AN 01-115CCA-1

HANDBOOK
FLIGHT OPERATING INSTRUCTIONS

USAF SERIES

C-119B AND C-119C

NAVY MODEL

R4Q-1

AIRCRAFT

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PREFACE

SECTION I, DESCRIPTION.
The purpose of this section is to describe the airplane, its equipment, systems and controls which are essential to flight and which will be needed for one complete non-combat mission in good weather at medium altitude. All emergency equipment which is not part of the auxiliary equipment and all miscellaneous equipment is also covered in this section.

SECTION II, NORMAL OPERATING INSTRUCTIONS.

This section contains the steps of procedure to be accomplished from the time the aircraft is approached by the flight crew until it is left parked on the ramp after accomplishing one complete non-combat mission in good weather at medium altitude.

SECTION III, EMERGENCY OPERATING INSTRUCTIONS.

This section clearly and concisely describes the procedure to be followed in meeting any emergency (except those emergencies in connection with the auxiliary equipment) that could reasonable be expected to be encountered.

SECTION IV, OPERATIONAL EQUIPMENT.

This section includes the description and operation of all equipment not directly contributing to flight but which enables the airplane to perform certain specialized function. Included in this category are such items of equipment as: oxygen equipment; communication equipment; lighting system; heating, ventilating, and anti-icing system; navigation equipment; aerial delivery system; glider tow equipment; cargo loading equipment; and casualty carrying equipment.

SECTION V, EXTREME WEATHER OPERATION.

The function of this section is to set forth the proper technique and procedure to be employed under conditions of cold weather, hot weather, and desert operation.

APPENDIX I, OPERATING CHARTS.

This section contains all operating data charts necessary for pre-flight and in-flight mission planning and includes a sample flight planning problem.

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INTRODUCTION

In order to identify instructions that are applicable to only certain airplanes, a boldface letter is located at the outside margin of the appropriate paragraph such as the following:

1-64. AC VOLTMETER.

B a. An ac voltmeter (5, figure 1-9) is installed on the right side of the instrument panel in the crew compartment to provide inverter voltage readings. This voltmeter automatically provides a reading for whichever inverter is operating.

F b. An ac voltmeter (5, figure 1-10) is installed in the center portion of the overhead panel to provide inverter voltage readings. This voltmeter automatically provides a reading for whichever inverter is operating.

This indicates that sub-paragraph a applies to Airplanes AF Serial No. 48-319 thru 48-345, and sub-paragraph b applies to Airplane AF Serial No. 48-346 and subsequent, as shown in the effectivity table. Thus by glancing down the outside margin of any column, those paragraphs applying to a particular airplane or group of airplanes are easily segregated.

It is important to remember that all paragraphs which do not have a particular designation, such as outlined above, apply to all airplanes.

EFFECTIVITY TABLE

Group Designation Letter	C-119B and C-119C Airplane AF Serial No.
A	48-319 and subsequent
B	48-319 thru 48-345
C	48-319 thru 48-355
D	49-101 and subsequent
E	49-131 and subsequent
F	48-346 and subsequent
G	49-319 thru 48-327
H	48-319 thru 49-118
J	49-119 and subsequent
K	48-319 thru 49-124
L	49-125 and subsequent
M	48-319 thru 49-139
N	Navy Serial No. 124324 thru 124331
O	49-140 and subsequent

AIRPLANE SERIAL NUMBERS

C-119B - AF Serial No. 48-319 thru 49-118
C-119C - AF Serial No. 49-119 and subsequent
R4Q-1 - Navy Serial No. 124324 thru 124331

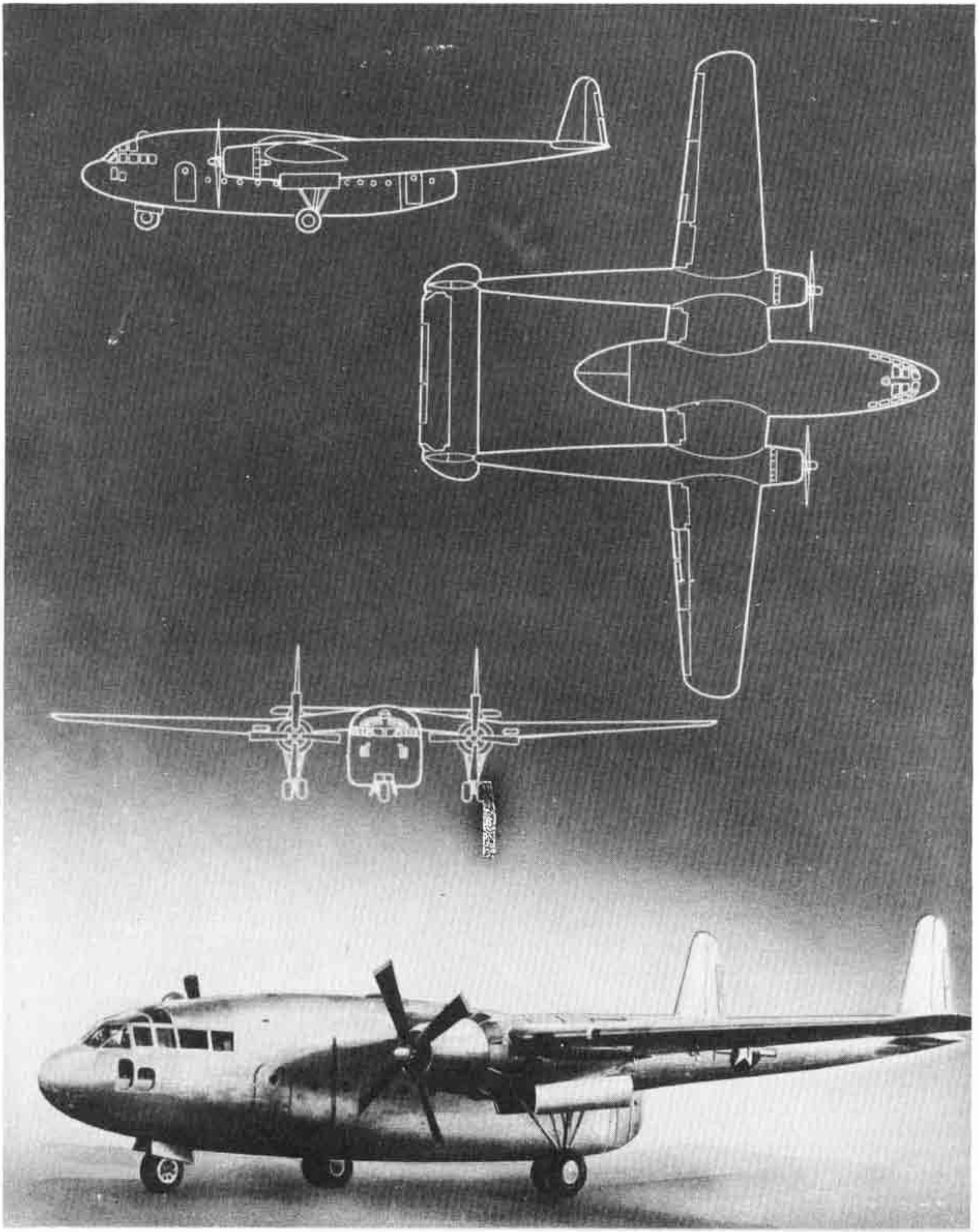


Figure 1-1. The Airplane

DESCRIPTION

SECTION I

1-1. AIRPLANE.

1-2. GENERAL. The Fairchild C-119B, C-119C, and R4Q-1 airplane is a two engine, twin boom, high wing, land monoplane of all metal construction designed for use as (1) a cargo carrier, (2) a troop or paratroop transport, including facilities for aerial delivery of supplies, (3) an ambulance evacuation airplane, or (4) a glider tow plane. It accommodates a normal crew complement of five men, including a pilot, copilot, navigator, crew chief, and radio operator. It features a tricycle-type landing gear with dual wheels on each main gear strut. All equipment, with the exceptions of the hydraulic brake system, nose gear steering mechanism, and the hydromatic propellers, is electrically operated. Two constant speed four-bladed reversible pitch propellers are driven by two supercharged radial engines. The twin booms and empennage section are at a sufficient height above the ground to allow a maximum of ease in the movement of cargo through the cargo doors at the aft end of the fuselage. Although closely resembling the C-82A airplane in appearance, more powerful engines, higher gross weights, improved performance, and increased pilot's visibility give this airplane greater dependability and efficiency characteristics.

1-3. SIZE.

Wing Span	109 feet	2-3/4 inches
Fuselage length	60 feet	11-1/4 inches
Overall length	86 feet	5-3/4 inches
Height	26 feet	5-3/4 inches
Turning radius	30 feet	

1-4. GROSS WEIGHT. (Refer to paragraph 2-2.)

1-5. LOADING. The contour of the airplane fuselage is such that a rectangular cross section exists throughout the main cargo hold, permitting easy stowage of a larger number of types of cargo. The tricycle landing gear positions the entire cargo compartment in a level attitude when the airplane is parked. The height of the floor above the ground is approximately four feet, or truck bed level. In order to facilitate loading, the cargo hold is marked along both sides to indicate load compartment limits and centroids. Paratroop doors with positive open locks are also installed in each of the cargo doors for loading passengers and litter patients, or for discharging paratroopers during flight. The cargo compartment dimensions are:

Height Clear (under trolley)	7 feet 7-1/2 inches
Height Clear (under monorail)	8 feet
Width Clear (15 inches above floor)	9 feet 2 inches
Width Clear (above 15 inches)	9 feet 10 inches
Area of Cargo Floor	353 square feet
Volume of Cargo Space	3150 cubic feet
Length	36 feet 11 inches

1-6. AS A CARGO CARRIER. Under various loading conditions, the airplane will transport 75-mm howitzers, 37-mm guns, 40-mm anti-aircraft guns and carriages, 10-wheel 2-1/2 ton trucks, large and small aircraft engines and cradles, propellers, and a wide variety of other military equipment. When equipped with special ramps and load-distributing devices, it can also carry light tanks, 75-mm guns and half-tracks, and medium tanks. Close attention should be paid to proper securing methods, as well as weight distribution.

1-7. AS A TROOP TRANSPORT. The airplane is equipped with 20 folding seats along the left side of the fuselage, and 22 seats along the right side, to carry 42 troops or paratroops. In addition, provisions are made for installation of 22 more troop seats along the center of the cargo compartment floor, giving a total troop carrying capacity of 64. A paratroopers' static line is stowed on the inside of each cargo door, and may be rigged along the sides of the cargo compartment for discharging paratroops during flight. An aerial delivery system is installed along the top of the cargo compartment to automatically eject aerial delivery supply containers for the paratroops.

1-8. AS AN AMBULANCE EVACUATION AIRPLANE. As an ambulance, the airplane carries 35 litters, 20 on the right and 15 on the left, arranged along each side of the cargo compartment. The litters are mounted in seven tiers, 5 litters high, and each is supported by posts and web straps. Thirty-five is the maximum number of litter patients which may be carried, but various combinations of troops or seated casualties and litter patients may be obtained by removing the litters in the region of the seats. A total of 78 troops may be carried when the

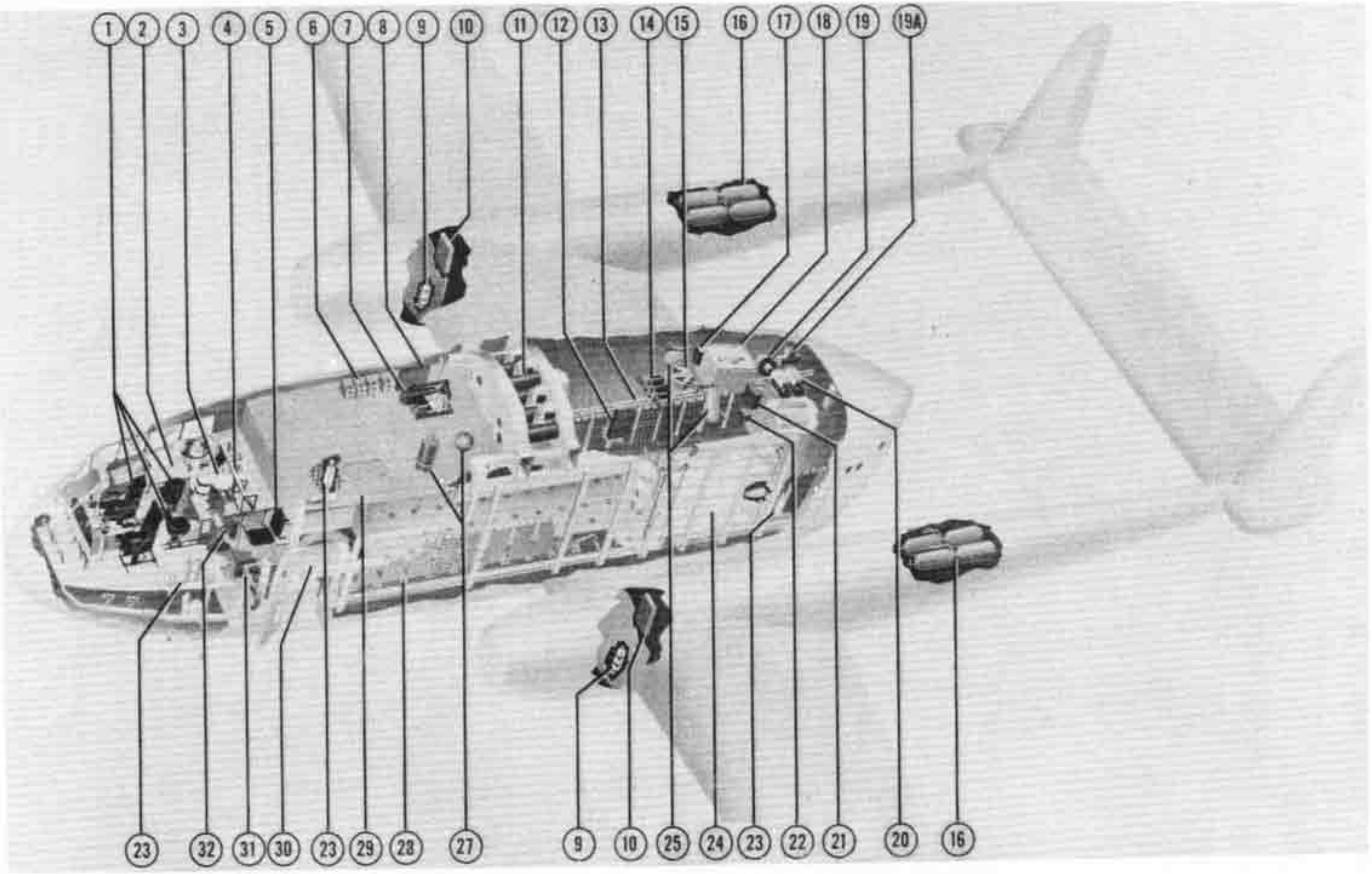


Figure 1-2. General Arrangement

1. Crew seats
2. Radio operator and navigator's table
3. Lavatory equipment compartment
4. Radio rack
5. Crew chief's seat
6. Fuel calibration units
7. Auxiliary power plant
8. Auxiliary floor junction box
9. Engine fire extinguisher cylinders
10. Nacelle junction box
11. Heater compartment
12. Main and power junction boxes
13. Aerial delivery system monorail
14. Auto pilot servos
15. Wing flaps mechanism
16. Crew oxygen cylinders
17. Wing flaps junction box
18. Life raft compartment
19. Aerial delivery system motor
19A. Automatic pilot inverter
20. Inverters
21. Controller junction box
22. Auto pilot junction box
23. Portable oxygen cylinders
24. Litters
25. Heater fire extinguisher cylinders
26. DELETED
27. Hydraulic equipment
28. Troop seats
29. Auxiliary floor hatches
30. Aerial delivery doors
31. Nose junction box
32. Radio junction box

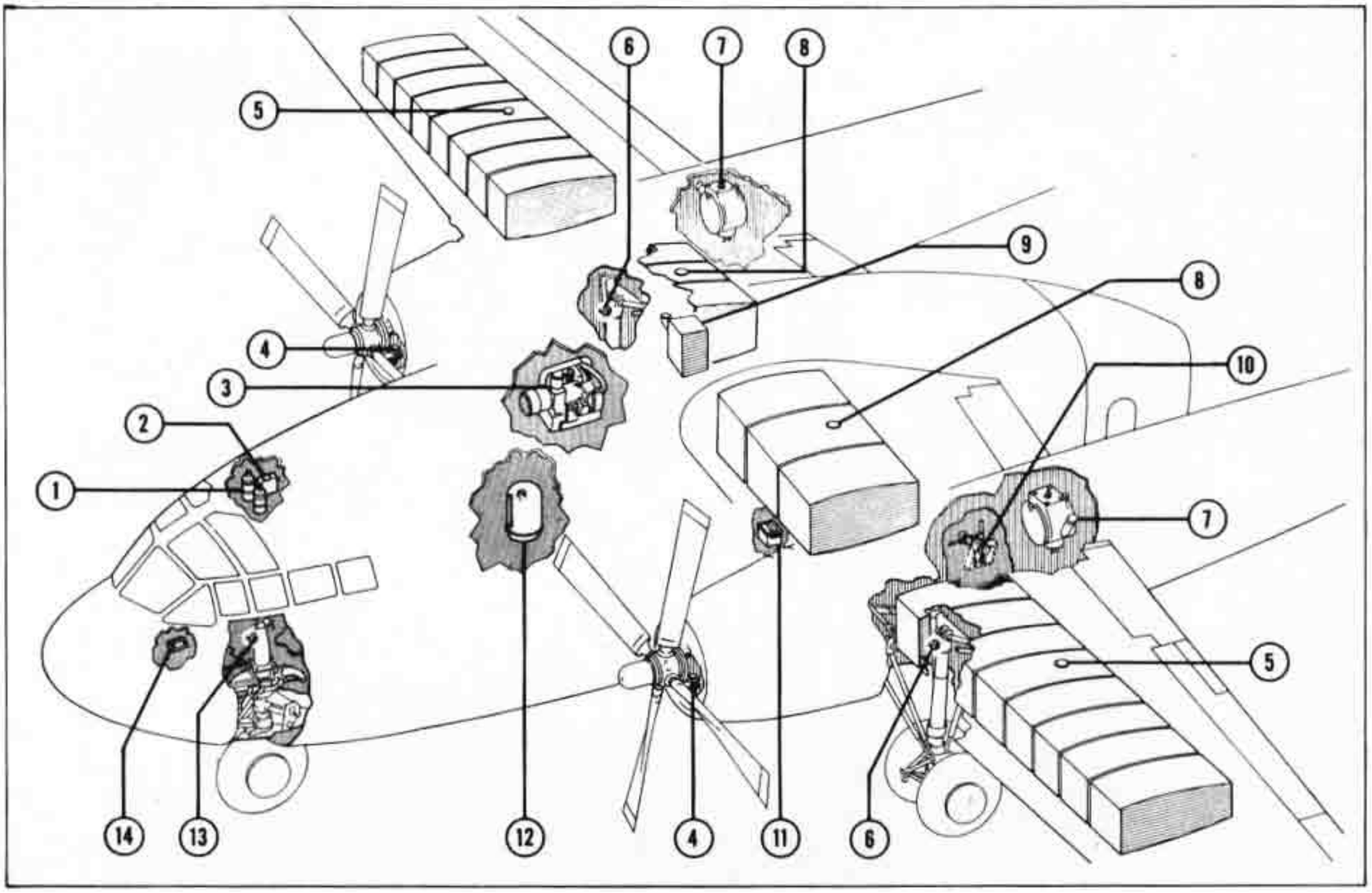


Figure 1-3. Replenishing Diagram

1. Drinking water tanks
2. Lavatory water tank
3. APP oil supply
4. Propeller oil supply
5. Fuel tanks (outboard)
6. Main landing gear shock strut
7. Oil tanks
8. Fuel tanks (inboard)
9. Water injection tank (Airplanes group J and R)
10. Oxygen filler valve
11. Battery
12. Hydraulic reservoir
13. Nose landing gear shock strut
14. External power receptacle

airplane is used for emergency evacuation purposes, with 64 troops seated and 14 litter patients, plus the regular complement of four medical attendants.

1-9. AS A GLIDER TOW PLANE. One 30,000-pound glider, or any number of gliders whose total gross weight does not exceed 30,000 pounds, can be towed. The tow rope is attached to a release cylinder located on the bottom of fuselage, just forward of rear cargo doors.

MAIN DIFFERENCE TABLE

	C-119B	C-119C	R4Q-1
Engines	R-4360-20	R-4360-20W	R-4360-20W
Water Injection	No	Yes	Yes
Oil Transfer System	Yes	No	No
Instrument Lighting:			
Ultraviolet light	Yes	Airplane Group M	Yes
Ultraviolet and Red light	No	Airplane Group O	No

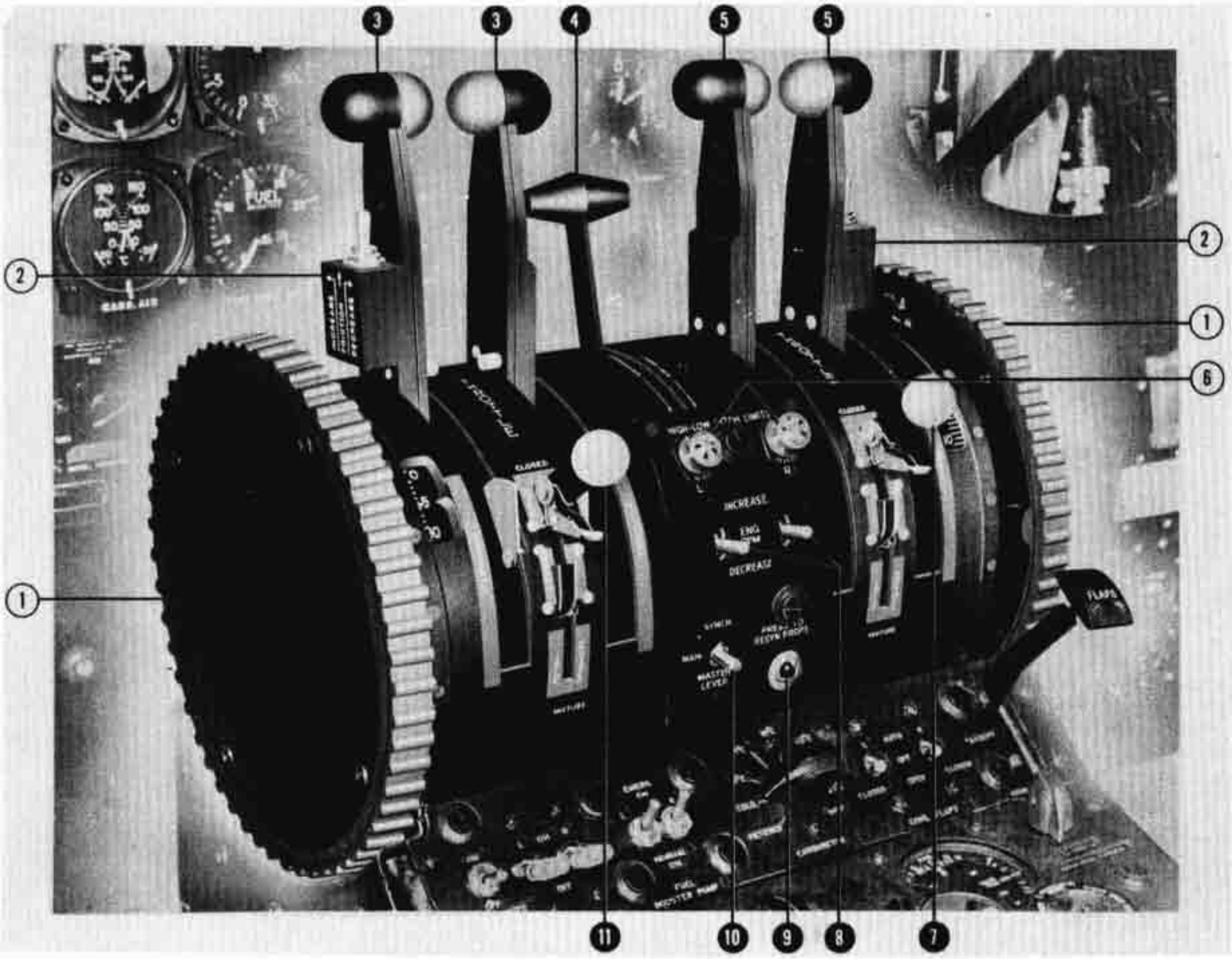


Figure 1-4. Control Quadrant

1. Elevator trim tab control wheels
2. Friction switches
3. Throttle controls (Pilot)
4. Propeller master control lever
5. Throttle controls (Copilot)
6. Pitch limit indicator lights
7. Right engine mixture control
8. Propeller pitch control switches
9. Resynchronization button
10. Control selector switch
11. Left engine mixture control

1-10. ENGINES.

1-11. Power for the C-119B airplane is supplied by two Pratt & Whitney R-4360-20, 28-cylinder, four row, radial, air-cooled, tractor-type engines. Each engine contains an automatic power control unit. Both engines incorporate a single-stage, variable speed supercharger which is automatically controlled by movement of the throttle. The engines are also equipped with a torquemeter for determining actual power output during operation. Each engine will produce 3250 bhp at 2700 rpm on take off.

H

1-12. Power for the C-119C and R4Q-1 airplanes is supplied by two Pratt & Whitney R-4360-20W, 28-cylinder, four row, radial, air-cooled, tractor-type engines. Each engine contains an automatic power control unit and an automatically regulated water injection system. Both of the engines incorporate a single-stage, variable speed supercharger which is automatically controlled by movement of the throttle. The engines are also equipped with a torquemeter for determining actual power output during operation. At take off, each engine will produce 3250 bhp at 2700 rpm without water injection and 3500 bhp at 2700 rpm with water injection.

J

N

Figure 1-4A. Water Injection Panel (Airplane Groups J and N)

1. Left engine water injection indicator light
2. Water injection switch
3. Right engine water injection indicator light

1-13. AUTOMATIC POWER CONTROL UNIT. The R-4360-20 and R-4360-20W engines are equipped with an automatic power control unit which functions automatically, in the high power engine operating range, to maintain manifold pressures as selected by throttle position regardless of changes in rpm, altitude, or airspeed. When the engines are not running or when engines are operating in the low power range (up to 24-26 inches manifold pressure) carburetor throttle valve is controlled manually by the throttle. When the engines are operating in the high power range (above 24-26 inches manifold pressure) the automatic power control unit automatically actuates the carburetor throttle valve or changes the blower speed as required to maintain manifold pressure at any selected valve. In the high power range response of the engine to the throttle movement will be approximately that which would be expected if the throttle were connected directly to the carburetor throttle valve.

1-14. When the airplane is in a climb at a fixed throttle position the automatic power control unit will function first to actuate the carburetor throttle valve to maintain the selected manifold pressure up to low blower critical altitude, and second to speed up the blower as required to maintain the selected manifold pressure up to high blower critical altitude. It will be noted that for all high blower variable speed operation the carburetor throttle valve remains wide open. During letdowns the blower speed is decreased and then the carburetor throttle valve is actuated to maintain the selected manifold pressure.

1-15. During climbs at more than normal rated power, it will be noticed that a steady decrease in manifold pressure will occur above high blower critical altitude. For all powers less than normal rated, the manifold pressure will be maintained as selected up to the critical altitude for the particular combination of engine rpm and manifold pressure in use.

1-16. In some installations an oscillation of manifold pressure may be experienced at the altitude at which the shift into high blower occurs without indicated changes in torque pressure or rpm. This condition is normal and should not be cause for discontinuance of flight. However, continuous operation as such an rpm, manifold pressure, and altitude combination is undersirable although it would not be harmful. To stop these oscillations a change of any or all of the quantities mentioned above should be made.

1-17. ENGINE CONTROLS.

1-18. ENGINE CONTROL QUADRANT. At the forward end of the control pedestal is an engine control quadrant (figure 1-4) containing propeller, mixture, dual throttle, and trim tab controls. An adjustable friction device, electrically controlled by a switch (2, figure 1-4) located on each outboard throttle, is provided so that the pilot and copilot may change the amount of force required to operate throttles.

1-19. THROTTLE CONTROLS. Dual throttle controls, (3, 5, figure 1-4) are installed in the control quadrant. The pilot's controls incorporate propeller pitch reversing features. The "OPEN" and "CLOSED" positions are conventional; however a third position, "REVERSE," provides reverse pitch operation of the propellers. When throttles are moved past "CLOSED" into "REVERSE" range, pitch of propellers is reversed.

1-20. MIXTURE CONTROLS. A mixture control lever (7, 11, figure 1-4) is provided on both the pilot's and co-pilot's side of the control quadrant, fuel mixture for the left engine being controlled from the pilot's side, and fuel mixture for the right engine being controlled from the copilot's side of control quadrant. The engines are started with the mixture control in "IDLE CUT-OFF." Take offs and landings are performed with mixture controls in "RICH," while the "NORMAL" is used during normal flight.

1-21. WATER INJECTION SWITCH. An "ON-OFF" switch (2, figure 1-4A), located on the water injection control panel, is provided for control of the water injection system. When this switch is in the "ON" position and the throttles are full forward, water is automatically injected into the carburetor blower throat. In the event of engine failure the water flow for the dead engine will automatically shut off, while the water flow for the live engine will continue. J N

1-22. CARBURETOR AIR CONTROL.

a. The carburetor air systems are controlled electrically by a knob (4, figure 1-5) on the pilot's switch panel. For temperature control, the knob may be turned to "COLD" or "HOT" position to gain desired temperature. The "HOLD HEAT" position will hold airflow at last selected condition. The knob may also be turned to "FILTERED" position, to obtain that condition in carburetor air. M N

NOTE

When turning control knob from "HOT" or "HOLD HEAT" to "FILTERED," pause at "COLD" to allow sufficient time for heat valve actuator to operate.

b. The carburetor air systems are controlled electrically by a knob (4, figure 1-5) on the pilot's switch panel. For temperature control, the knob may be turned to "COLD" or "HOT" position to gain the desired temperature. The "OFF" position will hold air flow at last selected condition. The "LOW AUTO" position will automatically control the temperature at approximately 15 degrees C, while the "HIGH AUTO" position will automatically control the temperature at approximately 35 degrees C. The knob may also be turned to "FILTER" position, to obtain that condition in carburetor air. O

NOTE

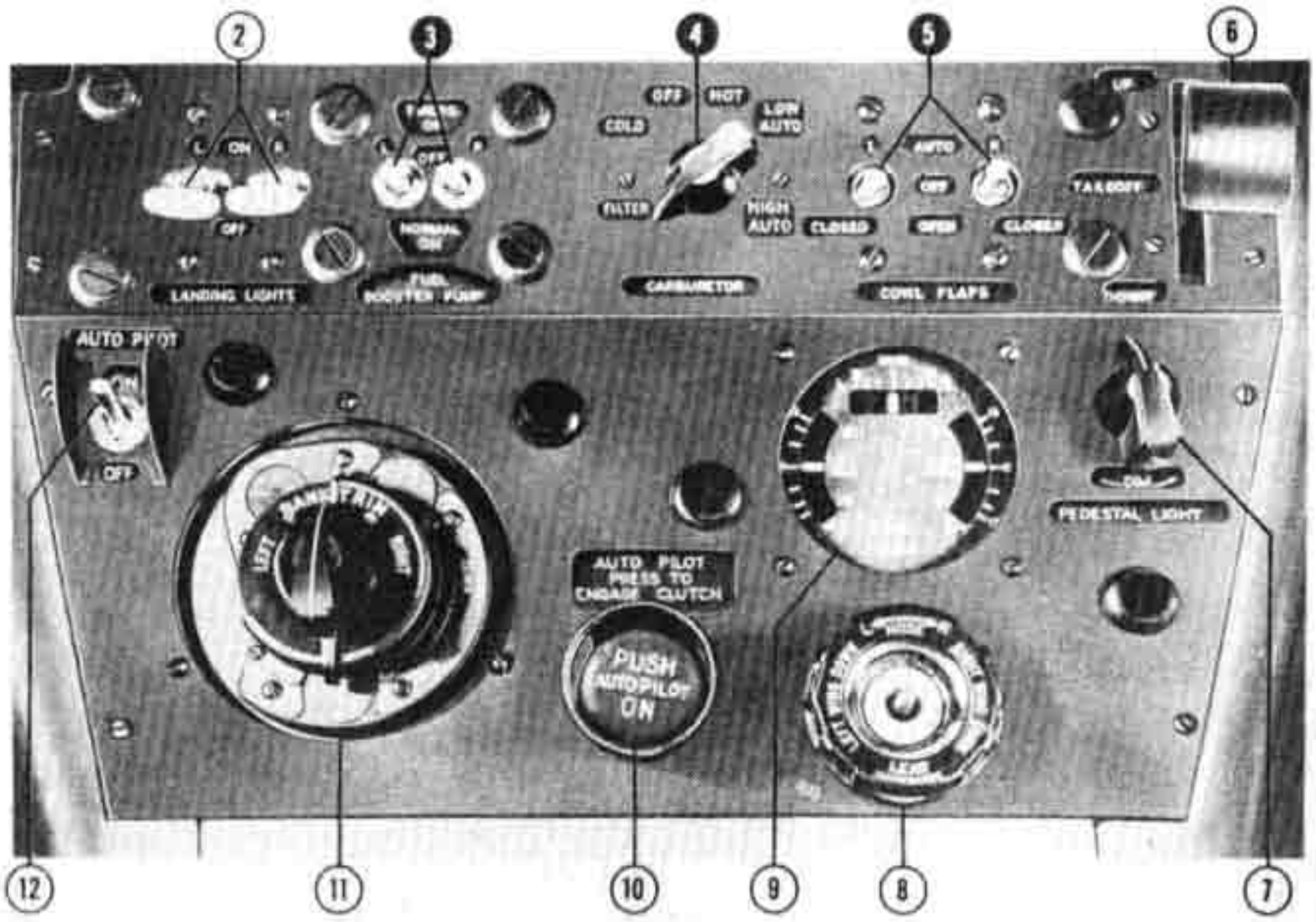
When turning control knob from "HOT," "LOW AUTO," or "HIGH AUTO" to "FILTER," pause at "COLD" to allow sufficient time for heat valve actuator to operate.

1-23. MASTER BATTERY AND IGNITION SWITCH. Engine ignition is controlled by a master battery and ignition switch (25, figure 1-10), and two conventional engine ignition switches (5, figure 1-10), all of which are located on the overhead panel. The following are the master battery and ignition switch positions and the function of each position:

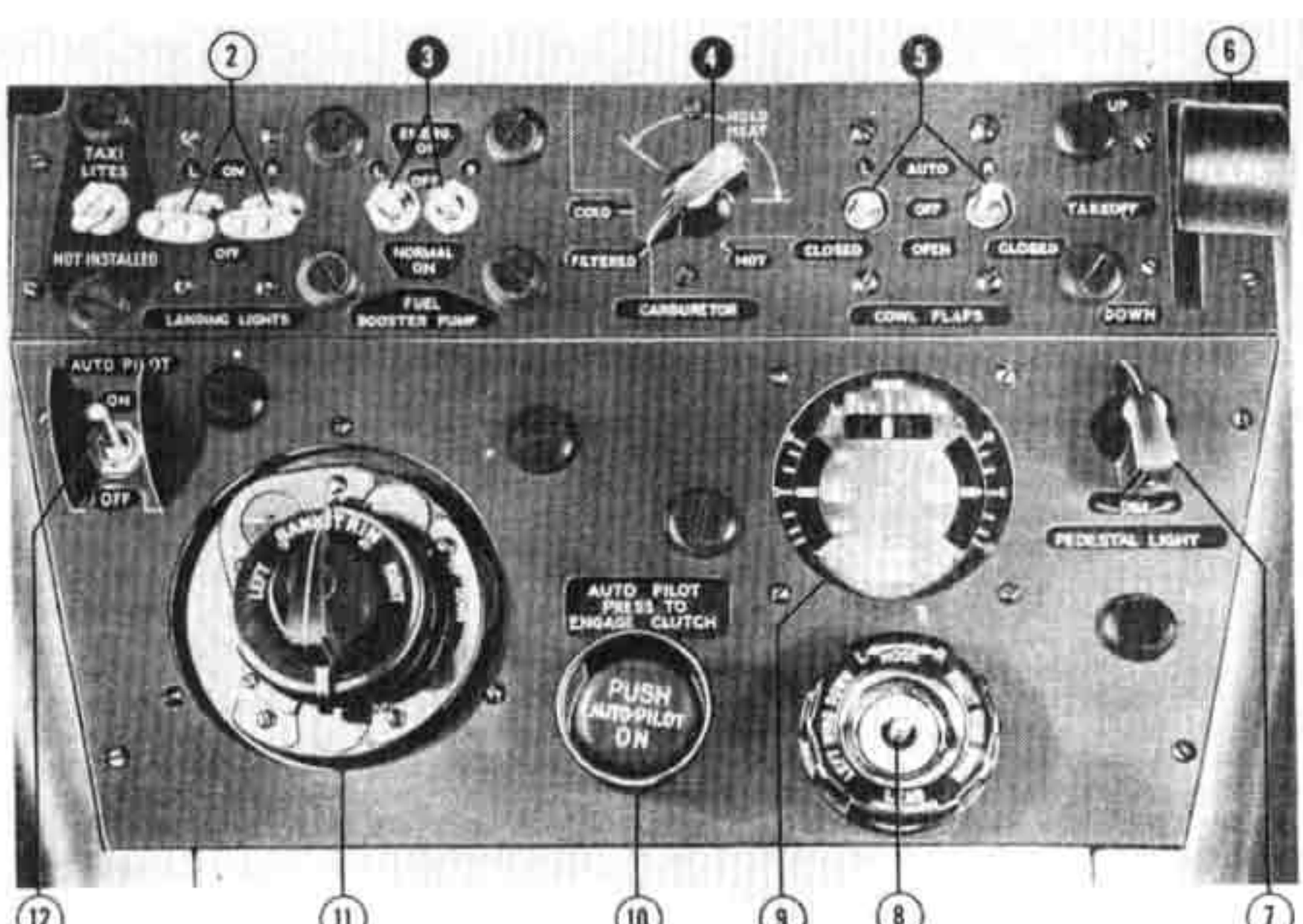
"IGN. OFF-BAT. OFF" - All internal source of power is cut off.

"IGN. ON-BAT. ON" - In this position when starting engines with battery, auxiliary power plant, or external power source; for starting auxiliary power plant; and during normal airplane operation.

"IGN. ON" - Emergency position used to cut current flow from the battery.



(Airplane Groups M and N)



(Airplane Group O)

Figure 1-5. Pilot's Switch Panel

1. DELETED
2. Landing light switches
3. Left and right engine fuel booster pump switches
4. Carburetor air control
5. Left and right engine cowl flaps switches
6. Flap control handle
7. Control pedestal lights rheostat
8. Aileron and rudder trim tab switch
9. Aileron and rudder trim tab indicator
10. Automatic pilot servo clutch engage switch
11. Automatic pilot turn-and-pitch controller
12. Automatic pilot power switch

1-24. ENGINE IGNITION SWITCHES. While the master battery and ignition switch controls power flow to all electrical systems, the two conventional ignition switches are utilized for engine ignition purposes only. These switches remain in "BOTH" during airplane operation except during magneto check, at which time they may be switched momentarily to "L" and "R."

1-25. STARTER SWITCH. A single momentary-type toggle switch (3, figure 1-10) on the overhead panel, with "L" and "R" position, controls the direct cranking starter on each engine.

1-26. COWL FLAP SWITCHES.

C a. The engine cowl flaps are electrically controlled by two toggle switches (5, figure 1-5) on the pilot's switch panel. These switches are provided with "OPEN," "CLOSED," "OFF," and "AUTO" positions. The "OPEN" position is used during all ground operations and for take off, while the "AUTO" position is used for flight. In the "AUTO" position the cowl flaps are automatically regulated, however, if the automatic control should fail, the "OPEN" and "CLOSED" position may be utilized as necessary with the "OFF" position to hold the cowl flaps at last selected position.

D N b. The engine cowl flaps are electrically controlled by two toggle switches (5, figure 1-5) on the pilot's switch panel. These switches are provided with "OPEN," "CLOSED," "OFF," and "AUTO" positions. The "AUTO" position is used for all normal operations and in this position the cowl flaps are automatically regulated in flight. When the airplane is on the ground the automatic control is overridden and the cowl flaps will remain open. If cowl flaps should fail to operate automatically, the "OPEN" and "CLOSED" positions may be utilized as necessary with the "OFF" position to hold the cowl flaps at last selected setting.

1-27. ENGINE PRIMER. A momentary-type toggle switch (4, figure 1-10) is located on the overhead panel. When held in the "L" or "R" position, fuel is injected into the engine. The fuel booster pumps must be operating to provide fuel pressure during priming.

1-28. INDICATORS.

C a. The engine instruments are comprised of a tachometer (11, figure 1-11), manifold pressure gage with purge valves (9, figure 1-11), cylinder head temperature (8, figure 1-11), carburetor air temperature (42, figure 1-11), torquemeter (15, figure 1-11), and fuel flow (13, figure 1-11) indicators, all of which are dual instruments.

D N b. The engine instruments are comprised of a right and left engine tachometer (11, figure 1-11), manifold pressure gage with purge valve (9, figure 1-11), cylinder head temperature (8, figure 1-11), carburetor air temperature (42, figure 1-11), torquemeter (15, figure 1-11), and fuel flow (13, figure 1-11) indicators.

1-29. WATER INJECTION INDICATOR LIGHTS. Right and

J N left engine water injection green indicator lights (1, 3, figure 1-4A) are located on the water injection control panel. These lights will come on when the engines are operating and water injection switch is turned "ON" and will remain on as long as water pressure is being supplied to the engines. If the lights go out while the water injection switch is "ON" it indicates that the water injection supply tank is empty.

1-30. PROPELLERS.

1-31. The two Hamilton Standard, hydromatic, four-bladed propellers are both full feathering and reversible. The propeller governors are remotely controlled by an electric governor head. The engines are synchronized by an automatic synchronizer. These propellers incorporate integral oil systems with emergency provisions for replenishing the oil supply from the engine oil system. De-icing facilities of the electrical type are also provided.

1-32. CONTROLS.

1-33. CONTROL SELECTOR SWITCH. The control selector switch (10, figure 1-4) is located on the control quadrant and serves to select which of the three propeller controls (master control lever, pitch control switch, or resynchronization button) are to be functional. The positions of the control selector switch and function of each position are as follows:

"MAN" - Pitch control switches operative.

"MASTER LEVER" - Pitch control switches and master control lever operative.

"SYNCH" - Pitch control switches, master control lever operative, and automatic limited range synchronization with resynchronization button operative.

1-34. MASTER CONTROL LEVER. The master control lever (4, figure 1-4) is located in the top center of the control quadrant and controls both governor heads simultaneously. This allows the pilot to increase or decrease rpm of both propellers at the same time and still maintain automatic synchronization once synchronization has been accomplished.

1-35. PITCH CONTROL SWITCHES. Two propeller pitch control switches (8, figure 1-4) are located on the control quadrant. These switches allow the pilot to increase or decrease the rpm of each propeller separately or both propellers in unison.

1-36. RESYNCHRONIZATION BUTTON. The resynchronization button (9, figure 1-4) is located on the front of the control quadrant and serves to resynchronize the propellers at approximately 60 to 90 rpm each time the button is depressed.

1-37. PROPELLER FEATHERING SWITCHES. Propeller feathering is controlled by two push-button type switches (39, 46, figure 1-10) on the overhead panel. Either button is pushed in to feather its corresponding propeller. After the propeller has become fully feathered, the feathering button returns to the neutral position. For unfeathering the propeller, the button is pulled out and held, until the tachometer indicates 800 - 1000 engine rpm. The button is then released and returned to neutral.

1-38. PROPELLER OIL LEVEL EMERGENCY SWITCHES. Propeller oil level emergency switches (43B, figure 1-11), with "AUTO-ON" and "OFF" positions, are provided on the instrument panel. Under normal operation these switches should remain in the "OFF" position. When turned to the "AUTO-ON" position they provide an emergency automatic means of replenishing propeller oil reservoir with engine oil.

NOTE

Switches are not for normal servicing; only emergency replenishing.

1-39. INDICATORS.

1-40. PITCH LIMIT INDICATOR LIGHTS. Two pitch limit

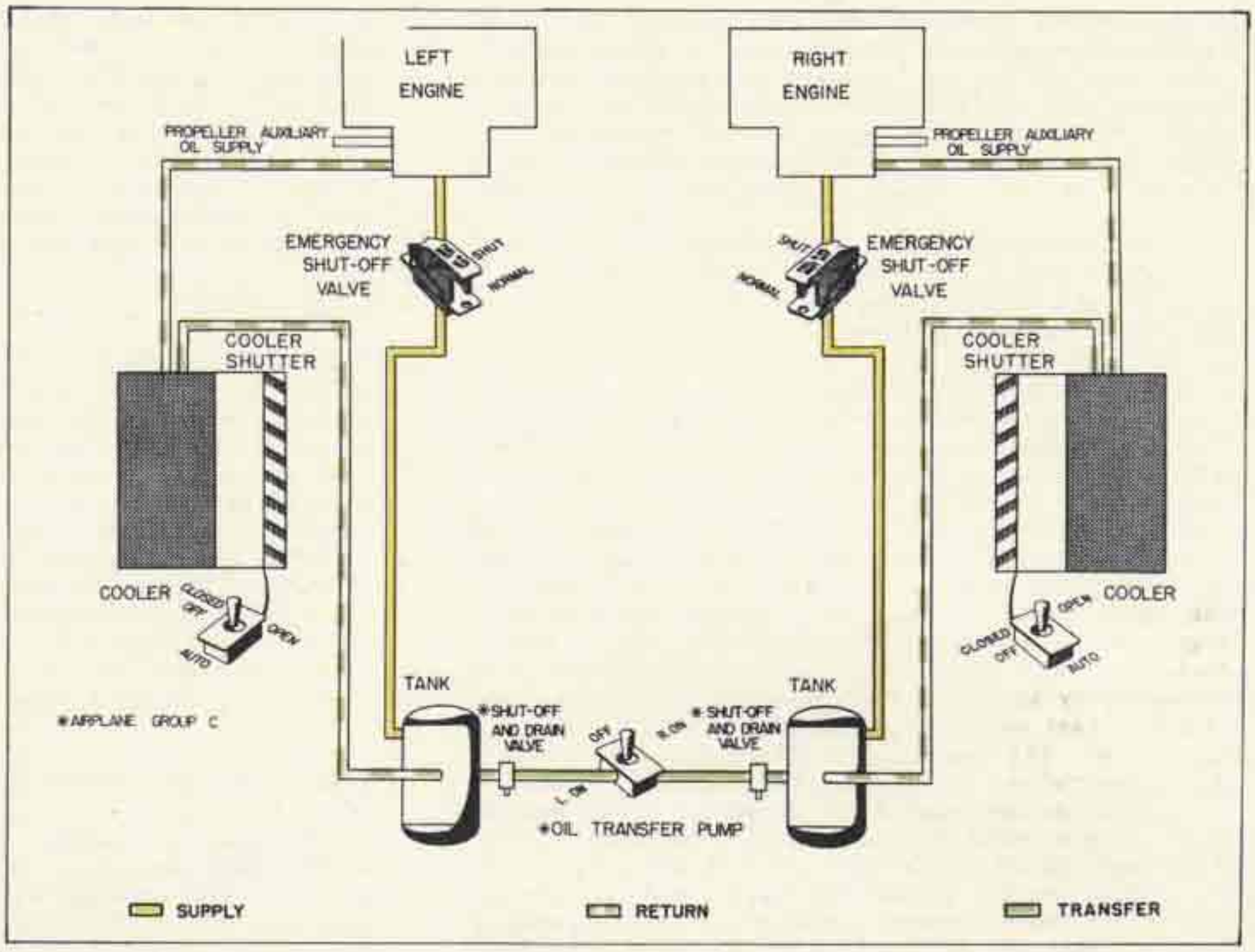


Figure 1-6. Oil System Diagram

indicator lights (6, figure 1-4) are located on the control quadrant. Each of these indicator lights flashes on automatically when its corresponding propeller reaches either full "INCREASE" or full "DECREASE" rpm.

