SECTION I—DESCRIPTION

TABLE OF CONTENTS

THE AIRCRAFT.

The EC-121R is a four-engine, low-wing monoplane designed for patrol and special search. Distinguishing external features are three vertical fins, three rudders and a dual-wheel tricycle landing gear. The EC-121R is powered by turbocompound R3350-93A-42A engines. Each engine is equipped with a three-blade, full-feathering, reversible-pitch Hamilton Standard hydromatic propeller. The flight controls incorporate hydraulic boosters to assist in the movement of the control surfaces, and an automatic pilot is provided for automatic control of the aircraft in flight. The semimonocoque fuselage is sealed for pressurization between the forward and aft pressure bulkheads. The C-121G airplane will be used for training.

GENERAL ARRANGEMENT

The forward bulkhead separates the flight station from the nose radome; the aft bulkhead is the rear wall of the cabin. (See figure 1-1.) All doors in the lower sides and bottom of the fuselage have additional sealing to minimize water leakage in the event of ditching. The interior of the fuselage is divided, by the station 260 bulkhead, into the flight station and the cabin. One cargo loading door, with an integral personnel door, is located on the left side aft of the wing. A crew door is located on the right side immediately forward of the station 260 bulkhead.

Crew Stations.

The active crew stations include the following: pilot, copilot, flight engineer, navigator, radio operator and additional specialists as the mission dictates.

Lavatory and Galley.

A lavatory is installed in the aft section of the cabin. The galley is on the right side aft of the forward cabin.

AIRCRAFT DIMENSIONS.

The overall dimensions of the aircraft are as follows:

- Length . . . . . 116 ft, 2 in.
- Height (to top of fins) . . . . . 24 ft, 9 in.
- Wing Span (without tip tanks) . . . . . 123 ft
- Wing Span (with tip tanks) . . . . . 123 ft, 6 in.

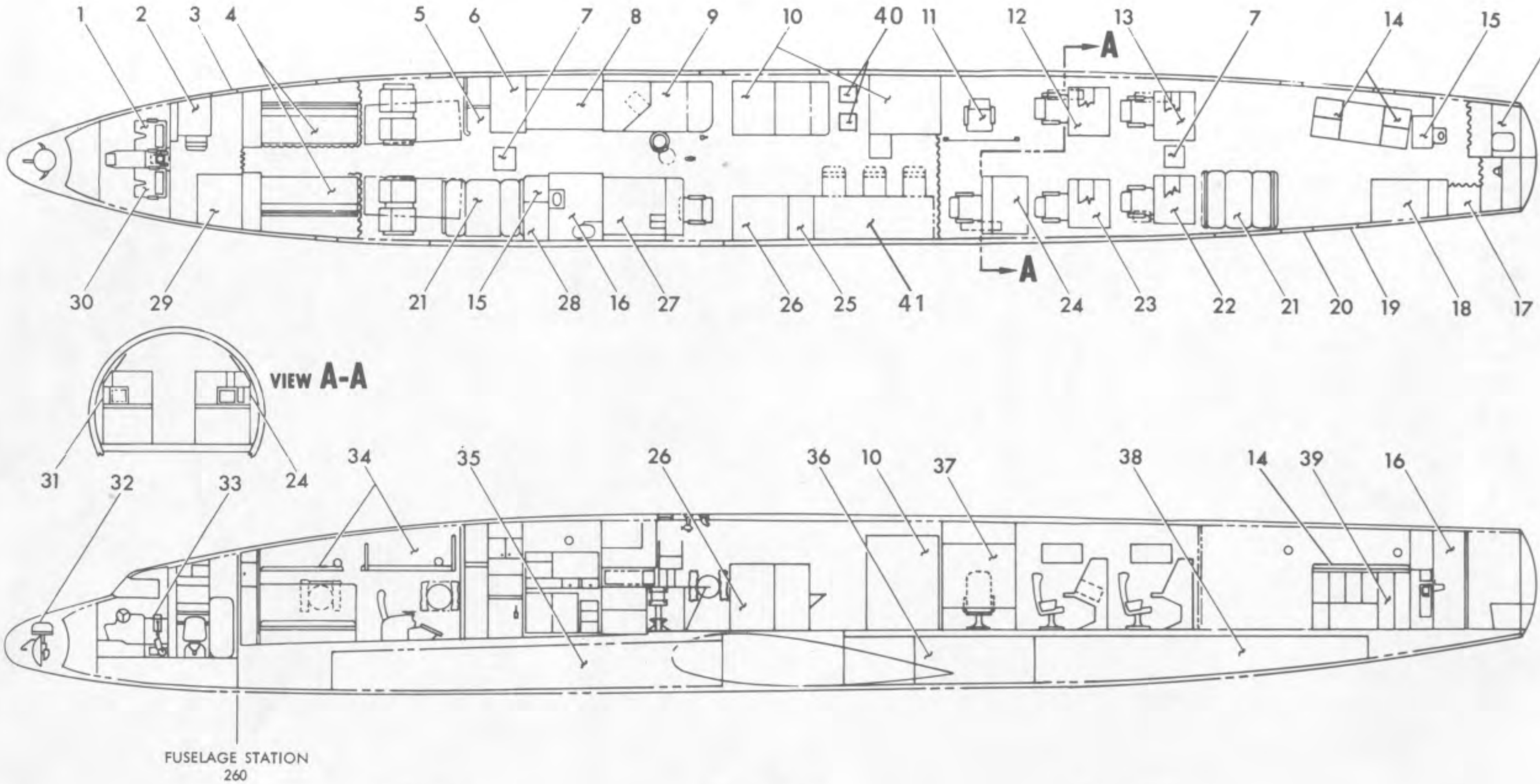
GROSS WEIGHTS.

The aircraft is in the 130,000 to 145,000 gross weight category. (Refer to Section V for weight limitations.)

ENGINES.

The four engines installed on the aircraft are turbocompound, 18-cylinder, air-cooled R3350-93A-42A engines. The total horsepower output of each engine is increased by

GENERAL ARRANGEMENT
(TYPICAL)



1 COPILOT
2 FLIGHT ENGINEER
3 CREW DOOR
4 SEAT OR BUNKS
5 CLOSET
6 REFRIGERATOR AND FOOD LOCKER
7 ACCESS
8 GALLEY
9 NAVIGATOR
10 ELECTRONICS RACK
11 PLOTTER'S STATION
12 NO. 3 CIM
13 NO. 4 CIM
14 SEATS (AFT)
15 WATER TANK
16 LAVATORY
17 CLOSET
18 TECHNICIAN'S TABLE
19 CARGO DOOR
20 AFT CABIN DOOR
21 TABLE AND BENCHES
22 NO. 2 CIM
23 NO. 1 CIM
24 CICO
25 ELECTRICAL LOAD CENTER
26 EQUIPMENT RACK
27 RADIO OPERATOR
28 LOCKER
29 RADIO RACK
30 PILOT
31 CIM (TYPICAL 4 PLACES)
32 APS-42 RADAR
33 APS-42 FLIGHT STATION INDICATOR (STOWS BENEATH FLOOR)
34 OVERHEAD BUNKS
35 FORWARD CARGO AREA
36 FUEL TANK
37 VERTICAL PLOTTING BOARD
38 ART CARGO AREA
39 MISCELLANEOUS STOWAGE
40 E. W. O.
41 ELECTRONIC TECHNICIAN

Figure 1-1

the installation of three power recovery turbines, each of which is driven by the combined exhaust from 6 of the 18 cylinders. Turbine energy is geared back to the engine crankshaft through a fluid coupling. (See figure 1-2.) Turbine speed is proportional to engine speed and requires no control. Each engine also incorporates a fuel injection system, a two-speed supercharger, and a low-tension ignition system.

THROTTLE LEVERS

One set of four throttle levers (5, figure 1-10) is located on the pilots' center control stand and another set (5, figure 1-14) is located on the flight engineer's control quadrant. The corresponding levers are mechanically connected to the carburetor butterfly shafts by cable, pulley, and linkage systems. The throttle levers also are electrically (dc) connected by microswitches to the propeller automatic feathering arming circuit and landing gear warning horn circuit.

Reverse Pitch Throttle Levers

The pilots' throttle levers incorporate an additional set of four reverse pitch throttle levers (4, figure 1-10) hinged on the main throttle arms. The reverse levers normally are folded forward and below the main throttle knobs so that they do not interfere with normal throttle operation. The reverse pitch throttle levers are connected by a linkage mechanism to the same cable system as the main throttle levers. A spring-loaded mechanical lock prevents inadvertent movement of the reverse throttle while in flight. The lock normally is released by a 28-volt dc reverse actuator controlled by landing gear microswitches. It can be released manually by depressing the reverse lock override lever (flag) (7, figure 1-10) located on the center control stand. When the main throttle levers are retarded to the full aft position, the reverse pitch throttle levers may be lifted upward and pulled aft, provided the reverse throttle lock has been released. This action energizes the propeller governor solenoid valves which release the low pitch stop levers of the propellers, thus turning the blades to the fixed reverse pitch stop position. As the reverse pitch throttle levers are moved aft the engine throttle valves are opened to increase power. The maximum travel of the carburetor butterfly valve is limited in the reverse range to approximately METO power.

FUEL MASTER CONTROL (CARBURETOR) AND FUEL INJECTION SYSTEM.

Each engine utilizes a direct fuel injection system which consists of a carburetor (master control unit), two injection pumps, and a fuel injection nozzle for each cylinder. The carburetor unit senses the amount of air passing through it and meters the correct proportion of fuel from the fuel p pressure chamber of the carburetor to the two injection pumps that are mounted on each side of the rear crankcase section of each engine. Each injection pump is geared to

TURBOCOMPOUND ENGINE POWER

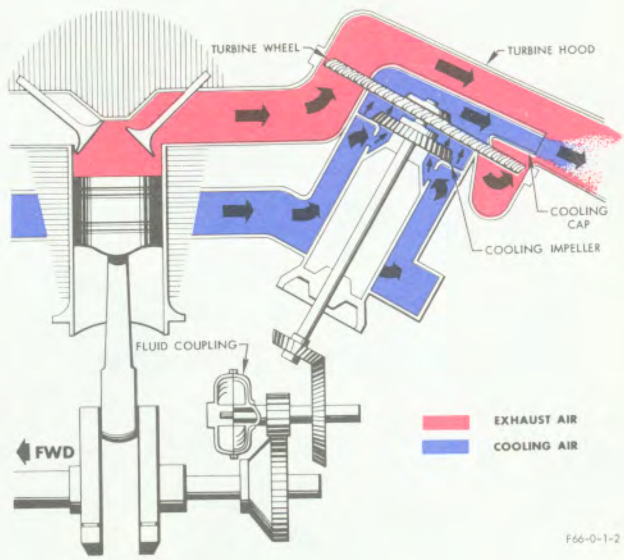


Figure 1-2

the engine and contains nine plungers which sequence and distribute the metered fuel to the cylinder combustion chambers. A flow divider is installed to ensure measured distribution to the injection pumps. Spring-loaded poppet valves in the fuel injection nozzles (one of which is located in each cylinder head) are opened by the pressure of the fuel, and the nozzle sprays fuel into the combustion chamber.

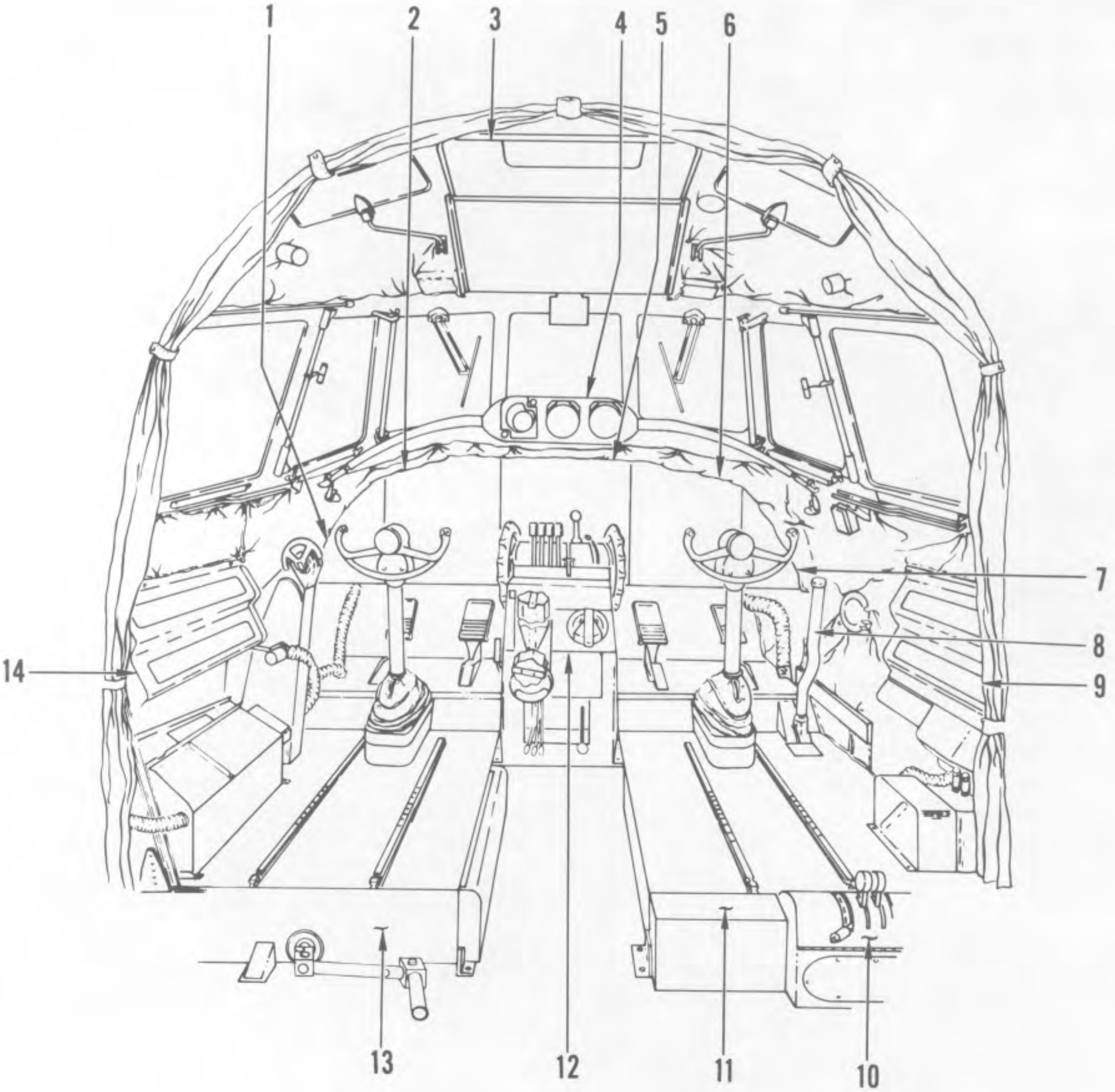
Carburetor Alternate Fuel Source

An alternate fuel source is provided within the carburetor to supply a positive increase in fuel flow when the normal metering differential pressure is partially or totally lost, such as might occur during icing conditions. The alternate fuel source functions as a standby only and not as a replacement for the alternate air, preheat, and alcohol systems normally used for combating ice.

Carburetor Alternate Fuel Source Switches. Four circuit-breaker switches (12, figure 1-26) are located on the MJB (main junction box) No. 2 switch panel. The carburetor alternate fuel source switches have two positions, EMERGENCY and NORMAL. Moving a switch to the EMERGENCY position energizes a dc solenoid which opens a valve to allow fuel pressure to supplant air measuring forces in the selected master control unit.

Oil Heated Boost Venturi Hanger. On aircraft modified by T.O. 1C-121-766, the master control boost venturi hangers are heated by engine oil routed through drilled passages in

PILOTS' STATION



1. PILOT'S AUXILIARY INSTRUMENT PANEL
2. PILOT'S INSTRUMENT PANEL
3. PILOTS' OVERHEAD PANEL
4. GLARESHIELD AND GLARESHIELD INSTRUMENT PANEL
5. PILOTS' CENTER INSTRUMENT PANEL
6. COPILOT'S INSTRUMENT PANEL
7. COPILOT'S AUXILIARY INSTRUMENT PANEL
8. EMERGENCY HAND PUMP
9. COPILOT'S SIDE PANEL
10. FLIGHT ENGINEER'S AUXILIARY CONTROL QUADRANT
11. IGNITION ANALYZER CONTROL PANEL
12. CENTER CONTROL STAND
13. HYDRAULIC RESERVOIR REPLENISHING CONTROLS PANEL
14. PILOT'S SIDE PANEL

Figure 1-3

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ENGINE AIR INDUCTION SYSTEM

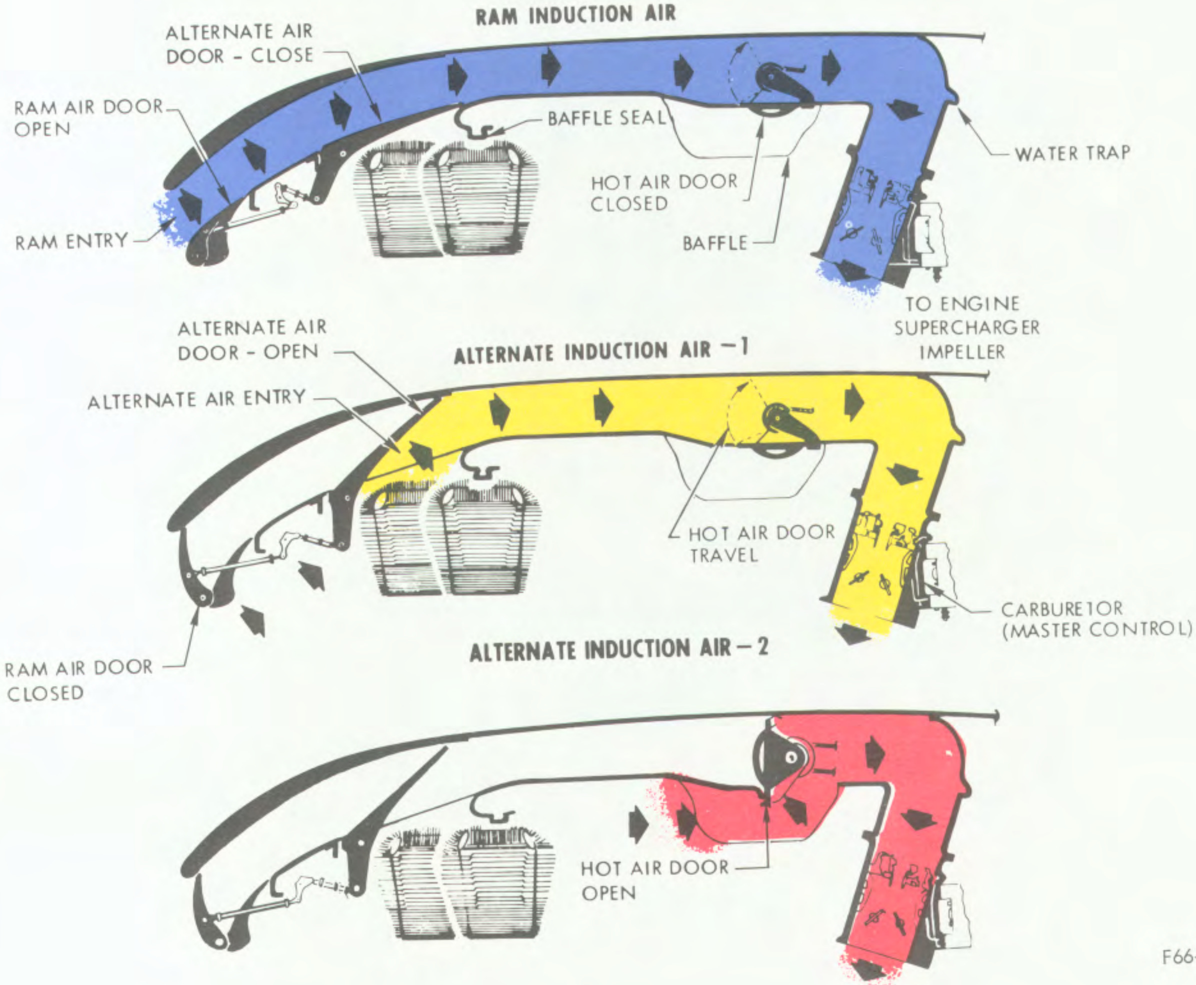


Figure 1-4

the hanger. The heating action is automatic and no manual controls are used.

ALTERNATE AND RAM AIR INDUCTION SYSTEM.

A ram-type induction scoop for directing air to the carburetor is located in the top of each nacelle. (See figure 1-4.) The duct directs either ram air from the front of the cowl or alternate air which has passed up into the duct from under the cowl. This permits selection of the alternate air source during icing conditions. A variable-position door is located in this duct ahead of the carburetor to mix hot air from behind the cylinders with the induction air.

Carburetor Alternate Air Switches

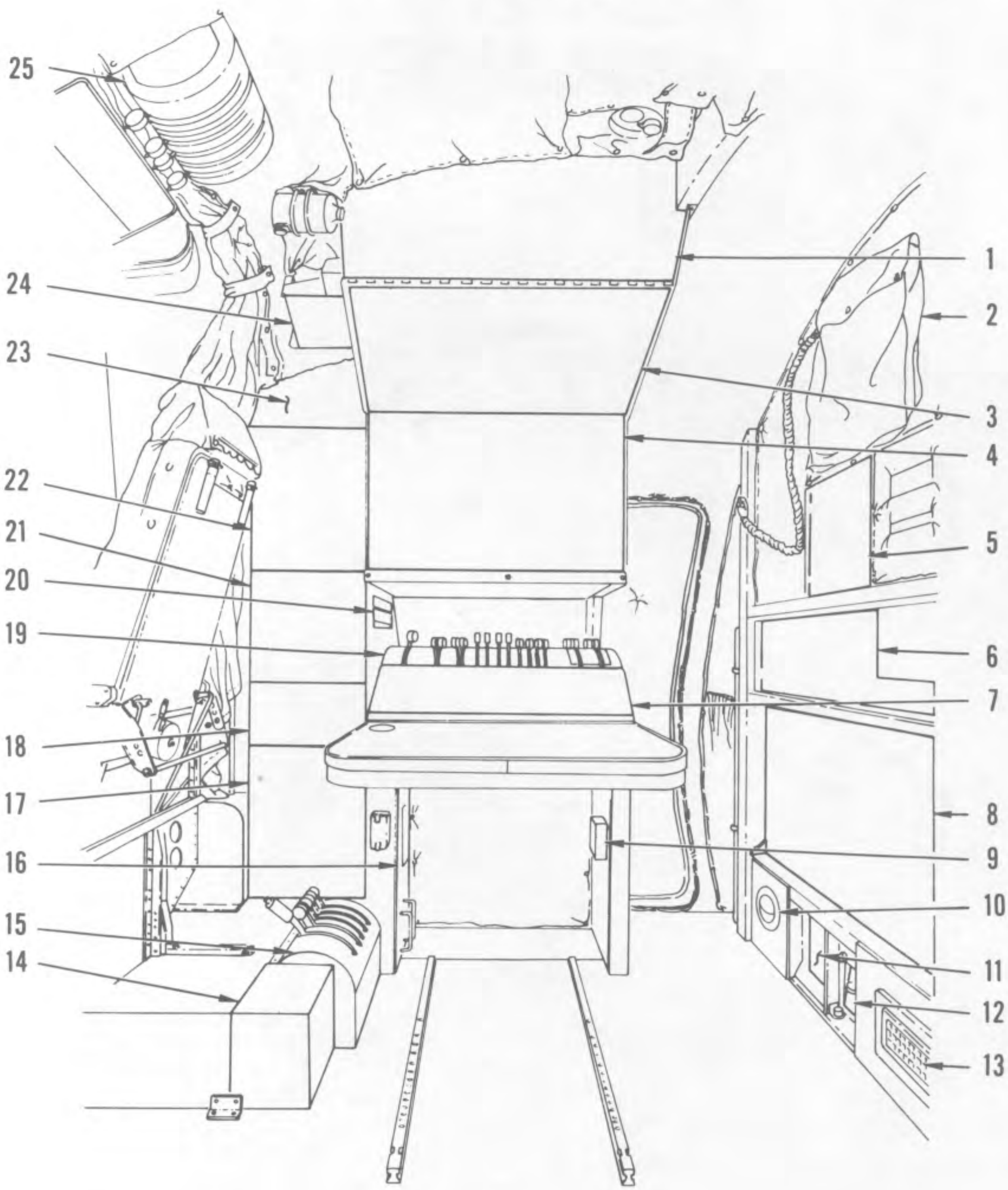
Four toggle switches (1, figure 1-14), located on the left side of the flight engineer's lower switch panel, are used to select either ram or alternate air from each carburetor. Each switch has two positions, RAM and ALTERNATE. When these switches are placed in the RAM (normal) position, an electric (dc) reversible motor opens the forward ram air scoop and simultaneously closes the alternate air doors in the induction duct. This allows ram air to pass directly into the carburetor. In the ALTERNATE position, the electrically operated motor closes the forward ram air opening and simultaneously opens the alternate air door, admitting sheltered air to the carburetor.

Carburetor Air Switches.

Four carburetor air toggle switches (1, figure 1-14), are located on the left side of the flight engineer's lower switch panel. Each switch has three positions, OFF, COLD, and HOT; they are spring-loaded from HOT to OFF. Holding the switch in the HOT position, electrically (dc) actuates a rotary valve (hot air door) in the carburetor air intake scoop, permitting hot air from behind the engine cylinders to enter the carburetor. Moving the switch to the COLD

FLIGHT ENGINEER'S STATION

(TYPICAL)



1. UPPER SWITCH PANEL
2. DITCHING ROPE AND CONTAINER
3. UPPER INSTRUMENT PANEL
4. LOWER INSTRUMENT PANEL
5. ENGINE FIRE EXTINGUISHER CONTROL PANEL
6. STATION 260 UPPER SWITCH PANEL
7. LOWER SWITCH PANEL
8. AIR CONDITIONING CONTROL PANEL
9. STATION 238 CIRCUIT BREAKER PANEL
10. CREW DOOR LIGHT
11. DITCHING VALVE RELEASE HANDLE
12. CABIN HEATER FIRE EXTINGUISHING CONTROL PANEL
13. STATION 260 AIR OUTLET
14. IGNITION ANALYZER CONTROL PANEL
15. FLIGHT ENGINEER'S AUXILIARY CONTROL QUADRANT
16. LOWER MJB 212 PANEL
17. MJB NO. 3 PANEL
18. MJB NO. 2A PANEL
19. FLIGHT ENGINEER'S CONTROL QUADRANT
20. UPPER MJB 212 PANEL
21. MJB NO. 2 PANEL
22. MJB NO. 1 PANEL
23. UPPER MJB PANEL
24. RADIO SELECTOR BOX
25. EMERGENCY SHUTOFF LEVERS AND QUADRANT

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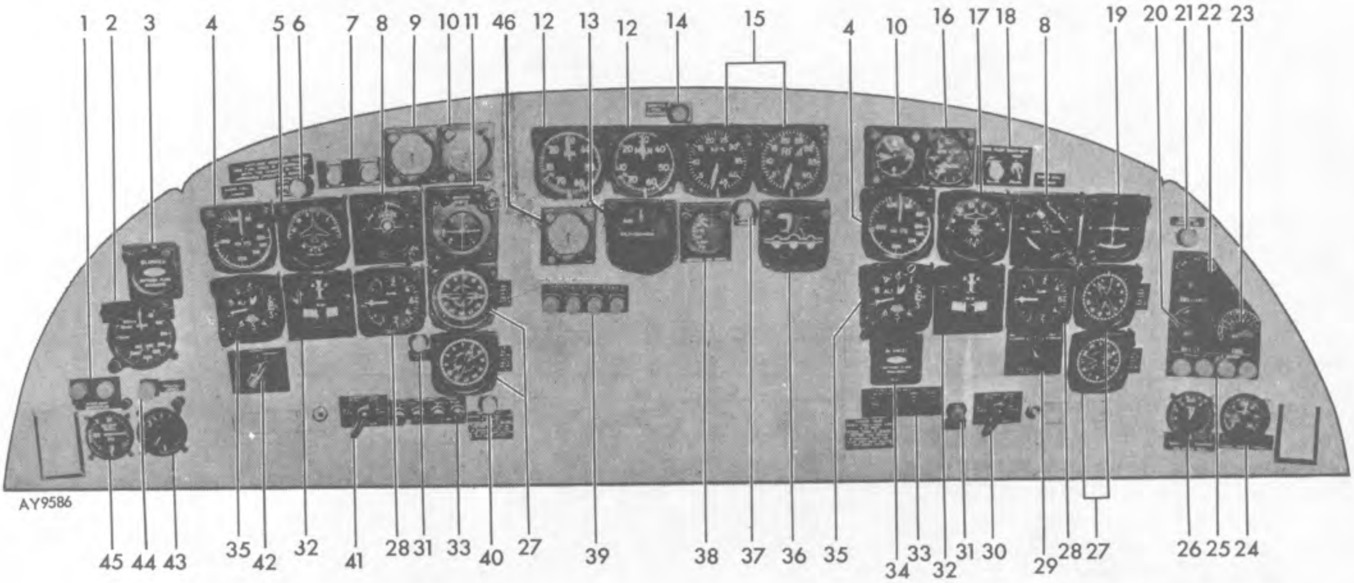
Figure 1-5

PILOTS' INSTRUMENT PANEL
(TYPICAL)



1 VACUUM WARNING LIGHTS (DEICER)
2 RADIO ALTIMETER INDICATOR
3 PILOT'S OXYGEN FLOW INDICATOR
4 AIRSPEED INDICATOR (2)
5 HEADING INDICATOR (J-2)
6 RADAR ALTIMETER LOW-LEVEL WARNING LIGHT
7 LOCALIZER AND GLIDE PATH - INOPERATIVE WARNING LIGHTS
8 ATTITUDE INDICATOR (GYRO HORIZON) (2)
9 CLOCK - ELAPSED TIME
10 CLOCK - 8 DAY (2)
11 COURSE INDICATOR AND MARKER BEACON LIGHT (PILOT'S)
12 MANIFOLD PRESSURE INDICATOR (2)
13 THREE-AXIS TRIM INDICATOR
14 MASTER FIRE WARNING LIGHT
15 TACHOMETER INDICATORS
16 WING FLAP ASYMMETRY INDICATOR
17 MASTER HEADING INDICATOR (FLUXGATE)
18 WING FLAP SHUTOFF VALVE TEST SWITCH AND WARNING LIGHT
19 COURSE INDICATOR AND MARKER BEACON LIGHT (COPILOT'S)
20 EXTERIOR LIGHTS MASTER SWITCH
21 RADOME WARNING LIGHT
22 POSITION LIGHTS BRILLIANCE CONTROL
23 FUSELAGE LIGHTS CODE SELECTOR SWITCH
24 EMERGENCY BRAKE PRESSURE INDICATOR
25 HYDRAULIC PUMPS LOW-PRESSURE WARNING LIGHTS
26 HYDRAULIC SYSTEM PRESSURE INDICATOR
27 RADIO MAGNETIC INDICATOR (2)
28 VERTICAL VELOCITY INDICATOR (2)
29 COPILOT'S HORIZON AND TURN AND SLIP (BANK) POWER SELECTOR SWITCH
30 COPILOT'S STATIC SELECTOR
31 TURN AND SLIP POWER FAILURE WARNING LIGHT (2)
32 TURN AND SLIP INDICATOR (2)
33 GYRO INSTRUMENT FUSES (2)
34 COPILOT'S OXYGEN FLOW INDICATOR
35 ALTIMETER (2)
36 LANDING GEAR AND WING FLAP POSITION INDICATOR
37 LANDING GEAR WARNING LIGHT
38 OUTSIDE AIR TEMPERATURE INDICATOR
39 PROPELLER REVERSE PITCH INDICATORS
40 PARKING BRAKE INDICATOR LIGHT
41 PILOT'S STATIC SELECTOR
42 PILOT'S HORIZON AND TURN AND SLIP (BANK) POWER SELECTOR SWITCH
43 VACUUM INDICATOR
44 AUTOMATIC FEATHERING ARMED LIGHT
45 DEICER PRESSURE INDICATOR
46 APR-25 SCOPE

Figure 1-6

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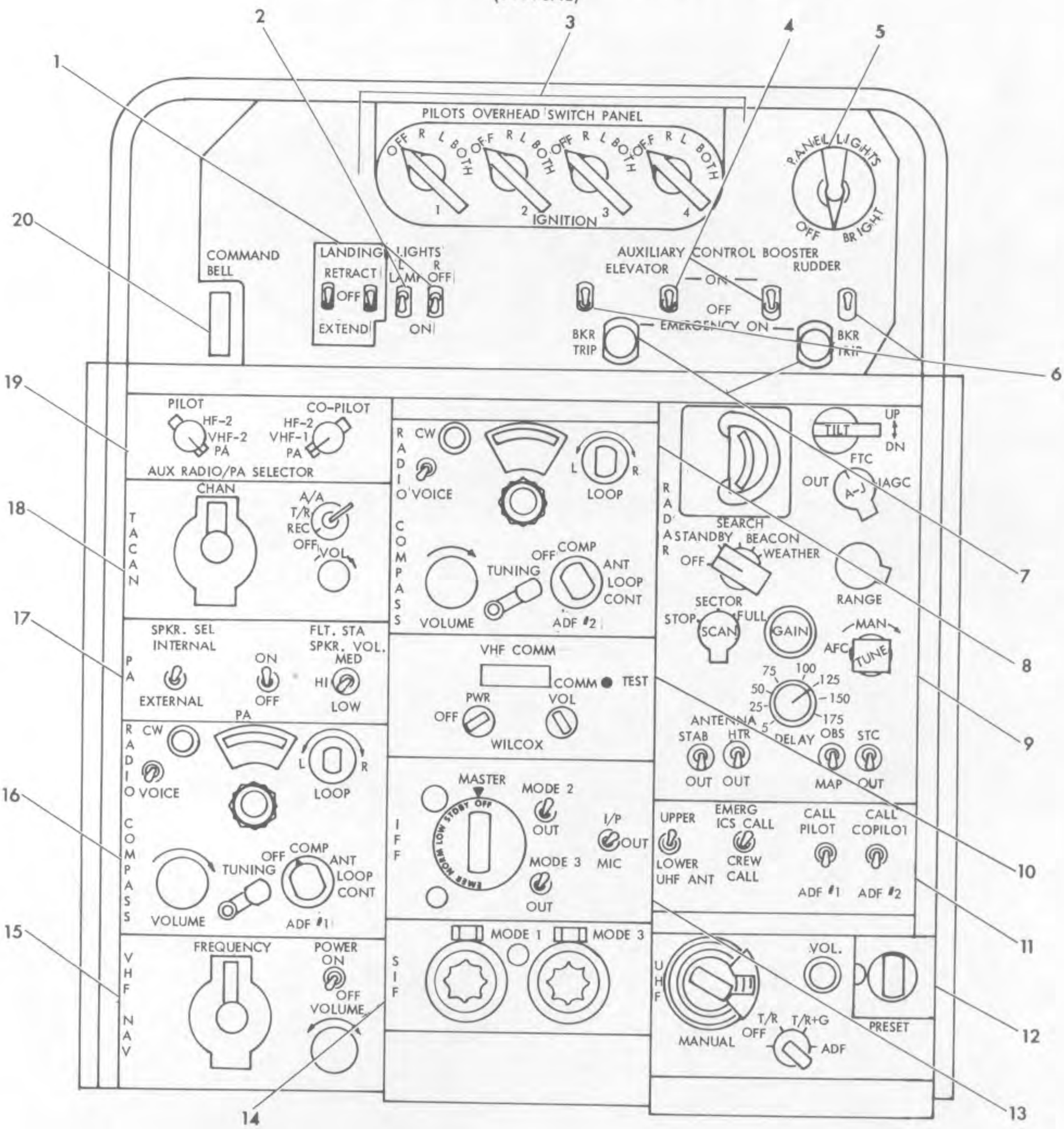
F66-0-1-6

PILOTS' OVERHEAD PANEL

(TYPICAL)

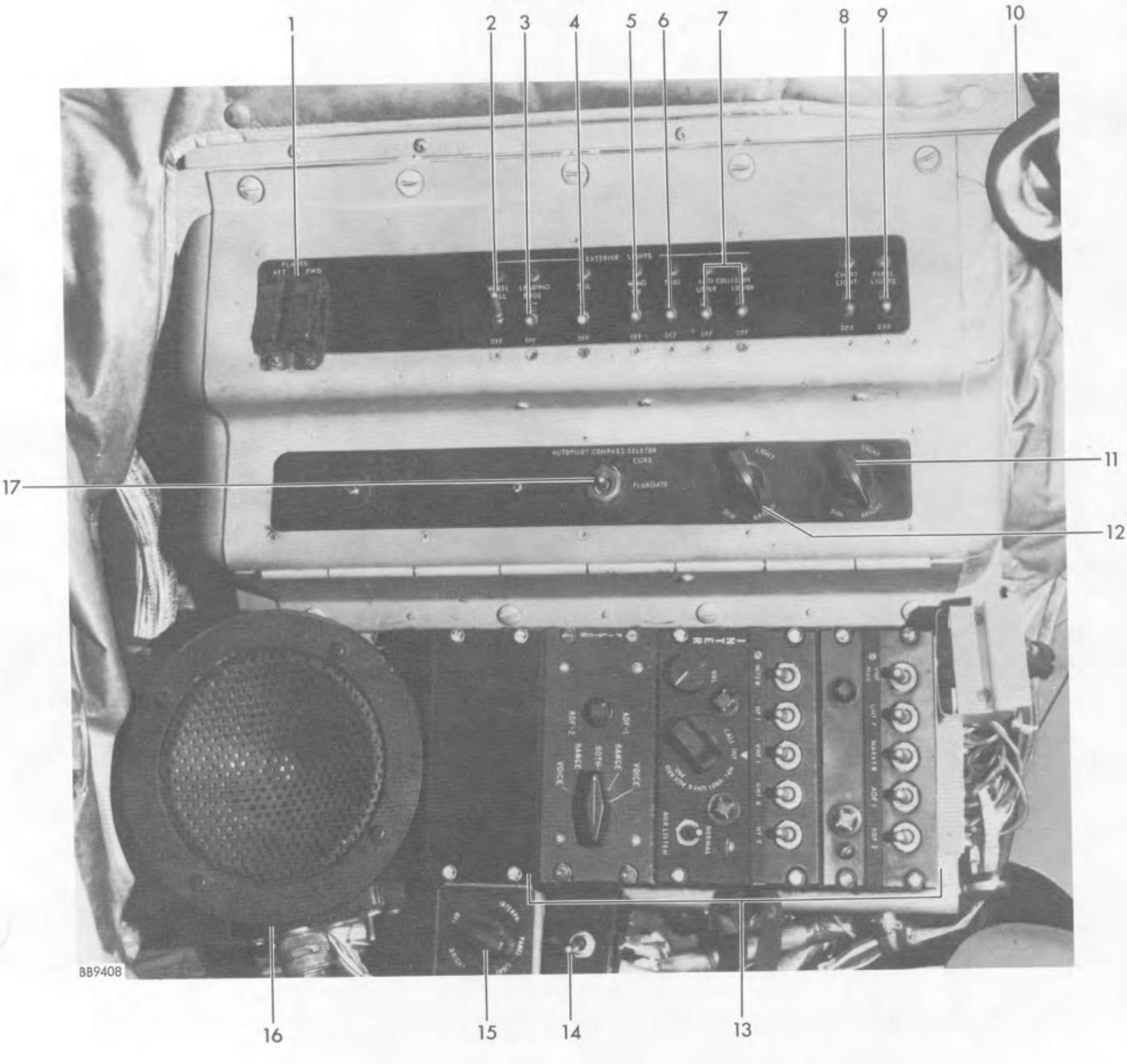


1. LANDING LIGHT EXTEND/RETRACT SWITCHES
2. LANDING LIGHTS SWITCHES
3. IGNITION SWITCHES
4. ELEVATOR AND RUDDER AUXILIARY BOOSTER SWITCHES
5. PANEL LIGHT RHEOSTAT
6. ELEVATOR AND RUDDER AUXILIARY BOOSTER CIRCUIT BREAKERS
7. ELEVATOR AND RUDDER AUXILIARY BOOSTER INDICATOR LIGHTS
8. AN/ARN-6 RADIO COMPASS CONTROL PANEL
9. AN/APS-42 RADAR CONTROL PANEL
10. VHF COMM. CONTROL PANEL
11. PILOT AND COPILOT ADF SELECTION AND AUXILIARY INTERCOM CONTROL PANEL
12. AN/ARC-27 UHF CONTROL PANEL
13. IFF CONTROL PANEL
14. SIF CONTROL PANEL
15. VHF NAV CONTROL PANEL
16. RADIO, COMPASS CONTROL PANEL
17. PA CONTROL PANEL
18. AN/ARN-21 TACAN CONTROL PANEL
19. PILOTS' AUX RADIO PA SELECTOR
20. COMMAND BELL SWITCH

