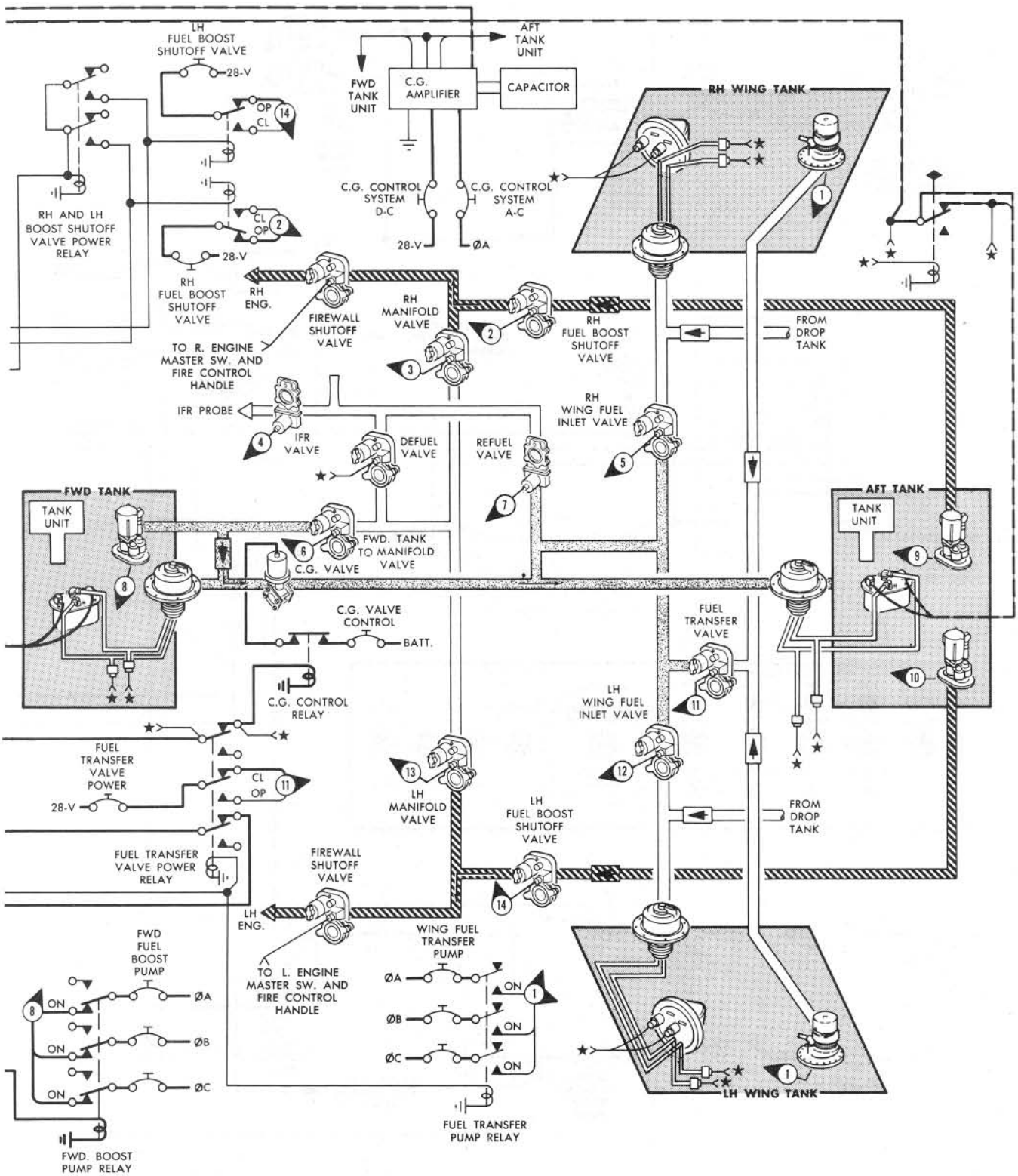

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Figure 7-5 (Sheet 3 of 5)

Aircraft Fuel System

GROUND REFUELING CONTROL SYSTEM

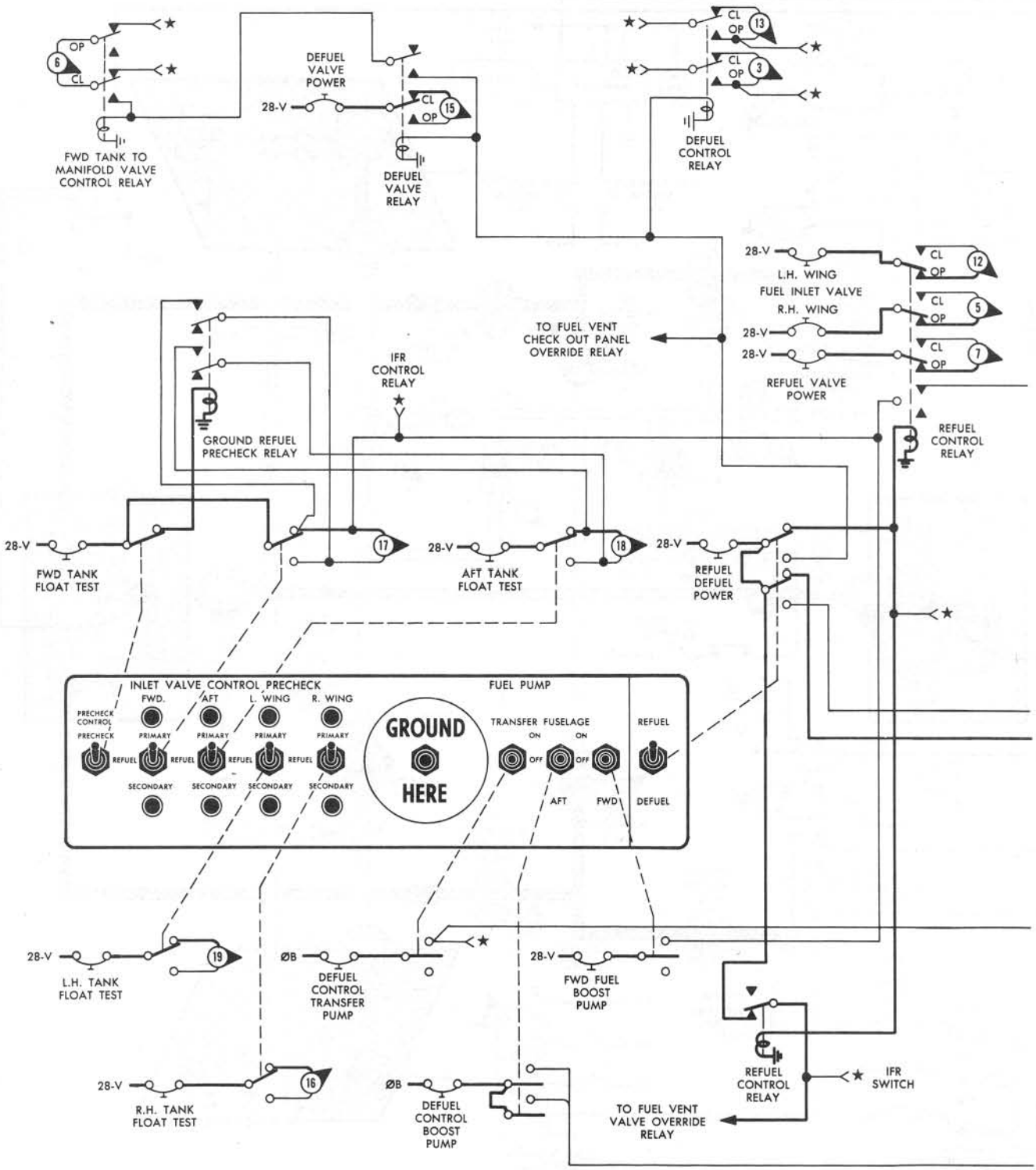

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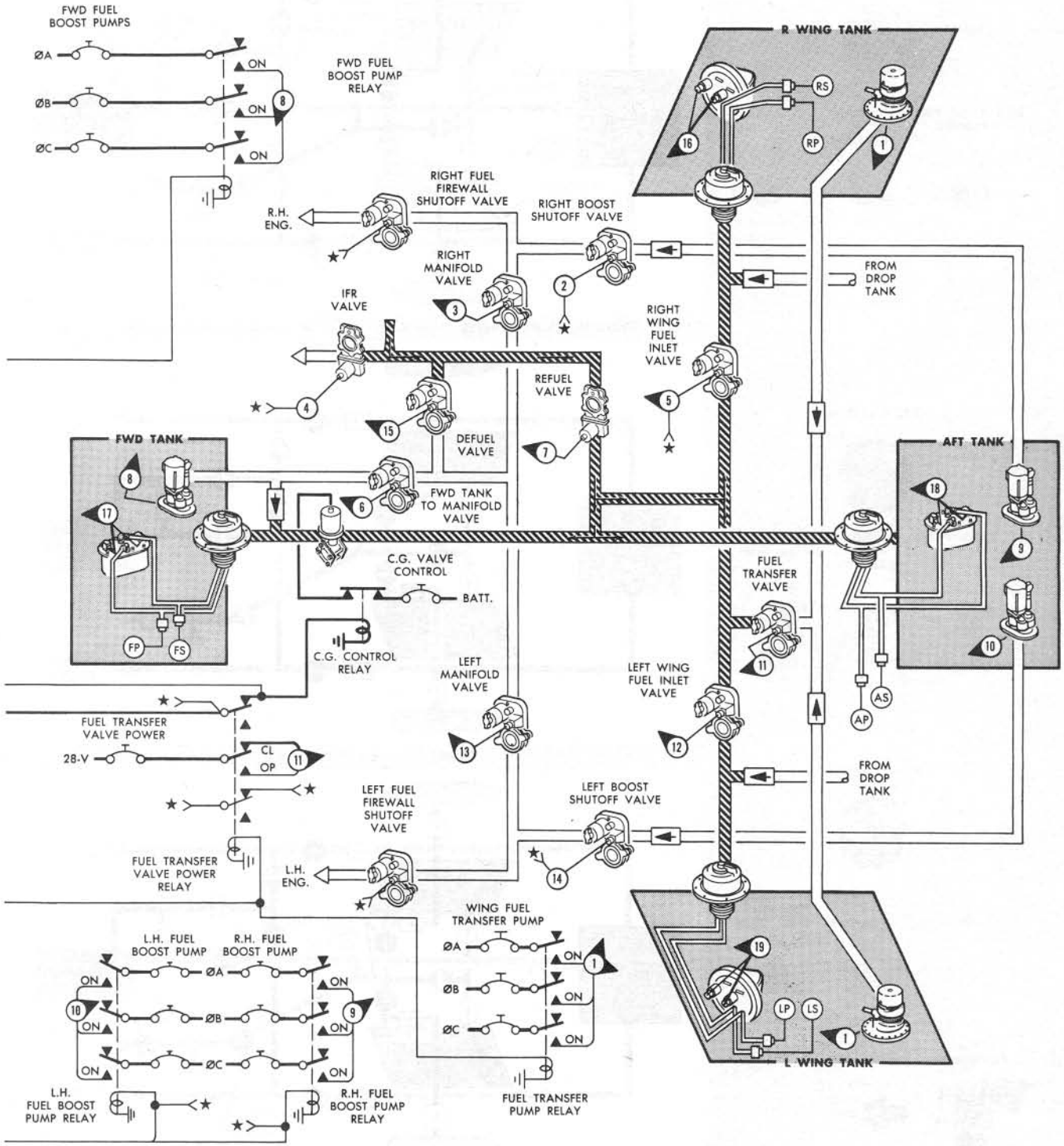
Figure 7-5 (Sheet 4 of 5)

—Detail Schematic



2223B

Figure 7-5 (Sheet 5 of 5)

Fuel Flow

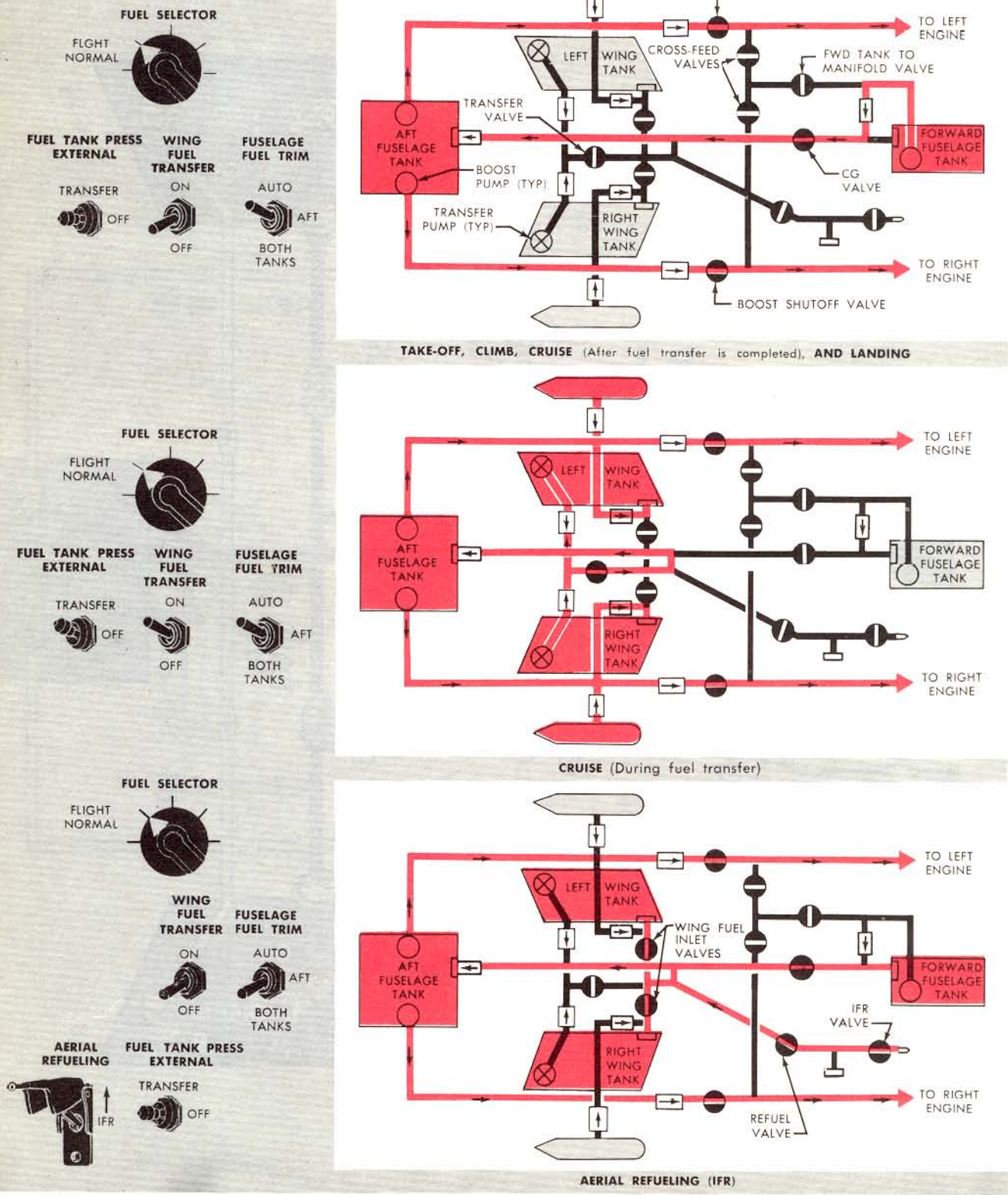


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Figure 7-6 (Sheet 1 of 2)

Diagram

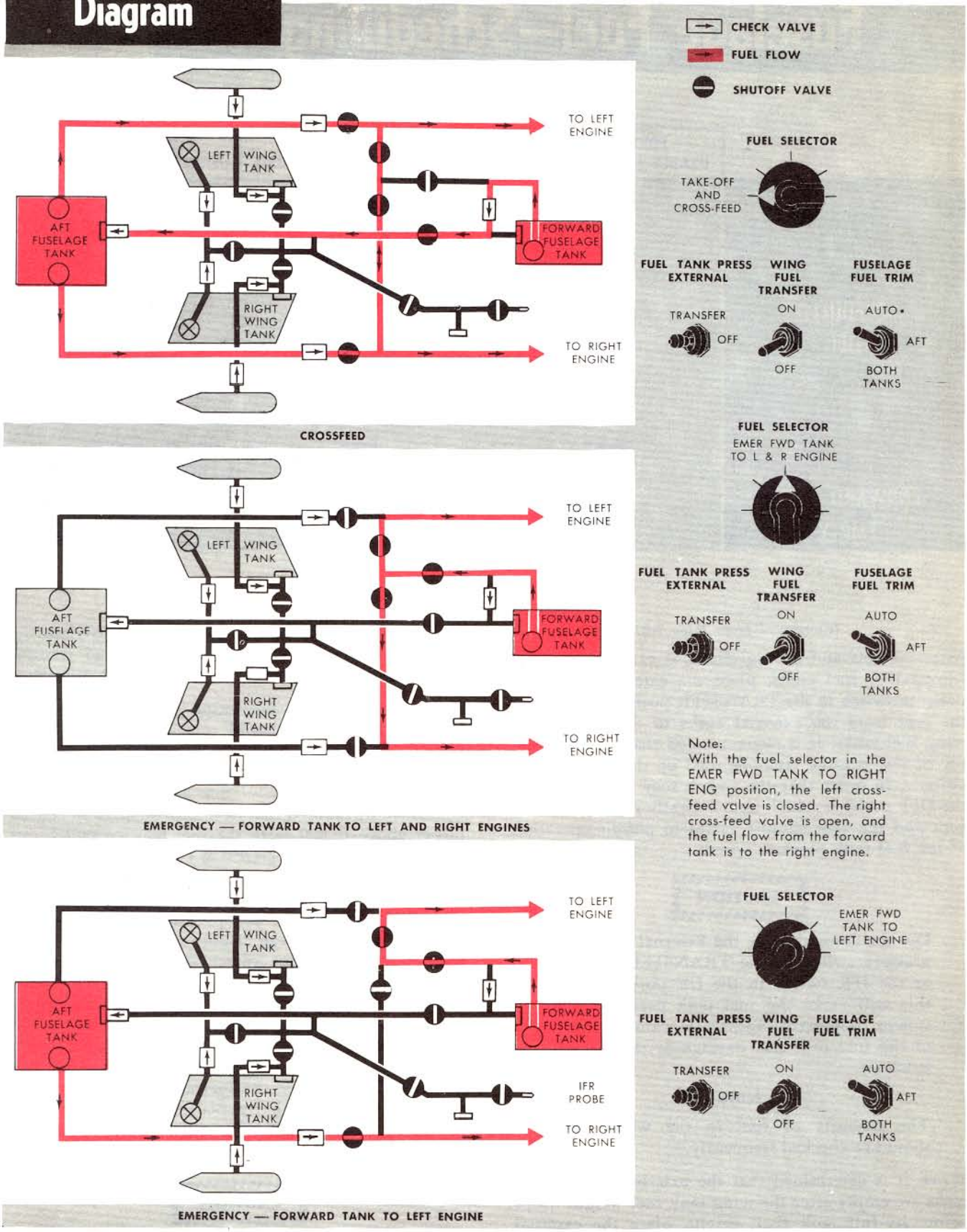

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Figure 7-6 (Sheet 2 of 2)

Fuselage Fuel—Scheduling

FUEL AT 6.5 LB/GALLON

	FORWARD TANK USABLE (POUNDS) VOLUME	AFT TANK USABLE (POUNDS) VOLUME	COMBINED TANKS USABLE (POUNDS) VOLUME
SCHEDULED FUEL	7000	11900	18900
	6000	10650	16650
	5000	9300	14300
	4000	7900	11900
	3000	6400	9400
	2000	4800	6800
	1000	3200	4200
	0000	1485	1485
FORWARD TANK EMPTY	0	1485	1485

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Figure 7-7

(Continued from Page 7-8)

After take-off and during climb, if carrying external (droppable) fuel tanks, place the external fuel tank pressure switch in the TRANSFER position to transfer the fuel from the external tanks to their respective wing fuel tanks. It is recommended that the fuel supply of the external tanks be used up during climb to altitude, in order that the switch may be returned to the OFF position which automatically closes the wing vent and the vent shutoff valves to permit operation of the fuel tank pressure system.

CAUTION

Do not descend with the external fuel tank pressure switch in the TRANSFER position or the IFR switch in the UP position since this will make the fuel tank pressurization system inoperative and could cause collapse of the fuel cells and damage to the aircraft structure.

Note

The quantity of fuel in the wing tanks should be checked frequently.

When it is determined that the external (droppable) tanks are empty after the wing tank fuel weight drops below its full tank fuel weight, place the external fuel tank pressure switch in the OFF position. When the wing fuel tanks register zero fuel, place the wing fuel transfer switch in the OFF position to close the aft tank inlet control valve, stop the fuel transfer pumps, and return the CG valve to normal operation.

During cruise, after completion of fuel transfer, the fuel selector switch should remain in the FLIGHT NORMAL position, so that each engine will be supplied with fuel from its respective fuel boost pump. In the event of failure of one aft tank boost pump (indicated by reduced fuel flow and/or surge in engine power above 18,000 feet), the fuel selector switch can be placed in the TAKE-OFF & CROSSFEED position so that the operating aft tank boost pump can supply fuel pressure to both engines. In the event of failure of both aft tank boost pumps (indicated by reduced fuel flow and/or a surge of both engines above 18,000 feet), the fuel selector switch can be placed in the EMER. FWD, TANK TO L. AND R. ENGINE position so that the forward tank boost pump can supply fuel pressure to both engines. Since the fuel is then being supplied from the forward tank only, it is advisable to descend below 18,000 feet so that fuel can be drawn from either the forward tank as described above or the aft tank by placing the fuel selector switch in either the TAKE-OFF & CROSSFEED or FLIGHT NORMAL positions.