1-41. PROPELLER OIL LEVEL INDICATOR LIGHTS. Two propeller oil level indicator lights (43A, figure 1-11) are provided on the instrument panel. These lights automatically come on when the oil in the corresponding propeller reservoir is low and will stay lit until the oil has been replenished.

1-42. OIL SYSTEM. (See figure 1-6).

1-43. a. An individual pressure-type oil system, with dry crankcase and external oil tank, lubricates each engine. An oil transfer system is C incorporated to permit the transfer of oil from either tank to opposite tank, thus maintaining an approximately equal level in both, and insuring an adequate supply for single-engine operation. The oil quantity, oil pressure, or oil temperature may be determined by dual indicators on the instrument panel.

D b. An individual pressure-type oil system, with dry crankcase and external oil tank, lubricates each engine. The oil quantity and N oil temperature may be determined by separate indicators for either engine on instrument panel.

1-44. OIL SPECIFICATION AND GRADE. Oil used in this airplane is Specification No. MIL-O-6082, grade 1100 or 1120.

1-45. OIL TANKS. An oil tank, with a usable capacity of 60 US gallons plus an expansion space of 12 gallons is installed in each nacelle, aft of the wheel well, to supply oil to the appropriate engine.

1-46. CONTROLS.

1-47. OIL COOLER SHUTTER SWITCHES. Two oil cooler shutter switches (35, figure 1-10) are located on the overhead panel. These switches control the flow of air through the oil cooler by regulating the shutter at the exit of each cooler, thereby keeping the oil which is returning from the engine, at a desired temperature before it re-enters the oil tanks. During normal operation, the switches are in the "AUTO" position. However, if system malfunction should make automatic operation impossible, the shutter may be manually operated by the "OPEN" and "CLOSED" positions of the switches.

1-48. OIL TRANSFER SWITCH. An oil transfer switch (12, figure 1-10) is located on the overhead panel and is utilized to transfer oil from either tank. A combination shut-off and drain valve at each oil tank, and a reversible oil pump in the center section, perform the oil transfer operation. These units are electrically and simultaneously operated by this switch. Oil is thereby transferred from the opposite tank to the tank selected on the transfer switch. C

NOTE

Upon completion of an oil transfer operation, oil remaining in the transfer line is automatically drained overboard through valves located at each oil tank.

1-49. OIL DILUTION SWITCHES. Two oil dilution switches (6, figure 1-10) are located on the overhead panel. These switches are utilized during cold weather to thin the engine oil with fuel. A 30 percent dilution of the oil system may be accomplished in six to eight minutes.

1-50. FUEL AND OIL SHUT-OFF SWITCHES. A fuel and oil shut-off switch (40, 48, figure 1-10) is provided for each engine. These switches are located on the overhead panel and remain in the "NORM" position during normal operation. When placed in the "SHUT" position, all fuel and oil flow is immediately shut off at the engine firewall.

1-51. INDICATORS.

C a. Dual oil pressure (14, figure 1-11), oil level (39, figure 1-11), and oil temperature (16, figure 1-11) indicators are located near the center of the instrument panel.

D b. Right and left engine oil pressure (14, figure 1-11), oil level (39, figure 1-11), and oil temperature (16, figure 1-11) indicators N are located near the center of the instrument panel.

1-52. FUEL SYSTEM. (See figure 1-7.)

1-53. Each engine is provided with its own separate fuel system and two fuel tanks. Both systems and both sets of tanks are interconnected by a crossflow system which makes it possible to operate either engine on any one of the four tanks. Each system provides facilities for engine priming, oil dilution, and vapor return from carburetor. A shut-off switch for each engine is available to the pilot for shutting off the fuel and oil flow to either engine in case of emergency.

1-54. FUEL SPECIFICATION AND GRADE. Fuel used in this airplane is Specification No. MIL-F-5572, grade 115/145 (recommended) or Specification No. MIL-F-5572, grade 100/130 (alternate).

NOTE

For alternate fuel grade operating limits, refer to paragraph 2-22.

1-55. FUEL TANKS.

M a. Four bladder type fuel tanks are utilized in the fuel system, one on each side of the N center section and one in each wing panel. Each set of tanks is interconnected and may be used to supply fuel to either engine by operation of the selector switches in the crew compartment. The highest cell of each tank is vented to the atmosphere in such a manner that no spilling or siphoning of the fuel is possible. Each tank is provided with a marked filler neck and drain for overflow fuel. A sump is located at the bottom of each tank with a drain to permit removal of accumulated water and foreign matter. The total usable fuel is 16,788 pounds.

b. Four self sealing fuel tanks are utilized in the fuel system, one on each side of the center section and one in each wing panel. Each set of tanks is interconnected and may be used to supply fuel to either engine by operation of the selector switches in the crew compartment. The highest cell of each tank is vented to the atmosphere in such a manner that no spilling or siphoning of the fuel is possible. Each tank is provided with marked filler neck and drain for overflow fuel. A sump is located at the bottom of each tank with a drain to permit removal of accumulated water and foreign matter. The total usable fuel is 15,744 pounds. O

1-56. CONTROLS.

1-57. FUEL SELECTOR SWITCHES. Two four-position fuel selector switches (38, 47, figure 1-10), installed on the overhead panel, electrically operate a crossflow valve as well as individual tank shut-off valves. The positions of the fuel selector switches, and the function of each position are as follows:

"OFF" - When switch is in "OFF," all fuel supply is shut off from its respective engine.

"INBOARD" - When the selector switch is in this position, fuel is supplied to its respective engine from the inboard tank.

"OUTBOARD" - When the selector switch is in this position, fuel is supplied to its respective engine from the outboard tank.

"CROSSFLOW" - With one of the selector switches in this position, fuel will be supplied to both engines from the tank selected by the other selector switch.

1-58. BOOSTER PUMP SWITCHES. Two fuel booster pump switches (3, figure 1-5), one left and one right, are mounted on the control pedestal and operate the booster pumps in the fuel tanks. When these switches are in the "NORMAL ON" or "EMERGENCY ON" positions, and the corresponding fuel selector switch is in any position except "OFF" or "CROSSFLOW," the booster pump will operate. When booster pump switches are "OFF," the pumps are inoperative.

1-59. FUEL AND OIL SHUT-OFF SWITCHES. A fuel and oil shut-off switch (40, 48, figure 1-10) is provided for each engine. These switches are located on the overhead panel and remain in the "NORM" position during normal operation. When placed in the "SHUT" position, all fuel and oil flow is shut off at the engine firewall.

FUEL QUANTITY DATA CHART

Tanks	Number	Usable Fuel (Pounds Each) Airplane Groups		Expansion Space (Pounds Each) Airplane Groups		Unusable Fuel-Level Flight (Pounds Each) Airplane Groups		Total Volume (Pounds Each) Airplane Groups	
		M N	O	M N	O	M N	O	M N	O
Inboard	2	2964	2742	90	84	18	43	3072	2869
Outboard	2	5430	5130	168	159	36	53	5634	5342

UNUSABLE FUEL CHART - WINGS LEVEL

Flight Attitude	Inboard (Pounds Each) Airplane Groups		Outboard (Pounds Each) Airplane Groups		Flight Attitude	Inboard (Pounds Each) Airplane Groups		Outboard (Pounds Each) Airplane Groups	
	M N	O	M N	O		M N	O	M N	O
5° Up	12	13	26	35	5° Down	20	20	43	48
10° Up	59	56	106	107	10° Down	76	68	135	140
15° Up	138	130	236	223	15° Down	157	145	296	273
20° Up	230	210	425	391	20° Down	237	226	503	455

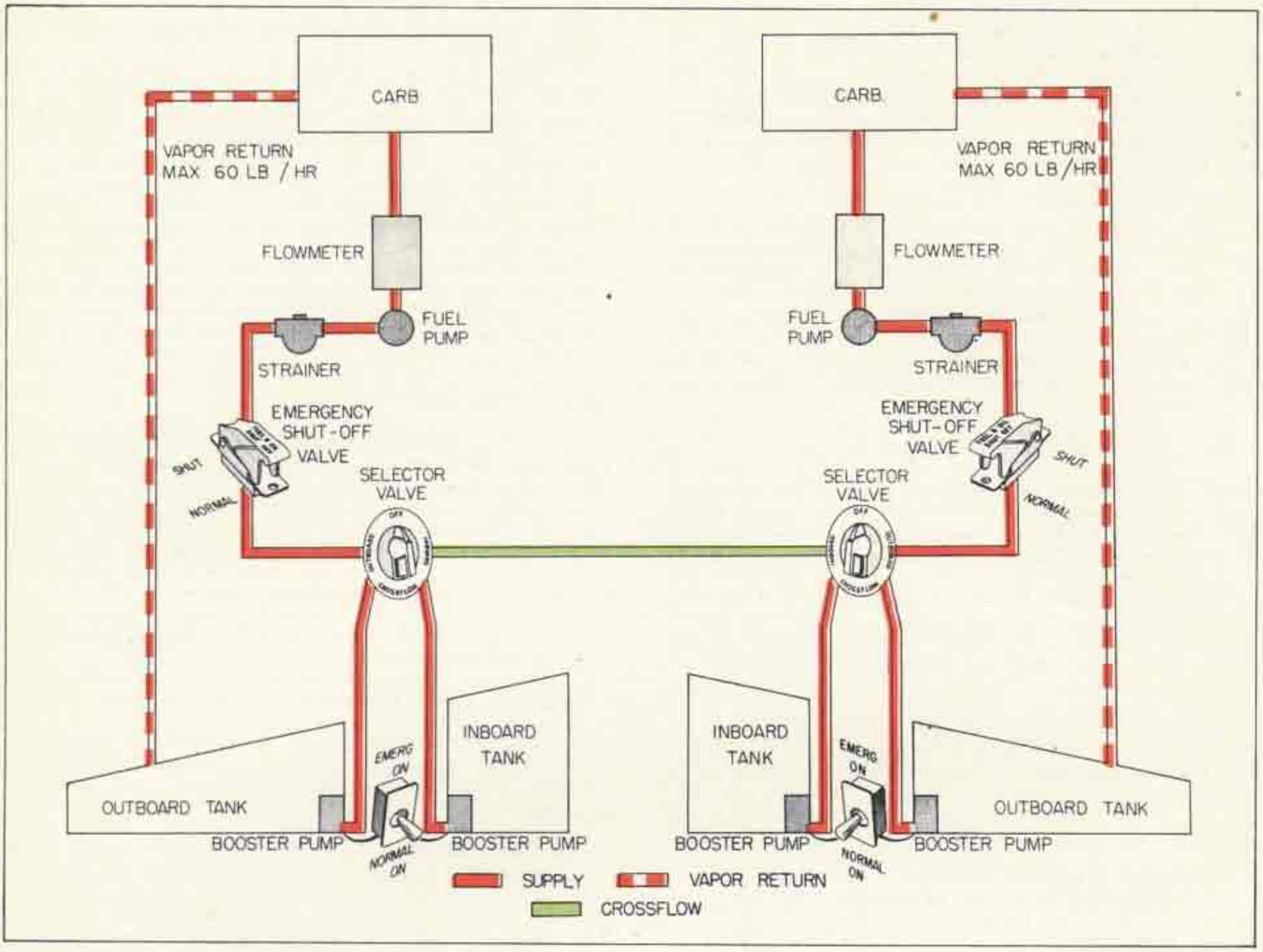


Figure 1-7. Fuel System Diagram

1-60. INDICATORS.

a. Arranged near the center of the instrument panel are four fuel quantity indicators (41, figure 1-11). These indicators are calibrated in pounds and relate separate fuel level readings for each of four tanks. If ac power failure occurs, each fuel level indicator pointer will remain where it is at that time, thus providing a reference for fuel calculation during the remainder of the flight. An indication is also given of fuel in the tanks at the time the engines are shut off. Each indicator may be tested by a "TEST" button on the case. This causes the pointer to move counterclockwise if the indicator is functioning properly, and to remain still if electrical failure has occurred. A dual fuel flowmeter (13, figure 1-11) and a dual fuel preasure indicator (10, figure 1-11) are also provided.

b. Arranged at the bottom center of the instrument panel are four quantity level indicators (41, figure 1-11). These indicators are calibrated in pounds and relate separate fuel level readings for each of the four tanks. If ac power failure occurs, each fuel level indicator pointer will remain where it is at that time, thus providing a reference for fuel calculation during the remainder of the flight. An indication is also given of fuel in the tanks at the time the engines are shut off. Each indicator may be tested by a "TEST" button on the case. This causes the pointer to move counterclockwise if the indicator is functioning properly, and to remain still if electrical failure has occurred. Right and left engine fuel flowmeters (13, figure 1-11) and fuel pressure (10, figure 1-11) indicators are also provided.

1-61. ELECTRICAL SYSTEM.

1-62. The electrical system is a 24-volt, direct current, single conductor-type, except where two conductors are necessary to minimize deflections of the magnetic compasses. Inverters are installed to supply alternating current to the various units in the airplane. The various electrical circuits are protected by push-pull type circuit breakers, most of which are mounted on a circuit breaker section of the overhead panel. Engine generators, an auxiliary power plant, and an external power receptacle are installed to supplement and relieve the power load of the battery.

1-63. EXTERNAL POWER RECEPTACLE. The external power receptacle (14, figure 1-3) is located on the right side of the fuselage just forward of the propeller plane area. A spring-loaded access door is installed over the external power receptacle in such a manner that it is held in place during flight.

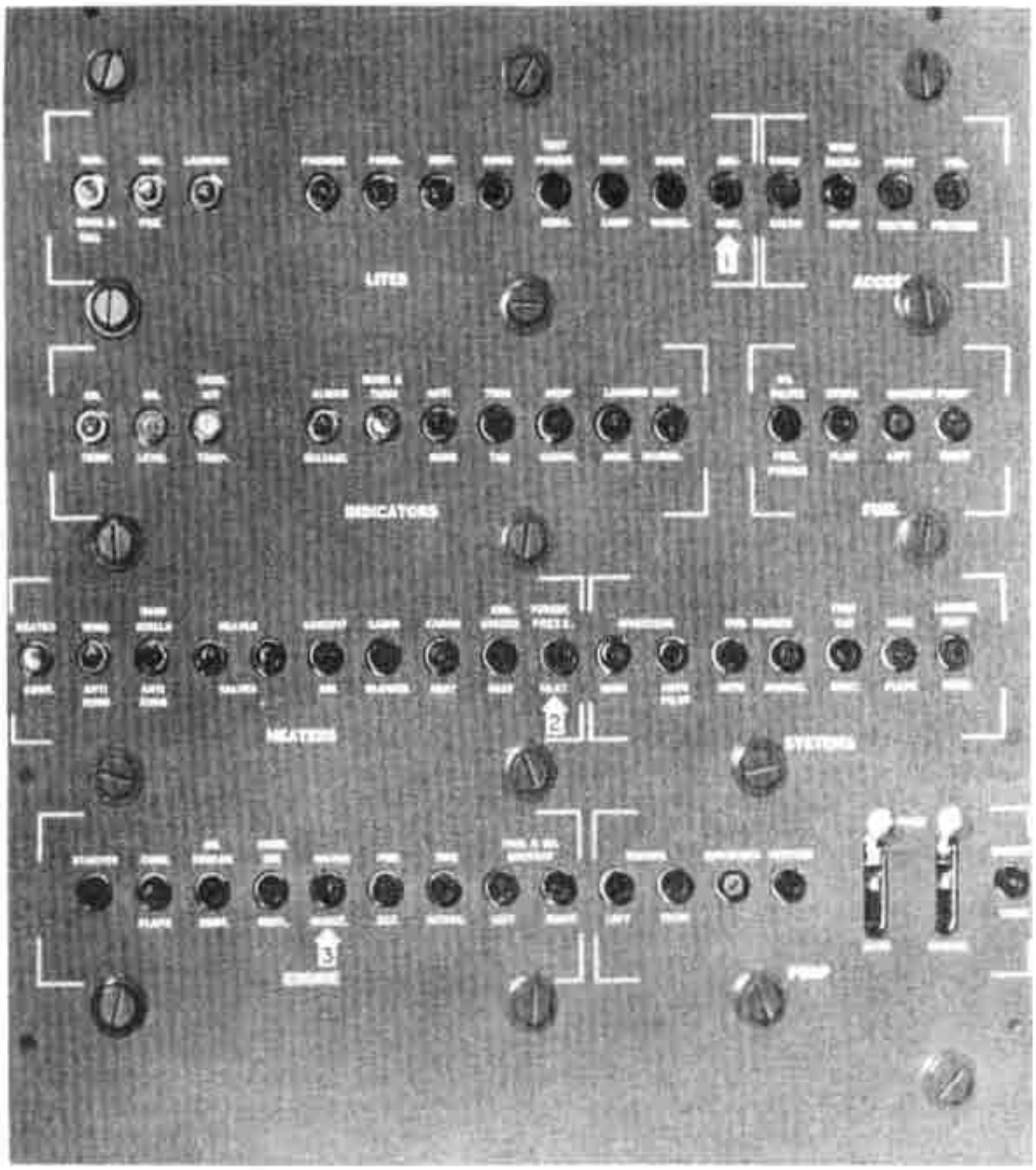


Figure 1-8. Circuit Breaker Panel

1. Airplane Group C only
2. Airplane Group C only
3. Airplane Group C (Oil Transfer) Airplane Group J (Water Injection)

1-64. BATTERY. A 24-volt, 34 ampere-hour shielded storage battery (11, figure 1-3) is installed under cargo compartment floor just aft of rear spar frame, in such a manner as to be easily accessible from the outside. It is controlled by a relay, which in turn is controlled by the master battery and ignition switch (25, figure 1-10) on overhead panel. When this is in "IGN. ON-BAT. ON," battery circuit is closed.

1-65. CONTROLS.

1-66. MASTER BATTERY AND IGNITION SWITCH. (Refer to paragraph 1-23.)

1-67. GENERATOR SWITCHES. A left and right generator switch (2, figure 1-10) is located on the overhead panel. Each of these switches controls a 24-volt, direct current generator which is installed on each engine. The positions of the generator switches, and the function of each position are as follows:

"OFF" - Generator inoperative.

"ON" - Generator operative. In this position during all normal flight operations.

"RESET" - Is temporarily placed in this position when ammeter indicator light shows that control relay has opened circuit because of excessive power load. The "RESET" position resets the relay and allows current to flow. If, however, the indicator light continues to flash on after the relay has been reset, it denotes a decided malfunction in the generator circuit.

1-68. MAIN AND SPARE INVERTERS SWITCH. A single two-position inverter switch (33, figure 1-10), located on the overhead panel, manually controls selection of two single-phase, 115-volt, 2500 volt-ampere, 400 cycle, alternating current inverters. These inverters supply ac power required for autosyn instruments, magnetic compass light, pilot's directional gyro, gyro horizon indicators, and communications equipment, and are installed on a shelf in the top rear of the cargo compartment. One inverter is considered the main, while the second is utilized as a spare. Main inverter failure is automatically offset by operation of the spare inverter. The "MAIN" and "SPARE" positions of the inverter switches are utilized for manual selection. Two warning lights (29, figure 1-11), on the instrument panel, indicate failure of either the "MAIN" inverter or "BOTH" inverters.

1-69. AUTOMATIC PILOT INVERTER SWITCH. A single two-position auto pilot inverter switch (33A, figure 1-10), with "OFF" and "ON" positions, is located on the overhead panel. This switch controls the 1000 volt-ampere, three-phase automatic pilot inverter located on a shelf in the top rear of the cargo compartment. A warning light (28A, figure 1-11), located on the instrument panel indicates failure of the automatic pilot inverter.

1-70. VOLTAGE REGULATOR RHEOSTAT. A voltage regulator rheostat (4, figure 1-15), for each engine and the APP, is provided in the right wall of the crew compartment. These rheostats are used in making adjustments in the voltage regulator.

CAUTION

Do not increase the voltage above 28.5.

1-71. CIRCUIT BREAKERS. A circuit breaker panel (figure 1-8) at the aft end of the overhead panel, contains self-identifying, push-pull type circuit breakers for most of the electrical control circuits in the airplane. Circuit breakers are also installed in the main, power, nose, auxiliary floor, and radio junction boxes.

CAUTION

The circuit breakers should not be utilized as switches.

1-72. AUXILIARY POWER PLANT.

K N

a. A 175-ampere, 28.5 volt auxiliary power plant (APP) is located in the accessory equipment compartment, aft of the crew compartment. This unit is used in supplying electrical current for starting the engines, operating electrical equipment on the ground, charging the battery, and other auxiliary electrical purposes. The APP controls are located at the crew chief's station and consist of a governor control lever (1, figure 1-9), a control switch (4, figure 1-9) and an ignition switch (2, figure 1-9). The positions of these controls and function of each position are as follows:

Governor Control Lever:
"CHOKE" - In this position for starting.
"IDLE" - In this position for warm up and slow operation.
"RUN" - In this position for normal operation.

Control Switch:
"START AND RESET" - In this position for starting. Switch is also returned temporarily to this position to reset generator control relay when APP voltmeter indicator light denotes overload conditions in APP generator circuit.
"ON" - Generator operative. In this position for normal operation.
"OFF" - In this position for cutting out generator.

Ignition Switch:
"ON" - In this position for turning on ignition to APP unit.
"OFF" - In this position for turning off ignition to APP unit.

b. A 175-ampere, 28.5-volt auxiliary power plant (APP) is located in the accessory equipment compartment, aft of the crew compartment. This unit is used in supplying electrical current for starting the engines, operating electrical equipment on the ground, charging the battery, and other auxiliary electrical purposes. The APP controls are located at the crew chief's station and consist of a governor control lever (1, figure 1-9A), starter switch (4, figure 1-9A), generator control switch (5, figure 1-9A), and an ignition switch (2, figure 1-9A). The positions of these controls and function of each position are as follows:

L

Governor Control Lever:
"CHOKE" - In this position for starting.
"IDLE" - In this position for warm up and slow operation.
"RUN" - In this position for normal operation.

Starter Switch:
"START" - In this position for starting.
"ON" - Moved to this position once APP is running.
"OFF" - In this position for shutting off the fuel supply to APP.

Generator Switch:
"GEN. ON" - In this position for turning APP generator on.
"RESET" - In this position temporarily to reset generator control relay when APP voltmeter indicator light denotes overload conditions in APP generator circuit.
"OFF" - In this position for turning generator off.

Ignition Switch:
"ON" - In this position for turning on ignition to APP unit.
"OFF" - In this position for turning off ignition to APP unit.

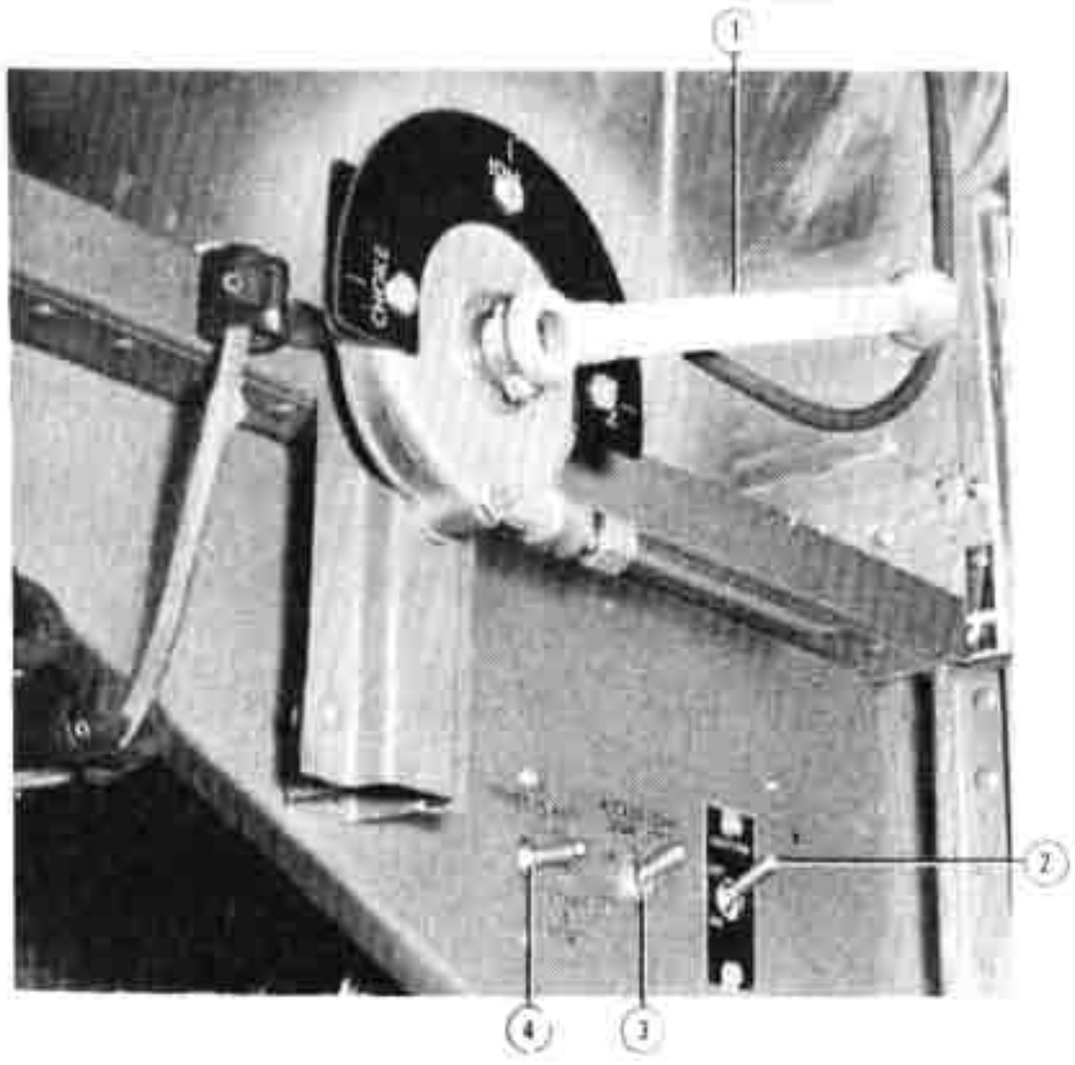


Figure 1-9. APP Controls (Airplane Groups K and N)

1. Governor control lever
2. Ignition switch
3. Accessory equipment compartment dome lights switch
4. Control switch

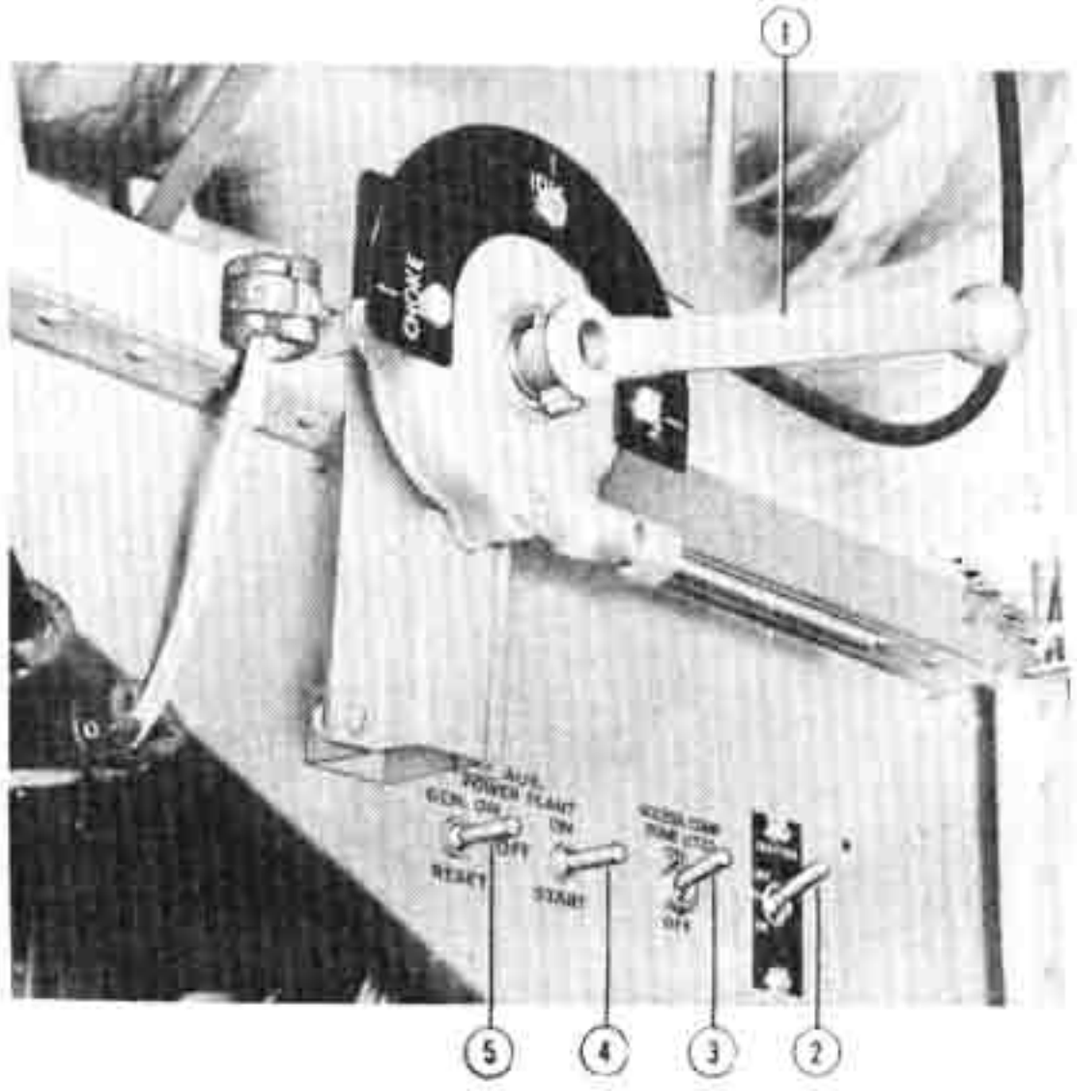
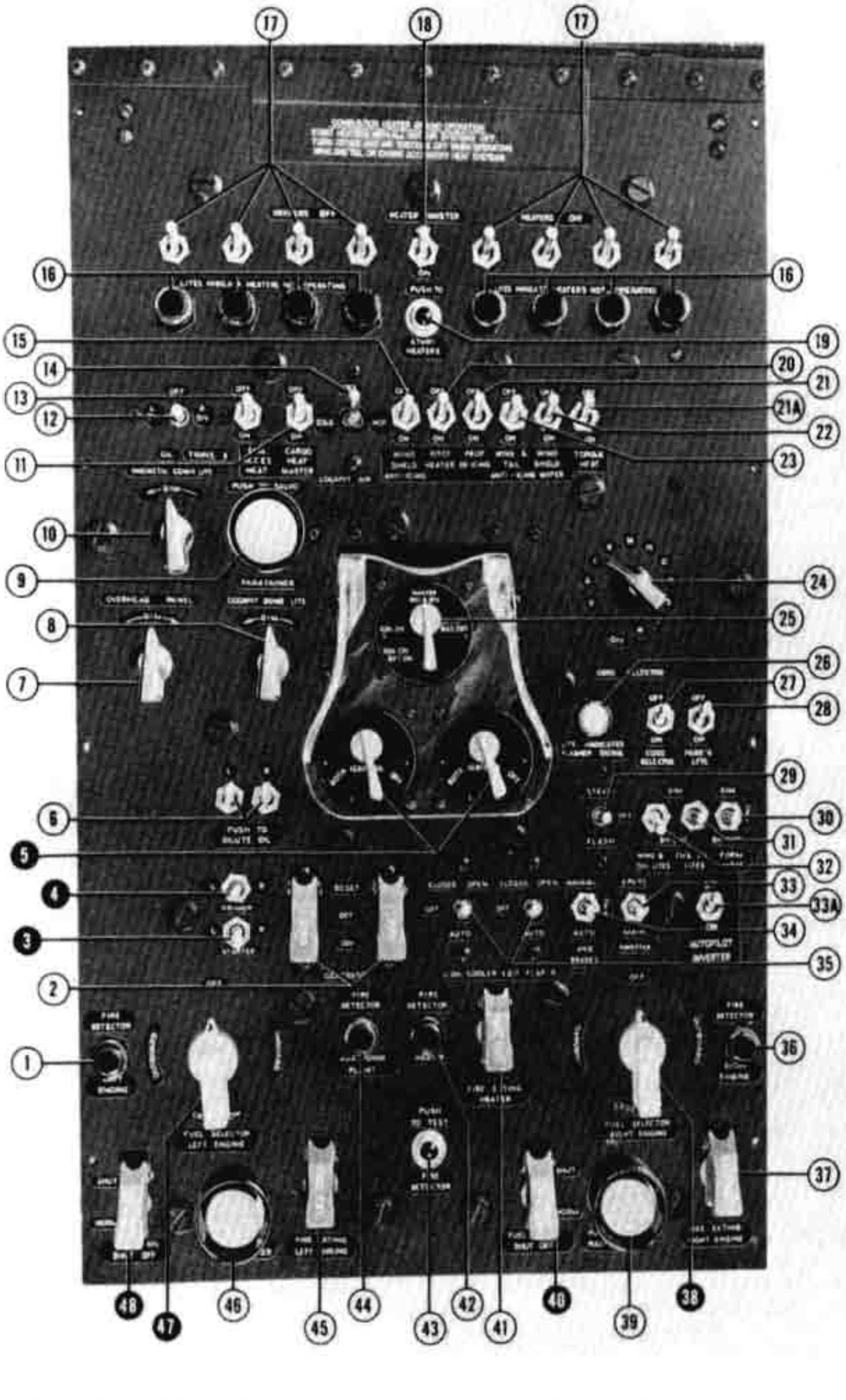


Figure 1-9A. APP Controls (Airplane Group L)

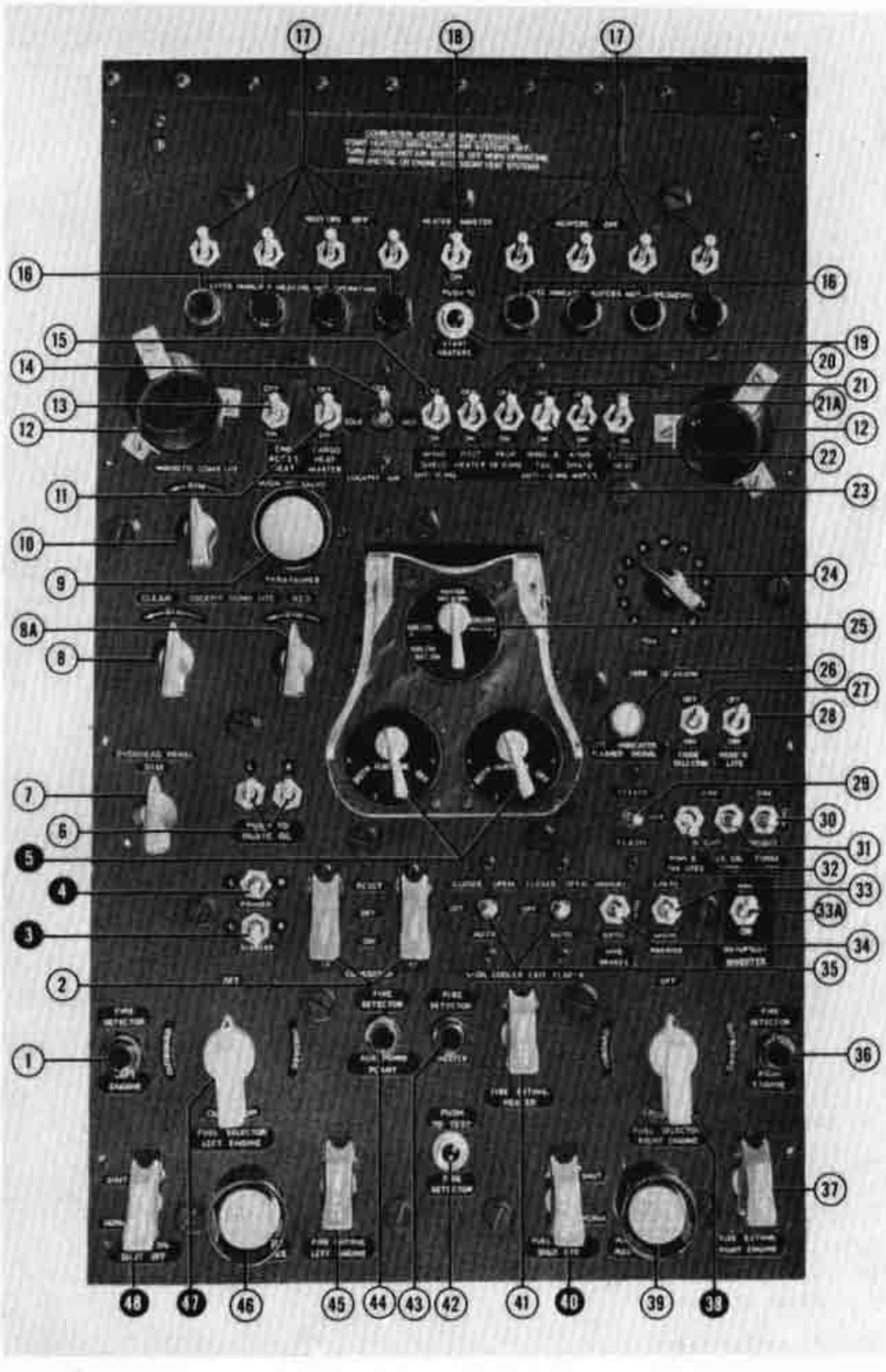
1. Governor control lever
2. Ignition switch
3. Accessory equipment compartment dome light switch
4. Starter switch
5. Generator switch

Figure 1-10. Overhead Panel (Airplane Groups K and N)

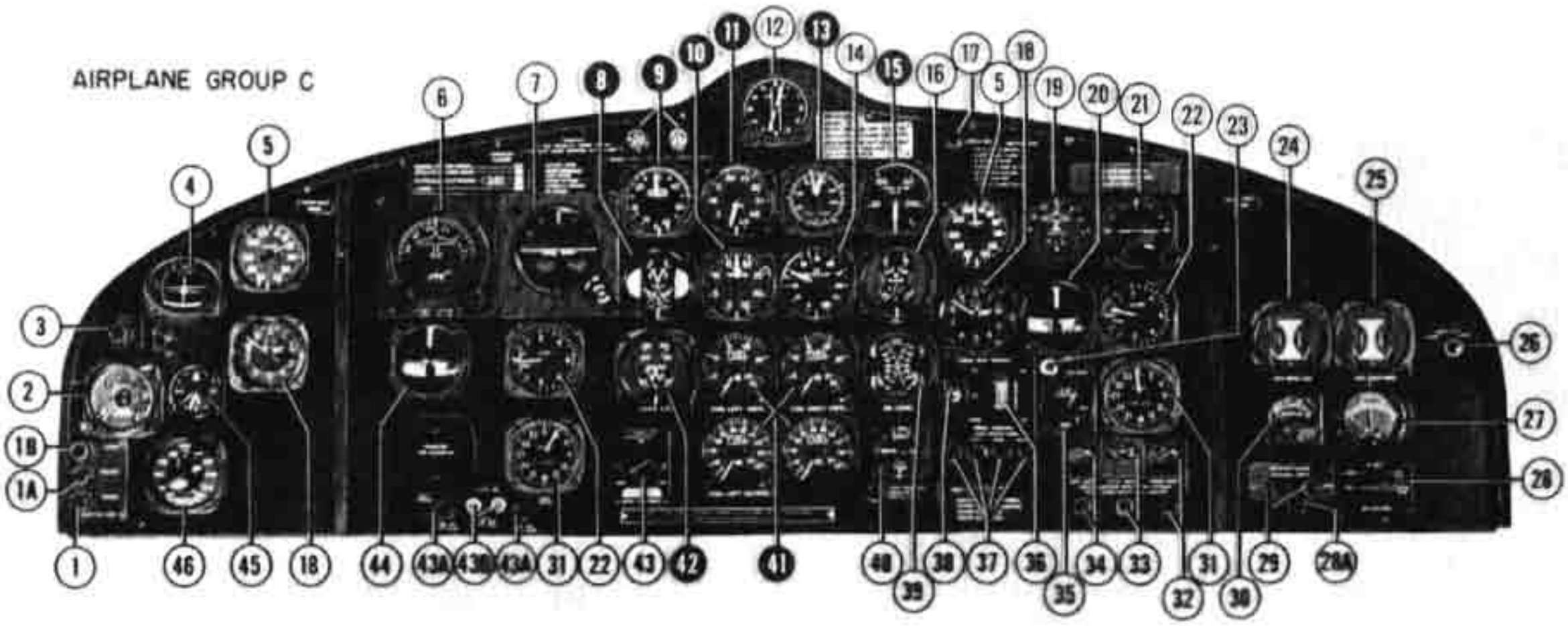


1. Left engine fire detector light
2. Left and right engine generator switches
3. Left and right engine starter switch
4. Primer switch
5. Left and right engine ignition switches
6. Left and right engine oil dilution switches
7. Overhead panel light rheostat
8. Cockpit clear dome light rheostat
9. Aerial delivery salvo switch
10. Magnetic compass light rheostat
11. Cargo heat master switch
12. Oil transfer switch (Airplane group D)
13. Engine accessory heat switch
14. Cockpit air switch
15. Windshield anti-icing switch
16. Heater indicator lights
17. Individual heater switch
18. Heater master switch
19. Heater starter button
20. Pitot heater switch
21. Propeller de-icing switch
21A. Torquemeter heater switch (Airplane group C)
22. Windshield wiper switch
23. Wing and tail anti-icing switch
24. Code selector switch
25. Master battery and ignition switch
26. Flasher indicator light
27. Code selector power switch
28. Passing light switch
29. Navigation light flash or steady switch
30. Formation light switch
31. Fuselage signal light switch
32. Wing and tail light switch
33. Inverter switch
33A. Automatic pilot inverter switch
34. Hydraulic brake switch
35. Left and right engine oil cooler shutter switches
36. Right engine fire detector light
37. Right engine fire extinguisher switch
38. Right engine fuel selector switch
39. Right engine propeller feathering switch
40. Right engine fuel and oil shut-off switch
41. Heater fire extinguisher switch
42. Fire detector test switch
43. Heater fire detector light
44. Auxiliary power plant fire detector light
45. Left engine fire extinguisher switch
46. Left engine propeller feathering switch
47. Left engine fuel selector switch
48. Left engine fuel and oil shut-off switch

Figure 1-10A. Overhead Panel (Airplane Group L)



1. Left engine fire detector light
2. Left and right engine generator switches
3. Left and right engine starter switch
4. Primer switch
5. Left and right engine ignition switches
6. Left and right engine oil dilution switches
7. Overhead panel light rheostat
8. Cockpit clear dome light rheostat
8A. Cockpit red dome light rheostat (Airplane Group O)
9. Aerial delivery salvo switch
10. Magnetic compass light rheostat
11. Cargo heat master switch
12. Radio control panel spotlight (Airplane group O)
13. Engine accessory heat switch
14. Cockpit air switch
15. Windshield anti-icing switch
16. Heater indicator lights
17. Individual heater switch
18. Heater master switch
19. Heater starter button
20. Pitot heater switch
21. Propeller de-icing switch
21A. Torquemeter heater switch (Airplane group C)
22. Windshield wiper switch
23. Wing and tail anti-icing switch
24. Code selector switch
25. Master battery and ignition switch
26. Flasher indicator light
27. Code selector power switch
28. Passing light switch
29. Navigation light flash or steady switch
30. Formation light switch
31. Fuselage signal light switch
32. Wing and tail light switch
33. Inverter switch
33A. Automatic pilot inverter switch
34. Hydraulic brake switch
35. Left and right engine oil cooler shutter switches
36. Right engine fire detector light
37. Right engine fire extinguisher switch
38. Right engine fuel selector switch
39. Right engine propeller feathering switch
40. Right engine fuel and oil shut-off switch
41. Heater fire extinguisher switch
42. Fire detector test switch
43. Heater fire detector light
44. Auxiliary power plant fire detector light
45. Left engine fire extinguisher switch
46. Left engine propeller feathering switch
47. Left engine fuel selector switch
48. Left engine fuel and oil shut-off switch



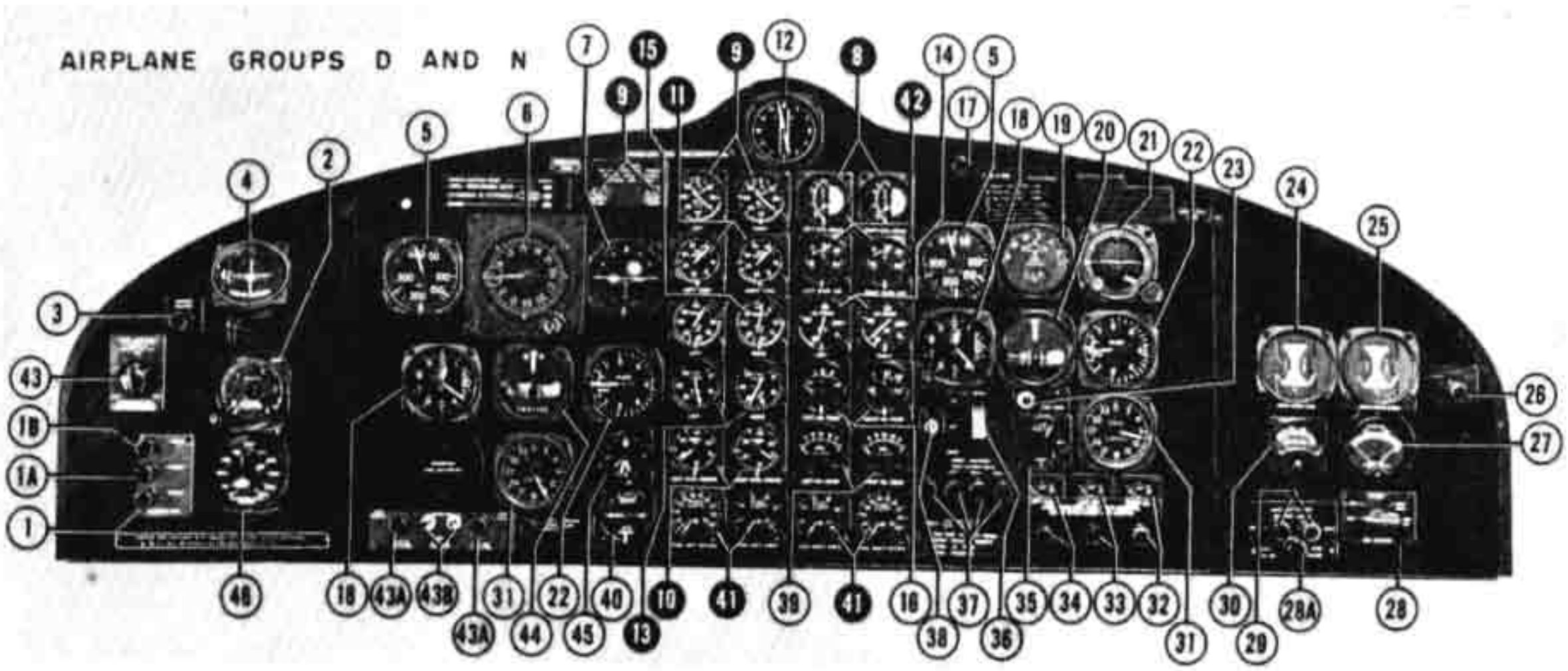


Figure 1-11. Instrument Panel

1. Altitude indicator light-Below
1A. Altitude indicator light-Preset (Airplane group A)
1B. Altitude indicator light-Above (Airplane group A)
2. Radio altitude indicator
3. Marker beacon indicator light
4. Blind landing indicator
5. Air speed indicator
6. Directional gyro indicator
7. Gyro horizon indicator
8. Cylinder head temperature indicator
9. Manifold pressure gage and purge valves
10. Fuel pressure indicator
11. Tachometer
12. Remote indicating compass
13. Fuel flowmeter indicator
14. Oil pressure indicator
15. Torquemeter gage
16. Oil temperature indicator
17. Master fire detector light
18. Altimeter
19. Master direction indicator
20. Rate gyro control (turn-and-bank indicator)
21. Vertical gyro control
22. Rate-of-climb indicator
23. Horn disconnect button
24. Tail anti-icing indicator
25. Wing anti-icing indicator
26. Doors warning light
27. DC voltmeter
28. DC voltage selector switch
28A. Automatic pilot inverter warning light
29. Inverter warning lights
30. AC voltmeter
31. Radio compass repeater indicator
32. Right ammeter and warning light
33. APP ammeter and warning light
34. Left ammeter and warning light
35. Wing flap position indicator
36. Landing gear emergency control switch
37. Landing gear indicator lights
38. Landing gear normal control switch
39. Oil level indicator
40. Hydraulic pressure gage and warning light
41. Fuel quantity indicators
42. Carburetor air temperature indicator
43. Windshield wiper rheostat
43A. Propeller oil level indicator lights
43B. Propeller oil level emergency replenishing switches
44. Turn-and-bank indicator
45. Clock
46. Altitude limit switch

1-73. INDICATORS.