Figure 1-7

F66-1-1-7

PILOT'S SIDE PANEL
(TYPICAL)



1 FLARE RELEASE SWITCHES
2 WHEEL WELL LIGHT SWITCH
3 LEADING EDGE LIGHTS SWITCH
4 TAIL LIGHT SWITCH
5 WING TIP LIGHTS SWITCH
6 TAXI LIGHT SWITCH
7 ANTI-COLLISION LIGHT SWITCHES
8 CHART LIGHT SWITCH
9 PANEL LIGHT SWITCH
10 MICROPHONE
11 PANEL LIGHT RHEOSTAT
12 CHART LIGHT RHEOSTAT
13 RADIO AND ICS PANEL
14 AUDIO SELECTOR SWITCH (VHF-NAV/ARN-21)
15 PANEL LIGHT RHEOSTAT
16 LOUDSPEAKER LS-184
17 AUTOPILOT COMPASS SELECTOR (INOPERATIVE IF INSTALLED)

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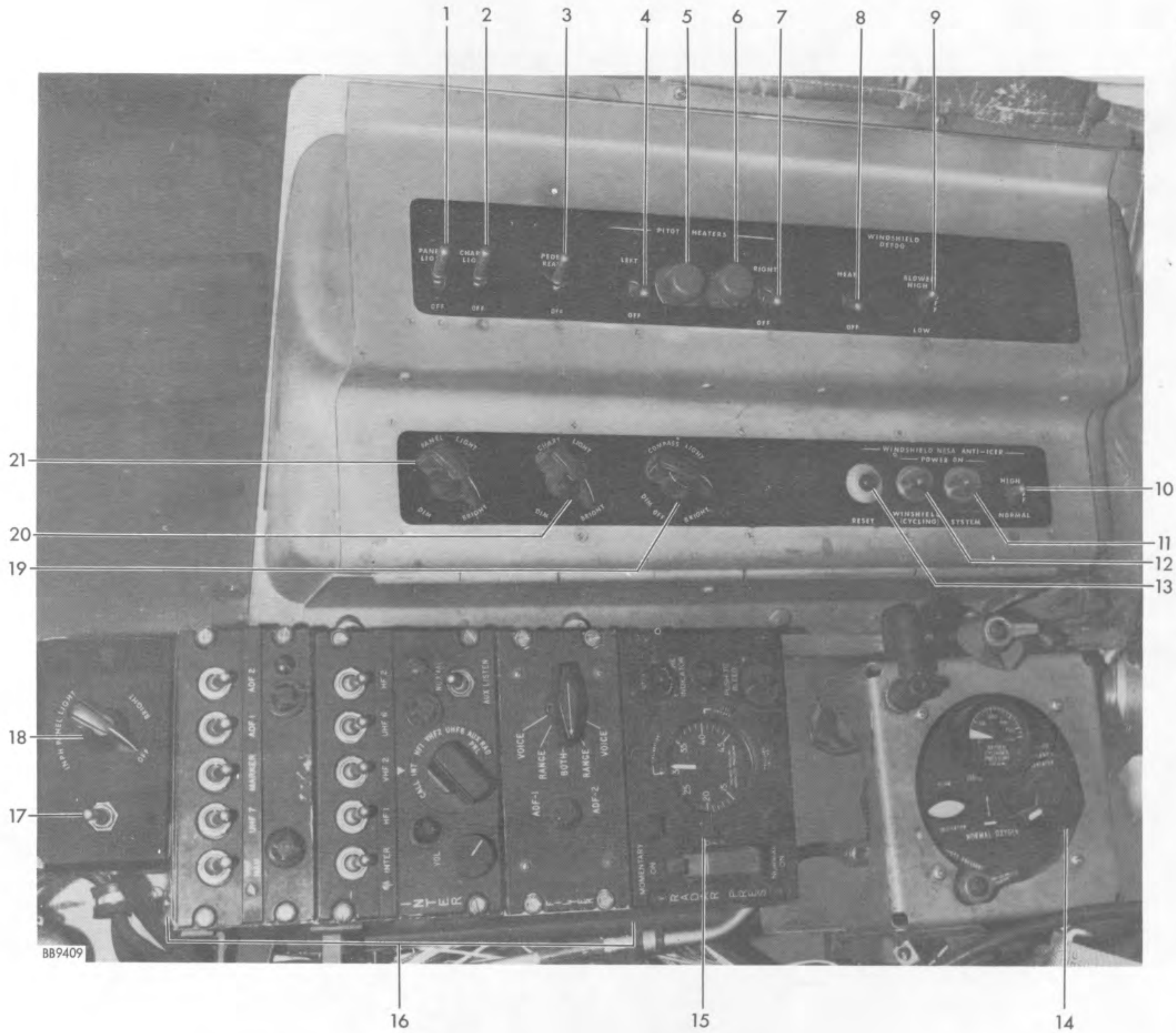
Figure 1-8

COPILOT'S SIDE PANEL

(TYPICAL)



1 PANEL LIGHT SWITCH
2 CHART LIGHT SWITCH
3 PEDESTAL REAR LIGHT SWITCH
4 LEFT PITOT HEATER SWITCH
5 LEFT PITOT HEATER INDICATOR LIGHT
6 RIGHT PITOT HEATER INDICATOR LIGHT
7 RIGHT PITOT HEATER SWITCH
8 WINDSHIELD DEFOG HEATER SWITCH
9 WINDSHIELD DEFOG BLOWER SWITCH
10 NESA SYSTEM SWITCH
11 NESA SYSTEM POWER-ON LIGHT
12 NESA CYCLING LIGHT
13 NESA RESET SWITCH
14 OXYGEN REGULATOR
15 RADAR PRESSURIZATION CONTROL AND INDICATOR
16 RADIO AND ICS PANEL
17 AUDIO SELECTOR SWITCH (VHF-NAV/ARN-21)
18 INPH. PANEL LIGHT RHEOSTAT
19 COMPASS LIGHT RHEOSTAT
20 CHART LIGHT RHEOSTAT
21 PANEL LIGHT RHEOSTAT

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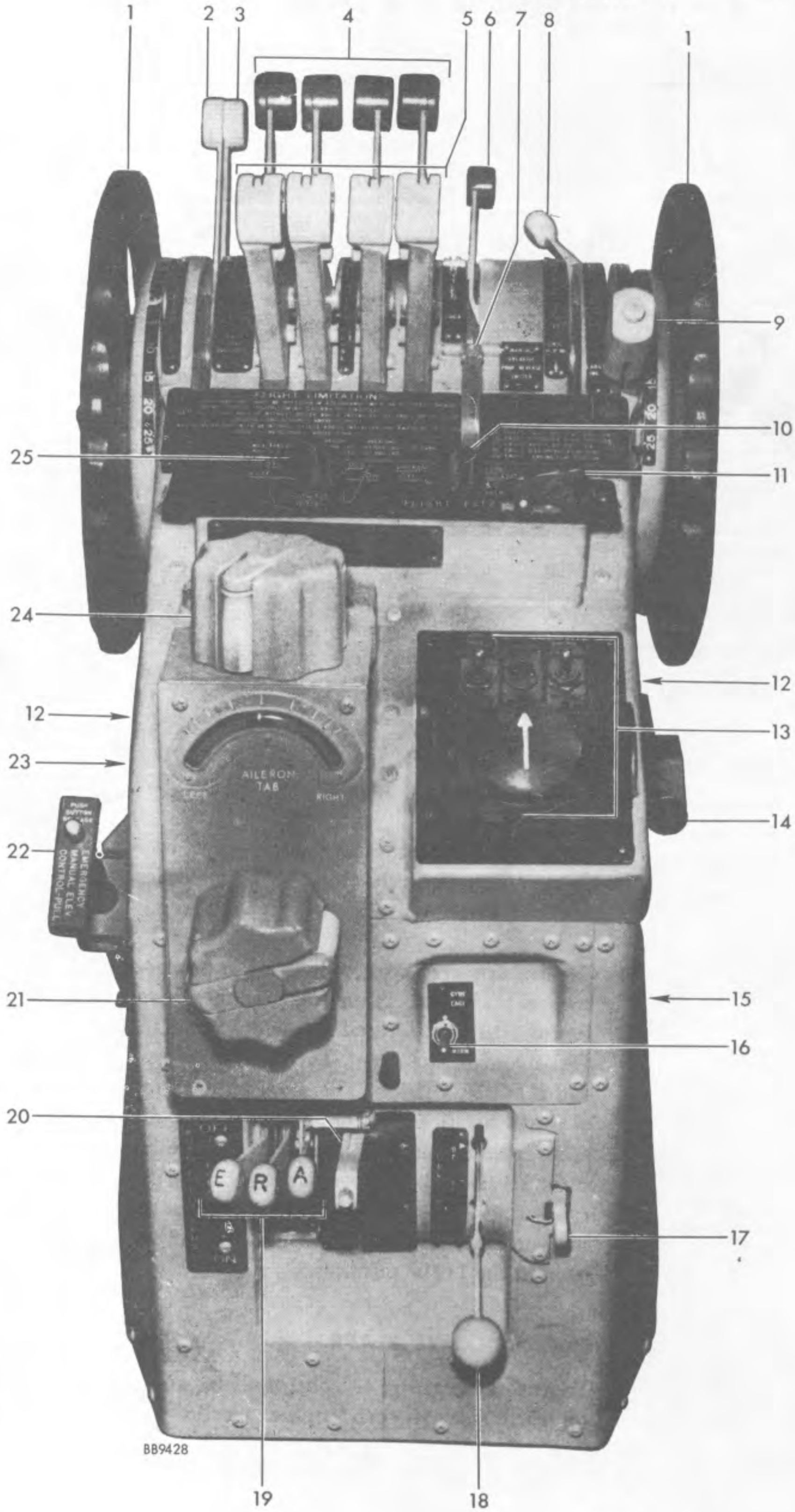
Figure 1-9

CENTER CONTROL STAND

(TYPICAL)



1. ELEVATOR TRIM TAB CONTROL WHEELS (2 PLACES)
2. RUDDER BOOSTER CONTROL LEVER
3. AILERON BOOSTER CONTROL LEVER
4. REVERSE PITCH THROTTLE LEVERS
5. THROTTLE LEVERS
6. THROTTLE FRICTION LOCK LEVER
7. REVERSE LOCK OVERRIDE LEVER
8. MASTER PROPELLER PITCH LEVER
9. WING FLAP LEVER
10. FLIGHT PATH MODE SELECTOR SWITCH
11. FLIGHT PATH DIRECTION SELECTOR SWITCH (INOPERATIVE)
12. PARKING BRAKE LEVERS (HIDDEN) (2 PLACES)
13. AUTOMATIC PILOT CONTROL PANEL
14. VENTILATION DAMPER (FOOT WARMER) CONTROL KNOB
15. LANDING GEAR SOLENOID LOCK RELEASE (HIDDEN)
16. FLUX-GATE GYRO CAGING SWITCH
17. LANDING GEAR LEVER RELEASE TRIGGER
18. LANDING GEAR LEVER
19. AUTOMATIC PILOT SERVO-DISCONNECT LEVERS
20. BRAKE SELECTOR VALVE LEVER
21. AILERON TRIM TAB HANDCRANK
22. ELEVATOR BOOSTER SHIFT CONTROL
23. LANDING GEAR WARNING HORN RELEASE LEVER (HIDDEN)
24. RUDDER TRIM TAB HANDCRANK
25. WINDSHIELD WIPER RHEOSTAT

Figure 1-10

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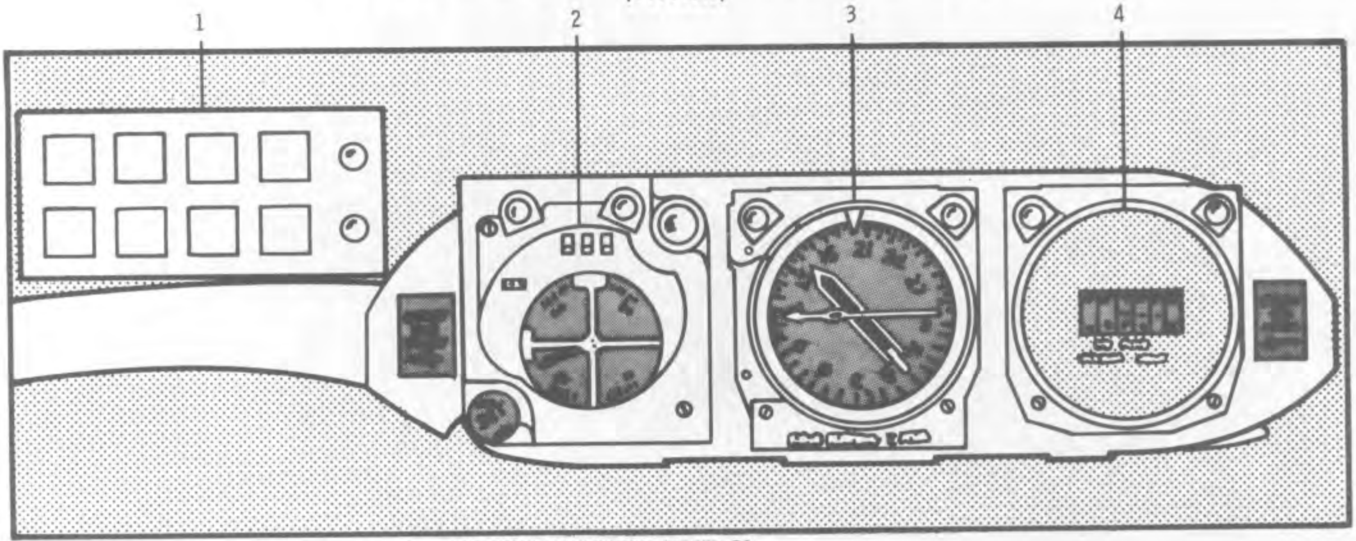
F66-0-1-10

PILOTS' GLARESHIELD PANEL

(TYPICAL)



1. APR 25/26 INDICATOR (REFER TO T.O. 1C-121 (E) R-1A FOR DETAILED INFORMATION)
2. ID-249 COURSE INDICATOR
3. ID-250 RADIO MAGNETIC INDICATOR
4. ID-310 RANGE INDICATOR

Figure 1-11

position rotates the valve to permit unheated air to enter the carburetor. The valve may be stopped in any intermediate position by moving the switch to OFF. Limit switches stop the valve automatically when it reaches either the full hot or full cold position.

Mixture Levers.

Four mixture levers (9, figure 1-14) are located on the flight engineer's control quadrant and are mechanically linked to the carburetor mixture control valves. The mixture control quadrant is marked OFF, AUTO LEAN and AUTO RICH but incorporates continuously serrated detent plates to permit setting the control at intermediate positions for best power and economy. (Refer to Manual Leaning in Section VII for procedures.)

Carburetor Air Temperature Indicators.

Two dual carburetor air temperature indicators (19, figure 1-15) located on the lower left side of the flight engineer's lower panel, register the induction air temperature at the carburetor throat by means of dc temperature resistance bulbs. The indicators are calibrated in degrees centigrade.

SUPERCHARGERS.

Each engine incorporates a single-stage, two-speed supercharger that is mechanically controlled from the flight engineer's station.

Engine Supercharger and Cabin Supercharger Disconnect Levers.

Four engine supercharger levers (7, figure 1-14) are located at the center of the flight engineer's control quadrant. Each of the levers has a HIGH and a LOW position. The two outboard levers also have a third position, which mechanically disconnects the cabin pressurization supercharger driveshafts from the engines. The cabin superchargers can be disconnected by compressing a springloaded lock, mounted adjacent to the outboard levers, and pushing the levers through and beyond the LOW position.

ENGINE COWL FLAPS.

Engine temperature is controlled by air exit flaps, one on each side of each engine nacelle. Flap position is controlled by two dc electrical actuators interconnected by a flexible shaft in each engine. The right actuator in each nacelle incorporates a position transmitter which registers a flap position indication at the flight engineer's station.

Cowl Flap Switches.

Four paddle-type cowl flap switches (15, figure 1-14), located on the left side of the flight engineer's lower switch panel, have three positions, OPEN, CLOSE, and OFF. The OFF positions holds the flaps in the last preset position. The switches are spring-loaded from CLOSE to the OFF position. The OPEN position is a steady-on position. Either OPEN or CLOSE position provides dc electrical power to the cowl flap actuators in each nacelle. Limit switches are installed to automatically stop the cowl flaps at the full open or the full closed position.

Cowl Flap Position Indicators.

Two dual cowl flap position indicators (11, figure 1-16) are located on the flight engineer's upper instrument panel and are marked from 0 to 100 percent. These indicators are actuated by magnasyn transmitters attached to the right actuator in each engine nacelle and are powered by 26-volt, 400-cycle alternating current.

Cylinder Head Temperature Indicators and Selector.

Two dual cylinder head temperature indicators (21, figure 1-15) and a two-position selector switch (20, figure 1-15) are located on the flight engineer's lower instrument panel. A resistance bulb in cylinders 1 and 18 of each engine electrically transmits cylinder head temperature to the indicators which are marked in degrees centigrade. The selector switch has two positions, A and B. Position A selects cylinder 1 on each engine and position B selects cylinder 18 on each engine.

IGNITION SYSTEM.

Each engine is equipped with a low-tension dual ignition system. The low-tension magneto installed on the rear accessory section produces a low-voltage spark for the right and left distributors located on the nose section case. The right distributor directs low voltage to high tension coils that fire the front plugs in each cylinder. The left distributor directs low voltage to high-tension coils that fire the rear plugs in each cylinder. A high-tension coil is provided for each plug and is attached to a cylinder rockerbox cover. An induction vibrator is also employed which provides the hot spark required during cold starts and low starting rpm below the effective speed of the magneto. The induction vibrator discharges through the right distributor. Aircraft are equipped with distributors that incorporate manual spark control circuits. (Refer to Section VII for use of the manual spark control.)

Ignition Switches.

Four ignition switches (3, figure 1-7) are located on the pilot's overhead panel. Reading clockwise the positions are OFF, R, L, and BOTH. With the ignition switch OFF, the circuits to the right and left ignition distributors are grounded. When the switch is positioned to R the left circuit only is grounded, allowing the right distributor to fire the front spark plugs in each cylinder. When the switch is positioned to L the right circuit only is grounded, allowing the left distributor to fire the rear sparkplugs in each cylinder. When the switch is positioned to BOTH, neither circuit is grounded and each distributor fires its set of sparkplugs.

Master Spark Control Switch.

A single spark control switch (14, figure 1-14), located on the flight engineer's lower switch panel, controls the ignition timing for the four engines simultaneously. A movable guard covers the switch and opens downward. The two positions are placarded RETARD and ADVANCE. When the guard is closed, the switch is moved to the RETARD position.

Spark Control Switches.

Four circuit-breaker switches (6, figure 1-17) are located on the flight engineer's upper switch panel. These switches have two positions, placarded NORMAL and RETARD. The spark control circuit is not complete unless these switches are in the NORMAL position. If the circuit of any engine is shorted the circuit breaker for that engine automatically snaps to the RETARD position. The circuit for any engine can be interrupted by moving the switch for that engine to the RETARD position.

PRIMING SYSTEM

Fuel for priming is supplied by the auxiliary fuel pumps through the solenoid priming valve mounted on the housing of each carburetor pressure chamber. The solenoid valve is actuated by direct current through a momentary contact switch. Primary fuel is discharged from the fuel inlet chamber directly into the engine blower section.

Engine Primer Switch.

A single priming switch (16, figure 1-26), located on the MJB No. 2 switch panel, is a momentary contact push button which electrically operates a solenoid primer valve on the carburetor to discharge fuel directly into the engine blower section. Selection of the solenoid primer valve and the engine to be primed is controlled by the engine starter selector switch. The fuel auxiliary boost switches also must be on.

ENGINE ANALYZER CONTROLS

HG 04996

Figure 1-12

STARTING SYSTEM.

Each engine is equipped with a direct-cranking dc electric starter mounted on the engine accessory section. The starter incorporates a disc-type clutch which will slip when the engine offers abnormal resistance to cranking, such as that caused by a hydraulic lock during starting.

Engine Starter Switches.

Two switches for the starting system are located on the MJB No. 2 switch panel. One switch, the engine starter selector (14, figure 1-26), is a rotary-type switch with five positions: 1, 2, OFF, 3, and 4. The other switch (15 figure 1-26), is a momentary-contact type pushbutton which energizes the selected engine starter.

ENGINE INDICATORS.

Tachometer Indicators.

Engine rotational speed is transmitted by tachometer generators mounted on the rear case of each engine to four dual self-energized electric indicators. Two indicators (15, figure 1-6) are located on the pilots' instrument panel, and two (16, figure 1-15) are located on the flight engineer's lower instrument panel. The indicators are marked in revolutions per minute.

Manifold Pressure Indicators

Two dual manifold pressure indicators (12, figure 1-6), located on the pilots' instrument panel, and two dual indicators (18, figure 1-15), located on the flight engineer's lower instrument panel, register the air induction pressures in the engine manifolds. The instruments are marked in inches of mercury and are operated by ac power.

Torquemeters (BMEP Indicators).

Two dual ac-operated torquemeter indicators (4, figure 1-15) located on the flight engineer's lower instrument panel, measure the torque at the propeller shaft. The indicators are marked in BMEP.

Oil Pressure Indicators.

Two dual oil pressure indicators (9, figure 1-15), located on the right side of the flight engineer's lower instrument panel, register pressure in pounds per square inch. The oil pressure transmitters are located in the accessory section on the transmitter panel in each engine nacelle. Immediately below the oil pressure indicators are four oil low-pressure warning lights (10, figure 1-15) which glow when the pressures drop to 55 psi. The lights are intentionally set to come on below the minimum in-flight oil pressure of 65 psi to allow for the tolerance (± 5 psi) of the pressure transmitters.

Oil Temperature Indicators.

Four dual oil temperature indicators, located on the flight engineer's upper and lower instrument panels, indicate degrees centigrade. Two of these indicators (4, figure 1-16) register the oil outlet temperature of the four engines by bulbs located in the oil-out line housing fittings near the engine oil sump cases. The other two indicators (8, figure 1-15) register the oil inlet temperatures of the four engines after the oil has passed through the oil cooler system and supply tanks. The oil-in temperature bulbs are located in the engine oil-in lines, zone 3. Signals are transmitted electrically from the bulb transmitters to the panel indicators.

Fuel Pressure Indicators

Two dual fuel pressure indicators (11, figure 1-15), located on the engineer's lower instrument panel, indicate fuel pressure at the carburetors.

Fuel Low Pressure Warning Lights.

Four fuel low-pressure warning lights (12, figure 1-15) are located on the flight engineer's lower instrument panel below the fuel pressure indicators. They light red when the fuel pressure measured at the carburetors drops to 20 ± 0.5 psi.

Fuel Flow Indicators.

Two dual fuel flow indicators (2, figure 1-15) are located on the flight engineer's lower instrument panel. They indicate the rate of fuel flow to the engine in pounds per hour.

IGNITION ANALYZER.

The aircraft incorporates a Sperry ignition analyzer which provides a visual means of detecting, locating, and identifying engine ignition abnormalities. The analyzer can be used on the ground or in flight and will reveal ignition malfunctions at high altitude that normally are not evident on the ground. Data is presented in the form of patterns on the face of the cathode ray tube indicator mounted on the flight engineer's table. The characteristic ignition patterns of each engine may be examined singly for individual cylinders or simultaneously for all cylinders. Any ignition malfunction during engine operation will alter the characteristic pattern and change its contour. Each engine pattern can be identified with the number of the cylinder, spark plug, or magneto associated with the malfunction. The power supply amplifier, located on the forward radio rack, operates on ac power and contains the electronic circuits that provide necessary voltages to operate the cathode ray tube indicator. The synchronizing generator is driven by the engine auxiliary tachometer drive at one-half engine speed, and provides 3-phase voltage for synchronizing the patterns with angular position of the engine crankshaft. This voltage initiates and produces the horizontal base sweep across the cathode ray tube of the indicator. (Refer to Section VII for ignition analyzer operating procedures.)

Cycle Switch.

The cycle switch, located on the floor adjacent to the flight engineer's auxiliary control quadrant, consists of a fixed index ring marked off with numbers that correspond to the number of cylinders of the engine in their firing order. (See figure 1-12.) The inner rotatable switch dial is marked with an index line and abbreviations at specific points which indicate events occurring during a complete engine cycle. The following abbreviated positions are inoperative on this unit because vibration pickups are not installed: I.O. (intake opens), E.C. (exhaust closes), I.C. (intake closes), E.O. (exhaust opens); the IGN (ignition) position, however, is used. The center selector switch incorporates a push-pull knob that controls the sweep of the horizontal pattern on the cathode ray tube indicator. The IGN position is alined with any cylinder designation on the fixed ring dial, and the operator may choose the pattern presentation. The number of patterns that will be seen is contingent upon the position of the push-pull knob. If the knob is in the pushed-in position (fast sweep), two complete patterns will appear on the indicator, beginning with the ignition pattern of the cylinder on which the cycle switch is indexed and concluding with the pattern of the next cylinder in firing order. In the pulled-out position (slow sweep), the patterns of all cylinders will appear, beginning with that of the cylinder on which the IGN is indexed. Some typical patterns are illustrated in Section VII.

Condition Switch.

The condition switch, located on the floor adjacent to the flight engineer's auxiliary control quadrant, functions as a selector for a specific engine for either ignition analysis or for checking the speed synchronism between engines. (See figure 1-12.) It also selects either left, right, or both distributors for observation. The inner rotatable dial has a single index mark which is rotated to the desired indices engraved on the fixed outer ring. The fixed ring is divided into five general sections which are engraved as follows: SYN, 2, 3, 4, and VIB (inoperative) for checking synchronization of respective engines with No. 1 engine; IGNITION, 1, 2, 3, and 4 for ignition analysis of the respective engines, and B (both), L (left), and R (right) magnetos.

Cathode Ray Tube Indicator and Controls.

The indicator assembly is a housing which encloses a 3-inch cathode ray tube. The assembly is mounted face-up in the flight engineer's table (16, figure 1-14). The power

PITCHLOCK SYSTEM

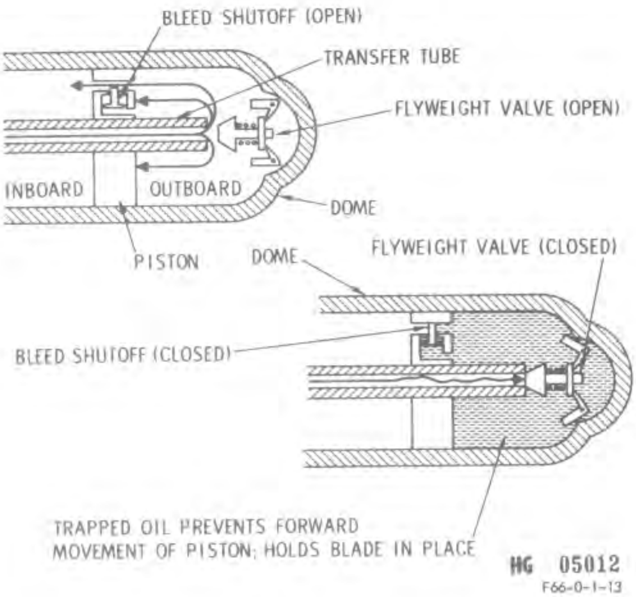


Figure 1-13

supply amplifier provides the adjustments of the indicator such as focus, gain and horizontal centering, and intensity. However, when these controls are set, they should not require frequent readjustment.

PROPELLERS.

A Hamilton Standard hydromatic, three-bladed, full-feathering and reversible pitch propeller is installed on each engine. Each propeller incorporates a fluid deicing distribution system. A propeller control system is provided for constant speed, synchronization individual selector control, a master control for changing rpm of all engines simultaneously, and manual and automatic feathering and reversing. The constant speed, reversing and unreversing feathering and unfeathering features of this propeller are controlled by a double-acting governor mounted on the top of the nose case of each engine. The governor consists of an engine-driven gear-type pump which takes oil from the engine oil system and boosts the pressure to that required for operation of the propeller pitch changing mechanism located in the propeller dome. Other components of the governor consist of the following: a pilot valve actuated by spring-balanced flyweights which control the flow of oil to and from the propeller dome; a pressure-operated check valve which allows high pressure oil from an auxiliary (feathering) pump to add to the governor output when the propeller is being feathered and unfeathered, or reversed and unreversed; and a relief valve system which limits the output pressure of the governor pump, yet allows it to provide sufficient operating force to control the propeller.

OVERSPEED PITCHLOCK SYSTEM.

Propeller overspeed is controlled by a speed-sensitive hydraulic overspeed pitchlock (figure 1-13) completely contained within the dome assembly. It is completely automatic, and will prevent decreased pitch operation above a preset rpm (approximately 5-10 percent above takeoff rpm). A typical example of the action of the pitchlock is the case in which the control oil pressure supply to the propeller is interrupted but the engine remains operating. With no control oil pressure available, centrifugal twisting moment will rapidly reduce blade angle until the rpm reaches the setting of the transfer tube check valve (between 2630 and 2740 rpm). The propeller may then be feathered; if it is not, rpm will continue to increase slowly since the trapped outboard oil must escape through the bleed hole. When the bleed shutoff rpm setting is reached (approximately 3110-3220 rpm), the dome will be effectively seated and no further significant reduction of blade angle will occur. At this point the propeller may be feathered or the engine power reduced to lower the rpm to a satisfactory value. Engine operation may be continued at reduced power but still produce positive thrust. Once the pitchlock is triggered, rpm may be reduced to a very low value (approximately 1600 rpm) without unlocking since the trapped oil will supply the force necessary to hold the check valve and shutoff valve closed. In this situation, the pitchlock will reduce the possibility of engine damage, improve featherability, or allow continued operation at reduced power.

There are other situations in which the pitchlock will prove beneficial. In all of these, the reduced rate of decrease pitch change above the transfer tube check valve rpm setting will allow more time for feathering to be initiated, allow more time for power and airspeed reduction, and will retard the increase of drag associated with a windmilling propeller. When the bleed shutoff valve is also triggered, it will limit the ultimate overspeed to a lower rpm and will, therefore, reduce final drag, limit engine damage, improve featherability, and allow continued, reduced-power operation.

FEATHERING SYSTEM.

During feathering, a dc electric-motor driven auxiliary (feathering) pump directs engine oil through the governor, which distributes and augments oil pressures through the propeller shaft to the forward side of the dome piston. As the piston is forced aft, a slotted cam gear is rotated which, in turn, rotates each of the three blades so that the blades move up to the feathered positions. Displaced oil from the aft side of the piston is forced back through the propeller shaft to the propeller governor to be recirculated in the system as long as the propeller feathering button is in the depressed position.

UNFEATHERING SYSTEM.

During unfeathering, the motor-driven auxiliary (feathering) pump and the solenoid valve in the governor, direct oil pressure to position the governor pilot valve in the decrease-pitch position. The oil flows through the decrease-pitch passages to the aft side of the propeller dome piston. The piston is forced forward, turning the blades toward low pitch. The oil on the forward side of the piston is forced back through the propeller shaft to the intake side of the propeller governor.

REVERSING FEATURES.

When reverse thrust braking is used, the motor-driven auxiliary (feathering) pump and the solenoid valve in the governor are energized and send high-pressure oil through the propeller shaft to the aft side of the dome piston, moving it forward until the piston sleeve contacts the low-pitch stop levers. As additional oil pressure builds up, force is exerted on the servo piston valve which unseats and moves the wedge from under the low-pitch stop levers, which in turn retract, allowing the piston to move forward, rotating the cam gear and causing the blade angle to decrease through zero pitch and into the reverse angle. Prior to reaching the reverse-pitch stop, the feathering pump is shut off by the blade angle switch and power for the last few degrees of travel is supplied by pressure from the governor. The full reverse angle stop is a fixed pitch position, and the blade is held in that position by oil pressure from the governor pump.

UNREVERSING FEATURES.

When unreversing, high-pressure oil from the motor-driven auxiliary (feathering) pump is directed to the forward side of the dome piston, forcing the blades to the positive angle. Unreversing will continue until the blade cam contacts a blade switch which stops the auxiliary (feathering) pump. This occurs when the blade angle reaches a point above the low-pitch stop setting, where the constant-speed control takes over.

SYNCHRONIZING FEATURES.

The synchronizer unit provides a flexible means of controlling and synchronizing engine speed. Among the features provided are limited-range synchronization with solenoid release to allow full-range synchronization by increments, speed adjustment of all engines throughout the entire operating range by a single master control lever, separate adjustment of each propeller governor by individual toggle switches, and positive positioning of all governors against the high-speed stops for take-off. Provision is made for selecting either engine No. 1 or engine No. 2 as a master speed reference and for switching the synchronizer on and off at will. Master lever control is retained even with the synchronizer function inoperative. Each propeller is under governor control at all times so that constant speed operation is retained in the event of complete failure of the synchronizer system. The synchronizer unit is contained in a moisture-proof case to the right of the copilot's seat. Electrical connections are by individual plugs to ensure correct connections. Incorporated in the synchronizer are 19 relays, three differential motor combinations with solenoids to release the limited range feature, one reversible dc motor and commutator switch combination, one nonreversible dc motor and commutator switch combination, a mechanical electrical switch operated by the master lever at the high speed limit, and the required wiring for these units. Four fuses are incorporated for electrical portection in addition to the circuit breaker panel. Refer to Section VII for operating procedures.

AUTOMATIC FEATHERING FEATURES.

An automatic feathering system will feather the propeller of an engine automatically if the BMEP drops to approximately 93-104 or less and remains there from 1 1/2 to 2 seconds, provided the system is armed and the throttle is beyond the halfway position. This delay is introduced to prevent automatic feathering in the event of momentary power losses and to prevent automatic feathering if the throttle is advanced rapidly enough to close the throttle switch before the BMEP has risen above the setting of the torque pressure switch. A blocking relay will disconnect the entire automatic feathering system after one propeller has feathered automatically.

Master Propeller Pitch Levers.

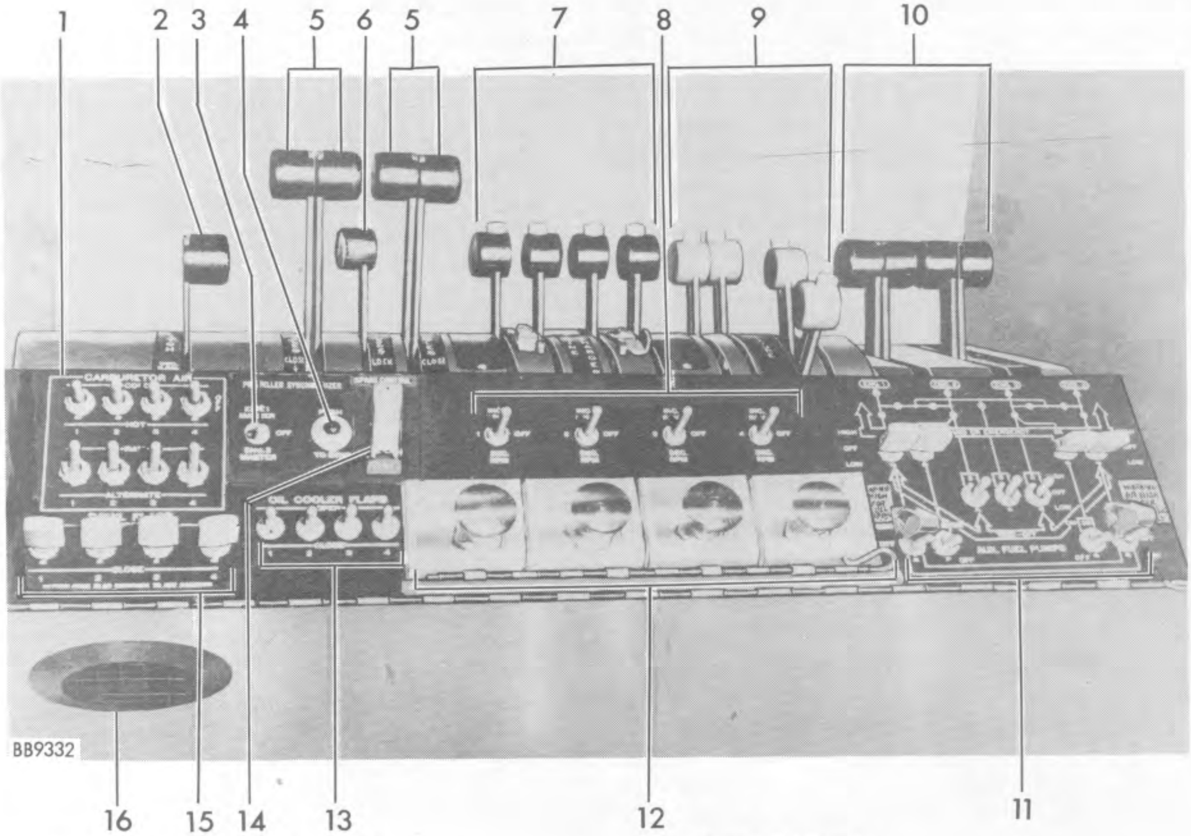
A master propeller lever (8, figure 1-10) is located on the center control stand, and (2, figure 1-14) on the flight engineer's control quadrant. Either lever mechanically resets all four propeller governors simultaneously throughout the governing range and at approximately the takeoff rpm position; it also sets the governors to maximum rpm and actuates the calibrate switch which disconnects the synchronizer from the system. The two master levers are mechanically linked with no override feature for either the pilot or the flight engineer.

Propeller Governor Switches.

Four individual governor switches (8, figure 1-14) are located on the flight engineer's lower switch panel; they are numbered from left to right. Each switch has three positions, INC RPM, OFF, and DEC RPM, and is spring-loaded to the OFF position. Holding the switch in either the INC RPM or DEC RPM position provides dc electrical power to the propeller governor to effect changes in pitch.