CAUTION

When the forward tank is empty, the forward tank boost pump should be turned off.

This may be accomplished by positioning the fuselage fuel trim switch to the AFT position.

With all boost pumps inoperative, fuel can be drawn from either the forward or aft fuselage tank (depending on positioning of the fuel selector switch); however, at higher altitudes, the reduced fuel flow may result in reduced power. Refer to figure 7-6 for fuel flow and valve positioning for five positions of the fuel selector switch.

FUSELAGE FUEL SCHEDULING.

The Fuselage Fuel Scheduling chart *(figure 7-7)* shows the fuel-weight relationship between the forward and aft fuselage tanks. The chart also shows the fuel loading and usable fuel in pounds for each fuselage tank and the combined 2 tanks. With the fuselage fuel trim switch (CG control) in the AUTO position, the CG control system will automatically control the flow of fuel from the forward tank to the aft tank to maintain a fuel-weight relationship as shown on the chart. For example, reading the column for the forward tank and the aft tank, the forward tank should have 3000 pounds remaining when the aft tank has 6400 pounds of fuel remaining, and the forward tank should have no fuel remaining when the aft tank has 1485 pounds of fuel remaining, etc. The total usable volume from the combined tanks is shown in the right column. In the event the CG control system does not maintain proper fuel load balance and a nose-heavy condition results, the fuselage fuel trim switch can be placed in the BOTH TANKS (CG valve open) position to reestablish the necessary weight relationship by allowing unrestricted flow from the forward tank to the aft tank. In the event of a tail heavy condition, the fuselage fuel trim switch can be placed in the AFT (CG valve closed) position, and the engines will use fuel from the aft tank only. During flight, check for proper CG control system operation by monitoring the fuel quantity indicators. In case of a malfunctioning CG control system, the fuel selector switch can be used to balance the fuel load by positioning the fuel selector switch to one of the three EMER. FWD. TANK positions, as required, to lighten nose load. The EMER. FWD. TANK TO L. & R. ENGINE position of the fuel selector switch will open the shutoff valve in the line from the forward tank, open both cross-feed valves, close both shutoff valves in the lines from the aft tank, and shut off both boost pumps in the aft tank: fuel is then supplied from the forward tank *(figure 7-6)*. Either of the two remaining EMER. FWD. TANK positions may be used to scale down the amount of fuel being used from the forward tank.

AIR REFUELING PROCEDURE.

The aircraft is equipped with a probe and drogue type air refueling system. The system allows light gross weight take-offs to be made and substantially increases the operating range of the aircraft. At present, only reciprocating engine tanker aircraft are available for air refueling and the procedure presented in this handbook is compatible with this type aircraft. Refer to Section IV for description of the air refueling system and to figure 7-6 for fuel flow diagram. The following is a general description of the air refueling procedure for the aircraft. A check list is provided for specific procedure to be followed during air refueling.

CAUTION

Air refueling should not be accomplished in conjunction with the KB-50 tanker unless the KB-50 tanker has been modified to deliver 10 psi. The KB-50 tanker air refueling system is presently restricted to fuel flows of 250 gpm. Approximately 6- to 8-psi system pressure will be required to obtain these fuel flow rates. The fuel shutoff valves in the aircraft are designed to operate at 10 psi. Therefore, there is a possibility that shutoff pressure might not be obtained, allowing fuel to be dumped overboard through the venting system and/or incurring damage to the fuel tanks and aircraft structure.

Several methods of rendezvous are available; the method used is dependent upon the equipment installed in the tanker aircraft. These methods are as follows:

METHOD I.

See T.O. 1B-66(W)D-1A.

METHOD II.

When the tanker aircraft is equipped with a homing adapter (AN/ARA-25), the receiver aircraft can transmit on the AN/ARC-27 command radio and the tanker aircraft can obtain a DF bearing for the receiver to fly to intercept the tanker. The bearing will be given to the receiver through UHF communication.

METHOD III.

When the tanker aircraft is equipped with an airborne radar navigational beacon (AN/APN-69), the receiver aircraft can utilize the AN/APS-63 radar to obtain the bearing to the tanker.

Depending upon the equipment in the tanker, a combination of the preceding methods may be used until visual contact with the tanker is established. The most satisfactory method of rendezvous is method III; however, the other methods may be used in event the AN/APN-69 equipment is not available in the tanker. One of the functions of the rendezvous equipment is to determine the optimum position for the rereiver aircraft to begin descent. A suggested rendezvous technique is outlined in figure 7-8. In most cases, the best procedure to be followed is for the tanker to orbit along the receiver course and as the receiver approaches, proceed on course

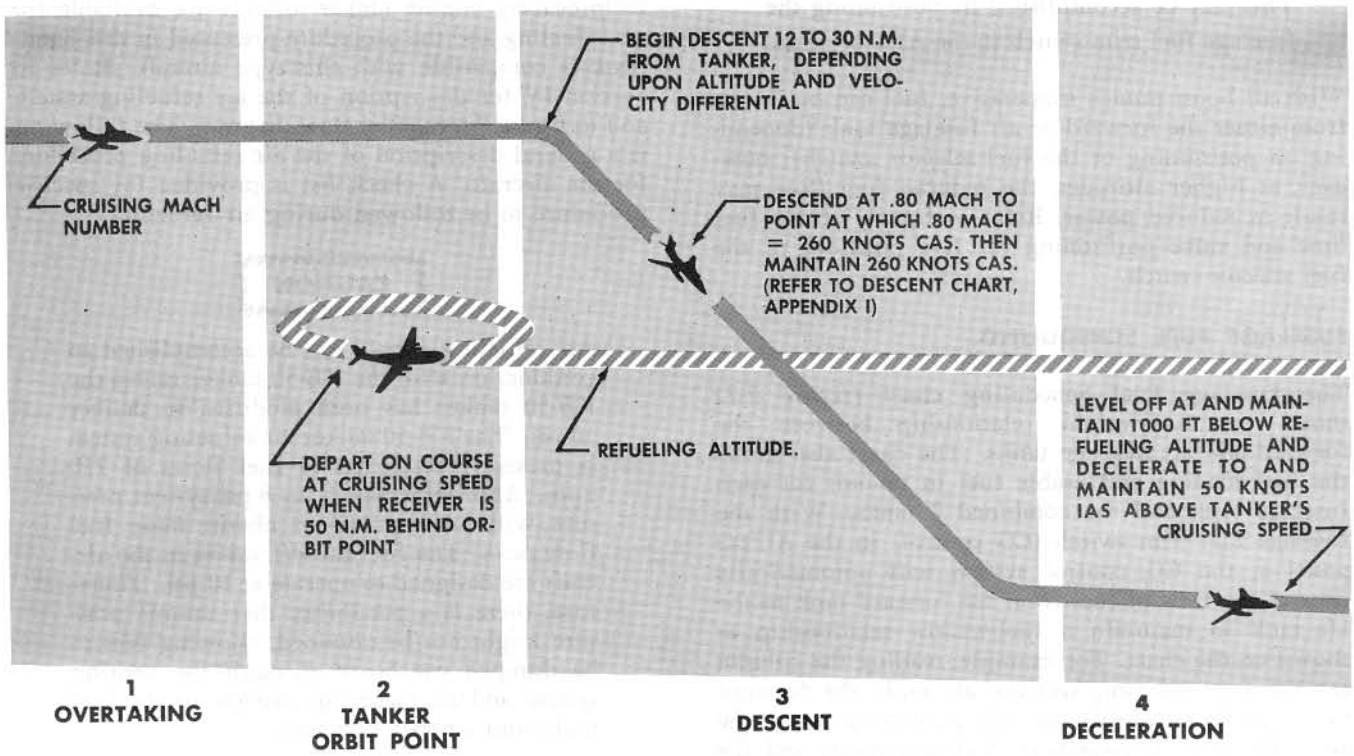

Figure 7-8 (Sheet 1 of 2)

while the receiver descends to refueling altitude. To obtain maximum performance, the receiver should not depart optimum cruise altitude prematurely. Caution should also be taken not to delay descent, as the receiver aircraft may overrun the tanker aircraft. A chart describing the descent with consideration given to altitude separation and differential airspeed is given in Appendix I.

CONTACT PROCEDURE.

After visual contact is established with the tanker aircraft, the gunner or navigator should read the air refueling check list to the pilot over the interphone so that the pilot may prepare the aircraft for air refueling. The wing flaps should be lowered between 20 and 30 per cent at 220 knots IAS or less (to prevent damage to the flaps). The receiver should inform the tanker of the amount of fuel desired. The amber light on the vertical stabilizer of the tanker aircraft will illuminate steadily if the tanker is ready to transfer fuel.

WARNING

If the amber light is blinking, the tanker aircraft is not ready to transfer fuel. This constitutes a signal for wave-off.

The receiver stabilizes airspeed approximately 80 feet aft and 25 feet below the tanker with the speed brakes CLOSED. This is known as the observation position. The hose will be extended 60 to 65 feet (as indicated by the number of white marks visible on the hose). Each white mark indicates approximately 10 feet. pilot to establish a 5- to 10-knot closure speed, maintaining the probe 2 or 3 feet above and slightly to the right of the drogue. This is important since the Power is then added (3 to 4 per cent) by the receiver drogue tends to rise and veer slightly to the right of the receiver as the probe approaches contact. When contact is established, the pilot's attention should be immediately directed to the hose length and power should be adjusted (reduced 3 to 4 per cent) to maintain position with no more than 55 feet of hose extended. A green light will illuminate when 55 feet of hose is extended, to indicate that the tanker aircraft is ready to transfer fuel.

WARNING

The green light on the tanker aircraft will illuminate when 55 feet of hose is extended regardless of the position of the receiver air refueling (IFR) switch. The air refueling (IFR) switch must be in the up position to transfer fuel.

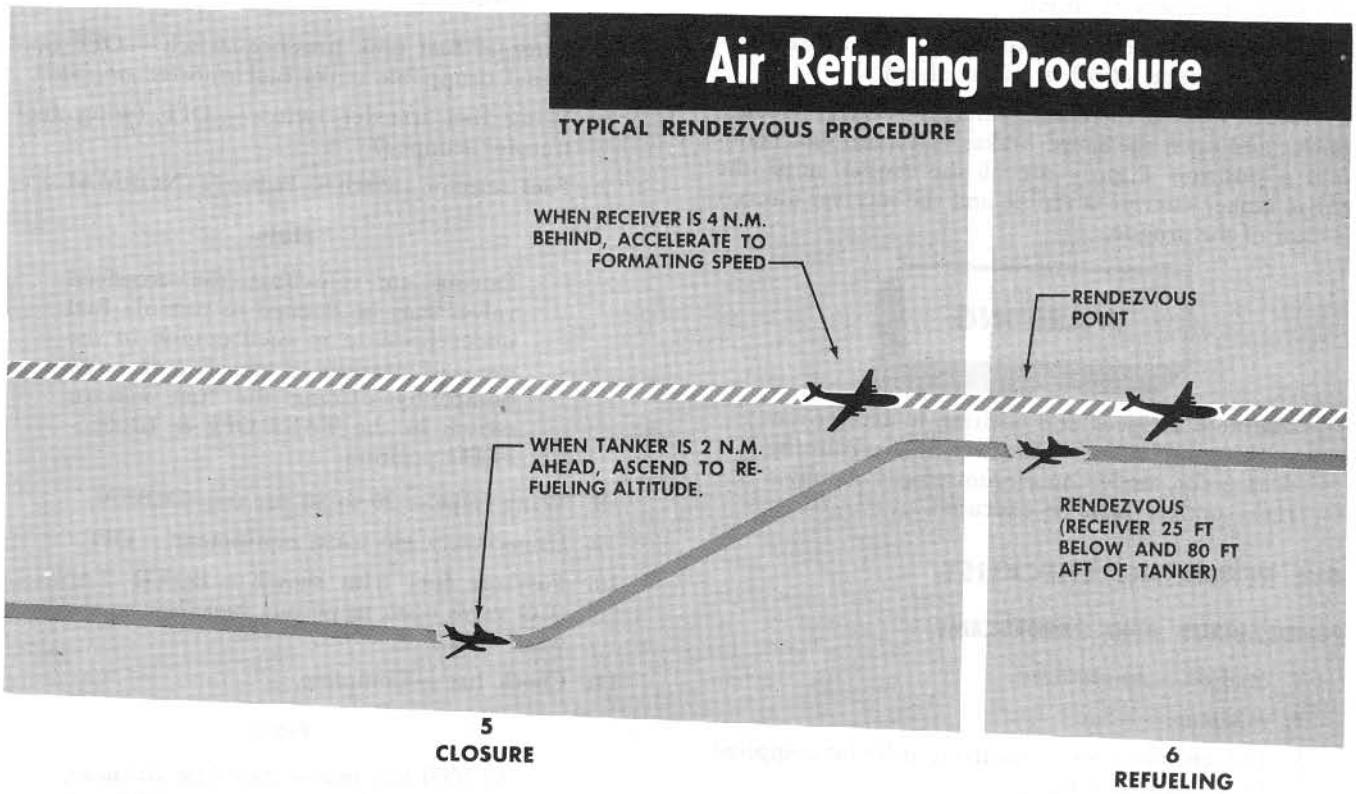

Figure 7-8 (Sheet 2 of 2)

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WARNING

If the tanker aircraft reel malfunctions and will not retract to the 55-foot position, notify the tanker aircraft. Fuel may be transferred with the hose fully extended if the emergency fuel valve on the tanker is actuated.

Note

If necessary to refuel from a wing drogue, the receiver aircraft should move slightly outboard to minimize down-wash effect.

FUEL MANAGEMENT.

The receiver pilot's attention will be focused on maintaining correct refueling position, in relation to the tanker, and he may be unable to monitor the fuel quantity indicators. Therefore, the receiver pilot must rely completely on the proper functioning of the fuel system for filling to proper level. The tanker aircraft crew should be alert to observe (if feasible) fuel venting from the receiver aircraft and be ready to instantly stop transfer of fuel if this occurs. During fuel transfer, a slight amount of fuel may leak from the drogue and reduce visibility; however, the pilot should have no difficulty in maintaining proper flight position. If the receiver aircraft desires a partial fuel load, the amount must be controlled by the tanker aircraft. The tanker aircraft should notify the receiver when fuel transfer is completed.

DISCONNECT PROCEDURE.

When the desired amount of fuel is transferred, the receiver reduces power and opens the speed brakes (if required) until break-away from the drogue occurs. The tanker aircraft then continues straight ahead. The receiver adds power and descends slightly until climbing airspeed is obtained. Climb should be made on climb schedule (see Appendix I).

AIR REFUELING EMERGENCY.

The aircraft call sign, plus the word "breakaway" repeated three times, is used to declare an emergency condition in either the tanker or the receiver aircraft.

At any time "breakaway" is announced over the radio, the following will be accomplished immediately by the crew members as listed:

Tanker Pilot: If the receiver calls "breakaway" increase power and climb straight ahead.

Receiver Pilot: If the tanker calls "breakaway" reduce power and open the speed brakes. Descend and maintain a position slightly aft of the tanker until the entire tanker aircraft is visible and the receiver aircraft is clear of the drogue.

WARNING

Maintain airspeed and position to avoid overrunning the tanker. However, if overrunning does occur, under no circumstances should a right or left turn be executed.

AIR REFUELING CHECKLIST.

RENDEZVOUS AND PREDESCENT.

1. Radios — As required.
2. Altimeter — Set.
3. Descent range — . . . nautical miles (as compiled from Appendix I).

Note

Compute the descent range from appropriate charts, Appendix I (normal descent is 0.8 Mach to intercept at 260 knots IAS, then maintain 260 knots IAS).

Note

Compute the gross weight and determine contact speed from Appendix I.

PRE-CONTACT.

1. Fuel quantity indicator selector switch — UP position (for indication of fuel quantity in the forward and aft fuselage fuel tanks).
2. Air refueling (IFR) circuit breakers (primary bus circuit breaker panel) — Checked IN.
3. Air refueling probe light rheostat — Adjust intensity as desired during night air refueling.
4. Air refueling switch — IFR, center (guarded) position.

CAUTION

Do not descend with the external fuel tank pressure switch in the TRANSFER position or the IFR switch in the UP position since this will make the fuel tank pressurization system inoperative and could cause collapse of the fuel cells and damage to the aircraft structure.

5. External fuel tank pressure switch — OFF (external droppable tanks fuel transfer stopped).
6. Wing fuel transfer switch — OFF (wing fuel transfer stopped).
7. Fuel selector switch — FLIGHT NORMAL.

Note

During air refueling, the crossfeed valves may be opened to provide fuel under pressure to each engine in the event of a failure of one aft tank boost pump, by placing the fuel selector switch in the TAKE-OFF & CROSSFEED position.

8. Wing flaps — 20 to 30 per cent DOWN.
9. Unnecessary electrical equipment — OFF.
10. Fuselage fuel trim switch — BOTH TANKS. (CG valve open to permit fuel flow to the forward tank.)
11. Check list — Complete.

Note

At 1000 feet below refueling altitudes, check that the auto pilot is OFF and the air refueling probe light rheostat is ON.

WARNING

Smoking is not permitted during air refueling operation.

CONTACT AND REFUELING.

The receiver should stabilize speed at approximately 80 feet aft and 25 feet below the tanker (speed brakes CLOSED). See Formating Speed Charts, Appendix I. After the hose is extended to the proper position (approximately 60 to 65 feet), power should be added by the receiver to establish a 5 to 10-knot closure speed while maintaining the probe 2 or 3 feet above and slightly to the right of the drogue. When contact is established, the pilot's attention is immediately directed to the hose length. Power should be adjusted to maintain position with no more than 55 feet of hose extended.

Note

A green light (on the tail of the tanker) will glow when 55 feet of the hose is extended, signifying that the tanker is ready to transfer fuel.

WARNING

The green light on the tanker will glow with 55 feet of hose extended even though the receiver air refueling (IFR) switch is down. No fuel can be transferred under this condition.

WARNING

If the tanker reel malfunctions so that it will not retract to the 55-foot position, notify the tanker. Fuel may still be obtained with the hose fully extended if the tanker actuates the emergency fuel valve.

FUEL MANAGEMENT.

The pilot must rely completely on the proper functioning of the fuel system for filling to the proper levels.

In the event of an unbalanced condition between the forward and aft fuselage tanks during refueling, and a nose heavy condition results, the fuselage fuel trim switch can be placed in the AFT position (CG valve closed) to stop fuel flow to the forward tank. When proper balance is regained, place the fuselage fuel trim switch in the BOTH TANKS position to resume fuel flow to the forward tank. In this position fuel flow must be monitored.

WARNING

The tanker crew should be alert to observe (if feasible) fuel venting from the receiver and be ready to instantly cease fuel transfer, if required.

Note

If the receiver desires a partial fuel load, the amount must be controlled by the tanker. The tanker should notify the receiver when transfer is completed.

POST REFUELING.

1. Wing flaps — UP.
2. Air refueling probe light rheostat — OFF.
3. Air refueling (IFR) switch — Center (guarded) position.
4. External fuel tank pressure switch — As required.
5. Fuselage fuel trim switch — AUTO (CG control system automatically controls the fuel flow from the forward tank to the aft tank).
6. Wing fuel transfer switch — As required.
7. Fuel selector switch — FLIGHT NORMAL (each engine is supplied fuel from its respective fuel boost pump).
8. Fuel quantity indicator switch — UP (for indication of fuel quantity in the forward and aft fuselage fuel tanks).
9. Altimeter — Reset.
10. Check list — Complete.

Note

After completion of air refueling, climb (on schedule) to desired cruise altitude (refer to Appendix I).

ALTERNATOR CONTROL.

The a-c system control panel on the pilot's right console provides facilities for monitoring alternator output and switching the alternators to the aircraft's a-c buses. The a-c ammeters, operated by current transformers that sense the current flow in phase B of each alternator output, indicate the division of the total alternator load. A wide divergence between the two ammeters indicates a malfunction. Each alternator may be individually switched to its main bus system by placing the NO. 1 ALT or the NO. 2 ALT switch in the ON position. Provided the alternator control relay has not been tripped by a fault, this operation closes the alternator circuit breaker relay to energize the buses. In the event the alternator control relay is tripped, the NO. 1 ALT or the NO. 2 ALT switch must first be placed momentarily in the RESET position to close this relay, after which the alternator is switched to its bus. If the fault persists, the alternator control relay will trip again, and resetting should not be attempted until the fault has been cleared. The BUS TIE switch has two positions, AUTO and OPEN. In the OPEN position, the alternators cannot be paralleled and this position of the switch should be used whenever it is desired to operate the alternators isolated. In the AUTO (guarded) position, whenever both alternators are operating normally and have been switched to their main buses, the alternators will be paralleled automatically by the automatic paralleling relay. This relay closes the bus-tie circuit breaker relay at the proper instant to parallel the alternators. Under normal conditions, in the event the alternator switches are allowed to remain in the ON position after engine shutdown, and the BUS TIE switch is allowed to remain in the AUTO position, the alternator controls will all function automatically when the engines are restarted. As an engine comes up to speed, its alternator will be switched to its main buses at the proper time, and when both alternators are switched to their buses, they will be automatically paralleled without manual assistance. The LT ON NO OUTPUT warning light is illuminated whenever an alternator switch (NO 1 ALT or NO 2 ALT) is in

the ON position, its corresponding alternator circuit breaker relay is tripped, and the d-c main bus is energized. This condition will occur during operation when an alternator is removed from its main buses by reason of a fault; it will also occur at any time the alternator switch is left in the ON position, the d-c main bus is energized, and the alternator is not operating. The LT ON BUS TIE OPEN warning light will be illuminated whenever the bus tie circuit breaker relay is open, the bus tie switch is in the AUTO position, and the d-c main bus is energized. This condition will occur during operation whenever the alternators are isolated by reason of a fault, or at any time the alternators are operating isolated and the switch is in the AUTO position, with the d-c main bus energized. On the ground, under static conditions, the light will be illuminated whenever the BUS TIE switch is in the AUTO position and the d-c bus is energized.