1-74. AC VOLTMETER. An ac voltmeter (30, figure 1-11) is installed on the instrument panel to provide inverter voltage readings. This voltmeter automatically provides a reading for whichever inverter is operating.

1-75. DC VOLTMETER AND VOLTAGE SELECTOR SWITCH. A dc voltmeter and voltage selector switch (27, 28, figure 1-11) are installed on the instrument panel to provide engine generator, APP generator, and main bus voltage readings. When the selector switch is turned to "APP GEN," "R. GEN," "L. GEN," or "MAIN BUS," the voltmeter will give corresponding readings.

1-76. AMMETERS. Three ammeters (percent load meters) and three indicator lights (32, 33, 34, figure 1-11) are located on the instrument panel, one for each of the two engine generators, and one for the APP unit. When one of the ammeter indicator lights flashes on, it indicates that the control relay for that particular generator has opened the circuit because of excessive power load, thus making it necessary to place the respective generator switch temporarily to the "RESET" position in order to reset the relay and allow current to flow.

1-77. HYDRAULIC SYSTEM.

1-78. The hydraulic system is utilized to operate the nose wheel steering mechanism and the dual wheel brakes on each main landing gear. A normal operating pressure of 980-1160 psi is maintained by an automatic pressure switch and a hydraulic pump. If the main system pressure falls below 980 psi, the pump will automatically operate to maintain normal operating pressure. If the pressure should fall below 800 psi, a red warning light on the instrument panel will glow, indicating to the pilot that unsafe pressure conditions exist. When the main system pressure reaches 1160 psi, the pressure switch will auto-

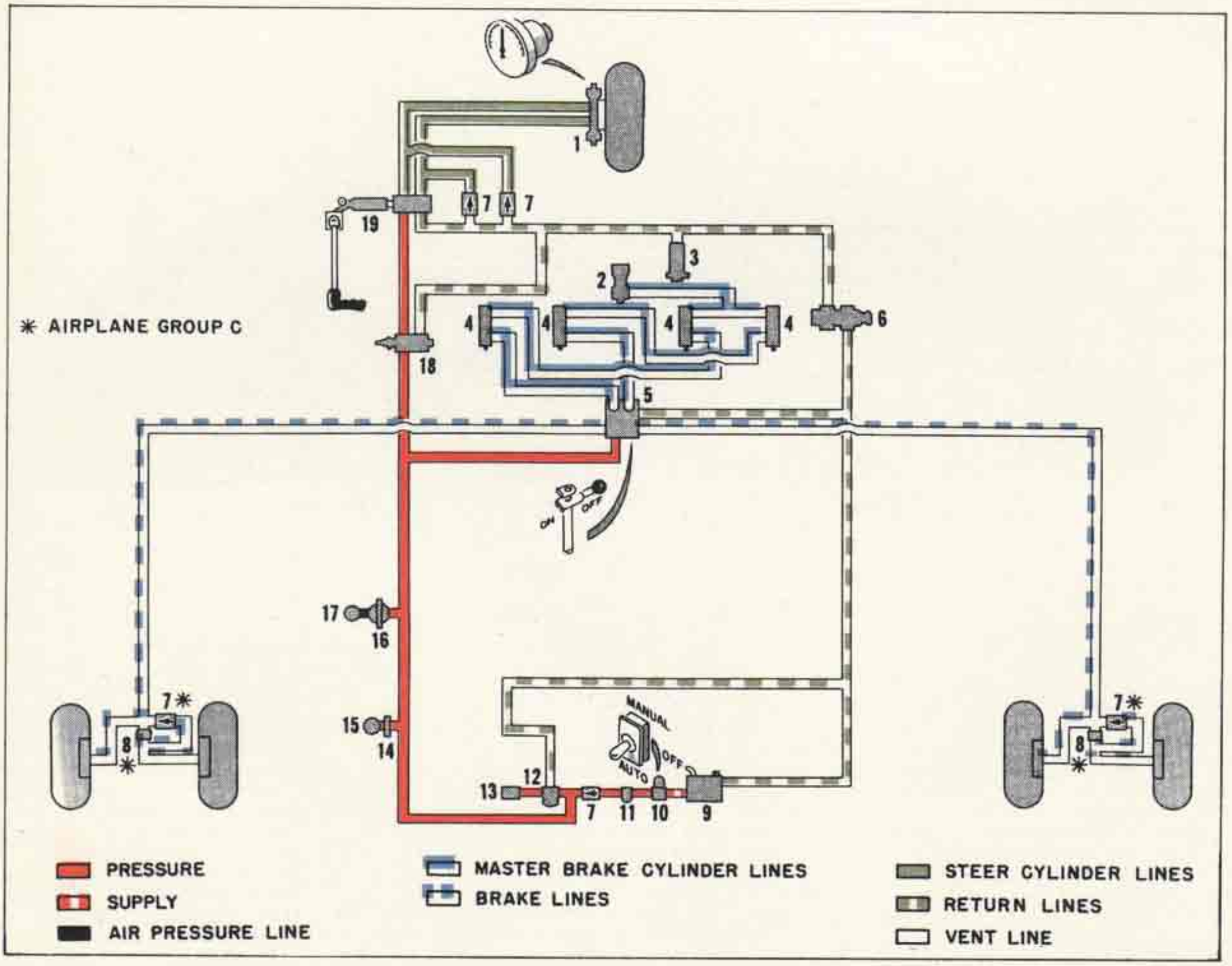


Figure 1-12. Hydraulic System Diagram

1. Steer cylinder
2. Pressure reservoir
3. Steer system accummulator
4. Master brake cylinders
5. Power brake valve
6. Pressure relief valve
7. Check valve
8. Restrictor
9. Reservoir
10. Pump
11. Filter
12. Pressure relief valve
13. Pressure switch
14. Snubber
15. System pressure gage
16. Brake system accumulator
17. Accumulator air pressure gage
18. Sequence shut-off valve
19. Steer valve

matically stop operation of pump, thus maintaining a constant operating pressure in main hydraulic system.

1-79. CONTROLS.

1-80. WHEEL BRAKES. The wheel brakes are applied by depressing toes of pilot's or copilot's rudder pedals.

1-81. EMERGENCY BRAKE (PARKING). The emergency brake (parking) control handle (11, figure 1-14) is located below the side window at pilot's station and is provided with "ON" and "OFF" positions. The control handle is used to apply brakes when airplane is parked or for emergency stops. When the control handle is in any intermediate position between "OFF" and "ON" a graduated portion of the braking power is obtained.

WARNING

When the control handle is in the "ON" position, brakes are full on. Do not use foot brake when applying emergency brake.

1-82. HYDRAULIC BRAKE SWITCH. A hydraulic brake switch (34, figure 1-10) on the overhead panel, controls entire hydraulic system. With this switch in "AUTO" position, pressure is automatically maintained by hydraulic pump and automatic pressure switch. If, however, pressure switch fails to function automatically the hydraulic brake switch may be held in "MAN" position until sufficient pressure is built up.

NOTE

When switch is turned to "OFF," and toes of rudder pedals are pumped, pressure in hydraulic lines is released. This is done only when flying in combat zones. However, with landing gear extended, and switch "OFF," pressure will build up as in "AUTO."

1-83. INDICATORS. A hydraulic system pressure gage (40, figure 1-21) is located on instrument panel. If hydraulic pressure falls below 800 psi, the hydraulic pressure warning light (40, figure 1-11), located on the instrument panel, will flash on. The accumulator, preloaded to 450 psi, has a pressure gage located adjacent to it on the auxiliary floor.

1-84. FLIGHT CONTROLS.

1-85. The primary flight control surfaces are conventionally operated from either the pilot's or copilot's stations, while spring tabs are incorporated on each rudder and the elevator to afford assistance to the pilot in control movement. These tabs are spring operated and are adjusted to operate automatically with movement of the controls. A flettner tab is incorporated on each inboard aileron.

1-86. CONTROL WHEELS AND RUDDER PEDALS. Dual control columns and rudder pedals for aileron, elevator, and rudder control, are of the conventional type. The rudder pedals may be adjusted to suit the stature of the pilot and copilot by means of an adjustment wheel below the instrument panel.

1-87. TRIM TAB CONTROLS. The aileron trim tab, installed in the right inboard aileron, and rudder trim tabs installed in the upper trailing edge of each rudder, are all electrically operated by a switch (8, figure 1-5) on the pilot's switch panel. An indicator (9, figure 1-5) for these tabs is located adjacent to the control switch. An elevator trim tab, installed in the trailing edge of the elevator, is operated manually by elevator trim tab control wheels (1, figure 1-4) located on each side of the engine control quadrant.

1-88. WING FLAP CONTROLS. Wing flaps, of the slotted type, are installed in the trailing edge of each wing between the inboard edge of the ailerons and the outboard side of the nacelle, and between the inboard side of the nacelle and the side of the fuselage. These flaps are electrically operated by a control handle (6, figure 1-5) at the right side of the engine control pedestal with "DOWN," "TAKE-OFF," and "UP" positions. The position of the flaps is shown by an indicator (35, figure 1-11) on the instrument panel. The flaps may also be operated manually in the event of electrical system failure by inserting a handcrank (4, figure 1-16) in the socket, located at top rear of the cargo compartment.

Figure 1-13. DELETED.

1-89. FLIGHT CONTROLS LOCK.

CAUTION

When engaging controls lock, during moderate to heavy winds or gusty conditions, head airplane into wind to prevent damage to control lock system or incomplete locking resulting in possible elevator damage.

1-89A. The flight controls lock is located under a cover plate on the floor directly in front of the pilot's seat. The controls are locked by placing the primary controls in neutral, opening the access door (8B, figure 1-14), and pulling up on the plunger handle (8A, figure 1-14). While pulling up on the plunger handle, a slight back and forth rapid motion should be applied to the control column and wheel and rudder pedals to seat lock cams at control surfaces. Positive lock of the surfaces can be checked by applying pressure to the controls. A cable (5A, figure 1-14), which is under tension, is then extended from the plunger and fastened to a hook at the top of the canopy. This conspicuous arrangement makes it impossible for the pilot to attempt flight operations without first unlocking the controls. To unlock the flight controls the cable is unhooked from the canopy and returned to its position in the plunger. The plunger is then pushed down into the floor.

CAUTION

Do not allow cable handle to snap back into plunger.

1-90. INDICATORS. The wing flaps position indicator (35, figure 1-11) is located on the instrument panel. The rudder and aileron trim tab position indicator (9, figure 1-5) is on the pilot's switch panel. An elevator trim tab indicator is incorporated on each side of the engine control quadrant. Trim tab position indicators are calibrated in degrees.

1-91. AUTOMATIC PILOT.

1-92. A type F-1, electrically operated automatic pilot is installed in the airplane to provide control of the ailerons, rudders, and elevator. It is a system of automatic controls which holds the airplane on any selected magnetic headings; brings it back

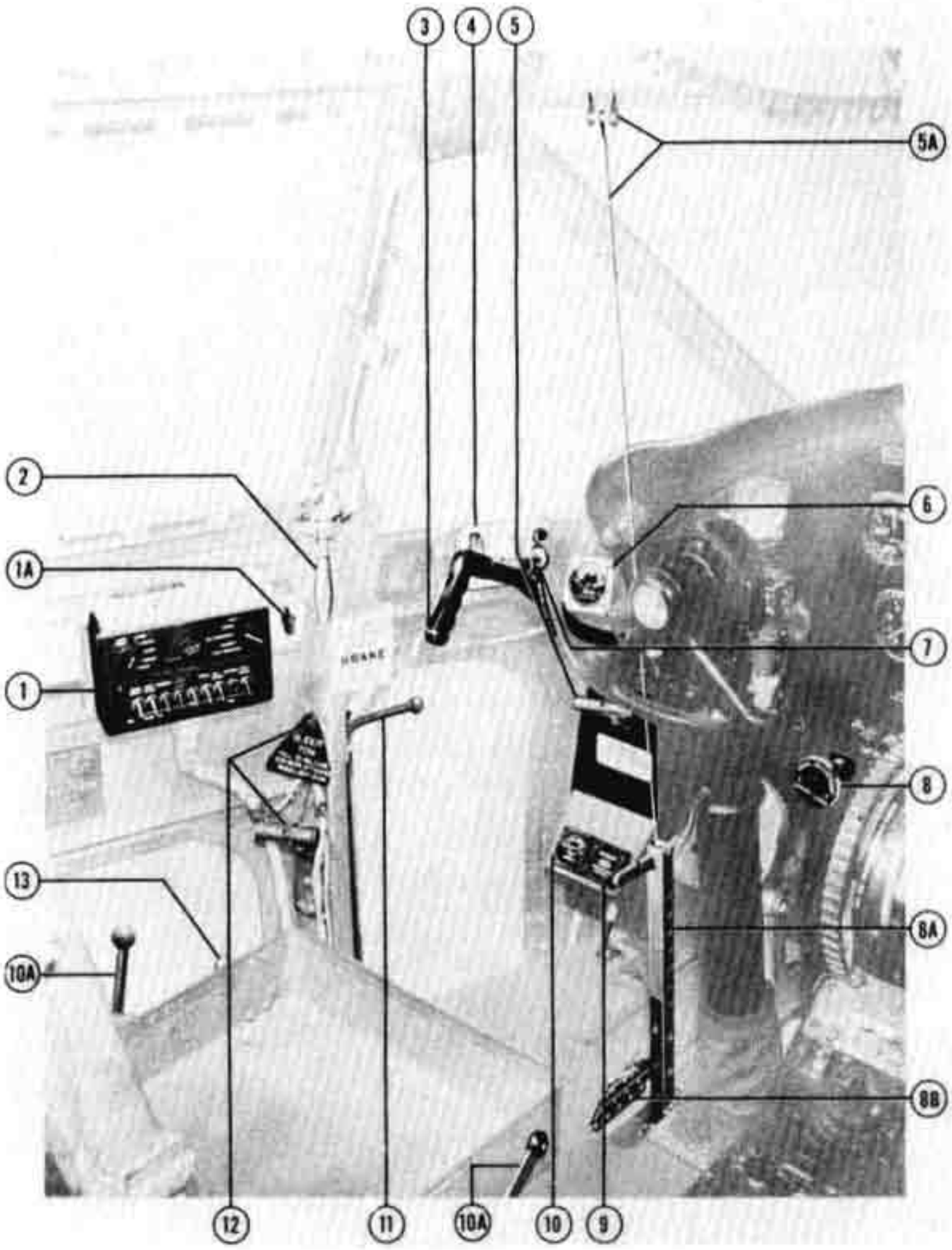


Figure 1-14. Pilot's Station

1. Interphone control box
1A. Interphone light rheostat (Airplane Group 0)
2. Side window lock
3. Nose gear steering handle
4. Jump signal control box
5. Automatic pilot disconnect lever
5A. Flight controls lock tape and hook
6. Nose gear steering indicator
7. Automatic pilot clutch disengage button
8. Rudder pedal adjustment wheel
8A. Flight controls lock plunger
8B. Flight controls lock access door
9. Oxygen flow indicator
10. Oxygen pressure gage
10A. Seat adjustment lever
11. Emergency brake
12. Glider towrope release handle and indicator light
13. Shoulder harness inertia reel lock control

without overswing when momentary displacements occur; and simultaneously keeps it stabilized in pitch and bank. While under automatic control, the airplane can be made to climb, dive, and execute coordinated turns. With the system operating, the auto pilot is always synchronized with the controls of the airplane and continues to function even when disengaged. It is, therefore, always ready to take over smoothly, and maintain the heading and attitude of the airplane at the moment of transfer from manual to automatic control. The auto pilot's response to displacement allows corrections to be made with a minimum of surface control movement. It includes a turn-and-pitch controller, two servo clutch disengage switches, a power switch, a servo clutch engage switch, and dual servo disconnect levers. With the exception of two servo clutch disengage switches and dual servo disconnect levers, the auto pilot controls are located on the control pedestal. An automatic pilot inverter, with control switch on the overhead panel, is provided to supply ac power to the automatic pilot circuit.

1-93. CONTROLS.

1-94. CONTROLLER. The turn-and-pitch controller (11, figure 1-5) changes the attitude of the airplane while the auto pilot is engaged. It contains a bank-trim adjustment wheel on the face, a turn-control knob on the face of the bank-trim adjustment wheel and a pitch-trim control on the right side of the controller.

1-95. TURN-CONTROL KNOB. (See 11, figure 1-5.) The automatic pilot system utilizes three separate servos, one each for rudder, aileron, and elevator operation respectively. The signals controlling these servos through the turn-control knob are coordinated to permit the execution of an automatic turn in flight. In straight flight, the turn-control knob remains in a neutral position and is held there by means of a lever which engages a detent on the turn-control knob shaft. When the turn-control knob is moved either right or left, for turning the airplane

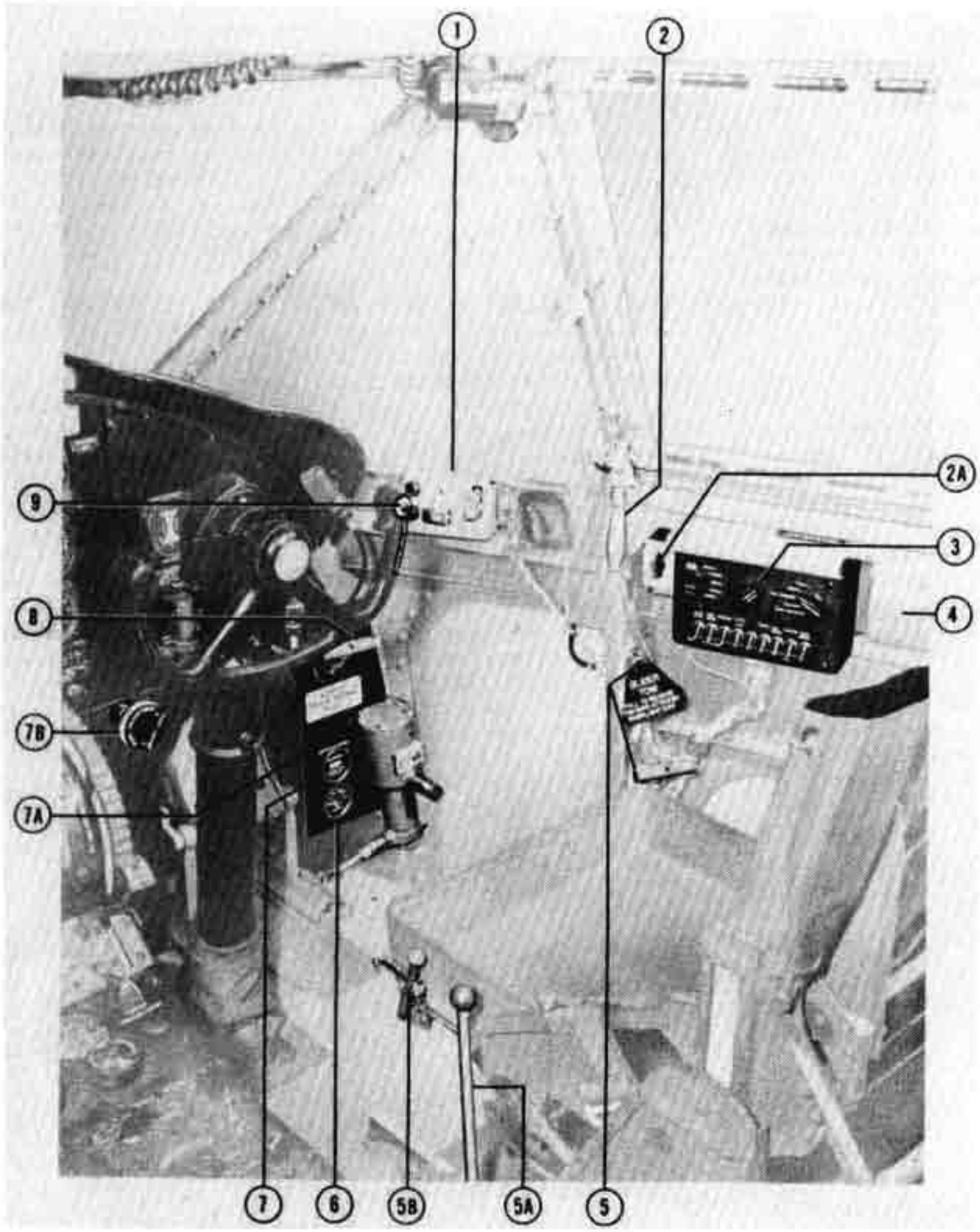


Figure 1-15. Copilot's Station

1. Jump signal control box
2. Side window lock
2A. Interphone light rheostat (Airplane Group 0)
3. Interphone control box
4. Voltage regulator rheostats
5. Glider towrope release handle and indicator light
5A. Seat adjustment lever
5B. Shoulder harness inertia reel lock control
6. Oxygen pressure gage
7. Oxygen flow indicator
7A. Hydraulic pressure reservoir
7B. Rudder pedal adjustment wheel
8. Automatic pilot disconnect lever
9. Automatic pilot clutch disengage button

right or left respectively, the lever is moved out of the detent and operates a switch which controls a clutch solenoid in the master direction indicator. The direction signal is thus disconnected whenever an automatic turn is made, allowing the airplane to turn in the selected direction.

1-96. BANK-TRIM ADJUSTMENT WHEEL. (See 11, figure 1-5.) The bank-trim adjustment wheel, is fundamentally a means of adjusting the airplane to a more desirable flight attitude about its lateral axis without disengaging the auto pilot. When it is moved to the right or left, an electrical signal is generated which actuates the aileron servo to move the ailerons in the proper direction, thereby resetting the lateral trim of the airplane.

1-97. PITCH-TRIM CONTROL. (See 11, figure 1-5.) The pitch-trim control is the means by which the airplane may be placed in a climb or dive, or trimmed to a nose high or nose low flight attitude, without disengaging the auto pilot. When it is moved to the "UP" or "DOWN" position, the airplane will nose up or down to an extent corresponding to the amount of movement of the pitch-trim control.

1-98. POWER SWITCH. The power supply for the automatic pilot is controlled by a switch (12, figure 1-5) located on the pilot's switch panel which must be turned to the "ON" position for two minutes before it is desired to engage the automatic pilot to the flight controls. This is necessary to provide sufficient time for the servo amplifier to warm up.

1-99. CLUTCH SWITCHES. The servo clutch engage switch (10, figure 1-5) is pushed to engage the automatic pilot. Each control column wheel contains a push-type servo clutch disengage button (7, figure 1-14 and 9, figure 1-15) which is pushed in, to normally disconnect the servo motors from the flight controls.

1-100. DISCONNECT LEVERS. Dual servo disconnect levers (5, figure 1-14 and 8, figure 1-15) one located on each side of the crew compartment at the

pilot's and copilot's stations, are used to disconnect the servo clutches from the airplane flight controls in case of emergency. These should be pulled only in the event of electrical system failure or some other emergency, as the automatic pilot cannot be engaged again in flight before resetting on the ground.

1-101. INDICATORS. The auto pilot instruments consist essentially of a master direction indicator (19, figure 1-11), a rate gyro control (turn and bank) (20, figure 1-11), and a vertical gyro control (21, figure 1-11), all of which provide conventional instrument readings as long as the master battery and ignition and auto pilot inverter switch is on.

1-102. LANDING GEAR.

1-103. Retraction and extension of the tricycle type landing gear is accomplished by electrically driven screw-type actuators. Both the nose and the main gear are retracted and extended simultaneously, either operation requiring a maximum of 10 seconds. Each of the main gears is equipped with dual wheels, and the nose wheel is steerable 62 degrees in either direction.

1-104. CONTROLS.

1-105. CONTROL SWITCH. The landing gear control switch (38, figure 1-11) is located on the instrument panel. This switch has "OFF," "UP," and "DOWN" positions and serves to extend and retract the gear for all normal operations.

CAUTION

The landing gear control switch must never be reversed before the up or down cycle is completed.

1-106. EMERGENCY SWITCH. The landing gear emergency switch (36, figure 1-11) is located on the instrument panel and is marked "EMERGENCY." This switch permits the pilot to retract the gear during the landing or take-off roll if circumstances should arise that demand this operation.

1-107. CIRCUIT BREAKER AND OVERRIDE SWITCHES. The main landing gear system is protected by circuit breakers in the nacelle junction boxes. Right and left override switches (5, figure 1-16) are provided to supply current to the gear actuators regardless of the setting of the circuit breakers. If the circuit breakers pop-out because of jamming of the main landing gear, holding these switches in the "ON" position and operating the landing gear control switch will supply current to the actuators.

1-108. EMERGENCY UP-LOCK RELEASE HANDLES. The two main landing gear up-lock release handles (1, figure 1-16) are located just above the doorway leading from the cargo compartment to the nose compartment. If the electrical system should fail to extend the gear, these handles, when pulled, release the lock holding the main landing gear in the up position, thus allowing it to free fall. The up-lock release handle for the nose landing gear (figure 1-17) is located in the center of the cargo compartment forward bulkhead.

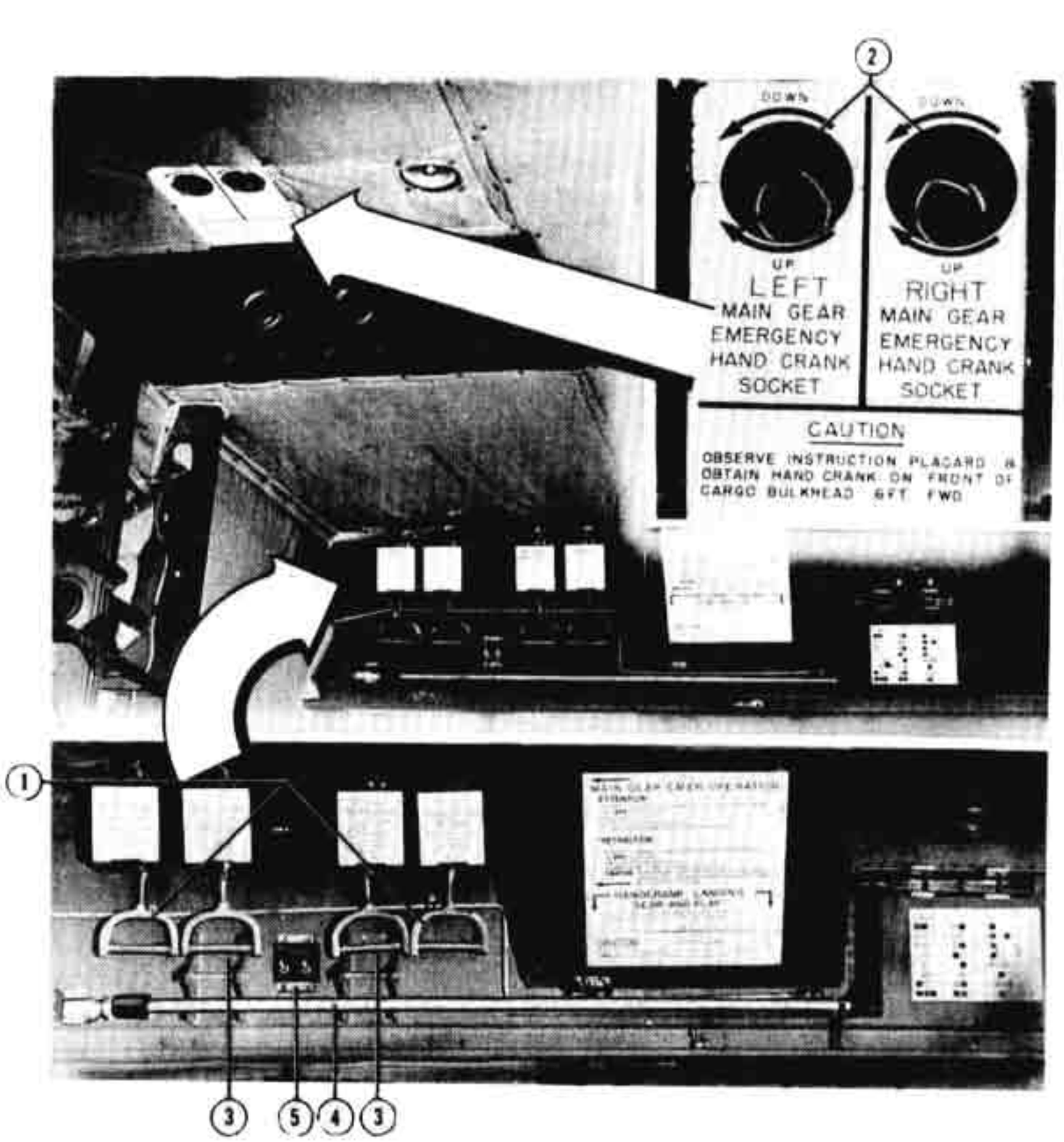


Figure 1-16. Main Landing Gear Emergency Controls

1. Emergency up-lock release handles
2. Emergency release crank sockets
3. Emergency crank clutch engage handles
4. Emergency hand crank and extension
5. Circuit breaker emergency override switches

NOTE

Once the up-lock release handles have been pulled, the up lock is inactive until the ground crew resets the emergency extension mechanism in the nacelles.

1-109. EMERGENCY CRANK CLUTCH ENGAGE HANDLES. The two main landing gear emergency crank clutch engage handles (3, figure 1-16) are located over the doorway leading from the cargo compartment to the crew compartment, and between the two main landing gear up-lock release handles. These main landing gear emergency crank clutch engage handles, when pulled, and latched in the rack, engage the clutch on the landing gear manual extension mechanism to the clutch on the actuator so that the hand crank can be utilized to manually move the landing gear into the locked position.

NOTE

Once the hand crank clutch engage handle has been pulled, the hand crank clutch will remain engaged until the ground crew resets the emergency extension mechanism in the nacelles.

1-110. EMERGENCY HAND CRANK.

C a. The emergency hand crank (4, figure 1-16) is fastened by stowage brackets to the forward bulkhead and consists of a crank and crank extension. The crank sockets (2, figure 1-16) are located on the ceiling of the cargo compartment and are utilized, together with the crank, for manually operating the main landing gear. With exception of the up-lock release handle, the construction of the nose landing gear does not necessitate facilities for manual operation, as the force of gravity is sufficient to drop the nose gear into the locked position.

D N b. The emergency hand crank (4, figure 1-16) is fastened by stowage brackets to the forward bulkhead and consists of a crank and crank extension. The crank sockets (2, figure 1-16) are located on the ceiling of the cargo compartment. A support is provided under the hand crank sockets. When crank is used for manual operation of the landing gear it is inserted through the support and into the socket. With exception of the up-lock release handle, the construction of the nose landing gear does not necessitate facilities for manual operation, as the force of gravity is sufficient to drop the nose gear into the locked position.

1-111. INDICATORS. A warning horn, three green indicator lights, and one red indicator light (37, figure 1-11) located on the instrument panel, comprise the landing gear position indicating system. The warning horn will blow at any time when landing gear is other than down and locked, and throttles are below minimum cruising power. A horn disconnect button (23, figure 1-11) is installed to permit this signal to be disconnected, but operation of the throttles above minimum cruising power will automatically reset the signal circuit. Visual indication of the landing gear position is provided by the indicator lights in the following manner:

GREEN OFF, RED OFF: Landing gear up and locked, throttles forward beyond minimum cruising power.
GREEN OFF, RED ON: Landing gear in some intermediate position between up and locked, and down and locked.
HORN ON, RED ON: Landing gear up and locked, and throttles below cruising.
GREEN ON, RED OFF: Landing gear down and locked, regardless of throttle position.

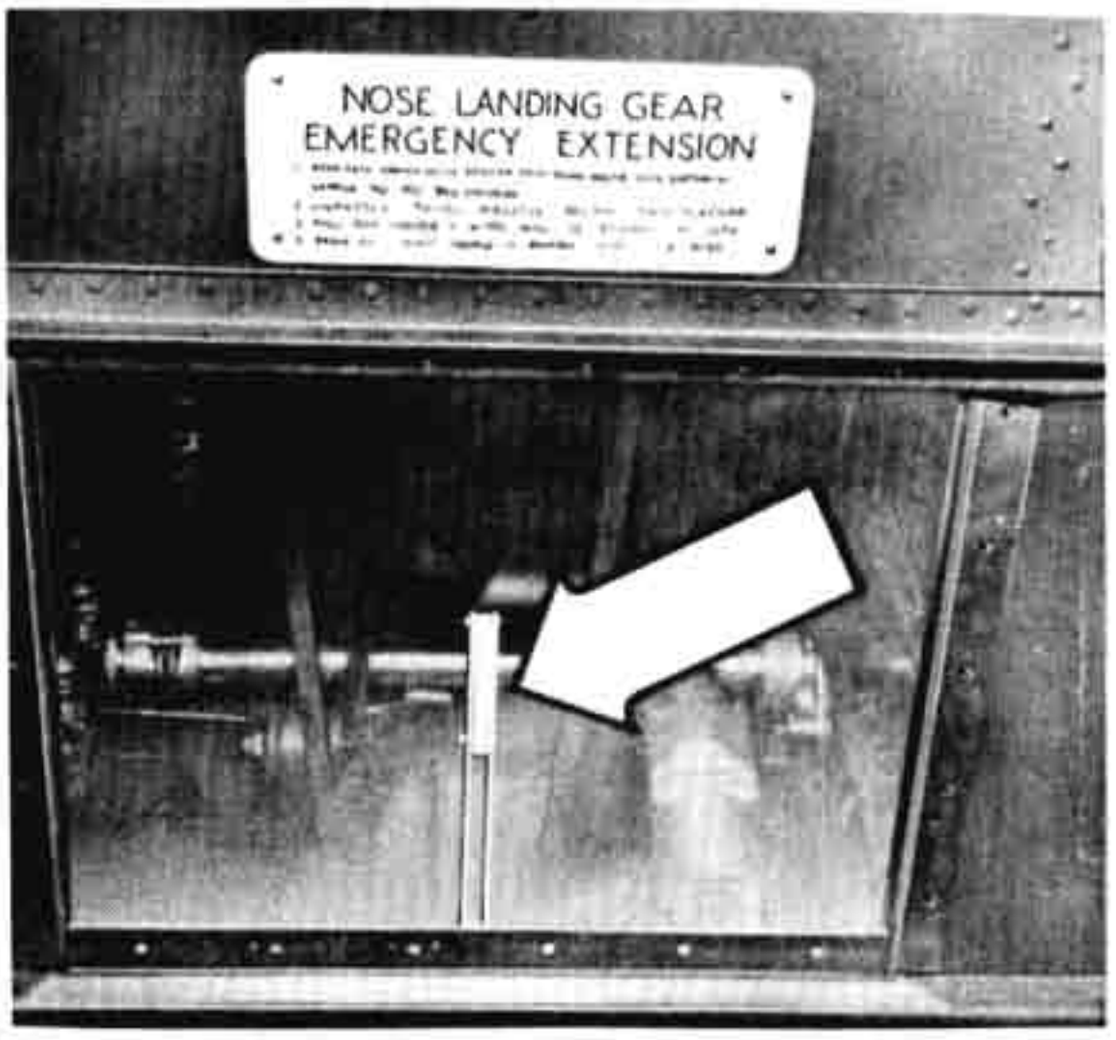


Figure 1-17. Nose Landing Gear Up-Lock Release Handle

1-112. NOSE WHEEL STEERING SYSTEM.

1-113. The hydraulically operated steering mechanism installed on the nose gear shock strut is capable of turning the nose wheel 62 degrees in either direction. With this amount of rotation the airplane can be turned completely around within a 30-foot radius. After the airplane is air-borne, the nose wheel reverts to the neutral position and the steering wheel is rendered ineffective. The nose wheel is therefore prevented from being turned during retraction or extension.

1-114. CONTROLS.

1-115. STEERING HANDLE. The nose gear steering handle (3, figure 1-14) is located on the left side of the instrument panel in front of the pilot's seat and serves to operate the hydraulic steering mechanism on the nose wheel strut. This system promotes ease and efficiency in taxi operations, and allows a 62 degree movement of the nose wheel in either direction.

1-116. INDICATOR. A turn indicator, (6, figure 1-14) located below the pilot's windshield side panel, indicates the amount and direction of turn, and serves as a taxiing aid for the pilot.

1-117. PERSONNEL EQUIPMENT.

1-118. SEATS. The pilot's and copilot's seats may be moved for vertical, lateral, forward and rear adjustment, and are reclining. The navigator's and radio operator's seats are both of the swivel type. The navigator's seat is adjustable laterally, and the radio operator's seat may be moved for forward and rear adjustment.

1-119. LAVATORY. A lavatory compartment is situated on the right side at the forward end of the cargo compartment. Furnished in this compartment are a chemical dry closet, modesty curtain, toilet paper holder, metal urinal, wash basin with a two gallon water container, towel rack, waste paper container, drinking water jug, and a drinking cup container. In addition, two relief tubes are installed in the rear cargo doors.

1-120. INSTRUMENTS.

1-121. The instrument panel is arranged with the engine instruments in the center visible to both the pilot and copilot. To the left of the engine instruments and directly in front of the pilot are the pilot's flight instruments which consist of air speed indicator (5, figure 1-11), directional gyro indicator (6, figure 1-11), gyro horizon indicator (7, figure 1-11), altimeter (18, figure 1-11), turn-and-bank indicator (44, figure 1-11), and a rate-of-climb indicator (22, figure 1-11). To the right of the engine instruments and directly in front of the copilot are the copilot's flight instruments which consist of an air speed indicator (5, figure 1-11), master direction indicator (19, figure 1-11), rate gyro control (turn-and-bank) (20, figure 1-11), vertical gyro control (21, figure 1-11), altimeter (18, figure 1-11) and rate-of-climb indicator (22, figure 1-11). The master direction indicator, rate gyro control and vertical gyro control are components of the automatic pilot and the automatic pilot inverter switch must be "ON" before these instruments are operative. A remote indicating compass (12, figure 1-11) is located in the top center of the instrument panel and a magnetic compass is mounted above the instrument panel in the windshield vee. The magnetic compass light is controlled by a rheostat (10, figure 1-10) on the overhead panel.

1-122. MISCELLANEOUS EQUIPMENT.

1-123. WINDSHIELD WIPERS. An electrically operated windshield wiper is installed on the windshield in front of each pilot. They are actuated by an electric motor, installed along the airplane centerline at the bottom of the windshield, with a flexible shaft extending to each wiper head. The control switch (22, figure 1-10) with "ON" and "OFF" positions is located on the overhead panel. The rheostat (43, figure 1-11) with "FAST" and "SLOW" positions is located on the instrument panel.

CAUTION

When turning the windshield wipers on the rheostat should be in the "FAST" position before the control switch is turned "ON."

1-124. BLACKOUT CURTAINS. Curtains are provided at each of the cargo compartment windows to seal in all light around the windows.

1-125. SAFETY BELTS AND SHOULDER HARNESSES. A lap safety belt and shoulder harness with inertia locks are installed on the pilot's and copilot's seats. The navigator's, radio operator's and crew chief's seats are provided with lap safety belts. All troop seats in the cargo compartment are equipped with lap safety belts.

1-126. A two-position (locked-unlocked) shoulder harness inertia reel lock control (10A, figure 1-14 and 5A, figure 1-15) is located on the left of the pilot's and copilot's seats. A latch is provided for positively retaining the control handle at either position. By pressing down on the top of the control handle, the latch is released and the control handle may then be moved freely from one position to another. When the control is in the unlocked position, the reel harness cable will extend to allow the pilot to lean forward in the cockpit; however, the reel harness cable will automatically lock when an impact force of 2 to 3 G's is encountered. When the reel is locked in this manner, it will remain locked until the control handle is moved to the locked and then returned to the unlocked position. When the control is in the locked position, the reel harness cable is manually locked so that the pilot is prevented from bending forward. The locked position is used only when a crash landing is anticipated. This position provides an added safety precaution over and above that of the automatic safety lock.

1-127. SEAT CUSHIONS. Seat cushions are provided for all crew members. The canvas back and bottom of troop seats obviate the need for cushions on these seats.

1-128. FLIGHT REPORT HOLDER. A combination flight report holder and map case, with a cover and latch to retain the contents, is installed on the right side wall of the crew compartment, just above the navigator's work table.

1-129. STOWAGE COMPARTMENTS. A stowage compartment, partitioned to accommodate handbooks, technical orders, and other pertinent data, is installed on the shelf over the radio rack. Stowage compartments are also located in the cargo compartment on each side wall near the aft end.

1-130. DATA CASE. A data case is installed adjacent to the flight report holder.

1-131. ENGINE AND CREW COMPARTMENT COVERS. Engine covers, fitted for an external heat duct, and crew compartment covers are stowed in the forward section of the cargo compartment.

1-132. DUST EXCLUDERS. Dust excluders are provided for carburetor air intakes, heater exhausts, manifold tailpipes, and oil cooler scoops. They are stowed in a bag located on the left side of the cargo door.

1-133. LANDING GEAR GROUND LOCK. Ground locking cables for main gear and a pin for nose gear are manually installed and removed, and serve as an extra safety device to prevent inadvertant retraction during maintenance and ground handling. These cables are carried in the left side of the forward cargo compartment when not in use.

1-134. SPARE LAMPS BOX. A box, containing spare lamps for all interior lights, is mounted on the cargo compartment forward bulkhead.

1-135. CREW COMPARTMENT SLIDING WINDOW. There is a sliding window on each side of the crew compartment. A handle is provided for moving the window forward and aft and a lock mechanism locks the window in the closed position. The window should be all the way forward and against the stops before the lock lever is pulled aft.

1-136. SPARE LENS STOWAGE. A bag, containing spare lenses for fuselage navigation lights, is located on the forward bulkhead of the lavatory.

1-137. STATIC LINES. Paratroop static lines are provided and extend along each side of the cargo compartment from the forward bulkhead to the aft end of

the rear cargo doors. An aerial delivery system static line is provided and extends from the aft end of the cargo compartment along the center line of the floor to a point just aft of the aerial delivery doors. These static lines when not in use are stowed in the rear cargo doors. Emergency static lines for dropping litter patients are located just forward of each paratroop door.

1-138. EMERGENCY EQUIPMENT.

1-139. ENGINE FIRE EXTINGUISHER SYSTEM. An engine fire extinguisher system, utilizing methyl bromide as the extinguishing agent, is installed in each nacelle. The engine fire detection system is comprised of individual thermocouple type detector units dispersed throughout each engine compartment, two fire detector warning lights on the overhead panel, and a master fire detector warning light on the instrument panel. Excessive temperature changes at any of the detector units will actuate the corresponding warning light, and the fire extinguisher system for that engine may be actuated by a switch on the overhead panel. An access door is provided in the bottom of each nacelle for inserting a portable hand fire extinguisher if fire should occur in the engine accessory compartment during ground starting.

WARNING

Vapors of methyl bromide used in the engine fire extinguishing system are poisonous.

1-140. CONTROLS. Two engine fire extinguisher switches (37, 45, figure 1-10), one for each engine, are located on the overhead panel. Operation of either switch releases the fire extinguishing agent in its respective engine.

1-141. INDICATORS. Two fire detector indicator lights (1, 36, figure 1-10) are located on the overhead panel. Either left or right detector light and the master fire detector light (17, figure 1-11) will flash red if fire exists in its corresponding engine. A push-to-test switch (42, figure 1-10) for these indicator lights is located on the overhead panel.

1-142. Overhead and cylinder discharge indicators, located on the forward left side of each nacelle, are provided for each system, giving a visual indication as to the condition of the cylinders. Ejection of the overheat (red) indicator disc denotes cylinder leakage due to expansion, while ejection of the discharge (yellow) indicator disc denotes the cylinder has been discharged by operation of the system.

NOTE

When testing fire detector circuit allow at least 15 seconds for indicator lights to come on.