FLIGHT ENGINEERS CONTROL QUADRANT AND LOWER SWITCH PANEL

(TYPICAL)



1. CARBURETOR AIR SWITCHES
2. MASTER PROPELLER PITCH LEVER
3. MASTER ENGINE SELECTOR SWITCH
4. SYNCHRONIZER BUTTON
5. THROTTLE LEVERS
6. THROTTLE LOCK
7. ENGINE SUPERCHARGER CONTROLS AND CABIN SUPERCHARGER DISCONNECT LEVERS
8. PROPELLER GOVERNOR SWITCHES
9. MIXTURE LEVERS
10. FUEL TANK SELECTOR LEVERS
11. AUXILIARY FUEL PUMP SWITCHES
12. PROPELLER FEATHERING BUTTONS & LIGHTS
13. OIL COOLER FLAPS SWITCHES
14. MASTER SPARK CONTROL SWITCH
15. COWL FLAPS SWITCHES
16. IGNITION ANALYZER INDICATOR

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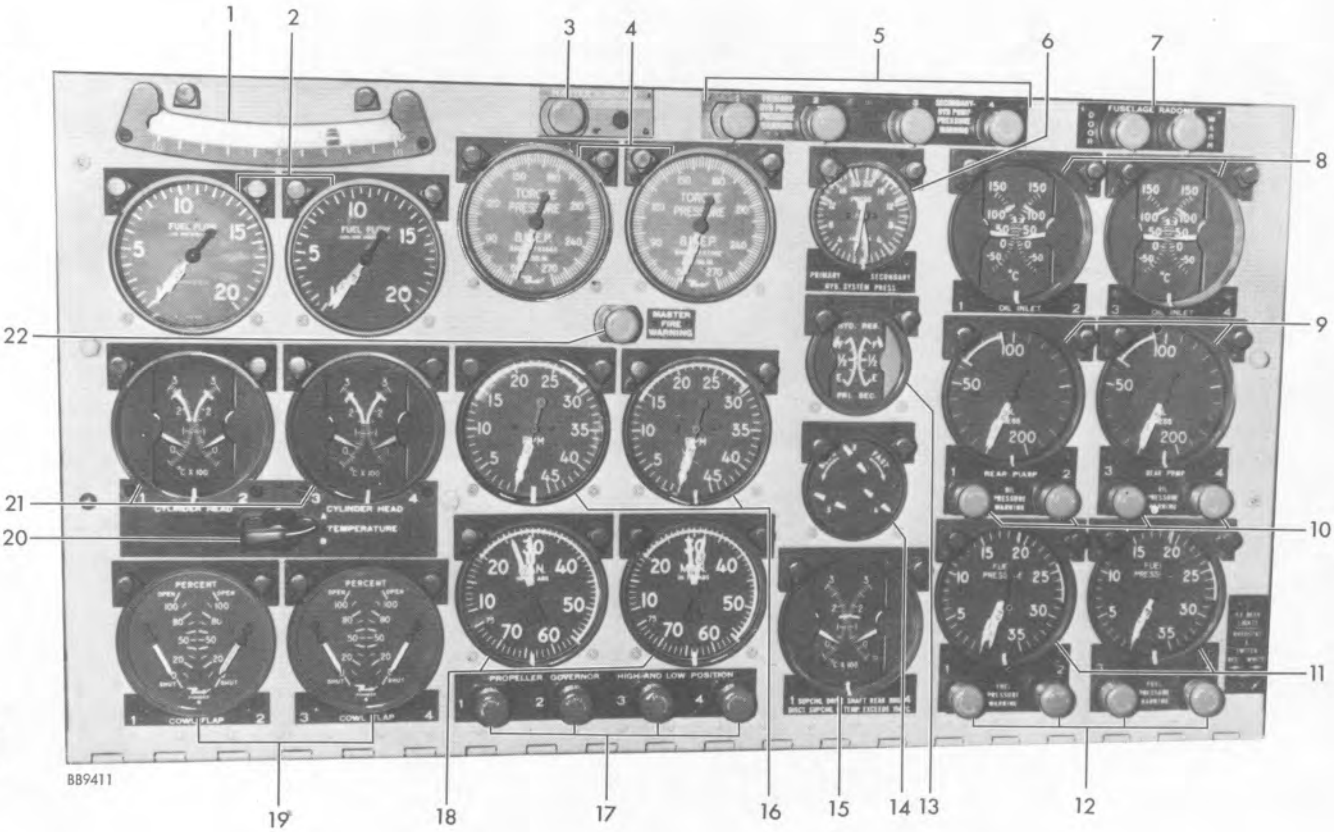
Figure 1-14

FLIGHT ENGINEER'S LOWER INSTRUMENT PANEL
(TYPICAL)



1 INCLINOMETER
2 FUEL FLOW INDICATORS
3 AC GENERATOR MASTER WARNING LIGHT
4 TORQUEMETERS (BMEP INDICATORS)
5 HYDRAULIC PUMPS LOW-PRESSURE WARNING LIGHT
6 HYDRAULIC SYSTEM PRESSURE INDICATOR
7 DOOR WARNING LIGHTS
8 OIL TEMPERATURE INDICATORS
9 OIL PRESSURE INDICATORS
10 OIL LOW-PRESSURE WARNING LIGHTS
11 FUEL PRESSURE INDICATORS
12 FUEL LOW-PRESSURE WARNING LIGHTS
13 HYDRAULIC FLUID QUANTITY INDICATOR
14 SYNCHROSCOPE
15 CABIN SUPERCHARGER DRIVESHAFT REAR BEARING TEMPERATURE INDICATOR
16 TACHOMETER INDICATORS
17 PROPELLER GOVERNOR HIGH AND LOW PITCH POSITION LIGHTS
18 MANIFOLD PRESSURE INDICATORS
19 COWL FLAPS POSITION INDICATORS
20 CYLINDER HEAD TEMPERATURE SELECTOR SWITCH
21 CYLINDER HEAD TEMPERATURE INDICATORS
22 MASTER FIRE WARNING LIGHT

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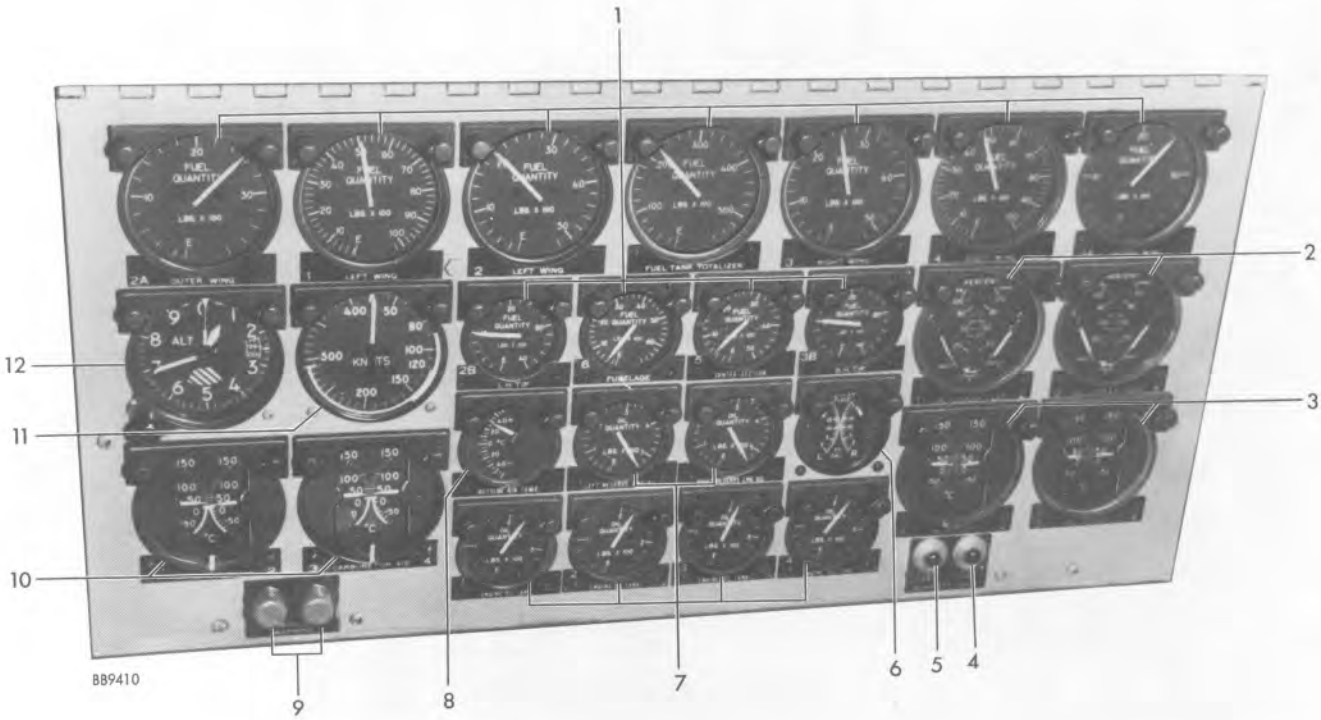
Figure 1-15

FLIGHT ENGINEER'S UPPER INSTRUMENT PANEL
(TYPICAL)



1. FUEL QUANTITY INDICATORS
2. OIL COOLER FLAP POSITION INDICATORS
3. OIL TEMPERATURE INDICATORS (OILOUT)
4. OIL QUANTITY INDICATORS TEST SWITCH
5. FUEL QUANTITY INDICATORS TEST SWITCH
6. ALCOHOL TANK DEICING FLUID QUANTITY INDICATOR
7. OIL QUANTITY INDICATORS
8. OUTSIDE AIR TEMPERATURE INIDCATOR
9. VACUUM WARNING LIGHTS (DEICER)
10. CARBURETOR AIR TEMPERATURE INDICATORS
11. AIRSPEED INDICATOR
12. ALTIMETER

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Figure 1-16

Master Engine Selector Switch.

A master engine selector switch (3, figure 1-14) located on the flight engineer's lower switch panel, selects the synchronization function and permits the selection of engine 1 or 2 as the master engine. It is a toggle-type switch that has three positions, ENG 1 MASTER, OFF and ENG 2 MASTER.

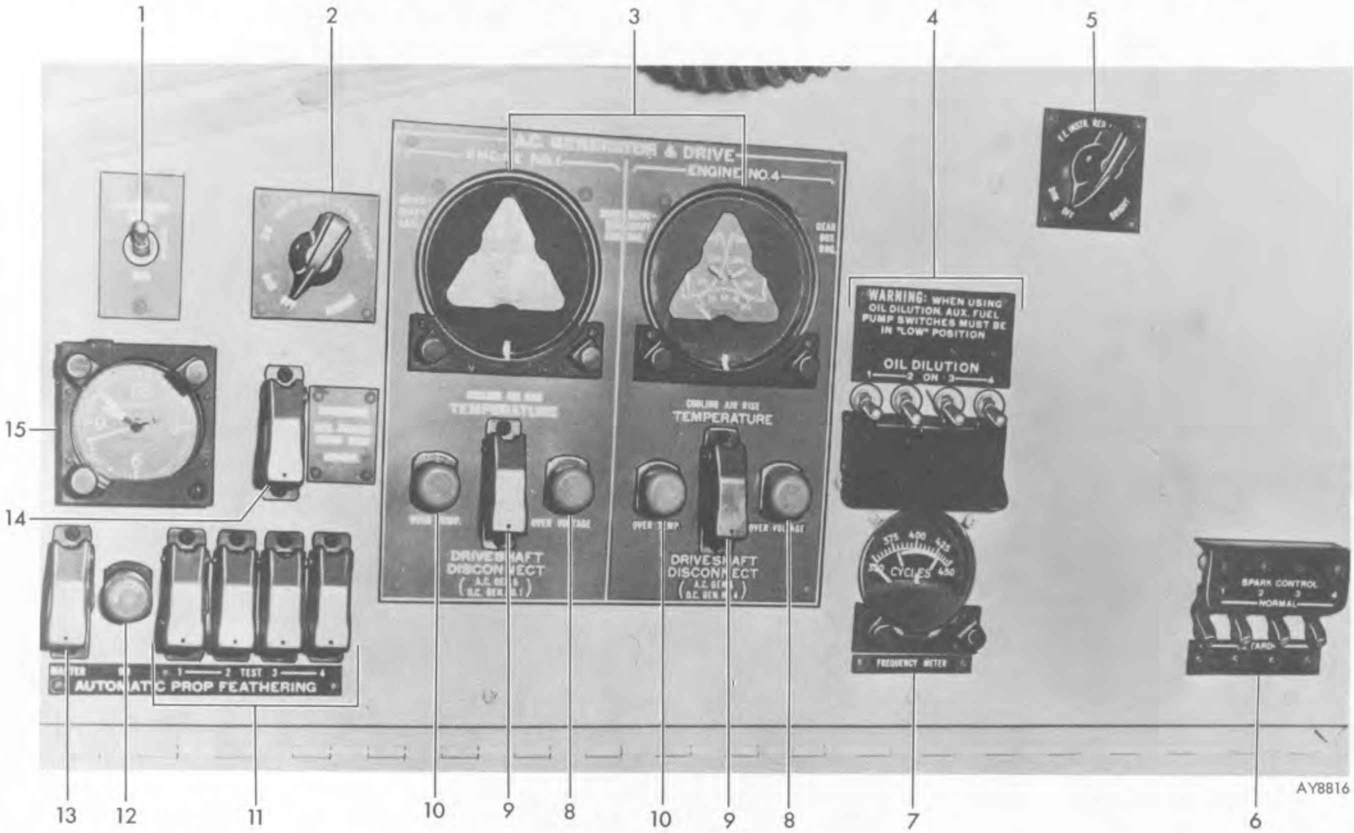
Propeller Feathering Buttons and Lights.

Four individual propeller feathering buttons (12, figure 1-14) are located on the flight engineer's lower switch panel and are numbered from left to right. Each button is protected by a plastic cover to prevent inadvertent feathering. Each cover is marked PUSH FEATHER and PULL UNFEATHER. Pressure on the selected button energizes the auxiliary (feathering) pump, and a holding coil holds the button in during the feathering operation. After the blades have reached the feathered position, the button must be pulled manually to the mid-position to de-energize the circuit and stop the auxiliary (feathering) pump. The feathering button must be held out manually to unfeather a propeller; however, the unfeathering action can be terminated by releasing the feathering button. Operation of any feathering button to the feather or unfeather position will interrupt the automatic feathering circuit of the other three propellers by energizing a feather-interlock relay. A light incorporated in each feathering button glows when the auxiliary (feathering) pump circuit is energized.

Synchronizer Button

The synchronizer button (4, figure 1-14) is located on the flight engineer's lower switch panel. Pushing and releasing this button will automatically release a dc solenoid which will synchronize propellers with the existing rpm indicated on the selected master engine tachometer, provided the

FLIGHT ENGINEER'S UPPER SWITCH PANEL



1 FLIGHT STATION DOME LIGHT SWITCH
2 INSTRUMENT PANEL FLOODLIGHTS SWITCH
3 AC GENERATOR TEMPERATURE INDICATORS
4 OIL DILUTION SWITCHES
5 FLIGHT ENGINEER INSTRUMENT RED LIGHT SWITCH
6 SPARK CONTROL SWITCHES
7 MAIN INVERTER FREQUENCY METER
8 AC GENERATOR OVERVOLTAGE WARNING LIGHT
9 AC GENERATOR DRIVESHAFT DISCONNECT SWITCHES
10 AC GENERATOR OVERTEMPERATURE WARNING LIGHTS
11 AUTOMATIC FEATHERING TEST SWITCHES
12 AUTOMATIC FEATHERING ARMED LIGHT
13 AUTOMATIC FEATHERING MASTER SWITCH
14 HYDRAULIC SYSTEM CROSSOVER SWITCH
15 CLOCK

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Figure 1-17

deviation is less than 3 percent from the master engine rpm. When the button is depressed, synchronization is disconnected and the range limitation feature is released so that it can re-center. Releasing the button reconnects the synchronization or makes the off-speed governors run up to 3 percent toward the master tachometer.

Automatic Feathering Master Siwtch.

A guarded automatic feathering master switch (13, figure 1-17) is located on the flight engineer's upper switch panel. When this switch is in the ON position, a dc holding coil energizes the automatic feathering system. The automatic feathering system is completely armed when this switch is turned on and the throttles are advanced beyond the half-way position.

Automatic Feathering Test Switches.

Four automatic feathering test switches (11, figure 1-17) are located on the flight engineer's upper switch panel. Each switch is protected by a guard which must be lifted before a system test can be made. The test switches bypass the throttle switches and make it possible to test the system by operating the engines at low power with the circuit simulating takeoff power, provided the automatic feathering master switch is ON.

STATION 260 UPPER SWITCH PANEL

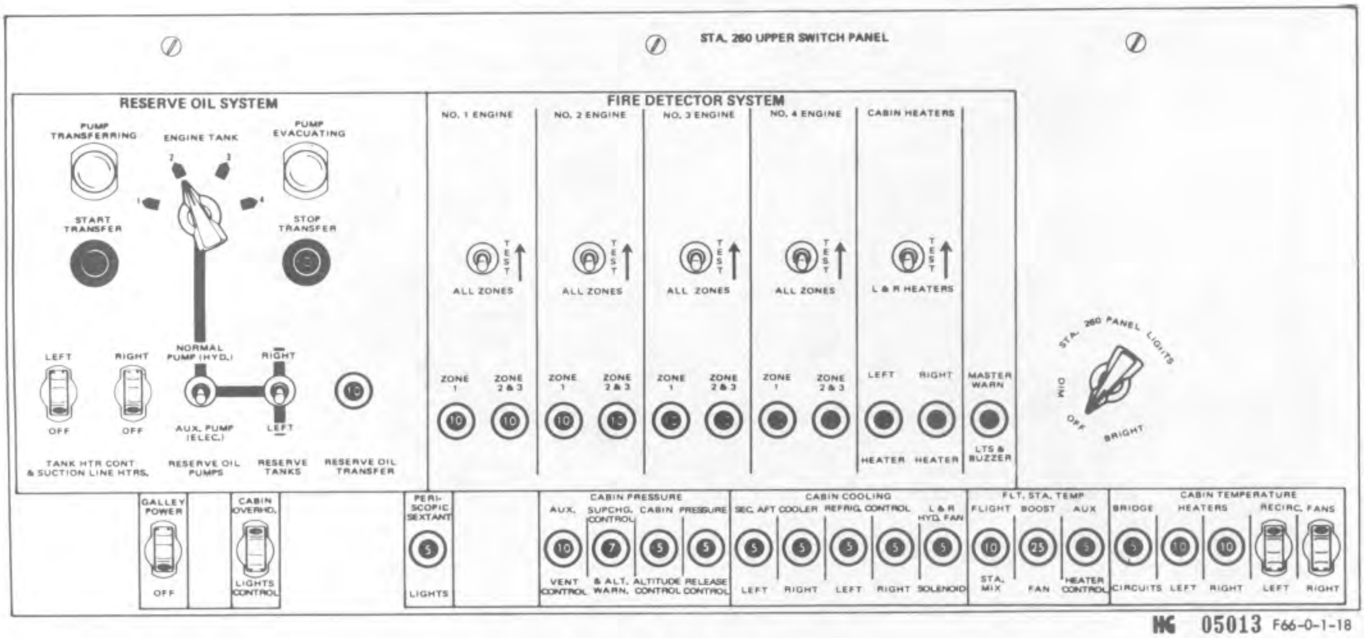

Figure 1-18

Reverse Lock Override Lever.

A guarded flag lever (7, figure 1-10), visible under a cover on the center control stand to the right of the No. 4 throttle lever, indicates when the reverse throttle levers are locked. This flag lever may be pushed down manually to release the reverse throttle lock. The reverse lock actuator is connected by cables to the reverse throttle locking bar which, when turned to the open position, lowers the flag lever and permits the reverse throttle levers to be pulled aft for reverse thrust. An automatic means of releasing the reverse throttle lock is also provided. A switch, mounted on each main landing gear fulcrum, releases the reverse throttle lock when the main gear shock struts pivot rearward as brakes are applied during a rejected takeoff, or as the wheels contact the runway during landing. As this contact is momentary, the action of this switch is maintained by means of a holding relay. These switches will permit use of the reverse thrust power with partial weight on the main gear, and the scissors switch on the left main gear permits the use of reverse thrust power when full weight is on the landing gear. The throttle reverse lock is reset when both outboard throttles are advanced beyond the halfway position and the aircraft weight on the left main landing gear is partially reduced.

Reverse Pitch Throttle Levers.

These reverse pitch throttle levers (4, figure 1-10) control the reverse power range and are discussed under Throttles, this section.

Propeller Reverse Pitch Indicators.

Four dc-operated reverse pitch indicator lights (39, figure 1-6) are mounted on the pilots' center instrument panel. These lights are set to come on 5 degrees before the reverse pitch stops are reached and go out when unreversing is initiated.

Propeller Governor High and Low Pitch Position Lights.

Four dc-operated indicator lights (17, figure 1-15) are located on the flight engineer's lower instrument panel. These lights are set to glow whenever the propeller governors are operating at either the high or low rpm pitch limit setting.

Automatic Feathering Armed Lights.

One, automatic feathering armed light (12, figure 1-17) is installed on the flight engineer's upper switch panel and one light (44, figure 1-6) is installed and on the pilot's auxiliary instrument panel. These lights are dc-operated and are set to glow when the automatic feathering system master switch is ON. When feathering is started automatically, the feathering button light comes on, and when the feathering button is pulled out the feathering button light and the automatic propeller feathering armed light go out.

Synchroscope.

The synchroscope (14, figure 1-15), located on the flight engineer's lower instrument panel, provides indications for synchronizing the four propellers. It is an ac electrical differential motor-type indicator that shows the frequency differences between the tachometer generator output of engine 1, and the output of engine tachometer generators 2, 3, and 4. Since the frequency is proportional to engine speed, the synchroscope provides a visual comparison of engine speeds. The three needles on the face of the instrument indicate the rpm of engines 2, 3, and 4 relative to engine 1. They rotate either clockwise or counterclockwise, depending upon whether the engine speed is faster (clockwise) or slower (counterclockwise) than engine 1. When the speeds of engines 2, 3, and 4 are synchronized with engine 1, the needles are stationary.

OIL SYSTEM.

ENGINE OIL SYSTEM.

Separate oil systems provide lubrication for each engine. (See figure 1-19). Oil flows from the engine oil tank to the engine oil pressure pump which pumps oil through the engine oil passages. After circulating through the engine, the oil is returned by an engine scavenging pump to the oil radiator for cooling. From the radiator, the oil flows through the return line and back into the engine oil tank. (Refer to the Servicing Diagram, figure 1-46, for oil grades and specifications.)

Engine Oil Tanks.

The oil tank for each outboard engine is located in the engine nacelle aft of the firewall, and the oil tank for each inboard engine is located in the center section leading edge, inboard of the engine nacelle. Each engine oil tank has a total volume of 54 gallons which includes an 11.5-gallon expansion and foaming space. The total oil content for each tank is 42.5 gallons, including an oil reserve of 2.5 gallons (which cannot be used by the engine) for feathering the propeller. External filling beyond the prescribed amount, or filling the expansion space, is impossible because of the design and shape of the filler unit. A capacitance-type oil quantity indicating system is installed in each tank to indicate the amount of usable oil. Each tank is also provided with a dipstick, marked in US gallons, encased in a foam-proof tube which is part of the tank filler unit.

Oil Cooler Radiators and Control Valves.

An oil cooler unit is installed on the underside of each engine nacelle. Ram air enters a scoop, passes through the oil radiator, and exits past an oil cooler flap which controls the amount of air necessary for cooling. A control valve, mounted on the oil radiator, automatically routes the flow of oil in one of the following ways:

1. Straight through the valve, bypassing the radiator.
2. Around the jacket of the oil cooler radiator.
3. Through the core of the radiator.

When the engine is started at low ambient temperature, the viscosity of the oil in the cooler prevents the flow of oil through the radiator. Oil pressure builds up in the control valve until the pressure opens the surge valve. When the surge valve is open, the oil cooler radiator is bypassed. As the temperature rises and the oil in the jacket of the radiator becomes more fluid, the pressure decreases and the surge valve closes. The bypass valve to the jacket is opened and as oil is circulated through the jacket, the oil in the core is heated and becomes more fluid until the rate of oil flow is increased and the pressure drops below the closing point of the bypass valve. When the bypass valve is completely closed, the oil is circulated directly through the core of the radiator, back into the control valve, and then out through the exit port to the oil tank return line. Under cruise conditions, oil temperature is further controlled by actuating the oil cooler flap which regulates the amount of air passing through the radiator.

Oil Cooler Flap Switches.

The switches (13, figure 1-14) that operate the cooler flaps are located on the left side of the flight engineer's lower switch panel. These switches are spring-loaded from the OPEN and CLOSE positions to OFF. The cooler flap is moved to the desired position by holding the switch in either the OPEN or CLOSE position, and is stopped at any setting by releasing the switch.

Emergency Shutoff Levers.

Movement of an emergency shutoff lever (25, figure 1-5) to the fourth detent position will shut off engine oil. (Refer to Emergency Equipment, this section.)

Oil Quantity Indicators and Test Switch.

Four ac electrically operated oil quantity indicators (8, figure 1-16) are located at the bottom of the flight engineer's upper instrument panel. These indicators register the oil quantity of each engine tank, and are calibrated in pounds. Depressing a test switch button (5, figure 1-16), installed on the flight engineer's upper instrument panel allows the indicating needle to drop to zero; when the button is released, the needle returns to the accurate quantity reading.

ENGINE OIL SYSTEM

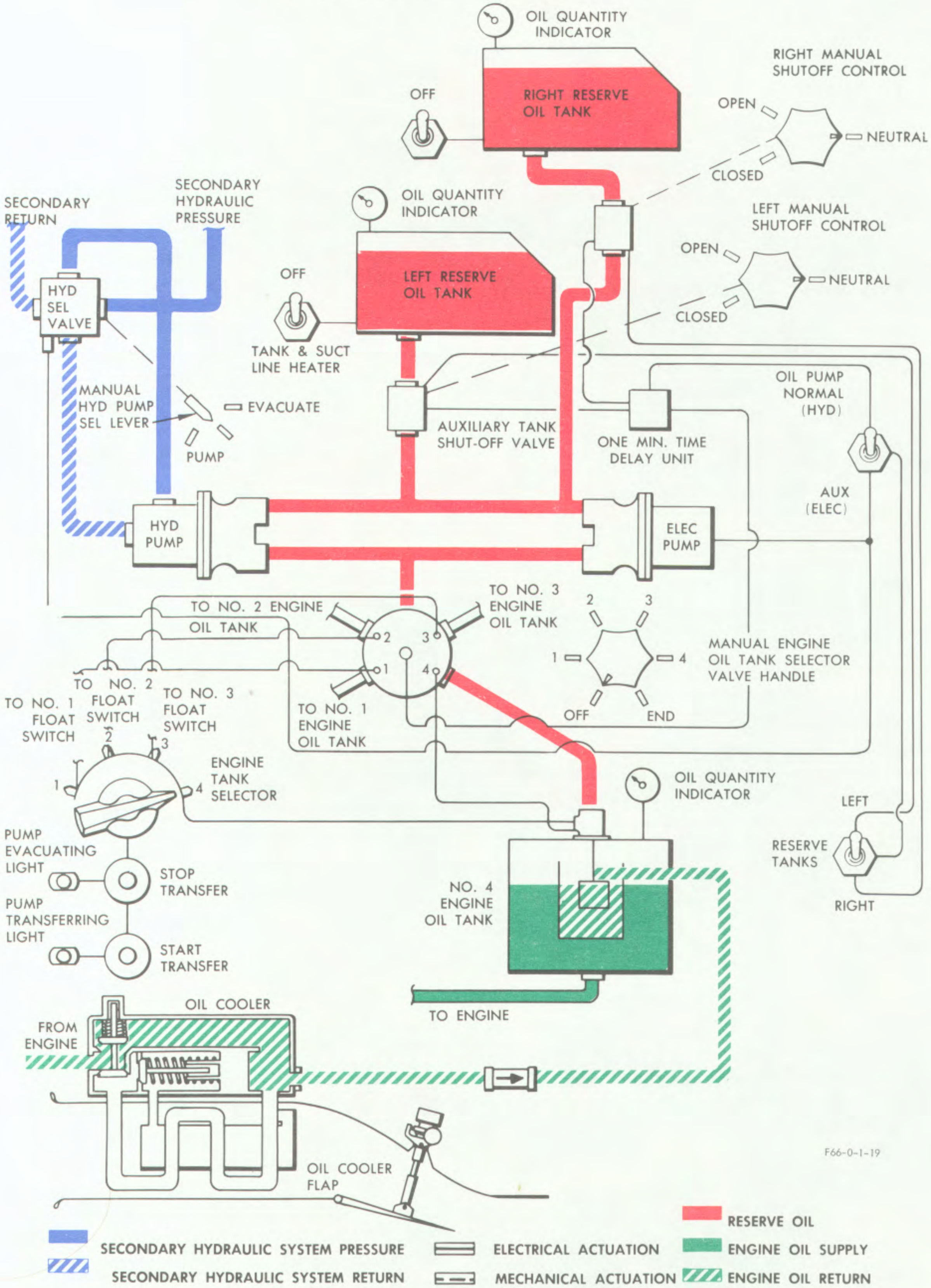

Figure 1-19

Oil Cooler Flap Position Indicators.

Two dual oil flap position indicators (3, figure 1-16) are located on the right side of the flight engineer's upper instrument panel and are marked to register the position of the flaps in percentage of travel from the full open (100 percent) position.

Oil Dilution.

Oil dilution is provided for each engine oil system and is controlled separately or collectively by switches located on the flight engineer's upper switch panel. The oil dilution solenoid valves are located aft of the firewall in each nacelle. Since the connections to the fuel lines are on the suction side of the engine-driven fuel pumps, the auxiliary fuel pumps must be operating while diluting. The fuel is delivered directly into the engine oil-in line.

Oil Dilution Switches.

Four dc-operated switches (4, figure 1-17) are located on the flight engineer's upper switch panel. They are spring-loaded to the OFF position. In the ON position, each switch opens a solenoid valve which admits fuel into the corresponding engine oil inlet line when the auxiliary fuel pumps are on.

CAUTION

Oil dilution is not recommended. The engine oil tanks do not include hoppers.

RESERVE OIL SYSTEM.

A reserve engine oil system permits the selective addition of oil to each engine oil tank from two reserve oil supply tanks. (See figure 1-19.) These supply tanks are insulated cell-type bladder tanks and have a usable fluid capacity of 67 gallons each. The cells are located in the outer bays of the center section aft of the front beam. The filler units are located in each wing-to-fuselage fillet and contain air vent shutoff valves and dipsticks marked in gallons. Each tank unit includes internal thermostatically controlled heating elements, laced to the cell walls and suspended approximately 1 inch above the bottom of each cell. The thermostats are set to maintain the oil temperature between 70 degrees and 100 degrees fahrenheit. Oil quantity transmitters are also provided in each tank.

Transfer System.

The reserve oil system includes a dc electric motor-driven engine tank selector valve with a manual override control to preselect the engine tank that requires replenishing. One reversible electrically operated pump and one reversible hydraulically operated pump are installed in the forward cargo compartment just forward of the front wing beam. Either pump will transfer oil to an engine tank at the rate of 3 gallons per minute at an oil temperature of 70 degrees fahrenheit. The reversing feature of these pumps is for evacuating the system lines after transfer operation in order to prevent the oil from congealing in the lines. Integral relief valves are provided in each pump for system protection. A float switch is installed to reverse the pump automatically for the evacuating operation which is set for 60 seconds duration. An additional oil float shutoff valve is also installed in each engine oil tank and is set to automatically close the inlet valve when the maximum filling level has been reached.

Auxiliary Oil Manual Transfer Panel.

In the event of electrical power failure, an auxiliary oil manual transfer control panel (figure 1-20) is provided for operation of the system. This panel, located under the floor forward of the front wing beam, includes three manual override controls to actuate the hydraulically driven oil pump and valves. Access to the panel is gained through a hatch on the floor between the emergency exits. (Refer to Section VII for sequence of operation of the auxiliary oil manual transfer system.)

Engine Oil Tank Selector Switch.

The engine oil tank selector switch is located on the station 260 upper switch panel and has four positions, 1, 2, 3, and 4. (See figure 1-18.) This switch actuates a dc motor to select the engine oil tank to be supplied.

Start Transfer Button and Pump Transferring Light.

The start transfer button is located on the station 260 upper switch panel. (See figure 1-18.) This button is depressed to start the transfer operation. The adjacent pump transferring light glows as long as the system is transferring oil.

Reserve Oil Tank and Suction Line Heater Switches.

Two switches, a reserve oil tank, and a suction line heater switch are located on the station 260 upper switch panel. (See figure 1-18.) These switches have two positions: one, LEFT and OFF; and the other, RIGHT and OFF. When these switches are operated to LEFT and RIGHT (on) positions, the tank heating element raises the oil temperature in the reserve oil tanks to the maximum set limit of the heating element thermostat (100^{o}F). When the maximum limit has been reached, the thermostat will automatically shut off the heating element. As long as the switch is ON the thermostat will maintain the temperature between 70 degrees and 100 degrees Fahrenheit.

AUXILIARY ENGINE OIL TRANSFER PANEL

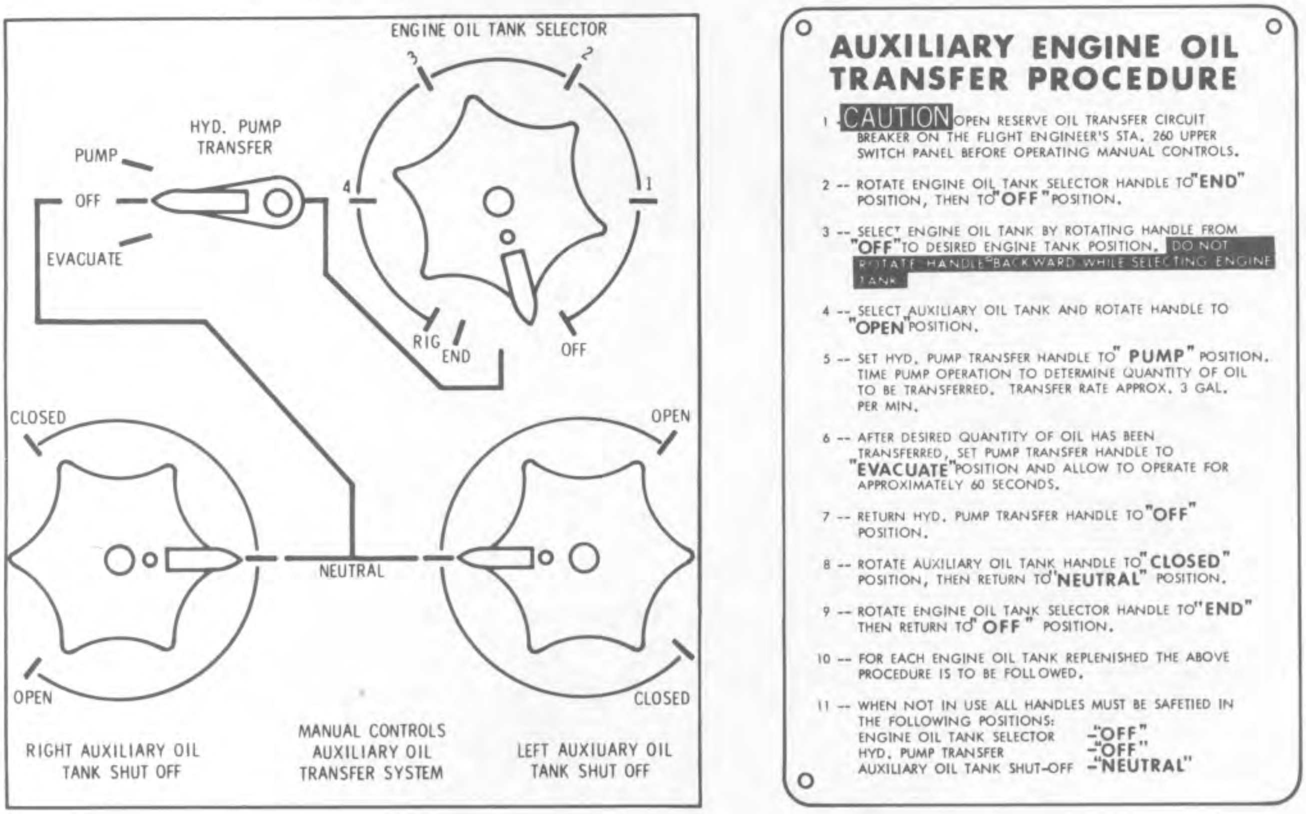

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Figure 1-20

Stop Transfer Button and Pump Evacuating Light.

The stop transfer button located on the station 260 upper switch panel (figure 1-18), is depressed to stop the oil transfer operation. This switch overrides the tank float switch. The adjacent pump evacuating light indicates that the transfer operation has stopped and that the pump has reversed and is evacuating oil from the lines.

Reserve Oil Pump Selector Switch.

The reserve oil pump selector switch is located on the station 260 upper switch panel (figure 1-18) and has two positions, NORMAL PUMP (HYD), and AUX PUMP (ELEC). It is used to select (by a dc electric actuator) either the electric or hydraulic transfer pump.

Reserve Oil Tank Selector Switch.

The reserve oil tank selector switch is located on the station 260 upper switch panel (figure 1-18) and has two positions, LEFT and RIGHT. It is used to select (by a dc electric actuator) either the right or left reserve tank.

Engine Oil Tank Selector Handle.

The engine oil tank selector handle is located on the auxiliary engine oil transfer panel (figure 1-20) under the cabin floor forward of the front wing beam and is used to override the motor-driven engine tank selector valve. When this handle is used it must be rotated from the OFF position through the four engine tank stops to the END position, back to OFF, and then to the desired engine tank number. The purpose of this procedure is to sequence the cam linkage arrangement properly to mechanically assure positive and correct tank selection.

Hydraulic Pump Transfer Handle.

The hydraulic pump transfer handle, located under the cabin floor forward of the front wing beam on the auxiliary engine oil transfer panel (figure 1-20), can be used to manually control the direction of rotation of the hydraulic pump that pumps the engine oil from the reserve oil tank. It has three positions, OFF, PUMP, and EVACUATE.

Auxiliary Oil Tank Shutoff Handles.

The two manual auxiliary oil tank shutoff handles are located under the cabin floor forward of the front wing beam on the auxiliary engine oil transfer panel (figure 1-20). These handles are used to mechanically select either the right or left reserve oil tank. They are labeled OPEN, NEUTRAL, and CLOSED. They manually override the motor-driven shutoff valves. The NEUTRAL position restores electrical control. If the normal transfer panel (station 260 panel) is inoperative, the circuit breakers must be pulled before operating the manual transfer panel.

Reserve Oil Quantity Indicators.

Two oil quantity indicators (8, figure 1-16) are located on the flight engineer's upper instrument panel. The indicators register (by ac transmitters) the oil quantity in pounds.

FUEL SYSTEM.

Fuel is carried in six integral wing tanks (No. 1, 2, 2A, 3, 3A, and 4), one bladder-type center section tank (No. 5), one fuselage tank (No. 6), and two wing-tip tanks (No. 2B and 3B). A fuel crossfeed system is installed to provide fuel flow from tanks 1, 2, 2A, 3, 3A, 4 and 5 to any engine. (See figure 1-21.)

NOTE

The recommended fuel consumption sequence is given in Section VII.

Provisions are made for dumping fuel from all tanks except No. 5. Tank 6 must be transferred to 1 and 4 to enable dumping. Each tank contains a submerged auxiliary fuel pump. Tanks 2A, 3A, 1, and 4 are provided with float valves which automatically open when the fuel level in these tanks reaches a predetermined level (approximately 150 gallons below the full level), allowing fuel to be pumped from tanks 2B and 3B to tanks 2A and 3A and tank 6 to tanks 1 and 4. For fuel tank capacities refer to Fuel Quantity Data, this section; for fuel grades and specifications refer to figure 1-46. Fuel for cabin heaters is supplied from engines 2 and 3 feed lines.

A surge box, which traps fuel when the attitude of the aircraft is other than straight and level, is located in the inboard aft corner of each integral wing tank. From the surge box, fuel flows to an electric motor-driven submerged auxiliary fuel pump located in the aft inboard corner of each tank. The auxiliary fuel pump for tank 5 is located in the right outboard cell of that tank. Tank 6 has two submerged fuel pumps. Each pump is controlled from the flight engineer's lower switch panel and pumps fuel under pressure to tanks 1 and 4. There are five tank selector valves in the system: three, serving tanks 1, 5, and 4, are two-way valves; the remaining two, serving tanks 2A, and 2, and 3A and 3, are three-way valves. From the selector valves fuel flows through micronic filters to the four 2-way cable-operated crossfeed valves. When the crossfeed valves are closed, fuel will flow directly to the engine associated with each tank after passing through one of the four cable-operated emergency shutoff valves, engine-driven fuel pumps, fuel-flow transmitters, and carburetors. A thermal relief valve is located in the crossfeed line to relieve pressure resulting from expansion when the crossfeed valves are closed. An additional thermal relief valve is in the system downstream of each emergency shutoff valve to relieve pressure in the fuel lines caused by fuel expansion when the emergency shutoff valves are closed. Water drain valves are located at low points in the system.

FUEL TANKS.

Tanks 1, 2, 3, and 4 are located in the inner wing panels. Tanks 2A and 3A are in the outer wing panels. A center section tank, No. 5, is located between the front and rear wing beams. This tank is lined with a bladder-type cell that, once it has been filled with gasoline, will tend to weather and crack if left dry. Although all but 11 gallons of fuel can be used, it is advisable, for cell preservation, to leave 50 gallons in the tank if it is not to be used for 10 days or longer. Tank 6 is located in the fuselage under the cabin floor, immediately aft of the wing trailing edge. The wing-tip tanks, 2B and 3B, cannot be jettisoned but are detachable. A different wing tip must be installed when the tip tanks are removed.

Filler Wells and Dipsticks.

Each integral fuel tank has a filler well, located in the upper surface of the wing, and must be filled separately. The filler well for tank 5 is located in the upper surface of the right wing fillet. Tank 6 filler well is located on the right side of the fuselage, aft of the wing trailing edge. Two plastic fuel-measuring dipsticks are stowed in the flight station on the station 260 bulkhead near the crew door. One dipstick is calibrated for use in tanks 1, 2, 3, 4, 5, 2A, and 3A. The other dipstick is calibrated for tanks 6, 2B, and 3B. These dipsticks are used in the tank filler wells, and because of wing dihedral, will not record low fuel levels.

Vapor Return Lines.

The vapor return lines from engines 1 and 2 are routed to fuel tank 1 and the lines from engines 3 and 4 are routed to tank 4. A check valve in each vapor return line allows vapor flow only to the tank.