ALTERNATOR PROTECTIVE DEVICES.

Each alternator is provided with protection against overvoltages in either isolated or paralleled operation, underfrequency, ground faults and reverse currents. These functions are accomplished through the use of special circuits and relays. The circuits connected to the various a-c buses are protected by circuit breakers which are located in the flight and weather compartments and in the crawlway.

SINGLE-ALTERNATOR OPERATION.

If an alternator is isolated automatically by reason of a fault in the system, as indicated by the illuminated NO OUTPUT light, the illuminated BUS TIE light, and zero reading on the ammeter, and, if the alternator control relay cannot be reset by placing the alternator switch momentarily in the RESET position, proceed as follows:

1. Place the alternator switch for the faulty alternator in the OFF position.
2. Place the bus tie switch in the OPEN position. The NO OUTPUT light and the BUS TIE light will go out. The output from the operating alternator will be sufficient for all a-c power requirements; however, unless urgent conditions require maximum operation of a-c powered equipment, reduce the alternator load by removing nonessential loads in order to prolong the operating efficiency of the good alternator and to insure a continued normal a-c power supply during flight.

GENERATOR CONTROL.

The d-c system control panel on the pilot's right console provides facilities for monitoring generator output and switching the generators to the main d-c bus. The ammeters indicate the division of the generator load. For proper operation, the generators should be balanced within 30 amps. When the generator switch is placed in the ON position, the generator will be automatically connected to the main bus whenever the generator output voltage exceeds the main bus voltage. In the OFF position, the generator is disconnected from the main bus regardless of generator output voltage. In the event the generator field relay has been tripped by a fault, the switch for the affected generator must be placed momentarily in the RESET position to reset the relay. If the fault persists and the field relay cannot be reset, as indicated by continued illumination of the NO OUTPUT light and/or zero reading on the ammeter, turn the respective generator switch OFF.

GENERATOR PROTECTIVE DEVICES.

The generator circuits are provided with complete control of output voltage and protection against overvoltage, undervoltage, reversed generator polarity and ground faults. Voltage regulation is accomplished by the use of a carbon pile voltage regulator and an equalizer circuit that is in use when the generators are operating in parallel. Circuit protection is provided by use of the generator field relay, the overvoltage relay, the differential relay, and the ground fault relay. The equalizer relay opens the equalizer circuit whenever a generator is disconnected from the main d-c bus. The circuits connected to the various d-c buses are protected by circuit breakers located in the flight and weather compartments and in the crawlway.

SINGLE GENERATOR OPERATION.

If a fault in the system removes the output of a generator from the main d-c bus, as indicated by the NO OUTPUT light illuminating and/or the zero reading on the ammeter, and if the generator field relay cannot be reset by placing the generator switch momentarily in the RESET position, turn OFF the respective generator switch. The NO OUTPUT light will go out. The output from the remaining generator will provide the required output for operation of the d-c equipment. If maximum operation of d-c powered equipment is not urgently required, reduce the generator load by shutting off nonessential equipment in order to prolong the operating efficiency of the good generator and to insure a continuous d-c power supply.

ELECTRICAL SYSTEM TROUBLE SHOOTING.

There are no provisions for inflight trouble shooting of the electrical system other than the controls and indicators provided on the pilot's right console and the circuit breakers in the flight and weather compartments and in the crawlway. The automatic control and protective devices incorporated in the electrical system and the ability of the system to function normally with single alternator or generator operation, reduces the immediate necessity of trouble shooting electrical equipment and circuits which are not readily accessible during flight.

N-1 COMPASS SYSTEM-PRINCIPLE OF OPERATION.

The information contained in this section is in addition to Description and Operation, Section IV, and Preflight Checks, Section VIII.

PRINCIPLE OF MAGNETIC SLAVED OPERATION.

To illustrate the principle of Magnetic Slaved Operation, assume the following conditions:

1. The aircraft is flying a steady course.
2. Latitude correction pointer-OFF. (The system to be functioning in magnetic slaved operation.)
3. The master indicator to be set to the correct magnetic heading of the aircraft.

By such assumptions, a change in aircraft heading will result in a change in the azimuth reference signal from the directional gyro. This signal is amplified and fed into the azimuth servo loop causing the azimuth servo motor of the master indicator to position the master indicator heading pointer to the new heading. This change in heading also results in a change of signal from the C-2 remote compass transmitter. However, the signals from the directional gyro and the C-2 remote compass transmitter have been changed an equal amount; therefore, they remain in step and the master indicator heading pointer will indicate the new magnetic heading. The apparent gyro drift (due to the earth's rotation) is an actual factor that must be considered. Its correction is accomplished by slaving the N-1 compass system to the C-2 remote compass transmitter when in magnetic slaved operation. Now assume a small change in azimuth of the gyro due to apparent gyro drift with no actual change in aircraft heading. There will be a change in the directional gyro azimuth reference signal to the azimuth servo loop and motor in the master indicator resulting in a corresponding movement of the master indicator heading pointer. However, the signal from the C-2 remote compass transmitter, no longer changing equally with the directional gyro, now incorporates an error signal since the heading pointer of the master indicator no longer indicates the correct magnetic heading of the aircraft. This error signal is transmitted to the motor of the correction loop through the amplifier. The correction servo motor then installs a correction signal in the azimuth servo loop and causes the heading pointer of the master indicator to return to its original position, thus indicating the correct magnetic heading of the aircraft, once more. The same correction is transmitted to the autopilot signal. With the aircraft maintaining a steady magnetic course, the master indicator heading pointer movement is not visible, since a state of equilibrium will be reached where the drift rate of the gyro spin axis is immediately counteracted by the output rate of the correction servo. The maximum speed of the correction servo loop is ample to compensate for the total gyro drift, which in a properly operating system, cannot exceed 15 degrees per hour, yet is sufficiently low to be unresponsive to the effects of shock, vibration and rapid changes in course and speed of the aircraft. To summarize, when the N-1 compass system is in magnetic slaved operation, the master indicator heading pointer is slaved to the C-2 remote compass transmitter, and the system operates as a remote indicating magnetic compass with the inertial stability of a directional indicator (gyro).

PRINCIPLE OF DIRECTIONAL INDICATOR (GYRO) OPERATION.

Again, assume that the aircraft is flying a steady course. In areas where the magnetic field is unreliable, the method of operation may be changed to directional indicator (gyro) operation. To accomplish this, manually rotate the latitude correction knob clockwise from the OFF position and set the latitude correction pointer at the latitude of the aircraft's position. This will isolate the C-2 remote transmitter signal and inroduce the latitude correction mechanism signal into the system. The desired gyro heading reference is set by engaging and rotating the synchronizer control knob on the master indicator. When we assume the above, the azimuth signal from the directional gyro follows through the azimuth servo loop in the same manner as previously described. Because of the rotation of the earth, the directional gyro spin axis will appear to drift in azimuth. Unless this is corrected, the azimuth pointer on the master indicator will move in the same direction and at the same rate as the apparent drift. An aircraft following a constant gyro heading reference thus will continuously turn away from the great circle course which it is desired to follow. To correct this apparent error, a signal is generated in the latitude correction mechanism which is proportional to the latitude at which the latitude correction pointer has been set. A special electronic circuit uses this signal to regulate the speed of the correction servo motor causing the azimuth servo loop and the master indicator heading pointer to compensate at the apparent drift rate of the gyro. To summarize, when the N-1 compass system is in directional indicator (gyro) operation, the system operates as a directional indicator (gyro) with an arbitrary gyro heading reference, selected by the operator. With the proper latitude setting on the latitude correction indicator, a correction is incorporated equal and opposite to the apparent drift in azimuth of the directional gyro. Assuming a no-wind condition, maintaining a constant gyro reference heading (as indicated by the master indicator heading pointer) will result in the aircraft's flight approximating that of a great circle.

CAUTION

For correct functioning of the N-1 Compass, power must be applied simultaneously.

crew duties

Section VIII

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INTRODUCTION.

This section lists responsibilities, other than primary functions performed by crew members. The additional duties listed are only a part of those which may be required of the crew member. Special missions will necessitate additional duty assignments which will be detailed during the mission briefing. In addition, it will be the duty of either the navigator or the gunner, as designated by the pilot, to perform normal or emergency operations in the crawlway.

PILOT.

It will be the responsibility of the pilot to insure that a thorough inspection of the aircraft and all equipment is properly conducted in sufficient time prior to departure to permit correction of discrepancies without incurring delays. The pilot will personally inspect all controls and items of equipment pertaining to the flight of the aircraft. The normal and emergency procedures for the pilot are covered in detail in Sections II and III.

NAVIGATOR.

The navigator will aid the pilot in all matters pertaining to flight planning. He will complete his assigned preflight duties and report the readiness of his equipment to the pilot. In addition to these and his normal duties as navigator, he should perform the following checks.

BEFORE EXTERIOR INSPECTION.

1. DD form 781 — Check.
2. Seat ejection controls ground safety pin — Installed.

WARNING

The A-5 or MC-1 seat cushion should not be left in the seat if the C-2A or PK-2 life raft is being carried. The combined use of these two items will increase the possibility of injury in the event of seat ejection or crash landing. If additional height in the seat is needed, a solid filler block may be used in conjunction with the C-2A pack, provided that the combined thickness does not exceed 5 inches.

3. Canopy hatch ground safety cable pin — Installed.
4. T-8 and M-4 or M-12 initiator ground maintenance safety pins — Removed.

WARNING

Safety pins may be installed by maintenance personnel in the T-8 and M-4 or M-12 initiators, located on the left and right sides of each flight compartment seat. These pins are used as an additional safety measure when performing maintenance on or near the crew seats. To insure operation of the seat ejection system, the navigator should make certain that these pins have been removed prior to all flights. If the pins are installed, the maintenance personnel should be consulted regarding the status of the ejection system before occupying the ejection seat.

5. M-3 (Seat Catapult) initiator safety pin — Properly installed.

WARNING

The safety pins installed in the M-3 seat catapult initiators, located on the top of each flight compartment seat structure, should be checked for installation and proper attachment to the respective hatch. These pins are automatically pulled when the hatches are jettisoned, thereby arming the seat catapult initiators.

EXTERIOR INSPECTION.

1. Radomes — Check.

Note

Check for damage and drains free of obstruction.

Note

If required for night operation, external power may be applied at this time. Coordinate with the pilot and insure that no damage to any equipment will result.

INTERIOR INSPECTION.

CRAWLWAY.

1. Radar equipment — Check.
   a. Check all cables and general installation.
   b. Servo amplifier (AM 193) STAB-UNSTAB switch — STAB.

c. Radar interconnecting box (J-543) gyro disable switch — NORMAL.

d. Fuse panel and spare fuse rack — Full and fuses of proper rating.

Note

The fuse panel is located at the navigator's position.

FLIGHT COMPARTMENT.

1. Circuit breaker panels — Check.

Note

APN-82 circuit breakers (located on the lower right corner of the gunner's radio and radar circuit breaker panel) — Pull (two breakers); all other Navigation equipment circuit breakers — IN.

2. Sextant mount — Shutter closed.
3. Variac (TF106/U) — 73.
4. Clock — Set.
5. Auxiliary control unit (C-412) — Controls set.
   a. Center switch — NORMAL.
   b. Bearing switch — RELATIVE.
   c. Altitude knob — OFF (counterclockwise).
   d. Gyro switch — NORMAL.
6. Auto-navigation radar control panel (C-1416) — Controls set.
   a. System power switch — OFF.
   b. System monitor switch — GROUND CHECK.
   c. Radar silent switch — SILENT.
7. Navigation radar interconnecting box (J-608) — Check spare fuses.
8. 0-15 camera — Check.

   Magazine:

   a. Detach the magazine and check that the emulsion side of the film is out and that the perforations in the film are aligned with the holes in the magazine.
   b. Check the magazine footage dial for sufficient film.
   c. Attach the magazine to the camera and check for correct seating.

   Camera:

   d. Move "f-stop" control to limits and check movement. Set "f-stop" as required.

   Recording chamber:

   e. Remove data plate.
   f. Wind and hack clock.
   g. Fill out data plate as required.
   h. Check that the range indicator holes in the data plate are not obstructed.
   i. Check that the two light bulbs are installed in the recording chamber.
   j. Replace the data plate in the camera.
   k. 0-15 power switch — OFF.
9. Navigation computer control panel (C-1196) — Switches set.
   a. Function switch — NORMAL.
   b. Departure switch — ST BY.
10. Ground position indicator control panel — Controls set.
    a. Variation — 0 (Zero).
    b. Wind force — Ground speed flag.
    c. Wind direction — 0 (Zero).
11. Interphone control panel — Switches set.
    a. Microphone selector switch — INTER.
    b. Normal-aux listen switch — NORMAL.
    c. Interphone mixer switch — As desired.
12. Autopilot remote turn control knob — In detent.
13. Altimeter — Set.
14. APS-63 fuse panel — Check.
15. APS-63 radar set control (C-1230) — Controls set.
    a. Power knob — OFF (counterclockwise).
    b. Meter knob — AC.
    c. Contrast knob — OFF (counterclockwise).
    d. Rcvr gain knob — Counterclockwise.
    e. Anti-jam knob — OFF.
    f. AMTI-NORMAL switch — NORMAL.
    g. ILLUM knob — As desired.
    h. Radar tuning knob — RAD AFC.
    i. Sweep delay knob — Counterclockwise depressed and in detent.
    j. Tilt knob — 0 (Zero).
    k. Range knob — 30 miles.
16. Indicator (IP-235) — Controls set.
    a. Bias — Counterclockwise.
    b. Sweep amp — Mid-point.
    c. Range lights — Mid-point.
    d. Sect amp — Clockwise (In detent).
    e. AMTI video gain — Counterclockwise.
    f. Normal video gain — Counterclockwise.
    g. Brill marks — Counterclockwise.

h. Scale illumination — As desired.

i. Backlash knob — Counterclockwise.

17. Oxygen system preflight check — Check (See Section IV).

POWER ON.

1. Ground power — ON (coordinate with pilot).
2. AN/ASQ-15 pressure pumps switch — NORMAL (Guard down), pressure within limits.
3. Radar set control (C-1230) power knob — ST BY. (Check AC-AC Block — DC-DC Block +1 Div.)

Note

If the voltages fall outside the tolerances, check the ground power supply.

4. Lights — Check.
   a. Instrument, panel, flood and interior lights — As desired.
5. Auto-navigation radar control panel (C-1416) — Switches set, lights checked.
   a. System power switch — ON.
   b. Power on indicator lights — ON (green).
   c. Memory warning light — ON (red).
   d. Transmit silent switch — TRANSMIT.
6. Navigation radar interconnecting box (J-608) — Lights OUT.
7. Parachute — On and adjusted.
8. Seat belt and shoulder harness — Adjusted.
9. Helmet — On; oxygen and interphone connected.
10. Canopy hatch — CLOSED and LOCKED (rollers checked).
11. Seat and locks — Checked and adjusted.
12. Interphone — Checked (at pilot's command).
13. N-1 compass preflight — Check.
    a. Power of warning light — OFF.
    b. Latitude correction pointer — OFF.
    c. Master indicator heading — Synchronized.

Note

Synchronization is accomplished by engaging and rotating the synchronizer control knob and thus rotating the heading pointer on the master indicator until the annunciator is zeroed. The master indicator heading pointer should then indicate the correct magnetic heading; any serious divergence from the magnetic heading should be investigated for possible local magnetic disturbances affecting the C-2 remote compass transmitter.

d. Synchronizer control knob — Engage and rotate the master indicator in a clockwise direction.

Note

The master indicator heading pointer should follow clockwise.

e. Master indicator heading pointer — Set 3 to 5 degrees to the right of the magnetic heading.

Note

The annunciator pointer should move to the right of center (approximately 30°) into the area marked "L." The position of the annunciator pointer in the "L" area indicates that the synchronizer control knob and the master indicator heading pointer are to be rotated to the left (counterclockwise) to synchronize the instrument.

f. Servo correction indicator (white dot seen through the the opening near the "E" mark on the master indicator dial) — Rotating counterclockwise.

Note

The servo correction indicator should rotate counterclockwise (during rotation of the synchronizer control knob to the left) to indicate that the correction servo motor is rotating in that direction, and is returning the master indicator heading pointer to the correction magnetic heading. The heading pointer should return slowly to the original heading and the annunciator should approach the center position.

g. Synchronizer control knob — Engage and rotate in a counterclockwise direction. The master indicator heading pointer should follow in the same direction. Set the heading pointer 3 to 5 degrees to the left of the magnetic heading. The annunciator pointer should move to the left of center (approximately 30°) into the area marked "R." The position of the pointer in the "R" area indicates that the synchronizer control knob and the master indicator are to be rotated to the right (clockwise) to synchronize the instrument.

h. Servo correction indicator (white dot seen through the opening near the "E" mark on

the master indicator dial) — Rotating clockwise.

Note

This indicates that the system is correcting in the proper direction to return the master indicator pointer to the correct magnetic heading. The heading pointer should return slowly to its original heading and the annunciator should approach the center position.

i. Latitude correction control knob — Rotate the latitude correction pointer to 90°N.

Note

Observe that the servo correction indicator rotates clockwise.

j. Latitude correction control knob — Slowly rotate the latitude correction pointer to zero degrees.

Note

Observe that the speed of the correction servo indicator gradually diminishes and stops completely when the zero degree position of the latitude correction pointer is reached.

k. Latitude correction control knob — Continue to rotate the latitude correction pointer to 90°S.

Note

Observe that the servo correction indicator rotates counterclockwise with speed of rotation reaching a maximum at 90°S.

1. For magnetic slaved operation, proceed as follows:

(1) Turn latitude correction control knob of OFF and check that system is synchronized by observing that the master indicator pointer is indicating the correct magnetic heading and that the annunciator is at the center position.

AFTER ENGINE START.

1. APN-82 circuit breakers — IN.
2. Ground position indicator (ID-389) — Set.
   a. Latitude and longitude counters — Check rates and set as required.
3. APS-63 radar set control (C-1230) — Power SCAN SLOW, adjust variac and check meter readings.
   a. Power knob (after range mark indicator reads 10 MILES) — SCAN SLOW.
   b. Meter readings:
   MAG — Adjust to 4.8 divisions.
   XTAL — 0.6 (±0.2) ma (divisions)
   MOD-HV — 8 divisions (±1)
   IND-HV — DC block.
   AC — AC block.
   26.5 — DC block to 1 division above.
   —300 — DC block.
   —105 — DC block.
   +150 — DC block.
   +300 — DC block.
   +600 — 10 to 18 divisions.
4. Indicator (IP-235) — Pedestal amplitude checked, controls set.
   a. Bias knob — Trace just visible.
   b. Normal vid gain — Check pedestal amplitude through full range and set as required.
   c. Bias knob — Trace just below visibility.
   d. Brill marks — Optimum.
   e. Focus — As required.
   f. Horz and vert — Center, as required.
   g. Swp amp — Adjust.
5. APS-63 heading mark — Check.
   a. Heading mark — 0 (bearing switch — relative).
   b. Bearing switch — True, check heading mark against N-1.

Note

With backlash maladjusted, in full scan operation, heading mark may be in error by several degrees.

   c. Set variation into ground position indicator control panel, note movement of heading marker.
6. APS-63 radar set control (C-1230) — Adjust for presentation.
   a. Power knob — SCAN FAST.
   b. Receiver gain — As required.

Note

If necessary for best presentation, a fine adjustment of the video gain may be made.

7. Auto-navigation radar control panel (C-1416) — Ground check function, checked.
   a. Memory warning light — OUT, system monitor light — ON.
   b. Radar-silent warning light — OUT.
   c. Ground speed indicator — 100 or multiples thereof (±10).

d. System monitor knob — NORMAL.

8. 0-15 camera — Power ON, check.
   a. Power switch — ON.
   b. Selector switch — Check settings and set as desired.
   c. Check counter and tell-tale knobs for operation.

BEFORE TAKE-OFF.

1. N-1 compass heading — Checked.
2. Canopy hatch — CLOSED and LOCKED (rollers in place).
3. Canopy hatch ground safety cable pin — Removed.
4. Seat ejection controls ground safety pin — As desired.
5. Flight compartment entrance door — CLOSED and LOCKED.
6. Seat — Stowed to rear and LOCKED.
7. All circuit breakers checked — IN.
8. Normal shoulder harness inertia reel locking lever — LOCKED.
9. Navigator ready for take-off — Report.

AFTER TAKE-OFF.

1. APN-82 departure switch — RUN, when over pre-set position.

Note

For departure procedures, see APN-82 Navigation System, Section IV.

BEFORE LANDING.