1-143. HEATER FIRE EXTINGUISHER SYSTEM. Distributed throughout the heater compartment are numerous fire detector units. Two CO_2 cylinders are provided to extinguish fires in the heater compartment.

1-144. CONTROLS. A heater fire extinguisher switch (41, figure 1-10) is located on the overhead panel and serves to release the charge from the CO_2 cylinders.

1-145. INDICATORS. A heater fire detector light (43, figure 1-10) located on the overhead panel, and the master fire detector light (17, figure 1-11) located on the instrument panel, will flash red if fire exists in the heater compartment. An overheat indicator for each cylinder and a discharge indicator, located on the left rear side of the fuselage, give a visual indication as to the condition of the cylinders. Ejection of the overheat (red) indicator discs denotes cylinder leakage due to expansion, while ejection of the discharge (yellow) indicator disc denotes the cylinder has been discharged by operation.

1-146. AUXILIARY POWER PLANT FIRE DETECTOR SYSTEM. Three fire detector units, located on the auxiliary power plant, will give an indication of fire by operating auxiliary power plant fire detector light (44, figure 1-10) on overhead panel and master fire detector light (17, figure 1-11) on instrument panel.

1-147. HAND FIRE EXTINGUISHERS. (See figure 3-4.) A CO_2 hand fire extinguisher is installed on the forward part of the auxiliary floor and on the left rear side of the cargo compartment. A carbon tetrachloride extinguisher is located on the inside of the forward entrance door, accessible from the ground.

1-148. PYROTECHNIC EQUIPMENT. (See figure 3-4.) A pyrotechnic pistol and a supply of flares are stowed in a canvas container, located on the shelf above the radio rack, just aft of the navigator's station. A mount for holding the pistol in the firing position is located in the top of the fuselage at the aft right side of the crew compartment. This arrangement allows firing of the pistol through the top of the fuselage.

1-149. BAIL-OUT SIGNAL LIGHTS AND EMERGENCY ALARM BELLS. Red and green bail out signal lights are installed, one set in each paratroop jump door, one set adjacent to the control switches (4, figure 1-14 and 1, figure 1-15) on each side of the crew compartment, and one set at a point in each boom where they may be easily seen from the jump doors. The control switches are so designed that the red light must be turned on before the green light will illuminate. One emergency bell is located near the crew compartment entrance hatch and another in the aft cargo doors, these locations affording an audible emergency signal to the crew members and all personnel in the cargo compartment. Both bells are controlled by a switch adjacent to the bail-out switches on each side of crew compartment.

1-150. PROVISIONS FOR PARACHUTES. Both pilot's and copilot's seats permit the use of either back or seat type parachutes, while seats for the navigator, radio operator, and crew chief allow the use of seat type parachutes. Seats for troops or paratroops in the cargo compartment permit use of chest or back type parachutes.

1-151. ESCAPE HATCHES. (See figure 3-6.) A panel around the navigator's astrodome and hatch may be jettisoned by a quick-release handle to provide an escape exit for the flight crew members.

1-152. DITCHING HATCHES. (See figure 3-6.) An escape hatch is provided on each upper side of the cargo compartment aft section for egress of personnel when it becomes necessary to ditch airplane. Each hatch is opened by pulling down release handle.

1-153. EMERGENCY AXE. An emergency axe (16, figure 3-4) is stowed at the crew compartment entrance to the right of the crew chief's seat.

1-154. FIRST-AID KITS. (See 5, figure 3-4.) Two first-aid kits are located adjacent to the crew chief's seat in the crew compartment. In addition,

four kits are located on each of the cargo compartment side walls.

1-155. LIFE RAFTS. A seven-man life raft is stowed in the life raft compartment, located in the upper aft section of the cargo compartment, in such manner that it may be automatically released and inflated by pulling either of two interior release handles. One release handle (4, figure 3-4) is located in the upper bulkhead at the aft end of the crew compartment, and the other release handle (12, figure 3-4) is installed on the inside of the cargo compartment, just aft of the forward entrance door. When either of these handles is pulled, the life raft compartment access door will be released and a valve on a CO_2 cylinder, installed in the compartment with the life raft, will open to inflate the raft. If, for any reason, it is impossible to pull either of these handles before the airplane is abandoned, the life raft may be released by means of an exterior handle (6, figure 3-4) installed in the top of the fuselage, just aft of the life raft compartment access door. However, when the external release handle is utilized, the release valve on the CO_2 cylinder must be tripped by hand. When the airplane is being used for troop or paratroop operations, 10, five-man life rafts are stowed along the left side of the cargo compartment. Regular tie-down fittings are provided for stowage of these auxiliary life rafts.

1-156. QUICK-RELEASE DOOR HANDLES. The forward entrance door and both paratroop doors are equipped with quick-release hinges. In case of an emergency, the paratroop doors may be quickly released by pulling up on release handle (10, figure 3-4), thus extracting the hinge pins. The main door may be opened from the inside of the outside of the airplane by pulling down on the release handles (14, 15, figure 3-4.)

1-157. OPERATIONAL EQUIPMENT.

1-158. The airplane is equipped with a complete oxygen system, communications equipment, a heating, ventilating and anti-icing system and aerial delivery and glider tow systems for prescribed military operations. Refer to Section IV for a detailed description and full operating procedures.

NORMAL OPERATING *Instructions*

SECTION II

2-1. BEFORE ENTERING THE PILOT'S COMPARTMENT.

2-2. TAKE-OFF, FLIGHT, AND LANDING RESTRICTIONS.

C

a. Spins and all acrobatics are prohibited.
*Maximum diving speed 260 mph.
Maximum engine overspeed 3060 rpm.
*Maximum IAS with aerial delivery doors open 150 mph.
Normal take-off gross weight 64,000 lb.
*Maximum alternate take-off gross weight 64,000 lb.
Landing gross weight 60,000 lb.
*Maximum limit load factor 2.25 G's at 64,000 lb.
*Maximum limit load factor 2.00 G's above 64,000 lb.
Avoid engine speeds between 1100 rpm and 1400 rpm on ground because of propeller configuration causing excessive vibration in area of engine mount.

D

b. Spins and all acrobatics are prohibited.
*Maximum diving speed 226 kts.
Maximum engine overspeed 3060 rpm.
*Maximum IAS with aerial delivery doors open 130 kts.
Normal take-off gross weight 64,000 lb.
*Maximum alternate take-off gross weight 64,000 lb.
*Landing gross weight 60,000 lb.
*Maximum limit load factor 2.25 G's at 64,000 lb.
*Maximum limit load factor 2.00 G's above 64,000 lb.

N

Avoid engine speeds between 1100 rpm and 1400 rpm on ground because of propeller configuration causing excessive vibration in area of engine mount.

*Temporary figures until static test is made. For flights above 64,000 pounds special permission must be obtained from Wright Field.

NOTE

These limitations and restrictions are subject to change. Consult latest service directives or orders.

2-3. Make sure that complete preflight check has been performed on airplane.

2-4. Obtain take-off gross weight and loading data. From this and flight information, calculate anticipated landing gross weight and balance.

2-5. Check and sign Form F. Refer to Handbook of Weight and Balance, AN 01-1B-40, for detailed loading information.

2-6. Visually examine exterior of airplane for damage, excessive wear or deterioration, or any condition which might affect flight characteristics.

2-7. Check that pitot tube covers and landing gear ground locking pins have been removed.

2-8. Check that propellers have been pulled through 16 to 20 blades.

2-9. GAINING ENTRANCE TO THE AIRPLANE. Enter through door in forward left side of fuselage by means of the metal hook ladder. Entrance may also be gained through the main cargo compartment doors which form the aft section of the fuselage. Enter crew compartment by means of steps, inside and to the left of the main entrance door.

2-10. MINIMUM CREW REQUIREMENTS. The minimum crew requirements for this airplane are pilot and co-pilot. Additional crew members to accomplish special missions will be added at the discretion of the Commanding Officer.

2-11. ON ENTERING THE PILOT'S COMPARTMENT.

a. Visually check hydraulic reservoir for adequate oil supply.
b. Check with crew chief for adequate water supply in water injection tank.
c. Check Form 1A.
d. Emergency landing gear switch "OFF."
e. Make sure that parking brake handle is "ON" and check hydraulic pressure gage for normal pressure.
f. Adjust seat, safety belt, shoulder harness, and rudder pedals for greatest ease and freedom of movement in flying.

2-12. CHECK FOR EVERY FLIGHT.

NOTE

Check that all circuit breakers are pushed in.

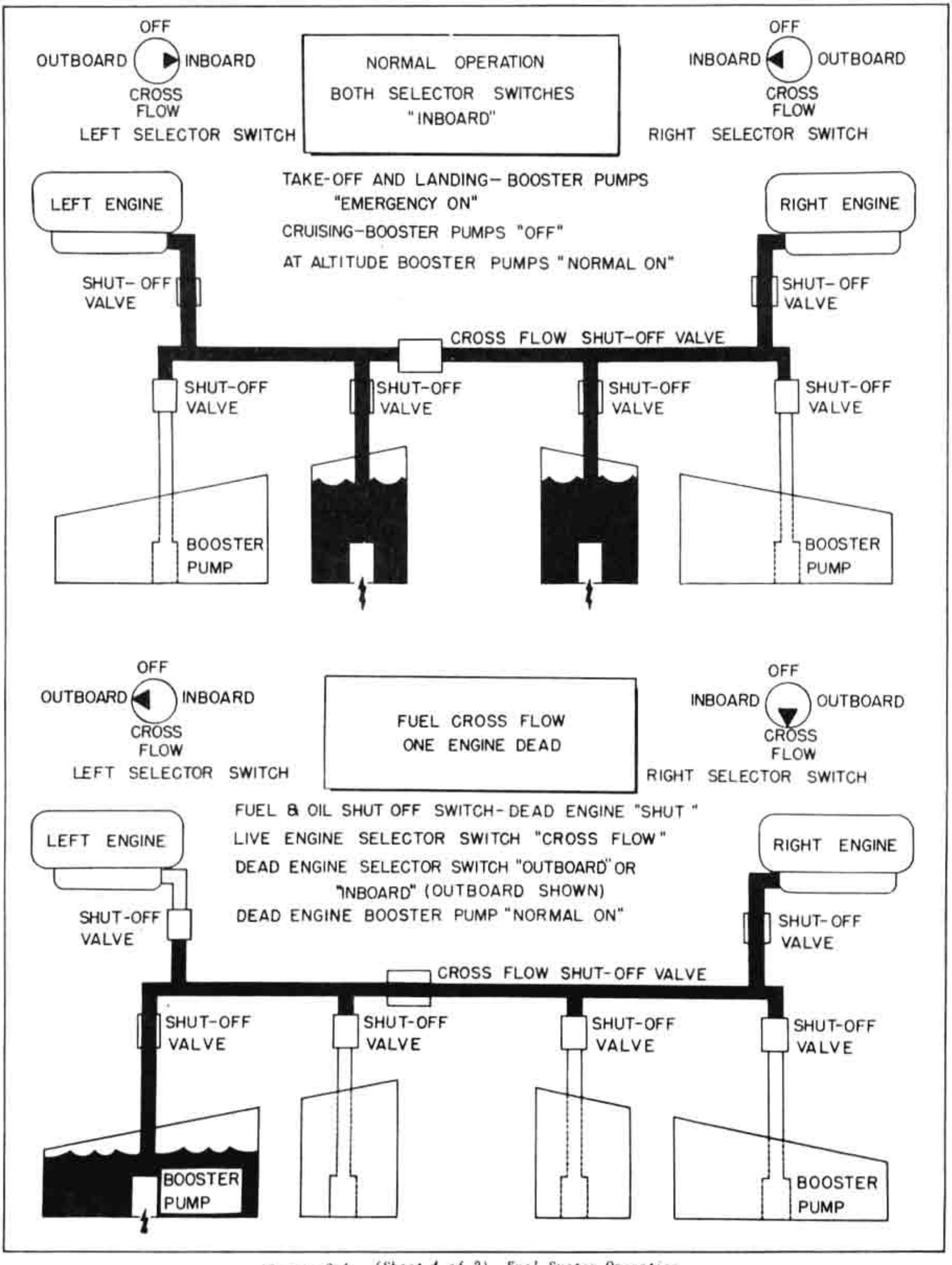


Figure 2-1. (Sheet 1 of 2) Fuel System Operation

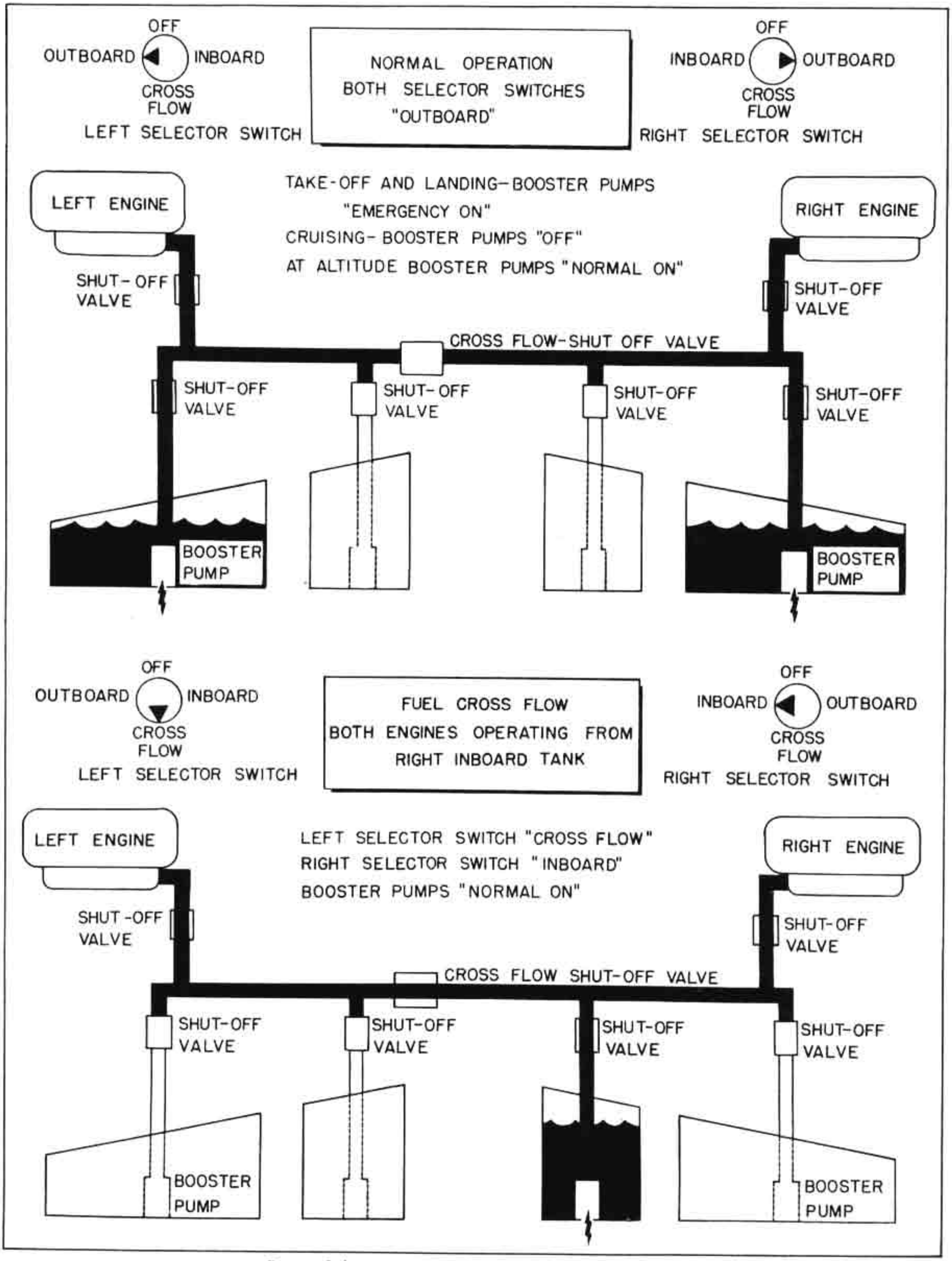


Figure 2-1. (Sheet 2 of 2) Fuel System Operation

a. Fuel and oil shut-off switches "NORM."
b. Check landing gear control switch "DOWN."
c. Check water injection control switch "OFF."
d. Check propeller oil replenishing switch "OFF."
e. Master battery and ignition switch "IGN. OFF-BAT. OFF."
f. Ignition switches "OFF."
g. All heater switches "OFF."
h. Inverter switches "OFF."
i. External power source connected.

NOTE

If external power is not available, the auxiliary power plant is to be used. Turn the master battery and ignition switch to "IGN. ON-BAT. ON" position. Use of the APP is to be considered as an emergency procedure.

j. Unlock and operate all flight controls in each direction, visually checking for free and correct movement.
k. Set all trim tabs to "0."
l. Check generator switches "ON."
m. Hydraulic brake switch "AUTO."
n. Test-operate fire detector lights.
o. Check pitot tube heater operation if precipitation or instrument weather is anticipated.
p. Wing flap control handle "UP."
q. Inverter switch "MAIN."
r. Check fuel and oil level indicator for required quantities.
s. Wind and set clock.
t. Altimeter to desired setting.
u. Automatic pilot power switch "OFF."
v. Check operation of radio equipment by communicating with control tower, interphone equipment by calling each station, and consult radio operator about operation of all radio and radar equipment. (For operation of communication equipment, refer to paragraph 4-11.)
w. Check crew oxygen pressure gage for required pressure and test-operate oxygen equipment.
x. Set emergency brake and test brake foot pedals for firm resistance with no spongy feel.

2-13. SPECIAL CHECK FOR NIGHT FLYING. Test-operate all lighting equipment.

2-14. FUEL AND OIL SYSTEM MANAGEMENT.

2-15. FUEL SYSTEM.

2-16. NORMAL OPERATION. Fuel and oil shut-off switches in "NORM" position. Fuel booster pump switches are used in "NORMAL ON" position for starting engines and all flights over 12,500 feet. The "EMERGENCY ON" position of these switches is utilized for take off and landing. Fuel selector switches first in "OUTBOARD" position in order to provide space for fuel return from the carburetor at a maximum rate of 60 pounds per hour. Use outboard tanks for take off and first two hours of flight. Then use inboard tanks. Complete flight on outboard tanks.

2-17. CROSSFLOW OPERATIONS. Numerous crossflow conditions are obtainable, but fuel cannot be transferred from one tank to another in flight. Either tank may be used to supply both engines by placing selector switch of empty tank to "CROSSFLOW" and selector switch of full tank to "OUTBOARD" or "INBOARD." In case of engine failure, fuel in dead engine tanks may be used by placing selector switch of dead engine in "OUTBOARD" or "INBOARD" fuel and oil shut-off switch of dead engine in "SHUT," and selector switch of live engine in "CROSSFLOW."

NOTE

Turn the booster pump switches to "NORMAL ON" during all crossflow operations.

2-18. OIL SYSTEM.

2-19. OIL TRANSFER. To transfer oil from one tank to the opposite tank, place oil transfer switch in either "L" or "R" position, depending on which direction oil is to be transferred. C When transferring, check oil level indicator frequently to prevent overfilling.

2-20. STARTING AUXILIARY POWER PLANT.

CAUTION

Make sure that APP is operating during all ground operations.

a. Master battery and ignition switch "IGN. ON-BAT. ON." K
b. APP ignition switch "ON."
c. Governor control lever "CHOKE." N
d. Move control switch to "START AND RESET;" hold until engine is firing; then move to "OFF."
e. Governor control lever "IDLE" for warm-up.
f. Governor control lever to "RUN" and control switch to "ON."

2-21. STARTING AUXILIARY POWER PLANT.

CAUTION

Make sure that APP is operating during all ground operations.

a. Master battery and ignition switch "IGN. ON-BAT. ON."
b. APP ignition switch "ON." L
c. Governor control lever "CHOKE."
d. Starter switch to "START;" until engine is firing; then move to "ON."
e. Governor control lever "IDLE" position for warm up.
f. Governor control lever to "RUN."
g. Generator control switch to "RESET" and then to "GEN. ON." |

2-22. ALTERNATE FUEL GRADE OPERATING LIMITS. (Specification MIL-F-5572, grade 100/130) |

Take-off Power (3000 HP):

2700 RPM

56 in. Hg at S.L.

55 in. Hg at 5,100 ft.

Mixture "RICH"

Normal Rated Power (2500 HP):

2550 RPM

48 in. Hg at S.L.

45.8 in. Hg at 9,000 ft

Mixture "RICH"

Maximum Cruising Power (1900 HP):

2300 RPM

39 in. Hg at S.L.

36.5 in. Hg at 15,500 ft.

Mixture "NORMAL"

2-23. STARTING ENGINES.

NOTE

Make sure that ground personnel are provided with fire fighting equipment. For fire fighting procedures, refer to paragraph 3-1.

a. Parking brake "ON."
b. Note manifold pressure before starting, as reference for power and magneto check.
c. Mixture controls "IDLE CUT-OFF."
d. Carburetor air control "COLD."
e. Propeller control selector switch "MASTER LEVER."
f. Propeller master control lever "INCREASE RPM."
g. Check that pitch limit indicator lights operate.
h. Cowl flap switches "OPEN" (Airplane group C) Cowl flap switches "AUTO" (Airplane groups D and N)
i. Oil cooler shutter switches "AUTO."
j. Throttles advanced 1/8 to 1/4.
k. Fuel booster pump switch "NORMAL ON."
l. Fuel tank selector switches "OUTBOARD."
m. Master battery and ignition switch "IGN. ON-BAT. ON."
n. Check inverter switch in "MAIN."

NOTE

If engines are cold and APP is to be used for starting, it may be necessary to turn the inverter switch "OFF." Immediately after first engine is running the inverter switch should be turned to "MAIN" and the oil pressure checked.

o. Starter switch "L" or "R" as required. After propeller has made one complete revolution, turn ignition switch to "BOTH" position.

NOTE

Replace guard after operating switches.

CAUTION

Do not crank engine for any period greater than one minute.

p. When engaging starter, prime as necessary.

NOTE

Priming may be continuous or intermittent depending on temperature conditions. Excessive priming may overload a warm engine. Do not use the mixture control to prime engine.

q. After insuring that engine is firing by indication of over 100 rpm on tachometer, move mixture control to "NORMAL."

CAUTION

An engine tending to become overloaded may often be saved by placing the mixture control back into "IDLE CUT-OFF" momentarily until it clears. Do not attempt to assist starting with throttle.

r. Discontinue priming as soon as engine is definitely running and move mixture control to the "RICH" position.
s. Adjust the throttle to 600-800 rpm, watching the oil pressure indicator for indication of rise.

NOTE

If oil pressure does not register almost immediately, stop engine and investigate.

t. Throttles 1000 rpm until oil temperature reaches 40 degrees C then increase to 1200-1600 rpm.
u. Start remaining engine.
v. Automatic pilot inverter switch "ON."
w. Uncage direction gyro and gyro horizon indicator.
x. Disconnect external power if used, and start APP.

2-24. GROUND OPERATION.

2-25. The ground operation of each engine must be held to an absolute minimum. Engine shall be run only when it is necessary to perform the required checks. An engine should be shut down, when possible, if running unnecessarily during a prolonged check of another engine. Ground running at low speeds causes fouling of spark plugs.

2-26. When it is necessary to run an engine on the ground for an extended time, it shall be run to 2200 rpm, 37 in. Hg manifold preasure, for a preiod of one minute, every 15 minutes. This procedure will act to clear away the fouling deposits in the incipient stages.

2-27. Every three hours, during a prolonged period of ground running, the foregoing procedure will be supplemented by wet take-off power in accordance with the following instructions. The thermal shock of water injection will act to clear away lead deposits before they reach the dangerous stage. J N

a. Operate the engine at 2000 rpm and bring the cylinder head temperatures to 250 degrees C.
b. Increase power to take-off with water on and hold for 30 seconds.
c. At the end of 30 seconds operate for one minute at dry take-off and then repeat wet take-off power for 30 seconds.
d. Reduce to idle.

2-28. WARM-UP.

a. Cowl flap switches "OPEN" (Airplane group C). Cowl flap switches "AUTO" (Airplane groups D and N).

CAUTION

Do not attempt to warm up engines more quickly by closing cowl flaps, as damage to ignition wiring or excessive cylinder head temperatures may result.

b. Propeller master control lever "INCREASE RPM."

c. Carburetor air as needed.
d. Oil cooler shutter switches "AUTO."
e. Throttles 1000 rpm until oil temperature reaches 40 degrees C, then increase to 1200-1600 rpm.
f. Mixture controls "RICH."
g. Engine ignition switches from "BOTH" to "R" to "L" and back to "BOTH."
h. Engine ignition switches to "OFF" (momentarily) and back to "BOTH."

NOTE

A slight drop in rpm when operating on each magneto, and complete cutting out of engine at "OFF" position, indicate proper functioning of the ignition switch.

i. Check fuel crossflow operation.
j. Check operation of wing flaps.
k. Fuel booster pump switches "OFF."

2-29. PROPELLER DE-ICING CHECK.
a. Run both engines at a minimum of 1500 rpm.
b. Observe left, right and APP ammeters. The load should be evenly divided.
c. Turn propeller de-icing switch "ON" for two minutes and observe ammeters. A de-icing load gain of 275 amps should be approximately divided over the three ammeters.

CAUTION

A 2-minute operation period is required to permit the 30-second on-off cycling of the system. Do not exceed this 2-minute period on the ground.

2-30. PROPELLER REVERSING TEST.

2-31. TO REVERSE.

CAUTION

Do not run propellers in reverse pitch for an extended period since engine cylinder head temperature indicators will not give a true indication. It is recommended that, when using reverse thrust for maneuvering, a period of three minutes at 1000 rpm, or its equivalent power-time relationship not be exceeded.

a. Place throttles in "CLOSED" position.
b. Raise the throttles over the reversing cams and without hesitation, continue to apply power with a steady throttle movement until the desired power is attained.

CAUTION

When using reverse pitch or taxiing downwind, the pilot or copilot should firmly hold the control column well forward so that elevator will not buffet and slam against the elevator stops.

2-32. TO UNREVERSE.
a. Move throttle lever forward into normal operating range.

2-33. PROPELLER FEATHERING TEST.
a. Operate engine at 1500 rpm.
b. Depress feathering button.
c. When rpm drops to 1000, return feathering button to neutral position by pulling out.
d. Make sure that engine returns to 1500 rpm.

2-34. PROPELLER OPERATION CHECK.
a. Set propeller control selector switch in "SYNCH."
b. Set throttles to operate engines at 2000 rpm.
c. Move pitch control switches to "DECREASE RPM" and then "INCREASE RPM." Engine speeds should decrease accordingly, both engines returning to 2000 rpm.
d. Move the master control lever toward "DECREASE RPM" until the engines are under governor control at 1800 rpm.
e. Depress resynchronize button to insure recentering of limit stops.
f. Run the left engine to 2000 rpm by moving pitch control switch to the "INCREASE RPM" position. Right engine should increase 60 - 90 rpm from the last setting.
g. Run the left engine to 1600 rpm by moving the pitch control switch to the "DECREASE RPM" position. Right engine should decrease 120 - 180 rpm from last setting.
h. Set control selector switch to "MAN."
i. Run left engine to 2000 rpm. Right engine should not change speed.
j. Return control selector switch to "SYNCH."
k. Move master control lever to "INCREASE RPM" position. Both engine speeds should settle at 2000 rpm, and propellers be adjusted to take-off settings as denoted by pitch limit indicator lights glowing.
l. Set control selector switch to "MASTER LEVER."
m. Run engines to minimum and then maximum rpm by moving master control lever to "DECREASE RPM" and then "INCREASE RPM." Engine speeds should follow movement of propeller controls and indicator lights should respond in full "INCREASE RPM" and "DECREASE RPM."

2-35. SUPERCHARGER CONTROL CHECK. Ground check of supercharger operation cannot be made, but check of the automatic power control unit for low impeller operation is made as follows:
a. With propeller master control lever in "INCREASE RPM," advance throttle lever to 2300 rpm.
b. Observe manifold pressure.
c. Move propeller master control lever to "DECREASE RPM" until 1900 rpm is reached.
d. Manifold pressure should remain approximately constant. This indicates proper operation of automatic power control unit for low impeller operation.
e. Return propeller master control lever to "INCREASE RPM" position.

2-36. POWER CHECK. (Oil temperature must be at least 40 degrees C and carburetor air control in "COLD" position.)
a. Advance throttle until the manifold pressure is equal to the field barometric pressure. (Indicated by the manifold pressure gage reading before starting the engine.)
b. Check that the rpm obtained is approximately 2200.

2-37. IGNITION SYSTEM CHECK.
a. Advance throttle until the manifold pressure is equal to the field barometric pressure.
b. Ignition switch from "BOTH" to "R" and back to "BOTH."
c. Ignition switch from "BOTH" to "L" and back to "BOTH."
d. Normal drop-off is 60 - 80 rpm in either "R" or "L" position, maximum drop-off in either "R" or "L" position is 100 rpm, maximum drop-off of 40 rpm in difference between "R" and "L" positions is permissible.

2-38. CRUISING FUEL AIR MIXTURE CHECK.

a. Throttles 1700 rpm.
b. Mixture control "RICH."
c. Move mixture control to "NORMAL" and check that rpm variation between "RICH" and "NORMAL" is not more than 25 rpm increase or 75 rpm decrease.

2-39. IDLE SPEED CHECK.

a. Move throttles to the closed position.
b. Check for an idle speed of 550 - 650 rpm.

2-40. ACCELERATION AND DECELERATION CHECK.

a. Mixture control "RICH."
b. With movement of the throttle, engine acceleration and deceleration should be rapid and smooth with no tendency to backfire.
c. Mixture control "NORMAL."
d. With movement of the throttle, engine acceleration and deceleration should be rapid and smooth with no tendency to backfire.

2-41. ENGINE TEST.

a. Check engine temperatures and pressures at 2300 rpm.
b. Open throttle to 61.5 in. Hg., manifold pressure, and check for rpm of 2700 and maximum torque pressure of 228.
c. Check engine instruments for desired operating ranges.

2-42. ENGINE TEST. (FOR WATER INJECTION ENGINES ONLY)

NOTE

If water injection is to be used on take off, the following engine test should be made instead of the engine test given in paragraph 2-41.

J
N

a. Water injection switch "ON."
b. Check that green indicator lights come on.
c. Open throttles to 61.5 in. Hg., manifold pressure and check for rpm of 2700 and maximum torque pressure of 246. Check that green indicator lights go out at full throttle.
d. Check engine instruments for desired operating ranges.

2-43. TAXIING INSTRUCTIONS.

CAUTION

When using reverse pitch or taxiing downwind, the pilot or copilot should firmly hold the control column well forward so that elevator will not buffet and slam against the elevator stops.

a. Propeller master control lever "INCREASE RPM."
b. Wheel chocks removed.
c. Emergency and parking brake "OFF."
d. Taxi several feet straight ahead before turning.
e. Check brakes while taxiing.

CAUTION

Use caution when utilizing reverse pitch for ground maneuvering because of limited cooling.

2-44. BEFORE TAKE OFF.

a. Mixture controls "RICH."
b. Propeller control selector switch "MASTER LEVER."
c. Propeller master control lever "INCREASE RPM."
d. Fuel booster pump switches to "EMERGENCY ON."
e. Carburetor air control "COLD."
f. Check engine instruments for desired ranges.
g. Allow for take-off rise in cylinder head temperature.
h. Safety belt and shoulder harness tightened and inertia reel lock control unlocked.
i. Fuel selector switches "OUTBOARD."
j. Automatic pilot power switch "OFF."
k. Check engine accessory heat switch "OFF."
l. Trim tabs set at "0."
m. Check doors warning light for indication of properly latched doors.
n. Pitot heater switch "ON" if required.
o. Check cowl flap switches "OPEN" (Airplane group C). Check cowl flap switches "AUTO" (Airplane groups D and N).
p. Move wing flaps lever to "TAKE OFF," if desired. Use of take-off flaps is not recommended for normal operations. However, their use is recommended for taking off from short, rough fields with heavy loads.
q. If water is desired turn water injection switch "ON."
r. Advance throttles to take-off position.
s. Check for maximum manifold pressure of 61.5 in. Hg., engine speed of 2700 rpm, and torque pressure of 228. If water injection is used check for maximum manifold pressure of 61.5 in. Hg., engine speed of 2700 rpm, and torque pressure of 246.

NOTE

At take-off rpm, fuel flow indicator will move to extreme end of flow range. This is normal.

2-45. TAKE OFF.

a. Refer to Appendix I, for rpm, manifold pressure, and mixture setting for take off, climb, and cruise, together with limits on use of take-off power.

CAUTION

Icing of carburetor throttle valve will not be indicated by manifold pressure drop until automatic power control unit has opened carburetor throttle valve fully and blower is at full high rpm. Decrease in airspeed and decrease in torquemeter pressure due to increased supercharging horsepower is an indication of this condition. If it is suspected that icing conditions exist, check for carburetor throttle valve icing as follows: open throttle full, check manifold pressure obtained against chart value for selected rpm and altitude. If manifold pressure is below chart value apply carburetor heat.

b. Refer to Take-Off, Climb, and Landing Chart, Appendix I, for minimum take-off distance required by gross weight, wind velocity, type of runway, and altitude. Also check this chart for best climbing speed, together with rate and time required for a specific climb, and fuel consumption.
c. Set parking brakes and open throttles to 30 in. Hg.
d. Release brakes and advance throttles to proper power setting.
e. Hold take-off power until landing gear is retracted, all obstacles have been cleared, and climbing speed has been established.

CAUTION

Do not use brakes during retraction.

TAKE-OFF SPEEDS

Gross Weight in Pounds	Normal Take-Off IAS		Safe Single Engine IAS	
	MPH	Knots	MPH	Knots
50,000	94	82	125	109
60,000	102	89	130	113
64,000	106	92		
74,000	114	99		

f. If wing flaps were used, move lever to "UP."
g. First power reduction, 50 in. Hg., and 2550 rpm.
h. Turn water injection switch "OFF" if water injection was used.

CAUTION

If water injection switch is not turned off after throttles are retarded, the mixture will be too lean for cruising.

i. For further reductions of power, reduce manifold pressure by 4.0 in. Hg., followed by a reduction of 200 rpm in successive steps.
j. For procedure to be followed in case of engine failure during take off, refer to paragraph 3-9.

2-46. CLIMB.
a. Refer to Take-Off, Climb, and Landing Chart, Appendix I.
b. Mixture controls "NORMAL."
c. Fuel booster pump switches "NORMAL ON."
d. Move cowl flap switches to "AUTO" (Airplane group C).
e. Check that cylinder head temperatures do not exceed limits.
f. Propeller control selector switch "SYNCH."

NOTE

In "SYNCH" position automatic synchronization will be accomplished within 3 percent of rpm. If propellers are out of synchronization more than 60 to 90 rpm, momentarily press "RESYNCHRONIZATION" button to bring right engine within the automatic synchronization range.

2-47. GENERAL FLYING CHARACTERISTICS.

2-48. With normal and full military loads the airplane is stable at all normal speeds. In two-engine flying there is no noticeable torque effect, and the airplane is easily controlled in single-engine flight. Very little change in elevator and rudder trim is necessary for changes in power and speed.

2-49. FLYING WITH CARGO LOADING DOORS OFF. The airplane may be flown with the cargo doors off. The flight characteristics when using up to take-off flap settings are practically the same as those experienced with an airplane with the cargo doors attached. Buffeting is most noticable and objectionable at speeds of 120 mph (104 knots) IAS and above, with 3/8 or more flap settings and decreases as airspeed is decreased. Equipment may be dropped at slow speeds as long as as the take-off flap 3/8 setting is not exceeded. The use of flaps during approach and landing should be restricted to a minimum to avoid objectionable buffeting. When buffeting is encountered, maneuvering in a tight turn or flying through extremely turbulent air should be avoided.

CAUTION

Do not lower flaps at IAS above 140 mph (122 knots), with doors removed, as severe buffeting will be encountered.

2-50. CRUISE.

2-51. Plan all cruising operations by Flight Operation Instruction Charts, Appendix I.
a. Adjust throttles to selected manifold pressure for cruise.

NOTE

If oscillation of manifold pressure should occur at altitudes at which blower shifts into high, engine rpm, manifold pressure, or altitude should be changed.

b. Reduce engine speed to selected rpm for cruise.
c. Carburetor air control "COLD" (unless heat required).

CAUTION

Icing of carburetor throttle valve will not be indicated by manifold preasure drop until automatic power control unit has opened carburetor throttle valve fully and blower is at full high rpm. Decrease in airplane speed and decrease in torquemeter preasure due to increased supercharging horsepower is an indication of this condition. If it is suspected that icing conditions exist, check for carburetor throttle valve icing as follows: open throttle full, check manifold pressure obtained against chart value for selected engine rpm and altitude. If manifold pressure is below chart value apply carburetor heat.

d. Check instruments to see that engine is operating within satisfactory limits.
e. Fuel booster pump switches "OFF," unless required to maintain operating fuel pressure.
f. Stop auxiliary power plant.

NOTE

APP should be idled for five minutes before stopping, to allow cylinder head temperature to drop.

2-52. TO ENGAGE AUTOMATIC PILOT.
a. Automatic pilot inverter switch "ON."
b. Gyro uncaged.
c. Turn power switch "ON." Allow two minutes for amplifier to warm up.
d. Trim airplane for desired flight attitude.
e. Center turn control knob.
f. Center pitch-trim and bank trim controls.
g. Engage automatic pilot by pushing clutch engage switch.

CAUTION

Do not engage automatic pilot when airplane is banked more than 10 degrees, or turning.

2-53. OPERATION OF AUTOMATIC PILOT DURING FLIGHT.

2-54. TO CLIMB. Turn pitch-trim control counterclockwise to "UP."

2-55. TO DIVE. Turn pitch-trim control clockwise to "DOWN."

2-56. TO TRIM-BANK. Turn bank-trim control clockwise to raise left wing; counterclockwise to raise right wing.

2-57. TO TURN OR TO TRIM COURSE. Turn the turn-control knob out of its central detent position, either to right or left until desired heading is obtained. To return to straight flight, center turn-control knob.

2-58. RETRIMMING. After any sudden change in load, disengage auto pilot, retrim airplane while in manual flight, then re-engage auto pilot.

CAUTION

Do not adjust trim tabs while automatic pilot is engaged.

2-59. TO DISENGAGE AUTOMATIC PILOT.
a. Push clutch disengage switch.
b. Power switch "OFF."
c. Automatic pilot inverter switch "OFF."

2-60. TO OPERATE RADIO ALTIMETER.
a. Power switch "ON."
b. Set range switch for low range, unless airplane is above low altitude range. Then set for high range.
c. Allow one minute for transmitter-receiver tubes to heat.
d. Observe that pointer of altitude indicator has moved from sub zero, indicating equipment is energized.

2-61. TO STOP RADIO ALTIMETER.
a. Power switch "OFF."
b. Range switch to "O."

2-62. STALLS.

2-63. The indicated air speeds for power off stalls at different gross weights is calculated to be as follows:

FLAPS AND GEAR DOWN

Gross Weight in Pounds	MPH	Knots
40,000	78	68
50,000	87	75
60,000	96	83
64,000	99	86
74,000	106	92

FLAPS UP GEAR DOWN

Gross Weight in Pounds	MPH	Knots
40,000	86	75
50,000	96	83
60,000	105	91
64,000	109	95
74,000	117	102

2-64. SPINS.

2-65. Spinning is prohibited. If an unintentional spin should occur, use conventional method of recovery.

2-66. PERMISSIBLE ACROBATICS.

2-67. All acrobatics are prohibited.

2-68. DIVING.
a. Maximum diving speed 260 mph (226 knots).
b. Engine speed must not exceed 3060 rpm.

2-69. NIGHT FLYING.
a. All position lights "ON."
b. Formation lights "ON."
c. Crew compartment lighting on as necessary.
d. Pitot heater switch "ON" as required.

2-70. APPROACH AND LANDING.

2-71. APPROACH. To obtain best approach speed for landing, refer to Take-Off, Climb, and Landing Chart, Appendix I.
a. Start APP.
b. Fuel booster pump switches "EMERGENCY ON."
c. Safety belt and shoulder harness tightened and inertia reel lock control unlocked.
d. Fuel selector switches "OUTBOARD" or to fullest tank.
e. Cowl flap switches "AUTO."
f. Carburetor air switch "COLD," or as needed.
g. Landing gear control "DOWN." Green indicator lights should come on. Make a visual check of the landing gear to insure that the wheels are extended.

CAUTION

Do not exceed 160 mph (140 knots) IAS with the landing gear extended.

h. Propellers at 2400 rpm, control selector switch "MASTER LEVER."
i. Hydraulic brake switch "AUTO."
j. Mixture controls "RICH."
k. Check water injection switch "OFF."
l. Move throttles as required.
m. Elevator trim tab as needed. Settings required are usually not more than five degrees "UP."
n. Wing flaps as desired.

CAUTION

Do not exceed 160 mph (140 knots) IAS with wing flaps down.

o. Check that automatic pilot is "OFF."
p. Approach at air speed for gross weights listed below:

APPROACH SPEED FLAPS DOWN

Gross Weight in Pounds	MPH	Knots
40,000 to 50,000	94-104	82-90
50,000 to 60,000	104-115	90-100
60,000 to 70,000	115-127	100-110

APPROACH SPEED FLAPS UP

Gross Weight in Pounds	MPH	Knots
40,000 to 50,000	103-115	89-100
50,000 to 60,000	115-126	100-109
60,000 to 70,000	126-140	109-121

2-72. NORMAL LANDING.
a. Land on main wheels with nose wheel slightly above ground. Immediately after making contact, allow nose wheel to drop gently.
b. With nose wheel contacting ground, apply brakes momentarily to test.
c. Cowl flap switches "OPEN" (Airplane group C).

NOTE

On Airplane groups D and N check that cowl flaps come open when airplane is on the ground. If they should fail to do so, move cowl flap switches to "OPEN."

d. Fuel booster pump switches "OFF."
e. Propeller master control lever "INCREASE RPM."
f. Wing flaps lever "UP."

2-73. CROSSWIND LANDING. Follow normal procedure for crosswind landings, using crabbing technique or as experience dictates.

2-74. MINIMUM RUN LANDING.
a. Make low approach, with wing flaps "DOWN" and power maintained to keep airplane slightly above stalling speed.
b. Permit main wheels to touch runway as soon as possible, cut power, and then lower nose gently.
c. Use brakes and/or reverse propeller pitch to stop forward roll of airplane as quickly as practicable.

2-75. POST FLIGHT CHECK (Last flight of the day only.)

2-76. IGNITION SWITCH CHECK.
a. Move throttle to 700 rpm.
b. Engine ignition switches from "BOTH" to "R" to "L" and back to "BOTH."
c. Engine ignition switches from "BOTH" to "OFF" (momentarily) and back to "BOTH."
d. A slight drop in rpm when operating on each magneto, and complete cutting out of engine at "OFF" position, indicates proper functioning of the ignition switch.

2-77. IDLE MIXTURE AND SPEED CHECK.
a. Move throttle to the closed position.
b. Check for idle speed of 550-650 rpm.
c. Move mixture control lever slowly toward "IDLE CUT-OFF."
d. Observe tachometer for a momentary increase (not over 30 rpm) and then a decrease of rpm.
e. Observe manifold pressure for a momentary decrease (about 1/4 inch) and then an increase of manifold pressure.
f. When engine speed has dropped to 300 rpm move mixture control to "NORMAL."

2-78. POWER CHECK.
a. Throttles at 2200 rpm.
b. Observe and make note of manifold pressure gage reading. (When engines are stopped the manifold pressure gage reading should be equal to reading obtained when operating at 2200 rpm.)

2-79. IGNITION SYSTEM CHECK.
a. Throttle at 2200 rpm.
b. Ignition switch from "BOTH" to "R" and back to "BOTH."
c. Ignition switch from "BOTH" to "L" and back to "BOTH."
d. Normal drop-off is 60-80 rpm in either "R" or "L" position, maximum drop-off in either "R" or "L" position is 100 rpm, maximum drop-off of 40 rpm in difference between "R" and "L" positions is permissible.

2-80. CRUISING FUEL AIR MIXTURE CHECK.
a. Throttles 1700 rpm.
b. Mixture control "RICH."
c. Move mixture control to "NORMAL" and check that rpm variation between "RICH" and "NORMAL" is not more than 25 rpm increase or 75 rpm decrease.

2-81. STOPPING ENGINES.
a. Cowl flap switches "OPEN."
b. Propellers "INCREASE RPM."
c. Propeller de-icing switch "OFF."
d. Idle engines at 1000 rpm until cylinder head temperature is less than 190 degrees C.
e. If necessary to dilute oil, bring oil temperature below 50 degrees C and engines to 1000 - 1200 rpm. Dilute for temperatures as shown in following table:

Add 1 minute dilution for each additional 5 deg below maximum shown in table.

Temperature	Dilution Time
4 deg C to -12 deg C (40 deg F to 10 deg F)	1 to 3 min
-12 deg C to -29 deg C (10 deg F to -20 deg F)	3 to 6 min
-29 deg C to -46 deg C (-20 deg F to -50 deg F)	6 to 9 min

f. Check fuel booster pump switches "OFF."
g. While idling at 800 - 1000 rpm, move mixture control lever to "IDLE CUT-OFF."

NOTE

Do not advance throttles.

h. When engines stop, engine ignition switches "OFF."
i. Fuel tank selector switches "INBOARD" or "OUTBOARD" (Airplane groups K and N).
Fuel tank selector switches "OFF." (Airplane group L)
j. Fuel and oil shut-off switches "SHUT."
k. Master battery and ignition switch to "IGN. OFF-BAT. OFF."
l. APP ignition switch "OFF." (Allow APP to idle for five minutes before stopping.)

2-82. BEFORE LEAVING THE PILOT'S COMPARTMENT.
a. Engage flight controls lock.
b. Check that wheels are chocked.
c. Check emergency brakes "OFF."
d. All electrical switches "OFF," except generators.

EMERGENCY OPERATING *Instructions*

SECTION III

3-1. ENGINE FIRE DURING GROUND OPERATION.

a. If fire is located in the air induction system, open the throttle of the affected engine. Fire is often sucked through the engine and extinguished.

b. Mixture control lever "IDLE CUT-OFF."

c. Fuel and oil shut-off switch "SHUT."

d. Engine fire extinguisher switch "ON," as soon as engine stops.

e. Engine ignition switch "OFF.".

f. Shut down engine completely.

g. Ground personnel should place hand fire extinguisher nozzle through the access door in bottom of nacelle, and release the extinguishing agent.

Figure 3-1. Omitted

3-2. ENGINE FIRE DURING FLIGHT.

a. Push feathering switch.

b. Mixture control lever "IDLE CUT-OFF."

c. Fuel and oil shut-off switch "SHUT."

d. Engine fire extinguisher switch "ON," as soon as engine stops.

e. Cowl flap switch "OPEN."

f. Engine ignition switch "OFF."

Figure 3-2. Engine Fire During Flight

g. Add power to live engine and retrim airplane.

h. After making sure fire is extinguished, shut down engine completely.