FUEL SYSTEM

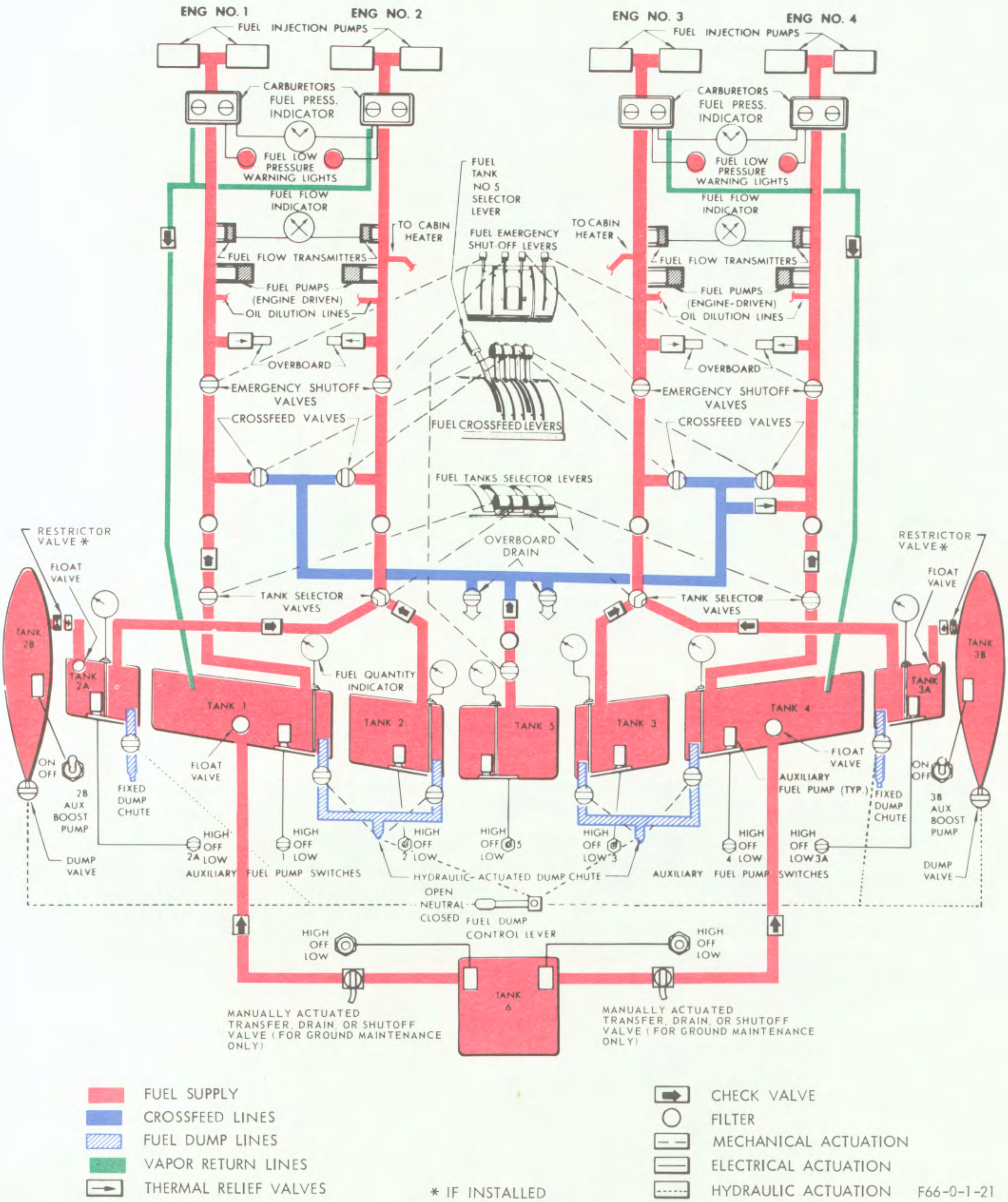


Figure 1-21

Fuel Tank Vents.

Fuel is vented from each wing tank through vent lines to a common flush-type vent in the lower surface of the outer wing panels. Separate overboard lines are teed into the vent lines which incorporate pressure and suction relief valves to prevent any possibility of excessive pressure existing in the tanks if icing should close the flush-type vent. The vent line from tank 5 extends to the flush vent on the left wing. A suction relief inlet for this tank is located beneath the fuselage, and the pressure relief scarf-type vent is located inboard of the left wing tank scarfed vents. Tank 6 vents from a small mast on the fuselage centerline and incorporates a suction relief valve at the high point of the vent line. Each tip tank has its own vent system including sniffle valve, float shutoff valve, flush ram scoop, and scarfed-type overboard line.

FUEL SYSTEM CONTROLS AND INDICATORS.

Fuel Tank Selector Levers.

There are five fuel tank selector levers that mechanically control the opening and closing of the fuel tank shutoff valves. Four of these levers (10, figure 1-14) are located on the flight engineer's control quadrant. The two outside levers have two positions, ON and OFF, and control tanks 1 and 4. The left inside lever is placarded OFF, No. 2, and No. 2A. The right inside lever is placarded OFF, No. 3, and No. 3A. Either of the two tanks placarded on each inside lever quadrant may be selected, but not both at the same time. The lever for the center section fuel tank (tank 5) is located on the flight engineer's auxiliary control quadrant (1, figure 1-22), inboard of the fuel crossfeed levers. This is a two-position lever, OPEN and CLOSED, that mechanically controls the tank shutoff valves from tank 5 to the crossfeed line.

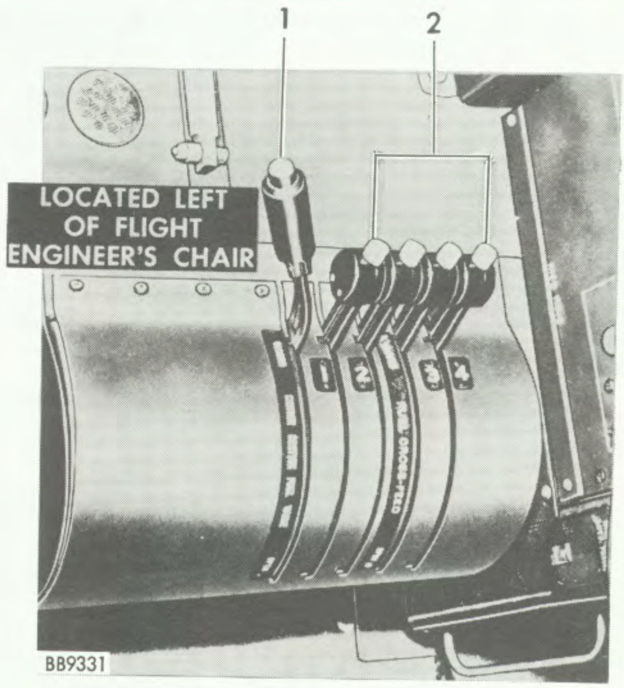
Fuel Crossfeed Levers.

Four 2-position fuel crossfeed levers (2, figure 1-22), are located on the flight engineer's auxiliary control quadrant. They are placarded OPEN and CLOSED and are numbered to correspond to the engine positions. These levers are used to direct fuel from the tanks to any engine combination. They mechanically operate the fuel crossfeed valves through control cables.

Auxiliary Fuel Pump Switches.

Eleven auxiliary fuel pump control switches (11, figure 1-14) are located on the right side of the flight engineer's lower switch panel. These switches are arranged on the panel according to the fuel tank locations. The switches for tanks 2B and 3B are labeled ON and OFF. All other

FLIGHT ENGINEER'S AUXILIARY CONTROL QUADRANT



1. TANK NO. 5 FUEL SELECTOR LEVER
2. FUEL CROSSFEED LEVERS

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Figure 1-22

auxiliary fuel pump switches have three positions, HIGH, OFF, and LOW. The HIGH and LOW positions control the dc-pump operating speeds.

CAUTION

Number 6 tank fuel pump switches have red guards to prevent inadvertent operation in the HIGH position. The switches for tanks 6R and 6L should not be in the HIGH position except during fuel dumping operations. In the event of a float-valve malfunction in tank 1 or 4, the HIGH position will deliver pressure to tanks 1 and 4 in excess of their design strength.

FUEL QUANTITY DATA

TANK NO.	USABLE FUEL		FULLY SERVICED		FUEL THAT CAN BE READ ON DIPSTICK	USABLE FUEL REMAINING AFTER DUMPING	
	Pounds	Gallons	Pounds	Gallons	Gallons	Pounds	Gallons
2B	3600	600	3606	601	25 to 600	144	24
2A	3390	565	3420	570	300 to 565	894	149
1	9330	1555	9396	1566	700 to 1555	870	145
2	4740	790	4836	806	300 to 790	732	122
5	4380	730	4446	741	350 to 730	4380	730
6	6000	1000	6138	1023	450 to 1000	—	—
3	4740	790	4836	806	300 to 790	732	122
4	9330	1555	9396	1566	700 to 1555	870	145
3A	3390	565	3420	570	300 to 565	894	149
3B	3600	600	3606	601	25 to 600	144	24
TOTAL	52,500	8750	53,100	8850		9660	1610

Note: Pounds of fuel based upon weight of 6.0 lb/gal.

Emergency Shutoff Levers.

Moving the emergency shutoff levers (25, figure 1-5) to the third detent position shuts off the fuel. (Refer to Emergency Equipment, this section.)

Fuel Quantity Indicators and Test Switch.

Eleven ac capacitance-type fuel quantity indicators (1, figure 1-16) are located on the flight engineer's upper instrument panel. Individual indicators for the ten fuel tanks and a totalizer indicator are provided to indicate the total fuel in all tanks. These indicators show fuel weight in pounds. There is a pushbutton fuel quantity indicator test switch (6, figure 1-16) located on the flight engineer's upper instrument panel. When pushed in, it disconnects the electrical circuit from the fuel quantity indicators and the needles should move toward empty. When released, the needles should return to their original positions. This provides a check to show whether the indicators are sticking or giving erroneous readings.

FUEL DUMP SYSTEM.

Fuel may be dumped simultaneously from all integral wing tanks and tanks 2B and 3B by moving a single dump control lever (figure 1-23) located under the station 260 step. Fuel from tanks 1, 2, 3 and 4 flows through two hydraulically operated dump chutes, one located in each inboard engine nacelle tailcone. Each of these tanks has an independent valve that is opened or closed mechanically by means of a linkage system connected to the dump chute. Fuel from tanks 2A and 3A flows through two fixed dump chutes located at the trailing edge of each outer wing panel. Tanks 2B and 3B each have a fixed dump chute. The dump valves for tanks 2A, 3A, 2B, and 3B are hydraulically operated. Standpipes are installed in fuel tanks 2A, 1, 4, and 3A to limit the amount of fuel that can be dumped from these tanks. There are no provisions for dumping fuel from tank 5. Fuel from tank 6 may be pumped to tanks 1 and 4 from which fuel may be dumped.

Fuel Dump Lever (Station 260).

The fuel dump control lever (figure 1-23) is located in the flight station step at station 260, and is accessible through a hinged door. The three-position lever is placarded OPEN, NEUTRAL, and CLOSED. When the lever is in the OPEN position, secondary hydraulic system pressure operates actuating cylinders which open the dump valves for tanks 2A, 2B, 3B, and 3A, and extend the dump chutes for tanks 1, 2, 3, and 4. When the lever is in the NEUTRAL position, action stops and secondary hydraulic system pressure is removed from the actuating cylinders. The CLOSE position of the lever reverses the direction of hydraulic fluid flow to the actuating cylinders which then retract the dump chutes for tanks 1, 2, 3, and 4 and close the dump valves for tanks 2A, 3A, 2B, and 3B. Gravity provides the force for dumping.

FUEL DUMP CONTROL LEVER (STATION 260)

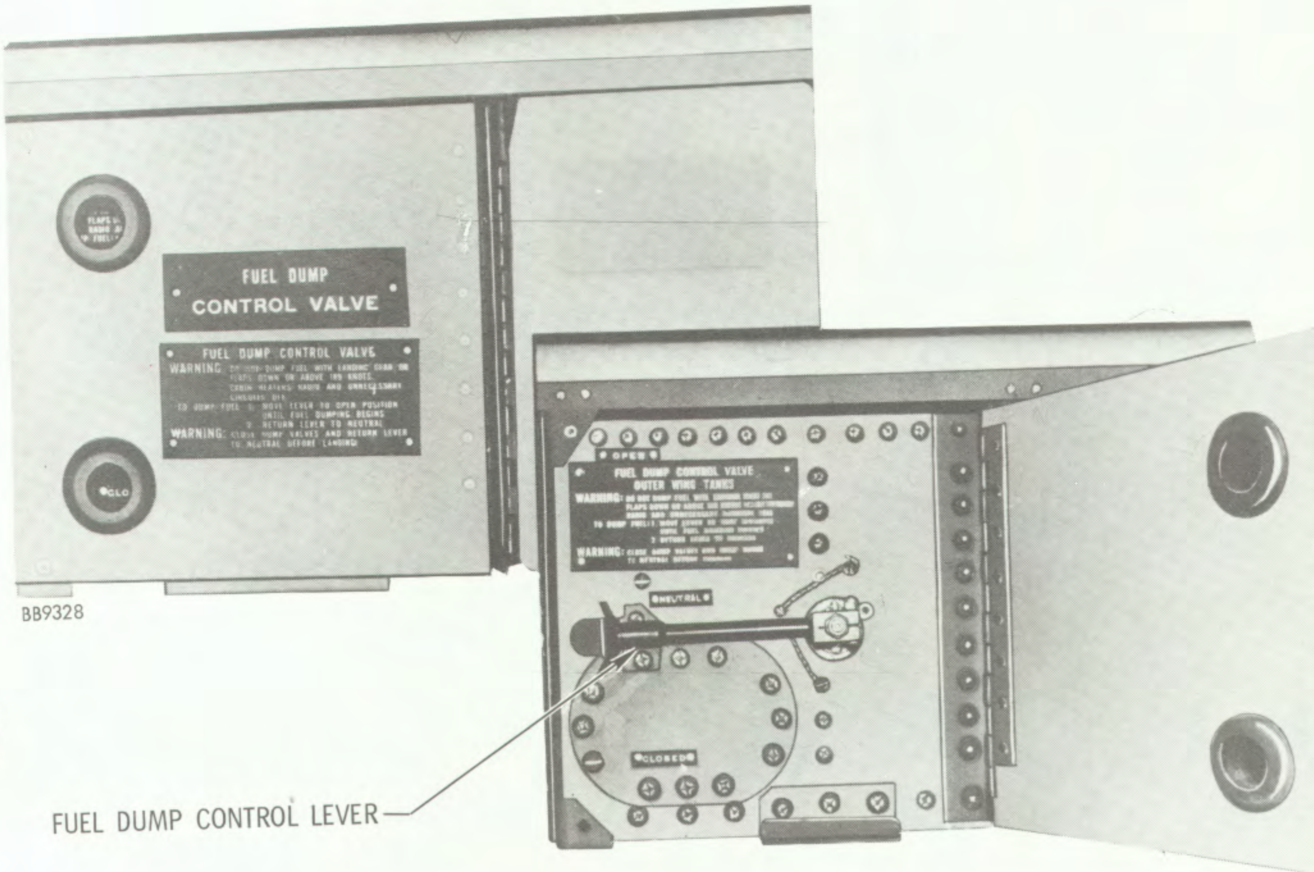


Figure 1-23

Fuel Dump Lever (Emergency).

If secondary hydraulic system pressure is not available, fuel may be dumped by using the emergency hydraulic system. An emergency fuel dump selector lever is located near the floor at the right of the copilot's seat. (See figure 1-31.) This lever has two positions, L.G. EMER EXT and FUEL DUMP. When the lever is in the FUEL DUMP position and the hand pump selector lever is in the aft (EMER GEAR) position, the hand pump can be used to supply hydraulic pressure for the dumping operation, provided the fuel dump lever at station 260 is positioned properly. If secondary hydraulic system pressure is not available, fuel may be dumped without the use of the emergency hydraulic system by use of the hydraulic system crossover switch. (Refer to Hydraulic System Crossover Valve, this section.)

ELECTRICAL SYSTEM.

Aircraft basic electrical power is furnished by two primary systems, a 28-volt dc system and a 115-volt ac system. Six dc generators, two ac generators, and six basic inverters are utilized to provide power for the various electrical systems. (See figures 1-25 and 1-28.) Each inboard engine drives two dc generators and each outboard engine incorporates a driveshaft which drives a gearbox on which is mounted one dc and one ac generator. These gearboxes can be disconnected from the engine while the engine is running by using the disconnect switches on the flight engineer's upper switch panel. A minimum of 1600 rpm is recommended for positive disconnect. Once disconnected, these gear boxes cannot be reconnected in flight. Three external power receptacles are installed in the fuselage between the No. 2 and 3 engines. Two receptacles are for dc power and the third is for ac power.

CIRCUIT BREAKER PANELS
(TYPICAL)

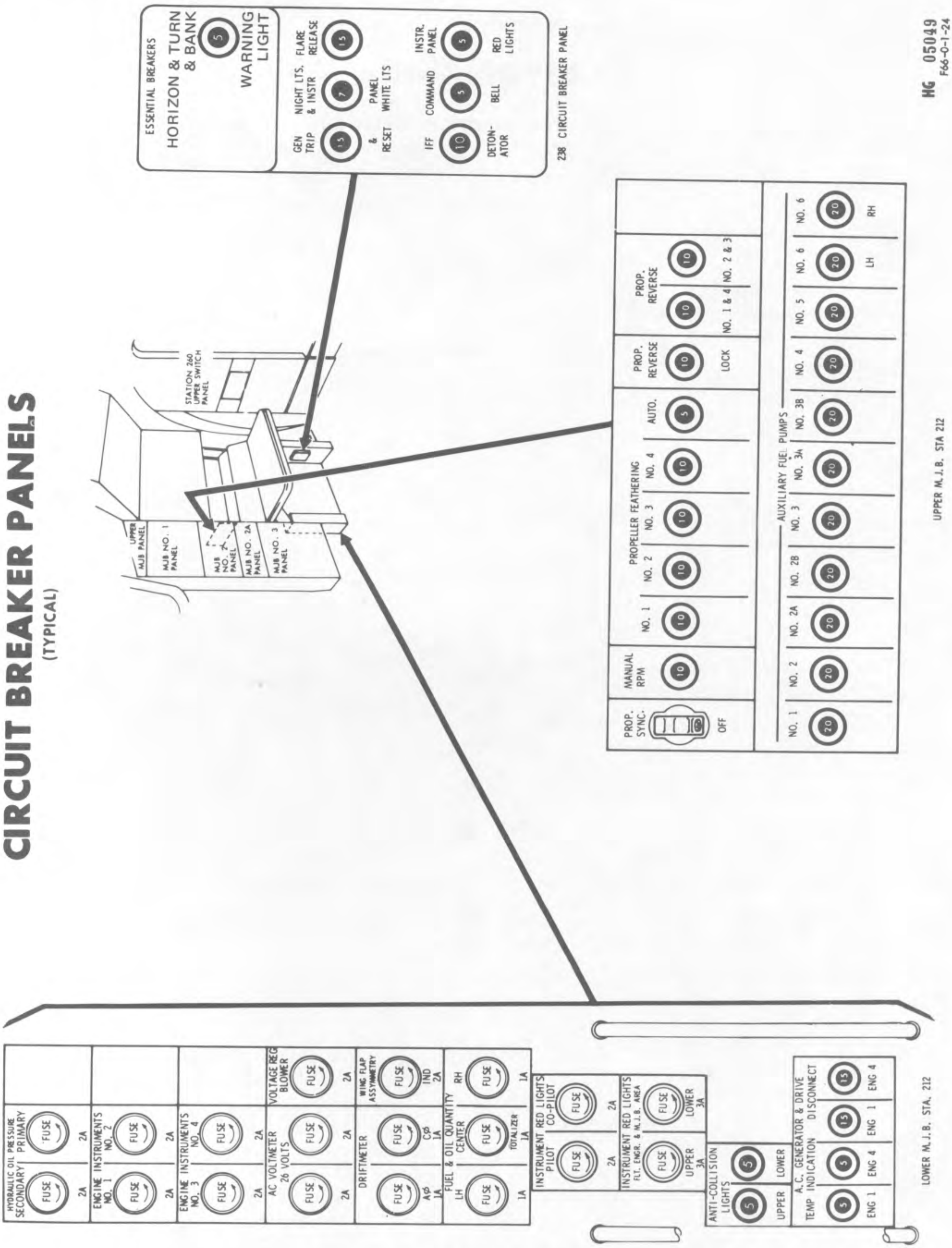


Figure 1-24

DC POWER DISTRIBUTION

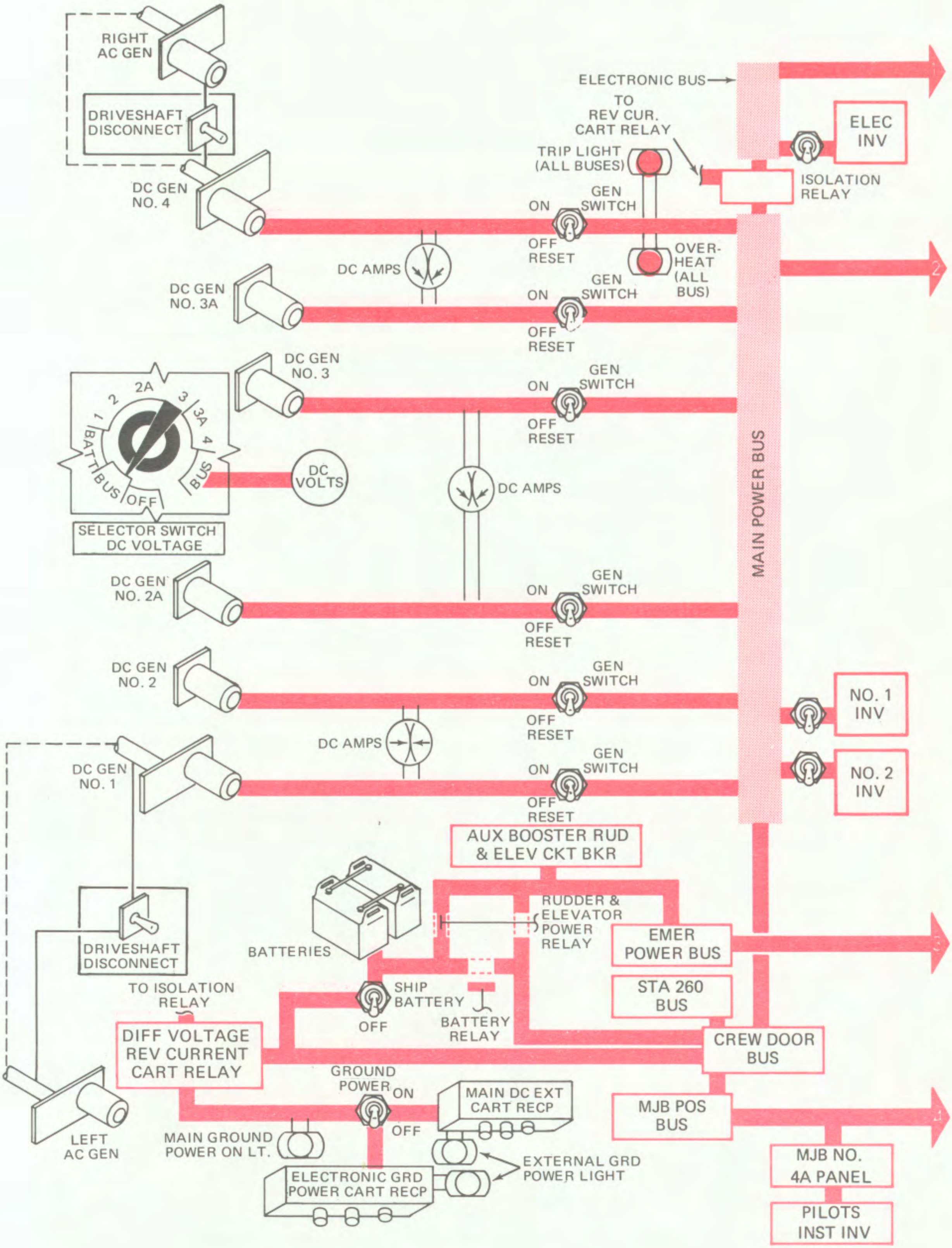


Figure 1-25 (Sheet 1 of 2)

1

DC EXTERNAL POWER CONTROL RELAYS
INVERTER BLOWERS
RADAR BLOWERS FORWARD & AFT
RADAR LOADS

2

AFT ALDIS LITES
ASTRO DOME LITES
BLAST TUBE SHUTOFF ACTUATOR
CABIN HEATERS
CABIN OVERHEAD LITES
DC RADIO EQUIPMENT
ELEC. BUS DC EXT PWR CONTACTOR
FLEX ARM & TABLE LITES
FLT STA AUX HEATER
GALLY POWER FEED
LANDING LITES
LAVATORY LITES
READING LITES
REFRIGERATOR
RESERVE OIL AUX PUMP
RESERVE OIL TANK HTRS
SOLDERING IRON OUTLETS

3

COMMAND BELL
FIRE DETECTION SYS (STA 260 UPP PNL)
FIRE EXTINGUISHER CKT BKR PNL (STA 260)
FLARE RELEASE
GENERATOR TRIP AND RESET
HORIZON & T & B POWER FAIL WARNING LITES
INST PANEL RED LITES
NITE LITES & INTER. PANEL WHITE LITES

4

(NOTE: MJB POS. BUS POWERS MJB PNLS 2.2A, 3, AND UPP. & LWR STA 212 PNLS)

AC GENERATOR AND DRIVE
ALDIS SIGNAL LITE OUTLET
ANTI COLLISION LITES
AUX FUEL PUMPS
CARB. ALTERNATE AIR
CARB. ALTERNATE FUEL SOURCE EMERG.
CARB. DE ICE
CARB, OIL, & AIR TEMP
CARB. PREHEAT
CARGO COMPARTMENT LITES
COWL FLAP CONTROL
CYL. HEAD & SUPCHG. BEARING TEMP
DE ICE PUMP
EXTERNAL LITES MASTER (WING & TAIL)
FLASHER CODER & FUS. LITES
FLT. PATH CONTROL
FLT. STATION LITES
HYD. OIL QUANTITY
HYD. SYSTEM CROSSOVER
INST. INVERTER CONTROL
LANDING GEAR & FLAP POSITION
LANDING LITE METERS
L.E., TAXI, & LANDING LITE RELAY
MANUAL RPM
NESA WINDSHIELD CONTROL DC
OIL COOLER FLAP
OIL DILUTION
PB-10A AUTOPILOT
PITOT HEATER
PROP. FEATHERING
PROP. REVERSE
PROP. REVERSE LOCK
PROP. SYNC
SPARK CONTROL MASTER
STARTER CONTROL
TAXI LITES
WARNING LITES (PILOT & FLT. ENGR.)
WINDSHIELD DEFOGGER
WINDSHIELD WIPER
WING FLAP SHUTOFF
DE-ICER TIMER

Figure 1-25 (Sheet 2 of 2)

DC ELECTRICAL SYSTEM.

All circuits are single wired, ground return except those forward of station 260 which carry steady current loads. These are two-wire installations to minimize deviation of the standby compass. Power is supplied by six engine-driven dc generators (1, 2, 2A, 3, 3A, and 4) and two 24-volt storage batteries installed in the nosewheel well. The dc generators can be controlled individually and connected for parallel operation. A differential reverse-current relay and a voltage regulator are provided for each dc generator and its protective system. Regulators No. 1 and No. 2 are located just aft of the pilot's seat under the floor; No. 2A and No. 3A are just forward of the copilots' seat under the floor; No. 3 and No. 4 are just aft of the copilot's seat under the floor. The differential voltage reverse-current relays are located in the forward lower compartment. Three ac motor-driven blowers provide cooling air for the voltage regulators.

DC Generator Switches.

Each dc generator is controlled by a three-position switch (5, figure 1-26) located on the MJB No. 1 switch panel. The switch has three positions, ON, OFF, and Reset. Each switch is spring-loaded from Reset to the OFF position. When a generator switch is in the ON position, output of the generator is connected to the main dc bus provided load and special conditions are correct. The down position (reset) is a momentary contact position which resets the field relay if it is tripped by overvoltage or by reversed generator polarity. If the relay was tripped by a feeder fault, it cannot be reset until the forward current relay in the forward cargo compartment is reset. This must not be done, however, until the fault is located and cleared. In the OFF position the generator is disconnected from the dc bus, but the field is not deenergized.

DC Generator Field Circuit Breakers.

Each generator is provided with a switch-type circuit breaker for emergency use. These circuit breakers (8, figure 1-26) are located on the MJB No. 1 switch panel and are guarded in the ON position. These circuit breakers should be moved to the OFF position only when it is necessary to deenergize the generators completely in the event the protection system malfunctions. They should not be used as generator switches and should be opened or closed only when the associated generator switch is in the OFF position.

Battery Switch.

A two-position battery switch (24, figure 1-26) placarded SHIP BATTERY and OFF, is located on the MJB No. 1 switch panel. Moving the switch to the SHIP BATTERY position connects the aircraft batteries to the airplane main dc bus.

External Power Switch.

The external power switch (25, figure 1-26), located on the MJB No. 1 switch panel, is placarded EXT POWER and OFF. In the EXT POWER position, the short prong of the cart receptacles closes the cart relay, and power from the cart is connected to the main dc bus. A cart relay is installed in the cart power circuit to provide automatic protection against reversed polarity, differential voltage, and reversed current.

CAUTION

It is possible to have the cart battery switch and the ship battery switch ON at the same time to charge the aircraft batteries from a ground power supply in an emergency. **However, extreme care must be exercised to prevent battery explosions, boiling dry, acids dripping from vents, fire from resulting short circuits, etc.** Normally, the two switches should never be ON at the same time for longer than a few seconds necessary to switch from the aircraft batteries to cart system or vice versa.

DC Generator Field Relays (Tripped) Warning Light.

Warning lights (6, figure 1-26), will glow when generator field relays have been tripped. They are located on the MJB No. 1 switch panel. If a generator is tripped by a feeder fault, its light will stay on when the generator switch is moved to the RESET position. If the cause is overvoltage or reversed polarity, the light will go out. If the cause of the trip persists, the light will immediately come on again and stay on even if the switch is held down.

DC Generator Overheat Warning Lights.

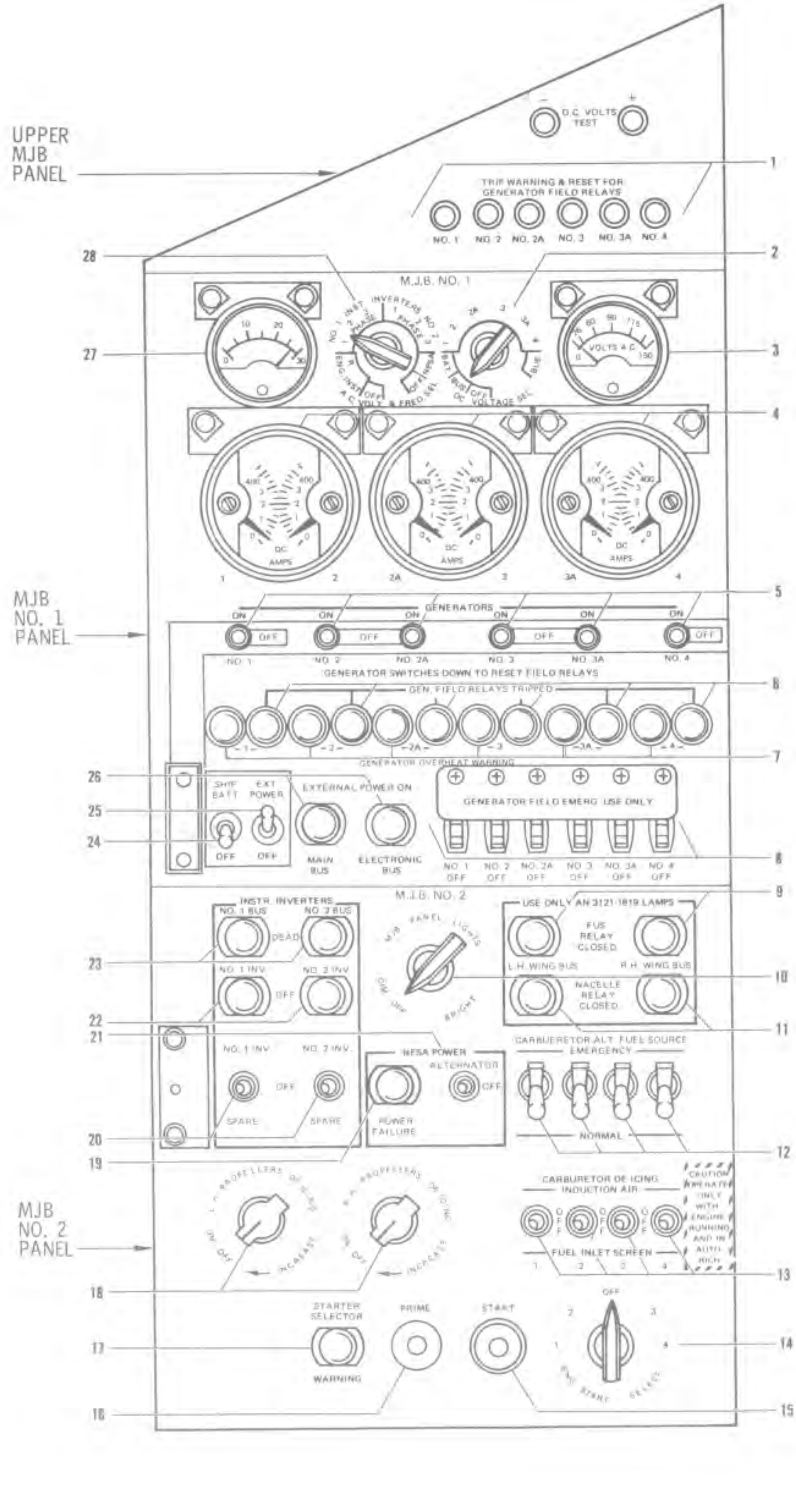
A generator overheat warning light is installed underneath each generator switch and beside each field relay warning light (7, figure 1-26). Overheating of a generator that causes one of these lights to glow may be caused by an electrical overload or failure of the generator. If the overheat condition is caused by an electrical overload on the system, the generator should not be shut off until the electrical load has been reduced, since it is possible that the resulting increased load on the remaining generators will cause these generators to overheat also.

Relay Closed Indicator Lights.

Two amber and two red relay-closed indicator lights (9, 11, figure 1-26) are located on the MJB No. 2 switch panel. They function as warning devices to indicate improper operation of relays connected to the wing buses. An amber fuselage relay closed indicator light and a red nacelle

MAIN JUNCTION BOX PANELS

(TYPICAL)



1. GENERATOR FIELD TRIP AND RESET RELAYS
2. DC VOLTAGE SELECTOR SWITCH
3. AC VOLTMETER
4. DC AMMETERS
5. DC GENERATOR SWITCHES
6. DC GENERATOR FIELD RELAYS (TRIPPED) WARNING LIGHTS
7. DC GENERATOR OVERHEAT WARNING LIGHTS
8. DC GENERATOR FIELD CIRCUIT BREAKERS
9. FUSELAGE RELAY (CLOSED) INDICATOR LIGHTS
10. MJB PANEL LIGHT RHEOSTAT
11. NACELLE RELAY (CLOSED) INDICATOR LIGHTS
12. CARBURETOR ALTERNATE FUEL SOURCE SWITCHES
13. CARBURETOR DEICING SWITCHES
14. ENGINE STARTER SELECTOR SWITCH
15. ENGINE STARTER SWITCH (BUTTON)
16. ENGINE PRIMER SWITCH (BUTTON)
17. ENGINE STARTER SELECTOR SWITCH WARNING LIGHT
18. PROPELLER DEICING SWITCHES
19. NESA POWER FAILURE INDICATOR LIGHT
20. INSTRUMENT INVERTER SELECTOR SWITCHES
21. NESA POWER SELECTOR SWITCH
22. INVERTER (OFF) WARNING LIGHTS
23. DEAD BUS WARNING LIGHTS
24. SHIP BATTERY SWITCH
25. EXTERNAL POWER SWITCH
26. GROUND POWER (ON) INDICATOR LIGHTS
27. DC VOLTMETER
28. AC VOLTAGE AND FREQUENCY METER SELECTOR SWITCH

Figure 1-26 (Sheet 1 of 2)

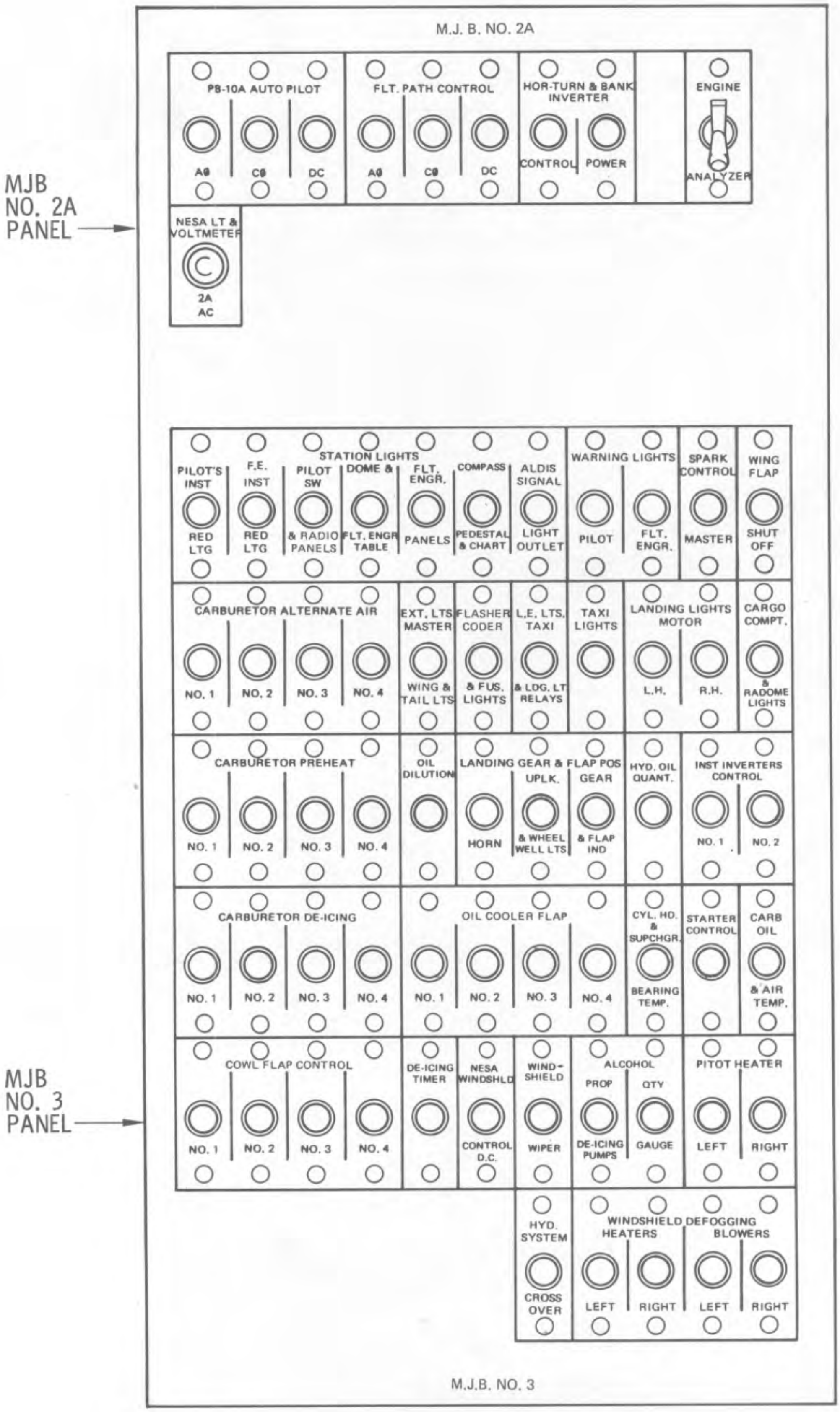


Figure 1-26 (Sheet 2 of 2)

REMOTE CIRCUIT BREAKER PANELS

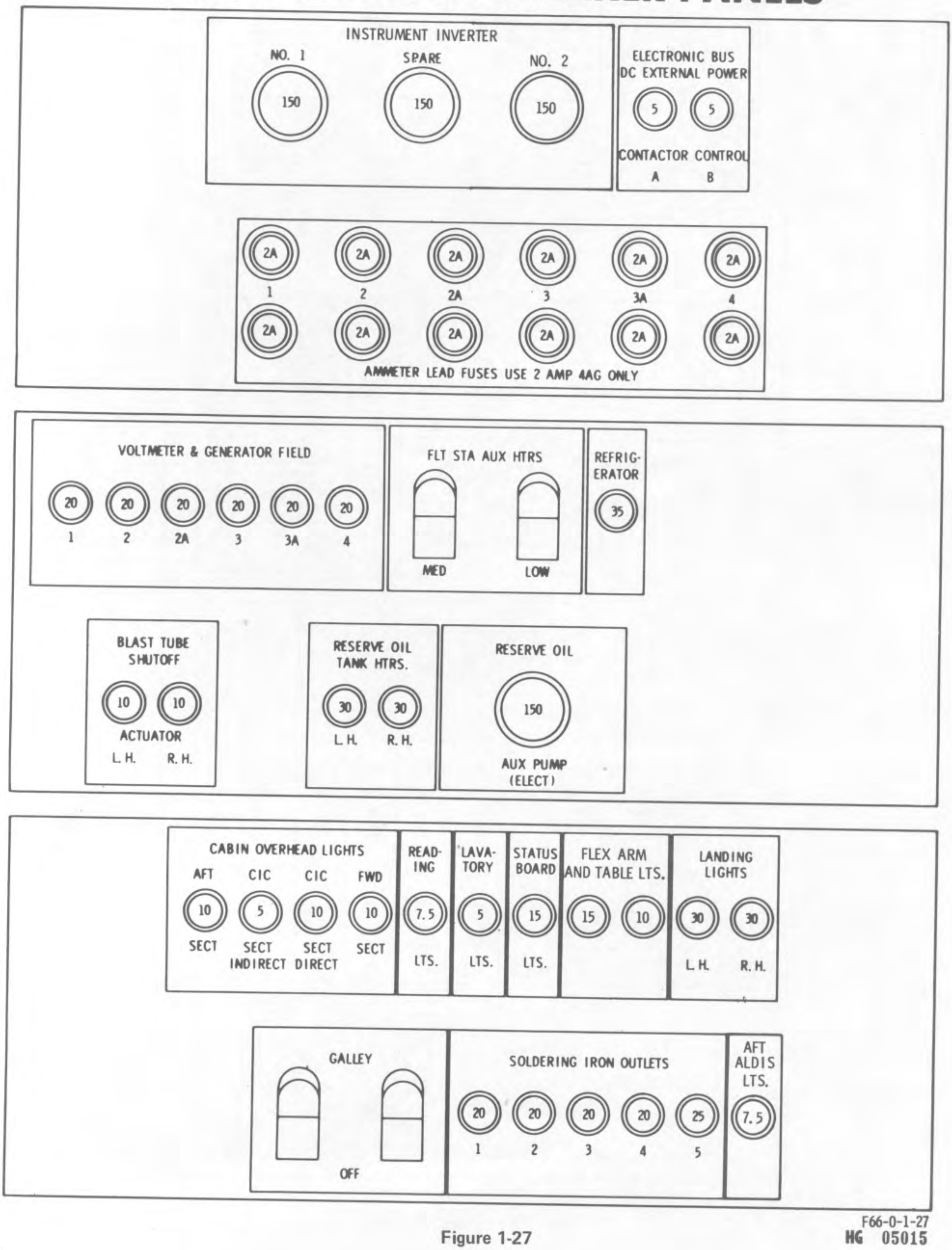


Figure 1-27

relay-closed indicator light are provided for the left and right wing buses of the aircraft. These indicator lights are connected in such a way that a bright amber light will indicate when the sectionalizing relay is closed and the wing bus is energized. When the relays are open, both the amber and the red lights illuminate dimly and have equal brilliance. If the amber light does not return to original brilliance after one of the sectionalizing relays has operated, the sectionalizing relay contacts have not opened. This does not represent a direct hazard to flight, but the condition should be corrected at the earliest opportunity. If the red light should become brighter after propeller feathering, unfeathering, reversing, or unreversing the propeller feathering pump relay has stuck closed; subsequent operation of cowl flaps, engine starters, or propeller feathering, unfeathering, reversing, or unreversing on that side of the aircraft will energize the feathering pump of the propeller whose previous operation caused the red light to burn brighter.