1. Navigator's table — Stowed.
2. Normal shoulder harness inertia reel locking lever — LOCKED.
3. Seat — Stowed to rear and LOCKED.
4. Navigator ready for landing — Report.

Note

For aircraft controlled approaches see Section IX.

AFTER LANDING.

1. Navigation computer departure switch — ST BY.
2. Auto-navigation radar control panel (C-1416) silent and power switches — OFF.
   a. Transmit-silent switch — SILENT.
   b. Power switch — OFF.
3. Seat ejection controls ground safety pin — Installed.
4. Canopy hatch ground safety cable pin — Installed.
5. Flight compartment entrance door — OPEN.
6. Bias — Counterclockwise.
7. APS-63 radar set control (C-1230) — Adjust range and Variac and record all voltages.
   a. Range — 30 miles.
   b. Mag — Adjust to 4.8 division.
   c. Record on maintenance log all voltages.
8. Variac (TF-106/U) — 73.
9. Power knob — OFF, after aircraft parked prior to engine shutdown.
10. 0-15 camera control — OFF.
11. APN-82 circuit breakers — Pulled.

BEFORE LEAVING AIRCRAFT.

1. Oxygen regulator diluter lever — 100%; supply lever — OFF.
2. All lights — OFF.
3. Forms — Completed.

NAVIGATOR'S WB-66D CONDENSED CHECKLIST.

Pages 8-17 through 8-20 are the Navigator's WB-66D Condensed Checklist and may be removed from this manual.

GUNNER.

The gunner will complete his assigned duties and report the readiness of his equipment to the pilot. At the discretion of the pilot, he will assist in making the Exterior Inspection. In addition to these and his normal duties as gunner, he should perform the following preflight checks.

BEFORE EXTERIOR INSPECTION.

1. DD Form 781 — Check.
2. Seat ejection controls ground safety pin — Installed.

WARNING

The A-5 or MC-1 seat cushion should not be left in the seat if the MD-1A survival kit is being carried. The combined use of these two items will increase the possibility of injury in the event of seat ejection or crash landing. If additional height in the seat is needed, a solid filler block may be used in

conjunction with the MD-1A survival kit, provided that the combined thickness does not exceed 5 inches.

3. Canopy hatch ground safety cable pin — Installed.
4. T-8 and M-4 or M-12 initiator ground maintenance safety pins — Removed.

WARNING

Safety pins may be installed by maintenance personnel in the T-8 and M-4 or M-12 initiators (located on the aft left and right side of each flight compartment seat). These pins are used as an additional safety measure when performing maintenance on or near the seats. To insure operation of the seat ejection system, the gunner should make certain that these pins are removed prior to each flight.

5. M-3 initiator safety pin — Properly installed.

WARNING

The safety pins installed in the M-3 seat catapult initiators, located at the top of each flight compartment seat structure, should be checked for installation and proper attachment to the respective hatch. These pins are automatically pulled when the hatch is jettisoned, thereby arming the seat catapult initiators.

6. Supplies — Check, adequate for the mission to be performed.
7. Equipment — Check stowage.
8. Emergency equipment — Check (including first aid kit, fire extinguisher, portable oxygen bottle [450 psi charge] and static line).
9. A-c primary circuit breaker panel — Check.
10. Auxiliary circuit breaker panel — Check.
11. AN/ASQ-15 circuit breakers — Check.
12. MD-1 oxygen regulator — Check; complete check after oxygen build up valve is in the BUILD-UP position.
13. MD-1A a-c power circuit breakers — IN.
14. MD-1A d-c power circuit breakers — IN.
15. D-c control power circuit breakers — IN.
16. Control indicator circuit breakers — IN.
17. Fire control power fuse and spare — In place.
18. Selector knob — OFF.
19. Remote hold-back switch — RELEASE.
20. Safe-fire switch — SAFE.
21. Intensity control knob — Fully, counterclockwise.
22. LO manual knob — Fully counterclockwise.
23. IF gain knob — Fully counterclockwise.
24. Range search limit knob — Fully counterclockwise.
25. Computer switch — OUT.
26. Spare bulbs — In place.
27. Rounds (ammunition) counters (left and right gun) — Set to number of rounds on board.

EXTERIOR INSPECTION.

1. Turret safe switch (located in interior or exterior of tail cone) — SAFE (access door opened).

WARNING

The turret safe switch must be in the SAFE position when working on or near the turret. Before flight, insure that the switch is in the FIRE (access door closed) position.

2. Turret — Checked STOWED and secure. (180 degrees in azimuth and full up in elevation.)
3. Turret cowling — Secure.
4. Link and spent case chute — Clear.
5. Turret drive motor brakes — ENGAGED.
6. Ammunition cam lockpins — ENGAGED.
7. MD-1A system — Preflighted and ready for gunnery mission.

Note

This check is to insure that sufficient ammunition has been loaded aboard and torqued into the gun feeder, that a complete ground checkout (in accordance with applicable directives) of the gunnery system has been accomplished, and that the system is functioning properly.

8. Turret safe switch — FIRE (power on).

Note

If no ammunition is aboard, and if the turret is to be operated during flight,

check the turret for freedom of movement as follows: Turn safe switch (S-31) to SAFE, and disengage turret drive brakes. Move turret in azimuth and elevation, then reengage turret drive brakes. The turret safe switch (S-31), must be in the FIRE (access door closed) position for turret operation during flight.

9. Report readiness of personal equipment to the pilot.

BEFORE TAKE-OFF.

1. Parachute — On and adjusted.
2. Safety belt and shoulder harness — On and adjusted.
3. Oxygen mask and head gear — On and adjusted.
4. Oxygen system preflight check — Check (see Section IV for Oxygen System Preflight Check).
5. Interphone — Connected and checked.
   a. Normal aux listen switch — NORMAL.
   b. Selector switch — INTER.
   c. Volume control — Clockwise.
6. The following procedure will be used as an operational check of the AN/ASQ-15 pressurization systems:
   a. AN/ASQ-15 pressurization systems circuit breakers — IN.
   b. Radar pressure switch — MOMENTARY ON, until the pressure reaches approximately 35 inches Hg.
   c. Observe the pressure indicator for evidence of system leakage.

CAUTION

System leakage should not exceed 0.5 inches Hg in a period of 5 minutes; otherwise, damage to the radar and/or pressurization system could result.

   d. After completion of test, bleed off excessive pressure by depressing the PUSH-TO-BLEED valve.
   e. Pressure indicator — Check that pressure is in the green.
7. Gunner's console lights — Check.
8. Gunner's flood lights — Check.
9. Canopy hatch — CLOSED and LOCKED (observe that the rollers are engaged and scribe marks are aligned).
10. Three landing gear safety pins aboard — Reported.
11. Crawlway interphone cord — Stowed and connected.
12. Crew entrance door — Closed and locked.
13. Flight compartment entrance door — Closed.
14. Canopy hatch ground safety cable pin — Removed.
15. Seat ejection controls ground safety pin — Removed.
16. Shoulder harness inertia reel locking lever — LOCKED.
17. Gunner ready for take-off — Report.

DURING FLIGHT.

In addition to normal duties, the gunner should operate and monitor the AN/ASQ-15 pressurization systems, and act as left scanner.

PREPARE TO FIRE.

1. Obtain permission from pilot to turn on the MD-1A system.
2. Selector knob — WARM UP (allow 5 minutes for warmup before switching to STANDBY).
3. Selector knob — STANDBY (allow 5 minutes for warmup before switching to OPERATION.
4. Intensity knob — Adjusted as required.
5. Selector knob — OPERATION.
6. Intensity knob — Adjusted.
7. LO manual knob — Checked fully counterclockwise.
8. IF gain knob — Adjusted as required.
9. Range sweep — Check for operation.
10. Scope illumination — Checked (adjust as required).
11. Antenna movement in search — Check.
12. Antenna movement in hand control — Check.
13. Range search limit — Check.
14. Range gate for lock on target — Check.
15. Range in-out switch — Check.
16. Long-short range switch — Check.
17. Scope presentation — Check.

FIRING MISSION.

(Combat only.) For training mission, use procedures as briefed.

TO FIRE GUNS.

1. Computer handset — Adjusted.

Note

Set computer handset on nearest pressure altitude, corrected O.A.T. (°C),

and TAS (knots). See the following Temperature Correction Chart.

a. Altitude — Varies plus or minus 500 feet.

b. Airspeed — Varies plus or minus 5 knots.

c. Temperature — Varies plus or minus 5 degrees centigrade.

Note

Check all settings at least every 10 minutes on all combat missions. Make new settings when one or all of the above changes occur.

TEMPERATURE CORRECTION CHART

TAS (KNOTS)	*TEMP CORR (°C)*	*TAS (KNOTS)*	*TEMP CORR (°C)*
300	9.5	475	23.5
325	11.0	500	26.5
350	13.0	525	29.0
375	15.0	550	32.0
400	17.0	575	35.0
425	19.0	600	38.0
450	21.0		

Note

True free air temperature is always colder than the indicated temperature.

2. Computer switch — IN.
3. Attack factor switch — As required.
4. Clearance to fire — Obtain from pilot.

Note

Step 4 to be followed during training missions only.

5. Remote hold-back switch — RELEASE.
6. MD-1A a-c and d-c power circuit breakers — IN.
7. Safe-fire switch — FIRE.

WARNING

Authorized burst control, cooling and safety procedures must be observed.

AFTER FIRING.

1. Safe-fire switch — SAFE.
2. Remote hold-back switch — HOLD-BACK.
3. Computer switch — OUT.
4. Turret — Stowed.

Note

Depress the action switch (on the hand control) and position the turret to 180 degrees in azimuth and full up in elevation, then perform the next step.

5. Selector knob — STANDBY.

Note

Turn the selector knob with quick decisive motion; otherwise, the slipstream may force the guns down before the turret drive motor brakes can engage.

6. Intensity control knob — Fully counterclockwise.
7. LO manual knob — Fully counterclockwise.
8. IF gain knob — Fully counterclockwise.
9. Range search limit knob — Fully counterclockwise.
10. After firing check complete — Report.

BEFORE LANDING.

1. Safety belt and shoulder harness — Adjusted.
2. Selector knob — STANDBY.

Note

If pilot's turret unlock indicator shows NO after gear is lowered, turn selector knob OFF. If indicator shows YES, turn selector knob to OPERATION and hold guns 180 degrees in azimuth and fully up in elevation until drag chute is deployed and aircraft is parked.

3. Shoulder harness inertia reel locking lever — LOCKED.
4. Gunner ready for landing — Report.

AFTER LANDING.

1. Seat ejection controls ground safety pin — Installed.
2. Canopy hatch ground safety cable pin — Installed.
3. Oxygen regulator diluter lever — NORMAL; supply lever — OFF.
4. Gunner's console lights — OFF.
5. Gunner's floodlights — OFF.
6. Gunnery logs — Completed.
7. DD Forms 781 — Completed.

MD-1A FIRE CONTROL SYSTEM EMERGENCY PROCEDURES.

SUDDEN SYSTEM FAILURE.

Indication	*Probable Cause*	*Action*
a. Failure of some or all indicator lights. b. Lack of jizzle. c. Complete darkening of scope screen.	Temporary surge in aircraft power may trip one or more circuit breakers.	a. Check circuit breakers on indicator. b. Check d-c fire control power circuit breaker. c. If set will not operate after waiting 2 minutes for automatic circuit breakers to reset, repeat steps a and b above. d. If set is still inoperative after completing above steps, shut down.

JITTERY TARGETS ON SCOPE.

Indication	*Probable Cause*	*Action*
a. Targets jittery. b. Targets are lost not due to jamming or exceeding limits of equipment.	Failure of AFC circuit in RF head.	a. Adjust LO manual knob until target re-appears at maximum brilliance. Note: The equipment has maximum effectiveness but requires frequent attention and adjustment of LO manual.

NO SWEEP LINE ON SCOPE.

Indication	*Probable Cause*	*Action*
a. Vertical sweep line disappears from scope. b. In search operation, a horizontal row of spots moves back and forth across bottom of scope. c. In Hand Control Operation, horizontal row of spots narrows to $\frac{1}{16}$ inch and follows azimuth movement of hand control.	Actuation of automatic overload protection circuit in modulator.	a. Turn selector knob to STAND-BY then to OPERATION. Note: Equipment is fully operational if sweep re-appears; other operation is not possible.

SEARCH FAILURE.

Indication	*Probable Cause*	*Action*
a. Vertical sweep on scope does not move horizontally in automatic search operation, but will in hand control.	a. Failure of antenna limit switch. b. Failure of search button. c. Failure of antenna control amplifier.	a. Slew antenna into limits using hand control. b. If equip still not searching, use manual search method. Note: Set requires continuous attention for effectiveness when in manual search operation. If sweep will not move with hand control, turn equipment OFF.

FAILURE TO TRACK.

Indication	*Probable Cause*	*Action*
a. Radar set may be *locked-on*, but repeatedly loses target.	a. AFC circuit failure b. Automatic tract circuit failure.	a. Manually track target. b. Operate all other functions normally. Note: Set is operational, but accuracy depends on skill of operator.

FAILURE TO FIRE WHEN FIRING BUTTON IS DEPRESSED.

Indication	*Probable Cause*	*Action*
a. Failure to fire when firing button is depressed.	a. Fault in firing circuit.	a. Check controls: fire-safe switch—FIRE; radar—locked on and tracking; check that firing button moves freely.
	b. Fault in ammunition feed circuits.	b. Place selector knob to OFF, then back to OPERATION.
		c. Charge through five rounds by pressing the firing button. Do not actuate hold back release switch.
		d. If guns still fail to fire, shut down system. Combat situations will be handled at gunner's discretion.
b. Cessation of fire.	c. Failure of firing voltage.	e. Do not release the firing button. Do not actuate the hold-back release switch.
	d. Jammed ammunition feed mechanism.	f. If one gun continues to fire, do not take any other action unless circumstances permit (combat conditions).
		g. If both guns cease to fire but rounds counters continue to operate (indicating charger action), proceed as follows:
		(1) Continue pressing fire button until five rounds have been charged through each gun.
		(2) If guns still do not fire, release firing button.
		(3) Attempt to fire while in hand control.
		(4) If guns fail to fire in either automatic or hand control, turn selector knob OFF. Then wait 3 minutes and return knob to OPERATION.
		(5) Wait for radar time out. Then lock-on again and repeat attempt to fire.

Note

Continued failure to fire indicates: (1) Failure of firing voltage (no airborne corrective action possible); (2) Jammed ammunition feed system. A jammed ammunition feed system may be cleared as follows:

1. Using the hand control, slew the guns to the maximum up elevation position, and position hold-back release switch to HOLD BACK. Slew the guns to the full down position and back to the full up position. As the guns move, joggle the hand control (left and right). Repeat several times.
2. Press firing button. If the guns still do not fire, repeat step 1. This action may release any jammed rounds.
3. If the preceding steps fail to return the system to operation, leave the hold-back release switch in the HOLD BACK position and secure the system. Under combat conditions, if both guns are jammed, these steps should be repeated in an attempt to return the system to operation. If only the gun is firing, do not repeat the preceding steps; use the single gun. Repeated attempts to restore the system to operation and use of the hand control will detorque the gun feeders.

GUNS CONTINUED TO FIRE AFTER RELEASE OF FIRING BUTTON.

Indication	*Probable Cause*	*Action*
a. Guns continue to fire after release of firing button.	a. Failure of ammunition firing circuit devices.	a. Push search button and position IF gain control to fully clockwise. If this does not interrupt the firing, proceed immediately as follows:
		(1) Selector knob—OFF.

GUNNER'S WB-66D CONDENSED CHECKLIST.

Pages 8-21 through 8-26 are the Gunner's WB-66D Condensed Checklist and may be removed from this manual.

WEATHER OBSERVER — STATION NO. 1 (CHIEF OBSERVER).

It will be the responsibility of the chief observer to insure that a thorough inspection of the weather compartment and all weather equipment is properly conducted. In addition, he will direct and supervise observer No. 2 for completion of the weather portion of the mission.

PILOT'S BRIEFING AND CREW INSPECTION.

1. Stand by for crew inspection and briefing by by pilot.
2. Briefing sheet — Check.

BEFORE ENTERING AIRCRAFT.

1. DD Form 781 and weather equipment maintenance log — Check for status of equipment.
2. P-220 cameras — Check film load, exposure control settings, shutter speed, appropriate filter.
3. SCR-718 and AN/AMR-3 flush antennas — Check cleanliness and possible damage.
4. Radiosonde spoiler door — Check for leaks, fit, possible damage.

INTERIOR CHECKS.

1. Seat ejection ground safety pins — Installed.
2. T-8, M-4, or M-12 initiator ground maintenance safety pins — Removed.

WARNING

Maintenance personnel may install safety pins in the T-8, M-4, or M-12 initiators (located on the aft inboard side of the ejection seat). These pins are used as additional safety measure when performing maintenance on or near the observer's seats. To insure operation of the seat ejection system, make certain that these pins are removed prior to each flight.

3. M-3 initiator safety pin — Installed.

WARNING

The safety pins installed in the M-3 seat catapult initiators located on the lower portion of the ejection seat structure should be checked for installation and proper attachment to the respective hatch. These pins are automatically pulled when the hatches are jettisoned, thereby arming the seat catapult initiators.

4. Crawlway pressure hatch — Check.
5. Mission equipment — Aboard and stowed.
6. Emergency equipment — Checked.
   a. First aid kit — Checked.
   b. Fire extinguisher — Checked.
   c. Portable oxygen bottles — Checked, (450 psi charge).
   d. Static line — Checked.
   e. Axe and knife — Checked.
7. Emergency ditching hatch — CLOSED AND LOCKED.

CAUTION

The emergency ditching hatch latching handle must be completely over-center and resting securely in the locked position. Any movement toward the unlocked position will cause the hatch to be in the closed position but unlocked. When locking the hatch the handle should be moved firmly over-center and should snap into the locked position with an audible click. An inspection window on the underside of the hatch provides a positive inspection method from inside the compartment to insure that the locking spider is correctly over-center and against its stop.

8. SCR-718 standby equipment — In place, secured.
9. Personal equipment — Check.
10. Survival equipment — Check.
11. After ground power has been applied to the aircraft, station No. 1 circuit breakers — Closed.

Note

When closing circuit breakers on the weather compartment main circuit

breaker panel, do not close circuit breakers to equipment or components not installed in the aircraft.

Thoroughly check the operation of all equipment at station No. 1 prior to each flight. If practicable, this check should consist of actual operation of each unit.

SCR-718 RADIO ALTIMETER PREFLIGHT CHECK.

1. Inspect all units, visible connections, and cables for security of installation, tightness of mounts and plugs, safety-wiring, and general good conditions.
2. Turn the REC. GAIN control located on the indicator past ON to near midrange. A green circular trace should appear on the CRT screen after about 30 seconds. Allow a 3 minute warm-up period.
3. With the SCALE switch in the TIMES ONE position, adjust the CIRCLE SIZE control so that the circular trace is of slightly greater diameter than the black calibrated scale. Its outer edge should just be visible. If badly out of round or concentricity, the indicator should be replaced.
4. Adjust the REC. GAIN control so that the lobe is about one-quarter inch in height. Place the SCALE switch in the TIMES TEN position. The trace should decrease in diameter, and appear about one-quarter inch inside the black calibrated scale. The lobe should now be much narrower than before and about three-sixteenths inch in height.
5. Without changing the preceding control settings, adjust the TIMES TEN ZERO ADJ. control so that the leading, or counterclockwise, edge of the lobe is exactly at the zero point on the calbrated scale. The control should move the lobe smoothly and cause no changes in size, shape or intensity.
6. Return the SCALE switch to the TIMES ONE position. Check the TIMES ONE ZERO ADJ. control for smooth and trouble-free operations as in the preceding paragraph. Set the leading edge of the lobe exactly to zero.

P-220 WEATHER CAMERA PREFLIGHT CHECK.

1. Inspect the unit, visible connections, and cables for security of installation, tightness of mounts and plugs, safety wiring, and general good condition.
2. Position the intervalometer to the exposure intervals desired.
3. Position the ON-OFF switches to ON.
4. Expose from 10 to 15 frames to insure that light has not infiltrated the film magazines during installation and exposed the lead film.
5. Check the frame counters for proper counting action.
6. Return the ON-OFF switch to OFF.
7. Enter number of frames exposed in camera log.

BEFORE TAKE-OFF.

1. Weather compartment entrance door — CLOSED and locked.

Note

The weather compartment entrance door latching mechanism is a two-position latch (intermediate and locked). In the intermediate position the door may be closed, but unlocked and the microswitch disengaged. In this position the door seal will not pressurize. See Section II for complete information on locking the weather compartment entrance door.

2. Parachute — On and adjusted.
3. Headgear — On.
4. Interphone — Connected, check intercommunications.
5. Aircraft interphone — Monitor.
6. Safety belt and shoulder harness — Fasten, adjust and check the following:
   a. Auto release lanyard — Connected.
   b. Crotch harness — Connected.
   c. Dinghy and/or survival kit — Properly attached.
   d. Helmet chin strap — Fastened.
7. Oxygen system — Check fit, connections and operation. Set regulator to NORMAL.
8. Emergency alarm bell (and warning light, if installed) — Check.
9. Time hack and AN/APN-82 setting — Obtain from navigator.
10. Weather equipment not essential for take-off— Deenergized.
11. Seat ejection ground safety pin — Removed.
12. Normal inertia reel locking lever — LOCKED.
13. Ascertain that station No. 2 is ready for take-off. Inform pilot that weather compartment is ready for take-off.

DURING FLIGHT.