CAUTION

Do not restart the dead engine.

3-3. WING FIRE.

a. All wing lights "OFF."

b. Follow progress of fire closely and land airplane as quickly as possible, or bail out, whichever the situation demands.

3-4. HEATING SYSTEM FIRE.

a. Heater master switch "OFF."

b. Turn all heating system control switches "OFF."

c. Heater fire extinguisher switch "ON."

NOTE

In order to prevent fumes from coming into crew compartment, the cockpit air switch should be turned "OFF."

Figure 3-3. Omitted

3-5. FUSELAGE FIRE.

a. Close all windows and ventilators, and keep all doors and emergency exits closed.

b. Heater master control switch "OFF."

c. Use all available hand fire extinguishers.

d. If fire is near heating system, operate heater fire extinguishing system.

e. If electrical fire, cut power to affected area.

f. If fuel or oil line fire, cut flow through line.

g. After it is certain that fire is extinguished, open windows and ventilators.

3-6. PYROTECHNIC PISTOL CARTRIDGE FIRE.

3-7. If cartridge should ignite, use hand fire extinguisher as needed, and, as soon as possible, throw cartridge overboard.

3-8. ENGINE FAILURE.

3-9. ON TAKE-OFF.

a. If safe air speed, according to the following gross weight and IAS table has not been attained, pilot should attempt landing at his own discretion.

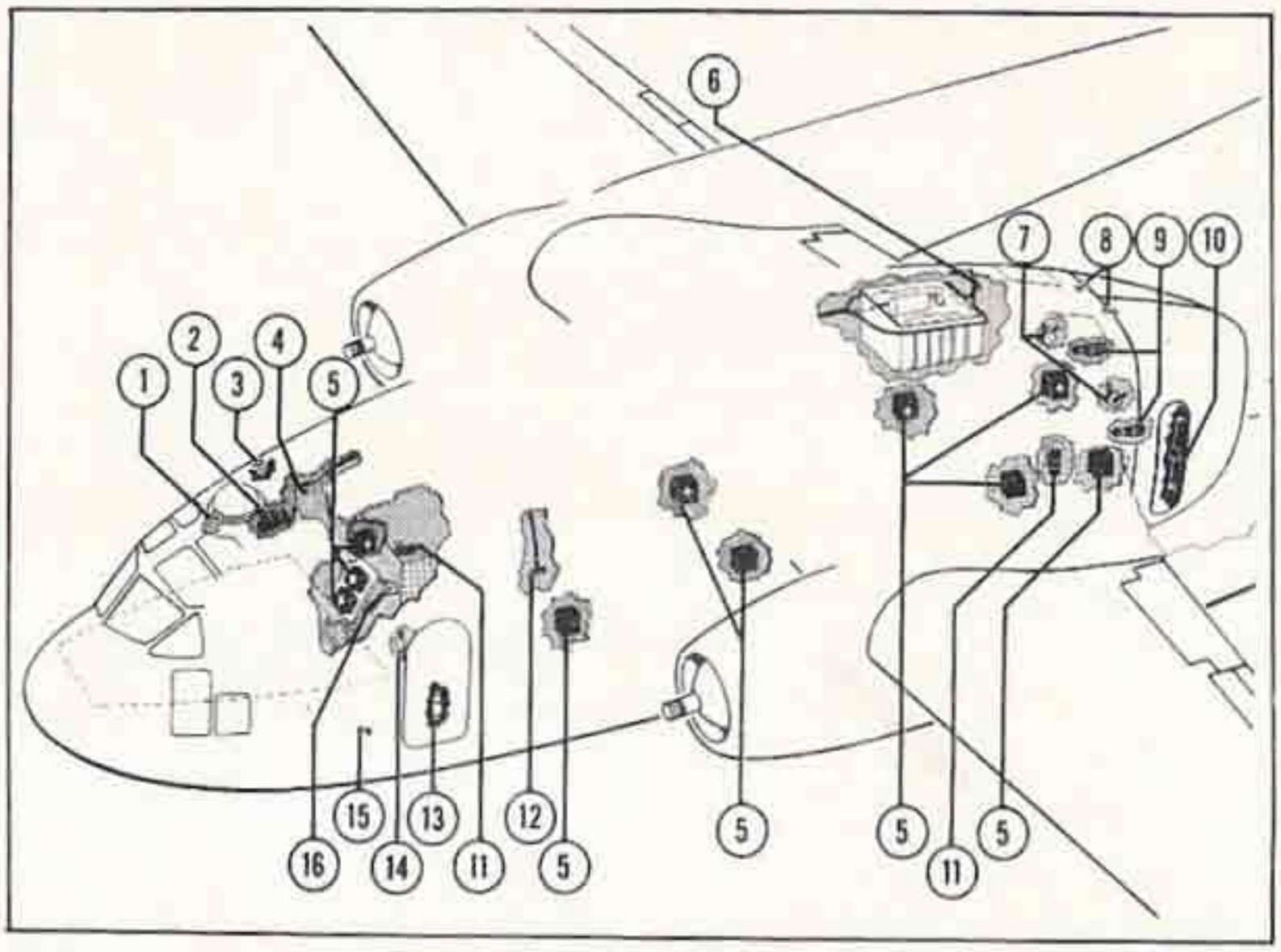


Figure 3-4. Emergency Equipment

1. Astrodome quick-release handle
2. Pyrotechnic pistol stowage
3. Pyrotechnic pistol mount
4. Crew compartment life raft release handle
5. First-aid kits
6. Exterior life raft release handle
7. Escape hatch interior release handle
8. Escape hatch exterior release handle
9. Emergency static line
10. Paratroop doors quick-release handle
11. CO_2 hand fire extinguisher
12. Cargo compartment life raft release handle
13. Carbon tetrachloride hand fire extinguisher
14. Forward entrance door interior quick-release handle
15. Forward entrance door exterior quick-release handle
16. Emergency hand axe

3-10. DURING FLIGHT.

Gross Weight in Pounds	50,000	60,000	64,000	74,000
Normal take-off IAS				
mph	94	102	106	114
knots	82	89	92	99
Safe single-engine IAS				
mph	126	130		
knots	109	113		

b. If safe air speed has been attained, retract landing gear immediately and raise flaps.

c. Turn water injection switch "ON" if desired.

d. Both throttles full forward.

e. Feather propeller of bad engine.

f. Mixture on dead engine "IDLE CUT-OFF."

g. Engine ignition switch of dead engine "OFF."

h. Fuel and oil shut-off switch of dead engine "SHUT."

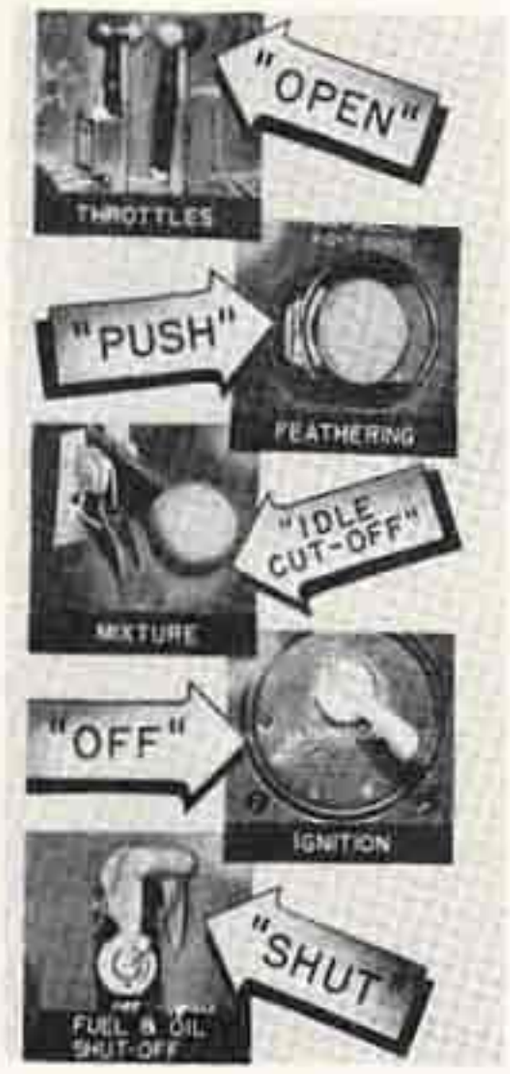


Figure 3-5. Engine Failure On Take Off

i. Trim airplane as needed.

j. Complete shutdown of dead engine and land airplane as soon as practicable.

a. Both throttles full forward.

b. Feather propeller on bad engine.

c. Mixture control of dead engine "IDLE CUT-OFF," and mixture control of live engine "NORMAL," unless engine cooling requires "RICH."

d. Engine ignition switch of dead engine "OFF."

e. Fuel and oil shut-off switch of dead engine "SHUT."

f. Fuel booster pump of live engine "EMERGENCY ON."

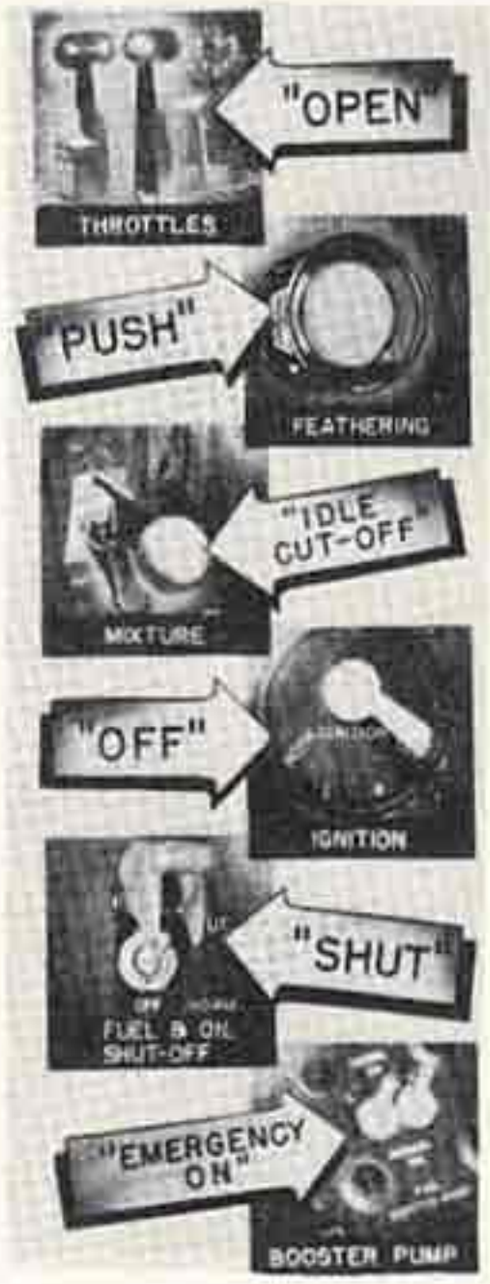


Figure 3-6. Engine Failure During Flight

g. Completely shut down the engine.

h. If necessary, transfer oil from dead engine tank to live engine tank.

i. Start APP unit to augment output of live engine generator.

j. If necessary, jettison cargo and equipment to reduce gross weight.

k. Turn off all unnecessary electrical equipment.

C

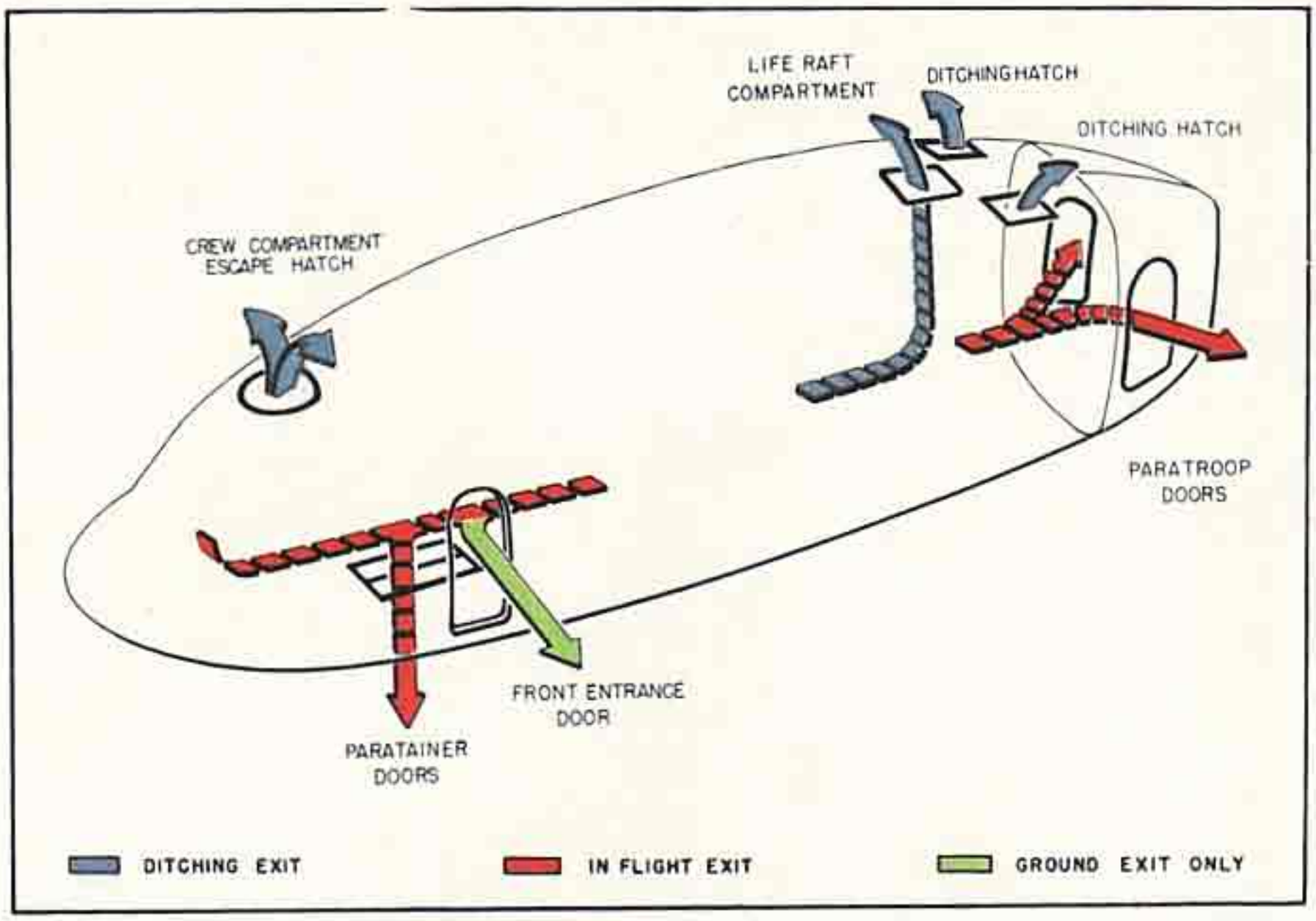


Figure 3-7. Emergency Exits

3-11. WING FLAPS EMERGENCY OPERATION.

3-12. In the event of electrical system failure, wing flaps may be lowered by using the hand crank (4, figure 1-16) in the socket located in the top rear section of the cargo compartment. Pull out the wing flaps circuit breaker, located on the circuit breaker panel, before attempting to operate wing flaps manually.

CAUTION

Do not retract the wing flaps by the hand-crank method in flight.

3-13. ELECTRICAL SYSTEM FAILURE.

3-14. In the event of electrical system failure, it becomes desirable to turn off all electrical power except that required for engine ignition. Turn master battery and ignition switch to "IGN. ON," engine generator switches "OFF," and APP ignition switch "OFF." This will cut out all of electrical system, except engine ignition, IFF radio, and jump signal.

3-15. GENERATOR FAILURE.

3-16. If either or both engine generators should fail to function properly, APP unit must be used to offset resultant loss of electrical output. The propeller de-icing, torquemeter heater, wing flap, landing gear, and heater circuits must be used separately.

CAUTION

When both generators fail, the propeller de-icing and torquemeter heater must not be used, and the heater circuit must not be used when landing.

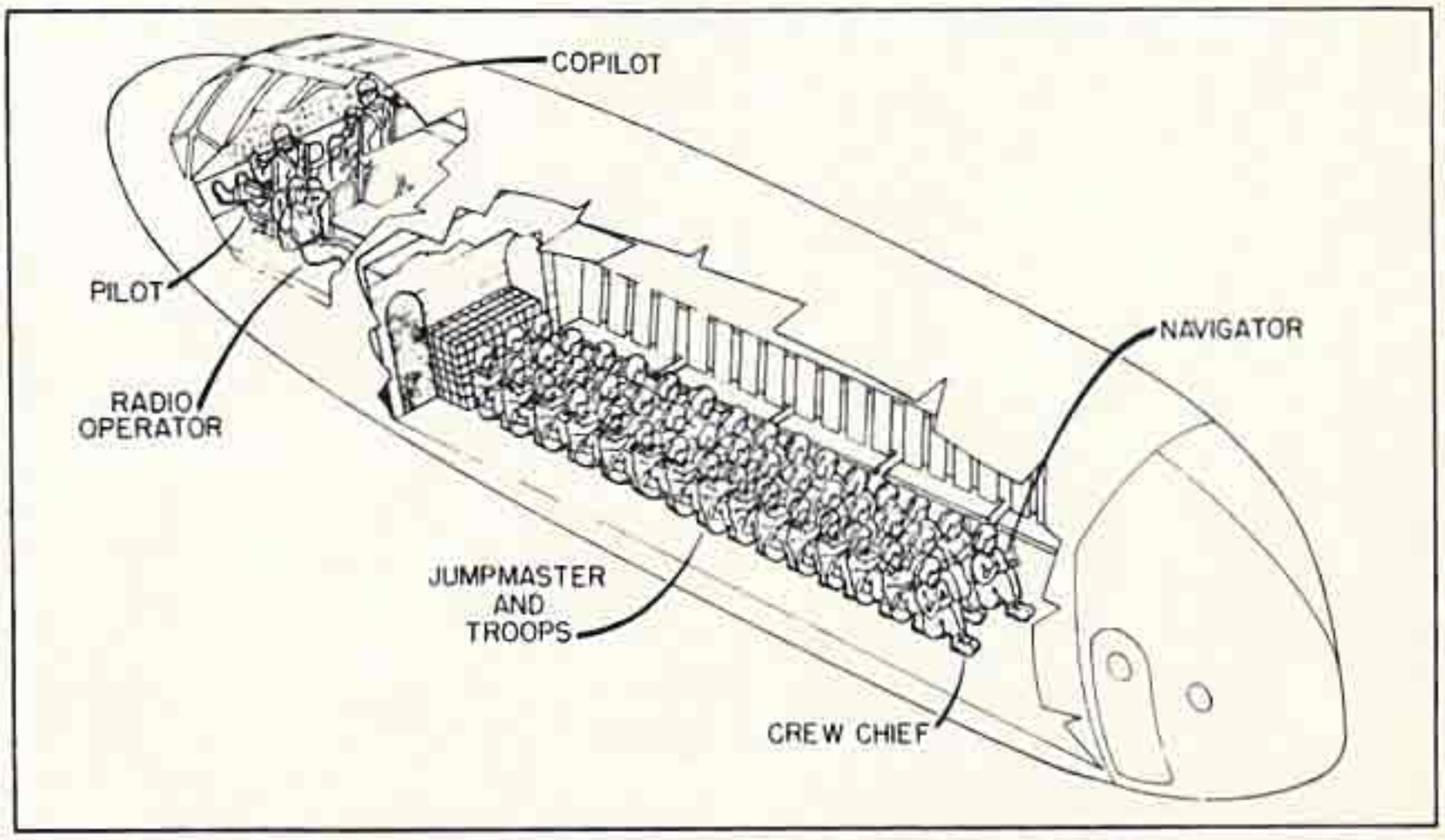


Figure 3-8. Forced Landing and Ditching Diagram

3-17. FORCED LANDING.

NOTE
FOR FORCED LANDING POSITIONS. SEE FIGURE 3-8.

Pilot	*Copilot*	*Radio Operator*	*Navigator*	*Crew Chief*	*Jumpmaster and Troops*
a. Give warning over interphone, and six short rings of alarm bell.					
b. Order crew to jettison all cargo and loose gear if time permits.		b. Transmit course, altitude, speed, position, and distress signals.	b. Give radio operator emergency information to be transmitted.		b. Assist crew chief in jettisoning cargo.
c. Shoulder harness and safety belt tightened and inertia reel lock control locked.	c. Shoulder harness and safety belt tightened and inertia reel lock control locked.	c. Turn APP ignition "OFF."	c. Open crew compartment escape hatch.	c. Order troops to assume forced landing positions.	c. Assume forced landing positions.
d. Check landing gear control in desired position.	d. Assist pilot.		d. Assist crew chief.		
e. All non-essential electrical switches "OFF."					
f. Land with as slow a forward speed as possible, wing flaps "DOWN," make normal approach.		f. Assume position behind pilot's seat with parachute for padding.	f. Take position in cargo compartment.	f. Take position in cargo compartment.	
g. One long sustained ring of alarm bell.	g. Brace for impact.	g. Brace for impact.	g. Brace for impact.	g. Brace for impact.	g. Brace for impact.
h. Close throttles on impact.					
i. After landing, fuel and oil shut-off switches "SHUT," fuel selector switches "OFF," master battery and ignition switch "IGN. OFF - BAT. OFF."					

CAUTION

The pilot and copilot are prevented from bending forward when the control is in the locked position; therefore, all switches not readily accessible should be "cut" before moving the control to the locked position.

CAUTION

Minimum damage results when the airplane is crash landed on as many wheels as it is possible to extend. Having some gear, even the nose gear, down in event of a crash landing will serve as a buffer and take a portion of the landing loads which would otherwise be transmitted directly to the fuselage. Having some gear down will also serve to increase the drag tending to slow down the approach to a crash landing. However, it is considered that gear-up crash landing on terrain which absorbs the initial impact loading and allows the aircraft to slide, such as deep snow, will result in the least damage.

3-18. DITCHING.

NOTE
FOR DITCHING POSITIONS, SEE FIGURE 3-8.

Pilot	*Copilot*	*Radio Operator*	*Navigator*	*Crew Chief*	*Jumpmaster and Troops*
a. Give warning over interphone and six short rings on alarm bell.					
b. Order crew to jettison cargo and prepare emergency equipment.		b. Transmit course, altitude, speed, position, and distress signals.	b. Give radio operator emergency information to be transmitted.	b. Take charge of jettisoning cargo. Use paratroop doors only.	b. Assist crew chief in jettisoning cargo.
c. Shoulder harness and safety belt tightened and inertia reel lock control locked.	c. Shoulder harness and safety belt tightened and inertia reel lock control locked.	c. Open crew compartment excape hatch.	c. Turn APP ignition "OFF."	c. Prepare ration kits, parachutes, life rafts, and other emergency equipment.	c. Assist crew chief in preparing emergency equipment.
CAUTION The pilot and the copilot are prevented from bending forward when the control is in the locked position; therefore, all switches not readily accessible should be "cut" before moving the control to the locked position.					
d. Give crew and troops a running account of ditching progress.	d. Assist pilot.	d. Get pyrotechnic pistol, flares, and first-aid kits from crew compartment.	d. Assist crew chief, get first-aid kits from cargo compartment.	d. Close paratroop doors, open ditching hatches.	
e. Ditch while power is available, at lowest possible speed. Use wing flaps as required.			e. Pile parachutes against forward cargo compartment bulkhead.	e. Order paratroops to assume ditching positions.	e. Assume ditching positions.
f. Choose the direction of ditching run to parallel with waves.		f. Assume position behind pilot's seat with parachute for padding.	f. Take position in cargo compartment.	f. Take position in cargo compartment.	
g. One long sustained ring of alarm bell.	g. Brace for impact.	g. Brace for impact.	g. Brace for impact.	g. Brace for impact.	g. Brace for impact.
h. Upon contact, throttles closed, fuel and oil shut-off switches "SHUT," master battery and ignition switch "IGN. OFF - BAT. OFF."		h. Release life raft.	h. Aid troops in leaving airplane.	h. Take charge of getting emergency equipment out of airplane.	h. Assist crew chief in getting emergency equipment out of airplane.
i. Leave through crew compartment escape hatch.	i. Leave through crew compartment escape hatch.	i. Leave through crew compartment escape hatch.	i. Leave through cargo compartment ditching hatch.	i. Leave through cargo compartment ditching hatch.	i. Leave through cargo compartment ditching hatch.

Section III

Paragraphs 3-19 to 3-28

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3-19. PROPELLER FEATHERING.

a. Throttle "CLOSED."

b. Depress feathering button.

c. Mixture control lever "IDLE CUT-OFF."

d. Fuel and oil shut-off switch "SHUT."

e. Cowl flap switch "AUTO."

f. Engine ignition switch "OFF."

Figure 3-9. Propeller Feathering

3-20. PROPELLER UNFEATHERING.

a. Propeller pitch control switch "DECREASE RPM."

b. Throttle advanced 1/8.

c. Fuel and oil shut-off switch "NORM."

d. Engine ignition switch "BOTH."

e. Pull feathering button and hold until tachometer indicates 800 - 1000 rpm, then release.

f. Move mixture control lever to "NORMAL."

g. Cowl flap switch "AUTO."

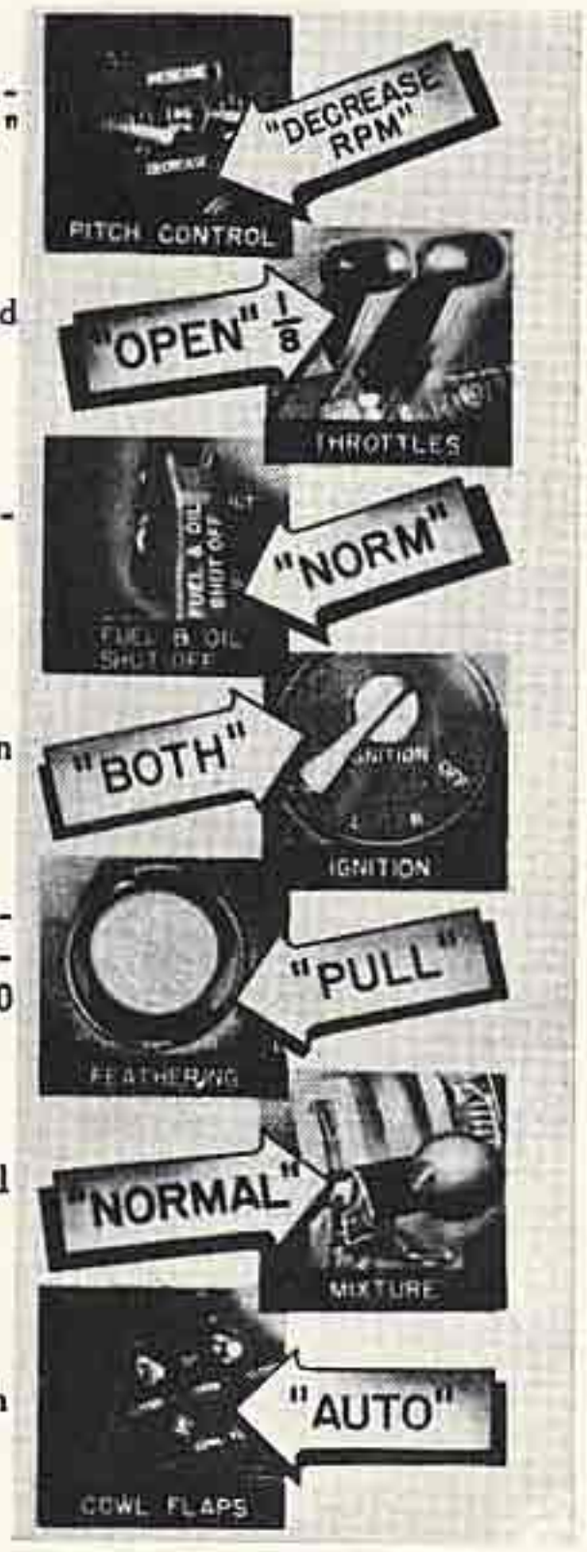


Figure 3-10. Propeller Unfeathering

NOTE

Allow engine to warm up at lower power until cylinder head temperature reaches 100 deg C.

3-21. PROPELLER EMERGENCY OIL REPLENISHING.

3-22. If either or both propeller oil level indicator lights come on, turn corresponding propeller oil level emergency switch to "AUTO-ON" until indicator light goes out. If indicator light comes on frequently, the switch may be left in "AUTO-ON" until a landing is made.

CAUTION

If the propeller emergency oil replenishing method is used, the propeller reservoir should be drained, loss of oil investigated, and reservoir refilled with proper oil before the next flight.

3-23. SINGLE-ENGINE LANDING.

a. Refer to paragraph 2-59 and keep air speed at prescribed gliding speeds for different gross weights.

b. Landing gear control "DOWN."

c. Turn water injection switch "ON" if desired.

d. Adjust trim tabs as needed.

e. Before landing with single engine, make sure propeller de-icing switch is in "OFF." This will eliminate the possibility of overloading the single operating generator upon landing.

f. When landing is assured, use wing flaps as desired, close throttle, and proceed with normal landing.

WARNING

For single-engine landing, do not lower wing flaps until landing is assured, as level flight cannot be maintained on one engine with landing gear and flaps extended. If it is deemed necessary to go around, apply full power to live engine and immediately retract landing gear.

3-24. BAIL OUT.

a. Give spoken warning over interphone, and three short rings on the alarm bell.

b. Reduce air speed as much as possible.

c. Trim airplane to approximately level flight.

d. Set automatic pilot to fly airplane away from inhabited area.

e. Open paratroop and aerial delivery doors.

WARNING

The only safe bail-out exits in flight are the paratroop and aerial delivery doors.

f. Give bail-out order over interphone, and one long ring on the alarm bell.

3-25. AUTOMATIC PILOT FAILURE.

3-26. If automatic pilot servo clutch disengage switches fail to operate and freeze controls, pull either servo clutch disconnect lever located at the pilot's or copilot's station and turn automatic pilot power and inverter switches "OFF."

3-27. FUEL PUMP FAILURE.

3-28. If, for any reason, the engine-driven fuel pump should fail to function properly, turn fuel booster pump switch to "EMERGENCY ON."

3-29. HYDRAULIC SYSTEM EMERGENCY OPERATION.

3-30. If there is insufficient hydraulic pressure for normal operation, for any reason other than electric failure, place hydraulic pressure control switch in "MANUAL" position and hold until pressure has reached desired point. Then release switch.

NOTE

In the "MANUAL" position, the hydraulic pressure switch is spring loaded, and therefore must be held until adequate pressure level is attained.

3-31. MAIN LANDING GEAR EMERGENCY EXTENSION.

CAUTION

Once the up-lock release handles and the hand crank clutch engage handles have been pulled, the up lock is inactive and the hand crank clutch will remain engaged until the ground crew resets the emergency extension mechanism in the nacelles.

a. Turn the landing gear switch (38, figure 1-11) "OFF."

b. Pull down on the outside stirrup-type handle (1, figure 1-16) to release the landing gear up-lock mechanism.

c. Pull down inside handle and latch in rack (3, figure 1-16) to engage crank clutch.

d. Insert hand crank (4, figure 1-16) in the socket (2, figure 1-16) at top of fuselage.

e. Turn crank counterclockwise until any further movement is impossible. Check that green indicator light is on.

Figure 3-11. M.L.G. Emergency Extension

CAUTION

Do not discontinue cranking until gear is down and locked even though green light on instrument panel comes on.

3-32. MAIN LANDING GEAR EMERGENCY POWER EXTENSION.

a. Use this procedure if main landing gear jams on normal operation, thus popping out circuit breaker, as indicated by ammeter load drop while landing gear control switch is in "UP" or "DOWN" position and gear has not completed cycle.

b. Hold desired circuit breaker emergency override switch (5, figure 1-16) in the "ON" position and operate landing gear control switch in "DOWN" position.

CAUTION

Circuit breaker emergency override switches must not be "ON" for more than 10 seconds at 5-minute intervals.

3-33. NOSE LANDING GEAR EMERGENCY EXTENSION.

a. Fully retract landing gear as far as possible.

b. Landing gear control switch "OFF."

c. Pull up-lock release handle (figure 1-17), located on cargo compartment forward bulkhead, back as far as possible.

d. When gear has reached full down and locked position, as indicated by green light, return release handle to normal position.

Figure 3-12. N.L.G. Emergency Extension

3-34. LANDING GEAR EMERGENCY RETRACTION.

3-35. No provision is made for emergency retraction of the nose landing gear. However, the main landing gear may be manually retracted.

a. Turn landing gear control switch located on instrument panel to "OFF."

b. Pull down inside handle and latch in rack to engage crank clutch.

c. Insert hand crank extension rod and crank in socket at top of fuselage.

d. Turn crank in clockwise direction until gear is full up and locked.

NOTE

Do not operate any switches while gear is being manually retracted.

CAUTION

The hand crank must be held in the socket until gear is full up and locked, otherwise gear will free-fall down.

FIGURE 3-13. Deleted

3-36. EMERGENCY STOPS.

a. Use reverse propeller pitch.

CAUTION

When using reverse pitch, the pilot or copilot should firmly hold the control column well forward so that elevator will not buffet and slam against the elevator stops.

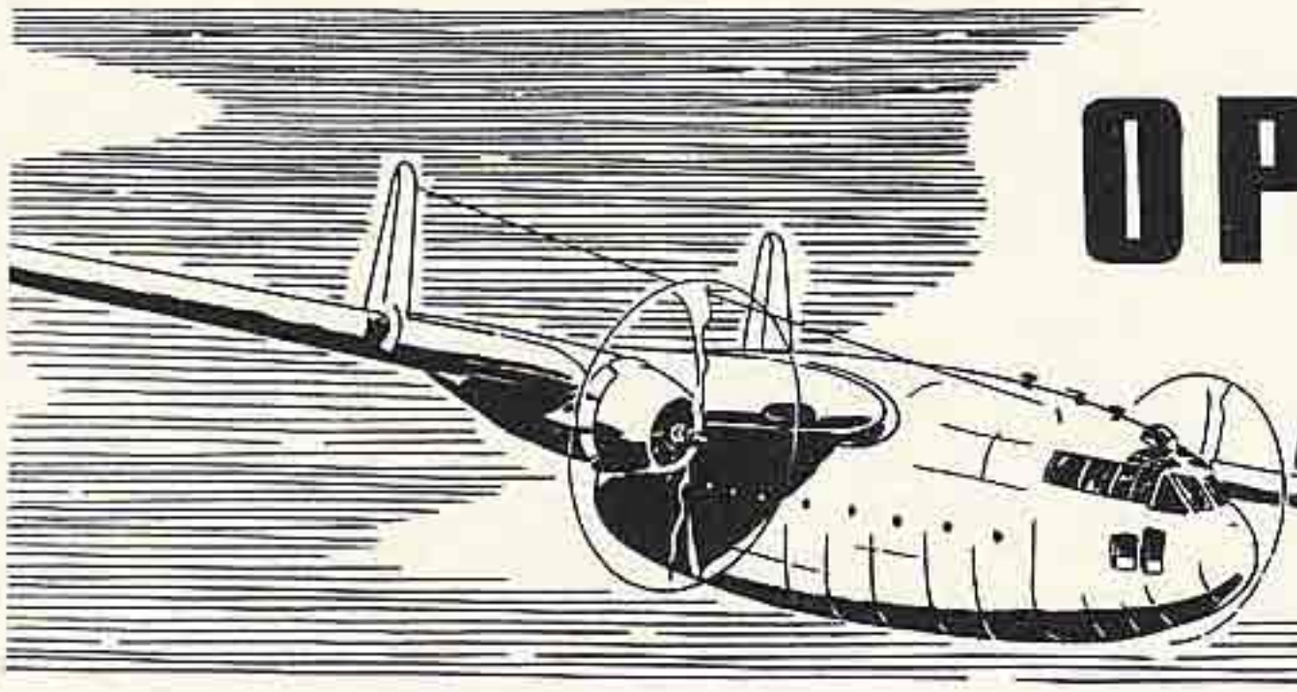
b. If reverse pitch is not sufficient use emergency brake or retract landing gear, using emergency switch.

3-37. STARTING AUXILIARY POWER PLANT MANUALLY.

NOTE

This procedure is to be used when there is no electrical power available for starting the APP.

a. APP ignition switch "ON."
b. Governor control lever "CHOKE."
c. Hold down manual fuel bypass valve located on auxiliary floor.
d. Wind starting cord around starting pulley and give a rapid steady pull on cord.
e. When APP starts, place governor control lever in "IDLE" for warm up.
f. Governor control lever to "RUN."
g. Control switch to "ON." (Airplane groups K and N)
Starter switch to "ON," and generator switch to "ON." (Airplane group L)



OPERATIONAL *Equipment*

SECTION IV

4-1. OXYGEN EQUIPMENT. (See figure 4-1.)

Figure 4-1A DELETED

4-2. GENERAL. A low pressure demand type oxygen system operating at a working pressure of 400 psi, is installed for all crew members. The oxygen flows from eight type G-1 cylinders four installed in each boom aft of the nacelles. The system is filled through a filler valve located on the left side of the fuselage. The following oxygen equipment is provided in each of the five crew member stations:

Pilot and Copilot Stations	Navigator and Radio Operator Stations	Crew Chief Station
Demand Regulator	Demand Regulator	Demand Regulator
Portable Recharger		
Flow Indicator	Flow Indicator	Flow Indicator
Pressure Gage		

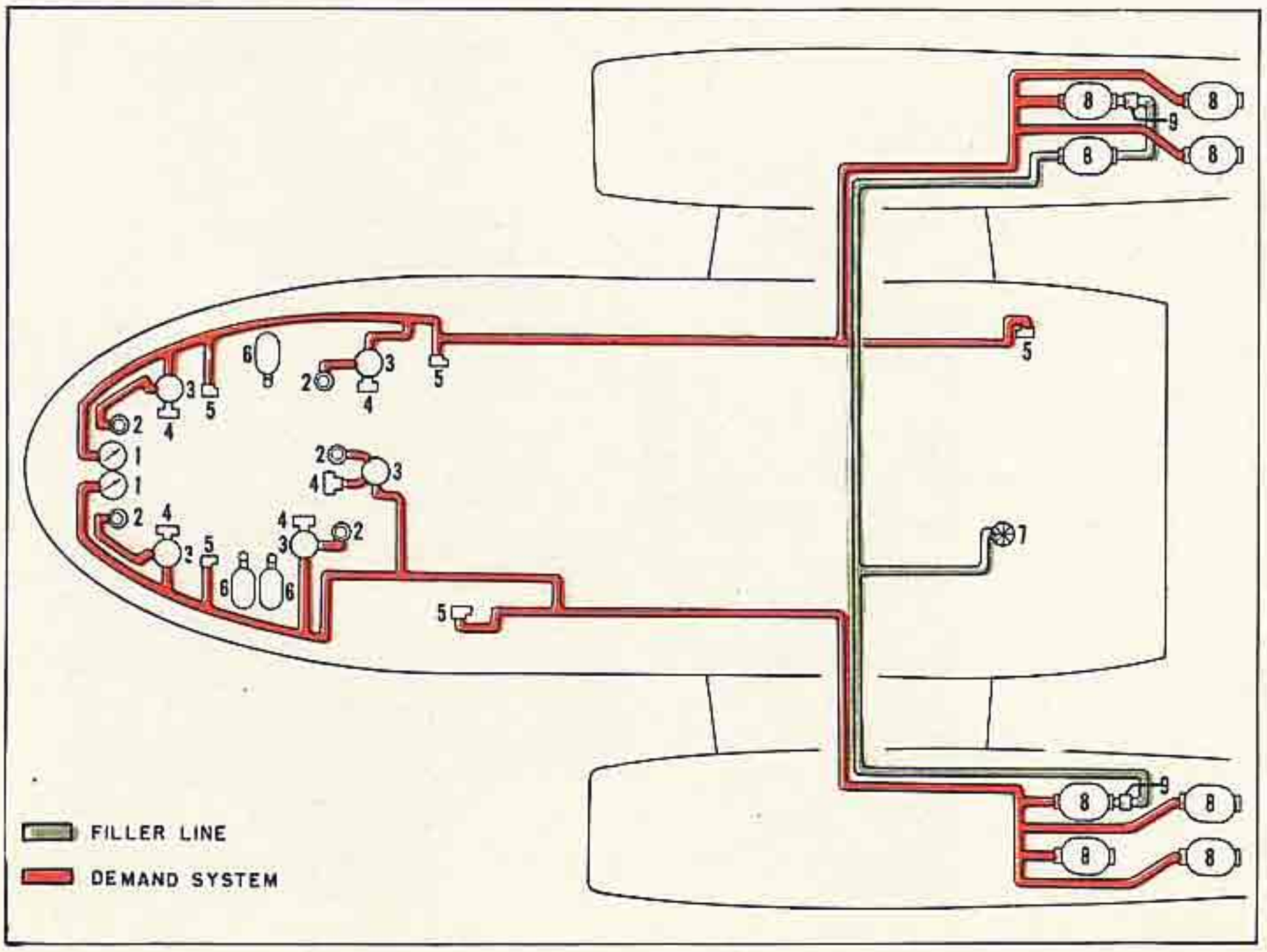


Figure 4-1. Oxygen System

1. Pressure gage
2. Flow indicator
3. Regulator
4. Mask regulator tubing
5. Portable recharger
6. Portable oxygen units
7. Filler valve
8. Oxygen cylinder
9. Check valve

4-3. DURATION OF CREW OXYGEN. The following durations represent estimated maximum man-hours available in the eight cylinders for one crew member. To obtain the actual duration of oxygen which the demand system will provide each man, divide the number of man-hours by the number of crew members.

Altitude	Duration
10,000 feet	58 man-hours, 6 minutes (58.1 hr.)
15,000 feet	44 man-hours, 42 minutes (44.7 hr.)
20,000 feet	36 man-hours, 54 minutes (36.9 hr.)
25,000 feet	32 man-hours, 0 minutes (32.0 hr.)

4-4. PORTABLE OXYGEN EQUIPMENT. There are three portable oxygen units, one on the copilot's side and two on the pilot's side of the crew compartment. Recharger units for filling the portable oxygen units are located at the pilot's station, copilot's station, lavatory, the left forward side of the cargo compartment and the right aft side of the cargo compartment.

4-5. FILLER VALVE. An oxygen filler valve (10, figure 1-3) is located on the outer left side of the fuselage, aft of the center section.

Paragraphs 4-6. thru 4-10. Deleted

4-11. COMMUNICATIONS EQUIPMENT.

NOTE

All radio equipment in the airplane is controlled by the master "ON-OFF" switch located at the radio operator's station.