WARNING

- If the propeller nacelle relay remains closed in flight, notify the pilot immediately.
- If this condition occurs while the aircraft is on the ground, it must be rectified before flight.

If one of the red lights becomes brighter after engine starter or cowl flap operation, operation of the same engine starter or cowl flap will occur if engine starters, cowl flaps, or propeller feathering, unfeathering, reversing, or unreversing electrical circuits on the same side of the aicraft are energized.

NOTE

If this condition occurs on the ground, notify the ground crew.

DC Voltmeter and Selector Switch.

A dc voltmeter (27, figure 1-26) located on the MJB No. 1 switch panel, indicates the output voltage of the generators, batteries, and bus voltage. A ten-position switch (2, figure 1-26), located on the MJB No. 1 switch panel, provides selection of generators 1, 2, 2A, 3, 3A, 4, BAT., two BUS positions, and OFF. Parallel operation of the generators and batteries necessitates that each be disconnected individually from the bus to measure its potential.

Ground Power Indicator Lights.

Two ground power indicator lights (26, figure 1-26), one of which indicates ground power available to the main dc bus and the other to the electronic dc bus, are located on the MJB No. 1 switch panel. An isolation relay prevents ground power from being applied to the dc electronic bus only. Two white indicator lights, located adjacent to the exterior fuselage mounted ground power receptacle, glow whenever the ground power supply is connected to the respective dc buses.

DC Ammeters.

Three dual dc ammeters (4, figure 1-26) are installed in the MJB No. 1 switch panel. The ammeters indicate the direct load on each generator.

Forward Lower Compartment Circuit Breaker Panel.

A circuit breaker panel, protecting the following equipment, is located on the main cabin floor support stringers at the aft end of the forward lower compartment: cabin overhead lights, reading lights, lavatory lights, status board lights, landing lights, flex-arm lights, aft Aldis lamp, soldering iron outlets, galley, voltmeter and generator field circuits, blast tube shutoffs, reserve oil tank heaters, reserve oil auxiliary pump (electric), flight station auxiliary heater, refrigerator, No. 1 and No. 2 instrument inverters and spare instrument inverter, dc generator lead fuses, and electronic bus dc external power contactor control. This circuit breaker panel is accessible in flight through a removable panel in the cabin floor, located adjacent to the navigator's station.

AC POWER SYSTEM.

Fixed Frequency.

The fixed frequency power system consists of five 2500-va inverters and one 250-va inverter. (See figure 1-28.)

One 2500-va inverter provides 115-volt ac power to the No. 1 inverter bus, and another 2500-va inverter provides 115-volt ac power to the No. 2 inverter bus. A third 2500-va inverter is a spare which will assume the load to either No. 1 or No. 2 bus if either the No. 1 or No. 2 inverter fails.

The switches (20, figure 1-26) for the No. 1 and No. 2 inverters, located on the MJB No. 2 panel have three positions, MAIN, OFF, and SPARE. In addition, four warning lights (22, 23, figure 1-26) are installed — one each to indicate when its respective inverter is inoperative and one each to indicate when its bus is dead. When both switches are ON, the No. 1 and No. 2 inverters are separately providing power to their respective buses. When either switch is on SPARE, that inverter is inoperative and the spare is carrying the load. In this instance, the inverter failure light will be on, but the system failure light will be out.

An automatic changeover relay system is incorporated which will automatically switch the load of the failed inverter to the spare inverter if the No. 1 or No. 2 inverter fails. If both the No. 1 and No. 2 inverters fail, that inverter which failed first will automatically take the spare.

A fourth 2500-va inverter supplies power for the electronic power bus and a fifth 2500-va inverter is its spare. A three-position switch placarded MAIN, SPARE, and OFF, located on the aft power distribution panel, controls these electronic inverters. If the main inverter fails, the spare inverter will automatically pick up the electrical load.

A 250-va inverter provides power for the pilot's essential flight instruments whenever his horizon, and turn-and-bank power selector switch (42, figure 1-6) is in the NORMAL position. If this inverter fails, the pilot may select EMERGENCY, in which case his essential instruments will receive their power from the No. 1 inverter bus.

Inverter Frequency Meter.

An inverter frequency meter (7, figure 1-17), located on the flight engineer's upper switch panel, provides a means of monitoring the frequency output of 400 cycles required for the left or right engine instruments, the No. 1 or No. 2 main inverter, or the spare inverter.

AC Voltmeter and Frequency Meter Selector Switch.

A rotary-type ac voltmeter and frequency meter selector switch (28, figure 1-26), located on the MJB No. 1 panel, permits selection of the inverter that is to be monitored. The switch is placarded L ENG INST., R ENG INST., No. 1 INST INVERTER – phases 1, 2, and 3, No. 2 INST INVERTER – phases 1, 2, and 3, and NESA. When the selector switch is changed for voltage readings, the frequency reading also will change to read for the selected position.

Bypassing Inverters.

Means are provided for bypassing the instrument and electronic inverters when using an external ac power source. This arrangement permits ac power to be drawn from an external source (usually a power cart) without unnecessary use of the inverters. This system is armed by connecting the ac ground power source to the ac ground power receptacle and positioning the rotary-type ac power selector control switch in the EXT position.

A three position ac Power Sel toggle switch is located on the aft power distribution panel. This switch is placarded INVERTER in the up position, CART in the center position and RESET CART in the down position. The INVERTER position is a momentary contact position for manual disconnect of external power. RESET CART is a momentary contact reset position, and is selected to energize the circuit after external power is connected to the aircraft at the external power receptacle. The RESET CART position is also used to regain external power when external power failure is experienced and the circuit has automatically reverted to inverter power. CART position is the position selected when external power is being used.

NOTE

> The inverter selector switches must be on if external power is to be furnished to the circuits supplied by the inverters.

Four indicator lights located on the aft power distribution panel, are placarded as follows: LOW FREQUENCY, PHASE REVERSE, HIGH FREQUENCY, and EXTERNAL POWER ON. If the LOW FREQUENCY, PHASE REVERSE, or HIGH FREQUENCY warning light glows, incompatible external power is indicated and the system is on inverter power. The EXTERNAL POWER ON light indicates that external power is avilable to the selected circuits of the aircraft. The inverter circuits are protected by six circuit breakers located at the top of the aft power distribution panel.

Variable Frequency.

One 30-kva variable frequency 115-volt ac generator is installed on each outboard engine. Under normal conditions, each ac generator separately supplies power to its own bus; however, if one ac generator fails, or the No. 1 or No. 4 engine is shut down, the remaining generator can provide power for both buses.

A rotary-type ac power selector control switch on the aft power distribution panel controls each generator's output. This switch has five positions: OFF, EXT, NORM, L, and R. When EXT is selected, the buses are being powered by an external power source. When NORM is selected, each generator is providing power to its respective equipment.

AC/DC Generator Driveshaft Disconnect Switches.

Two ac generator disconnect switches (9, figure 1-17), located on the flight engineer's upper switch panel, are placarded DRIVESHAFT DISCONNECT (A.C. GEN. & D.C. GEN. NO. 1) for engine No. 1 and DRIVESHAFT DISCONNECT (A.C. GEN. & D.C. GEN. NO. 4) for

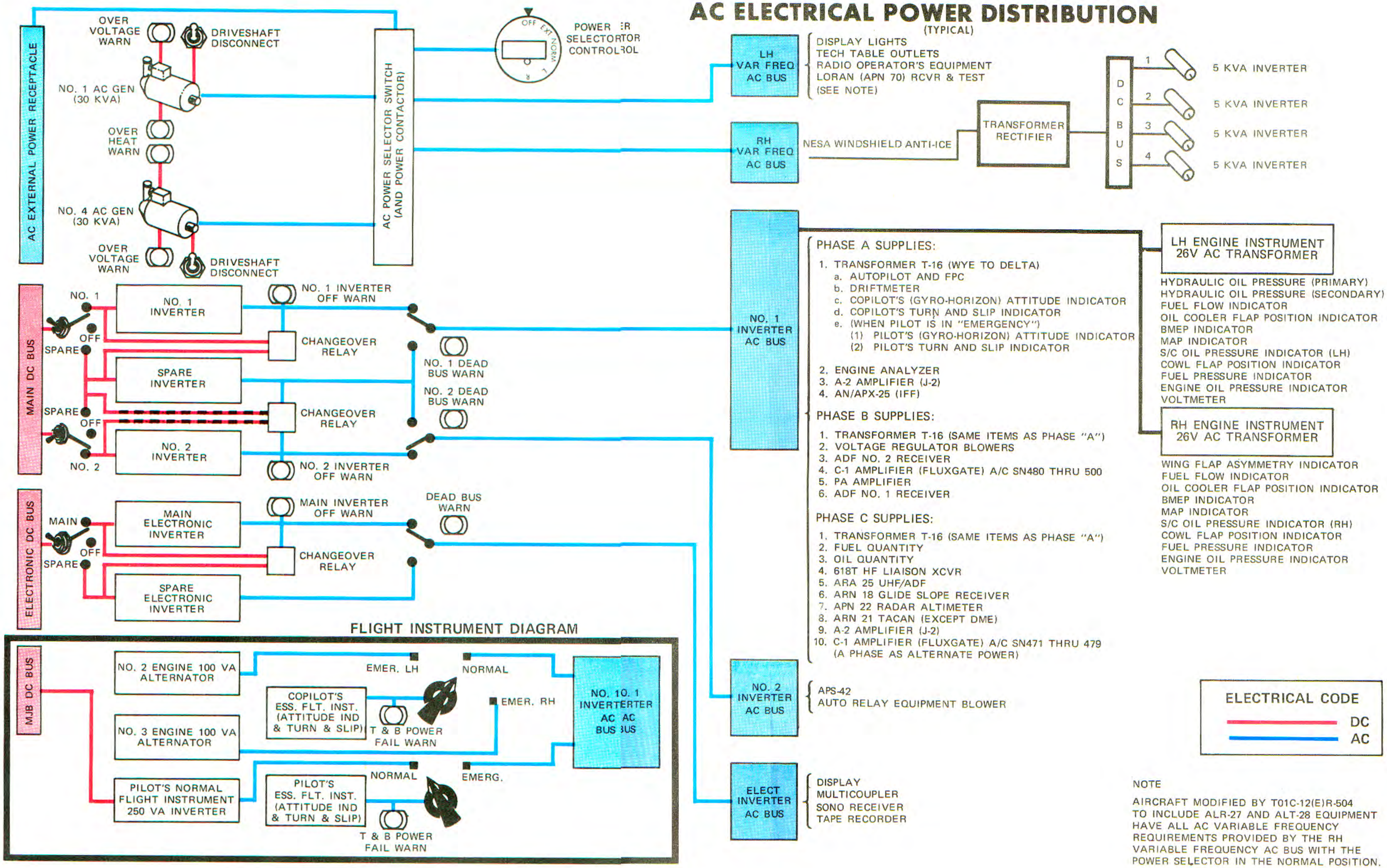

AC ELECTRICAL POWER DISTRIBUTION
(TYPICAL)
AC EXTERNAL POWER RECEPTACLE
OVER VOLTAGE WARN
DRIVESHAFT DISCONNECT
NO. 1 AC GEN (30 KVA)
OVER HEAT WARN
NO. 4 AC GEN (30 KVA)
OVER VOLTAGE WARN
DRIVESHAFT DISCONNECT
AC POWER SELECTOR SWITCH (AND POWER CONTACTOR)
OFF EXT NORM 1 R
POWER SELECTOR CONTROL
LH VAR FREQ AC BUS
DISPLAY LIGHTS
TECH TABLE OUTLETS
RADIO OPERATOR'S EQUIPMENT
LORAN (APN 70) RCVR & TEST
(SEE NOTE)
RH VAR FREQ AC BUS
NESA WINDSHIELD ANTI-ICE
TRANSFORMER RECTIFIER
DC BUS
1 5 KVA INVERTER
2 5 KVA INVERTER
3 5 KVA INVERTER
4 5 KVA INVERTER
MAIN DC BUS
NO. 1
OFF
SPARE
NO. 1 INVERTER
NO. 1 INVERTER OFF WARN
CHANGEOVER RELAY
SPARE INVERTER
NO. 1 DEAD BUS WARN
NO. 2 DEAD BUS WARN
SPARE
OFF
CHANGEOVER RELAY
NO. 2 INVERTER
NO. 2
NO. 2 INVERTER OFF WARN
NO. 1 INVERTER AC BUS
PHASE A SUPPLIES:
1. TRANSFORMER T-16 (WYE TO DELTA)
a. AUTOPILOT AND FPC
b. DRIFTMETER
c. COPILOT'S (GYRO-HORIZON) ATTITUDE INDICATOR
d. COPILOT'S TURN AND SLIP INDICATOR
e. (WHEN PILOT IS IN "EMERGENCY")
(1) PILOT'S (GYRO-HORIZON) ATTITUDE INDICATOR
(2) PILOT'S TURN AND SLIP INDICATOR
2. ENGINE ANALYZER
3. A-2 AMPLIFIER (J-2)
4. AN/APX-25 (IFF)
PHASE B SUPPLIES:
1. TRANSFORMER T-16 (SAME ITEMS AS PHASE "A")
2. VOLTAGE REGULATOR BLOWERS
3. ADF NO. 2 RECEIVER
4. C-1 AMPLIFIER (FLUXGATE) A/C SN480 THRU 500
5. PA AMPLIFIER
6. ADF NO. 1 RECEIVER
PHASE C SUPPLIES:
1. TRANSFORMER T-16 (SAME ITEMS AS PHASE "A")
2. FUEL QUANTITY
3. OIL QUANTITY
4. 618T HF LIAISON XCVR
5. ARA 25 UHF/ADF
6. ARN 18 GLIDE SLOPE RECEIVER
7. APN 22 RADAR ALTIMETER
8. ARN 21 TACAN (EXCEPT DME)
9. A-2 AMPLIFIER (J-2)
10. C-1 AMPLIFIER (FLUXGATE) A/C SN471 THRU 479 (A PHASE AS ALTERNATE POWER)
LH ENGINE INSTRUMENT 26V AC TRANSFORMER
HYDRAULIC OIL PRESSURE (PRIMARY)
HYDRAULIC OIL PRESSURE (SECONDARY)
FUEL FLOW INDICATOR
OIL COOLER FLAP POSITION INDICATOR
BMEP INDICATOR
MAP INDICATOR
S/C OIL PRESSURE INDICATOR (LH)
COWL FLAP POSITION INDICATOR
FUEL PRESSURE INDICATOR
ENGINE OIL PRESSURE INDICATOR
VOLTMETER
RH ENGINE INSTRUMENT 26V AC TRANSFORMER
WING FLAP ASYMMETRY INDICATOR
FUEL FLOW INDICATOR
OIL COOLER FLAP POSITION INDICATOR
BMEP INDICATOR
MAP INDICATOR
S/C OIL PRESSURE INDICATOR (RH)
COWL FLAP POSITION INDICATOR
FUEL PRESSURE INDICATOR
ENGINE OIL PRESSURE INDICATOR
VOLTMETER
ELECTRONIC DC BUS
MAIN
OFF
SPARE
MAIN ELECTRONIC INVERTER
MAIN INVERTER OFF WARN
DEAD BUS WARN
CHANGEOVER RELAY
SPARE ELECTRONIC INVERTER
FLIGHT INSTRUMENT DIAGRAM
MJB DC BUS
NO. 2 ENGINE 100 VA ALTERNATOR
EMER. LH
NORMAL
COPILOT'S ESS. FLT. INST. (ATTITUDE IND & TURN & SLIP)
EMER. RH
T & B POWER FAIL WARN
NO. 3 ENGINE 100 VA ALTERNATOR
NO. 1 INVERTER AC BUS
PILOT'S NORMAL FLIGHT INSTRUMENT 250 VA INVERTER
NORMAL
EMERG.
PILOT'S ESS. FLT. INST. (ATTITUDE IND & TURN & SLIP)
T & B POWER FAIL WARN
NO. 2 INVERTER AC BUS
APS-42
AUTO RELAY EQUIPMENT BLOWER
ELECT INVERTER AC BUS
DISPLAY
MULTICOUPLER
SONO RECEIVER
TAPE RECORDER
ELECTRICAL CODE
DC
AC
NOTE
AIRCRAFT MODIFIED BY T01C-12(E)R-504 TO INCLUDE ALR-27 AND ALT-28 EQUIPMENT HAVE ALL AC VARIABLE FREQUENCY REQUIREMENTS PROVIDED BY THE RH VARIABLE FREQUENCY AC BUS WITH THE POWER SELECTOR IN THE NORMAL POSITION.

Figure 1-28

SIMPLIFIED HYDRAULIC SYSTEM

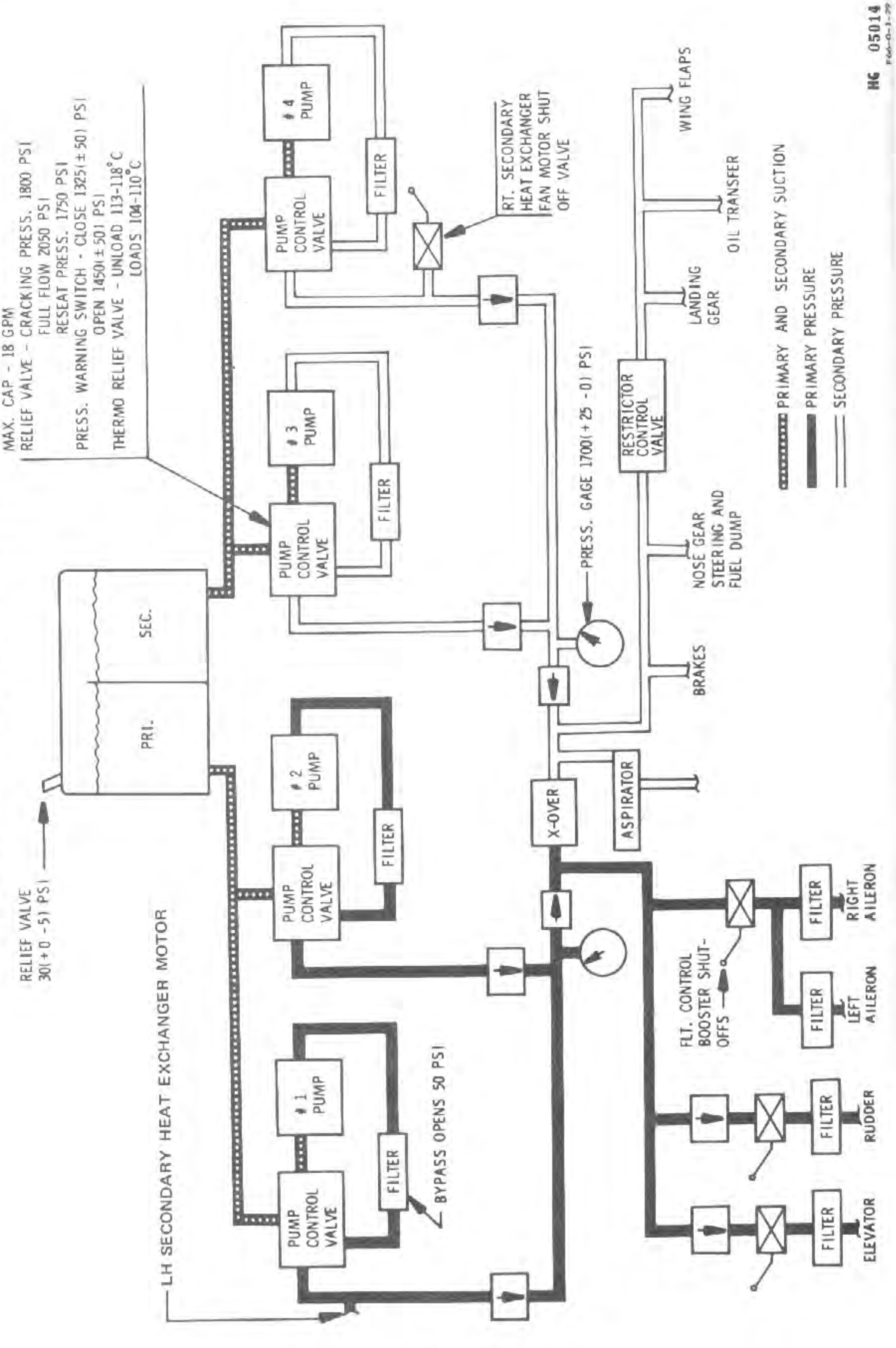


Figure 1-29

AFT POWER DISTRIBUTION PANEL

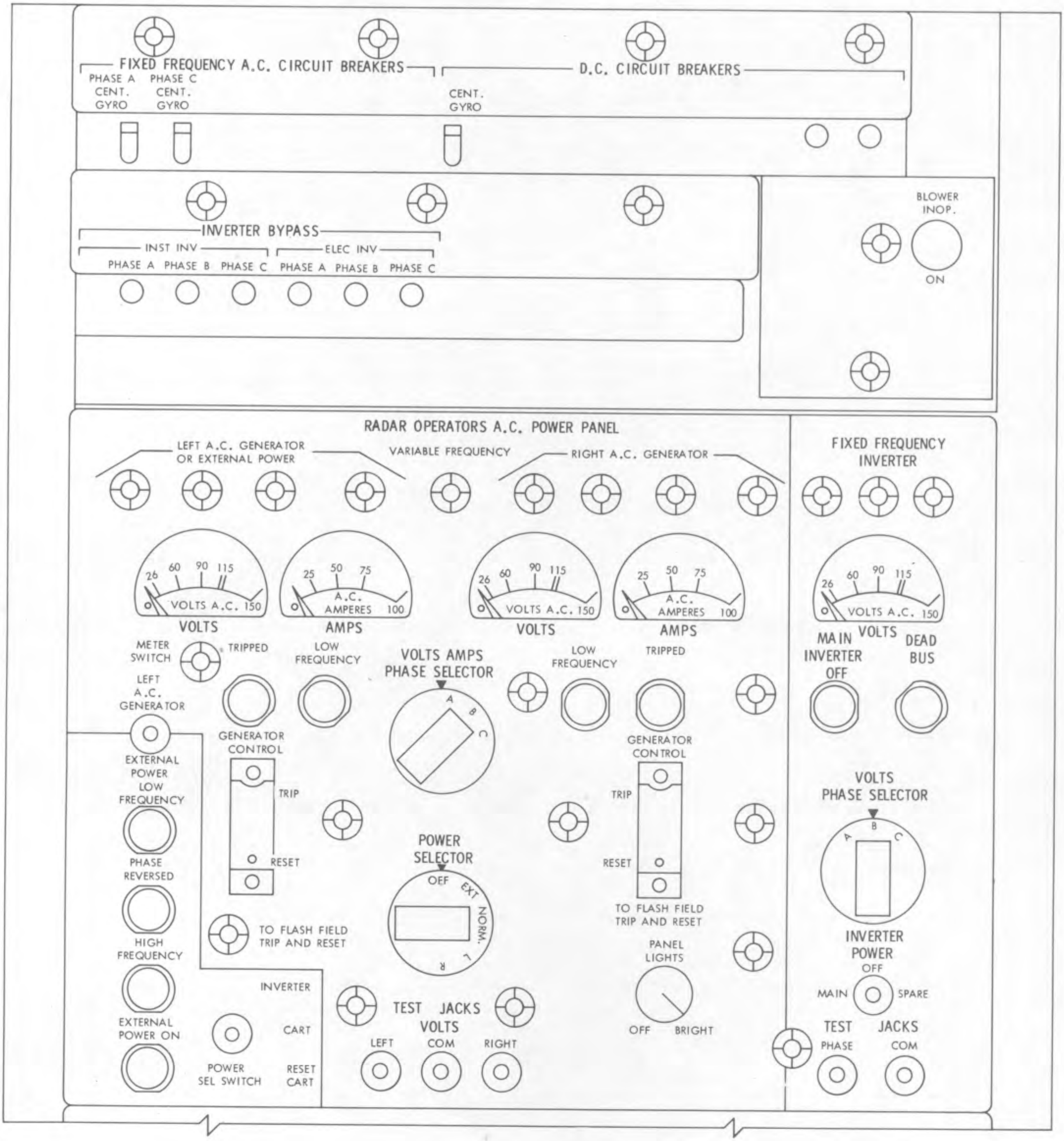


Figure 1-30 (Sheet 1 of 3)

AFT POWER DISTRIBUTION PANEL

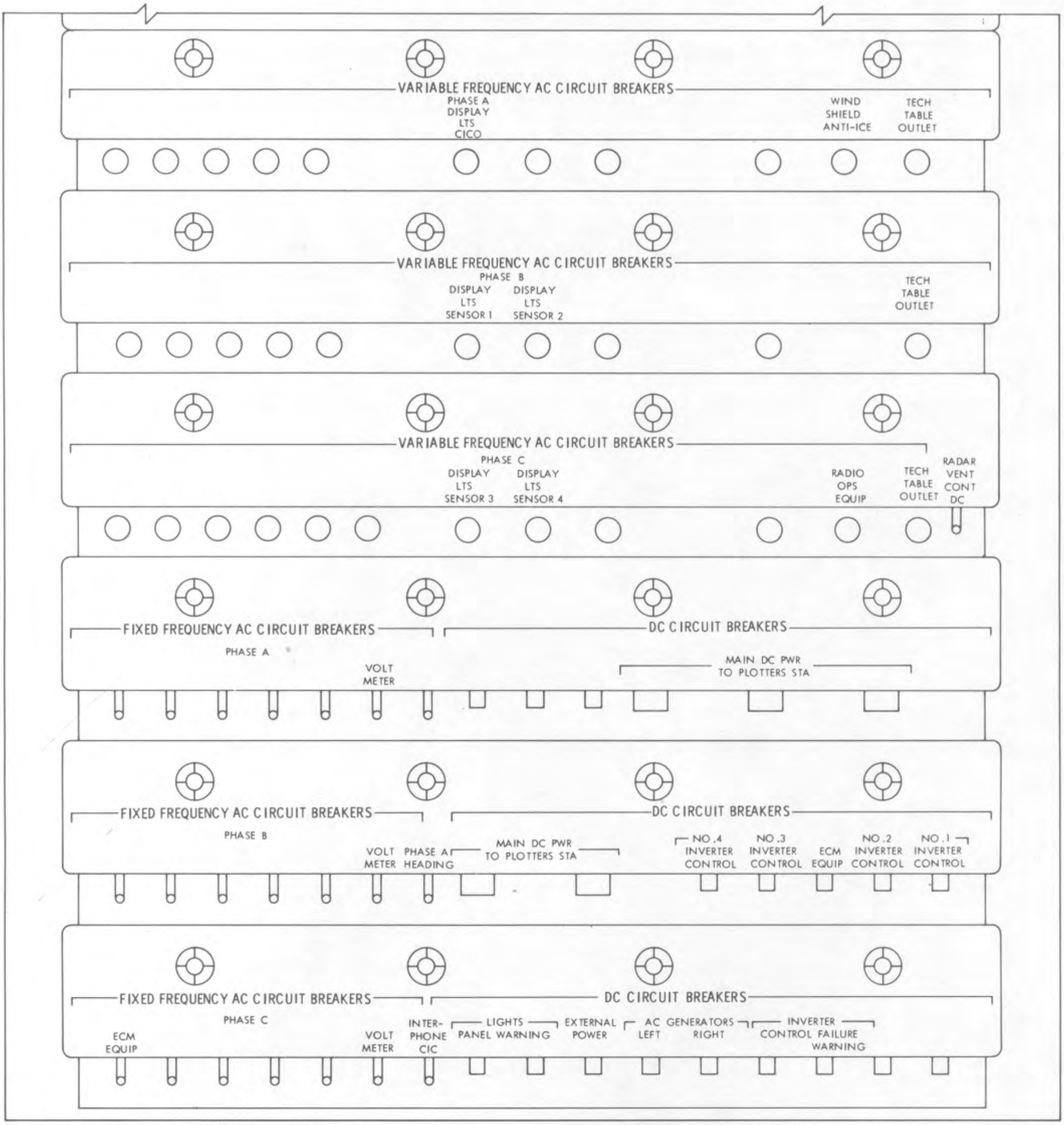
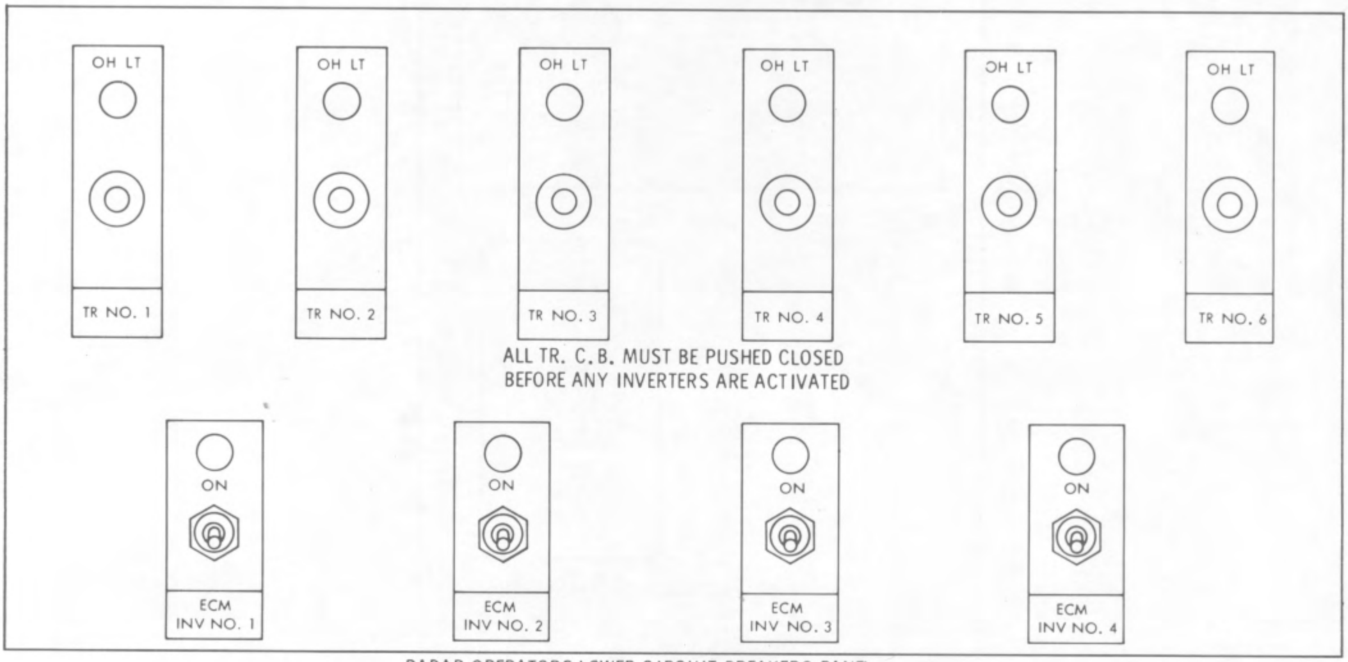


Figure 1-30 (Sheet 2 of 3)

AFT POWER DISTRIBUTION PANEL



RADAR OPERATORS LOWER CIRCUIT BREAKERS PANEL

Figure 1-30 (Sheet 3 of 3)

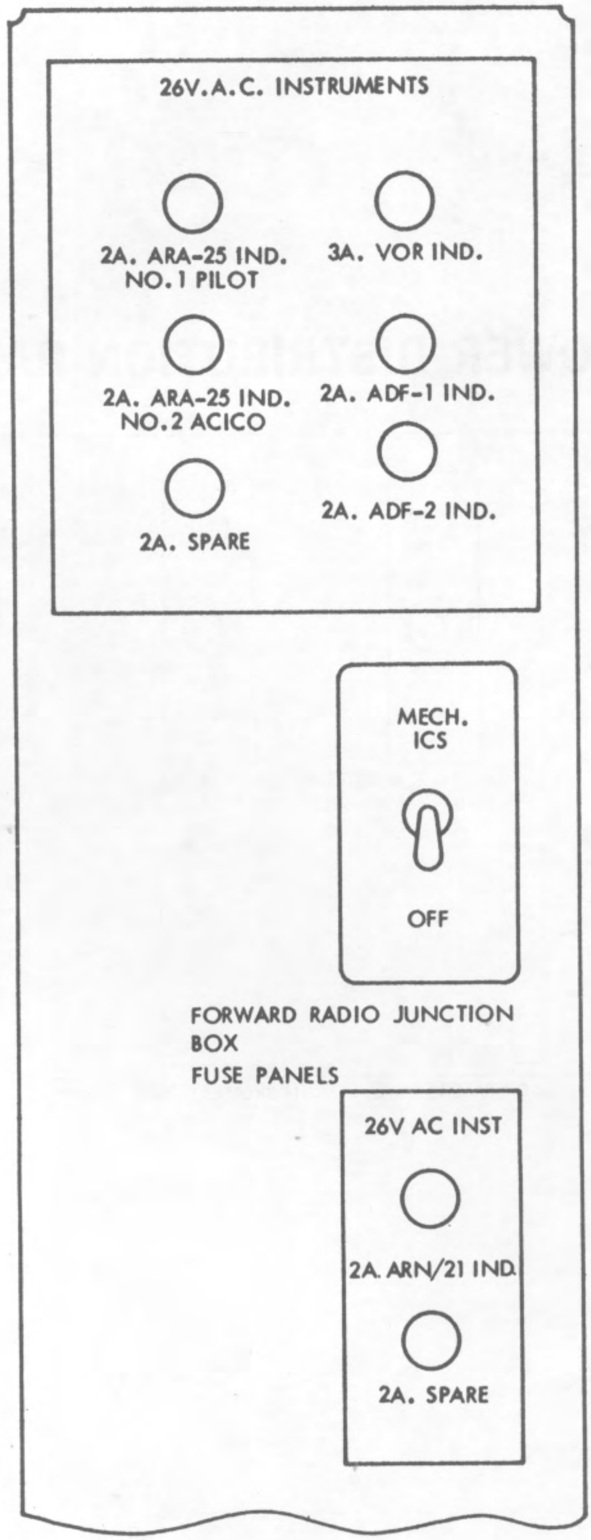
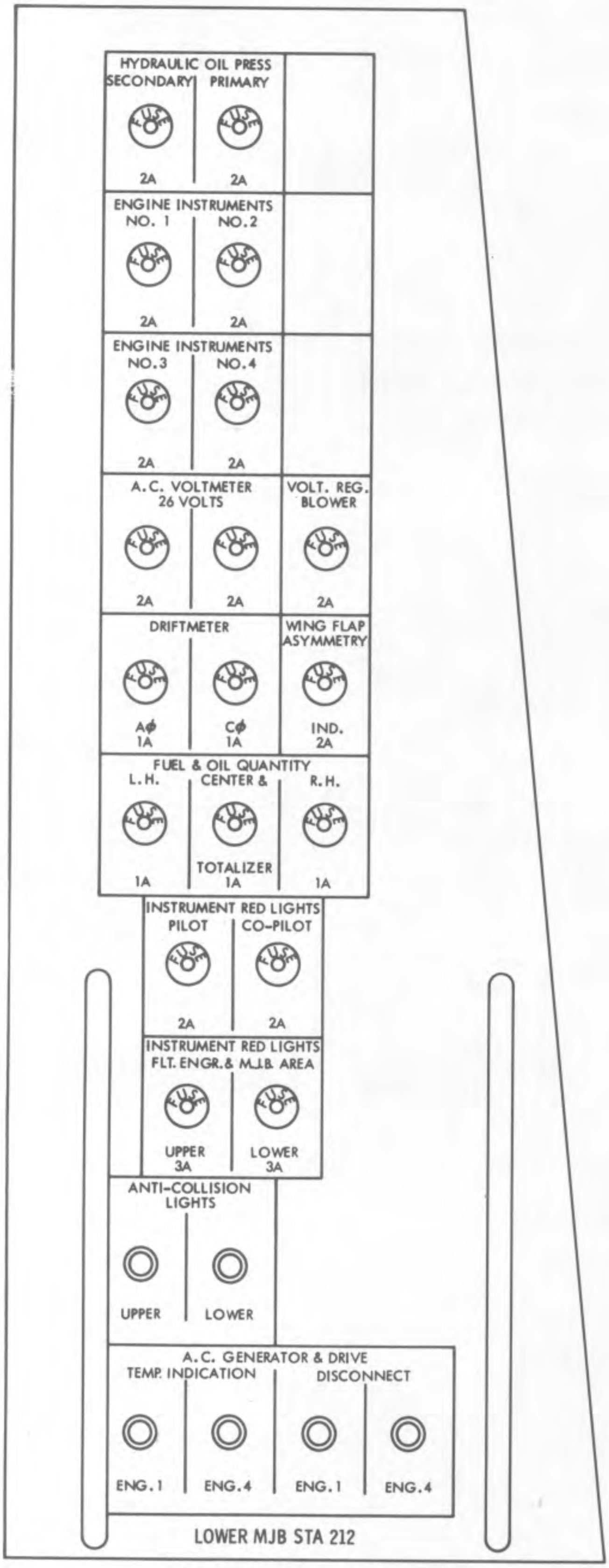
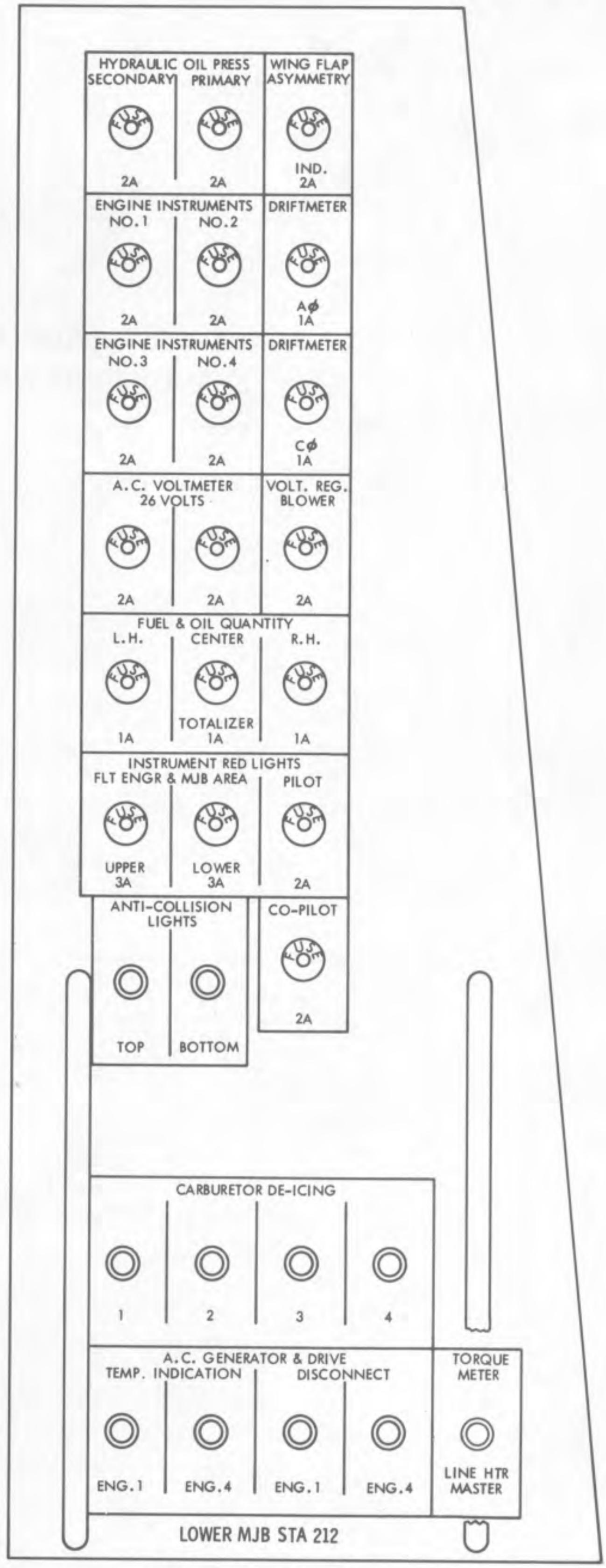