1. Inform pilot that observers are switching to the private interphones. Upon conformation from pilot, switch to private interphones.
2. Inform pilot when weather equipment is going on the line.

3. Conduct mission as briefed.
4. Act as left aft scanner and report any irregularities to the pilot.

PRETRAFFIC PATTERN.

1. Upon completion of weather reconnaissance portion of mission, direct observer No. 2 to deenergize the equipment at his station. Deenergize the station No. 1 equipment which is not necessary for flight.
2. Determine that observer No. 2 is ready for landing.
3. Direct observer No. 2 to switch to aircraft interphone.
4. Loose equipment and table — Stowed.
5. Safety belt and shoulder harness — Adjusted.
6. Switch to aircraft interphone and inform pilot that observers are ready for landing.

AFTER LANDING.

1. Seat ejection controls ground safety pin — Installed.
2. Expose from 10 to 15 frames of film on the P-220 cameras to insure that when the film is removed from the magazines over exposure will not occur through infiltration of light rays.
3. Enter number of frames exposed in camera log.

BEFORE LEAVING AIRCRAFT.

1. Oxygen regulator supply lever — OFF.
2. Oxygen diluter lever — NORMAL (bleed regulator).
3. Weather equipment maintenance log — Completed.
4. DD Form 781 — Enter equipment condition, if necessary.
5. Mission summary log — Completed.
6. All equipment in weather compartment — Secured.
7. Interior lights — OFF.

WEATHER OBSERVER — STATION NO. 2.

The weather observer at station No. 2 will complete his assigned preflight duties and report the readiness of his equipment to the chief weather observer. In addition to his normal duties, he will perform other checks and duties as the chief weather observer may direct.

PILOT'S BRIEFING AND CREW INSPECTION.

1. Stand by for crew inspection and briefing by pilot.

BEFORE ENTERING THE AIRCRAFT.

1. DD Form 781 and weather equipment maintenance log — Check for status of the equipment at station No. 2.
2. At the discretion of the chief observer, observer No. 2 will assist in making the exterior inspection.

INTERIOR INSPECTION.

1. Seat ejection ground safety pin — Installed.
2. T-8, M-4, or M-12 initiator ground maintenance safety pins — Removed.

WARNING

Maintenance personnel may install safety pins in the T-8, M-4 or M-12 initiators (located on the aft inboard side of the ejection seat). These pins are used as an additional safety measure when performing maintenance on or near the observer's seats. To insure operation of the seat ejection system make certain that these pins are removed prior to each flight.

3. M-3 initiator safety pin — Properly installed.

WARNING

The safety pins installed in the M-3 seat catapult initiators located on the lower portion of the ejection seat structure should be checked for installation and proper attachment to the respective hatch. These pins are automatically pulled when the hatches is jettisoned, thereby arming the seat catapult initiators.

4. Personal equipment — Check.
5. Mission equipment — Aboard and stowed.
6. AN/ANH-2 interphone sound recorder — Cables, connectors and magazines in place and secure.
7. Relief containers — Secure and empty.
8. Spare fuses and bulbs — Check supply.
9. Personal equipment — Check.
10. Survival equipment — Check.
11. All equipment, cables and connectors — Check for security.

12. After ground power has been applied to the aircraft, station No. 2 circuit breakers — Closed.

Note

When closing circuit breakers on the weather compartment main circuit breaker panel, do not close circuit breakers to equipment or components not installed in the aircraft.

Thoroughly check the operation of all equipment at station No. 2 prior to each flight. If practicable, this check should consist of actual operation of each unit.

AN/ARC-21 LIAISON RADIO, CV-357/A CONVERTER, AND TT-76/GGC TELETYPEWRITER PREFLIGHT CHECK.

1. Position the *take* switch located on the CV451/-ARC-21 control panel to ON, the CW-VOICE-FSK knob to FSK. Place the TRANS-REC switch on the FSK control to REC and allow a two minute warm-up.
2. Position the selector switch located on the TT-76/GGC teletypewriter to the number 1 position. Position the MOTOR, LIGHT, and POWER switches to ON. Position the keyboard switch to LOCK.
3. On the CV-357/A converter, position the POWER switch to ON, the TUNE-OPERATE switch to OPERATE, the AFC switch to ON, and allow a two minute warm-up.
4. Reposition the TUNE-OPERATE switch (on CV-357/A) to TUNE.
5. Adjust the tuning carefully to vertically center the horizontal lines on the monitor tube and place the TUNE-OPERATE switch to OPERATE.
6. Press the CAL IN button and adjust the threshold control to produce a tuning monitor pattern that matches the top and bottom lines engraved on the tuning monitor window.

Note

The equipment is energized to transmit from previously prepared tape, transmission is not required if all operations seem normal.

7. Place the FSK control switch to TRANS, the TT-76/GGC selector switch to position number 2, and the KEYBOARD switch to SEND.
8. Position the FSK control switch to REC.
9. Position the TT-76/GGC selector switch in position number 3. Prepare sufficient punched tape to insure that the punching mechanism is operating satisfactorily. This tape may be threaded through the transmitter and the transmitter started to insure that it is functioning properly.

Note

Check the tape reel for sufficient tape and check condition of typing ribbon.

10. To secure the equipment for take-off, position the AN/ARC-21 liaison radio out of FSK operation and the MOTOR, LIGHT, and POWER switches on the teletypewriter to OFF.

AN/AME-1 RADIOSONDE DISPENSER AND AN/-AMR-3 RADIOSONDE RECEPTOR PREFLIGHT CHECK.

1. Position the AN/AMR-3 radiosonde receptor power switch to STD BY.

Note

At least 45 minutes is required for the radiosonde receptor to warm-up; therefore, the first operation should consist positioning it to STD BY for warm-up.

2. Position the power switch on the AN/AME-1 control panel to ON. The red indicator light should come on, indicating power is applied.
3. Position the heater switch on the AN/AME-1 control panel to ON. The red light should come on indicating the heaters are operating. Return the switch to OFF.
4. Position the door switch on the AME-1 control panel to OPEN. The radiosonde spoiler door should open and when fully opened the indicator light should come on. Return the switch to CLOSE. When the door starts to close, the indicator light should extinguish.
5. Position the ARM-REJECT switch on the AME-1 control panel to REJECT for approximately two seconds. The radiosonde dispensing drum should index one position (45° rotation) and the R/S counter-indicator should indicate the index. Repeat until all eight positions have been checked.
6. Depress the RESET switch located on the AME-1 control panel. The R/S position counter-indicator should move up one digit. Release, and depress again, repeating until counter-indicator indicates dispenser drum position correctly.

CAUTION

Care must be taken not to position the EJECT switch to EJECT when power is applied to the unit, and the spoiler door is open, since inadvertent operation of the ejection unit will occur.

7. If the proceeding checks have required less than 45 minutes, allow additional warm-up time for

the AN/AMR-3 radiosonde receptor, since the receptor requires 45 minutes to stabilize.

8. Position the signal selector switch on the AN/-AMR-3 to S-CKT and turn the POWER switch ON. The printing stylus should move to the O division on the chart.
9. If the printing stylus does not position on O, adjust the AERO ADJ potentiometer for O reading.
10. Position the receptor power switch to STD BY.

Note

The receptor power switch may be left in the STD BY thereby eliminating the 45 minute warm-up period prior to each drop.

11. No further operational check is required prior to take-off.

AN/ANH-2 INTERPHONE SOUND RECORDER PRE-FLIGHT CHECK.

1. Position the recorder switch to STANDBY and allow one minute for warm-up.
2. Position the AN/AIC-10 selector switch to RECORD.
3. Depress the microphone control switch. The green record light on the recorder control panel should illuminate and the recorder drive motor should operate. Sidetone from the recorder should be heard in the headset while the operator is recording.

BEFORE TAKE-OFF.

1. Report to the chief observer that preflight check at station No. 2 is complete and all equipment is satisfactory for the mission to be flown.
2. Parachute — On and adjusted.
3. Headgear — On.
4. Interphone — Connected, check intercommunications.
5. Aircraft interphone — Monitor.
6. Adjust and fasten safety belt and shoulder harness; check the following:
   a. Auto release lanyard — Connected.
   b. Crotch harness — Connected.
   c. Dinghy and/or survival kit — Properly attached.
   d. Helmet chin strap — Fastened.
7. Oxygen system — Check fit, connections and operation. Set regulator to NORMAL.
8. All weather equipment not essential for take-off — OFF or STANDBY.
9. Master temperature control panel — Set controls (after both engines are started).
   a. Air conditioning switch — NORMAL.
   b. Temperature control switch — AUTO.
   c. Pressure control switch — NORMAL.
10. Seat ejection ground safety pin — Remove.
11. Normal inertia reel locking lever — LOCKED.

DURING FLIGHT.

1. Energize equipment at station No. 2 when directed by chief weather observer.
2. Conduct mission as briefed and as directed by chief weather observer.
3. Report to the chief observer any irregularity in the equipment at station No. 2.
4. Act as right aft scanner and report any irregularities to the pilot.
5. Monitor air conditioning and pressurization system.
6. Upon completion of weather reconnaissance portion of the mission, and at the discretion of the chief observer, deenergize the equipment at station No. 2.

PRETRAFFIC PATTERN.

1. At the discretion of the chief observer, switch to the aircraft interphone.
2. Loose equipment — Stowed.
3. Adjust safety belt and shoulder harness; normal inertia reel locking lever — LOCKED.

AFTER LANDING.

1. Seat ejection controls ground safety pin — Installed.
2. Master temperature control panel — Set controls.
   a. Air conditioning switch — NORMAL.
   b. Temperature control switch — AUTO.
   c. Temperature selector — As desired.
   d. Pressure control switch — DEPRESSURIZE.

BEFORE LEAVING AIRCRAFT.

1. Oxygen regulator supply lever — OFF.
2. Oxygen diluter lever — NORMAL (bleed regulator).
3. AN/AME-1 radiosonde receptor chart paper — Remove for evaluation.
4. AN/ANH-2 interphone sound recorder magazine — Remove for evaluation.
5. Mission summary log — Completed (with chief observer).
6. DD Form 781 — Enter equipment condition if necessary.
7. All equipment at station No. 2 — Secure.
8. Master temperature controls — Set.
   a. Air conditioning switch — RAM.
   b. Temperature control switch — NORMAL.
   c. Temperature selector — 12 o'clock.
   d. Pressure control switch — NORMAL.
9. Interior lights — OFF.

NAVIGATOR'S WB-66D CONDENSED CHECK LIST

BEFORE EXTERIOR INSPECTION.

1. DD Form 781 — Check.
2. Seat ejection pin — Installed.
3. Canopy safety cable pin — Installed.
4. Maintenance pins — Removed.
5. M-3 initiator pin — Properly installed.

EXTERIOR INSPECTION.

1. Radomes — Check.

INTERIOR INSPECTION.

CRAWLWAY.

1. Radar equipment — Check.

FLIGHT COMPARTMENT.

1. Circuit breaker panels — Check.
2. Sextant mount — Shutter closed.
3. Variac — 73.
4. Clock — Set.
5. Auxiliary control unit control panel (C-412) — Controls set.
6. Auto-navigation radar control panel (C-1416) — Controls set.
7. Navigation radar interconnecting box (J-608) — Check spare fuses.
8. 0-15 camera — Check.
9. Navigation computer control panel (C-1196) — Switches set.
10. Ground position indicator control panel — Controls set.
11. Interphone control panel — Switches set.
12. Remote turn control knob — In detent.

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NAVIGATOR'S WB-66D CONDENSED CHECK LIST (Continued)

13. Altimeter — Set.
14. APS-63 fuse panel — Check.
15. APS-63 radar set control (C-1230) — Controls set.
16. Indicator (IP-235) — Controls set.
17. Oxygen preflight — Check.

POWER ON.

1. Ground power — ON (coordinate with pilot).
2. ASQ-15 pressure pumps switch — NORMAL (guard down), pressure within limits.
3. Radar set control (C-1230) power knob — ST BY. (Check AC-AC Block — DC-DC Block +1 division.)
4. Lights — Check.
5. Auto-navigation radar control panel (C-1416) switches — Set, lights checked.
6. Navigation radar interconnecting box (J-608) — Lights OUT.
7. Parachute — On and adjusted.
8. Seat belt and shoulder harness — Adjusted.
9. Helmet — ON; oxygen and interphone connected.
10. Canopy hatch — CLOSED and LOCKED (rollers checked).
11. Seat and locks — Checked and adjusted.
12. Interphone — Checked and adjusted.
13. N-1 compass — Preflight check.

AFTER ENGINE START.

1. APN-82 circuit breakers — IN.
2. Ground position indicator (ID-389) — Set.
3. APS-63 radar set control (C-1230) — Power SCAN SLOW, adjust variac and check meter readings.

NAVIGATOR'S WB-66D CONDENSED CHECK LIST (Continued)

4. Indicator (IP-235) Ped Amp — Checked, controls set.
5. APS-63 heading mark — Check.
6. APS-63 radar set control (C-1230) — Adjust for presentation.
7. Auto-navigation radar control panel (C-1416) — Ground check; function checked.
8. 0-15 CAMERA — Power ON, checked.

BEFORE TAKE-OFF.

1. N-1 compass heading — Checked.
2. Canopy hatch — CLOSED and LOCKED (rollers in place).
3. Canopy safety cable pin — Removed.
4. Seat ejection pin — As desired.
5. Entrance door — CLOSED and LOCKED.
6. Seat — Stowed to rear and LOCKED.
7. All circuit breakers checked — IN.
8. Shoulder harness — LOCKED.
9. Navigator ready for take-off — Report.

AFTER TAKE-OFF.

1. APN-82 departure switch — RUN, when over preset position.

BEFORE LANDING.

1. Navigator's table — Stowed.
2. Shoulder harness — LOCKED.
3. Seat — Stowed to rear and LOCKED.
4. Navigator ready for landing — Report.

NAVIGATOR'S WB-66D CONDENSED CHECK LIST (Continued)

AFTER LANDING.

1. Navigation computer departure switch — ST BY.
2. Auto-navigation radar control panel (C-1416) silent and power switches — OFF.
3. Seat ejection pin — Installed.
4. Canopy safety cable pin — Installed.
5. Entrance door — OPEN.
6. Bias — Counterclockwise.
7. APS-63 radar set control (C-1230) — Adjust range and variac and record all voltages.
8. Variac — 73.
9. Power knob — OFF, after aircraft parked prior to engine shut-down.
10. 0-15 camera control — OFF.
11. APN-82 circuit breakers — Pulled.

BEFORE LEAVING AIRCRAFT.

1. Oxygen regulator diluter lever — 100%, supply lever OFF.
2. All lights — OFF.
3. Forms — Completed.

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GUNNER'S WB-66D CONDENSED CHECK LIST

BEFORE EXTERIOR INSPECTION.

1. DD Form 781 — Check.
2. Seat ejection controls ground safety pin — Installed.
3. Canopy hatch ground safety cable pin — Installed.
4. T-8 and M-4 or M-12 initiator ground maintenance safety pins — Removed.
5. M-3 initiator safety pin — Properly installed.
6. Supplies — Check, adequate for the mission to be performed.
7. Equipment — Check stowage.
8. Emergency equipment — Check (including first aid kit, portable oxygen bottles 450 psi, fire extinguisher and static lines).
9. A-c primary circuit breaker panel — Check.
10. Auxiliary circuit breaker panel — Check.
11. AN/ASQ-15 circuit breakers — Check.
12. MD-1 oxygen regulator — Check; complete check after oxygen build-up valve is in the BUILD-UP position.
13. MD-1A a-c power circuit breakers — IN.
14. MD-1A d-c power circuit breakers — IN.
15. D-c control power circuit breakers — IN.
16. Control indicator circuit breakers — IN.
17. Fire control power fuse and spare — In place.
18. Selector knob — OFF.
19. Remote hold-back switch — RELEASE.
20. Safe-fire switch — SAFE.
21. Intensity control knob — Fully counterclockwise.
22. LO manual knob — Fully counterclockwise.
23. IF gain knob — Fully counterclockwise.
24. Range search limit knob — Fully counterclockwise.

GUNNER'S WB-66D CONDENSED CHECK LIST (Cont'd)

25. Computer switch — OUT.
26. Spare bulbs — In place.
27. Rounds counters — Set to number of rounds on board.

EXTERIOR INSPECTION.

1. Turret safe switch — SAFE (access door opened).
2. Turret — Check STOWED and secure.
3. Turret cowling — Secure.
4. Link and spent case chutes — Clear.
5. Turret drive motor brakes — ENGAGED.
6. Ammunition cam lockpins — ENGAGED.
7. MD-1A system — Preflighted and ready for gunnery mission.
8. Turret safe switch — FIRE.
9. Report readiness of personal equipment to the pilot.

BEFORE TAKE-OFF.

1. Parachute — On and adjusted.
2. Safety belt and shoulder harness — On and adjusted.
3. Oxygen mask and head gear — On and adjusted.
4. Oxygen system preflight check — Check.
5. Interphone — Connected and checked.
6. AN/ASQ-15 — Checked for leakage.
7. Gunner's console lights — Check.
8. Gunner's floodlights — Check.
9. Canopy hatch — Closed and locked.
10. Three landing gear safety pins aboard — Reported.
11. Crawlway interphone cord — Stowed and connected.
12. Crew entrance door — Closed and locked.

GUNNER'S WB-66D CONDENSED CHECK LIST (Cont'd)

13. Flight compartment entrance door — Closed.
14. Canopy hatch ground safety cable pin — Removed.
15. Seat ejection control ground safety pin — Removed.
16. Shoulder harness inertia reel locking lever — LOCKED.
17. Gunner ready for take-off — Report.

DURING FLIGHT.

In addition to normal duties the gunner should operate and monitor the AN/ASQ-15, and act as left scanner.

PREPARE TO FIRE.

1. Obtain permission from pilot to turn on the MD-1A system.
2. Selector knob — WARM UP (5 minutes).
3. Selector knob — STANDBY (5 minutes).
4. Intensity knob — Adjusted as required.
5. Selector knob — OPERATION.
6. Intensity knob — Adjusted.
7. LO manual knob — Checked and fully counterclockwise.
8. IF gain knob — Adjusted as required.
9. Range sweep — Check for operation.
10. Scope illumination — Check and adjust.
11. Antenna movement in search — Check.
12. Antenna movement in hand control — Check.
13. Range search limit — Check.
14. Range gate for lock on target — Check.
15. Range in-out switch — Check.
16. Long-short range switch — Check.
17. Scope presentation — Check.

GUNNER'S WB-66D CONDENSED CHECK LIST (Cont'd)

FIRING MISSIONS.

TO FIRE GUNS.

1. Computer handset — Adjusted.
   a. Altitude — Varies plus or minus 500 feet.
   b. Airspeed — Varies plus or minus 5 knots.
   c. Temperature — Varies plus or minus 5 degrees centigrade.

TEMPERATURE CORRECTION CHART
(Condensed)

TAS — KNOTS — TEMP — CENTIGRADE

TAS	*TEMP CORR*	*TAS*	*TEMP CORR*	*TAS*	*TEMP CORR*	*TAS*	*TEMP CORR*
300	9.5	400	17.0	475	23.0	550	32.0
325	11.0	425	19.0	500	26.5	575	35.0
350	13.0	450	21.5	525	29.0	600	38.0
375	15.0						

Note

True free air temperature is always colder than indicated temperatures.

2. Computer switch — IN.
3. Attack factor switch — As required.
4. Clearance to fire — Obtain from pilot (during training mission only).
5. Remote hold-back switch — RELEASE.
6. MD-1A a-c and d-c power circuit breakers — IN.
7. Safe-fire switch — FIRE.

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GUNNER'S WB-66D CONDENSED CHECK LIST (Cont'd)

AFTER FIRING.

1. Safe-fire switch — SAFE.
2. Remote hold-back switch — HOLD-BACK.
3. Computer switch — OUT.
4. Turret — Stowed (180 degrees in azimuth and full up in elevation).
5. Selector knob — STANDBY.
6. Intensity control knob — Fully counterclockwise.
7. LO manual knob — Fully counterclockwise.
8. IF gain knob — Fully counterclockwise.
9. Range search limit knob — Fully counterclockwise.
10. After firing check complete — Report.

BEFORE LANDING.

1. Safety belt and shoulder harness — Adjusted.
2. Selector knob — STANDBY.
3. Shoulder harness inertia reel locking lever — LOCKED.
4. Gunner ready for landing — Report.

AFTER LANDING.

1. Seat ejection controls ground safety pin — Installed.
2. Canopy hatch ground safety cable pin — Installed.
3. Oxygen regulator diluter lever — NORMAL; supply lever — OFF.
4. Gunner's console lights — OFF.
5. Gunner's floodlights — OFF.
6. Gunnery logs — Completed.
7. DD Form 781 — Completed.