4-12. INTERPHONE EQUIPMENT AN/AIC-3. An interphone control system is installed for the pilot, copilot, navigator, and radio operator with a control box at each of their stations. The pilot and copilot are provided with plug-in jacks on bottom of their control box, while the navigator and radio operator are provided with plug-in jacks located under the navigator's and radio operator's work tables. Additional interphone jack boxes are located at jumpmaster's station, right and left nacelle, and right side of cargo compartment. The interphone equipment has the following functions: A

Voice communication between any interphone stations.
Individual selection at each station of the audio output of six receivers: V.H.F. command, liaison, automatic radio compass No. 1, automatic radio com-

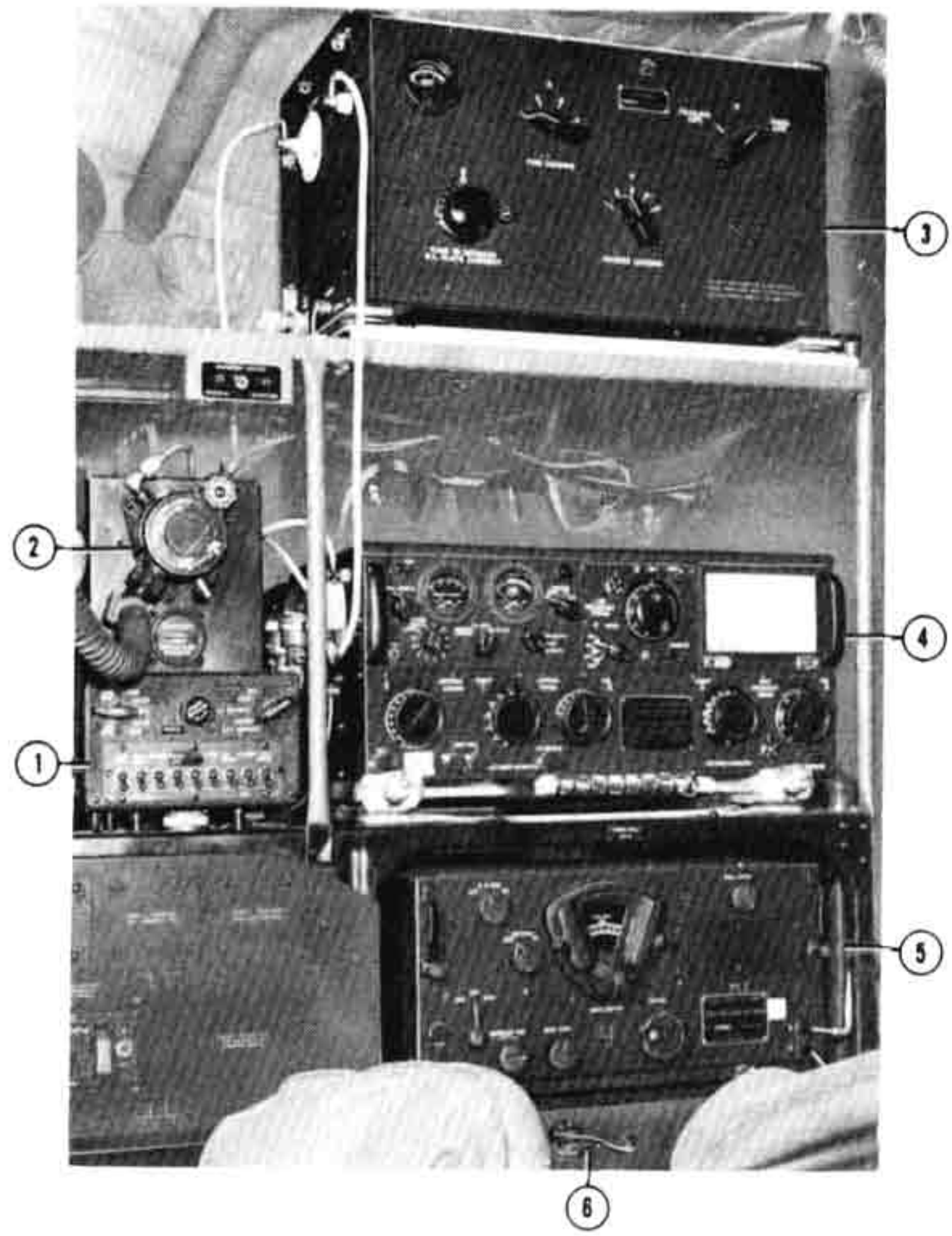


Figure 4-2. Radio Operator's Station (Airplane Group A)

1. Interphone control box AN/AIC-3
2. Oxygen panel
3. Antenna loading unit CU-32/ART-13A
4. Liaison transmitter AN/ART-13A
5. Liaison receiver BC-348-Q
6. Key

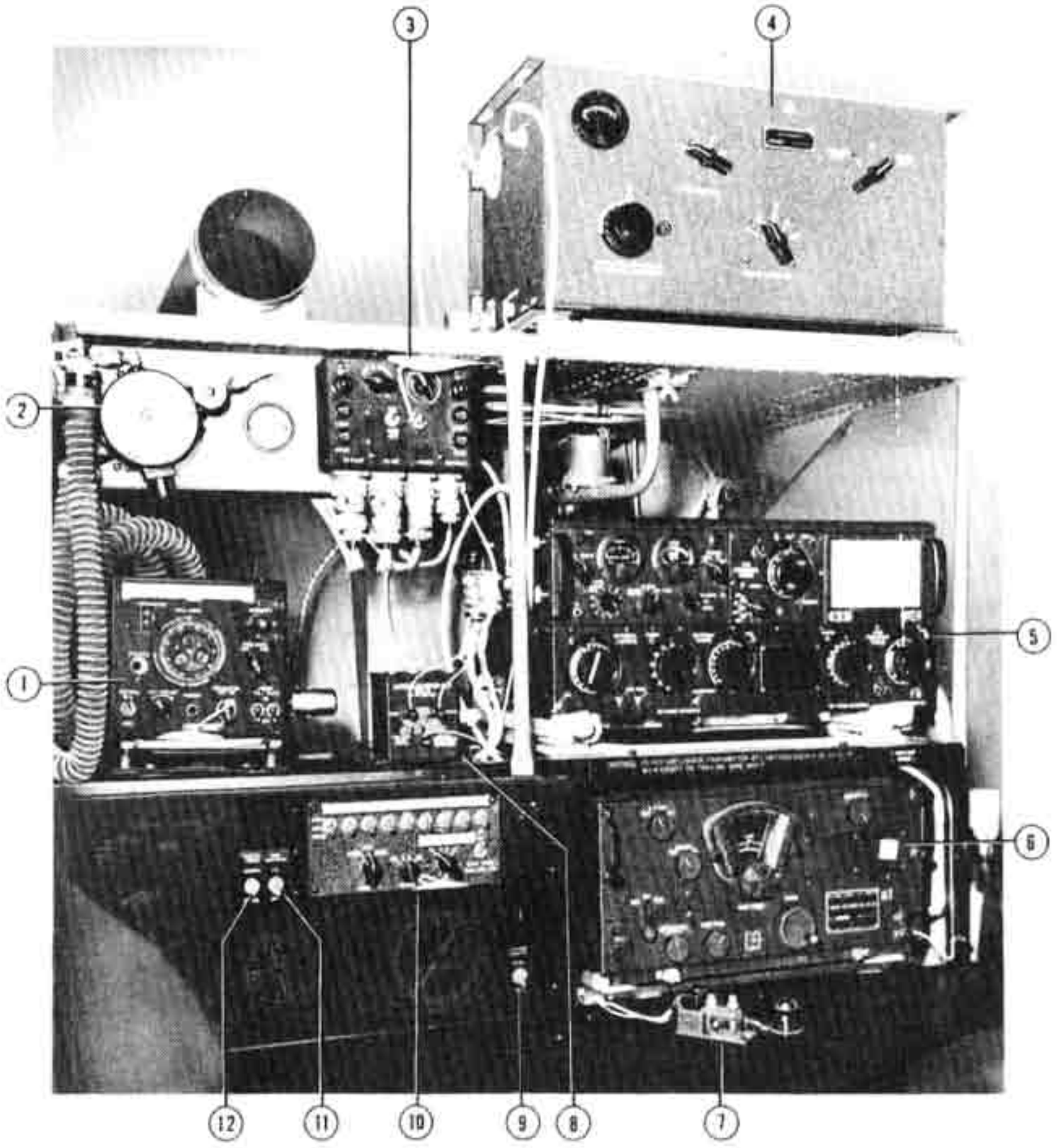


Figure 4-2A. Radio Operator's Station (Airplane Group N)

1. Frequency meter LM-14
2. Oxygen panel
3. Control unit AN/APX-2
4. Antenna loading unit AN/ART-13
5. Transmitter AN/ART-13
6. Receiver liaison set AN/ARC-8
7. Key
8. Antenna matching unit
9. Interphone dynamotor selector switch
10. Interphone control panel
11. Master radio control switch
12. Monitor switch for AN/ARC-8

pass No. 2, marker beacon, and blind landing; and provisions for selection of H.F. command and one special receiver.

A means of switching the microphone to: V.H.F. command transmitter, liaison transmitter, or the interphone system; with provisions for switching to an H.F. command transmitter.

A "call" facility whereby all positions may be called by voice communications regardless of the setting of the microphone or facility switches at any of the called stations.

A "filter" facility whereby the output signal of either automatic radio compass receiver may be fed through a radio range filter at each interphone station.

An "emergency tel" facility at pilot's, copilot's, and navigator's control boxes is connected to the output circuit of navigator's, radio operator's and pilot's control boxes respectively to provide emergency listening facilities in case of failure of a particular control box.

4-13. INTERPHONE EQUIPMENT AN/AIA-2A. An interphone control system is installed for the pilot, copilot, and radio operator, with a control box at each of their stations. Additional interphone jack boxes are located at the navigator's station, jumpmaster's station, right and left nacelle, and the right side of the cargo compartment. The interphone equipment has the following functions:

Voice communications between any or all interphone stations.

A means for selecting an audio output of the associated radio receivers.

A means of switching the associated microphone and control circuit of the interphone system to any of the radio transmitters.

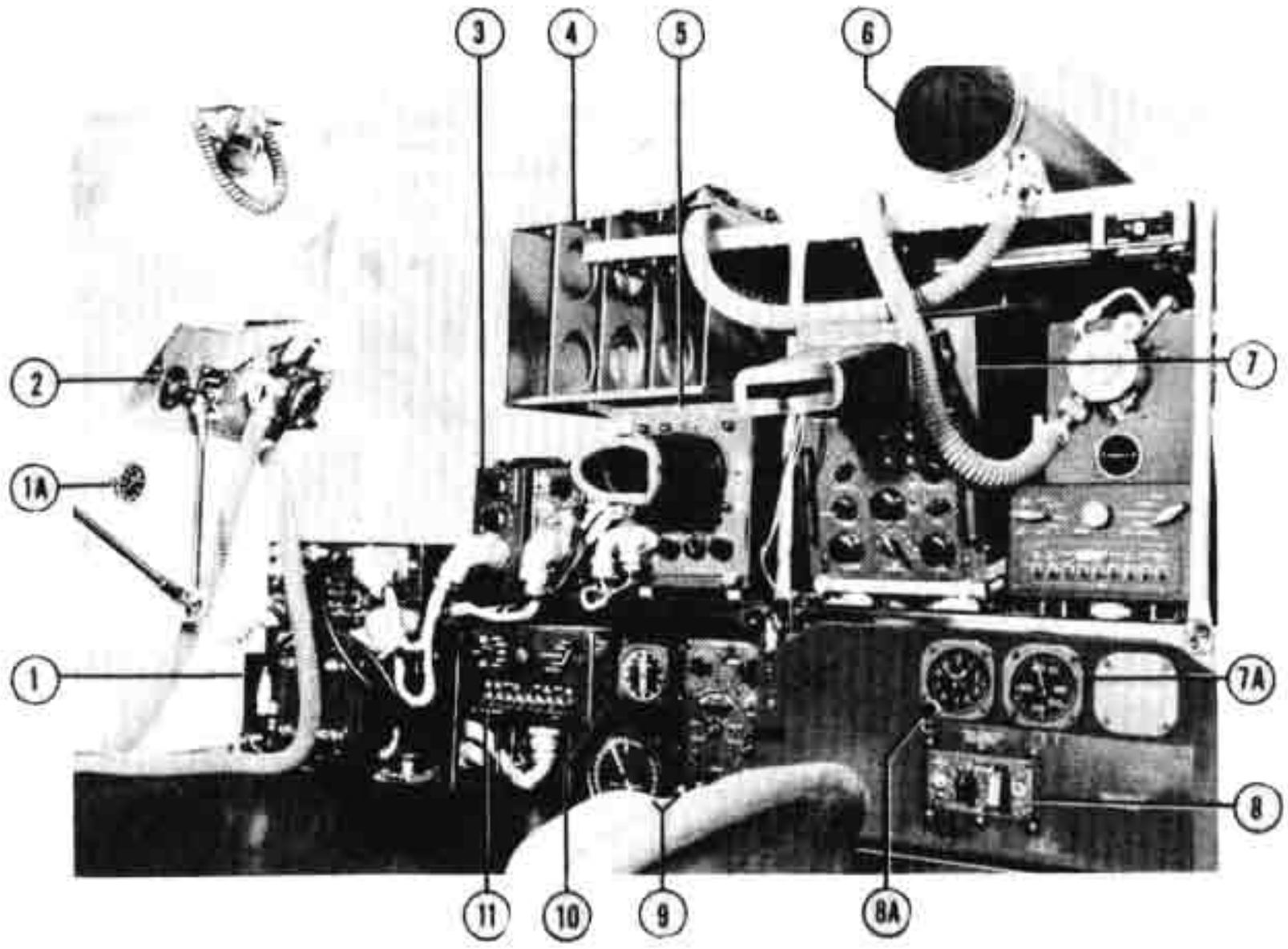
NOTE

The radio operator is provided with an interphone over-ride switch located on the floor below the radio operator's table. When this foot controlled switch is held down, the radio operator is cut out from the interphone circuit.

4-14. To operate, turn master battery and ignition switch to "IGN. ON - BAT. ON." Turn the microphone switch to "CALL" and check reception from each crew member. Check own reception from each crew member's response. Adjust volume as desired. All positions may be called in this manner, regardless of setting of microphone or facility switches of the called station.

Figure 4-2B. Navigator's Station (Airplane Group A)

1. Transceiver AN/APN-12 (Airplane Groups G and E)
1A. Free air temperature gage (Airplane Group L)
2. Oxygen panel
3. Radar beacon control box AN/APN-12 (Airplane Groups G and E)
4. Stowage compartment
5. Radar beacon AN/APN-12 (Airplane Groups G and
6. Chart tube
7. Loran Receiver AN/APN-9 or AN/APN-9A
7A. Air speed indicator (Airplane group L)
8. IFF Control panel (Airplane Group C)
8A. Altimeter (Airplane Group L)
9. Radio compass control box and indicator AN/ARN-7
10. Remote indicating compass
11. Interphone control box AN/AIC-3



4-15. INTERPHONE EQUIPMENT AN/AIA-1A. A plug assembly, located near the glider release mechanism, is utilized when conversation is desired with crew members of glider or gliders being towed.

A

4-16. V.H.F. COMMAND SET AN/ARC-3. This set is an air-borne receiving and transmitting set designed to provide plane-to-plane or plane-to-ground communication. The controls are located on the radio control panel.

A

4-17. To operate, insert headset plug in the "TEL" jack and microphone plug in "MIC" jack on the interphone control box. Turn the frequency selector switch to the channel desired and allow set to warm up. The receiver will continuously monitor that frequency indicated by the frequency selector switch, except during periods of transmission, at which time the receiver is shut off. To stop the unit, turn master switch to "OFF."

A

4-18. V.H.F. COMMAND SET AN/ARC-1. This set provides two-way voice communication between aircraft, or between aircraft and ground stations, on any of nine prearranged main-channel communication frequencies or a guard-channel frequency. Incoming signals are received with the equipment except for those intervals when transmission is desired. The change from the receiving to transmitting condition is accomplished simply by operating the microphone push button.

N

4-19. To operate, turn power switch located on the interphone panel to "ON." Turn guard-main switch to position desired and turn channel selector switch to channel desired. To stop the equipment turn power switch "OFF."

N

4-20. LIAISON SET AN/ARC-8. This set is a long range, two way, voice and code communications set consisting of a 10-channel AN/ART-13A transmitter and a BC-348E receiving set. The transmitter controls are available to the pilot, copilot, and radio operator. A trailing antenna is used for low frequency transmission while a fixed antenna is used for high frequency transmission. An antenna switch, located in the crew compartment ceiling just over the crew chief's station, is provided for selecting fixed or trail antenna.

I

WARNING

Do not use the liaison transmitter at low frequencies on voice or code except on the trailing wire antenna.

4-21. To transmit, adjust frequency selector switch to desired frequency. Turn liaison switch to "ON." Turn emission switch to "VOICE." Adjust volume control as desired. To receive, turn receiver switch to "MVC." To stop the AN/ARC-8 set, turn transmitter emission switch "OFF," and receiver switch to the "OFF" position.

NOTE

A switch is provided for monitoring the AN/ARC-8 transmissions, and is located at the radio operator's station.

4-22. RADIO COMPASS AN/ARN-7. Two compasses are automatic navigational instruments providing an automatic visual indication of direction from which radio frequency energy is being received. It acts as navigational aid in homing operations and in position finding operations. Indicators are on instrument panel before the pilot and copilot, and on navigator's control panel. The pilot, copilot, and navigator have remote control units for this equipment.

4-23. Start equipment by turning function switch "COMP," "ANT" or "LOOP." Turn light control clockwise. Turn receiver to desired frequency. To stop equipment, turn function switch "OFF."

4-24. MARKER BEACON BC-193-A. The marker beacon BC-193-A set is a navigation and landing aid giving the pilot a visual indication when the airplane passes over a ground marker beacon station. The set is operative when the master battery and ignition switch is in "IGN. ON-BAT. ON."

C

4-25. MARKER BEACON AN/ARN-12. The marker beacon AN/ARN-12 set is a navigation and landing aid giving the pilot a visual indication when the airplane passes over a ground marker beacon station. The set is operative when the master battery and ignition switch is in "IGN. ON-BAT. ON." D

4-26. MARKER BEACON AN/ARN-8. The marker beacon set is a navigation and landing aid giving the pilot a visual indication when the airplane passes over a ground marker beacon station. The set is operative when the master battery and ignition switch is in "IGN. ON - BAT. ON." N

4-27. RADIO ALTIMETER AN/APN-1. This set provides direct indication of altitude, relative to the terrain during flight. Operating controls consist of a power switch, range switch, limit switch, and three indicator lamps.

4-28. To operate, turn power switch to the "ON" position. Movement of indicator hands shows that equipment is energized. Use range switch to select desired altitude range. To stop unit turn power switch to the "OFF" position.

CAUTION

Never use the high range when flying in the low altitude range.

4-29. The limit indicator consists of the following colored-light systems.

a. Green - indicates flight above the "preset" altitude. (Limit switch setting.)

b. Red - indicates flight below the "preset" altitude.

c. Amber - indicates flight at approximately the "preset" altitude.

The altimeter is calibrated in tens of feet for low altitude range; and in hundreds of feet (on the same indicator) for high altitude range.

4-30. GLIDE PATH APPROACH RADIO AN/ARN-5A AND LOCALIZER APPROACH RADIO RC-103A. Both of these installations are navigational equipment designed to function cooperatively in giving lateral guidance and glide angle to pilot during instrument landings. The combined equipment consists of a localized receiver, an indicator giving glide angle and lateral path of airplane, and a frequency selector switch.

4-31. To operate, turn "ON-OFF" switch to "ON" approximately 20 minutes before approaching the runway. This will allow receiver to warm up. Turn frequency selector switch to corresponding frequency as that being used by ground localizer transmitter. Make approach, applying corrections as indicated on indicator. To stop unit, turn "ON-OFF" switch "OFF."

4-32. STATIC DISCHARGERS AN/ASA-3. These consist of 10 lengths of cotton wick, each approximately 12 inches long. Three extend from trailing edge of each wing tip and two from each rudder. Their function is to dissipate static electricity.

4-33. EMERGENCY (DINGHY) RADIO SET AN/CRT-3. This set is an emergency radio transmitter which is stowed in the life raft compartment. It is automatically ejected with the raft, is water proof, and will float. It is pretuned to an international distress frequency of 500 kc and, when operated, transmits on M.C.W. signal. The set is equipped with a hand powered light by which visual blinker code may be transmitted.

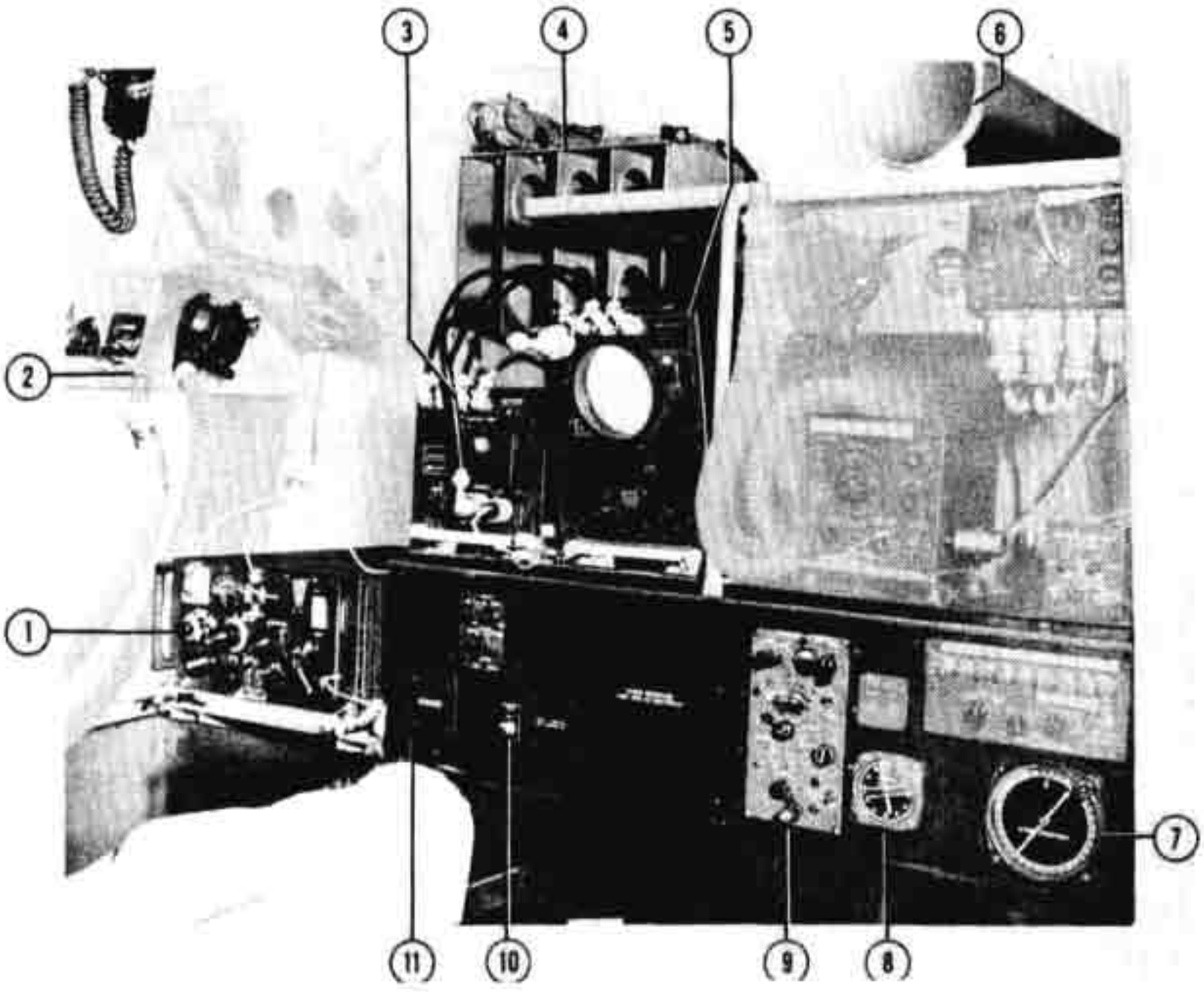


Figure 4-2C. Navigator's Station (Airplane Group N)

1. Transmitter-Receiver AN/ARC-2
2. Oxygen panel
3. Receiver APN-4
4. Stowage compartment
5. Indicator APN-4
6. Chart tube
7. Radio compass indicator
8. Remote indicating compass
9. Radio compass control panel AN/ARN-7
10. Radio selector switch for interphone control box
11. Interphone control panel AN/AIA-2A

4-34. Power for both radio and light is furnished with a hand powered generator in transmitter case. Operational instructions may be found in unit.

4-35. LORAN SET AN/APN-9 or AN/APN-9A. This set is a navigation set which receives, amplifies, and detects Loran signals, and displays them on a screen of the receiver indicator. This set will operate at altitudes ranging from sea level to 40,000 feet and temperatures ranging from -55 degrees C to +50 degrees C. It is equipped with controls for navigator only. A

4-36. To operate, set amplitude balance control and drift control at their center position of rotation, and turn "receiver gain" control clockwise until station rate identification illuminates. To stop, turn "receiver gain" control to "POWER OFF" and check to see that pilot light is not illuminated and pattern on indicator screen has disappeared. A

4-37. LORAN RADAR AN/APN-4. This set is a navigation set which receives, amplifies, and detects loran signals, and displays them on the screen of the receiver indicator. It is used for finding the geographical position of the airplane in which it is installed. The controls are provided for the navigator. N

4-38. To operate, set amplitude balance control and drift control at their center position of rotation, and turn receiver gain control clockwise until station rate identification illuminates. To stop, turn receiver gain control to "POWER OFF" and check to see that pilot light is not illuminated and the pattern on indicator screen has disappeared. N

4-39. RADAR BEACON SET AN/APN-12. This set is a remotely controlled air-borne navigation and recognition unit designed to direct an airplane to within 200 yards of a ground beacon; and to identify other airplanes equipped with IFF sets. E G

4-40. To start equipment, turn transmitter high-low-off switch to the "OFF" position. Turn power on-off switch to the "ON" position. Turn indicator on-off switch to the "ON" position. To stop equipment, turn all switches to the "OFF" position. E G

4-41. IFF SET SCR-695B.

4-42. The IFF radio set provides identification for friendly aircraft. An inertia switch is provided on this set, and when the destructor unit is installed, violent impact of the airplane will destroy this equipment. C

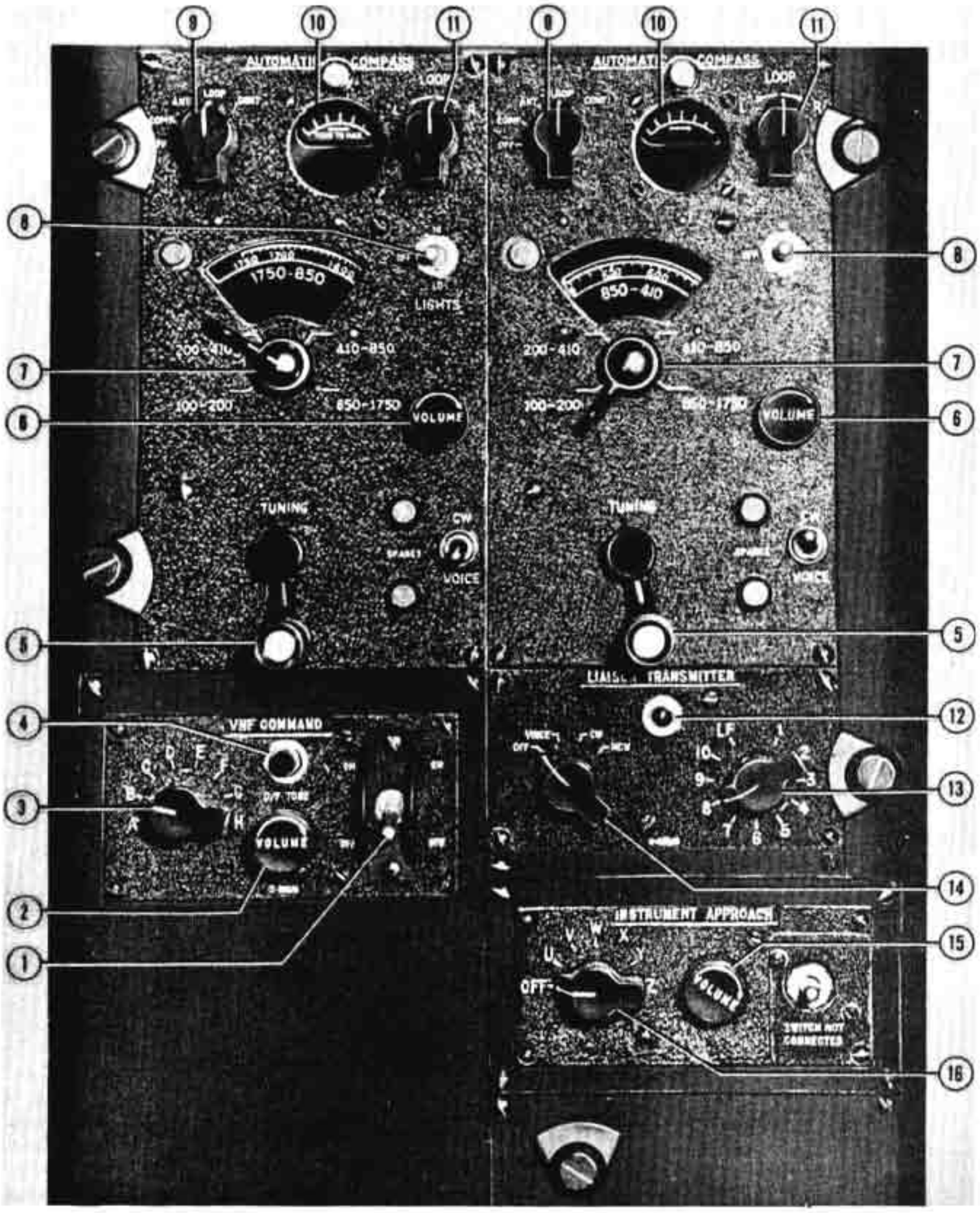


Figure 4-3. Radio Control Panel (Airplane Group A)

1. V.H.F. master switch
2. Volume control
3. V.H.F. command frequency selector switch
4. Tone button
5. Tuning crank
6. Volume control
7. Frequency selector switch
8. Light switch
9. Automatic compass switch
10. Tuning meter
11. Loop rotator switch
12. Pilot light
13. Liaison frequency selector switch
14. Liaison transmitter emission switch
15. Volume control
16. Instrument approach frequency selector control

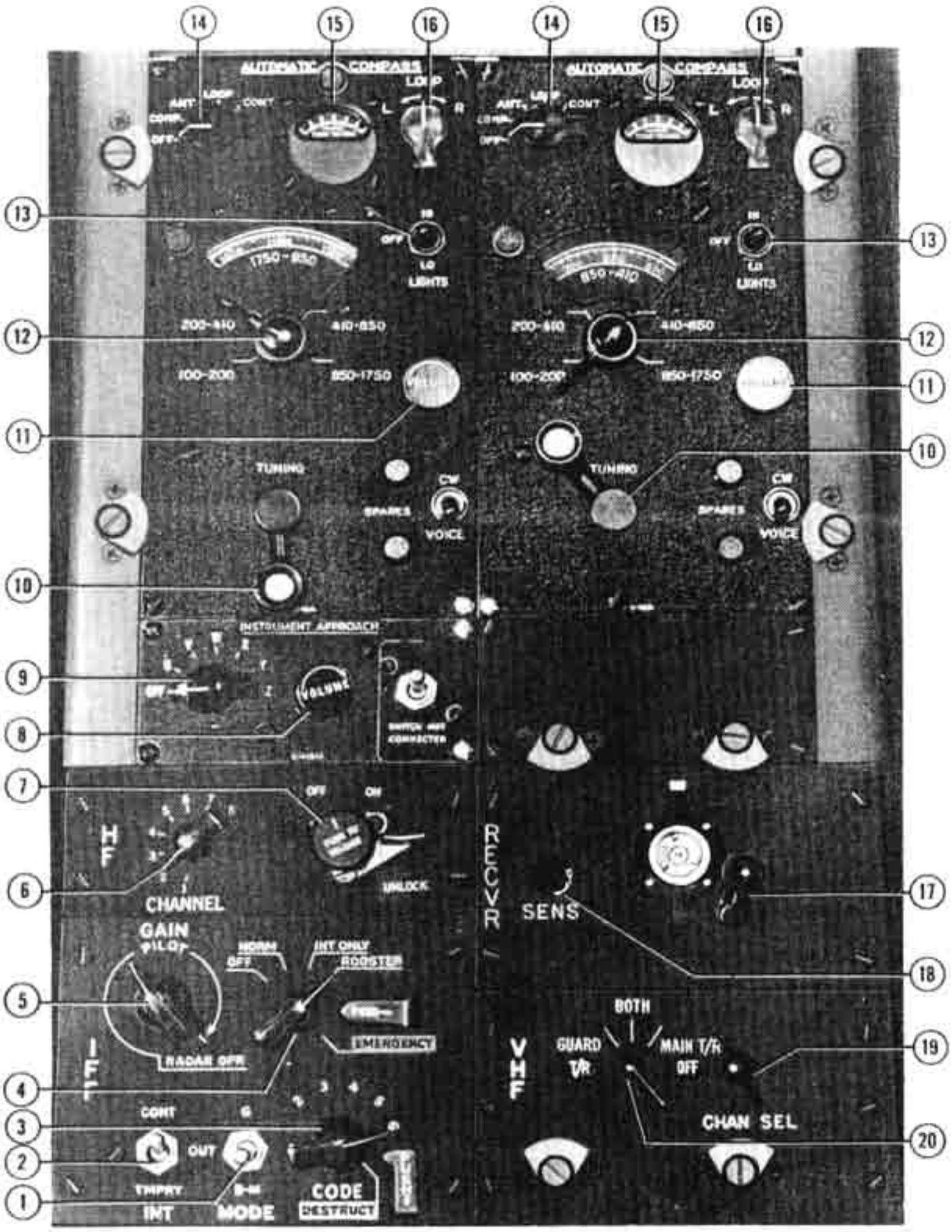


Figure 4-3A. Radio Control Panel (Airplane Group N)

1. G-band switch, IFF
2. Interrogation switch, IFF
3. Code selector switch, IFF
4. Master control switch, IFF
5. Gain control, IFF
6. Channel selector switch, Liaison Set
7. ON-OFF switch, Liaison Set
8. Volume control, Instrument Approach
9. Frequency control, Instrument Approach
10. Tuning crank, Radio Compass
11. Volume control, Radio Compass
12. Frequency selector switch, Radio Compass
13. Light switch, Radio Compass
14. Automatic compass switch, Radio Compass
15. Tuning meter, Radio Compass
16. Loop rotator switch Radio Compass
17. Tuning control, Radio Range Receiver
18. Sensitivity control, Radio Range Receiver
19. Channel selector switch, VHF
20. Guard-Main switch, VHF

4-43. In starting, be sure emergency switch is "OFF." Communications Officier-in-Charge will supply detailed instructions concerning use of IFF C emergency switch. Place remote on-off switch "ON." Set six position code switch to position "1" unless otherwise directed by Communications Officer. Insert destructor unit plug when operating over enemy territory. To stop the equipment, turn the on-off switch to the "OFF" position.

4-44. IFF SET AN/APX-2A. This IFF set provides identification for friendly airplanes. Means for destroying this equipment are provided in N the airplane through the use of an inertia switch. The switch automatically operates on violent impact of the airplane.

4-45. To operate this equipment turn master control switch to desired position and code switch to N code number desired. To stop the equipment turn master control switch to "OFF."

4-46. RADIO RANGE RECEIVER AN/ARC-5. The radio range receiver AN/ARC-5 is a low frequency range receiver with the control unit mounted on the pilot's radio control panel. N

4-47. To operate this equipment turn control switch, located on interphone control box, to "ON." Adjust tuning and sensitivity controls as desired. To stop the equipment turn control N switch to "OFF."

4-48. LIAISON SET AN/ARC-2. This set is a two way radio communications set with eight preset channels for voice, cw, or mcw communication. N The controls are available to the radio operator and a remote control unit is located on the pilot's radio control panel.

4-49. To operate turn "ON-OFF" switch to "ON" and channel selector to channel desired. To stop the equipment push the "ON-OFF" switch all the N way in toward the panel.

4-50. TABLE OF COMMUNICATIONS AND ELECTRONIC EQUIPMENT. (Airplane Group A)

	EQUIPMENT	LOCATION	FUNCTION	PRIMARY OPERATOR	RANGE
	Interphone equipment AN/AIC-3	Control panel in each crew member station and one at the jumpmaster's station.	Inter-communication of the crew.	Crew members	Crew stations within the airplane.
	Interphone equipment AN/AIA-1A	Plug assembly near glider release mechanism.	Interplane communication between tow plane and glider.	Pilot and copilot	Airplane to glider
	V.H.F. Command Set AN/ARC-3	Control panel on pedestal.	Short range, two-way voice and code communication.	Pilot and copilot	Line-of-sight
	Liaison Set AN/ARC-8	Radio operator's station; and control panel on pedestal.	Long range, two-way voice and code communication.	Radio operator and pilot and copilot	200-2500 miles, depending on operating frequency and time of day.
	Radio Compass Set AN/ARN-7 (No. 1)	Indicator on instrument panel and at navigator's station; control panel on pedestal and navigator's station.	Receive voice and code signals for direction homing and bearing.	Pilot and navigator	20-200 miles, depending on frequency used and time of day.
I	Radio Compass Set AN/ARN-7 (No. 2)	Indicator on instrument panel, control panel on pedestal.	Receive voice and code signals for direction homing and bearing.	Copilot	20-200 miles, depending on frequency used and time of day.
C	Marker Beacon Set RC-193A	Indicator light in cockpit visible to pilot.	Receives location marker signal on navigational beam.	Pilot and copilot	
D	Marker Beacon Set AN/ARN-12				
	Radio Altimeter AN/APN-1	Indicators on instrument panel.	Indicates distance in feet from airplane to ground.	Pilot	Airplane to ground or water.
	Glide Path Approach Radio AN/ARN-5A	Indicator on instrument panel. Control panel on pedestal.	Indicates glide angle for landing	Pilot and copilot	15 miles
	Localizer Approach Radio RC-103A	Indicator on instrument panel. Control panel on pedestal.	Indicates lateral alignment with runway	Pilot	15 miles
	Static Dischargers AN/ASA-3	Units on upper rudders and outboard ailerons.	Reduces radio static noises.		
	Emergency (Dinghy) Radio AN/CRT-3	Stowed in life raft compartment.	Emergency transmitter for life raft.	Crew	100 miles on low frequency (500 KC) 1000 miles on high frequency (8280 KC)
	Loran Set AN/APN-9	Navigator's Station.	Indicates mapping fixes for distance, location, and courses.	Navigator	Day-700 miles, Night-450-1400 miles, depending on type of operation.
GE	Radar Beacon Set AN/APN-12	Navigator's Station.	Acts as radar beacon and interrogator-responsor.	Navigator	150 miles
C	IFF SET SCR-695B	Controls at radio operator's station.	Identifies aircraft as friend or foe.	Radio operator	Line-of-sight

4-51. TABLE OF COMMUNICATIONS AND ELECTRONIC EQUIPMENT. (Airplane Group N)

EQUIPMENT	LOCATION	FUNCTION	PRIMARY OPERATOR	RANGE
Interphone equipment AN/AIA-2A	Control boxes at pilot's, copilot's and radio operator's, navigator's and jumpmaster stations.	Inter-communication for the crew.	Crew members	Crew stations within the airplane
V.H.F. Command Set AN/ARC-1	Control panel on pilot's radio control panel.	Short range, two-way voice and code communication.	Pilot and copilot	Line-of-sight
Liaison Set AN/ARC-8	Radio operator's rack.	Long range, two-way voice and code communication.	Radio operator	200-2500 miles, depending on operating frequency and time of day.
Radio Compass Set AN/ARN-7 (No. 1)	Indicator on instrument panel and at navigator's station; control panel on pedestal and navigator's rack.	Receives voice and code signals for direction homing and bearing.	Pilot and navigator	20-200 miles, depending on frequency used and time of day.
Radio Compass Set AN/ARN-7 (No. 2)	Indicator on instrument panel, control unit on pedestal.	Receives voice and code signals for direction homing and bearing.	Copilot	20-200 miles, depending on frequency used and time of day.
Marker Beacon Set AN/ARN-8	Indicator light on instrument panel.	Receives location marker signal on navigational beam.	Pilot	
Radio Altimeter AN/APN-1	Indicator on instrument panel.	Indicates distance in feet from airplane to ground.	Pilot	Airplane to ground or water.
Glide Path Approach Radio AN/ARN-5A	Indicator on instrument panel; control panel on pedestal.	Indicates glide angle for landing.	Pilot	15 miles
Localizer Approach Radio RC-103A	Indicator on instrument panel; control panel on pedestal.	Indicates lateral alignment with runway.	Pilot	15 miles
Static Dischargers AN/ASA-3	Units on upper rudders and outboard ailerons.	Reduces radio static noises.		
Emergency (Dinghy) Radio AN/CRT-3	Stowed in life raft compartment.	Emergency transmitter for life raft.		100 miles on low frequency, 1000 miles on high frequency.
Loran Set AN/APN-4	Navigator's station.	Indicates mapping fixes for distance, location, and courses.	Navigator	Day-700 miles, night 450-1400 miles, depending on type of operation.
IFF Set AN/APX-2A	Controls on pedestal and radio operator's station.	Identifies airplane as friend or foe.	Pilot, copilot and radio operator.	Line-of-sight
Radio Range Set AN/ARC-5	Control panel on pedestal.	Low frequency range receiver.	Pilot and copilot	Long range
Liaison Set AN/ARC-2	Control panel on pedestal and navigator's station.	Long range two-way voice and code communication.	Pilot, copilot and navigator.	Long range depending on time of day.

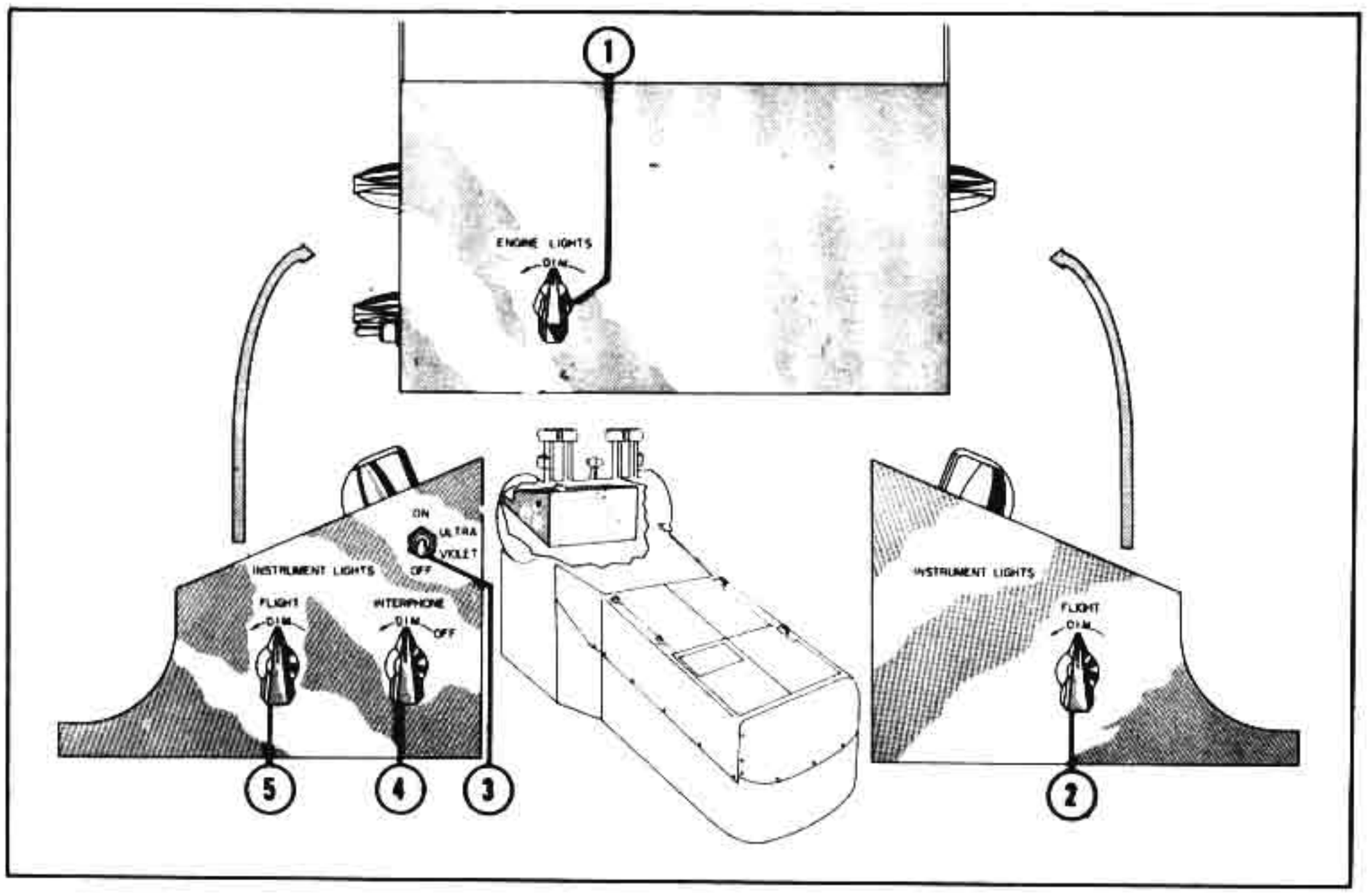


Figure 4-4. Instrument Lights Control Panel (Airplane Groups M and N)

1. Engine instrument lights rheostat
2. Flight instrument lights rheostat (Copilot's)
3. Instrument lights control switch
4. Interphone panel lights rheostat
5. Flight instrument lights rheostat (Pilot's)

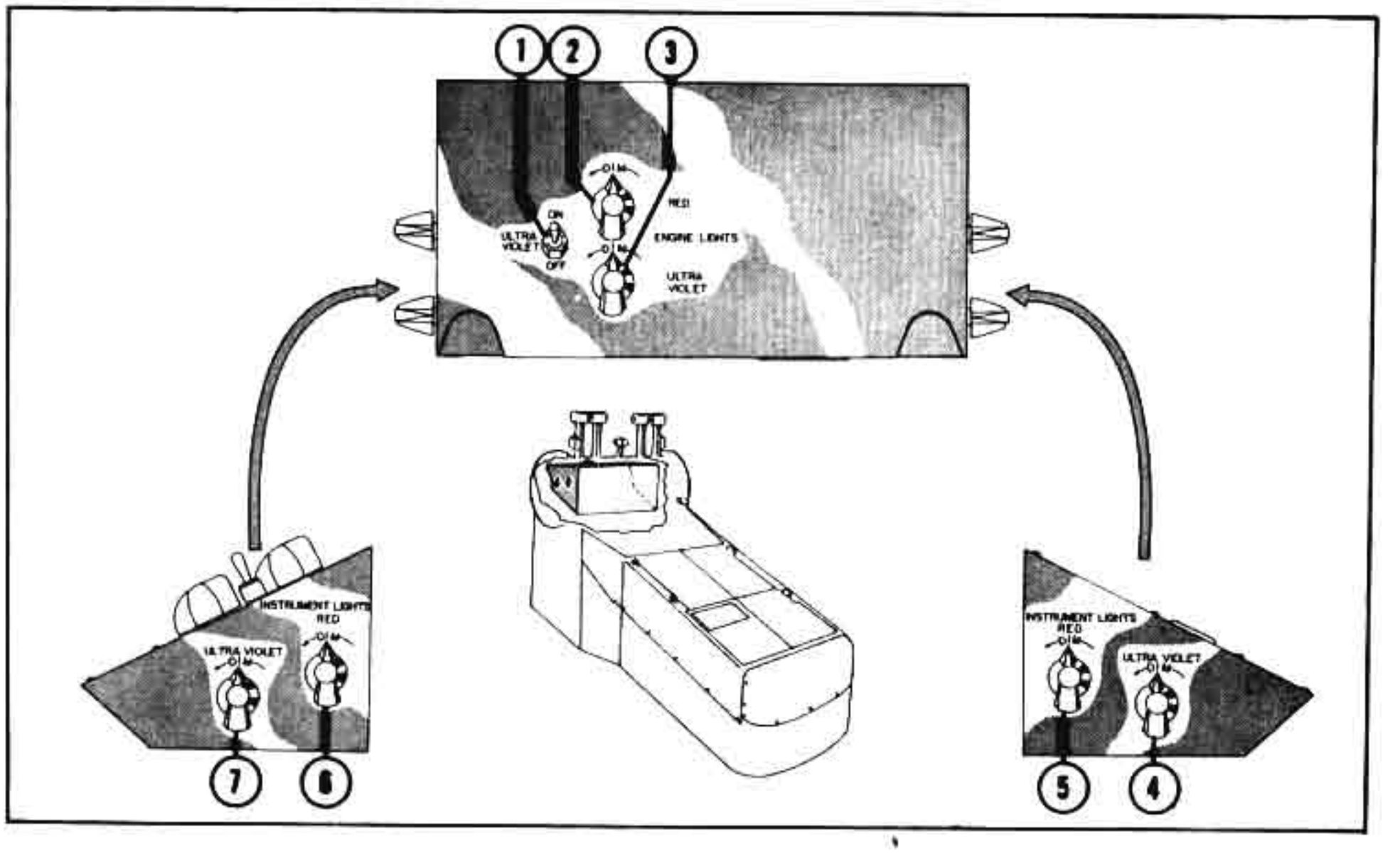


Figure 4-4A. Instrument Lights Control Panel (Airplane Group O)

1. Instrument lights control switch
2. Engine instrument red lights rheostat
3. Engine instrument ultra violet lights rheostat
4. Flight instrument ultra violet lights rheostat (Copilot's)
5. Flight instrument red lights rheostat (Copilot's)
6. Flight instrument red lights rheostat (Pilot's)
7. Flight instrument ultra violet lights rheostat (Pilot's)

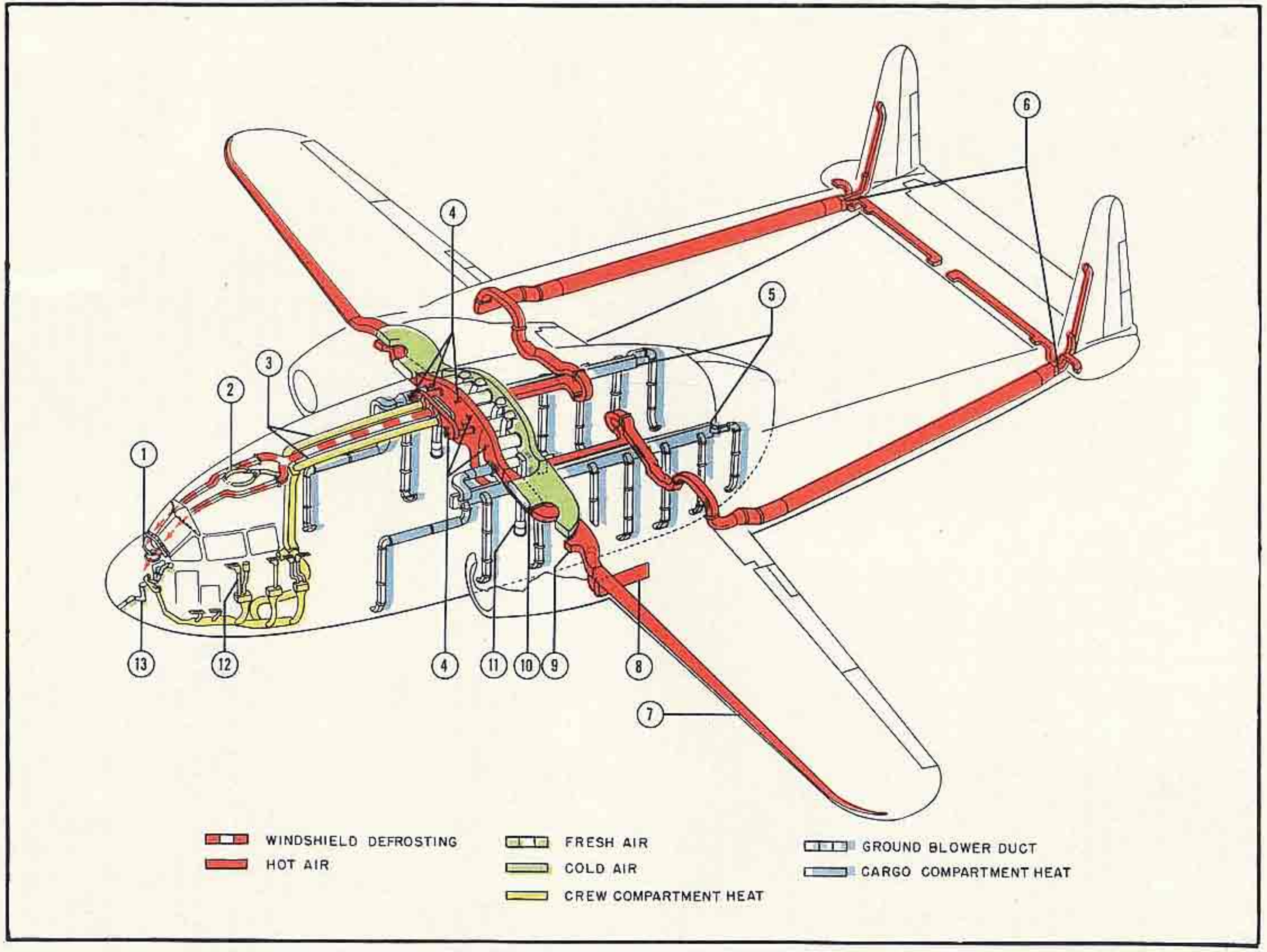


Figure 4-5. Heating, Ventilating, and Anti-Icing System

1. Windshield blower
2. Astrodome outlets
3. Crew compartment heating and ventilating ducts
4. Heater cold air shut-off valve controls
5. Cargo heat ducts
6. Tail anti-icing ducts
7. Wing anti-icing ducts
8. Oil lines preheat muff
9. Engine accessory compartment preheat
10. Ram air scoop
11. Ground blower
12. Window de-frosting
13. Fresh air duct

4-52. LIGHTING SYSTEM.