Figure 1-31 (Sheet 1 of 3)



USAF SERIAL NO. 67-21480
THRU 67-21500



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THRU 67-21479

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Figure 1-31 (Sheet 2 of 3)

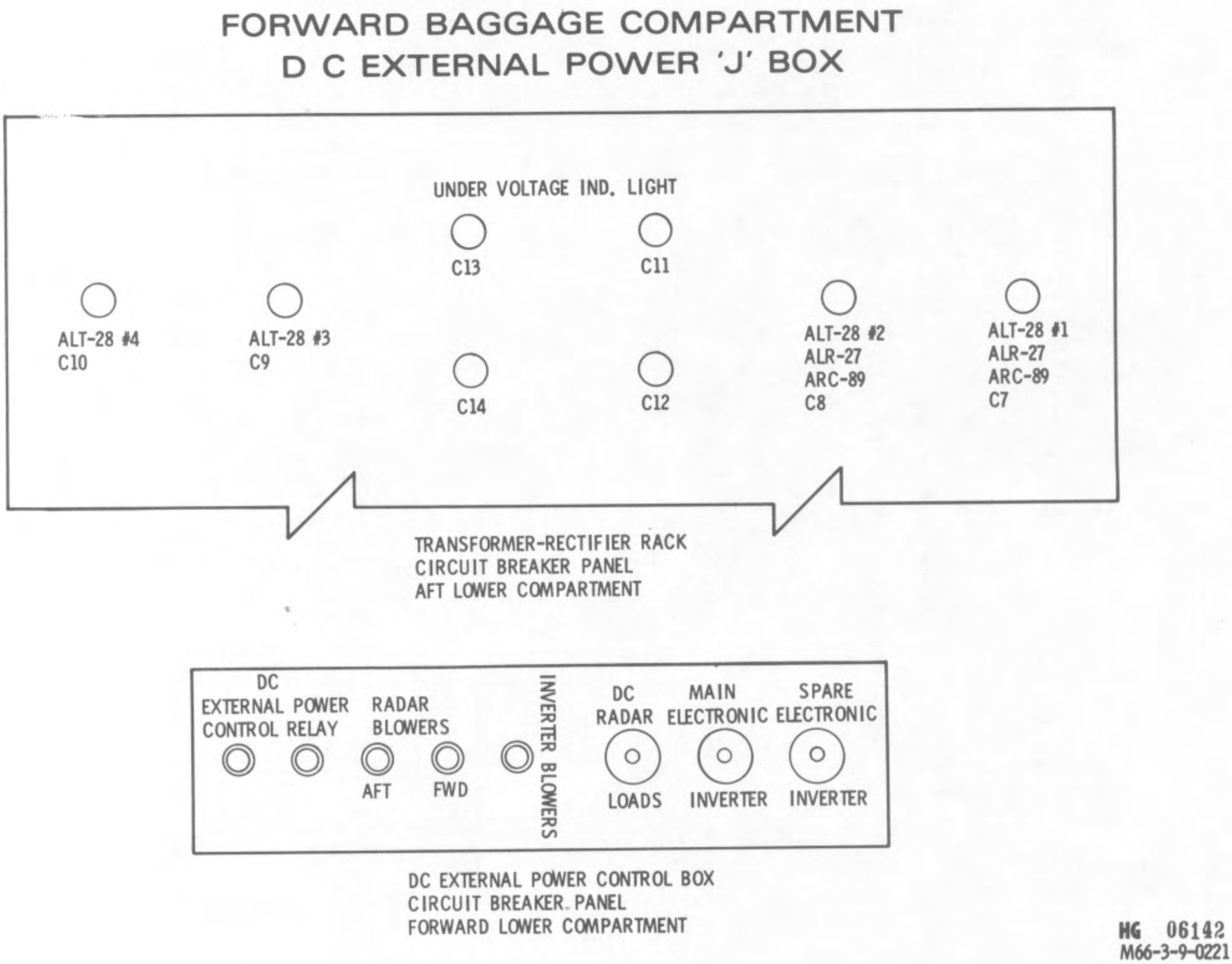


Figure 1-31 (Sheet 3 of 3)

engine No. 4. These switches are protected by a red guard cover. When either switch is actuated, the associated driveshaft is mechanically disconnected from the engine by a solenoid.

AC Generator or Driveshaft Overtemperature and Overvoltage Warning Lights.

Adjacent to each ac generator disconnect switch are two warning lights (8, 10, figure 1-17), one placarded OVER TEMP., and the other OVER VOLTAGE. (In addition, a single master A.C. GEN. OR DRIVE warning light (5, figure 1-15) is installed on the flight engineer's lower instrument panel.)

AC Generator Temperature Indicators.

Above each ac generator disconnect switch is a single gage (3, figure 1-17) with three semicircular dials, indicating DRIVESHAFT BRG. temperature, GEAR BOX BRG. temperature, and COOLING AIR RISE.

COPILOT'S EMERGENCY FLIGHT INSTRUMENTS.

One 100 va alternator is installed on each inboard engine to provide emergency power for operation of the copilot's essential flight instruments if both the No. 1 and the spare inverters fail. These alternators are controlled by the copilot's horizon and turn-and-bank power selector switch (29, figure 1-6) which has three positions, EMERG LH, NORM, and EMERG RH. When on NORM, the copilot's essential instruments are powered by the No. 1 inverter bus.

HYDRAULIC SYSTEM.

Four variable-displacement hydraulic pumps, one driven by each engine, provide operating power up to 1700 psi for the various hydraulically operated units. (See figure 1-32.) Hydraulic power is divided into primary and secondary systems, each of which obtains fluid from the main hydraulic reservoir, located in the left center section leading edge. The reservoir is divided vertically into two compartments up to approximately 2/3 its height. The reservoir partition separates secondary system fluid from the primary system fluid and each system draws fluid from its respective compartment. An aspirator supplies air to pressurize the reservoir. As hydraulic fluid passes through the aspirator at normal pressure, air is bled into the return system downstream from the aspirator orifice, thereby providing pressure in the reservoir. A separate emergency handpump power system, with its own reservoir, provides pressure for emergency braking, emergency landing gear extension, and emergency fuel dumping.

Hydraulic System Crossover Valve.

An electric motor-driven crossover valve is installed in the hydraulic system to connect the primary and secondary systems in the event of failure of either. Should a loss of system pressure occur in either the primary or secondary system, pressure from the other system may be used by opening the crossover valve. Opening the crossover valve allows primary system pressure to feed secondary services as well as the booster systems, or will allow the secondary system pressure to feed the booster systems as well as secondary services. However, operation time of some of the secondary system units may be slower.

WARNING

Before opening the crossover valve after loss of system pressure from either the primary or secondary system, determine that opening the valve will not result in loss of fluid in the remaining system.

Return Bypass Valves.

Three return bypass valves are installed, one in the primary return, one in the secondary return and one in the aspirator return. They automatically direct the flow of return fluid to the section of the main hydraulic reservoir from which it came.

PRIMARY HYDRAULIC SYSTEM.

The primary hydraulic system supplies pressure to operate the control surface boosters and left wing secondary heat exchanger fan motor. The hydraulic pumps on engines No. 1 and No. 2 furnish the volume and pressure required for operation of the primary system. Return lines from all primary units are manifolded into the common return line through the main primary filter and primary return bypass valve to the primary return port of the main hydraulic reservoir.

SECONDARY HYDRAULIC SYSTEM.

The secondary hydraulic system supplies pressure to operate the landing gear, brakes, nosewheel steering, aspirator, wing flaps, fuel dump system, oil pump for the reserve oil system, and the right wing secondary heat exchanger fan motor. Pressure for the secondary system is supplied by the pumps on engines No. 3 and 4. Return lines from all of the secondary system units are manifolded into a common line through the main secondary filter and secondary return bypass valve to the secondary return port of the main hydraulic reservoir.

Restriction Control Valve.

A restriction control valve is installed in the secondary system pressure manifold to operate as a flow control valve if the hydraulic system pressure drops to a preset value. When one of the systems is providing hydraulic pressure for both systems through the hydraulic crossover valve, extension of the landing gear and wing flaps may be slower than normal because the restriction control valve will give priority to the pressure requirements of the flight control boosters. Brakes, nose steering, and fuel dumping are not affected.

EMERGENCY HANDPUMP POWER SYSTEM.

The emergency handpump power system (figure 1-33) consists of a separate fluid reservoir (emergency extension tank), located forward of the pilot's rudder pedals, and a handpump with two selector valves. The system provides an auxiliary source of fluid and pressure, independent of the normal hydraulic system, for emergency braking, landing gear extension, and fuel dumping in the event of normal system failure. A separate and independent set of lines, connected to the downside of the landing gear actuating cylinders, is used during emergency gear extension. During emergency braking, fluid is directed to the brake selector valve. (Refer to Brake System, this section.) Other components of the emergency handpump system include provisions for replenishing the system fluid. These components consist of a hand wobble pump with a capped inlet line (to be attached to a portable fluid container) and an outlet line that connects the wobble pump to a filler selector valve which directs replenishing fluid to the emergency extension tank or to the main system hydraulic reservoir. If neither primary nor secondary system pressure is available, the emergency handpump power system may be used.

Pump Control Valve.

A multiple-function pump control valve is installed with each engine-driven hydraulic pump. It acts as a manual emergency shutoff valve, a thermal relief valve, a pressure relief valve, and a pressure switch. The manual shutoff valve consists of a cam-operated poppet valve acting against a suction inlet port of the control valve. The thermal relief valve automatically bypasses the hydraulic fluid from the pressure side to the suction side of the control valve when the fluid pressure, because of high temperature, reaches the high limit. The pressure relief valve operates automatically when system pressure reaches the maximum limit by allowing a piston valve to open and divert fluid to the suction side of the control valve. The pressure switch consists of a spring-loaded piston which actuates a switch that closes the cirtuit to the indicator light in the flight station when the hydraulic pressure drops to the minimum limit.

Handpump Selector Lever.

The handpump and selector lever are located on the flight station floor, outboard of the copilot's seat. (See figure 1-33.) The selector lever has two positions, EMER BRAKES and EMER GEAR. When the lever is in the EMER BRAKES position, the handpump may be used to direct fluid and pressure to the brake selector valve located in the normal brake system. (Refer to Brake System, this section.) When the selector lever is in the EMER GEAR position, the handpump lever may be used to supply pressure through an independent system of lines to the downside of the landing gear actuating cylinders or to the emergency fuel dumping valves. If this lever is left in the EMER GEAR position, the landing gear cannot be retracted by the normal system.

Emergency Shutoff Valve Levers.

Emergency shutoff levers (25, figure 1-5) are located on a control quadrant in the ceiling of the flight station. There is one lever for each engine, each lever having four notched positions. The second stop position (as the lever is moved from the full forward position) mechanically shuts off the hydraulic oil supply to the engine-driven pump at the pump control valve. The emergency shutoff levers and the pump control valves are mechanically connected by a cable and pulley system.

Emergency Fuel Dump Selector Lever.

This lever directs hydraulic fluid, from the hand pump selector valve to the landing gear emergency extension lines when in the LG EMER EXT position. (See figure 1-33.) When in the FUEL DUMP position (and the handpump selector lever is in the EMER GEAR position) it directs handpump pressure to the fuel dump control valve.

Hydraulic Reservoir Filler Pump.

A wobble pump (5, figure 1-34) is located on the flight station floor offset behind the pilot's seat. This pump is used to transfer hydraulic fluid from a portable container to the emergency or main reservoir through a selector valve.

Hydraulic Reservoir Filler Selector.

The hydraulic reservoir filler selector lever (2, figure 1-34), labeled OFF, EMER RES, and MAIN, operates mechanically; it is located near the hydraulic reservoir filler pump. The EMER RES position permits hydraulic fluid to be transferred from the portable container to the emergency reservoir. The MAIN position provides a means of replenishing the main reservoir.

Hydraulic System Crossover Switch.

The hydraulic system crossover switch (14, figure 1-17) is installed at the flight engineer's station and has two positions, NORMAL and EMERGENCY. NORMAL is the closed position. When the switch is in the EMERGENCY position, a dc motor opens the valve and the primary and secondary hydraulic systems are interconnected.

EC-121D. HYDRAULIC POWER SYSTEM

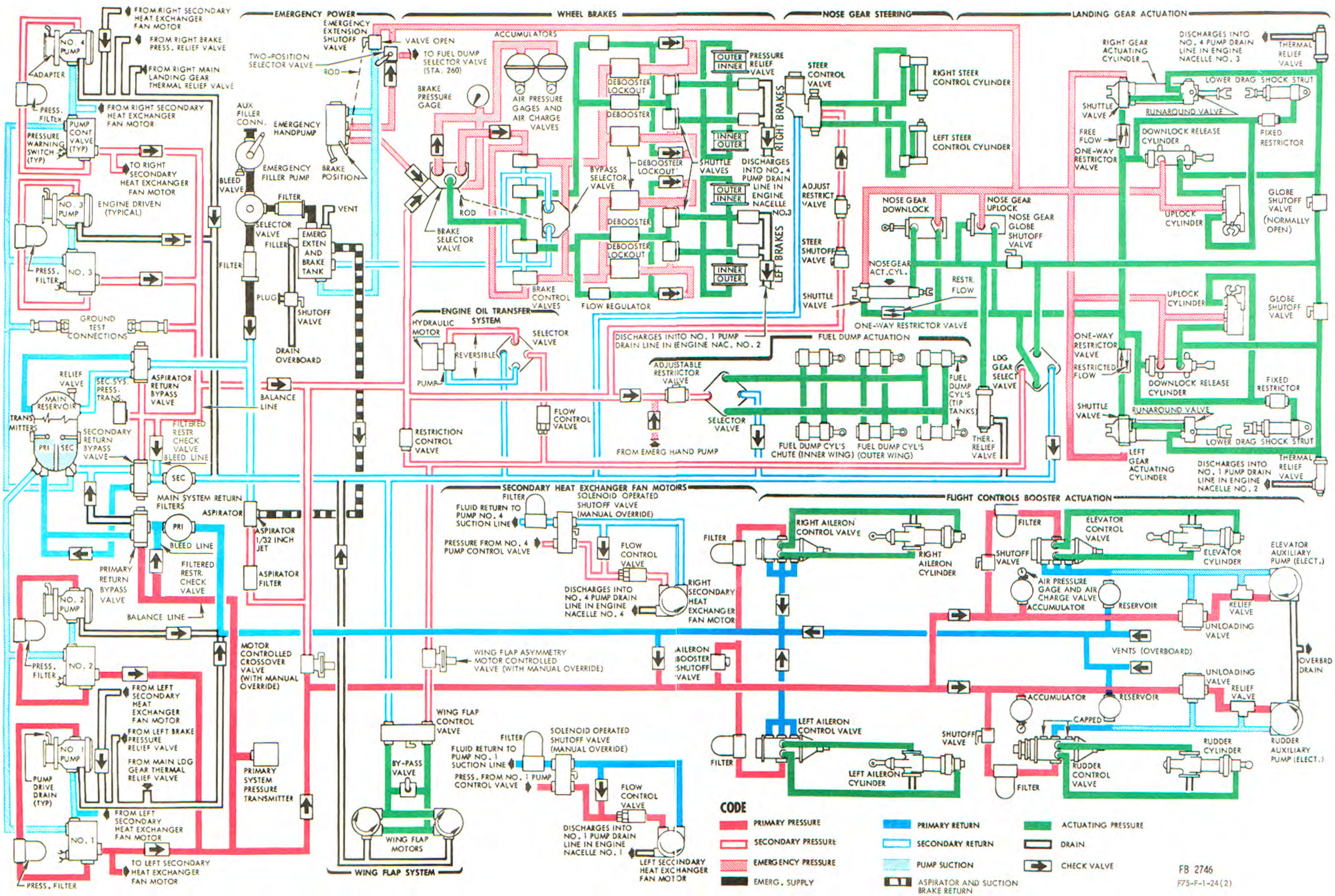


Figure 1-32

EMERGENCY HYDRAULIC SYSTEM (FUEL DUMP)

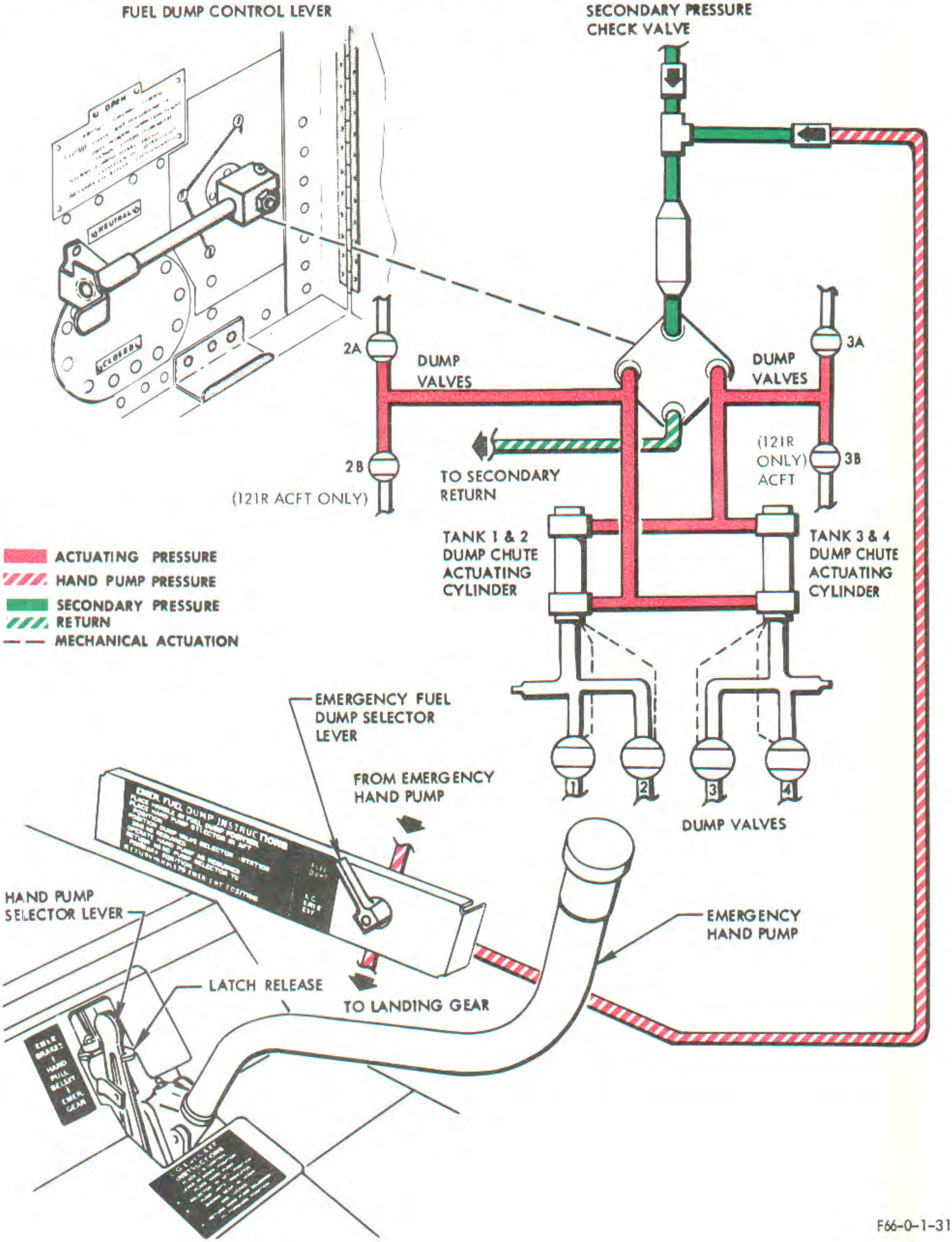


Figure 1-33

Hydraulic System Crossover Manual Control Lever.

A manual hydraulic system crossover valve lever is part of the hydraulic system crossover valve unit and is installed in the rear of the forward cargo compartment, aft of the manual auxiliary oil control panel. Access to the unit is made through the forward cargo compartment hatch. On some aircraft the control lever can be operated through an access plate in the fuselage floor.

Hydraulic Fluid Quantity Indicator.

The main hydraulic fluid quantity indicator (13, figure 1-15) is located on the flight engineer's lower instrument panel. This is a dual dc-operated indicator actuated by two liquidometer transmitters, one in the primary side of the main hydraulic reservoir and one in the secondary side. The dials are marked in quarters from empty to full.

Hydraulic System Pressure Indicators.

Two dual hydraulic oil pressure indicators are installed, one (26, figure 1-6) on the copilot's auxiliary instrument panel and one (7, figure 1-15) on the flight engineer's lower instrument panel. These indicators are marked in psi. One needle in each instrument indicates the hydraulic pressure in the primary system and the other indicates the pressure in the secondary system. Each indicator is electrically (ac) connected to a pressure transmitter located in the pressure lines of each system.

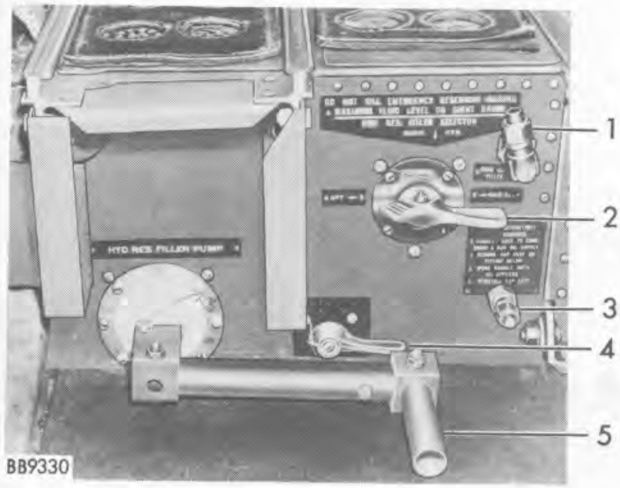
Hydraulic Pump Low Pressure Warning Lights.

Four pump low-pressure warning lights (6, figure 1-15) are installed on the flight engineer's lower instrument panel and (25, figure 1-6) on the copilot's auxiliary instrument panel. These lights are numbered from left to right and are electrically (dc) connected to the pressure side of their respective pump control valves. When the pump pressure decreases to the low limit (1325 ±50 psi), the pump control valve pressure switch will close the circuit to the respective light on each panel.

Emergency Extension Hydraulic Reservoir Sight Gage.

A sight gage, marked at MAX and MIN fluid levels, is mounted on the emergency extension reservoir and is visible between the rudder pedals from the pilot's seat.

HYDRAULIC RESERVOIR FILLER CONTROLS



1. HOSE CONNECTION FILLER PUMP
2. HYDRAULIC RESERVOIR FILLER SELECTOR
3. PUMP BLEED VALVE
4. CABIN PRESSURE REGULATOR VACUUM SHUTOFF LEVER
5. HYDRAULIC RESERVOIR FILLER PUMP

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Figure 1-34

FLIGHT CONTROL SYSTEM.

The elevators, rudders, and ailerons are actuated by cable and pulley systems which incorporate tension regulators that automatically maintain constant tension in the cable systems. Each outboard rudder, each elevator, and each aileron is provided with a cable-operated trim tab that is controlled from the flight station. Hydraulic booster units are built into the elevator, rudder, and aileron cable systems to assist the pilot in moving the control surfaces. (See Figure 1-35.) The characteristic control "feel" is retained throughout movement of all controls. The elevator and rudder booster systems incorporate a complete electrical power unit that will provide an auxiliary source of hydraulic power to the booster assemblies in the event of primary and secondary hydraulic system failure. Electrical power is obtained from the emergency dc bus. There is no source of auxiliary hydraulic power for the aileron booster system.

FLIGHT CONTROL BOOSTERS.

Hydraulic pressure for the flight control boosters normally is supplied by the primary hydraulic system. In the event of failure of the primary system, hydraulic pressure can be supplied to the flight control boosters from the secondary system through the hydraulic crossover valve.

Each booster assembly includes a hydraulic actuating cylinder which applies the force and a four-way control valve which regulates the speed and direction of movement of the

FLIGHT CONTROLS HYDRAULIC SYSTEM

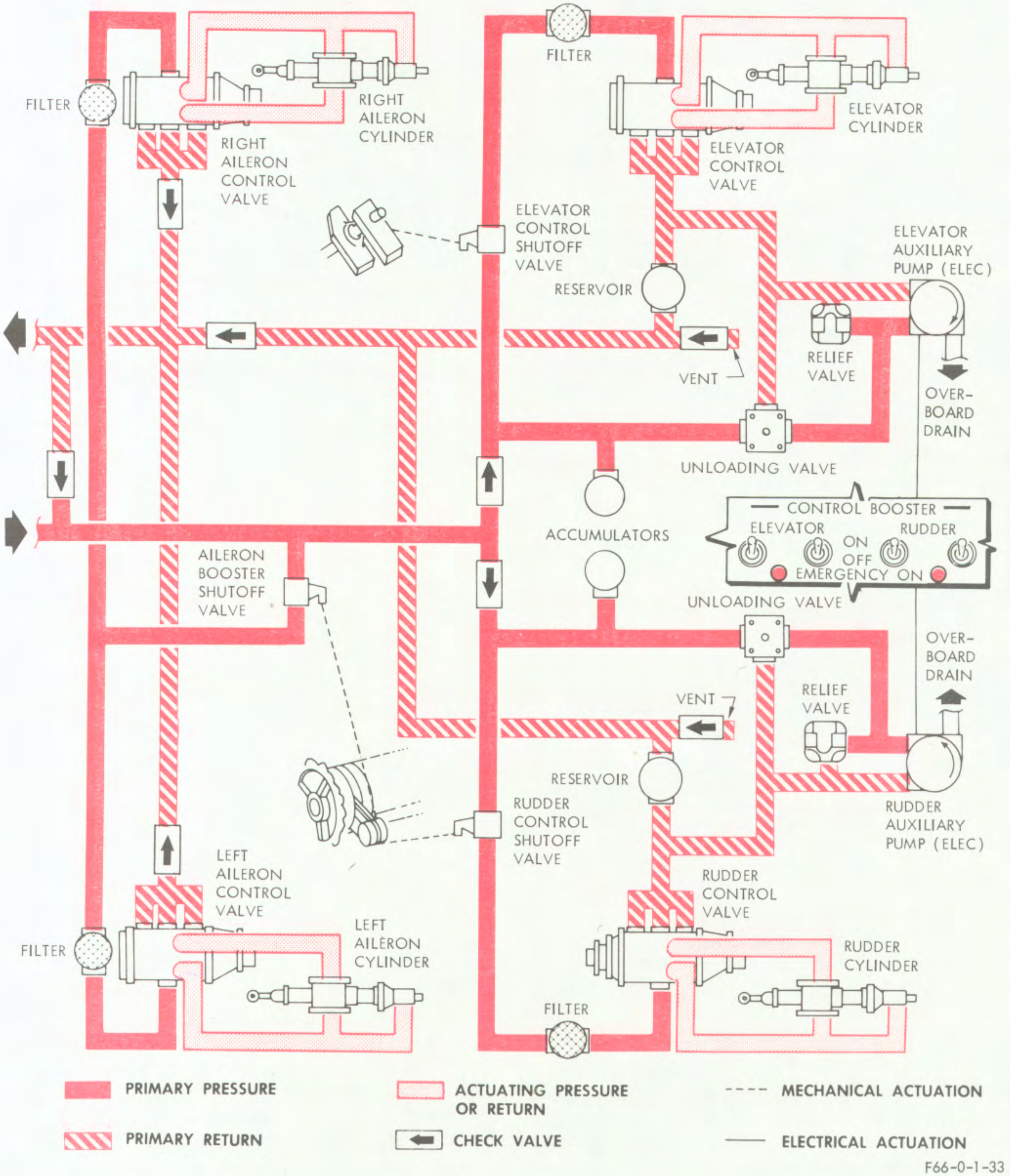


Figure 1-35

AILERON CONTROL SYSTEM

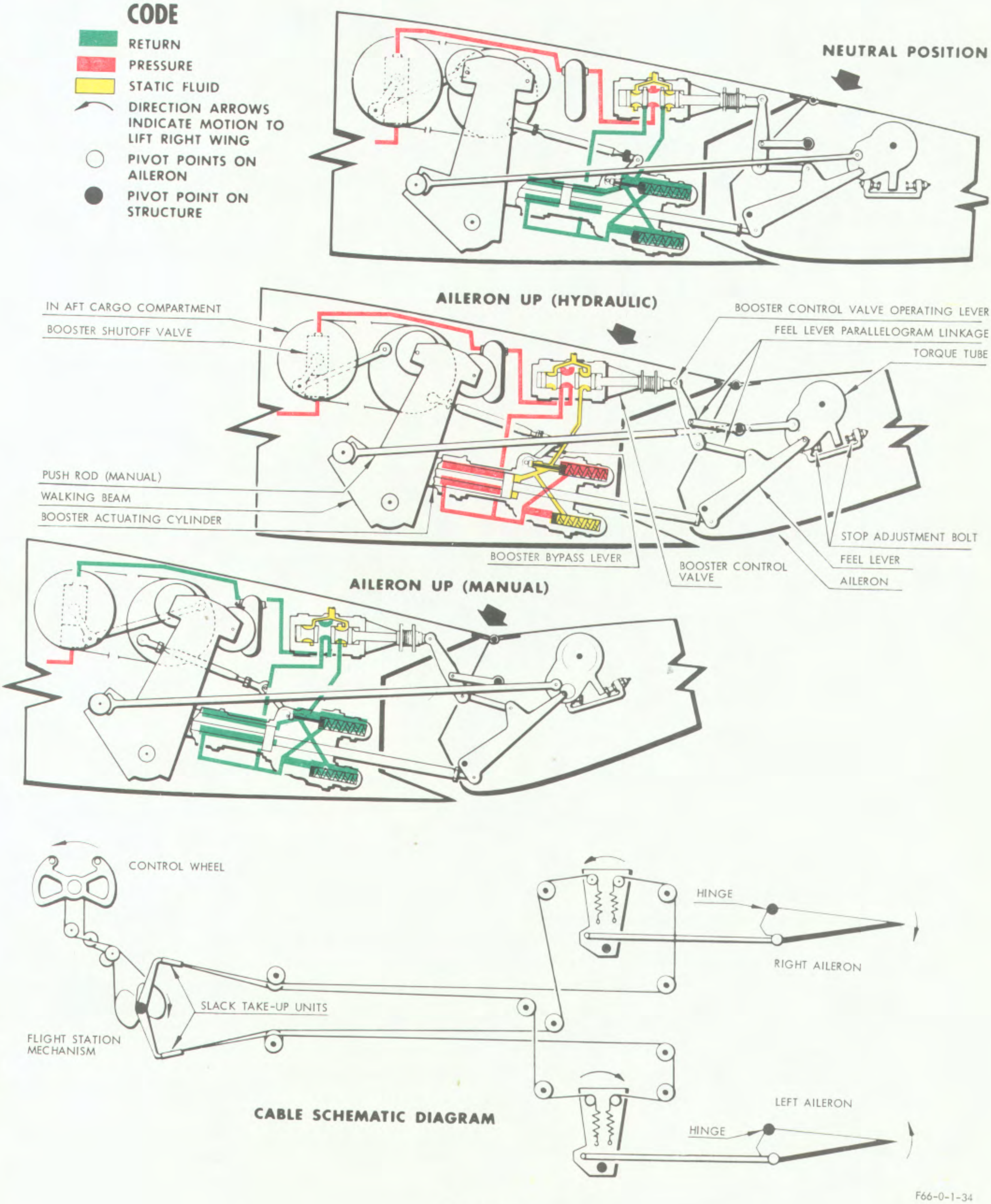


Figure 1-36

ELEVATOR CONTROL SYSTEM

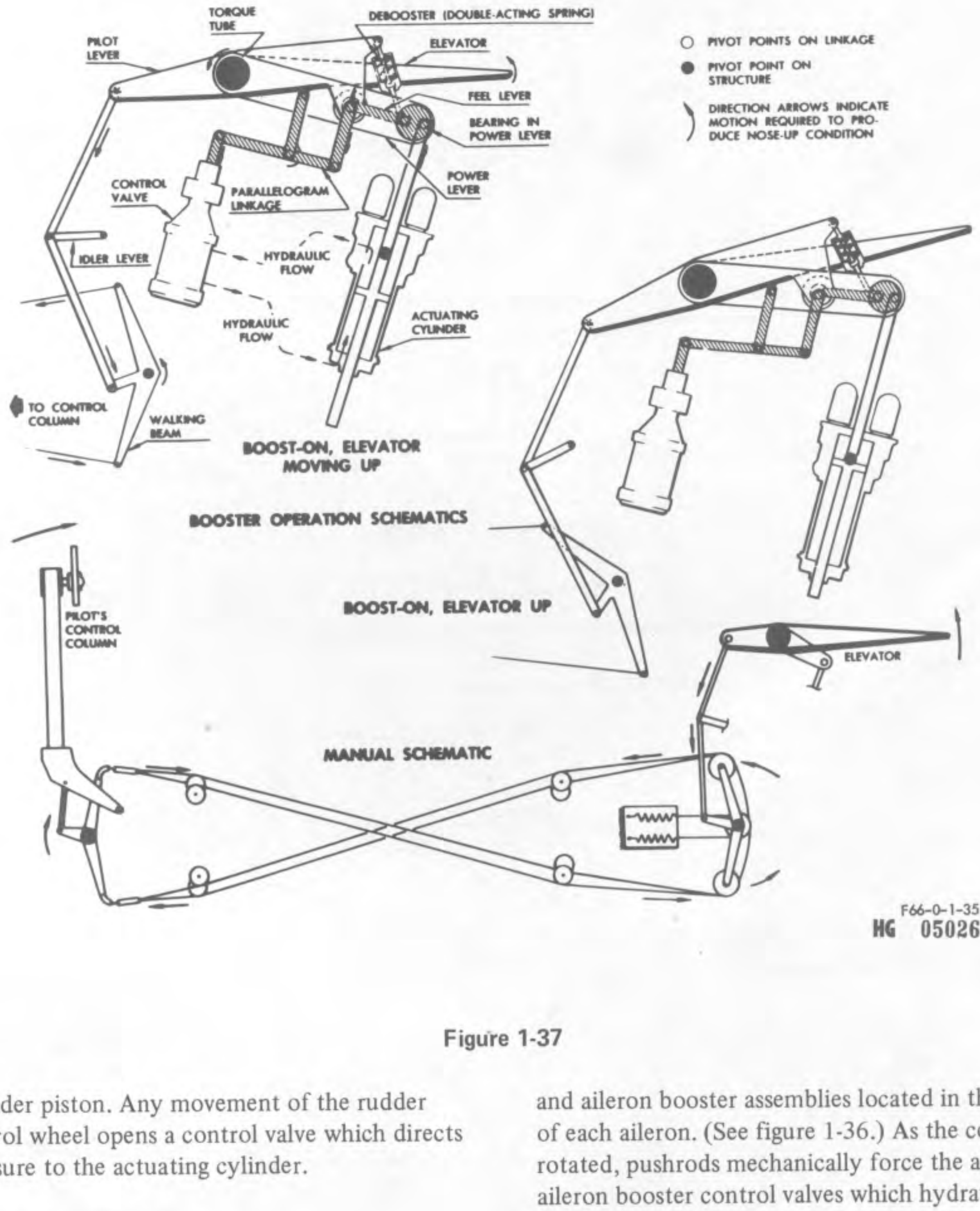


Figure 1-37

actuating cylinder piston. Any movement of the rudder pedals or control wheel opens a control valve which directs hydraulic pressure to the actuating cylinder.

SURFACE CONTROL LOCK.

The effect of surface control locks is achieved by engaging the flight control boosters while the aircraft is parked. The boosters provide sufficient resistance in the system to absorb impact loads caused by wind gusts.

AILERON CONTROL SYSTEM.

The aileron control system consists of a cable and pulley system connecting the pilots' control wheels to the ailerons and aileron booster assemblies located in the wing, forward of each aileron. (See figure 1-36.) As the control wheel is rotated, pushrods mechanically force the ailerons and the aileron booster control valves which hydraulically boosts control wheel action.

Aileron Trim Tabs.

A trim tab located in the trailing edge of each aileron, is controlled mechanically through a cable system. Movement of the cables is converted into rod linkage servo-action by a tab-actuating unit located in the outer wing structure. The rod linkage is connected to the tab and passes through the aileron to the aileron tab actuating unit.

Aileron Trim Tab Handcrank and Indicators.

An aileron trim tab handcrank (21, figure 1-10) located on the center control stand, is rotated to actuate a cable system to each aileron tab. Internal stops limit the number of turns of the handcrank in each direction from the NEUTRAL position. Tab position is shown by a needle forward of the handle and by a dial indicator above the handcrank. The needle on the lower dial gives the most sensitive indication and moves from the NEUTRAL position toward either the LEFT or RIGHT extremities as the handcrank is rotated.

Aileron Booster Control Lever.

The aileron booster control lever (3, figure 1-10) is located on the center control stand to the left of the throttle controls. When the booster control lever is pulled to the OFF position, a cable system actuates a hydraulic shutoff valve and opens a bypass valve in each aileron actuating cylinder. Fluid from the hydraulic system is then shut off from the boosters, and the bypass valves in each cylinder allow the fluid to flow freely from one end of the cylinder to the other as the ailerons are moved. When the boosters are shut off, control wheel forces are transmitted to the ailerons through the mechanical system of cables and linkage.

RUDDER CONTROL SYSTEM.

Each rudder pedal is connected by cable to a quadrant assembly, located in the aft fuselage section. (See figure 1-38.) The quadrant assembly is connected by push-pull rods to each rudder. Linkage also connects the cable quadrant to the rudder booster assembly, which, in mechanical arrangement, is different from the aileron and elevator booster assemblies in that it incorporates a trail center valve.