GUNNER'S WB-66D CONDENSED CHECK LIST (Cont'd)

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all weather operation

Section IX

1565B

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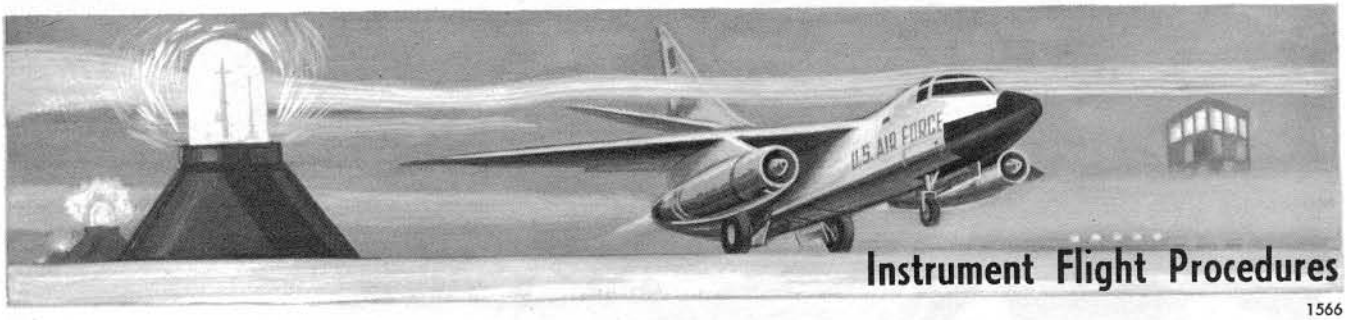
INTRODUCTION.

This section contains only those procedures that differ or are in addition to the normal operating instructions covered in Section II, except where repetition is necessary for clarity. Operation of the various aircraft systems is included in Sections IV and VII.



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It is calculated that the handling of the aircraft and all flight characteristics will be normal and satisfactory while the aircraft is being flown entirely by reference to instruments. The aircraft is equipped with radio navigational aids and an anti-icing and de-icing system for flight under all weather conditions. Preplanning for an instrument take-off should include the possibility of *return to the field* or *single-engine alternate airport* and additional time for approach procedures. Therefore, use particular care in planning fuel requirements. See Appendix I for flight planning information.

BEFORE TAKE-OFF.

The following steps should be completed prior to each instrument take-off:

1. Anti-icing and de-icing systems and cabin window defogging — As required.
2. Windshield anti-icing and defogging switches — NORMAL.
3. Pitot heater — ON, if necessary.
4. Autopilot power switch — ON.
5. Yaw damper switch — OFF.
6. Check flight instruments while taxiing.
7. Visually align the aircraft on the centerline of the take-off runway, and check directional indicator against runway heading.

TAKE-OFF.

The normal take-off techniques will be employed with the additional following precautions:

1. Set the miniature aircraft on the attitude indicator to align with the horizon bar.
2. At approximately 10 knots below take-off speed, raise the nose wheel off the runway three to four bar widths above the horizon on the altitude indicator and allow the aircraft to fly at normal take-off speed. (See Take-Off Chart, Appendix I.)
3. Landing gear lever — UP, when the altimeter and vertical velocity indicator show a definite climb is established (minimum of 500 feet per minute).
4. Wing flap handle — UP, at or above the 600 feet above the ground and at above the speed at the 50 foot height using normal technique (see Appendix I).
5. Maintain 1000-feet-per-minute rate of climb during acceleration to best climb (see Appendix I).
6. Establish and maintain normal climb schedule for the gross weight and configuration of the aircraft (see Appendix I).

INSTRUMENT CLIMB.

1. Maintain 1000-feet-per-minute rate of climb during acceleration to Best Climb Speed (see Appendix I).

CAUTION

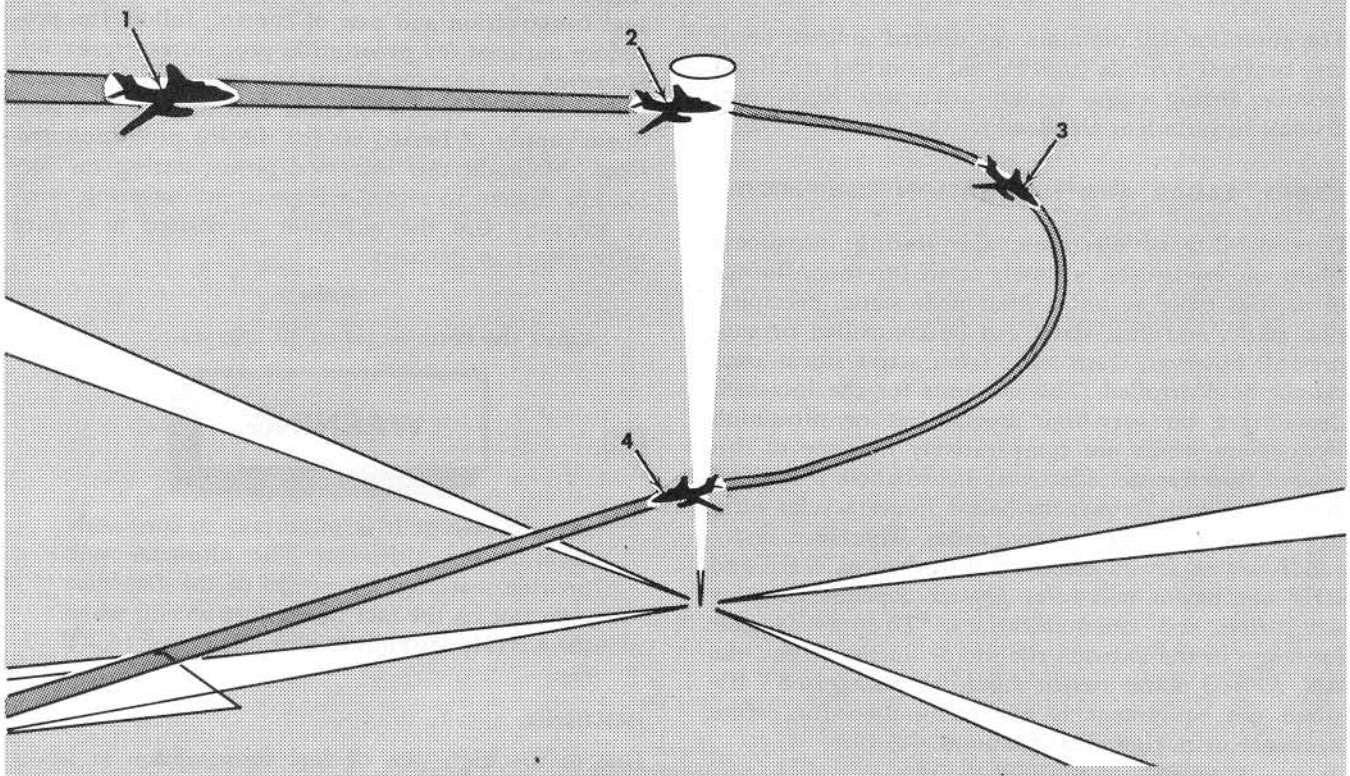
Care should be used in making turns exceeding 30-degree bank angle. Obstructions, terrain, and minimum altitude should be considered in determining rate of turn.

CRUISING DURING INSTRUMENT FLIGHT CONDITIONS.

Under normal instrument conditions, the aircraft should be handled in the same manner as under VFR conditions. In addition, the following should be accomplished:

1. Keep the aircraft trimmed.
2. Avoid extreme turbulence, if possible.

Penetration Procedure



NORMAL PROCEDURE (TWO ENGINE)

1. INBOUND
   A. DESCENT CHECK LIST — Completed.

2. INITIAL PENETRATION
   A. Throttles — 80%/88%.
   B. Airspeed — 260K/280K IAS.
   C. Speed brakes — OPEN.
   D. Begin descent, maintain penetration airspeed.

3. PENETRATION TURN
   A. Angle of bank turn — 30° maximum.

4. MINIMUM PENETRATION ALTITUDE — INBOUND
   A. Speed brakes are required.
   B. Reduce airspeed to 190-210K IAS.
   C. Execute published approach.

EMERGENCY PROCEDURE (SINGLE ENGINE)

1. INBOUND
   A. DESCENT CHECK LIST — Completed.

2. INITIAL PENETRATION
   A. Throttle — 90%.
   B. Airspeed — 260K/280K IAS.
   C. Speed brakes — OPEN.
   D. Begin descent, maintain penetration airspeed.

3. PENETRATION TURN
   A. Angle of bank in turn — 30° maximum.

4. MINIMUM PENETRATION ALTITUDE — INBOUND
   A. Speed brakes as required.
   B. Reduce airspeed to 190-210K IAS.
   C. Execute published approach.

Note:
When icing conditions are known to exist or are suspected, the penetration configuration will be 88% power, speed brakes — OPEN, and descent airspeed 280K IAS.

Note:
Use speed brakes and power as required unless specified otherwise. On single engine maintain power at 90% or above.

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Figure 9-1

3. Prior to entering known or suspected icing conditions, turn ON all de-icing and anti-icing equipment.

The autopilot will maintain any desired compass heading, constant altitude control, and a normal stabilized attitude during cruise under instrument flight conditions. In turbulent air, *hand fly* the aircraft.

RADIO, RADAR AND NAVIGATION EQUIPMENT.

Dependability of electronic aids during instrument flight and navigation is closely related to the influence of various types of static. Man-made static, precipitation static, and dust static can be controlled or suppressed; however, crash static from active storm areas cannot be controlled. This accounts for the increased dependence on very-high frequencies or ultra-high frequencies which are comparatively immune to this type of interferente. Electrical disturbances will affect equipment with frequencies below 75 megacycles within a radius of several thousand miles. Therefore, under conditions of severe electrical disturbances, VHF and UHF equipment will offer greater dependability for navigation and communications. To prevent gear breakage in the antenna tilt motor during flight, the AN/APS-63 power switch should be placed in ST BY when the equipment is not being used for reconnaissance or navigational purposes.

UNUSUAL MANEUVERS.

Unusual maneuvers should be avoided at all times. Recovery from unusual attitudes or maneuvers can be accomplished by the use of the attitude indicator. However, a crosscheck of all instruments is recommended and the pilot should be cognizant of the limitations of the attitude indicator. The indicator has 360 degrees of gimbal freedom in roll and ±82 degrees of gimbal freedom in pitch. A warning flag is incorporated in the indicator that will disappear in 2 minutes (±30 seconds) after power is applied to the a-c and d-c lines. The flag will appear and read OFF immediately when either a-c or d-c power is cut off.

WARNING

The OFF flag on the attitude indicator will appear in case of a complete a-c or d-c power failure. However, a slight reduction in a-c or d-c power, or failure of certain electrical components within the system, *will not* cause the OFF flag to appear, even though the system is not functioning properly. It is possible that a malfunction of the attitude indicator may be determined only by checking it with the slaved magnetic compass and the turn-and-slip indicator.

DESCENT.

Descents can be made satisfactorily in various configurations and at various airspeeds. For optimum fuel conservation and ease of control, follow the procedure outlined for penetration procedures, *figure 9-1.* However, if icing conditions are anticipated, increase power to 88% rpm, 280 knots IAS to insure an adequate supply of heated air for the ice protection systems. Maintain this increased power setting for formation descent to afford wingman maneuvering power margin. Use the autopilot as desired to reduce pilot effort in descents.

Note

Limit the bank angle to 30 degrees.

WARNING

During descent it is important to constantly monitor the altimeter. The altimeter will provide warning, by means of the flag-type indicator on the face of the instrument, when the aircraft descends to altitudes below 16,000 feet.

HOLDING.

Due to the high rate of fuel consumption at lower altitudes, the pilot should plan his flight to avoid holding. If it becomes necessary to hold, hold at maximum endurance speed (see Maximum Endurance Charts, Appendix I). The desired speed of the aircraft for holding may then be maintained by the use of the speed brakes and throttles. Ordinary precautions observed during normal instrument flight apply in the holding pattern.

INSTRUMENT APPROACHES.

Although the instrument capabilities of the aircraft are adequate for all approach patterns and configurations flown, several problems areas are encountered in deriving satisfactory instrument approach procedures. The large thrust changes encountered with relatively small throttle movements dictate that power changes be kept to a minimum. The slow acceleration characteristics of the aircraft in the landing configuration require two throttle changes for each change in airspeed. An investigation of GCA final approach configuration will reveal that the power setting required with gear and full flaps extended fails at the point where the opening and closing of the compressor bleed valves causes a power surge. Therefore, in order to minimize "jockeying" it is recommended that the speed brake actuation be used for all normal pattern descents and deceleration.

Note

The typical instrument approach procedures (GCA, ILAS, and VOR/ADF Radio Range)

(Continued on Page 9-9)

GCA Procedure

GROSS WEIGHT — 55,000 POUNDS

NORMAL PROCEDURE (TWO-ENGINE)

1. INBOUND TO PICK-UP POINT.
   - A. BEFORE LANDING CHECK — Initiated.
   - B. Maintain airspeed 190-210 knots IAS.
2. AFTER PASSING PICK-UP POINT.
   - A. Maintain 190-210 knots IAS.
   - B. Wing flaps — 60%.
3. DOWNWIND LEG.
   - A. Maintain 190-210 knots IAS.
   - B. Landing gear lever — GEAR DOWN and locked.
4. BASE LEG.
   - A. BEFORE LANDING CHECK — Completed.
   - B. Reduce airspeed to final approach speed plus 10 knots.
5. FINAL APPROACH.
   - A. Wing flaps — 100%.
   - B. Reduce airspeed to final approach speed.
   - C. Upon interception of glide path, speed brakes — OPEN.
6. VFR.
   - A. Execute normal landing.
7. MISSED APPROACH.

   If visual contact is not established at published minimums or if approach is discontinued at any time:
   - A. Throttles — TAKE-OFF POWER.
   - B. Speed brakes — CLOSED.
   - C. Landing gear — UP.
   - D. Wing flaps — UP (at or above the speed at 50 ft. height and definite climb established).
   - E. Accelerate to 190-210 knots IAS.
   - F. Execute prescribed missed approach procedure.

EMERGENCY PROCEDURE (SINGLE-ENGINE)

1. INBOUND TO PICK-UP POINT.
   - A. BEFORE LANDING CHECK — Initiated.
   - B. Maintain airspeed to 190-210 knots IAS.
   - C. Request a 45° leg to final approach.
2. AFTER PASSING PICK-UP POINT.
   - A. Maintain 190-210 knots IAS.
   - B. Wing flaps — 60%.
3. DOWNWIND LEG.
   - A. Maintain 190-210 knots IAS.
4. BASE LEG.
   - A. Reduce airspeed to final approach speed plus 10 knots.
   - B. Remind GCA of 45° leg to final and request gear warning.
5. FINAL APPROACH.
   - A. Landing gear lever — GEAR DOWN and locked (after turn to final approach is completed).
   - B. BEFORE LANDING CHECK — Completed.
   - C. Reduce airspeed to final approach speed.
   - D. Upon interception of glide path, speed brakes — as required. Wing flaps — 100% (at pilot's discretion).
6. VFR.
   - A. Execute normal single-engine landing.
7. MISSED APPROACH.

   If visual contact is not established at published minimums or if approach is discontinued at any time:
   - A. Maintain above minimum velocity for zero rate of climb.
   - B. Throttle — TAKE-OFF POWER.
   - C. Speed brakes — CLOSED.
   - D. Landing gear — UP.
   - E. Wing flaps — UP (at or above the speed at 50 ft. height and definite climb established).
   - F. Accelerate to 190-210 knots IAS.
   - G. Execute prescribed missed approach procedure.

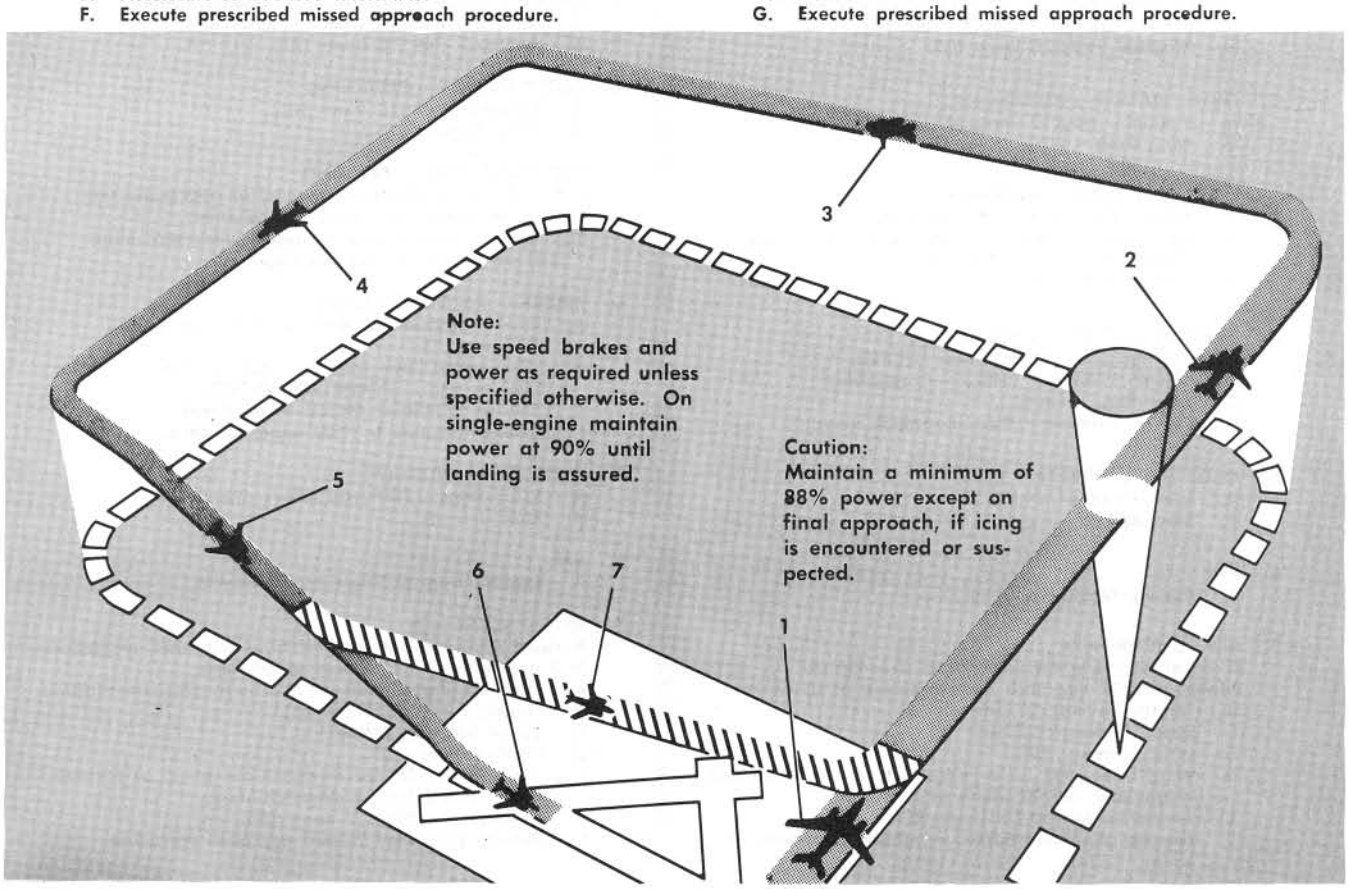

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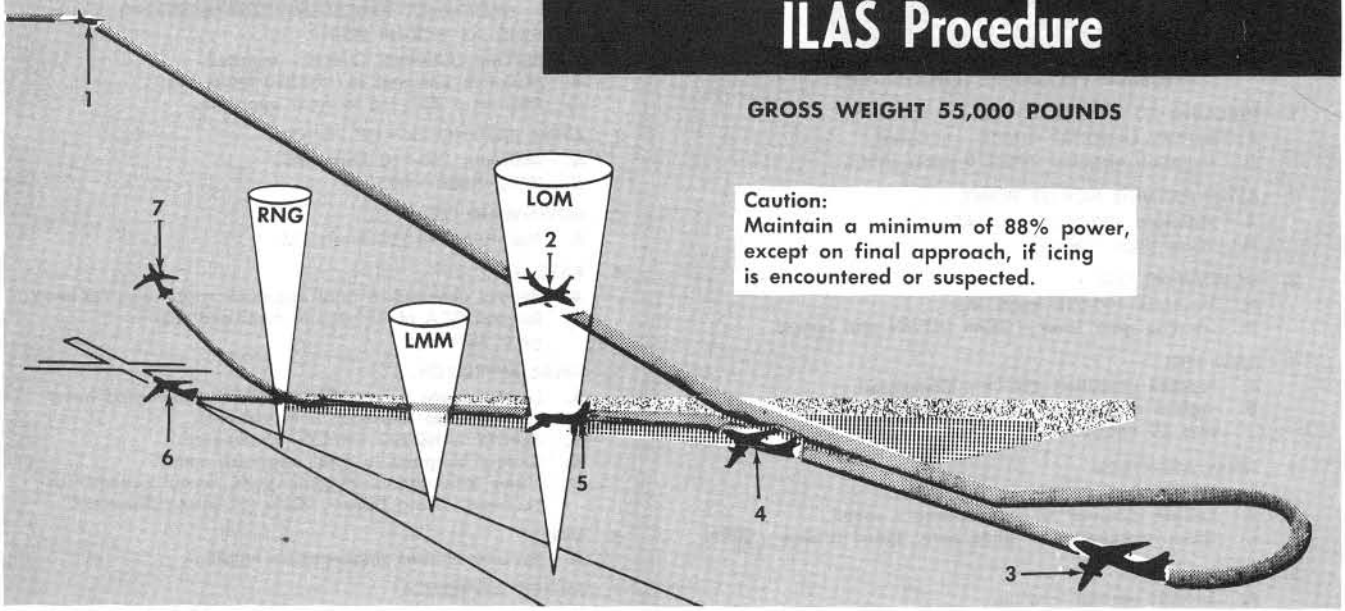
Figure 9-2

ILAS Procedure

GROSS WEIGHT 55,000 POUNDS



Caution:
Maintain a minimum of 88% power, except on final approach, if icing is encountered or suspected.