4-53. EXTERIOR LIGHTS.

4-54. NAVIGATION LIGHTS. The navigation lights consist of a red light on the left wing tip, a green light on the right wing tip, one yellow and one white light on the left aft boom, and a white light on the top and bottom of the fuselage. Wing and tail lights are controlled by a switch (32, figure 1-10) on the overhead panel providing "BRIGHT," "DIM," and "OFF" positions. Fuselage lights are controlled by a similarly operated switch (31, figure 1-10). Flasher operation of all navigation lights is controlled by a two position switch (29, figure 1-10) with "FLASH" or "STEADY" positions. In addition, flasher operation may be coded through the use of the code selector switch. To operate, place primary navigation light control switches to the required position, "DIM" or "BRIGHT." Next, set flasher switch to "FLASH." Set code selector switch (24, figure 1-10) to desired letter and place code selector power switch (27, figure 1-10) "ON." A flasher indicator light (26, figure 1-10) on the overhead panel provides a check on the flasher operation by duplicating letter flashed by navigation lights.

4-55. PASSING LIGHT. A passing light is mounted on the leading edge of the left wing, which is controlled by a switch (28, figure 1-10) on the overhead panel.

4-56. FORMATION LIGHTS. A total of nine blue formation lights are installed on top of the wing, fuselage, nacelle, and stabilizer in such a manner as to form a "T." These lights are operated by a switch (30, figure 1-10) on the overhead panel and can be turned to "ON," "OFF," or "DIM."

4-57. LANDING LIGHTS. A fixed landing light is installed in the leading edge of each wing outer panel. A transparent cover, conforming to the contour of the wing leading edge, is mounted over each light, and ventilation is provided to eliminate condensation on the cover glass. A shield is installed just inboard of each light to prevent glare in the crew compartment. Each landing light is controlled by a switch (2, figure 1-5) on the pilot's switch panel.

4-58. TAXI LIGHTS.

DELETED.

4-59. INTERIOR LIGHTS.

4-60. CREW COMPARTMENT.

K a. The single dome light located in the crew compartment is controlled by a rheostat (8, figure 1-10) located on the overhead panel.

N b. The dome light located in the crew compartment is of the floodlight type with a red and a clear lamp. The lamps are controlled by two rheostats (8, 8A, figure 1-10A) located on the overhead panel.

I L

4-61. ACCESSORY EQUIPMENT COMPARTMENT. Three dome lights are located in the accessory equipment compartment and are controlled by an "ON-OFF" switch (3, figure 1-9) placed next to the radio operator's work table, near the crew compartment entrance hatch.

4-62. LAVATORY. Illumination for the lavatory is furnished by a dome light controlled by a built-in "ON-OFF" switch.

4-63. NOSE WHEEL WELL. A dome light with built-in "ON-OFF" switch provides light for nose wheel well.

4-64. NOSE COMPARTMENT. The fuselage nose compartment is lighted by a dome light which is controlled by a built-in "ON-OFF" switch.

4-65. CARGO COMPARTMENT.

a. Five dome lights mounted on each side of the cargo compartment provide light for the whole compartment. All 10 lights are controlled by an "ON-OFF" switch (2, figure 4-6) and dimming rheostat (1, figure 4-6) located on the cargo compartment forward bulkhead. In addition to the dome lights, four floor lights are located along each side of the compartment, and are controlled by a switch (1, figure 4-7) on the jumpmaster's control panel. K N

b. Seven dome lights mounted on each side of the top of the cargo compartment provide light for the whole compartment. All 14 lights are controlled by an "ON-OFF" switch (2, figure 4-6) and dimming rheostats (1, 1A, figure 4-6) control the intensity of each side, these controls being located on the cargo compartment forward bulkhead. In addition to dome lights, four floor lights are located along each side of the compartment. These lights are controlled by a switch (1, figure 4-7) on the jumpmaster's control panel. L

4-66. INSTRUMENT PANEL.

a. Eleven ultraviolet lights are used for illumination of the instrument panel. Five of these lights are located on the instrument panel anti-glare shield, two on each control column, and two on the forward part of the control pedestal. These lights are controlled by an "ON-OFF" switch (3, figure 4-4) and three rheostats, located on the instrument lights control panel. The intensity of illumination for the flight and engine instruments is controlled by rheostats (1, 2, 5, figure 4-4). Also two spotlights with built-in "ON-OFF" switches and flexible cord are provided for auxiliary lighting in the crew compartment. Mounts for these lights are provided above the windshield, on the right and left side of the overhead panel, and on the instrument panel anti-glare shield. M N

b. Eleven ultraviolet and ten red lights are used for illumination of the instrument panel. Five ultraviolet and six red lights are located on the instrument panel anti-glare shield, two ultraviolet lights on each control column, and two ultraviolet and four red lights on the forward part of the control pedestal. The ultraviolet lights are controlled by an "ON-OFF" switch (1, figure 4-4A) and three rheostats (3, 4, 7, figure 4-4A) located on the instrument lights control panel. The red lights are controlled by three rheostats (1, 5, 6, figure 4-4A) located on the instrument lights control panel. Also two spotlights with built-in "ON-OFF" switches and flexible cord are provided for auxiliary lighting in the crew compartment. Mounts for these lights are provided above the windshield and on the right and left side of the overhead panel. O

4-67. CONTROL PEDESTAL.

a. Illumination for the control pedestal is provided by light diffused through a plexiglas plate on the control quadrant and pilot's switch panel and by shielded lights on the radio control panel. These lights are controlled by a rheostat (7, figure 2-5) located on the pilot's switch panel. M N

b. Illumination for the control pedestal is provided by light diffused through a plexiglas plate on the control quadrant and pilot's switch panel and by two spotlights on the overhead panel for illumination of the radio control panel. These lights are controlled by a rheostat (7, figure 1-5) located on the pilot's switch panel. O

4-68. OVERHEAD PANEL. Light from 37 bulbs diffused through a plexiglas plate provides illumination for the overhead panel. These lights are controlled by a rheostat (7, figure 1-10) located on the overhead panel.

4-69. COMPASS. The compass light, located in the compass, is controlled by a rheostat (10, figure 1-10) on the overhead panel.

4-70. NAVIGATOR'S AND RADIO OPERATOR'S WORK TABLE. Illumination for the navigator's and radio operator's work table is provided by three spotlights with built-in "ON-OFF" switches and flexible cords located above the work table. The navigator is also provided with a full swivel light which is controlled by a rheostat located beside the light.

4-71. INTERPHONE PANEL.

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a. Two lights, one each on the pilot's and copilot's interphone panel, are controlled by an "ON-OFF" switch (3, figure 4-4) and a rheostat (4, figure 4-4) located on the left side of the instrument lights control panel.

b. Two lights, one each on the pilot's and copilot's interphone panel, are controlled by rheostats (2A, figure 1-14 and 2A, figure 1-15) located adjacent to the interphone panel.

4-72. INTERAIRCRAFT SIGNAL LIGHT. An interaircraft signal light is located on the right side of the crew compartment. An electrical outlet for plugging this light in is provided on the forward part of the navigator's work table.

4-73. HEATING, VENTILATING, AND ANTI-ICING SYSTEM. (See figure 4-5.)

4-74. Hot air for heating the crew and cargo compartments, windshield anti-icing, and for anti-icing the flight surfaces, is provided by eight internal combustion-type gasoline heaters, located in the accessory equipment compartment, just aft of the crew compartment. The master controls for the heating and anti-icing systems are located on the pilot's overhead panel, and consist of one heater master switch and a series of eight individual switches for heaters. In addition, an indicator light is situated adjacent to each individual heater switch, and will glow when affected heater switch is on but heater is not operating. Any desired combination of heaters may be obtained by these switches, or all heaters may be shut off by the heater master switch. Separate, manually operated, air flow controls regulate the flow of air from each heater. These control valves allow the flow of cold air to be shut off when any individual heater is inoperative so that the cold air will not dilute the system when maximum heat is needed. Two automatically controlled blowers are installed to provide air to heaters on the ground, making heater operation possible under such conditions. The system also incorporates overheat switches to shut off heater fuel supply and ignition automatically in case of an excessive rise in temperature. A low temperature safety switch in the exhaust system shuts off heater fuel supply and ignition in case the heater fails to ignite. Fire warning devices are installed in the heater compartment to give the pilot a warning of excessive temperature changes. A fire extinguishing system for the heaters is controlled by a switch on the overhead panel.

4-75. CREW COMPARTMENT HEAT. Heated air is directed to outlets along the right and left side of the crew compartment. The flow of air is controlled by the cockpit air switch (14, figure 1-10) on the overhead panel. Operation of the cockpit air switch will also defog the side windows.

4-76. CARGO COMPARTMENT HEAT. Heated air is supplied to the cargo compartment through direct ducting from the internal combustion heaters. It is controlled by the following switches: a cargo heat master switch (11, figure 1-10) with "ON" and "OFF" positions, located on the overhead panel; and by individual cargo heat switches (3, figure 4-6) with "OFF," "HOT," and "COLD" position, located on the cargo compartment forward bulkhead. However, the individual cargo heat switches will turn on the cargo compartment heated air flow only if the cargo heat master switch on the overhead panel is turned on. The pilot may shut off the cargo heat by turning the cargo heat master switch to "OFF."

4-77. VENTILATION. The airplane may be ventilated by turning master heater switch (18, figure 1-10) "ON" and individual heater switches (17, figure 1-10) "OFF." The ground blowers supply air for heating when airplane is not in flight. Circulating air flow is controlled by cockpit air and cargo heat switches. Fresh air is supplied to pilot and copilot through fresh air ducts forward of the control pedestal.

4-78. WINDSHIELD. The two front windshield panels consist of double window panes, between which hot air is passed. An automatic temperature control system

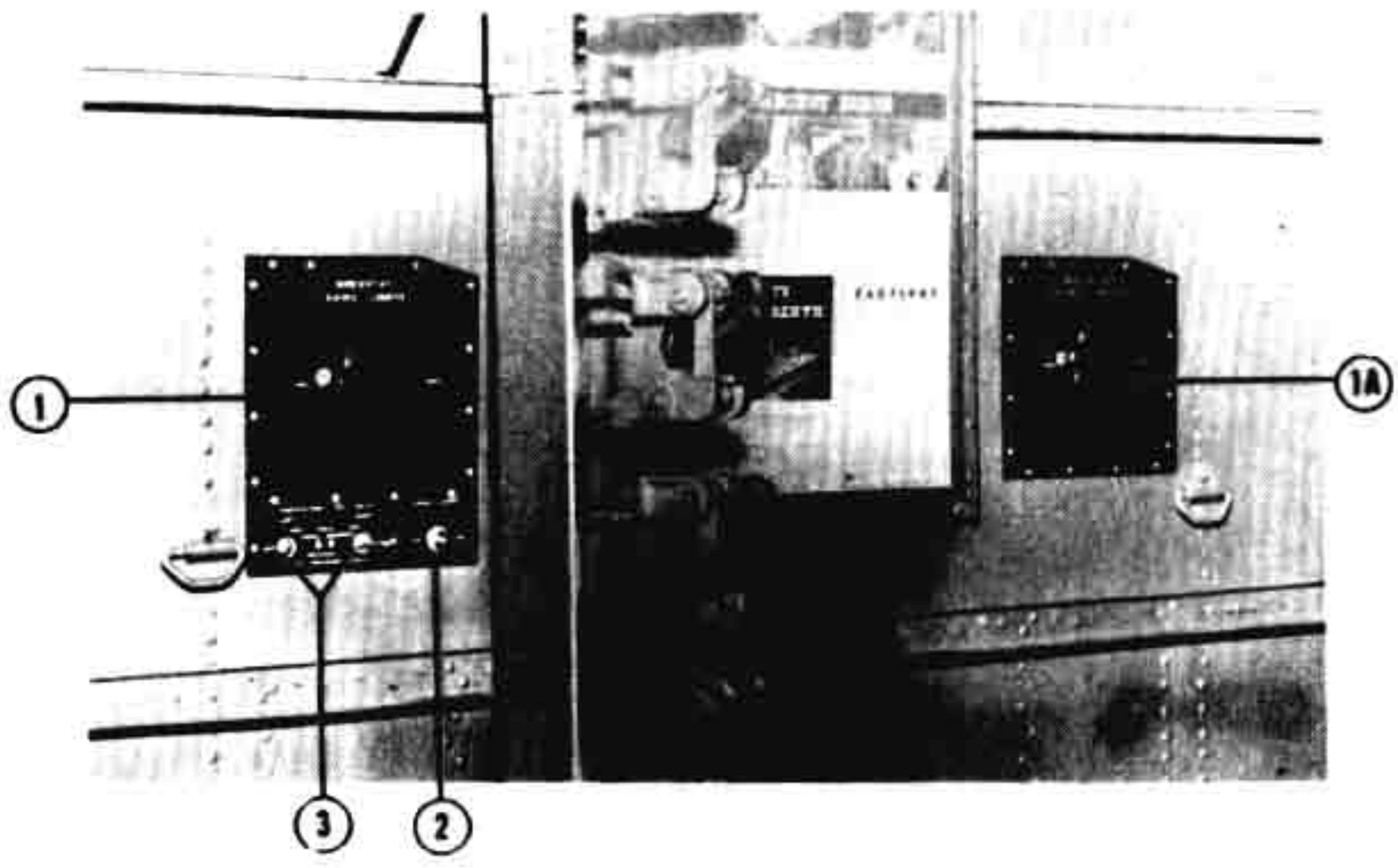


Figure 4-6. Cargo Heat and Dome Light Controls

1. Cargo dome lights rheostat
1A. Cargo dome lights rheostat (Airplane Group L)
2. Cargo dome lights switch
3. Cargo heat control switch

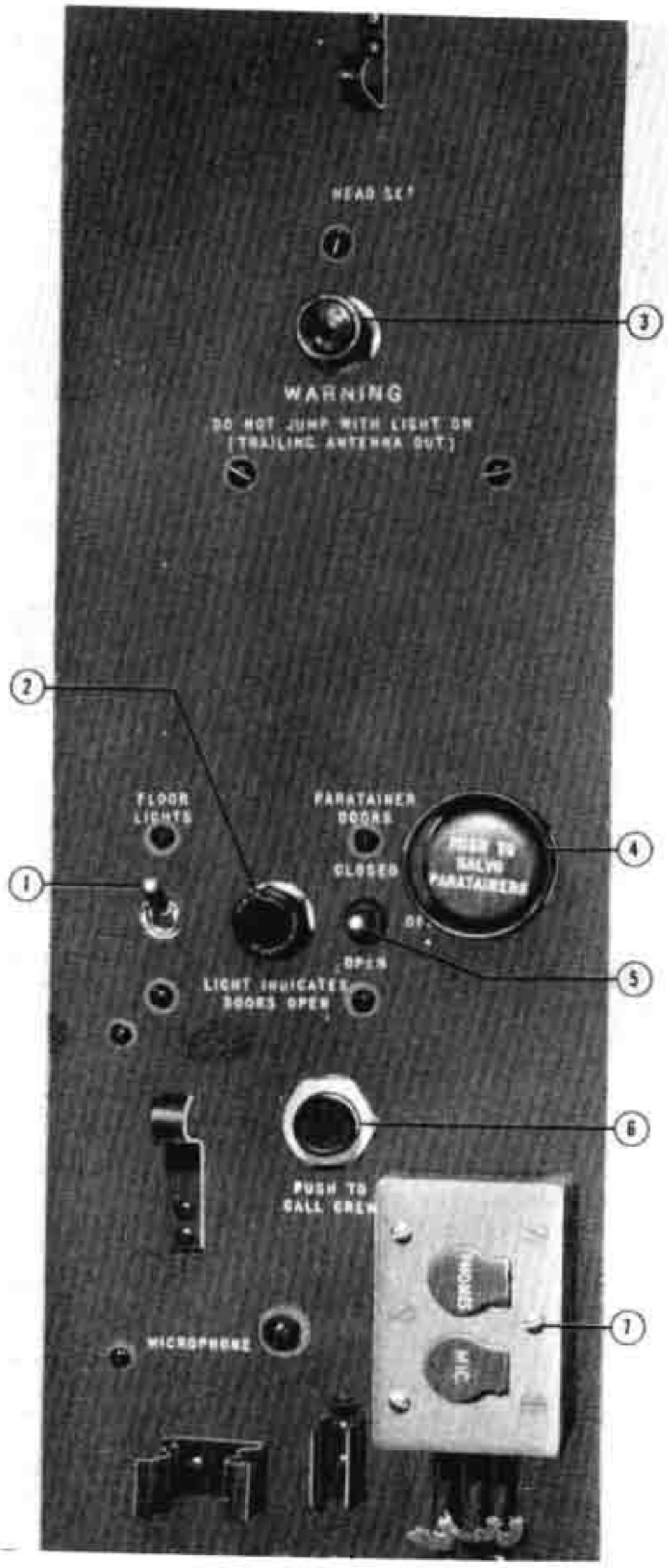


Figure 4-7. Jumpmaster's Panel (Airplane Group A)

1. Cargo compartment floor lights switch
2. Aerial delivery doors indicator light
3. Trailing antenna warning light
4. Aerial delivery salvo switch
5. Aerial delivery doors switch
6. Intercall signal switch
7. Interphone call box

is provided to regulate windshield air, which is drawn through the double panes by a continuously operating electrical blower, when the windshield anti-icing switch (15, figure 1-10) is turned "ON."

4-79. SIDE WINDOWS. The side windows are defogged by means of heated air outlets directly beneath each window. These outlets direct heated air against windows, and the system is controlled by the cockpit air switch.

4-80. ASTRODOME. A fixed distributing system, through which hot air is forced, accomplishes defogging of the astrodome. The system is controlled by the cockpit air switch on the overhead panel.

4-81. PITOT-STATIC TUBES. Two pitot-static tubes, one on each side of the fuselage just forward of the main entrance door, contain electrical heating elements which prevent formation of ice around the tube openings. A single pitot heater switch (20, figure 1-10) controls the heating elements.

4-82. PROPELLERS. The de-icing system for the propellers is comprised of electrical heating elements imbedded in the leading edge of the propeller blades. The power supply is controlled by a propeller de-icing switch (21, figure 1-10) on the overhead panel.

4-83. TORQUEMETER PRESSURE LINE HEATER. The portion of the torquemeter pressure line located forward of the firewall is heated by electrical heating element. The heating element is controlled by a switch (21A, figure 1-10) on the overhead panel and the circuit is protected by a circuit breaker on the circuit breaker panel. C

4-84. FLIGHT SURFACES. An anti-icing system of the heated wing type is installed to heat the leading edge of all wing and tail surfaces. This system will defrost on the ground, as well as prevent ice formation during flight. Heated air is ducted from the heaters to the leading edge of the wing center section, outer panel, horizontal stabilizer, stabilizer tips, and vertical fins. The air flow to the wing and tail is controlled by a wing and tail anti-icing switch (23, figure 1-10) on the overhead panel. Two wing and tail anti-icing indicators (24, 25, figure 1-11) are provided on the instrument panel with "OVERHEAT," "NORMAL," and "OFF" positions.

4-85. TO START HEATERS.

a. Turn all heat control switches "OFF," for ground operation.

CAUTION

To preclude overheating when starting heaters in flight, turn cockpit and cargo heating systems to "HOT." After heaters are operating, select systems desired.

b. Heater air flow manual controls (4, figure 4-5) "ON."

c. Turn fuel selector switches (38, 47, figure 1-10) to desired tank. When operating heaters on ground without engines running, turn booster pump switches to "EMERGENCY ON" (mixture controls in "IDLE CUT-OFF"). APP must be running.

d. Heater master switch "ON."

e. Individual heater switches "ON."

f. Push in heater starter button (19, figure 1-10) and hold until individual heater indicator light (16, figure 1-10) goes out. Heater should start within a 1-minute period.

g. If it is desired to start additional heaters after system is in operation, turn individual heater switch "ON" and push starter button.

h. Turn heat control switches "ON" as desired.

CAUTION

If heater indicator light comes on after heater has been started, repeat starting procedure several times. If condition persists, determine malfunction.

4-86. TO OBTAIN AND REGULATE CREW COMPARTMENT HEAT.
a. Start heaters.
b. Hold cockpit air switch in the "HOT" position until a blast of hot air is felt at the outlets.
c. To regulate the degree of heated air, momentarily toggle the cockpit air switch to either "COLD" or "HOT" as desired.
d. To shut off air flow to crew compartment turn cockpit air switch to "OFF."

4-87. TO OBTAIN AND REGULATE CARGO COMPARTMENT HEAT.
a. Start heaters.
b. Move cargo heat master switch to "ON."
c. Hold cargo heat switches in the "HOT" position until a blast of hot air is felt at the outlets.
d. To regulate the degree of heated air, momentarily toggle the cargo heat switches to either "COLD" or "HOT" as desired.
e. To shut off air flow to cargo compartment turn cargo heat switches "OFF."

4-88. TO ANTI-ICE WING AND TAIL SURFACES.
a. Start heaters.
b. Place wing and tail anti-icing switch (23, figure 1-10) "ON."
c. For ground operation turn other systems off.

4-89. TO OBTAIN ENGINE ACCESSORY COMPARTMENT PREHEAT.
a. Start heaters.
b. Move engine accessory heat switch (13, figure 1-10) "ON."
c. After compartments are heated and engines are started, move switch to "OFF."
d. For ground operation turn other systems off.

WARNING

Accessory compartment heat must be turned "OFF" before attempting take off. Failure to do so may overheat engine accessories, causing damage and possible engine failure.

4-90. HEATER SHUT DOWN.
a. Individual heater switches "OFF."
b. Heater master switch "OFF."
c. Heat control switches as desired.

CAUTION

For heater shut down on the ground, allow heater master and heat control switches to remain in "ON" for 4 minutes to provide cooling of heaters.

4-91. NAVIGATION EQUIPMENT.

4-92. NAVIGATOR'S STATION. The navigator's station is directly aft of the copilot's seat, and is equipped with a work table and an instrument panel, on which are mounted the navigator's instruments. The location of the navigator is such that he may also view the instruments on the main instrument panel.

4-93. CHART AND MAP STOWAGE. A chart stowage tube is located above the navigator's instruments, and a map case is mounted on the side of the fuselage directly in front of the work table.

Figure 4-8. Jumpmaster's Panel (Airplane Group N)

1. Trailing antenna warning light
2. Cargo compartment floor lights switch
3. Aerial delivery doors indicator light
4. Aerial delivery salvo switch
5. Aerial delivery doors switch
6. Interphone jack box

4-94. ASTRO COMPASS. Provisions are made for installing an astro compass within the observation dome. The astro compass is located on a shelf above the radio rack.

4-95. NAVIGATOR'S OBSERVATION DOME. A circular observation dome, approximately 20 inches in diameter, is mounted on top of the crew compartment enclosure, directly above the navigator's and radio operator's stations along the centerline of the airplane.

4-96. DRIFTMETER. A driftmeter is installed next to the navigator's work table. The light in the driftmeter is controlled by a switch located on the navigator's oxygen panel.

4-97. AERIAL DELIVERY SYSTEM.

4-98. An automatic, electrically operated aerial delivery monorail system is employed to drop paracans from the cargo compartment through doors located in the forward section of the floor. The system is normally operated by a salvo switch (9, figure 1-10) on the overhead panel in the crew compartment, or by a similar salvo switch (4, figure 4-7) on the jumpmaster's control panel. When either of these buttons is pushed, the doors will open and the system will operate to drop as many as 20 delivery containers with a maximum weight of 500 pounds each. A separate switch (5, figure 4-7) is provided in the jumpmaster's panel to operate the doors independently of the delivery system, and an indicating light (2, figure 4-7) adjacent to the switch will glow when the doors are open, and go off when they are closed.

4-99. GLIDER TOWROPE RELEASE EQUIPMENT.

4-100. A glider towrope release handle (12, figure 1-14, and 5, figure 1-15) is mounted diagonally in front of the pilot's and copilot's seats on each side of the crew compartment. Directly above the handle is located a red indicator light. When either of these handles is pulled, the glider tow rope release cylinder at the aft end of the fuselage will open, releasing the tow rope. When the release jaws open, the red indicator light will go out, indicating that the tow rope has been released.

4-101. CARGO LOADING EQUIPMENT.

4-102. BLOCK AND TACKLE FITTING. A swivelling hitch for block and tackle, attached either at the front or rear of the cargo compartment, is provided and can be secured to the tie-down fittings at those locations.

4-103. CARGO TIE-DOWN FITTINGS. A total of 77 cargo tie-down fittings are installed on the cargo compartment floor. The spacing of these fittings allows equipment of various sized to be secured to the floor.

4-104. LOADING RAMPS. Two light, metal, treaded loading ramps with a load limit of 9400 pounds per ramp, are provided to facilitate the loading of wheeled vehicles through the aft cargo doors. Provisions are made for attaching the ramps to the cargo door sill. Rings installed in the ramps permit them to be lashed to the cargo floor when in flight. The ramps, when not in use, are lashed beneath the paratroop seats along either side of the cargo compartment except when paratroops or personnel are being carried. At this time the ramps are lashed down along the center of the cargo compartment.

4-105. CARGO LOADING DOORS. Two hinged cargo doors form the aft contour of the fuselage. When these doors are opened, a clear loading space, 8 feet high and 9 feet 2 inches wide, is made available. Stops prevent the open doors from striking the booms, and a lock is provided to hold the doors open.

4-106. CARGO LOADING ROLLER. A roller is installed at floor level at the aft end of the cargo compartment to facilitate loading through the cargo doors.

4-107. LITTER EQUIPMENT.

4-108. A total of 35 litters can be carried when the airplane is used for ambulance purposes. The litters are mounted along the sides of the cargo compartment in tiers of five, with three tiers on the left side and four on the right. Posts, mounted vertically along the sides of the fuselage, and straps extending from roof beams to the floor, are used to secure the litters. The posts are installed permanently, and the straps are stowed when not in use.

EXTREME WEATHER Operation

SECTION V

5-1. COLD WEATHER.

5-2. PREPARATION FOR FLIGHT.

a. Check that the fuel and oil tank vents are free of ice.

CAUTION

Freezing of an, water droplets in the vent line will stop the flow of fuel, causing engine failure and possible collapsing of the tanks.

b. At outside air temperatures below 0 degrees F, (-18 degrees C) preheat the engines with the engine covers installed using at least one portable ground heater for each engine. The heater air flow should be directed to the front of the engine and to the engine accessory section. The following timetable lists the approximate time required to preheat the engines.

Free Air Temperature	Time Required to Preheat
-10 deg F (-23 deg C)	30 min
-20 deg F (-29 deg C)	1 hour
-30 deg F (-34 deg C)	1 hour 30 min
-40 deg F (-40 deg C)	2 hours
-50 deg F (-46 deg C)	2 hours 30 min
-60 deg F (-51 deg C)	3 hours

c. Check flight surfaces for freedom from frost, snow, or ice. Brush off all light snow and frost. Remove any accumulation of ice by direct flow of air from a portable ground heater. Wing and tail anti-icing system may be turned on while on the ground to remove frost from the leading edges of the flight surfaces.

CAUTION

Do not chip away ice as this may damage airplane.

d. At outside air temperatures below -10 degrees F, (-23 degrees C) use the oil immersion heaters and preheat the entire length of the engine "oil-in-line."

e. At outside air temperatures below -10 degrees F, (-23 degrees C) apply preheat directly to the auxiliary power plant.

f. At temperatures below -20 degrees F, (-29 degrees C) use preheat in the crew compartment and fuselage. Do not remove heater ducts until ready to start engines.

g. At temperatures below -30 degrees F, (-34 degrees C) apply preheat directly to the propeller domes and oil reservoir.

h. Check oil drains for fluid oil. If no flow is obtained, re-apply heat along the entire length of the "oil-in-line" from the tank to the engine.

5-3. STARTING ENGINES.

a. Pull propeller through 16 - 20 blades before engaging starter.

CAUTION

Make sure master battery and ignition switch is in "IGN-OFF - BAT-OFF."

b. Use external power for starting.

c. Prime 10 to 20 seconds before engaging the starter and continue to prime intermittently while the engine is being turned over until there is regularity of firing.

NOTE

If no oil pressure is obtained within 30 seconds, shut down engine and investigate. This will usually be caused by congealed oil or ice in the oil-drain, oil-in-line, or, oil-in-pressure line from engine to the oil pressure transmitter.

NOTE

Moisture forms quickly on spark plugs during cold starts. After three or four unsuccessful attempts, remove at least one spark plug from each of the engine cylinders and heat to dry points. Attempt to start engine immediately after replacing the spark plugs.

d. Keep carburetor air control "COLD."

5-4. ENGINE WARM UP.

a. If the outside air temperature is below 0 degrees F (-18 degrees C) use sufficient carburetor heat to improve vaporization and prevent the engine from backfiring.

b. At temperatures below 0 degrees F (-18 degrees C) use cowl flaps to maintain cylinder head temperatures of 150 degrees C to 180 degrees C.

c. Pitot-static tube heater switch "ON."

5-5. PROPELLER FEATHERING CHECK. Operate engines at 1500 rpm, momentarily push propeller feathering button and check for a drop of 200 to 300 rpm. Then pull out on propeller feathering button. If feathering action cannot be obtained, shut down engine and apply preheat to the propeller dome.

5-6. PROPELLER DE-ICING CHECK.

a. Run both engines at a minimum of 1500 rpm.

b. Observe left, right and APP ammeters; the total load should be evenly divided.

c. Turn the propeller de-icing switch to the "ON" position for two minutes and observe ammeters. A de-icing load gain of 275 amps should be approximately divided over the three ammeters.

5-7. TAKE OFF.

a. If external battery cart was used for starting engines, start auxiliary power plant before taxiing and allow APP to run for a few minutes after take off.

b. When outside air temperature is below 0 degrees F (-18 degrees C) carburetor heat may be applied to prevent rough engine operation and improve vaporization and distribution of fuel.

NOTE

Icing of carburetor throttle valve will not be indicated by manifold pressure drop until automatic power control unit has opened carburetor throttle valve fully and blower is at full high rpm. Decrease in airspeed and decrease in torquemeter pressure due to increased supercharging horsepower is an indication of this condition. If it is suspected that icing conditions exist, check for carburetor throttle valve icing as follows: open throttle full, check manifold pressure obtained against chart value for selected rpm and altitude. If manifold pressure is below chart value apply carburetor heat.

c. Operate propeller feathering system (200 to 300 rpm drop) just before take off to insure the presence of warm oil in the propeller dome and reservoir.

d. Use cowl flaps during engine run-up so as to maintain cylinder head temperatures of 150 degrees C to 180 degrees C.

e. Line up airplane on the runway and apply power holding the brakes until engines are operating smoothly. Maintain carburetor air temperatures between 15 degrees C and 20 degrees C during the take off run, or higher, if smoother engine operation is obtained

NOTE

Proper use of cowl flaps and carburetor heat will materially assist in normal engine performance and safe take off.

f. Do not attempt to take off with a frosted windshield.

WARNING

Never take off with snow, ice, or frost on the wings. (Even loose snow may not blow off.) Loss of lift and treacherous stalling characteristics will ensue.

5-8. IN FLIGHT.

a. After take off from a snow or slush-covered field, operate the landing gear and the wing flaps through several complete cycles to preclude their freezing.

b. Under icing conditions apply carburetor heat as required to prevent formation of ice. When cruising under severe icing conditions, use at least 75 percent of rated engine power with mixture control "NORMAL." Under all conditions operate engines with carburetor heat between 15 degrees C and 40 degrees C.

NOTE

At low-power settings, low cylinder head and carburetor air temperature will result in poor fuel vaporization and distribution, causing engine roughness and backfiring. Sufficient carburetor heat should be applied to obtain smooth engine operation. Placing mixture control in "RICH" will also correct rough engine operation, but proper use of carburetor heat is preferable to operation in "RICH" since a decrease in fuel consumption is obtained.

c. Operate de-icing and anti-icing systems as necessary to prevent formation of ice on propellers and lifting surfaces.

d. If it is necessary to transfer oil while in flight at temperatures below -20 degrees C (-4 degrees F) operate wing anti-icing system for approximately 15 minutes before transferring so as to warm oil in the transfer line sufficiently to permit oil flow C

5-9. LANDING.

a. Start APP three minutes before landing.

b. When letting down for landing, watch engine temperatures closely. Atmospheric temperature changes are common in winter and ground temperatures may be 15 degrees C to 30 degrees C colder than at altitude. Therefore maintain cylinder head temperatures above 100 degrees C, and oil temperatures above 30 degrees C. Also maintain considerable power and keep the cowl flaps closed.

WARNING

Do not fail to use sufficient carburetor heat during approach and landing. If this is not done, engine may miss or die when power is applied.

c. Carburetor air control in "HOT" position while taxiing.

5-10. OIL DILUTION.

a. Allow oil to cool to 50 degrees C before diluting. Dilute engine oil in accordance with the following table if expected temperature is 4 degrees C (40 degrees F) or below.

Expected Temperature	Dilution Time
4 deg C to -12 deg C (40 deg F to 10 deg F)	1 to 3 min
-12 deg C to -29 deg C (10 deg F to -20 deg F)	3 to 6 min
-29 deg C to -46 deg C (-20 deg F to -50 deg F)	6 to 9 min

b. Idle engines at 1200 rpm while diluting and watch oil pressure carefully when diluting for five minutes or more. If oil pressure becomes dangerously low, shut down engine and allow to cool before diluting again.

c. Observe fuel pressure for drop in order to be sure that dilution solenoid is operating.

d. Hold dilution switches "ON" until propellers stop turning.

WARNING

Dilution solenoid may stick in the open position subsequent to diluting. If this occurs, dilution will continue when the engines are started again. Observe the fuel and oil pressures closely when starting engines, and before take off, be sure that dilution solenoid is closed. If any spewing of oil, low oil pressures, or high cylinder head temperatures are noted after take off, land and investigate cause of trouble.

NOTE

As a result of daily dilution, carbon and sludge deposits in engine are noticeable increased. Therefore, it is advisable to remove all engine oil screens every 10 to 15 hours and thoroughly clean them.

5-11. PARKING.

a. When the airplane is parked for the night, leave some aperture, such as a side window, partly open. If this is not done, lack of air circulation within the compartment will cause frosting of the windows.

b. Leave brakes off. If brakes are on, the formation of ice may lock the control so that it cannot be operated.

c. Wipe shock struts carefully with hydraulic oil. It is advisable to keep shock struts exceptionally clean as the slightest scarring of the "O" ring seals in the struts will result in leakage due to low temperatures.

d. Always leave the airplane parked with full fuel tanks. This prevents the condensation of moisture on the walls of partially filled fuel tanks.

e. When placing airplane into, or removing from a hangar, open as many windows as possible to aid in equal warming or cooling of the interior. Rapid cooling or heating will cause sufficient differential contraction of the transparent areas to cause cracking.

5-12. PREVENTION AND REMOVAL OF ICE, SNOW, OR FROST FORMATION.

a. Place covers and tarpaulins over wings, tail, windshields, and propellers to prevent formation of ice, snow, or frost.

5-13. SUMP DRAINAGE. Drain fuel and oil tank sumps frequently. Under prolonged freezing conditions a small amount of ice or snow gets into the fuel tanks each time the airplane is serviced. When there is a sufficient rise in temperature, because of placing the airplane in a hangar or warm weather, these crystals melt, resulting in water in the systems. Regular and frequent drainage of the sumps, especially under thawing conditions, is the best method of preventing ice forming in the fuel and oil lines when the airplane is again subjected to freezing weather operations.

5-14. HOT WEATHER.

5-15. PREPARATION FOR FLIGHT.

a. If operating the airplane in sandy country, ascertain that the carburetor air filters and the instrument filters have been thoroughly cleaned for each flight.

b. Check to see that hatch seals and tires are not blistered or show other evidences of deterioration.

5-16. ENGINE WARM UP.

NOTE

During all ground operations in sandy or dusty regions, keep carburetor air control in "FILTERED" position.

a. Keep time of warm up and engine tests to a minimum, with engines headed into the wind for better cooling, as cylinder head temperatures will rise very rapidly during warm weather.

b. If on sandy or dusty ground, conduct warm-up and engine tests with the airplane on landing mats or any hard natural surface swept clean of sand and dust. This will help avoid sand pitting of the propellers and airplane surfaces. Do not operate engines to the windward of other airplanes parked on the ground.

5-17. TAKE OFF.

a. Carburetor air control in the "FILTERED" position.

b. If the ground is sandy or dusty, avoid taking off in the wake of another airplane.

NOTE

Remember that take-off distances will be longer because the air is thinner during warm weather operations.

5-18. IN FLIGHT.

5-19. Do not climb the airplane at less than the flying speed specified in the Take-Off, Climb and Landing Chart, Appendix I, as low flying speed will result in higher than normal cylinder head temperatures.

5-20. LANDING.

5-21. True airplane stalling speed will be greater and additional distance will be required for landing, because hot air is less dense than cold air.

5-22. PARKING.

a. If operating in sandy country, close and cover all openings to keep sand out, particularly pitot tubes and engines, including carburetor intakes, oil cooler ducts, breathers, and engine exhaust ports. Cover windshield and all windows to prevent sand scratching.

b. Keep canvas covers on the windshield whenever the airplane is parked in the sun.

c. If blowing sand does not present a hazard, keep main entrance door, cargo doors and crew compartment hatches open to permit air circulation.

OPERATING Charts

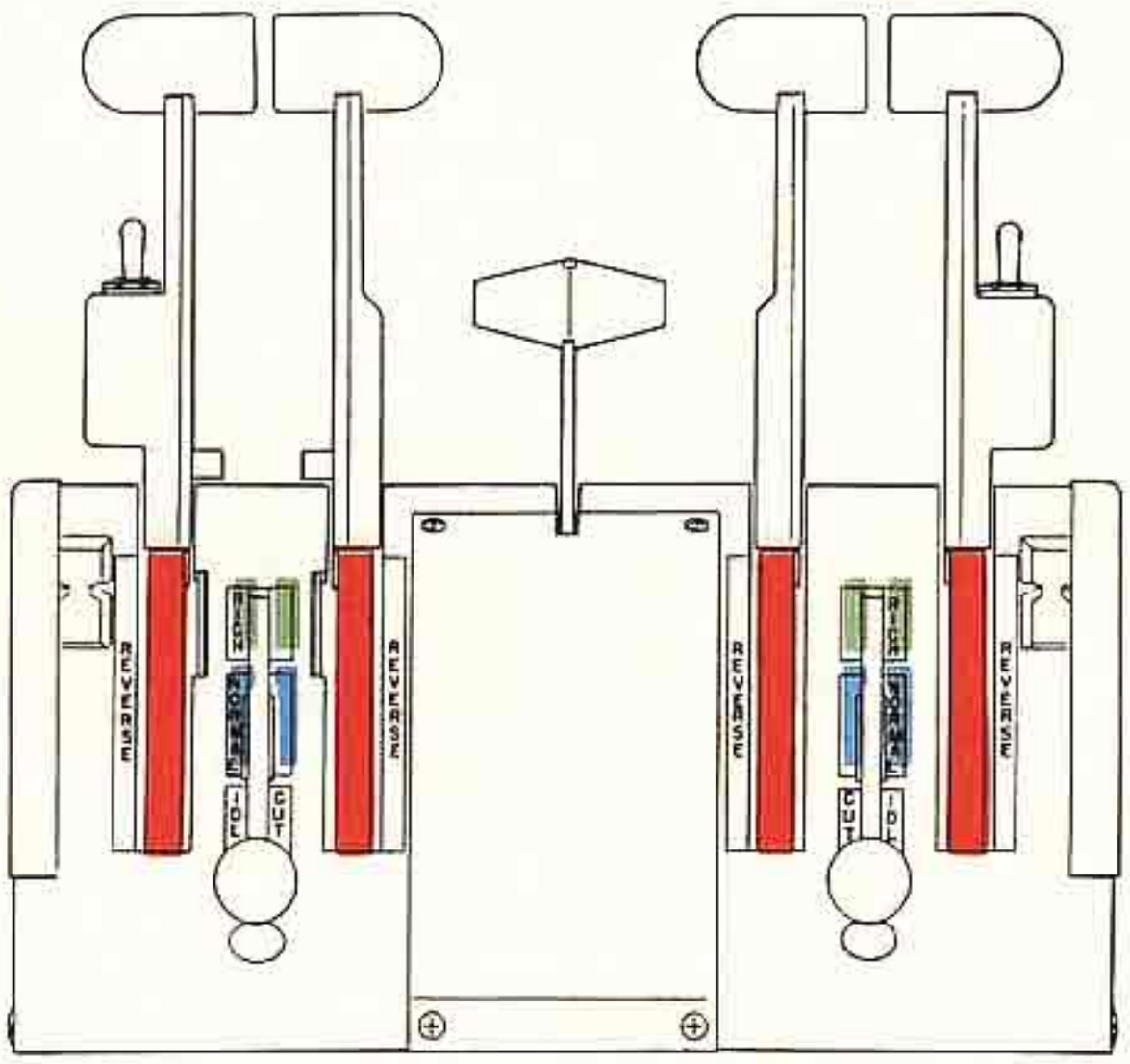
APPENDIX I

AIR SPEED INSTALLATION CORRECTION TABLE			
GEAR AND FLAPS EXTENDED			
I.A.S.		Correction	
MPH	KNOTS	MPH	KNOTS
100	87	-2	-1-3/4
120	104	-3-1/2	-3
130	113	-4	-3-1/2
140	122	-4-1/2	-4
150	130	-5	-4-1/2
160	139	-5-1/2	-4-3/4
GEAR AND FLAPS RETRACTED			
I.A.S.		Correction	
MPH	KNOTS	MPH	KNOTS
130	113	-2	-1-3/4
140	122	-2-1/2	-2
160	139	-3-1/2	-3
180	156	-4-1/2	-4
200	174	-5	-4-1/2
220	191	-6	-5
240	208	-6-1/2	-5-1/2

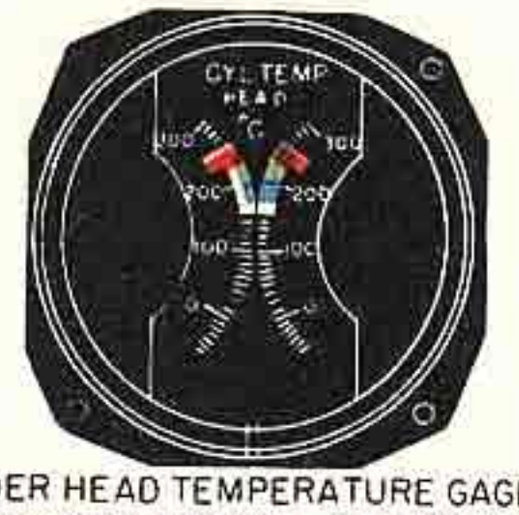
MANIFOLD PRESSURE GAGE
- 22" MINIMUM PERMISSIBLE FOR FLIGHT
- 22" TO 50" NORMAL PERMITTED
- 50" MAX CONTINUOUS - NORMAL OR RICH (OPERATION ABOVE THIS PRESSURE LIMITED TO 5 MIN IN RICH)
- 61.5" TAKE OFF

TACHOMETER
- 1800 TO 2550 NORMAL PERMITTED
- 2550 MAX CONTINUOUS - NORM OR RICH (OPERATION AB THIS RPM LIMITED TO 5 M IN RICH)
- 2700 MAXIMUM

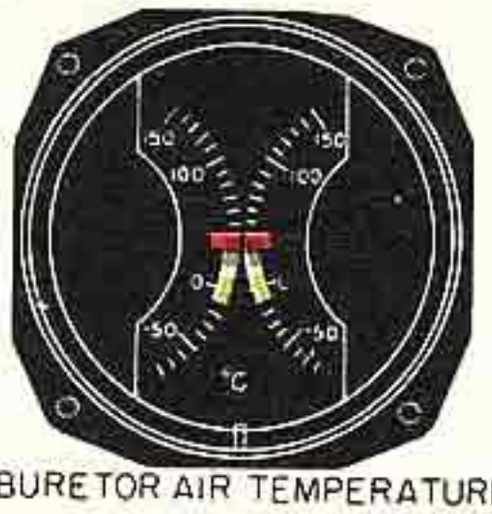
FUEL GRADE 115/145



CONTROL QUADRANT
- PROPELLER REVERSE PITCH RANGE
- ALL INDICATORS IN BLUE-NORMAL PERMITTED
- WHEN ANY INDICATOR MOVES ABOVE BLUE- RICH REQUIRED



CYLINDER HEAD TEMPERATURE GAGE
- 150°C TO 232°C NORMAL PERMITTED
- 232°C TO 249°C RICH REQUIRED
- 249°C MAXIMUM (OPERATION AT THIS TEMPERATURE LIMITED TO 5 MIN.)