Rudder Trim Tabs.

The flight station trim tab control is connected by cable to each outboard rudder tab actuating unit. The tab actuating units are connected to the tabs by adjustable link rods which screw forward and rearward by action of the actuator, thus deflecting the tab. The rudder trim tabs have no servo action.

Rudder Booster Control Lever.

A rudder booster control lever (2, figure 1-10) is located on the center control stand to the left of the throttles. When the booster control lever is pulled to the OFF position, a control cable actuates a hydraulic shutoff valve and opens a bypass valve in the rudder actuating cylinder. Fluid from the hydraulic system is then shut off from the booster, and the bypass valve in the cylinder opens and allows the fluid to flow freely from one end of the cylinder to the other as the rudder is moved. When the rudder booster is shut off, rudder pedal forces are transmitted to the rudders through the mechanical system of cables and linkage.

Rudder Auxiliary Booster Switch.

The rudder auxiliary booster switch (4, figure 1-7), located on the pilots' overhead panel, has three positions, ON, OFF, and EMERGENCY ON. It is spring-loaded from the EMERGENCY ON position to OFF. When the switch is moved to the ON position, the electrically operated hydraulic pump is energized, which supplies auxiliary hydraulic power to the rudder booster if normal hydraulic power is not available. When the switch is held in the EMERGENCY ON position, electrical power is supplied directly to the auxiliary motor from the dc bus or, if that bus is dead, directly from the aircraft batteries without the protection of circuit breakers.

Rudder Trim Tab Handcrank and Indicator.

The rudder trim tab handcrank (23, figure 1-10) is located on the center control stand and is rotated to drive a drum in the control unit. This drum is connected by cables to a similar drum in each of the two tab-actuating units located in the outboard rudders. Internal stops limit the number of turns of the handcrank in each direction from the NEUTRAL position. Tab position is shown by a dial indicator forward of the handcrank. The needle on the dial moves from the NEUTRAL position toward either the LEFT or RIGHT extremities as the handcrank is rotated.

Rudder Auxiliary Booster Indicator Light.

A rudder auxiliary booster indicator light (7, figure 1-7) is located on the pilot's overhead panel adjacent to the rudder auxiliary booster switch. The indicator light glows amber whenever the auxiliary boost pump is in operation.

ELEVATOR CONTROL SYSTEM.

Both control columns are connected by cable to an elevator walking beam which is connected by a linkage system to the elevators. (See figure 1-37.) Direct linkage connects the elevators and the hydraulic booster assembly. The principle of operation of the booster assembly is similar to that of the aileron booster. An actuating cylinder, a control valve, and connecting linkage are the essential parts of the booster assembly. Elevator booster operation can also be provided by an auxiliary dc electrically-driven hydraulic pump which supplies hydraulic power to the booster unit in the event of failure of the normal hydraulic system. An emergency elevator booster shift control is provided to shut off the booster and to alter the leverage ratio between the flight station controls and the booster mechanism.

RUDDER CONTROL SYSTEM

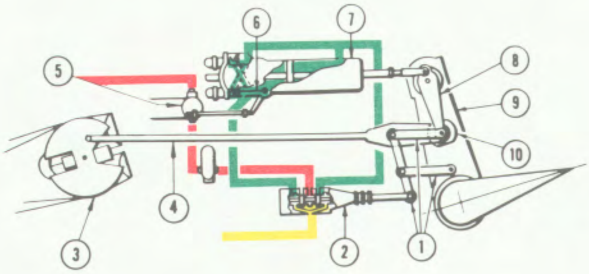
VIEW A illustrates the rudder booster mechanism with the rudder approximately 15 degrees to right. The parallelogram linkage (1) is positioned to hold control valve (2) in neutral. Any movement of lever (8) from alignment with rudder-operating arm (9) will open the control valve.

VIEW B illustrates opening of the control valve by force initiated by the pilot. The control cables have rotated rudder quadrant (3) and, by pulling push-pull feel bar (4), have rotated lever (8) about the actuating-cylinder piston-rod attaching bearing. The rudder moves slightly as the control valve is opened.

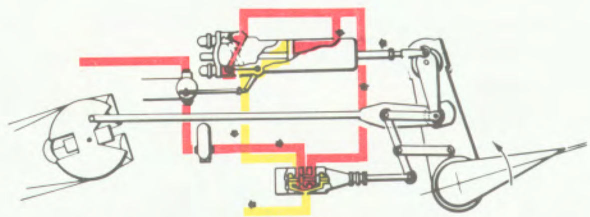
Hydraulic pressure is directed by the control valve to the actuating-cylinder, as long as the rudder quadrant is rotated in advance of the rudder-operating arm, or as long as force is necessary to overcome air load on the rudder. Hydraulic pressure, acting upon the cylinder piston, creates a force proportional to that applied to the push-pull feel bar (4) by the pilot. These combined forces move the rudder, and because the pilot must furnish a part of the force to move the rudder, he has a continuous "feel" of the air load on the rudder.

When the movement of the rudder quadrant is discontinued the hydraulic pressure continues the movement of the rudder-operating arm (9) until the arm is aligned with lever (8) and the valve is thereby returned to neutral.

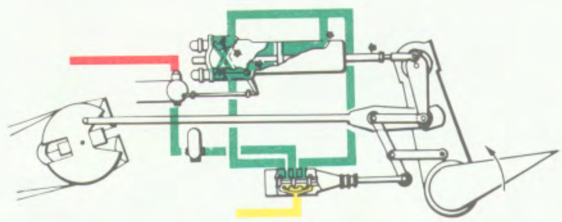
VIEW C illustrates the operation of the rudder by manual force alone. The cable-controlled shut-off valve (5) has been closed and the bypass valve (6) opened, leaving the cylinder piston free to move. Rotation of the rudder quadrant by the cables has moved lever (8) until it has taken up the lost motion in the oversize hole (10) in the rudder-operating arm. Direct force is then applied in moving the rudder-operating arm and the rudder to the right.



VIEW A



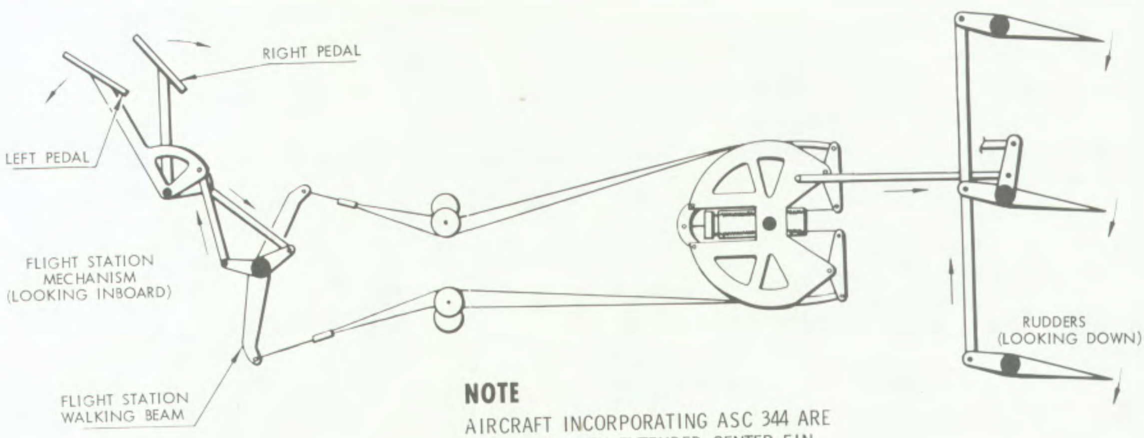
VIEW B



VIEW C

WITH THE TRAIL CENTER CONTROL VALUE CENTERED AS SHOWN IN VIEW "A," RESIDUAL EQUAL PRESSURE IS PRESENT ON BOTH SIDES OF THE ACTUATED CYLINDER PISTON.

PRESSURE | **STATIC FLUID**
RETURN | **PIVOT POINT ON STRUCTURE**



NOTE

AIRCRAFT INCORPORATING ASC 344 ARE PROVIDED WITH EXTENDED CENTER FIN (FIXED CENTER RUDDER)

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Figure 1-38

Elevator Trim Tab Control Wheels and Indicator.

Elevator trim tabs may be controlled manually by control wheels (1, figure 1-10) located on each side of the pilots' center control stand. They are interconnected by a shaft which drives a drum pulley. A control cable connects the drum pulley in the stand with the tab actuating units. The control wheel is rotated forward for nose-down and backward for nose-up trim. A dial needle indicator, driven by the drum shaft by means of gears, is mounted inboard of the wheels on the control stand and indicates the relative position of the tabs.

Elevator Booster Shift Control.

The elevator booster shift control (22, figure 1-10) is located on the left side of the center control stand and consists of a shaft with a pushbutton lock on the handle grip. Normally, the control is in the forward and downward position for boost ON. It is pulled upward and aft for boost OFF. In the event of elevator booster system failure, the elevators may be actuated manually by use of the emergency elevator booster shift control. When this shift lever is pulled upward, it shuts off and bypasses the normal and auxiliary booster systems and alters the leverage ratio between the control columns and the elevator. This provides the pilots with sufficient mechanical advantage to actuate the elevators manually during boost-off operations. The amount of elevator travel in relation to control column movement is reduced by a factor of approximately 3-to-1, and there is approximately one and one-half inches of free movement in the control column before elevator movement results.

Elevator Auxiliary Booster Switch.

The elevator auxiliary booster toggle switch (4, figure 1-7) located on the pilots' overhead panel, has three positions, ON, OFF, and EMERGENCY ON. It is spring-loaded from the EMERGENCY ON position to OFF. When the switch is moved to the ON position, the electrically-driven auxiliary hydraulic motor is energized and supplies hydraulic power to the booster. In the event of electrical system failure, the switch can be held in the EMERGENCY ON position to energize the auxiliary booster. The electrical circuit to the EMERGENCY ON position includes the aircraft batteries; it is not protected by circuit breakers.

CAUTION

The rudder and elevator boost levers must be ON before the auxiliary boost system is effective.

WING FLAPS.

Wing flaps are Fowler type; flap motion during extension is a combination of an aft and a downward tilting movement. There are ten flap sections located in the inner wing panels (five in each wing). The flap control unit consists of a hydraulic selector valve and a follow-up mechanism that controls two hydraulically-driven flap motors which supply the driving force for the wing flaps. The control unit also allows prepositioning of the flaps and changing of the flap movement at any time before completing a selected cycle. The two hydraulic motors are located on the rear wing beam in the center section and normally are powered by the secondary hydraulic system. Output of the hydraulic motors is transmitted by a main driveshaft to driveshafts that extend into each inner wing panel to operate separate intermediate drive units. There are 12 intermediate drive units bolted to carriage track ribs and to brackets on the wing rear beam. The intermediate drive units turn sprockets that are connected by chains and cables to the wing flap carriages. The carriages are attached to the wing flap sections and roll on tracks riveted to adjacent wing ribs. Spring units take up the slack on the loose side of the chains to prevent jamming. If the wing flaps fail to operate by normal means, the flaps may be extended or retracted manually. Access to the shaft-and-gear mechanism is through the flap emergency access door, centrally located in the main cabin floor.

WING FLAP SYMMETRY PROTECTION SYSTEM.

Wing flap symmetry is protected by a system consisting of cam-operated switches mounted on the wing flap gearbox drive located on each extreme outboard flap mechanism. These switches are adjusted so that an open circuit exists during normal operation of the wing flaps. Should an asymmetrical wing flap condition occur, the open circuit is closed by rotation failure of the opposite cam-driven switch. This completed electrical circuit then trips a mechanical latching relay, which in turn energizes an asymmetrical-wing-flap warning light in the flight station and closes a dc electric motor-driven hydraulic shutoff valve. This valve shuts off hydraulic pressure to the wing flap motors and stops travel of the wing flaps.

Wing Flap Shutoff Valve Test Switch and Warning Light.

A two-position wing flap shutoff valve test switch and an asymmetrical wing flap warning light (18, figure 1-6) are located on the copilot's instrument panel. The test switch is spring-loaded from TEST to NORMAL. The test switch provides a means of testing the asymmetrical wing flap warning light and the operation of the hydraulic shutoff valve without energizing the dc latching relay. With the switch in the TEST position, the warning light is energized and the shutoff valve is closed. With the test switch in the

WING FLAP MOTOR HYDRAULIC SYSTEM

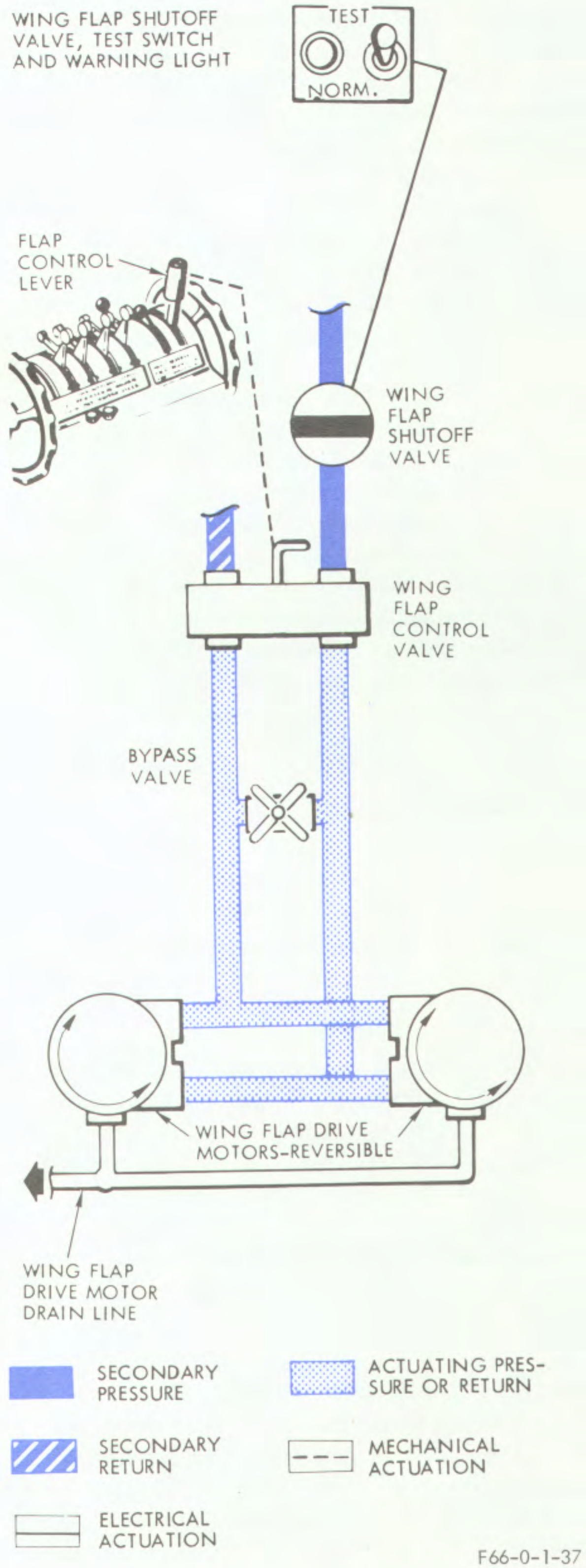


Figure 1-39

NORMAL position, the warning light will be out and the shutoff valve open.

Wing Flap Lever.

The wing flap lever (9, figure 1-10) is located on the top right side of the center control stand. There are four placcarded positions on the quadrant, TAKE OFF, APPROACH, 80%, and LANDING. When the lever is full forward, the flaps are in the up position. Moving the flap lever progressively aft permits the following flap extensions.

TAKE OFF	(60 percent extension)
APPROACH	(66 percent extension)
80%	(80 percent extension)
LANDING	(100 percent extension)

NOTE

There is no detent at the APPROACH position; however, the lever will remain at that position.

A switch is installed in the wing flap followup mechanism and is wired to the landing gear warning horn. This switch is wired in parallel with the landing gear warning horn throttle switches and energizes the warning horn circuit when the wing flap selector lever is in the 66 percent through 100 percent positions and the landing gear is not down and locked.

Emergency Extension Handcrank.

The emergency extension handcrank is strapped on the aft side of the bulkhead opposite the galley. It fits onto the emergency extension crank square drive socket (1, figure 1-38) located below the wing flap emergency extension access door.

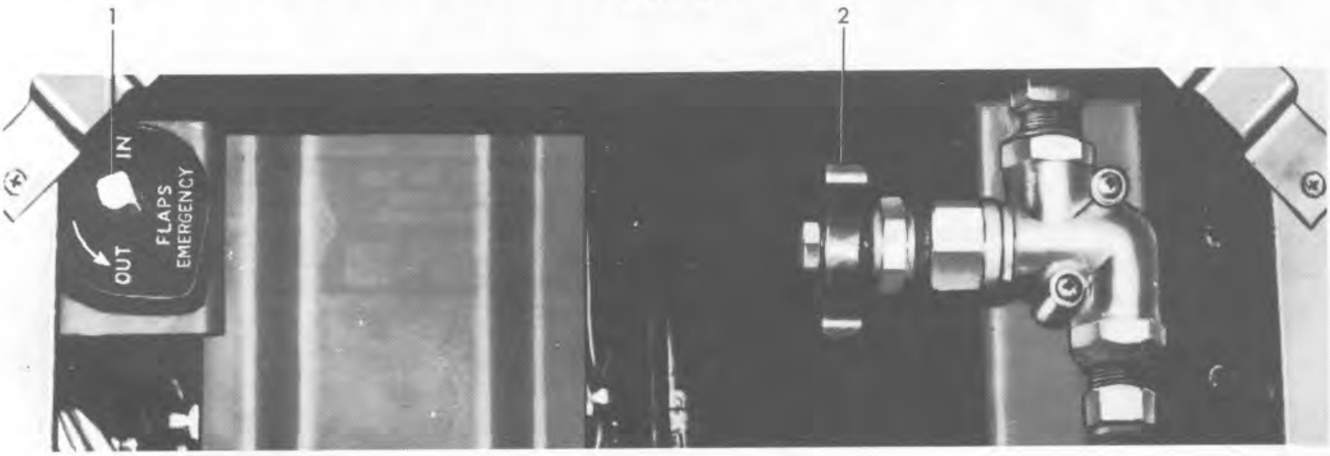
Wing Flap and Landing Gear Position Indicator.

The wing flap and landing gear position indicator (36, figure 1-6) is dc-operated and is located on the pilots' center instrument panel. The upper portion of the indicator shows flap position by illustrating a flap in the UP, DOWN, or intermediate positions. The DOWN position corresponds to 100 percent extension. The lower portion of the indicator shows landing gear position.

Wing Flap Asymmetry Indicator.

The wing flap asymmetry indicator (16, figure 1-6) is operated by 26-volt ac current and is located on the copilot's instrument panel adjacent to the wing flap shutoff valve test switch. It is a dual indicator, placarded UP and DOWN, showing the position of each wing flap.

WING FLAP EMERGENCY EXTENSION CONTROLS
(TYPICAL)



1 WING FLAP EMERGENCY OPERATION DRIVE

2 WING FLAP MOTOR BYPASS VALVE

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Figure 1-40

Wing Flap Motor Bypass Valve.

A wing flap motor bypass valve (2, figure 1-40) permits hydraulic fluid to circulate through the hydraulic flap motor preventing a hydraulic lock during emergency wing flap extension. Turning the control valve counterclockwise opens the valve. (Refer to Section III for emergency procedures.)

LANDING GEAR SYSTEM.

All aircraft are equipped with a fully retractable, tricycle landing gear. When the gear retracts, the nose gear pivots aft into the underside of the fuselage, and the main gears pivot forward into the nacelle wheel wells. Landing gear doors, which are mechanically operated by oleo-pneumatic shock struts, lie flush with the airplane contour when the gears are retracted. The secondary hydraulic system provides pressure to operate the uplocks, downlocks, and actuating cylinders which extend and retract the landing gear. The nose and main gears have oleo-pneumatic shock struts which utilize air and hydraulic fluid to give controlled resistance to taxiing, takeoff, and landing shocks. Dual wheels are mounted on each landing gear shock strut. The nose gear wheels are cambered 12 degrees to help forward castering. A centering saddle cam is built into the nose gear shock strut to aline the gear when there is no weight on it. Scissors links keep the landing gear shock strut pistons and cylinders in alinement. For ground handling, the nose gear scissors link may be quickly disconnected by removing the center pivot bolt.

LANDING GEAR HYDRAULIC SYSTEM.

A cable-actuated hydraulic selector valve, located in the aft end of the forward cargo compartment, directs secondary hydraulic system pressure to either the retracting or extending end of the landing gear actuating cylinders, and to the uplocks or downlocks. (See Figure 1-41.) The main gear actuating cylinders, which are located on each upper drag strut assembly, have a runaround valve which allows hydraulic fluid to pass from one side of the actuating cylinder pistons to the other without returning the fluid to the hydraulic reservoir when the gears extend, thereby reducing operating time. The right wing secondary heat exchanger fan motor receives hydraulic fluid from the secondary hydraulic system. Normally, the motor is shut off by a main gear scissors switch when the right-hand strut is extended. In the event of failure of this switch, landing gear operating time may be increased because the flow of fluid to the fan motor will tend to starve the landing gear system.

Emergency Landing Gear Extension.

If the secondary hydraulic system does not supply sufficient pressure, the landing gear can be extended by means of a handpump system. Hydraulic fluid for the handpump is taken from an emergency extension hydraulic reservoir and

LANDING GEAR HYDRAULIC SYSTEM

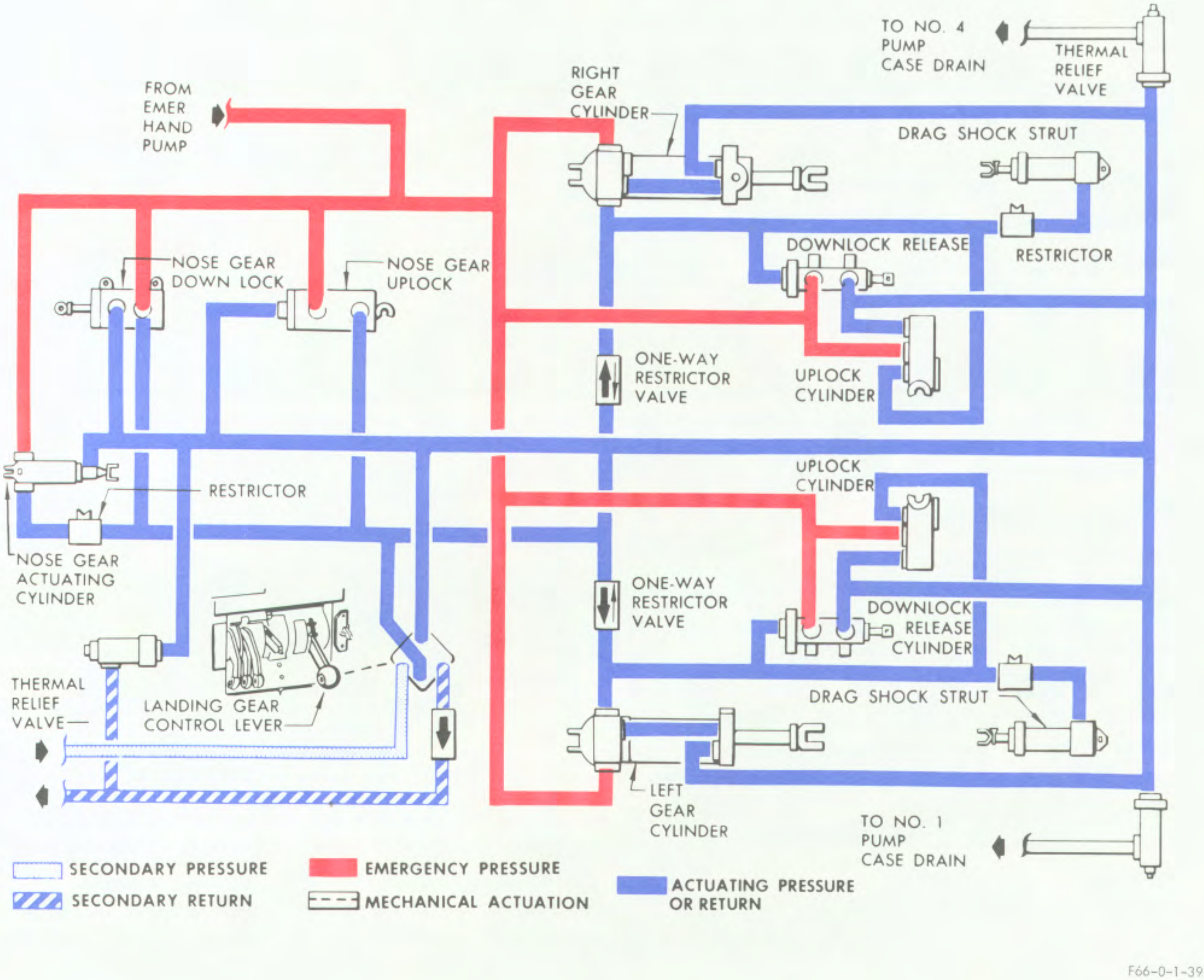


Figure 1-41

is directed to the uplocks, gear actuating cylinders, and downlocks through separate hydraulic lines. No emergency means is provided for gear retraction. The hydraulic system crossover valve provides means for extending and retracting the landing gear if normal secondary hydraulic system pressure is not available. (Refer to Hydraulic System Crossover Valve, this section.)

Main Gear Drag Struts.

The main gear drag strut assembly consists of an upper and lower drag strut. The upper strut is composed of two rigid triangular forgings which are bolted together with pivot points at each end. The lower drag strut is a hydraulic cylinder that absorbs forward and backward shock loads of landing and taxiing, by the combined action of an internal spring and a metering orifice. There is no circulation of fluid through the lower drag strut, but when the landing gear lever is in the DOWN position, pressure from the secondary hydraulic system is used to maintain hydraulic fluid in the lower drag strut.

Uplocks.

The main gear uplocks are mechanically latched to the landing gears which trip the uplock triggers when they are completely retracted. The locks are released by hydraulic pressure and are held open by springs and pressure as the gear extends. The nose gear uplock operation is similar to that of the main gear. The gears cannot be dislodged from the uplocks by any maneuvering loads.

Downlocks.

When each main gear is down, a downlock strut prevents the drag strut from folding. One end of the downlock strut connects to the pivot that connects the upper and lower drag struts; the other end hooks over a lock shaft mounted in the wheelwell. A spring-loaded latch in the hook prevents disengagement except by operation of a hydraulic downlock release cylinder. The nose gear downlock is a mechanical cam that locks the drag strut in the extended position. The gear cannot retract until the cam is released by the nose gear downlock release hydraulic cylinder.

Gear Pins.

When the aircraft is parked, ground safety pins must be inserted through the downlock mechanisms. (See figure 1-42.) These pins will prevent accidentally folding the gears should inadvertent downlock release occur as the result of mispositioning of the landing gear lever while secondary hydraulic system pressure is available. These pins cannot be removed if hydraulic pressure is directed to the up side of the cylinders.

Landing Gear Lever and Solenoid Lock Release.

The landing gear lever (18, figure 1-10) located on the right aft face of the center control stand, actuates the landing gear selector valve by control cables. It has three positions, UP, DOWN, and NEUTRAL. The lever is moved to the UP position to retract the landing gear and to the DOWN position to extend it. There is a detent in the NEUTRAL position (midway between the UP and DOWN positions). The landing gear lever must be pulled out to move it toward the UP position. The release trigger to the right of the lever must be held toward the lever to move it past the NEUTRAL position and into the UP position. After the landing gear has been retracted, the lever should be moved to the NEUTRAL position to decrease the possibility of leaks occurring in the landing gear system during flight, by shutting off unnecessary hydraulic pressure. The uplocks and downlocks are automatically positioned by hydraulic pressure. The uplocks hold the gear in the retracted position. When the landing gear is extended, the landing gear lever must be left in the DOWN position so that hydraulic pressure in the actuating cylinders supplements the downlocks. A solenoid lock prevents accidental movement of the lever to the UP position when the weight of the aircraft is on the gear. The solenoid lock is operated by a dc series circuit through both main gear scissors switches. The solenoid lock may be released manually by depressing the landing gear solenoid lock release, accessible through a hole in the right side of the center control stand (15, figure 1-10).

Emergency Handpump and Selector Lever.

The emergency handpump and selector lever are located on the flight station floor outboard of the copilot's seat. (See figure 1-33.) The selector lever has two positions, EMER BRAKE and EMER GEAR. When the selector lever is in the EMER GEAR position (with the landing gear lever in DOWN and the emergency fuel dump selector lever in LG EMER EXT), operating the handpump supplies pressure to the uplocks, actuating cylinder, and downlocks through independent emergency extension lines.

NOTE

If the emergency handpump selector lever is in the EMER GEAR position and normal hydraulic pressure is available, it may not be possible to retract the landing gear since hydraulic pressure cannot return from the down side of the landing gear actuating cylinders.

Landing Gear Position Indicators.

A combination landing gear and wing flap position indicator (36, figure 1-6) is located on the pilot's center instrument panel. This indicator shows, individually, the position of all three wheels. When the word UP appears in an indicator window, the landing gear is up and locked. When the picture of a wheel appears, the gear is down and locked. When a red and white flag appears, the gear is somewhere between the two positions or the aircraft dc electric system is inoperative.

Landing Gear Warning Light.

The landing gear warning light (37, figure 1-6) is located near the landing gear position indicator. The dc light glows red whenever the landing gear is in an unlocked or an unsymmetrical position. It goes out when all gears are in the full retracted or extended and locked position. The push-to-test feature of this light is not operative when the gear is down and locked.

Landing Gear Warning Horn and Release Lever.

A landing gear warning horn is operated by four throttle switches connected in parallel, and the unlock contacts of the downlock switches are also connected in parallel. This horn will sound if one or more of the throttles is retarded beyond a critical setting and all gears are not down and locked. The landing gear warning horn can be silenced by locking the landing gear down, by advancing the throttles, or by raising the horn release lever, located on the left side

LANDING GEAR SAFETY PINS

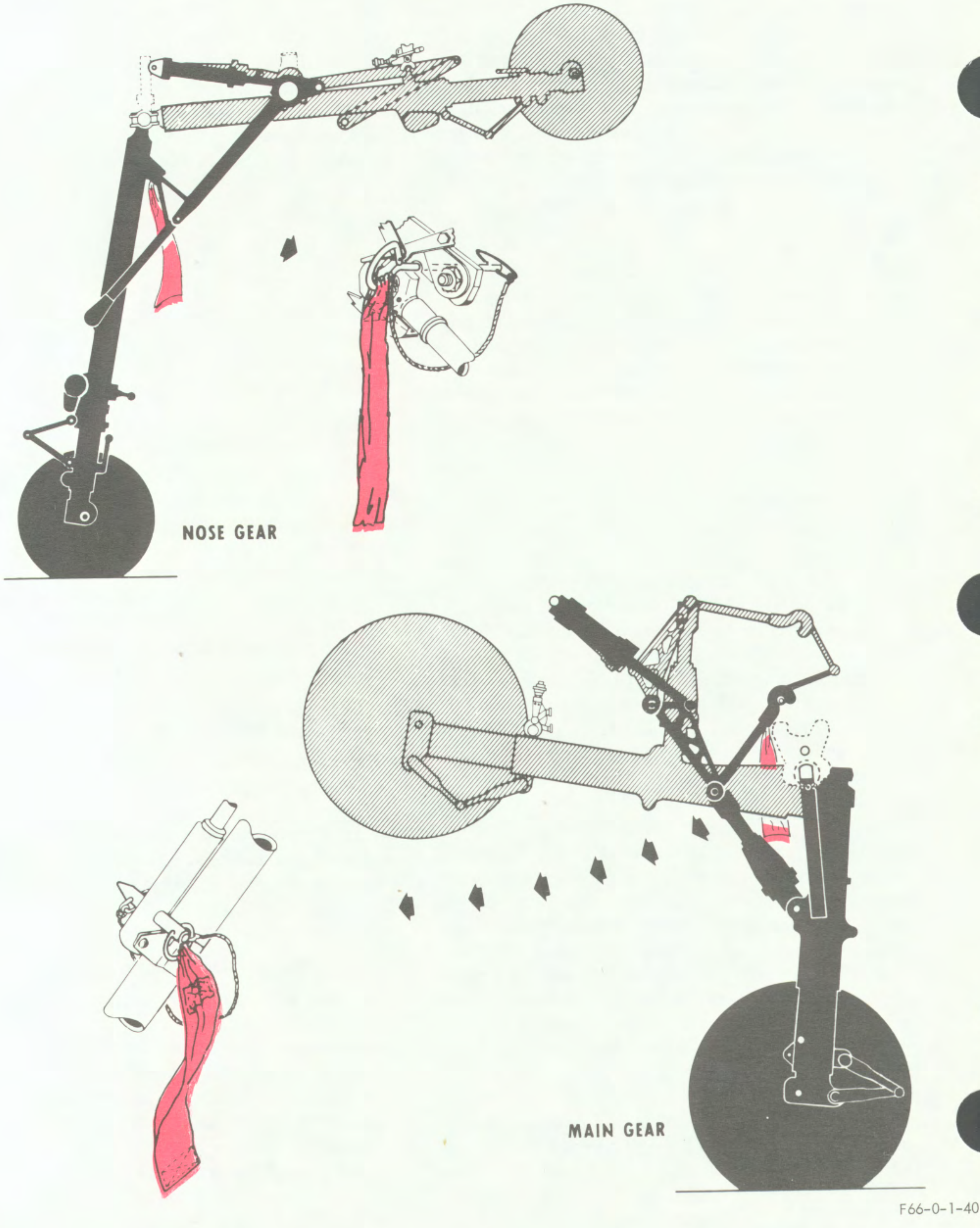


Figure 1-42

of the center control stand. If the horn has been silenced by the release lever, the dc circuit will be reset when the throttles are advanced. A switch installed in the wing flap followup mechanism is wired in parallel with the landing gear warning horn throttle switches. (Refer to Wing Flap Lever, this section.)

NOSE GEAR STEERING SYSTEM.

When the nose gear is extended it can be turned by the small control wheel located on the left side of the pilot's station. Turning the control wheel operates the control cables which actuate the steering control valve. This valve directs secondary hydraulic system pressure to the left or right steering control actuating cylinder to turn the nose gear. (See figure 1-43.) The control wheel must be held to keep the nose gear turned; when the wheel is released, the nose gear will center. Approximately one and one-half turns of the control wheel will deflect the nose gear approximately 58-1/2 degrees either side of center. When the nose gear is turned the maximum amount, the inside main gear will turn on a radius of 12 feet. Oscillations are dampened by orifices in the steering control actuating cylinders that restrict the flow of hydraulic fluid; these cylinders serve as shimmy dampers when the nose gear is in the neutral position. The control wheel folds along its diameter so that it will clear full forward and aft movement of the pilot's control column. A shutoff valve in the hydraulic line is linked to the nose gear strut to shut off hydraulic pressure to the steering control valve when the nose gear is approximately 37 degrees from the fully retracted position.

BRAKE SYSTEM.

Each of the four main landing gear wheels is equipped with an inner and an outer hydraulically-powered brake. These brakes are actuated by the pilot's and copilot's toe pedals which, when depressed, meter hydraulic fluid through either the normal brake system or the emergency brake system. (See figure 1-44.) The two systems employ separate valving and plumbing between the brake selector valve and the shuttle valves. The normal brake system is operated by secondary hydraulic system pressure. The emergency brake system also is operated by secondary hydraulic system pressure and, in addition, may be operated by accumulator pressure. If neither secondary hydraulic system pressure nor accumulator pressure is available, and if time permits, the emergency brake system may be operated by pressure supplied by the emergency handpump. The hydraulic system crossover valve may permit normal operation of the brake system. The aircraft is equipped with an emergency brake lockout debooster bleed system which bleeds fluid from

NOSE GEAR HYDRAULIC STEERING SYSTEM

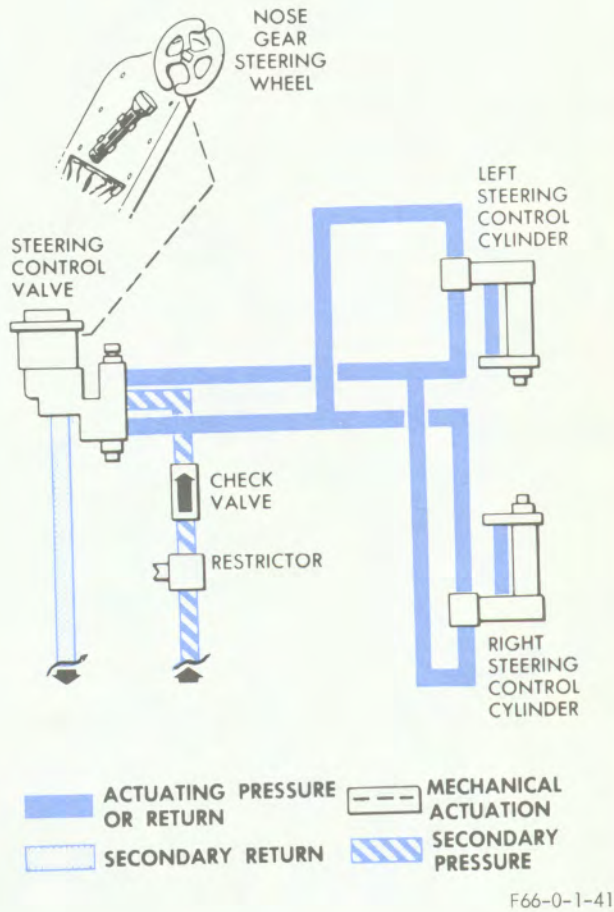


Figure 1-43

the normal brake system into the emergency brake system plumbing, downstream of the lockout deboosters, whenever the brakes are applied with the brake selector in the NORM position. The plumbing of this system precludes effective use of the emergency handpump to operate the brakes with the brake selector in the NORM position. When the brake pedals are released, the excess hydraulic fluid returns from the brake control valves to the emergency extension reservoir.

NORMAL BRAKE SYSTEM.

The normal brake system is selected by placing the brake selector in the NORM position. When the toe pedals are

BRAKE SYSTEM

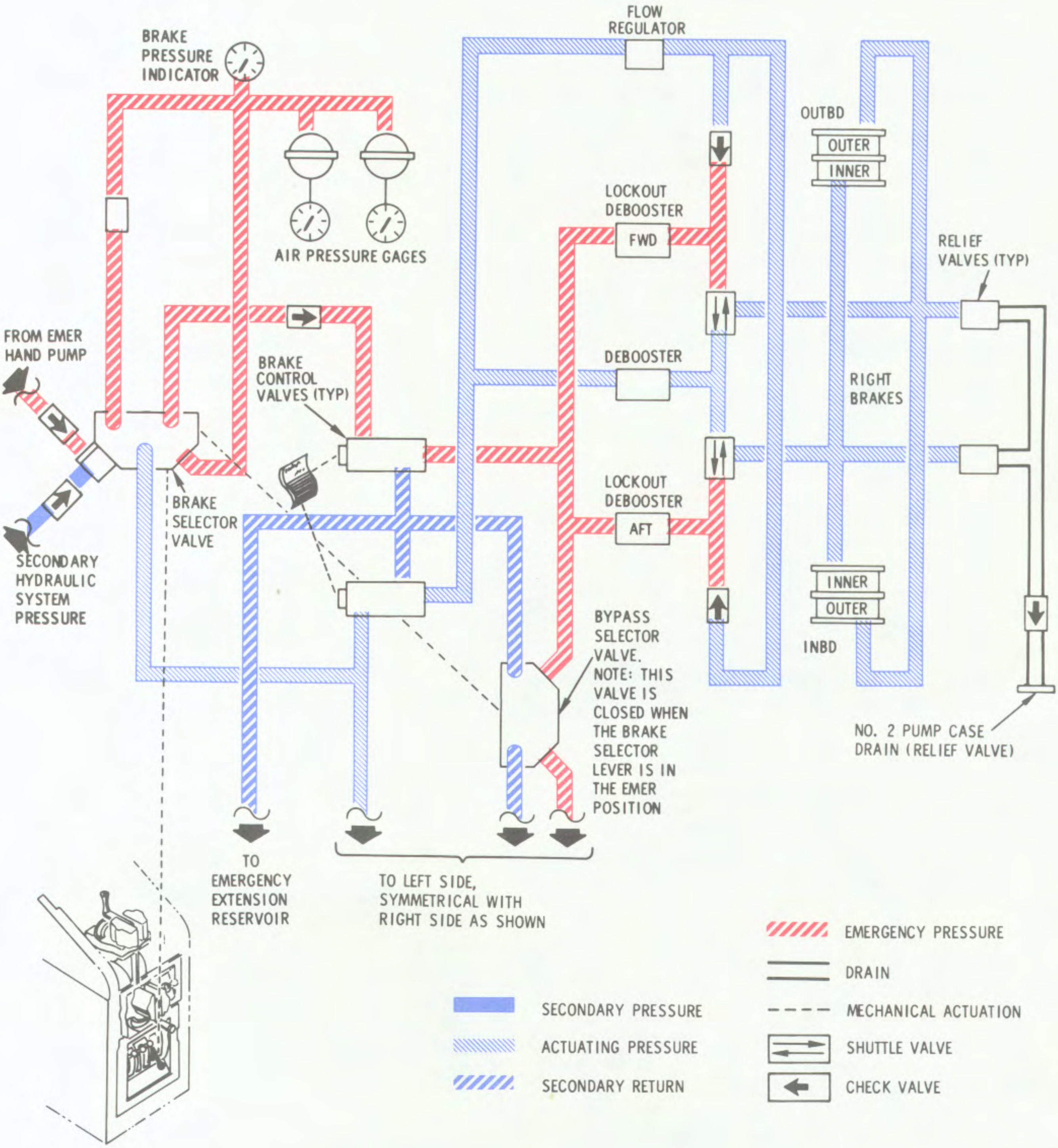


Figure 1-44

depressed, pressure from the secondary hydraulic system is transmitted through the brake selector valve and through the normal side of the dual brake control valves to the deboosters. From the deboosters, pressure reduced for optimum braking action, is transmitted through the suttle valves to the brakes. Brake relief valves are installed, one in the outboard brake and one in the inboard brake common lines, to provide protection against excessive pressures in the common pressure lines that may damage the brakes.