Note:
Use speed brakes and power as required unless specified otherwise. On single-engine maintain power at 90% or above until landing is assured.

Note:
For landing speed variation vs gross weight, refer to the Landing Speed Charts, Appendix 1.

NORMAL PROCEDURE (TWO-ENGINE)

1. INITIAL APPROACH TO FACILITY (OUTER MARKER)
   - A. BEFORE LANDING CHECK — Initiated.
   - B. Airspeed 190-210 knots IAS.
2. OUTER MARKER — OUTBOUND
   - A. Maintain 190-210 knots IAS.
   - B. Wing flaps — 60%.
3. PROCEDURE TURN — INBOUND
   - A. Reduce airspeed to 150 knots IAS.
   - B. When vertical needle (on course indicator) starts to move, turn to localizer heading.
   - C. Speed brakes — OPEN; power, as required.
4. INBOUND TO OUTER MARKER
   - A. Landing gear — DOWN and LOCKED.
   - B. BEFORE LANDING CHECK — Completed.
   - C. Wing flaps — 100%.
   - D. Reduce airspeed to final approach speed.
5. GLIDE SLOPE INTERCEPT
   - A. Speed brakes — OPEN.
   - B. Start descent.
6. VFR
   - A. Execute Normal Landing.
7. MISSED APPROACH
   If visual contact is not established at published minimums or if approach is discontinued at any time:
   - A. Throttles — TAKE-OFF (thrust).
   - B. Speed brakes — CLOSED.
   - C. Landing gear — UP.
   - D. Wing flaps — UP (at or above the speed at 50-foot height and definite climb established).
   - E. Accelerate to 190-210 knots IAS.
   - F. Execute prescribed missed approach procedure.

EMERGENCY PROCEDURE (SINGLE-ENGINE)

1. INITIAL APPROACH TO FACILITY (OUTER MARKER)
   - A. BEFORE LANDING CHECK — Initiated.
   - B. Airspeed 190-210 knots IAS.
2. OUTER MARKER — OUTBOUND
   - A. Maintain 190-210 knots IAS.
   - B. Wing flaps — 60%.
3. PROCEDURE TURN — INBOUND
   - A. Maintain a minimum airspeed of 200 knots IAS; speed brakes and power, as required.
   - B. When vertical needle (on course indicator) starts to move, turn to localizer heading.
4. INBOUND TO OUTER MARKER
   - A. Reduce airspeed to final approach speed plus 10 knots IAS.
   - B. When glide slope indicator starts to move — landing gear — DOWN and LOCKED.
   - C. BEFORE LANDING CHECK — Completed.
   - D. Reduce airspeed to final approach speed.
5. GLIDE SLOPE INTERCEPT
   - A. Wing flaps — 100% (at pilot's discretion).
   - B. Start descent.
6. VFR
   - A. Execute Normal Single-Engine Landing.
7. MISSED APPROACH
   If visual contact is not established at published minimums or if approach is discontinued at any time:
   - A. Maintain above minimum velocity for zero rate of climb.
   - B. Throttle — TAKE-OFF (thrust).
   - C. Speed brakes — CLOSED.
   - D. Landing gear — UP.
   - E. Wing flaps — UP (at or above the speed at 50-foot height and definite climb established.
   - F. Accelerate to 190-210 knots IAS.
   - G. Execute prescribed missed approach procedure.

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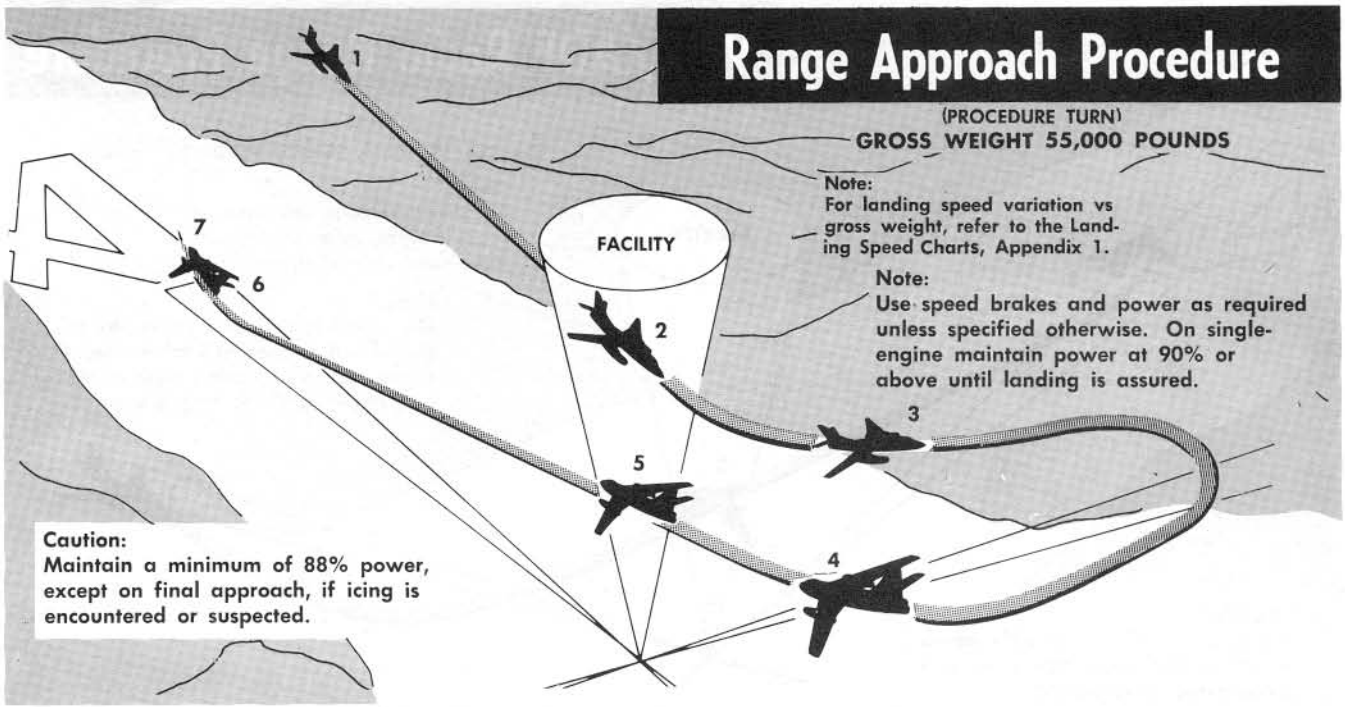
Figure 9-3

Range Approach Procedure



Note:
For circling approach maintain final approach speed plus 10 knots throughout the circling maneuver. In event of a single-engine circling approach do not lower landing gear at FACILITY – INBOUND. When VFR establish a single-engine pattern, lower landing gear and complete a normal single-engine landing consistent with field and weather conditions.

WARNING

If, in making a single-engine go-around the test switch on the landing gear warning horn has been positioned to the HORN OFF position, advancing the throttle on the good engine will not reset the circuit. Both throttles must be advanced to reset the circuit.

NORMAL PROCEDURE (TWO-ENGINE)

1. INITIAL APPROACH TO FACILITY
   - A. BEFORE LANDING CHECK – Initiated.
   - B. Reduce airspeed to 190-210 knots IAS.
2. FACILITY – OUTBOUND
   - A. Maintain 190-210 knots IAS.
   - B. Wing flaps – 60%.
3. PROCEDURE TURN – INBOUND
   - A. Reduce airspeed to 150 knots IAS.
   - B. TRAFFIC PATTERN CHECK LIST – Completed (gear DOWN and LOCKED).
   - C. Establish desired rate of descent to cross low cone at prescribed altitude.
4. FINAL APPROACH – INBOUND
   - A. Landing gear lever – DOWN.
   - B. BEFORE LANDING CHECK – Completed.
   - C. Reduce airspeed to final approach speed plus 10 knots.
5. FACILITY – INBOUND
   - A. Wing flaps – 100%.
   - B. Reduce airspeed to final approach speed.
6. VFR
   - A. Execute Normal Landing.
7. MISSED APPROACH
   If visual contact is not established at published minimums or if approach is discontinued at any time:
   - A. Throttles – TAKE-OFF (thrust).
   - B. Speed brakes – CLOSED.
   - C. Landing gear lever – UP.
   - D. Wing flaps – UP (at or above the speed at 50-foot height and definite climb established).
   - E. Accelerate to 190-210 knots IAS.
   - F. Execute prescribed missed approach procedure.

EMERGENCY PROCEDURE (SINGLE ENGINE)

1. INITIAL APPROACH TO FACILITY
   - A. BEFORE LANDING CHECK – Initiated.
   - B. Reduce airspeed to 190-210 knots IAS.
2. FACILITY – OUTBOUND
   - A. Maintain 190-210 knots IAS.
   - B. Wing flaps – 60%.
3. PROCEDURE TURN – INBOUND
   - A. Maintain a minimum of 200 knots IAS.
   - B. TRAFFIC PATTERN CHECK LIST – Completed, except for gear and flaps.
4. FINAL APPROACH – INBOUND
   - A. Reduce airspeed to final approach speed plus 10 knots.
5. FACILITY – INBOUND
   - A. Landing gear lever – DOWN.
   - B. BEFORE LANDING CHECK – Completed.
   - C. Reduce airspeed to final approach speed.
   - D. Wing flaps – 100% (at pilot's discretion).
6. VFR
   - A. Execute Normal Single-Engine Landing.
7. MISSED APPROACH
   If visual contact is not established at published minimums or if approach is discontinued at any time:
   - A. Maintain above minimum velocity for zero rate of climb.
   - B. Throttle – TAKE-OFF (thrust).
   - C. Speed brakes – CLOSED.
   - D. Landing gear lever – UP.
   - E. Wing flaps – UP (at or above the speed at 50-foot height and definite climb established).
   - F. Accelerate to 190-210 knots IAS.
   - G. Execute prescribed missed approach procedure.

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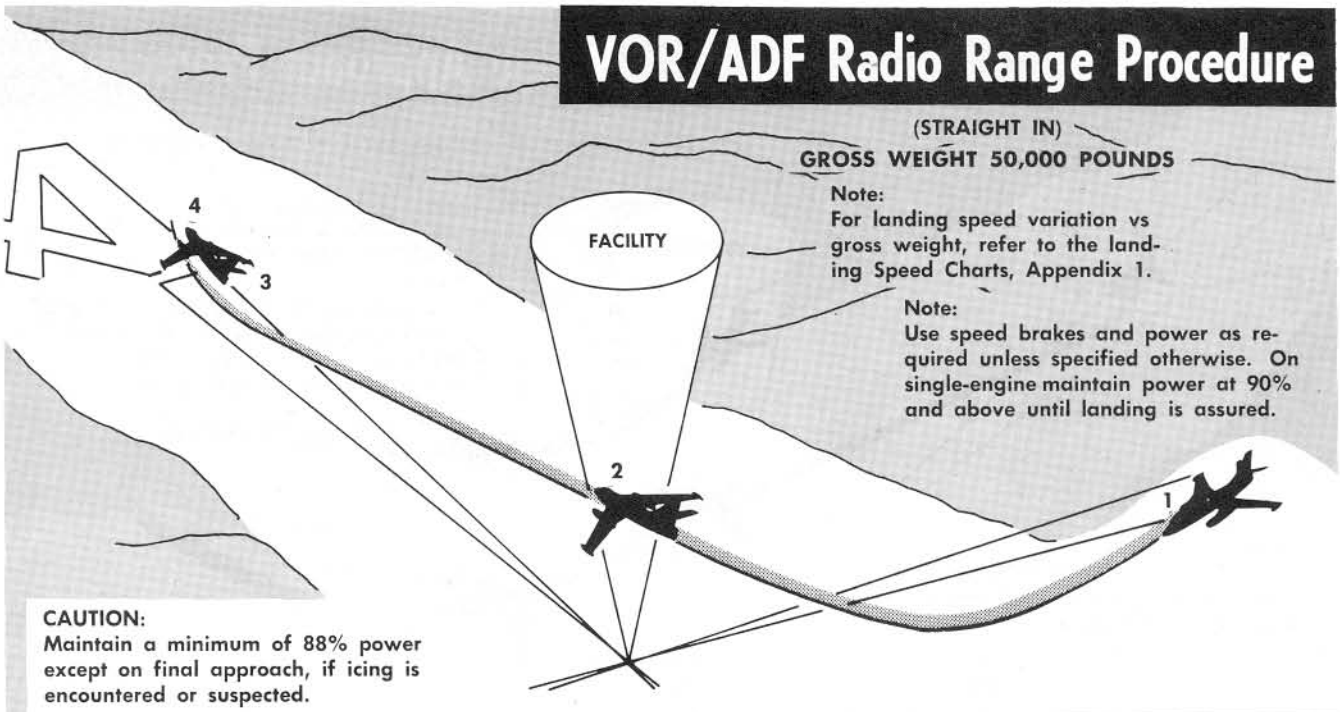
Figure 9-4

VOR/ADF Radio Range Procedure



Note:
In event of a single-engine approach do not lower landing gear at FACILITY-INBOUND. When VFR establish a single-engine pattern, lower landing gear and complete a normal single-engine landing consistent with field and weather conditions.

WARNING
If, in making a single-engine go-around the test switch on the landing gear warning horn has been positioned to the HORN OFF position, advancing the throttle on the good engine will not reset the circuit. Both throttles must be advanced to reset the circuit.

NORMAL PROCEDURE (TWO-ENGINE)

1. INITIAL APPROACH TO FACILITY
   - A. Wing flaps — 60%.
   - B. Landing gear lever — DOWN.
   - C. BEFORE LANDING CHECK — Completed.
   - D. Reduce airspeed to final approach speed plus 10 knots.
2. FACILITY — INBOUND
   - A. Wing flaps — 100%.
   - B. Reduce airspeed to final approach speed.
3. VFR
   - A. Execute Normal Landing.
4. MISSED APPROACH
   If visual contact is not established at published minimums or if approach is discontinued at any time.
   - A. Throttles — TAKE-OFF (thrust).
   - B. Speed brakes — CLOSED.
   - C. Landing gear lever — UP.
   - D. Wing flaps — UP (at or above the speed at 50 foot height and definite climb established).
   - E. Accelerate to 190-210 knots IAS.
   - F. Execute prescribed missed approach procedure.

EMERGENCY PROCEDURE (SINGLE-ENGINE)

1. INITIAL APPROACH TO FACILITY
   - A. BEFORE LANDING CHECK — Initiated.
   - B. Wing flaps — 60%.
   - C. Reduce airspeed to final approach speed plus 10 knots.
2. FACILITY — INBOUND
   - A. Landing gear lever — DOWN.
   - B. BEFORE LANDING CHECK — Completed.
   - C. Reduce airspeed to final approach speed.
   - D. Wing flaps — 100% (at pilot's discretion).
3. VFR
   - A. Execute Normal Single-Engine Landing.
4. MISSED APPROACH
   If visual contact is not established at published minimums or if approach is discontinued at any time.
   - A. Maintain above minimum velocity for zero rate of climb.
   - B. Throttle — TAKE-OFF (thrust).
   - C. Speed brakes — CLOSED.
   - D. Landing gear lever — UP.
   - E. Wing flaps — UP (at or above the speed at 50 foot height and definite climb established).
   - F. Accelerate to 190-210 knots IAS.
   - G. Execute prescribed missed approach procedure.

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Figure 9-5

(Continued from Page 9-4)

reflect the Normal Approach procedures (two engine) and the Emergency Approach procedures (single-engine).

GCA PROCEDURE.

For typical GCA procedure, see figure 9-2.

ILS PROCEDURE.

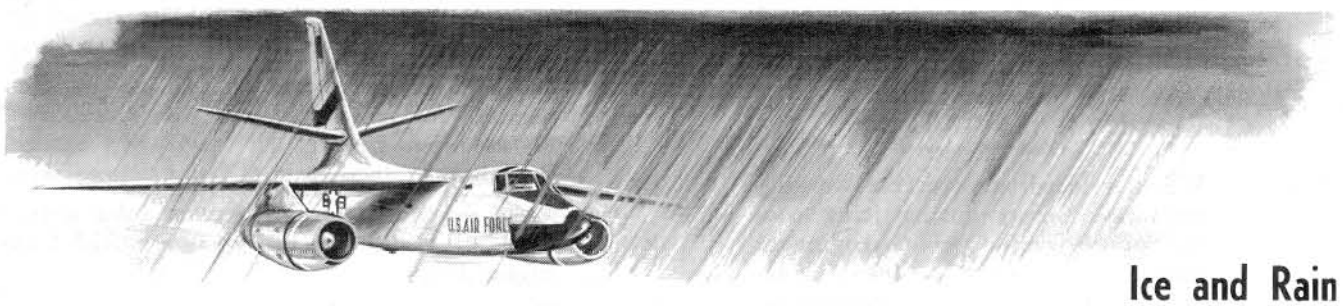
Make approach in accordance with instructions received from Approach Control and the applicable ILS instrument Approach Chart for the facility being used. For typical ILS procedure, see figure 9-3.

VOR/ADF RADIO RANGE PROCEDURE.

See *figures 9-4 and 9-5* for typical VOR/ADF Radio Range Procedures.

AIRBORNE RADAR CONTROLLED APPROACH (ARA) MONITOR.

The AN/APS-63 search radar and the AN/APN-82 navigation radar equipment can be used to monitor instrument approaches. Depending on crew proficiency, and actual weather instrument approach is possible using this equipment. It is recommended that all instrument approaches be monitored to increase the crew proficiency in this method of approach. The airborne radar controlled approach may be used as an alternate emergency approach. The ARA pattern should be the same as the normal approved instrument approach pattern, if satisfactory fixed targets can be obtained from the surrounding terrain to identify the pattern (azimuth and range). The navigator should control the entire approach and call out necessary pattern checks to the pilot. The final approach can be executed with precision as to azimuth if a satisfactory fixed target can be obtained that aligns with the desired final approach. Required rate of descent may be computed from altitude and range information.



Ice and Rain

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The systems provided for anti-icing and de-icing the aircraft and engines are adequate to maintain extended safe flights through moderate to heavy icing conditions and limited operation in severe icing conditions. The aircraft is capable of maintaining flight in icing conditions with as much as two inches of ice accumulated on the wing and empennage leading edges, with an airspeed loss of 8 to 10 knots. However, an excessive build-up of ice (one inch or more) on the engine nacelle lips, inlet dome, and guide vanes, before the engine anti-icing system is placed into operation, can cause the loss of an engine due to airflow restriction or ice ingestion damage. Operation of the engine anti-icing system results in a loss of approximately 2 per cent rpm; engine anti-icing and aircraft anti-icing systems simultaneously in a loss of approximately 5 per cent engine rpm and approximately 8 to 10 knots airspeed.

Note

Icing may be expected when the temperature is between approximately – 10°C(14°F) and 5°C (41°F) and fog is present or the dew point is within 4°C (or 39°F) of the ambient temperature. When the temperature is between O°C (32°F) and approximately 5°C (41°F) and the dew point within 4°C (or 39°-F) of the ambient temperature, conditions exist under which engine icing can occur without wing icing. See Engine Icing, Section VII, and Anti-Icing and De-Icing Systems – Normal and Emergency Operation, Section, Section IV.

Areas of probable icing conditions should be avoided: however, if icing conditions are encountered, turn ON the anti-icing and deicing systems prior to entering the icing area. If the ambient temperature is between O°C (32°F) and 5°C (41°F), and sufficient moisture is present in the atmosphere, the speed of the aircraft should be maintained at 250 knots TAS or above, to prevent engine inlet icing. If actual icing is encountered (visible on wings) at freezing temperatures of 0°C (32°F) or lower, the following action should be taken:

1. Reduce airspeed, if practicable, to minimize rate of ice build-up.
2. If flight is through cloud layers, change altitude by a rapid climb or descent, or vary course to avoid cloud formation.
3. Maintain close watch of exhaust gas temperature, and reduce power settings as necessary to prevent excessive exhaust temperature.

CAUTION

During descent under extreme icing conditions, it may be necessary to maintain NORMAL power (approximately 92 per cent rpm), or use a throttle burst technique of advancing the throttle to NORMAL power, then back, once every 30 to 60 seconds. This will allow any build-up of ice on the engine inlet components to be melted off and enter the engine before the amount of build-up ice is enough to damage the engine.

CAUTION

If ice accumulates on the engine inlet duct lips, depart from the icing conditions immediately. After reaching clear air, close the engine inlet screens until all visible ice has been removed from the engine inlet area.

CAUTION

When a bleed air overheat warning indication occurs during icing conditions, determine which engine is causing the overheat condition by reducing power on first one engine and then the other until the bleed air overheat warning light is out. Then increase power on the faulty engine to the maximum allowable EGT with the light out. Do not turn off the engine anti-icing system while in actual icing conditions, as engine failure could occur as a result of ice build-up on the engine.

FAILURE OF ANTI-ICING AND DE-ICING SYSTEMS.

When, with the de-icing system in DE-ICE and the engine anti-icing system ON, visible ice collects and remains on the aircraft, an ice protection system failure has occurred. The corrective action required is determined by the portion of the system which has failed. However, performance penalties will result from any malfuction of the ice protection system and action to vacate the icing condition must be undertaken.

ENGINE ANTI-ICING SYSTEM FAILURE.