EMERGENCY BRAKE SYSTEM.

The emergency brake system is selected by placing the brake selector in the EMER position. When the toe pedals are depressed, secondary hydraulic system pressure, accumulator pressure, or pressure supplied by the emergency handpump is transmitted through the emergency porting of the brake selector valve and through the emergency side of the dual brake control valves to the lockout deboosters. From the lockout deboosters, pressure, reduced to the optimum for braking action, is transmitted through the shuttle valves to the brakes. There are two lockout deboosters for each pair of wheels. They differ from the deboosters in the normal brake system in that they isolate the low-pressure section of the brake system from the high-pressure hydraulic system. Each lockout debooster controls one of the dual brakes on each wheel, thus ensuring hydraulic pressure to one brake on each wheel in the event of a leak downstream from the other lockout debooster. With secondary hydraulic system pressure available, brake operation with the brake selector in the EMER position is similar to operation with the brake selector in the NORM position except that secondary hydraulic system pressure is directed to the brakes through the emergency system valving and plumbing instead of through the normal brake system. Wiehout secondary hydraulic system pressure, but with accumulator pressure, brake operation with the brake selector in the EMER position is also similar to operation with the brake selector in the NORM position, except that accumulator pressure, instead of secondary hydraulic system pressure, is directed to the brakes through the emergency system valving and plumbing; the number of brake applications is limited by the pressure stored in the accumulators as indicated by the emergency brake pressure gage. When the accumulators are the sole source of pressure, some pressure should be maintained in the accumulators during braking by operating the emergency handpump with the brake selector in the EMER position.

If neither the primary nor secondary hydraulic system is available, the emergency handpump system may be used. If the two main hydraulic power sources fail, hydraulic pressure to operate the brakes can be built up with the emergency handpump with the brake selector in the EMER position. In this configuration, pressure from the emergency handpump is directed to the brakes through the emergency brake system valving and plumbing. This procedure should be used as a last resort because of the time required to build up pressure manually.

Brake Pedals.

Aircraft brakes are controlled by the toe portion of the rudder pedals; they are connected to the brake control valves. The pilot's and copilot's brake pedals are interconnected by cables. Slack take-up springs are installed on each cable to take up the slack when the brake pedals are applied. The linkage is so arranged that the toe pedals can be depressed five degrees before pressure is fed to the brakes. As the pedals are depressed beyond five degrees the pressure increases. The rudder pedals are so hinged, and geometry of the linkage is such, that pedal movement for rudder control does not actuate the brake valve unless the pedals are tilted forward by toe pressure.

CAUTION

The pedals can be locked down without hydraulic pressure available.

Parking Brake Handle.

There are two parking brake handles (12, figure 1-10), one on each side of the center control stand. (See figure 1-45.) They are both connected to a lever at the rear of the control stand. With the parking brake handle in the lowered position, the parking brake is off. When raised after the toe pedals have been depressed, the mechanical linkage holds the brake valves in the open position. The parking brakes are released by depressing the toe pedals.

Brake Selector Valve Lever.

The brake selector valve lever (20, figure 1-10) is located on the aft face of the center control stand and has two positions, NORM and EMER. The lever is mechanically connected to the brake selector valve which directs hydraulic pressure through the normal or emergency hydraulic brake lines. When the lever is in the NORM position and the brake pedals are depressed, secondary hydraulic system pressure is directed to the normal brake lines. When the lever is moved to the EMER position while secondary hydraulic system pressure is available, the brake accumulators are charged and hydraulic fluid flows through the emergency brake lines. If secondary hydraulic system pressure is not available, the hydraulic power necessary to operate the brakes is provided by the charged brake accumulators or by operating the emergency handpump (which charges the brake accumulators when the brake selector lever is in the EMER position).

PARKING BRAKE LEVER AND VENTILATION DAMPER

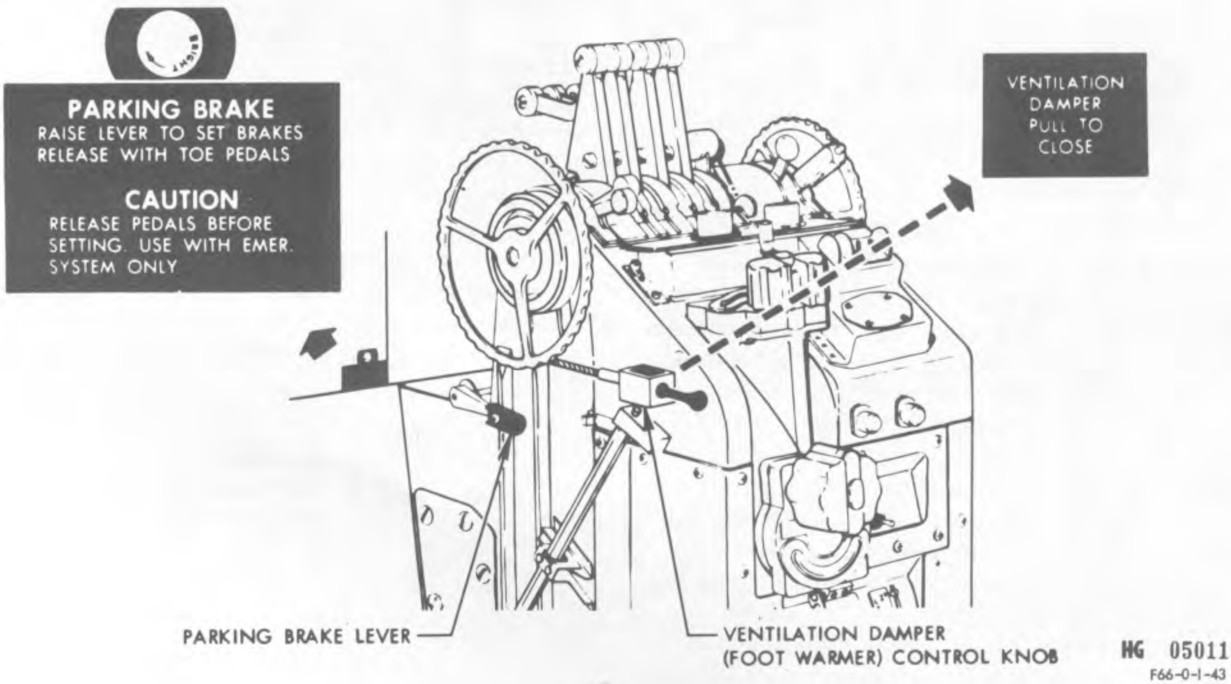


Figure 1-45

CAUTION

Do not shift the brake selector from NORM to EMER or from EMER to NORM position with brake pedals depressed because pressure surges may damage the brake system.

When the engines are shut down, normal secondary system pressure drops; therefore, the EMER position must be selected to provide constant pressure to the brakes.

Emergency Handpump Selector Valve Lever.

The emergency handpump selector valve lever is located near the base of the emergency handpump to the right of the copilot's seat. (See figure 1-33.) The lever is placarded EMER BRAKES and EMER GEAR. The lever normally is in the EMER BRAKES position, and must be in this position when the emergency handpump is used to supply emergency brake pressure.

Parking Brake Indicator Light.

A parking brake indicator light (40, figure 1-6) is located on the pilot's instrument panel and is operated by a microswitch actuated by the parking brake lever.

CAUTION

The parking brake warning light merely indicates that the parking brake handle is raised. It does not indicate that the brakes are locked sufficiently to keep the aircraft from rolling.

Emergency Brake Pressure Indicator.

The emergency brake pressure indicator (24, figure 1-6), located on the copilot's auxiliary instrument panel, is a direct-reading pressure instrument marked in psi and actuated by hydraulic pressure in the lines near the brake accumulators.

INSTRUMENTS.

Instruments are grouped on the pilots', flight engineer's, and navigator's instrument panels, and on the airconditioning control panel.

Altimeters.

The altimeters (35, figure 1-6) include an extended 10,000-foot pointer incorporating a notched disc warning indicator. At altitudes below 16,000 a striped section will appear through the notched disc.

NOTE

It is possible to make a 10,000-foot error in setting the standard altimeters in use in the USAF. When the barometric set knob is continuously rotated after scale is out of view, the numbers will reappear in the Kollsman window from the opposite side. If the correct altimater setting is then established, the altimeter will read approximately 10,000 feet in error. As a preflight check, special attention should be given to the altimeter to ensure that the 10,000-foot pointer is reading correctly.

Vertical Velocity Indicators.

Vertical velocity indicators (28, figure 1-6) are mounted on the pilot's and copilot's instrument panels and on the air-conditioning control panel. The vertical velocity indicator on the air-conditioning control panel indicates only the equivalent cabin pressure rate of change. The other two indicators show the aircraft rate of climb or descent in feet per minute.

Master Heading Indicator (Fluxgate).

The fluxgate master heading indicator (17, figure 1-6), located on the copilot's instrument panel, indicates the magnetic heading of the aircraft. It receives heading signals from a fluxgate transmitter installed in the left wing outer panel. Output from the indicator is amplified by a C-1 compass amplifier and distributed to the compass cards of the radio magnetic indicators on the pilot's and copilot's instrument panels, on the glareshield panel, and on the navigator's instrument panel.

Magnetic Compass (Stand-By).

The magnetic compass is mounted above the center windshield panel. It contains a card graduated in degrees and indicates the direction of flight with reference to magnetic north. A compass correction card is mounted on the pilot's and copilot's auxiliary instrument panels and each card shows compass deviation corrections.

Gyro Compass System (J-2).

The J-2 gyro compass system provides magnetic heading information to the pilot, navigator, and EWO. A flux-valve in the right wing outer panel sends heading signals to an A-2 magnetic compass amplifier at the navigator's station. Outputs from the amplifier are sent to the pilot's gyro compass repeater (5, figure 1-6), to the navigator's gyro compass repeater, and to the EWO's gyro compass repeater.

Attitude Indicators (Gyro Horizon).

Two gyro horizon attitude indicators (8, figure 1-6), powered by alternating current, are mounted on the pilot's and copilot's instrument panels. Each indicator is an electrically driven vertical-seeking gyro, coupled with a bank marker and a horizontal reference bar. A knob on the instrument provides adjustment of the horizontal reference bar to correspond to different pitch attitudes. Quick erection of the gyro is accomplished in this indicator by means of a mechanical caging device. The gyro must be caged immediately after power is applied to the indicator by pulling out the caging knob on the front bezel. The knob should be held in the extended position until the horizontal bar and the bank index stop oscillating, at which time they should indicate zero roll and pitch within approximately 3 degrees. Caging time will depend upon the position of the gyro; however, the longest time will be approximately 10 seconds. Instantaneous erection may be obtained by holding the caging knob in the extended position when the power is turned on. The indicator contains a power warning flag that is visible whenever the power supply is shut off, or there is an improper phase rotation or an open or short circuit in the instrument. The flag will disappear under normal circumstances, indicating that the power supply is on and satisfactory.

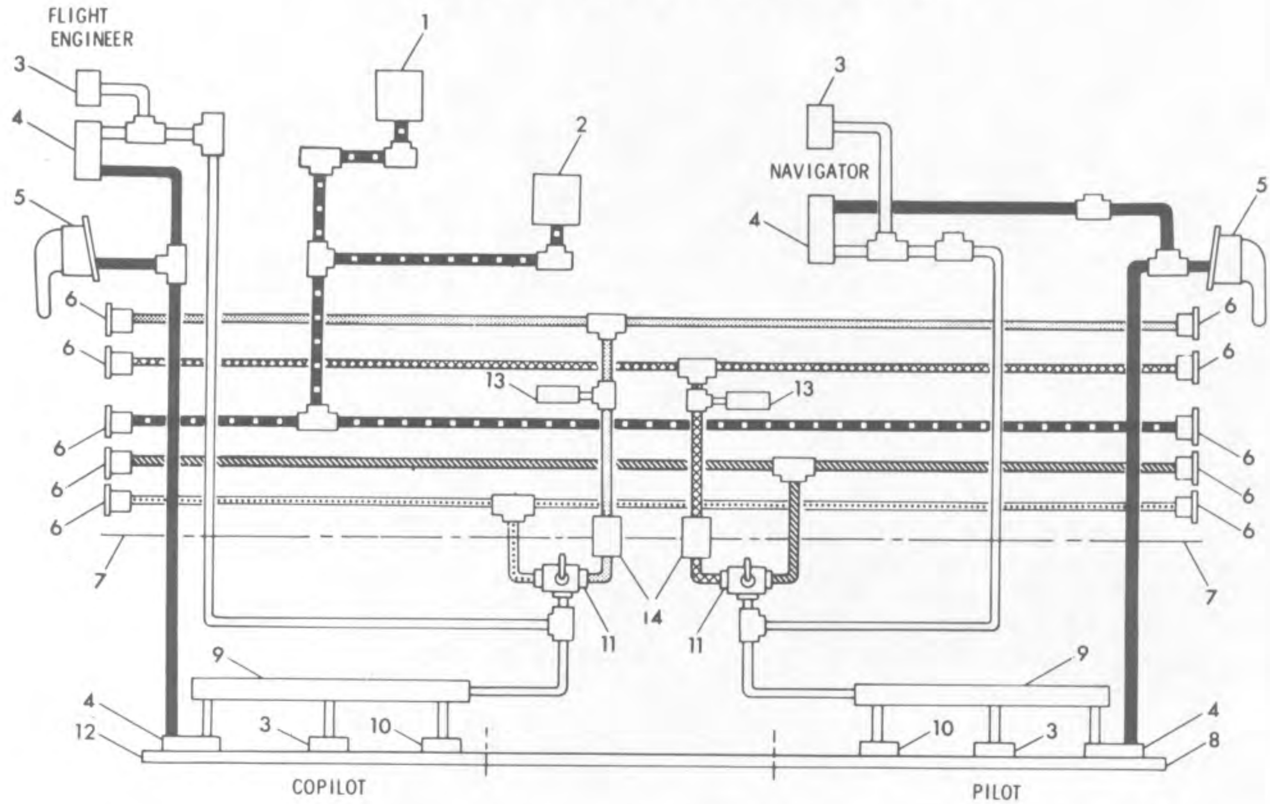
Free Air Temperature Indicator.

An air temperature indicator is mounted on the pilot's, flight-engineer's upper, and the navigator's instrument panels. The indicators are energized by dc electrical resistance bulbs located in the right side of the nosewheel well.

Clocks.

Standard Clock. Eight day clocks with 12 hour dials and center sweep hands are mounted on the pilot's and copilot's instrument panels (10, figure 1-6). Other clocks are mounted on the radio operator's panel, above the navigator's panel, and at the CICO station desk.

PITOT - STATIC SYSTEM



1 CABIN DIFFERENTIAL PRESSURE GAGE
2 AUTOMOATIC PILOT AMPLIFIER - SIGNAL GENERATOR
3 ALTIMETER
4 AIRSPEED INDICATOR (KNOTS)
5 TOTAL PITOT HEAD
6 FLUSH STATIC PORTS
7 BRACKET ASSEMBLY
8 PILOT'S LEFT PANEL
9 MANIFOLD
10 RATE OF CLIMB INDICATOR
11 STATIC SELECTOR SWITCH
12 PILOT'S RIGHT PANEL
13 WATER TRAP
14 PULSATION FILTER

PILOT'S FIRST STATIC
PILOT'S SECOND STATIC
COPILOT'S FIRST STATIC
COPILOT'S SECOND STATIC
FLUSH STATIC
PITOT STATIC
PITOT PRESSURE

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Figure 1-46

Elapsed Time Clock. An elapsed time clock (9, figure 1-6) is installed on the pilot's instrument panel. An hour, minute, and sweep second hand indicates the elapsed time on a twelve hour dial, with sixty second graduations marked on the outer edge of the dial. The clock requires winding each day. Successive depressions of the stem simultaneously causes the hour, minute, and sweep second hands to start, stop and return to zero.

Inclinometers.

An inclinometer (1, figure 1-15) is installed on the flight engineer's lower instrument panel. The instrument is a ball-bank type and indicates the pitch attitude of the aircraft about the lateral axis.

PITOT-STATIC SYSTEM.

The pitot-static system includes the pitot system through which impact air pressure is transmitted to the airspeed indicators and the static system through which outside static air pressure is transmitted to the altimeters, airspeed indicators, vertical velocity indicators, cabin differential pressure indicator, and altitude control of the automatic pilot. (See figure 1-46.)

Pitot System.

Two separate pitot systems are provided, each of which includes a pitot head installed on the lower fuselage nose. The left pitot head supplies impact air pressure for the pilot's and navigator's airspeed indicators. The right pitot head supplies impact air pressure for the copilot's and the flight engineer's airspeed indicators.

Static System.

Flush-type static openings on each side of the fuselage nose are the source of static air pressure. Two separate systems, first static (aft) and second static (fwd), are installed to provide separate and alternate static selection to both the pilot and copilot in an emergency. The selection of either system is controlled by the static selector valves on the pilot's and copilot's instrument panels (30, 41, figure 1-6).

EMERGENCY EQUIPMENT.

The following equipment consists of fixed systems and loose equipment that contribute to safety of flight.

EMERGENCY SHUTOFF LEVERS.

Four emergency shutoff levers (25, figure 1-5) are located on the control quadrant aft of the pilot's overhead panel. These levers actuate valves that shut off hydraulic oil, fuel, generator blast air, and lubricating oil to the engines. Each lever has four notched positions on the control quadrant. The full forward position is ALL ON; the next position shuts off hydraulic oil; the third position shuts off fuel and generator blast air; the last and full aft position shuts off engine oil (however, oil is still available for feathering the propeller.) These levers mechanically operate cam arrangements through cable and pulley systems, which in turn actuate the hydraulic, fuel, and oil shutoff valves. As the lever enters the third position on the quadrant, it trips a switch that energizes a small dc electrical actuator, mounted on the aft face of the firewall, that shuts off the blast air.

FIRE DETECTION SYSTEM.

Heat-sensitive fire detector switches are installed in each zone of all engine nacelles and in each cabin heater compartment. These switches close and complete the electric circuits to the fire warning buzzer if the temperature in any of these areas rises to the setting of the switches. The switches in zone 1 are set at approximately 400°C (750°F). They reset automatically after cooling to below this temperature. Each circuit is a double loop with two-wire (ungrounded) detectors in parallel between the loops. There is one circuit for zone 1 and one circuit for zones 2 and 3 of each nacelle. There is also one circuit for each cabin heater installation. A resistor is connected in parallel with each individual area warning light and master relay coil, so that the system will not be rendered inoperative by a defective bulb or a master relay coil open circuit. If a short to ground occurs any place in the fire warning system, the circuit breaker will trip to prevent any false warning and neither the warning lights nor the warning buzzer will operate. A short circuit within the detector switches will activate both buzzer and lights. There is one test switch for each nacelle and one for both of the heaters. These switches break both loops and connect them in series around the fire detector switches.

Master Fire Warning Lights and Buzzer.

A master fire warning light (14, figure 1-6) is located in the top center of the pilot's instrument panel and on the flight engineer's lower instrument panel (22, figure 1-15). The fire warning buzzer is located on the bulkhead behind the copilot's seat. These lights and the buzzer are energized simultaneously by the dc electrical system and actuated when one or more fire detector switches close. Each warning light can be tested by pressing its cap.

HRD FIRE EXTINGUISHING SYSTEM.

A dc electrically-operated, two-shot, high rate of discharge fire extinguishing system is installed in each wing to extinguish fires in engine zones 1, 2, 3 (engine induction system), and in the cabin heater compartments. (See figure 1-47.) The extinguishing equipment in each wing is a completely independent system. The fire extinguishing installation consists of four separately controlled bottles of dibromodifluoromethane. Two HRD bottles are mounted in each main gear wheel well. Gas is released from each bottle when the seal is broken. Placing one of the guarded discharge switches located on the station 260 bulkhead in the up position electrically breaks the seal in the selected bottle. The selector switches provide independent selection of each engine and each cabin heater. Electric power for this system comes from the emergency dc bus and is then routed through the fire extinguisher circuit breaker panel located on the lower part of the 260 bulkhead.

Safety Valves.

A safety valve is provided in each bottle which will break and allow the bottle to discharge overboard if the pressure becomes too high due to overcharging or excess heat. Two safety discharge ports terminate at the aft outboard side of each inboard engine nacelle. Each is capped with a red celluloid seal. If the bottle discharges the seal will break. A broken seal indicates that the system should be checked, any trouble corrected, and the bottle replaced. Ground connections that permit refilling of bottles are not provided in this system. Empty bottles must be replaced with refilled bottles.

FIRE EXTINGUISHING SYSTEM (HRD)

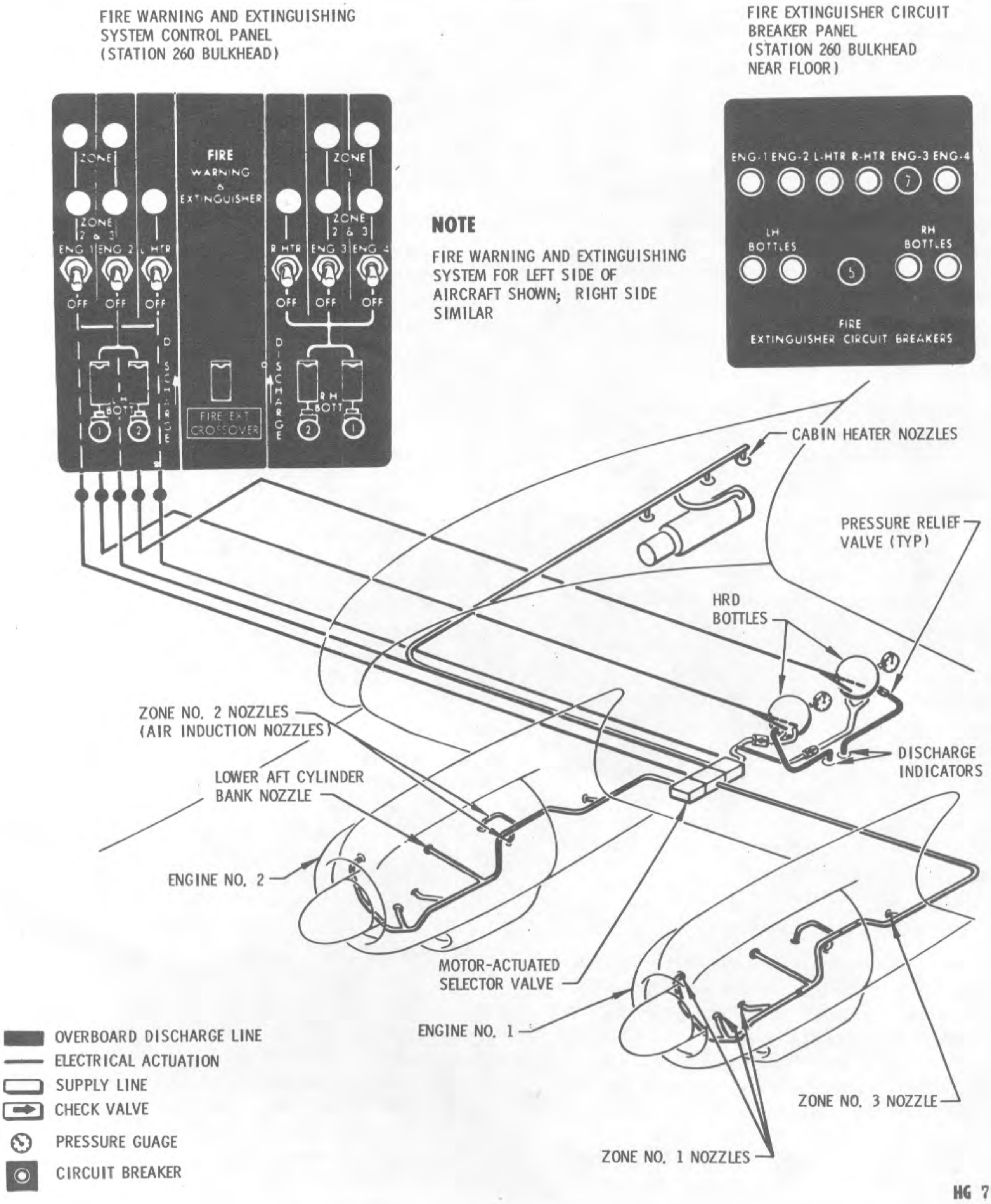

Figure 1-47

Engine Fire Extinguisher Selector Switches.

The engine fire extinguisher selector switches, located above the station 260 upper switch panel, are placarded ENG. 1, ENG. 2, ENG. 3, ENG. 4; each selector switch has an OFF position. (See figure 1-45.) Operating the selector switches operates a remote, dc electric-motor-driven selector valve which connects the pressure line to the line leading to the selected engine. Normally, the switch is left in the OFF position. Each selector valve port is piped to a distributing tube routed to each engine. Nozzles are attached to the tubes to direct the agent simultaneously to zones 1, 2, and 3.

Fire Extinguisher Crossover Switch.

The fire extinguisher crossover switch, labeled CROSSOVER VALVE, is located on the FIRE WARNING AND EXTINGUISHING SYSTEM CONTROL PANEL (Station 260 bulkhead). Raising the switch to OPEN operates a crossover valve enabling the operator to select the third and fourth bottles to amother an engine fire. This switch is protected by a circuit breaker on the FIRE EXTINGUISHING CIR– CUIT BREAKER PANEL.

Cabin Heater Fire Extinguisher Selector Switch.

Two cabin heater fire extinguisher selector switches are mounted on the same panel as the engine selector switches, and have the following positions: L HTR. R HTR, and OFF.

Fire Extinguisher Control Switches.

Four momentary-contact fire extinguisher control or discharge switches are located beneath the selector switches. Each discharge switch releases one bottle when the guard is raised and the switch turned on. If one charge, consisting of one bottle, is insufficient to smother the fire, the second bottle may be released by operating the second guarded switch.

Individual Area Fire Warning Lights.

Fire warning lights for each engine nacelle and cabin heater are dc-operated and are located on the fire extinguisher switch panel mounted on the station 260 bulkhead. (See figure 1-45.) These warning lights are arranged to indicate the presence of fire in each engine zone 1, or 2 and 3, and each cabin heater. Each warning light is the press-to-test type. The master warning lights on the flight engineer's lower instrument panel and on the pilot's center instrument panel will light, and the fire warning buzzer will sound, whenever one or more of the area warning lights are energized, either during test or by fire. If an "open" exists in the master circuit, the lights will still illuminate.

MISCELLANEOUS EMERGENCY EQUIPMENT.

(Refer to figure 3-14.)

Hand Fire Extinguishers.

Fire extinguishers are located in each upper compartment of the fuselage.

Hand Fire Axes.

Two crash axes are provided, one mounted on aft side of 238 bulkhead and one clamped under the aft work bench.

Fireman's Axes.

Two fireman's axes are provided, one on the right side of station 430 forward of the galley and one clamped under the aft work bench.

Emergency Lights.

Three dry-battery-operated emergency lights, with integral switches, are installed in the aircraft. One is located on the forward radio rack in the flight station, and the other two are located in the cabin aft of the navigator's station and on the aft work bench. These lights are used to illuminate the doors or escape area during an emergency and takeoff and landing.

Parachutes.

Provisions for stowing parachutes are provided on the main cabin ceiling and under the forward left and right bunks.

Ladder and Escape Ropes..

One telescoping metal ladder is installed at the aft personnel door.

WARNING

When the ladder is extended for use, be certain to check that the latching lugs are in place.

Four escape ropes are installed as follows: One over the upper station 260 switch panel, one over each emergency exit window, and one over the forward edge of the aft personnel door. (Refer to emergency equipment diagram, figure 3-14.)

First-Aid Kits.

First-aid kits are installed prominently in each compartment of the aircraft. (Refer to emergency equipment diagram, Figure 3-14.)

Liferafts.

Two 20-man liferafts are installed. One raft is located in each inner wing panel, aft and inboard of the inboard engine nacelles. Liferaft release handles (Figure 3-12), are located in the window frames of the emergency exits over the wings. These handles are accessible after the windows have been removed. Pulling these handles automatically inflates the rafts and ejects them into the water. The rafts may also be released by activating the handles in the wing liferaft wells (Figure 3-11). Additional rafts can be carried in the cabin area.

Liferaft Radio Transmitter.

One liferaft radio transmitter is located on the floor beneath the right side emergency exit window.

Emergency Alarm Bell, Cabin Alert Rotating Beacon.

Two emergency alarm bells are installed, one on the 545 bulkhead and one on the ceiling near the aft cabin door. A cabin alert red rotating beacon is installed adjacent to the aft bell to visually alert the crew.

Command Bell Switch.

The command bell switch is located on the pilots' overhead switch panel and is guarded in the off position. When the guard is raised and the switch is closed, the command bells sound a warning and the cabin alert beacon illuminates and begins to rotate. The electrical circuit is energized by the emergency dc bus.

Pyrotechnic Equipment.

A pyrotechnic pistol and a container for carrying 12 rounds of ammunition are clipped to the partition forward of the radio operator's or navigator's station. A pressure trap mount is provided for firing the pyrotechnic pistol during pressurized flight; it is located in the ceiling of the fuselage aft of the navigator's station.

WARNING

Insert pistol into the pressure trap mount prior to loading it with a cartridge. This procedure will prevent accidentally firing the pistol inside the aircraft.

Flares.

Two flares are installed in separate chutes located in the aft fuselage, aft of the pressure bulkhead. Each flare is provided with a parachute which allows it to descend at the rate of approximately 360 feet per minute. Burning time of the flare is approximately 3 minutes and the light output is 300,000 to 400,000 candlepower. The release and triggering provisions consist of release switches, cover latch, lanyard, and dc-operated solenoids. When the release switches are operated, the solenoid triggers the latch and the flare drops through the flare chute.

NOTE

The cover plate is a thin sheet of aluminum alloy and is pushed out by the weight of the falling flare.

The flare will not ignite, nor will the parachute be ejected if the release switch is inadvertently closed when the aircraft is on the ground, because the lanyard is long enough to permit the flare to drop to the ground without tripping the parachute release and the flare ignition mechanism. In flight, the flare falls a considerable distance below the aircraft before the parachute is ejected and the flare ignited.

Flare Release Switches.

Flare release switches (1, figure 1-8) are located near the top and aft end of the pilot's side panel. Guards cover the flare release switches and are safetied in the closed position. The circuit breaker is located on the station 238 circuit breaker panel.

NOTE

- Flares should be released at or near approach speeds to provide maximum illumination time.
- Flares have been successfully ejected up to 217 knots indicated airspeed.

ENTRANCE DOORS.

CREW DOORS.

The crew door is located on the right side of the aircraft, forward of station 260. The door is opened from the outside by turning the exterior latch handle and pushing inward, then lifting upward. The door is opened from the inside by turning the interior latch handle, and pulling the door inward then lifting upward. (Refer to Section IV for the rear entrance door.)

CREW SEATS.

PILOTS' SEATS.

The pilot's and copilot's seats are track-mounted to provide fore-and-aft positioning. A small pin is attached to the seat for inserting in the track as an extra safety measure to prevent the seat from inadvertently slipping backward during takeoff and landing. The seats have tilting backs, and are adjustable for height. Each seat is equipped with folding armrests, a removable headrest, and a shoulder harness connected to an inertia reel. The inertia reels are mounted on the backs of the seats.

Pilots' Seat Controls.

Levers for tilting the backs and for adjusting the height of the pilots' seats are located on the outboard side of each seat. The handles for releasing the seats for fore-and-aft movement and for locking them in position are located on the inboard sides near the floor. Height adjustment is accomplished by overcoming the up-spring action when the control lever is lifted to release the position lock. The inertia reel control lever is located on the inboard side of each seat near the forward end of the cushion. It has detents in two positions, LOCKED and UNLOCKED. In the LOCKED position, the inertia reel holds the shoulder harness so that the pilot cannot lean forward. In the UNLOCKED position the harness will not restrict movement but is set for inertia action. When set for inertia action, the reel automatically restrains the shoulder harness when the aircraft encounters an impact force of from 2 to 3 g. When the reel is locked by impact it must be released by moving the control lever to the LOCKED position, then to the UNLOCKED position.

FLIGHT ENGINEER'S CHAIR.

The flight engineer's chair is mounted on a track and arranged to swivel and lock in the aft-facing position. A fore-and-aft adjustment is provided.

SAFETY BELTS.

Lap-type safety belts are provided for all crew seats, seat bunks, and fixed bunks. Fittings are installed to permit the seat bunk belts to be used as bunk safety belts. Additional new restrain is located on the forward bunk. Instructions for use are as follows:

a. Leg restraining strap is hooked to the right shoulder strap.

b. Chest restraining strap is brought under the right arm and loop fitted onto lap safety belt.

c. Right shoulder strap loop is fitted onto lap safety belt.

d. Left shoulder strap loop is fitted onto lap safety belt.

e. Secure safety belt.

AUXILIARY EQUIPMENT.

Auxiliary equipment, such as the airconditioning, communication, electronic, lighting, oxygen, automatic pilot, and navigation are discussed in Section IV of this handbook.

SERVICING DIAGRAM

(TYPICAL)

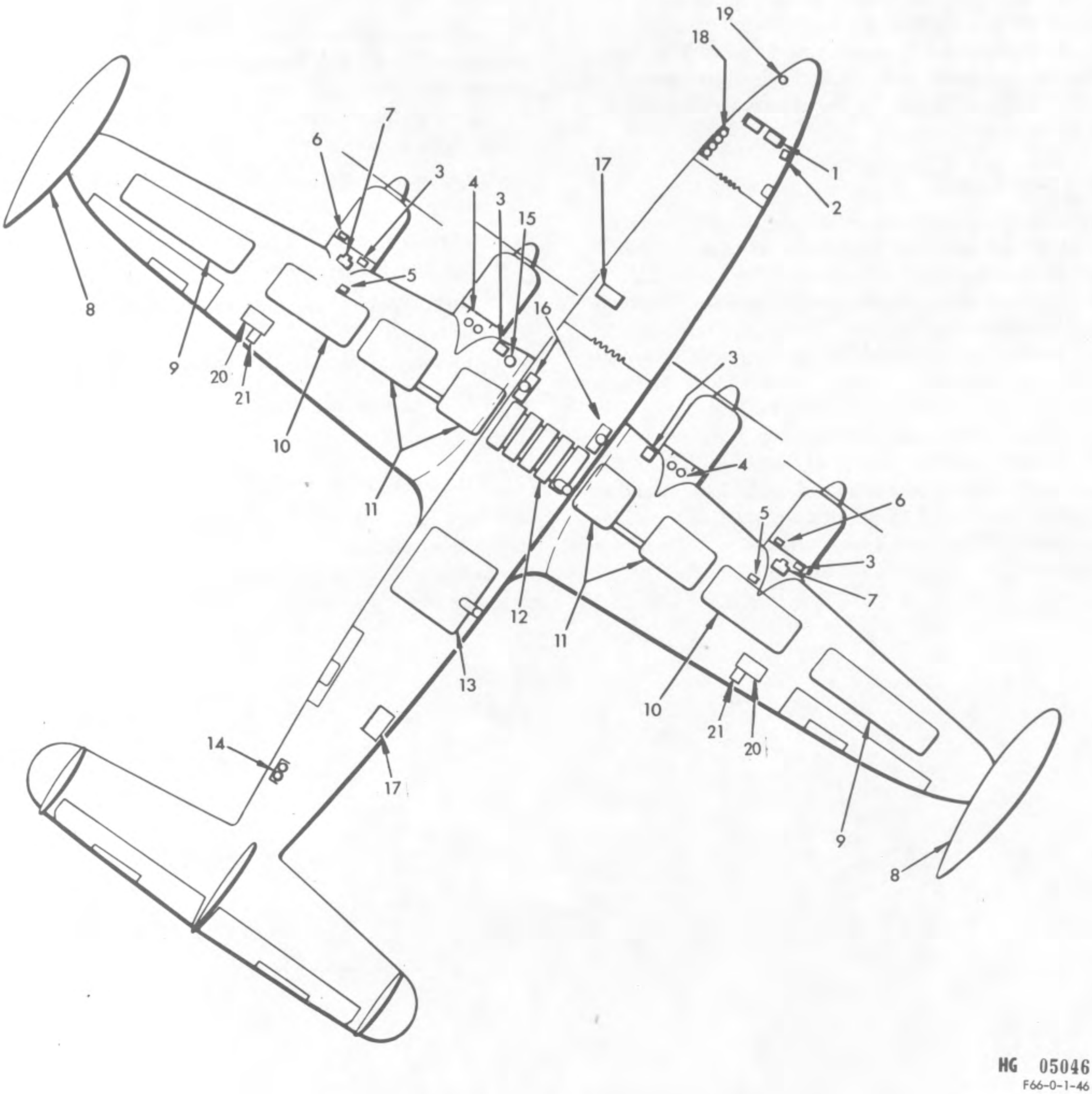

Figure 1-48 (Sheet 1 of 2)

REF	PART	NO. OF POINTS	REPLENISH WITH	REF	PART	NO. OF POINTS	REPLENISH WITH
1	BATTERIES	2	DISTILLED WATER	11	FUEL TANKS 2 AND 3	1 EACH	GRADE 115/145* MIL-G-5572 (NATO F-22)
2	OXYGEN FILLER VALVE	1		12	FUEL TANK 5	1	GRADE 115/145* MIL-G-5572 (NATO F-22)
3	ENGINE OIL TANKS	4	GRADE 1100 (ABOVE 35°F) MIL-L-22851 (NATO 0-117)	13	FUEL TANK 6	1	GRADE 115/145* MIL-G-5572 (NATO F-22)
4	HRD SYSTEM						
5	DEICING FLUID TANK	2	MIL-A-6091	14	FLARES	2	FLARES & ALUMINUM SEAL
6	GENERATOR GEAR BOX	2	OIL SAE 10W MIL-O-2104	15	MAIN HYDRAULIC RESERVOIR	1	MIL-H-5606 (NATO H515)
7	CABIN SUPERCHARGER OIL-TANK	2	AEROSHELL 1 AC	16	RESERVE ENGINE OIL TANK	2 EACH	GRADE 1100 MIL-L-22851 (NATO 0-117)
8	FUEL TANKS 2B AND 3B	1 EACH	GRADE 115/145* MIL-G-5572 (NATO F-22)	17	WATER TANK	1	WATER
9	FUEL TANKS 2A 3A	1 EACH	GRADE 115/145* MIL-G-5572 (NATO F-22)	18	OXYGEN SYSTEM SUPPLY CYLINDERS	4	OXYGEN MIL-0-27210
				19	EMERGENCY HYDRAULIC RESERVOIR	1	MIL-H-5606 (NATO H-515)
10	FUEL TANKS 1 AND 4	1 EACH	GRADE 115/145* MIL-G-5572 (NATO F-22)	20	REFRIGERATOR SUMP	2	AEROSHELL 1 AC
				21	SECONDARY HEATER EXCHANGER	2	AEROSHELL 1 AC

*GRADE 100/130 FUEL MAY BE USED AS AN ALTERNATE

Figure 1-48 (Sheet 2 of 2)