When ice collects on engine inlets, a complete failure of the engine anti-icing system may have occurred. Because of the extreme vulnerability of an unprotected engine to icing conditions, immediate action to vacate the icing condition will be taken. Engine damage or failure from ingestion or airflow restriction can occur with as little as one-half inch of ice on the engine inlets. This amount can accumulate in less than one minute in a severe icing condition. Complete the following procedure to minimize the possibility of engine damage:

1. Place the engine anti-icing switch in the ON position.
2. Declare an emergency and take immediate action to vacate the icing conditions. Normally, a change of altitude will provide the quickest route to clear air while minimizing the total ice accumulation.
3. Maintain a high indicated airspeed, 350 knots IAS, with only sufficient rpm to maintain the desired flight condition. The increased airspeed will reduce the amount of ice collecting on the inlet lips as a result of frictional heating while the lowered rpm will reduce the amount of ice passing through the engine. Avoid the low airspeed-high rpm configuration in icing.
4. Maintain a close watch on exhaust gas temperature for indication of airflow restriction. Reduce rpm immediately with any sudden, though small, increase in tail pipe temperatures.
5. After reaching clear air, extend inlet screens until all visible ice has been removed from engine inlets.
6. Plan the remainder of the flight to avoid further icing encounters.

WARNING

If failure of the anti-icing and de-icing systems occurs, attempt an instrument let down and low approach in icing conditions only as an emergency measure.

SURFACE PROTECTION FAILURE.

The ice accumulations resulting from a surface protection system failure will cause increased drag, poor handling characteristics and higher stall speeds. However, the aircraft can be operated satisfactorily, with allowances made for these performances losses, with as much as two inches of ice on the leading edges of the wing. The following procedures are recommended for satisfactory completions of the flight:

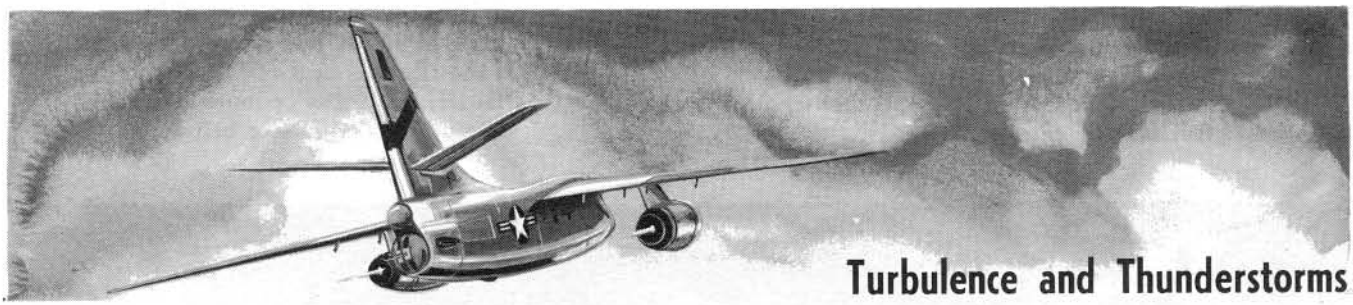
1. Check the operation of the surface protection system in both DE-ICE and ANTI-ICE positions.
2. If possible, increase airspeed to 350 knots IAS (250 knots IAS minimum) to utilize aerody-

namics (frictional) heating to reduce rate of ice accumulation. This procedure is not effective at altitude.

3. Take evasive action to depart and avoid icing conditions.
4. If a penetration and low approach are necessary in an icing condition, maintain a high indicated airspeed, 250 to 350 knots IAS, to reduce total ice accumulation. Complete a minimum fuel (small) pattern and delay final cockpit check until final approach. Increase approach speed ten knots for each inch of ice accumulation on the leading edge of the wing.

Note

In order to insure an adequate supply of hot bleed air for the anti-icing and de-icing systems, maintain at least 88 per cent engine rpm.



Turbulence and Thunderstorms

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The recommended turbulence penetration speed is 250 knots IAS. The power setting and pitch attitude should be established before entering the thunderstorm, and, if maintained throughout the storm, will result in an approximate average airspeed of 250 knots, regardless of airspeed indicator readings.

APPROACHING THE STORM.

Prepare the aircraft prior to entering a zone of turbulent air. If the storm cannot be seen visually, its proximity can be determined through the use of radar. Soft spots can be located and an appreciable reduction in gust loads can be achieved by circumnavigation or by penetrating the areas of least return.

WARNING

Flight through thunderstorms should not be attempted unless there is no alternative. Circumnavigate the thunderstorm whenever possible by visual means or by using the search radar equipment.

If a flight is forced into an area of turbulence and thunderstorm activity, the following procedures are suggested:

1. Autopilot – DISENGAGED.
2. Adjust power and use speed brakes as necessary to obtain safe penetration speed. A SAFE, COMFORTABLE PENETRATION SPEED IN SEVERE TURBULENCE IS 60 KNOTS ABOVE POWER-ON STALL SPEED FOR THE WEIGHT AND CONFIGURATION BEING FLOWN.
3. Turn pilot's thunderstorm light full BRIGHT to avoid temporary blindness caused from lightning flashes.
4. Pitot heater – ON.
5. Anti-icing and de-icing switches – As required.
6. Check gyro instruments for proper settings.
7. Tighten safety belts.

IN THE STORM.

1. Maintain NORMAL power and use the attitude gyro for maintaining level flight. Do not chase the airspeed and altimeter.

CAUTION

Do not chase the airspeed indicator as this will result in extreme aircraft attitudes. If a sudden gust is encountered while the aircraft is in a nose high attitude, a stall might easily result.

Note

A heavy rain may (by partially blocking the pitot tube pressure heads) decrease the indicated airspeed reading considerably.

2. Fly totally on instruments: do not attempt to fly partially on instruments and partially on contact.
3. Turbulence, precipitation, and lightning may be expected. If hail is encountered, seek a new course and/or altitude after clearing with Air Traffic Control.

4. Overcontrolling is usually a natural tendency in heavy turbulence; try to avoid it by applying steady but positive control pressures.
5. Make allowances for altimeter error when determining minimum safe altitudes.

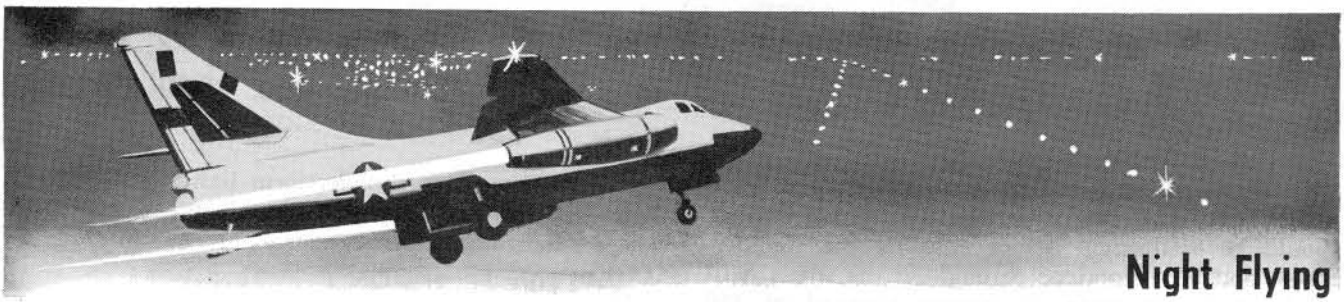
WARNING

The altimeter may be unreliable in thunderstorms because of differential barometric pressures within the storm. A gain or loss of several thousand feet may be expected.

6. Do not lower the wing flaps; *hand fly* the aircraft until well out of the turbulent area.

Note

Altitudes between 10,000 and 20,000 feet are usually the most turbulent areas in a thunderstorm. The least turbulent areas will be below 6000 feet and above 30,000 feet. Therefore, if flying at an altitude near 30,000 feet or if over rugged terrain, altitudes in excess of 30,000 feet are recommended. If the flight is near 6000 feet and over flat terrain, it may be more desirable to descend to 6000 feet or below.



Night Flying

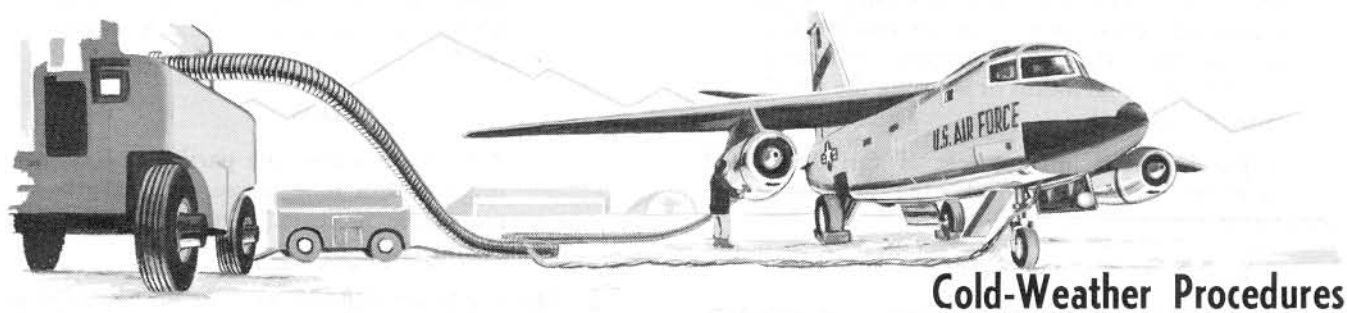
1574B

Night flying and instrument flying are identical in many points of technique. Take-off, climb, and landing will require instrument reference when visual orientation becomes uncertain. The following checks and information are in addition to the Normal Procedures (Section II):

1. Check all interior lighting.
2. Check navigation lights.
3. Check landing light.
4. Check that flashlight is included in personal equipment.
5. Adjust all normal lighting to desired brilliance.

BEFORE TAKE-OFF.

1. Cockpit lights — As required to protect vision.
2. Blackout curtains — As required to eliminate glare.
3. Alert crew for taxiing. If conditions require, a wing walker with flashlight should be used until clear of obstruction.
4. Taxi light — As required for taxi.
5. Landing light — As desired. For night take-off, climb, cruise, and landing procedures other than VFR, see Instrument Flight Procedures, this Section.



Cold-Weather Procedures

1575B

BEFORE ENTERING AIRCRAFT.

The following Cold Weather Procedures are in addition to the Normal Procedures outlined in Section II, and should be complied with when cold weather conditions are encountered. The success of extreme weather operation depends greatly on postflight procedures.

1. Inspect fuel vents, pitot tubes, static ports, fuselage, nacelle and wing drainage and ventilation holes, and remove any ice that may be present.
2. Check shock struts and all exposed actuating cylinder pistons for freedom from dirt and ice. Check shock struts and tires for proper inflation.
3. Remove all ice and snow from the fuselage, wings, nacelles, empennage, and control surfaces.

WARNING

Failure to remove snow and ice accumulated on the aircraft while on the ground can result in serious aerodynamic and structural effects when flight is attempted. Depending on the weight, distribution, roughness, pattern, and location, the snow and ice on the aircraft can adversely affect the take-off distance, climb out performance, stall speed and handling characteristics to a dangerous degree; also, inflight structural damage can occur due to vibration induced by an unbalanced load of the unremoved accumulations. These hazards can be eliminated by removing the snow and ice from the wings, fuselage, and empennage before flight is attempted.

4. Check all surface controls, control hinges, and limit switches for frozen *runback* water and freedom of operation.
5. Complete the normal Before Entering Aircraft check list *(see Section II)*.

ON ENTERING AIRCRAFT.

Use external power for operating and ground checking all electrical radio and radar equipment. Perform the normal check list (Section II), and make a visual and *feel* check of all flight controls for full freedom of movement.

BEFORE STARTING ENGINES.

If the aircraft is on ice or snow, check that the wheels are well chocked to prevent slippage when the engines start. See that all ground equipment is placed at a safe distance from the aircraft to prevent possible damage in case of slippage when the engines start. Check the brakes for proper operation and set parking brake.

STARTING ENGINES.

Caution must be exercised when ambient temperature is 0°C (32°F) or lower, as the engine rotor may be ice-locked as the result of frozen condensation. If any indication of a locked rotor or an unusual noise or low engine speed is noted, discontinue the start and blow hot air through the engine for a period of from 10 to 15 minutes. If the starter air supply is regulated to a maximum of 30 psi, no damage will be incurred by the starter. Start the engines in the normal manner (see Section II). If the ambient temperature is between 0°C (32°F) and +5°C (41°F), and water is present on the parking ramp or runways, the inlet screens should be retracted and the engine anti-icing system turned ON immediately upon starting the engines.

WARM-UP AND GROUND TEST.

Refer to Section II for normal engine warm-up and ground test. Select a spot that is free of ice and snow, if possible, to make ground tests and runup. A full power check may be impossible, due to ice and snow, until the aircraft is in take-off position; therefore, it will be necessary to make the power check in conjunction with take-off. Power should be applied as rapidly as possible to provide use of the maximum amount of the runway in the event take-off is discontinued.

TAXIING.

Exercise caution when taxiing on ice or packed snow. Taxiing through deep snow should be avoided, if possible. Taxiing speed should be slower than normal so that the aircraft is under complete control at all times. Use nose wheel steering for turning and directional control, and the brakes only when necessary to aid in turning or slowing taxi speed. Use caution when applying brakes on ice or snow covered areas. Do not taxi through snow drifts and wind rows of plowed snow, especially after a "thaw and refreeze." Do not taxi with wing flaps extended.

BEFORE TAKE-OFF.

Recheck all flight controls for freedom of movement and full travel. Turn ON pitot heat, cabin window defogging, windshield anti-icing, and any anti-icing or de-icing system, if necessary.

Note

A full power check may be impossible, due to ice and snow; therefore, it will be necessary to make the power check in conjunction with take-off. Power should be applied as rapidly as possible to provide use of the maximum amount of the runway in the event take-off is discontinued due to an engine malfunction or failure.

TAKE-OFF AND CLIMB.

Make a normal take-off and climb. After a take-off is made from a slush covered runway, operate the gear and wing flaps through several cycles to break loose ice and slush as it freezes.

DURING FLIGHT, DESCENT, AND APPROACH TO PATTERN.

Cruising flight and descent are made in the normal manner. Turn on the cabin window defog switch and

check that the windshield anti-icing switches are in the NORMAL position. If icing conditions exist, when flying at 3000 feet or below, and airspeeds of 200 knots IAS or below, place the wing and empennage, anti-icing and de-icing switch in the ANTI-ICING position.

LANDING.

Keep the landing roll straight and use nose wheel steering as soon as it is practical. Use caution when using brakes on slick runways. With the anti-skid system in operation, the possibility of skidding is reduced.

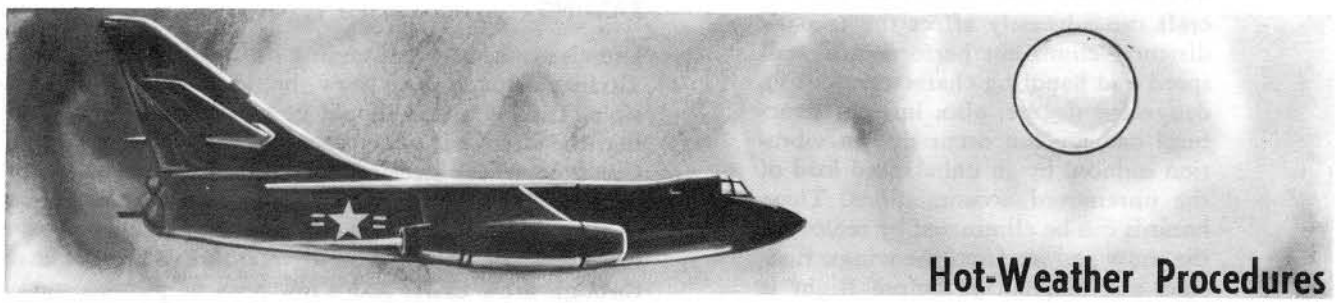
ENGINE SHUTDOWN.

Stop the engines and complete the Before Leaving Aircraft check list as outlined in Section II.

BEFORE LEAVING AIRCRAFT.

After chocks are in place, leave the brakes in the off position. See that the following duties are performed before leaving the aircraft for long periods:

1. Clean dirt and ice from shock struts and all exposed actuating cylinder pistons; wipe with a rag soaked in the same type of hydraulic fluid as used in the system.
2. Install wing, empennage, and canopy covers. Install dust plugs in the air intake duct and tail pipe after engine has cooled sufficiently.
3. Tie down the aircraft securely.
4. If a layover of several days is expected, or if temperature is –6°C (20°F) and a layover is expected to exceed 4 hours, remove the battery.
5. If the fuel load can be determined, service the fuel tanks to the maximum, and drain the sumps regularly to remove condensation.



Hot-Weather Procedures

1576

Many of the malfunctions that occur during hot weather operation may be the result of improper care of the aircraft. Since most of the procedures in Section II also apply to hot weather procedures, only specific information for care of the aircraft during ground and flight operation will be covered in this section.

BEFORE ENTERING AIRCRAFT, ENTERING AIRCRAFT, AND BEFORE STARTING ENGINES.

1. Wear gloves and use care when working around the metal surfaces of the aircraft that are exposed to the sun.

Note

A ground cooling unit should be connected and operating any time the aircraft electrical equipment is operated on the ground in ambient temperatures of 100°F or above.

2. Disconnect ground cooling unit just prior to taxi.
3. If fuel supply is adequate and conditions permit, maintain 80% RPM during ground tests and before take-off operation to assure adequate cooling.

Note

During taxi operation, however, RPM settings must be kept at the minimum required for safe taxi operation to prevent over-heating of the brakes.

4. Remove all protective cover.
5. Blast cooling from the eyeball outlets will provide maximum crew comfort prior to take-off.

STARTING ENGINES, WARM-UP AND GROUND TESTS, AND TAXIING INSTRUCTIONS.

1. Use the normal procedure in starting the engines and keep ground tests to the minimum required time.
2. Do not *ride* the brakes.

CAUTION

Use brakes only when necessary, as high ambient temperature will retard brake cooling.

BEFORE TAKE-OFF.

1. Keep ground operation to an absolute minimum and use all the available runway.
2. Check take-off performance charts (Appendix I) for runway length and gross weight for the existing temperature. More runway is needed for take-off on a hot day.

TAKE-OFF AND CLIMB.

1. Make a normal take-off.
2. After lift-off and gear retraction, be alert to any settling of the aircraft due to the instability of hot air and the loss of *ground cushion.*
3. Maintain best climb speed (see Climb Speed Charts, Appendix I) or, if necessary, climb at an airspeed faster than normal climb speed.

CRUISE, DESCENT AND APPROACH TO PATTERN.

Cruise, descent, and approach to pattern are normal except that turbulence may be expected on descent (10,000 feet and sometimes higher, depending on terrain temperature). It is recommended that the Operating Flight Strength Diagram (Section V of T.O. 1B-66(W)D-1A) be checked before starting descents.

LANDING.

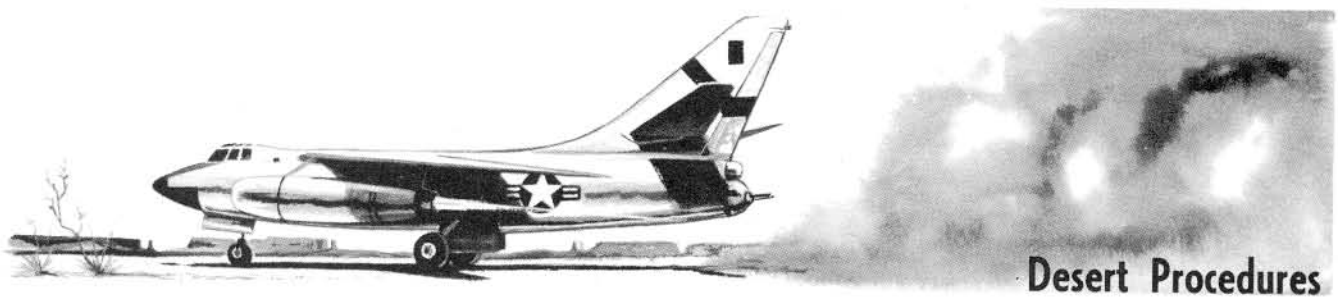
Make a normal approach and landing and use caution on final approach and touchdown. If the approach is over water or a green field, a change in attitude may be expected as the end of the runway is crossed, due to the difference in temperatures and instability of the air directly over the two areas. Allowance should be made for a longer landing roll due to the faster (4 to 7 knots) touchdown speed on a hot day.

WARNING

During extremely high temperatures, it is essential that stricter adherence to the normal landing procedure and the normal approach and landing indicated airspeeds be observed than at other times. This is necessitated by the fact that the higher the temperature, the higher the true airspeed for a given indicated airspeed; thus, a faster touchdown speed results.

ENGINE SHUTDOWN AND BEFORE LEAVING AIRCRAFT.

Stop the engines. After the wheels are chocked, release the parking brake. Install all protective coverings after engines have cooled sufficiently, and secure the aircraft.



Desert Procedures

1577

The normal procedures in Section II, and hot weather procedures in this section, are to be used and observed under desert conditions, plus the following precautions:

1. When operating in sandy country, ascertain that air filters, instrument filters, and oil filters (if installed) have been cleaned before each flight.
2. If the runway is sandy or dusty, avoid taking off in the wake of another aircraft.
3. Close and cover all openings to keep out sand. Cover the windshield and flight compartment windows for protection from the sun and pitting caused by blowing sand.
4. Aircraft should be well dispersed when parked in sandy areas.
5. Care should be taken not to run up the engines in a location where sand will be drawn into the engine inlet or blown on other aircraft, equipment or personnel.

CAUTION

Avoid flying through dust storms or sandstorms, as grit or dust will cause damage to the engines.

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