CARBURETOR AIR TEMPERATURE GAGE
- -10°C TO +15°C DANGER OF ICING
- 15°C TO 40°C CONTINUOUS OPERATION
- 40°C MAX-DANGER OF DETONATION

Figure A-1. (Sheet 1 of 2 Sheets) Instrument Range Markings (Airplane Group C)

OIL PRESSURE
- 50 PSI - MIN FOR FLIGHT
- 50 TO 85 PSI - CONTINUOUS OPERATION
- 100 PSI - MAXIMUM

OIL TEMPERATURE
- 40°C - MIN FOR FLIGHT
- 65°C TO 80°C CONTINUOUS OPERATION
- 100°C - MAXIMUM

FUEL GRADE 115/145

FUEL PRESSURE
- 24 PSI - MIN FOR FLIGHT
- 24 TO 26 PSI - CONTINUOUS OPERATION
- 35 PSI - MAXIMUM

AIRSPEED INDICATORS
- 160 MPH - MAX FULL FLAPS OR LANDING GEAR
- 250-260 MPH - MAX DIVING (74,000 - 64,000 LB)
- 260 MPH - MAXIMUM DIVING

HYDRAULIC PRESSURE
- 800 PSI - ONE BRAKE APPLICATION REMAINING
- 980 TO 1160 PSI NORMAL PRESSURE
- 1250 PSI MAXIMUM PRESSURE

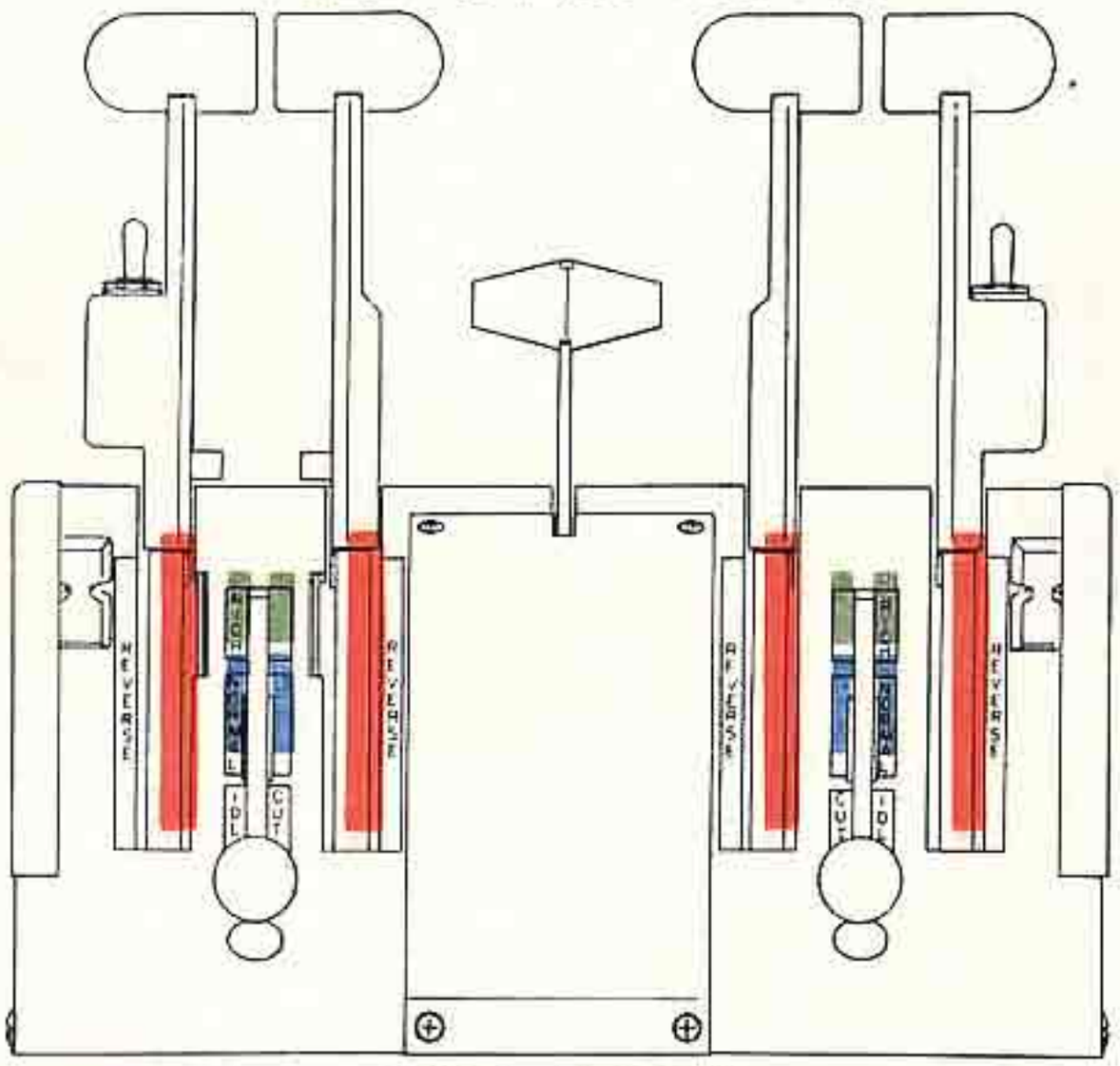
TORQUE METER
- 100 PSI MINIMUM FOR FLIGHT
- 100 TO 197 PSI NORMAL PERMITTED
- 197 PSI MAX CONTINUOUS - NORMAL OR RICH (OPERATION ABOVE THIS PRESSURE LIMITED TO 5 MIN IN RICH)
- 228 PSI MAXIMUM

Figure A-1. (Sheet 2 of 2 Sheets) Instrument Range Markings (Airplane Group C)

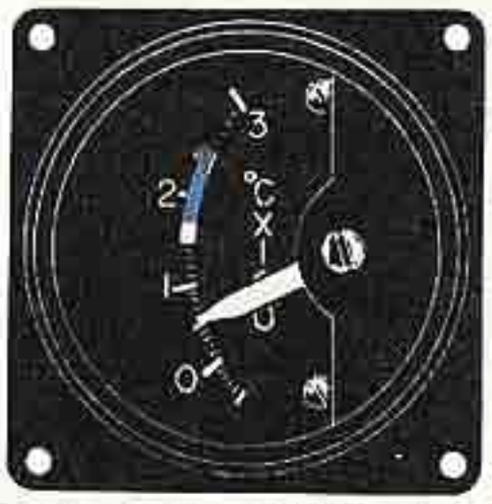
MANIFOLD PRESSURE GAGE
22" MINIMUM PERMISSIBLE FOR FLIGHT
22" TO 50" NORMAL PERMITTED
50" MAX CONTINUOUS - NORMAL OR RICH
(OPERATION ABOVE THIS PRESSURE LIMITED TO 5 MIN IN RICH)
61.5" TAKE OFF

TACHOMETER
1800 TO 2550 NORMAL PERMITTED
2550 MAX CONTINUOUS - NORMAL OR RICH
(OPERATION ABOVE THIS RPM LIMITED TO 5 MIN. IN RICH)
2700 MAXIMUM

FUEL GRADE 115/145



CONTROL QUADRANT
PROPELLER REVERSE PITCH RANGE
ALL INDICATORS IN BLUE - NORMAL PERMITTED
WHEN ANY INDICATOR MOVES ABOVE BLUE - RICH REQUIRED



CYLINDER HEAD TEMPERATURE GAGE
150°C TO 232°C NORMAL PERMITTED
232°C TO 249°C RICH REQUIRED
249°C MAXIMUM (OPERATION AT THIS TEMPERATURE LIMITED TO 5 MIN.)

CARBURETOR AIR TEMPERATURE GAGE
-10°C TO +15°C DANGER OF ICING
15°C TO 40°C CONTINUOUS OPERATION
40°C MAX DANGER OF DETONATION

Figure A-1A. (Sheet 1 of 2 Sheets) Instrument Range Markings (Airplane Groups D and N)

OIL PRESSURE
- 50 PSI-MIN. FOR FLIGHT
- 50 TO 85 PSI-CONTINUOUS OPERATION
- 100 PSI - MAXIMUM

OIL TEMPERATURE
- 40°C - MIN. FOR FLIGHT
- 65°C -TO 80°C-CONTINOUS OPERATION
- 100°C - MAXIMUM

FUEL GRADE 115/145

FUEL PRESSURE
- 24 PSI-MIN. FOR FLIGHT
- 24 TO 26 PSI- CONTINOUS OPERATION
- 35 PSI-MAXIMUM

AIRSPEED INDICATORS
- 140 KTS - MAX FULL FLAPS OR LANDING GEAR
- 217-226 KTS - MAX DIVING (74,000-64,000 LB)
- 226 KTS - MAXIMUM DIVING

HYDRAULIC PRESSURE
- 800 PSI - ONE BRAKE APPLICATION REMAINING
- 980 TO 1160 PSI - NORMAL PRESSURE
- 1250 PSI - MAXIMUM PRESSURE

TORQUE METER
- 100 PSI - MINIMUM FOR FLIGHT
- 100 TO 197 PSI - NORMAL PERMITTED
- 197 PSI - MAX CONTINUOUS - NORMAL OR RICH (OPERATION ABOVE THIS PRESSURE LIMITED TO 5 MIN. IN RICH)
- 228 PSI - MAXIMUM - DRY
- 246 PSI - MAXIMUM - WET

Figure A-1A. (Sheet 2 of 2 Sheets) Instrument Range Markings (Airplane Groups D and N)

Paragraphs A-1 to A-10

A-1. FLIGHT PLANNING.

A-2. GENERAL.

A-3. A series of charts are provided on the following pages to aid in selecting the speed and power to be used for obtaining optimum range. These charts are divided into three sets: take-off, climb, and landing; two engine; and single-engine operation.

A-4. These charts are provided to give the pilot sufficient data on which to make an intelligent and safe flight plan. Inasmuch as the number of variables involved make very accurate range predictions impossible, the emphasis in these charts has been towards conservatism. For example, calculated ranges and fuel flows are 15 per cent conservative and all speeds and fuel flows in a chart are based on the heaviest weight shown on that chart. This policy has been followed on the practical premise that "it is better to overestimate the fuel reserve than to have to bail out one hour before the base is reached." No allowance has been made for wind, navigational error, or other contingencies. No allowance has been made for combat or formation flight. Appropriate allowances for these items should be dictated by local regulations.

A-5. The charts are arranged to give maximum facility of use for pre-flight and in-flight range planning. The following will be noted on inspection:

a. The Take-Off, Climb, and Landing Chart gives fuel requirements for warm-up, take-off, and climb to any altitude for three typical weights.

b. The Flight Operation Instruction Charts vary in 10,000 pound increments from maximum gross weight to minimum possible flying weight.

c. Maximum to minimum practical fuel loadings are entered in each chart.

d. Power settings at the bottom of Column I will give maximum continuous speed but least range; Column V will give maximum range at a considerably lower speed. From the remaining columns, intermediate range-speed relationships can be chosen.

e. Ranges shown on a given chart, automatically take into account changes in power settings with the changes in weight as shown on succeeding charts for lower weights. It is essential that as airplane gross weight diminishes the power be reset in accordance with the decreased weight-ranges which have been computed on this basis.

A-6. USE OF CHARTS.

A-7. The following sample problem based on a typical mission and employing actual chart values demonstrates how the charts should be used.

A-8. It is required that 19,000 pounds of equipment be dropped to troops located 550 miles from the airfield. Flight must be accomplished at a minimum altitude of 5,000 feet to clear terrain except for descent to 500 feet at drop point.

A-9. Write down the conditions of the problem and the questions to be answered.

Required Range----------1,100 miles
Weather----------CAVU
Winds (at the base)-----40 mph tailwind at 5,000 ft
30 mph tailwind at 10,000 ft
Cargo Weight----------19,000 lb
Airplane Basic Weight---37,172 lb (includes trapped fuel and oil, miscellaneous equipment)
Crew (5) Weight---------1,000 lb
Full Oil Weight (120 gal) -900 lb
Total Weight (less fuel) -58,072 lb

Maximum allowable gross weight is 74,000 pounds, therefore, 74,000 - 58,072 = 15,928 lb (permissible weight).
Fuel Load (15,960 lb)
Weight----------15,928 lb
Total Weight----------74,000 lb

Climb from sea level to 10,000 ft - 438 lb
After dropping the cargo, climb the airplane to 10,000 ft to take advantage of the more favorable winds. At the return point of the trip, after dropping the cargo, the weight will be reduced to approximately 49,000 lb. Reference to the Climb Data Chart shows that approximately 438 lb (1158-720) are required to climb from sea level to 10,000 ft. Note that the 720 pounds represents fuel required for warm up, and take-off.

Collecting all the required fuel allowances:
General reserve for unexpected difficulties--2700 lb
Wind Reserve (outgoing)---------- 0 lb
Wind Reserve (return)---------- 624 lb
Warm-up, take-off, and climb to 5,000 ft @ 74,000 lb----------1176 lb
Climb from sea level to 10,000 ft @ approximately 49,000 lb-- 438 lb
Total allowances---------4938 lb

Therefore, the actual fuel on which it is desired to complete the mission is: 15,960 - 4938 = 11,022 lb
Reference to the 74,000 lb chart shows that the required 1,100 miles can be flown with 10,800 pounds of fuel if the flight is accomplished in Column V. This is the quick solution of the problem.

a. However, to ascertain that the mission is actually being flown in the most efficient manner, a more thorough analysis of the problem will have to be accomplished. Referring to Column V of the 74,000 lb chart, it is noted that the 10,800 pound entry indicates a range of 1,190 miles. However, note that added conservatism is introduced since the ranges shown in charts are computed on the basis of weight change due to fuel consumption only (except when only one chart is used for the entire mission). Changes of weight due to the disposal of cargo should give longer ranges than those shown.

A-10. Determine the actual flight plan. Now that the conditions of the flight have been determined, it becomes necessary to establish a flight plan as follows:

a. The flight out will be accomplished at 5,000 feet to take advantage of the favorable tailwinds that will be encountered there.

b. Determine fuel available for flight planning by deducting the necessary fuel allowances and reserves from the actual fuel available.

General reserve for unexpected difficulties--2700 lb
It will be noted that 2700 lb of fuel represents two hours flying time in Column V at gross weight of 45,000 - 40,000 lb at 10,000 ft. Two hours fuel reserve is considered sufficient for this mission. The endurance is figured at the lightest weight because reserve fuel, obviously, will not be used until this light weight is reached. Ten thousand feet is the probable altitude of return because of the favorable winds.

Wind reserve (outgoing)----------0 lb
Normally, tailwinds are treated as a no-wind condition.

Wind reserve (return)----------624 lb
This figure is arrived at as follows: The return trip is 550 miles in length and it will be flown at a TAS of 205 mph (find air speed opposite the 10,000 ft entry in Column V of the 45,000 - 40,000 lb chart. The ground speed will be the true air speed - wind, i.e., 205 - 30 = 175 mph. The additional flight time due to the headwind is (500

divided by 175) - (550 divided by 205) = .46 hours. The wind reserve is then the fuel flow x .46 i.e., Warm-up, take off, and climb to 5,000 ft---1176 lb Reference to the Climb Data Chart shows that 1176 lb are required for warm-up, take off, and climb to 5,000 ft when the airplane weighs 74,000 lb.

c. It has been noted that the charts are divided into 9,000 and 10,000 pound increments; and since the airplane weight will vary by more than 10,000 pounds, it will be necessary to divide the flight into several legs. (Note: The use of fuel will reduce airplane weight by 10,000 pounds.)

Leg 1 (Fig A-2 and A-2A)

Plane Wt. (lb)	Fuel (lb)	Condition	Altitude S.L. (ft)	Power Settings	Fuel Used (lb) *
74,000	15,960	Climb	5,000	2,550 rpm 48.0 in. Hg Normal	1176

* *Includes 726 pounds allowance for warm-up and take off.*

Entries whose derivation may not be clear are explained as follows (refer to the Climb Data Chart for 74,000 pounds):

FUEL:
Because of the weight restriction the fuel load was limited to 15,960 pounds. Note that this includes an estimated 2700 pounds general reserve.

RPM, M.P., MIXT., AND FUEL-USED:
These items are read directly from the chart.

NOTE

Time consumed and distance covered in climbing is considered negligible in this instance; however, these items should be considered in extremely long climbs.

Remember that the outgoing flight will be accomplished at 5,000 feet with Column V conditions.

Leg 2 (Fig A-3)

Plane Wt (lb)	Fuel (lb)	Power Settings	Pounds Per Hr	TAS	Ground Speed	Hour	Mileage	Fuel Used (lb)
72,824	14,784	1950 rpm 40 in. Hg Normal	1950	211	211	2.60	550	5082

Note that the length of Leg 2 is determined by the required range of 550 miles. A check on gross weight at the end of the flight indicates that the weight does not fall below the limits of the 74,000 - 65,000 pound chart.

WEIGHT:
In using 1,176 pounds of fuel in warm-up, take off, and climb, weight becomes 74,000 - 1,176 = 72,824 pounds.
FUEL:
Fuel was reduced 1176 pounds in Leg 1.
RPM, M.P., MIXT., TRUE AIR SPEED, AND LB/HR:
These items were read directly as entries opposite 5,000 feet in Column V.

GROUND SPEED:
Since tailwinds are considered negligible, the ground speed equals TAS.
FUEL USED:
Calculated by multiplying fuel consumption by flight time, i.e., 1,950 x 2.60 = 5,082 pounds.
HOURS:
The time was arrived at by dividing the desired range by the ground speed, i.e., 550 divided by 211 = 2.60 hours.
GROUND MILEAGE:
Desired 550 miles
Gross weight at end of Leg 2----------67,742 lb
Drop Cargo----------19,000 lb
Gross Weight at beginning of return flight----------48,742 lb

Leg 3 (Fig. A-2 and A-2A)

Plane Wt (lb)	Fuel (lb)	Condition	Altitude S.L. (ft)	Power Settings	Fuel Used (lb)
48,742	9,702	Climb	10,000	2550 rpm 48.0 in. Hg Normal	438

After dropping the cargo, it is planned to climb to 10,000 feet, because of the lower headwinds. Note that the fuel used is determined by deducting the fuel required for warm-up and take off from that required to climb to 10,000 feet. Note also that the airplane had to go to sea level to drop the cargo.

Leg 4 (Fig. A-5)

Plane Wt (lb)	Fuel (lb)	Power Settings	Pounds Per Hr	TAS	Ground Speed	Hour	Mileage	Fuel Used (lb)
48,304	9,264	1800 rpm 31.5 in. Hg Normal	1350	198	168	2.45	411	3306

Note that the length of Leg 4 is determined by the reduction in airplane weight below the limits of the 55,000 - 45,000 pound chart. This reduction is effected solely by the consumption of fuel. Refer to 55,000 - 45,000 pound chart.

WEIGHT:
In using 438 pounds of fuel to climb to 10,000 feet weight becomes 48,742 - 438 = 48,304 pounds.
FUEL:
Fuel was reduced 438 pounds in Leg 3.
RPM, M.P., MIXT., TRUE AIR SPEED, AND LB/HR:
These items were read directly as entries opposite 10,000 feet in Column V.
GROUND SPEED:
TAS minus headwind, 198 - 30 = 168 mph.
FUEL USED:
When the airplane weight is down to 45,000 pounds, 3306 pounds of fuel will be consumed in Leg 4.
HOURS:
The time was determined by dividing the fuel used by the fuel consumption; i.e., 3306 divided by 1350 = 2.45 hr.
MILEAGE:
Ground speed multiplied by hours gives mileage, i.e., 168 x 2.45 = 411 miles.

Leg 5 (Fig. A-6)

Plane Wt (lb)	Fuel (lb)	Power Settings	Pounds Per Hr	TAS	Ground Speed	Hour	Mileage	Fuel Used (lb)
44,998	5958	1800 rpm 31.5 in. Hg Normal	1350	205	175	.794	139	1074

Note that this last leg is determined by the remaining distance to the base 550 - 411 = 139 mph.

GROUND SPEED:
TAS minus headwind, 205 - 30 = 175 mph.
FUEL USED:
Calculated by multiplying fuel consumption by flight time, i.e.; 1350 x .794 = 1074 pounds.
HOURS:
The time was determined by dividing the desired range by the ground speed, i.e.; 139 divided by 175 = .794 hours.

A-11. It will be noted that the flight will be completed with a 4884 lb reserve. The additional 2184 lb (4884-2700 = 2184) represents the economy effected by dropping 19,000 pounds of cargo at the mid-point of the flight.

A-12. Once the plan is satisfactorily computed, it should be assembled into one master chart to facilitate use of the data in flight.

A-13. On completion of the flight, comparison should be made between the actual and computed data. This will give the pilot a better idea of the margin of safety afforded by the charts. He should then be able to plan succeeding missions with increasing accuracy.

A-14. The sample problem just completed shows how the charts could be used for pre-flight planning and post-flight analysis. Should an engine fail near the drop-zone for example, the remainder of the flight would have to be planned while in the air. Such a contingency would require in-flight planning and the following variation to the first problem will demonstrate a recommended procedure:

a. After dropping the cargo and climbing to 10,000 feet, it is seen from Leg 4 that the airplane weighs 48,304 pounds, and has 9264 pounds of fuel to fly 550 miles.

b. Assuming that the 3264 pounds will be held as general reserve and referencing single engine charts it will be seen that 550 miles range can be obtained with 6000 pounds of fuel.

Leg 4A (Fig. A-8)

Plane Wt (lb)	Fuel (lb)	Power Settings	Pounds Per Hr	TAS	Ground Speed	Hour	Mileage	Fuel Used (lb)
48,304	9,264	2500 rpm 43 in. Hg. Normal	1800	166	136	1.84	250	3306

RPM, M.P., MIXT., TRUE AIR SPEED AND LB/HR:
These items were read directly as entries opposite 10,000 ft in column III.
GROUND SPEED:
TAS minus headwind, 166 - 30 = 136 mph.
FUEL USED:
By the time airplane weight is down to 45,000 lb, 3306 lb of fuel will be consumed in Leg 4A.
HOURS:
The time was determined by dividing the fuel used by the fuel consumption, i.e.; 3306 divided by 1800 = 1.84 hours.
MILEAGE:
Ground speed multiplied by hours gives mileage, i.e.; 136 x 1.84 = 250 miles.

As the weight is now reduced to 45,000 lb reference to the 45,000 - 40,000 pound single-engine chart will be made for the balance of the flight. Note that this last leg is determined by the remaining distance to the base 550 - 250 = 300 miles.

Since there is a 30 mph headwind at 10,000 feet for the return trip a wind reserve of approximately 558 pounds is necessary. This figure is determined as follows: The balance of the return trip is 300 miles and it will be flown at 174 TAS (find air speed opposite 10,000 feet entry in Column III of the 45,000 -40,000 lb single-engine chart).

The ground speed will be 174 - 30 = 144 mph. The additional flight time due to the 30 mph headwind is (300 divided by 144) - (300 divided by 174) = .35 hrs. The wind reserve is then 1590 x .35 = 558 pounds.

This leaves 5958 - 558 = 5400 pounds of fuel for the balance of the return trip. Column III of the 45,000 -40,000 lb single-engine chart indicates that the flight can be completed with approximately 2700 pounds of general reserve. A check on this figure will be made using Column III of the 45,000 - 40,000 lb single-engine chart.

Leg 5A (Fig A-9)

Plane Wt (lb)	Fuel (lb)	Power Settings	Pounds Per Hr	TAS	Ground Speed	Hour	Mileage	Fuel Used (lb)
44,998	5958	2450 rpm 42 in. Hg Normal	1590	174	144	2.08	300	3312

RPM, M.P., MIXT., TRUE AIR SPEED AND LB/HR:
These items were read directly as entries opposite 10,000 ft in Column III.
GROUND SPEED:
TAS minus headwind 174 - 30 = 144 mph.
FUEL USED:
Calculated by multiplying fuel consumption by Flight time, i.e.; 1590 x 2.08 = 3312 pounds.
HOURS:
The time was determined by dividing the desired range by the ground speed, i.e.; 300 divided by 144 = 2.08 hrs.

The flight therefore can be completed with 2646 pounds of general reserve which is considered adequate.

AAFMC-527
8-1-48

AIRCRAFT MODEL: C-119B

TAKE-OFF, CLIMB & LANDING CHART

ENGINE MODEL(S): R-4360-20

TAKE-OFF DISTANCE FEET

GROSS WEIGHT LB.	HEAD WIND M.P.H.	HEAD WIND KTS.	HARD SURFACE RUNWAY AT SEA LEVEL GROUND RUN	HARD SURFACE RUNWAY AT SEA LEVEL TO CLEAR 50' OBJ.	HARD SURFACE RUNWAY AT 3000 FEET GROUND RUN	HARD SURFACE RUNWAY AT 3000 FEET TO CLEAR 50' OBJ.	HARD SURFACE RUNWAY AT 6000 FEET GROUND RUN	HARD SURFACE RUNWAY AT 6000 FEET TO CLEAR 50' OBJ.
54,000	0	0	1465	2360	1755	2705	2080	3100
	12	10	1145	1850	1390	2145	1665	2480
	23	20	890	1440	1095	1690	1350	2000
	35	30	650	1050	820	1265	1000	1500
64,000	0	0	2300	3340	2780	3880	3380	4655
	12	10	1840	2670	2240	3130	2755	3795
	23	20	1465	2125	1810	2525	2240	3090
	35	30	1115	1620	1395	1950	1765	2430
74,000	0	0	3200	4475	3870	5310	4740	6450
	12	10	2600	3635	3160	4335	3920	5335
	23	20	2110	2950	2600	2570	3240	4410
	35	30	1645	2295	2060	2825	2590	3525

GROSS WEIGHT LB.	HEAD WIND M.P.H.	HEAD WIND KTS.	SOD-TURF RUNWAY AT SEA LEVEL GROUND RUN	SOD-TURF RUNWAY AT SEA LEVEL TO CLEAR 50' OBJ.	SOD-TURF RUNWAY AT 3000 FEET GROUND RUN	SOD-TURF RUNWAY AT 3000 FEET TO CLEAR 50' OBJ.	SOD-TURF RUNWAY AT 6000 FEET GROUND RUN	SOD-TURF RUNWAY AT 6000 FEET TO CLEAR 50' OBJ.	SOFT SURFACE RUNWAY AT SEA LEVEL GROUND RUN	SOFT SURFACE RUNWAY AT SEA LEVEL TO CLEAR 50' OBJ.	SOFT SURFACE RUNWAY AT 3000 FEET GROUND RUN	SOFT SURFACE RUNWAY AT 3000 FEET TO CLEAR 50' OBJ.	SOFT SURFACE RUNWAY AT 6000 FEET GROUND RUN	SOFT SURFACE RUNWAY AT 6000 FEET TO CLEAR 50' OBJ.
54,000	0	0	1530	2425	1880	2830	2265	3285	1915	2815	2285	3235	2810	3830
	12	10	1200	1905	1490	2245	1815	2630	1500	2205	1810	2565	2250	3070
	23	20	930	1480	1175	1765	1475	2125	1165	1715	1425	2015	1825	2475
	35	30	680	1080	880	1325	1090	1585	855	1255	1070	1515	1350	1850
64,000	0	0	2540	3580	3120	4220	3820	5095	3435	4475	4370	5470	5720	6995
	12	10	2030	2860	2520	3410	3110	4150	2740	3570	3530	4420	4660	5700
	23	20	1620	2280	2030	2745	2540	3390	2185	2845	2840	3555	3800	4650
	35	30	1230	1735	1565	2120	1995	2660	1665	2170	2190	2745	2990	3655
74,000	0	0	3550	4825	4380	5820	5375	7085	4840	6115	6150	7590	8120	9830
	12	10	2880	3915	3580	4755	4450	5865	3925	4960	5025	6200	6720	8135
	23	20	2340	3180	2940	2910	3680	4850	3190	4030	4140	5110	5560	6730
	35	30	1825	2475	2320	3085	2940	3875	2480	3135	3265	4030	4450	5305

NOTE: INCREASE CHART DISTANCES AS FOLLOWS: 75°F + 10%; 100°F + 20%; 125°F + 30%; 150°F + 40%

OPTIMUM TAKE-OFF WITH 2700 RPM, 60.5 IN.HG. & 20 DEG. FLAP IS 80% OF CHART VALUES

DATA AS OF July 28, 1948 BASED ON: Estimates

CLIMB DATA

GROSS WEIGHT LB.	AT SEA LEVEL BEST I.A.S. MPH	AT SEA LEVEL BEST I.A.S. KTS	AT SEA LEVEL RATE OF CLIMB F.P.M.	AT SEA LEVEL lb. OF FUEL USED	AT 5000 FEET BEST I.A.S. MPH	AT 5000 FEET BEST I.A.S. KTS	AT 5000 FEET RATE OF CLIMB F.P.M.	AT 5000 FEET FROM SEA LEVEL TIME MIN.	AT 5000 FEET FROM SEA LEVEL FUEL USED	AT 10,000 FEET BEST I.A.S. MPH	AT 10,000 FEET BEST I.A.S. KTS	AT 10,000 FEET RATE OF CLIMB F.P.M.	AT 10,000 FEET FROM SEA LEVEL TIME MIN.	AT 10,000 FEET FROM SEA LEVEL FUEL USED
44,000	119	103	2110	720	119	103	2090	2.40	894	119	103	1880	4.90	1068
64,000	136	118	1140	720	135	117	1080	4.50	1050	135	117	885	9.75	1416
74,000	144	125	820	720	144	125	775	6.25	1176	142	123	585	13.75	1698

GROSS WEIGHT LB.	AT 15,000 FEET BEST I.A.S. MPH	AT 15,000 FEET BEST I.A.S. KTS	AT 15,000 FEET RATE OF CLIMB F.P.M.	AT 15,000 FEET FROM SEA LEVEL TIME MIN.	AT 15,000 FEET FROM SEA LEVEL FUEL USED	AT 20,000 FEET BEST I.A.S. MPH	AT 20,000 FEET BEST I.A.S. KTS	AT 20,000 FEET RATE OF CLIMB F.P.M.	AT 20,000 FEET FROM SEA LEVEL TIME MIN.	AT 20,000 FEET FROM SEA LEVEL FUEL USED	AT FEET BEST I.A.S. MPH	AT FEET BEST I.A.S. KTS	AT FEET RATE OF CLIMB F.P.M.	AT FEET FROM SEA LEVEL TIME MIN.	AT FEET FROM SEA LEVEL FUEL USED
44,000	117	102	1680	7.70	1254	115	100	1390	11.00	1446					
64,000	133	115	735	15.75	1818	130	113	460	23.25	2250					
74,000	140	122	420	23.50	2358	136	118	140	39.50	3276					

DATA AS OF July 28, 1948 BASED ON: Estimates

FUEL USED INCLUDES WARM-UP & TAKE-OFF ALLOWANCE

LANDING DISTANCE FEET

GROSS WEIGHT LB.	BEST IAS APPROACH POWER OFF MPH	BEST IAS APPROACH POWER OFF KTS	BEST IAS APPROACH POWER ON MPH	BEST IAS APPROACH POWER ON KTS	HARD DRY SURFACE AT SEA LEVEL GROUND ROLL	HARD DRY SURFACE AT SEA LEVEL TO CLEAR 50' OBJ.	HARD DRY SURFACE AT 3000 FEET GROUND ROLL	HARD DRY SURFACE AT 3000 FEET TO CLEAR 50' OBJ.	HARD DRY SURFACE AT 6000 FEET GROUND ROLL	HARD DRY SURFACE AT 6000 FEET TO CLEAR 50' OBJ.
40,000					960	1850	1050	1975	1120	2090
60,000					1555	2640	1700	2840	1855	3060

GROSS WEIGHT LB.	FIRM DRY SOD AT SEA LEVEL GROUND ROLL	FIRM DRY SOD AT SEA LEVEL TO CLEAR 50' OBJ.	FIRM DRY SOD AT 3000 FEET GROUND ROLL	FIRM DRY SOD AT 3000 FEET TO CLEAR 50' OBJ.	FIRM DRY SOD AT 6000 FEET GROUND ROLL	FIRM DRY SOD AT 6000 FEET TO CLEAR 50' OBJ.	WET OR SLIPPERY AT SEA LEVEL GROUND ROLL	WET OR SLIPPERY AT SEA LEVEL TO CLEAR 50' OBJ.	WET OR SLIPPERY AT 3000 FEET GROUND ROLL	WET OR SLIPPERY AT 3000 FEET TO CLEAR 50' OBJ.	WET OR SLIPPERY AT 6000 FEET GROUND ROLL	WET OR SLIPPERY AT 6000 FEET TO CLEAR 50' OBJ.
40,000	1110	2000	1220	2145	1300	2270	3820	4710	4180	5105	4500	5470
60,000	1800	2890	1970	3115	2150	3360	5210	6290	5750	6900	6275	7475

DATA AS OF July 28, 1948 BASED ON: Estimates

OPTIMUM LANDING IS 80% OF CHART VALUES

REMARKS: LANDING DISTANCES ARE PRESENTED WITHOUT REVERSE THRUST. REVERSE THRUST IS AVAILABLE AND IS EXPECTED TO REDUCE LANDING GROUND ROLL TO 60% OF VALUES SHOWN.

NOTE: TO DETERMINE FUEL CONSUMPTION IN BRITISH IMPERIAL GALLONS, MULTIPLY BY 10, THEN DIVIDE BY 12

FUEL GRADE 115/145

LEGEND
- I.A.S. : INDICATED AIRSPEED
- M.P.H. : MILES PER HOUR
- KTS. : KNOTS
- F.P.M. : FEET PER MINUTE

Figure A-2. Take-Off, Climb, and Landing Chart (Airplane Group H)

AAFNC-527 4-1-48

AIRCRAFT MODEL(S)

C-119C and R4Q-1

TAKE-OFF, CLIMB & LANDING CHART

ENGINE MODEL(S)

R-4360-20W

TAKE-OFF DISTANCE FEET

GROSS WEIGHT LB.	HEAD WIND	HARD SURFACE RUNWAY						SOD-TURF RUNWAY						SOFT SURFACE RUNWAY					
		AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET		AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET		AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET	
	M.P.H. / KTS.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.
54000	0 / 0	1330	2180	1625	2555	1960	2940	1430	2280	1780	2710	2160	3140	1680	2530	2130	3060	2680	3660
	12 / 10	1040	1705	1290	2030	1570	2360	1120	1785	1410	2150	1650	2430	1315	1980	1690	2430	2140	2925
	23 / 20	810	1330	1010	1590	1255	1880	870	1390	1110	1690	1310	2065	1020	1540	1330	1910	1700	2330
	35 / 30	590	965	760	1195	955	1430	635	1010	830	1265	1000	1480	745	1120	995	1430	1300	1780
64000	0 / 0	2140	3115	2600	2660	3220	4450	2350	3325	2900	3960	2570	4750	2980	3955	3840	4895	5210	6450
	12 / 10	1710	2485	2100	2950	2620	3610	1875	2650	2340	3190	2980	3960	2380	3155	3100	3950	4275	5210
	23 / 20	1360	1975	1690	2370	2140	2930	1500	2115	1880	2560	2425	3210	1900	2515	2500	3180	3480	4250
	35 / 30	1040	1505	1300	1820	1690	2300	1140	1605	1455	1975	1910	2520	1445	1910	1925	2445	2720	3340
74000	0 / 0	2960	4120	3610	4930	4430	6100	3250	4410	4040	5360	5150	6740	4300	5460	5550	6870	7750	9290
	12 / 10	2400	3340	2950	4030	3750	5060	2640	3580	3300	4380	4270	5600	3490	4430	4540	5620	6400	7710
	23 / 20	1950	2715	2425	3315	3105	4190	2140	2905	2710	3600	3550	4640	2840	3605	3730	4620	5280	6380
	35 / 30	1520	2115	1920	2625	2490	3360	1670	2265	2140	2845	2840	3710	2210	2805	2950	3655	4240	5100

NOTE: INCREASE CHART DISTANCES AS FOLLOWS: 75°F + 10%; 100°F + 20%; 125°F + 30%; 150°F + 40%

OPTIMUM TAKE-OFF WITH 2700 RPM. 62 IN.HG. & 20 DEG.FLAP IS 80% OF CHART VALUES

DATA AS OF Nov. 22, 1949 BASED ON: Estimates

CLIMB DATA

GROSS WEIGHT LB.	AT SEA LEVEL				AT 5000 FEET					AT 10,000 FEET					AT 15,000 FEET					AT FEET					AT FEET				
	BEST I.A.S.		RATE OF CLIMB F.P.M.	GAL. OF FUEL USED	BEST I.A.S.		RATE OF CLIMB F.P.M.	FROM SEA LEVEL		BEST I.A.S.		RATE OF CLIMB F.P.M.	FROM SEA LEVEL		BEST I.A.S.		RATE OF CLIMB F.P.M.	FROM SEA LEVEL		BEST I.A.S.		RATE OF CLIMB F.P.M.	FROM SEA LEVEL		BEST I.A.S.		RATE OF CLIMB F.P.M.	FROM SEA LEVEL	
	MPH	KTS			MPH	KTS		TIME MIN.	FUEL USED	MPH	KTS		TIME MIN.	FUEL USED	MPH	KTS		TIME MIN.	FUEL USED	MPH	KTS		TIME MIN.	FUEL USED	MPH	KTS		TIME MIN.	FUEL USED

FOR CLIMB DATA SEE FIGURE A-2

POWER PLANT SETTINGS: (DETAILS ON FIG. SECTION III):

DATA AS OF BASED ON:

FUEL USED (U.S. GAL.) INCLUDES WARM-UP & TAKE-OFF ALLOWANCE

LANDING DISTANCE FEET

GROSS WEIGHT LB.	BEST IAS APPROACH				HARD DRY SURFACE						FIRM DRY SOD						WET OR SLIPPERY					
	POWER OFF		POWER ON		AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET		AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET		AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET	
	MPH	KTS	MPH	KTS	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.

FOR LANDING DATA SEE FIGURE A-2

DATA AS OF BASED ON:

OPTIMUM LANDING IS 80% OF CHART VALUES

REMARKS:

NOTE: TO DETERMINE FUEL CONSUMPTION IN BRITISH IMPERIAL GALLONS, MULTIPLY BY 10, THEN DIVIDE BY 12

FUEL GRADE 115 / 145

LEGEND

I.A.S. : INDICATED AIRSPEED
M.P.H. : MILES PER HOUR
KTS. : KNOTS
F.P.M. : FEET PER MINUTE

Figure A-2A. Take-Off, Climb, and Landing Chart (Airplane Groups J and N)

AAFMC-528 4-1-48

AIRCRAFT MODEL(S)
C-119B, C-119C, and R4Q-1

ENGINE(S): R-4360-20 and R-4360-20W

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 74,000 TO 65,000 POUNDS

EXTERNAL LOAD ITEMS
NONE

NUMBER OF ENGINES OPERATING: 2

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL lb/hr
WAR EMERG.							
MILITARY POWER	2700	61.5	Low	Normal	30 Min.	249° C	2850

FOR DETAILS SEE POWER PLANT CHART (FIG. SECT. III)

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING[1] MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER POUND (MI./lb) (NO WIND), POUNDS PER HR. (lb/hr) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND).[1] TO OBTAIN BRITISH IMPERIAL lb (OR lb/hr): MULTIPLY U.S. lb (OR lb/hr) BY 10 THEN DIVIDE BY 12.

COLUMN I		FUEL	COLUMN II		COLUMN III		COLUMN IV		FUEL	COLUMN V	
RANGE IN AIRMILES			RANGE IN AIRMILES		RANGE IN AIRMILES		RANGE IN AIRMILES			RANGE IN AIRMILES	
STAUTE	NAUTICAL	lb	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	lb	STATUTE	NAUTICAL
			SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING[1]								
		16020							16020		
850	735	15300	1065	925	1290	1120	1515	1315	15300	1740	1510
800	695	14400	1000	865	1210	1050	1420	1230	14400	1630	1415
735	635	13200	915	795	1105	960	1295	1125	13200	1485	1290
665	575	12000	830	720	1000	865	1170	1015	12000	1340	1160
595	515	10800	740	640	890	770	1040	900	10800	1190	1030
530	460	9600	655	565	785	680	915	795	9600	1045	905
465	405	8400	570	495	685	595	795	690	8400	910	790
395	340	7200	490	425	585	505	680	590	7200	780	675
330	285	6000	410	355	490	425	570	495	6000	650	560
265	230	4800	325	280	390	335	455	395	4800	520	450
195	165	3600	245	210	290	250	340	295	3600	390	335
130	110	2400	160	135	195	165	225	195	2400	260	225
65	55	1200	80	65	95	80	110	95	1200	130	110

MAXIMUM CONTINUOUS						PRESS ALT. FEET	(.068 STAT. (.06 NAUT.) MI./lb)						(.081 STAT. (.071 NAUT.) MI./lb)						(.095 STAT. (.081 NAUT.) MI./lb)						PRESS ALT. FEET	108 MAXIMUM AIR RANGE .093					
R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. lb/hr	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.		R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. lb/hr	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. lb/hr	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. lb/hr	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.		R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. lb/hr	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.
						40000																			40000						
						35000																			35000						
						30000																			30000						
						25000																			25000						
2500	46.0	Norm.	4080	259	225	20000	2550	46.0	Norm.	3750	256	222	2650	42.0	Norm.	2820	255	221	2500	41.0	Norm.	2580	244	212	20000	2350	37.0	Norm.	1950	212	184
						15000							2450	43.0	Norm.	3030	247	214	2500	36.5	Norm.	2460	235	205	15000	2450	35.5	Norm.	2040	320	191
2550	44.0	Norm.	3540	250	217	10000	2550	44.0	Norm.	3540	250	217	2400	41.5	Norm.	2910	239	208	2250	39.0	Norm.	2370	226	195	10000	2150	37.0	Norm.	1980	213	185
2550	48.0	Norm.	4320	244	212	5000	2350	44.0	Norm.	3450	236	205	2200	43.0	Norm.	2790	228	198	2100	41.5	Norm.	2310	219	190	5000	1950	40.0	Norm.	1950	211	183
2550	48.0	Norm.	4200	232	201	S.L.	2350	44.0	Norm.	3210	220	191	2250	43.0	Norm.	2640	215	187	2150	41.5	Norm.	2190	208	181	S.L.	1950	40.5	Norm.	1800	196	170

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB (SEE FIG. A-2 or A-3) PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.

FUEL GRADE 115/145

DATA AS OF 7-28-48 Rev 2-21-50 BASED ON: Estimates

EXAMPLE

AT 70000 LB. GROSS WEIGHT WITH 13200 lb OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 1674 lb) TO FLY 1100 STAT. AIRMILES AT 10000 FT. ALTITUDE MAINTAIN 2400 RPM AND 41.5 IN. MANIFOLD PRESSURE WITH MIXTURE SET: Normal, until Gross Weight is reduced to 65,000 lbs. Then refer to next chart (65,000 to 55,000 lbs.) under Column III at 10,000 ft.

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
lb/hr: lb PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL
F.R. : FULL RICH
A.R. : AUTO-RICH
A.L. : AUTO-LEAN
C.L. : CRUISING LEAN
M.L. : MANUAL LEAN
F.T. : FULL THROTTLE
NORM: Normal Mixture Setting

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure A-3. Flight Operating Instruction Chart

AAFMC-528 11-1-48

AIRCRAFT MODEL(S)
C-119B, C-119C, and R4Q-1

ENGINE(S): R-4360-20 and R-4360-20 W

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 65,000 TO 55,000 POUNDS

EXTERNAL LOAD ITEMS
NONE

NUMBER OF ENGINES OPERATING: 2

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL lb/hr
WAR EMERG.							
MILITARY POWER	2700	61.5	Low	Normal	30 Min.	249° C	2850

FOR DETAILS SEE POWER PLANT CHART (FIG. SECT. III)

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING[1] MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER POUND (MI./lb.) (NO WIND), POUNDS PER HR. (lb/hr) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND).[1] TO OBTAIN BRITISH IMPERIAL lb. (OR lb/hr): MULTIPLY U.S. lb. (OR lb/hr) BY 10 THEN DIVIDE BY 12.

COLUMN I		FUEL	COLUMN II		COLUMN III		COLUMN IV		FUEL	COLUMN V	
RANGE IN AIRMILES			RANGE IN AIRMILES		RANGE IN AIRMILES		RANGE IN AIRMILES			RANGE IN AIRMILES	
STAUTE	NAUTICAL	lb	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	lb	STATUTE	NAUTICAL
			SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING[1]								
		16020							16020		
860	745	15300	1130	980	1410	1220	1700	1475	15300	1990	1725
810	700	14400	1060	920	1320	1145	1590	1380	14400	1855	1610
740	640	13200	970	840	1200	1040	1440	1250	13200	1680	1455
675	585	12000	870	755	1080	935	1295	1120	12000	1505	1305
605	525	10800	785	680	960	830	1145	990	10800	1330	1155
540	465	9600	685	595	845	730	1005	870	9600	1165	1010
470	405	8400	600	520	740	640	880	760	8400	1020	885
405	350	7200	515	445	635	550	755	655	7200	875	760
335	290	6000	430	370	530	460	630	545	6000	730	630
270	230	4800	340	295	420	365	500	430	4800	580	500
200	170	3600	255	220	315	270	375	325	3600	435	375
135	115	2400	170	145	210	180	250	215	2400	290	250
65	55	1200	85	70	105	90	125	105	1200	145	125

MAXIMUM CONTINUOUS						PRESS	(.071 STAT. (.061 NAUT.) MI./ lb.)						(.088 STAT. (.076 NAUT.) MI./ lb.)						(.105 STAT. (.091 NAUT.) MI./ lb.)						PRESS	.12 MAXIMUM AIR RANGE .10					
R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. lb/hr	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. lb/hr	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. lb/hr	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. lb/hr	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. lb/hr	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.
						40000																			40000						
						35000																			35000						
						30000																			30000						
						25000																			25000						
						20000							2550	42.0	Norm.	2820	263	228	2450	39.5	Norm.	2370	250	217	20000	2150	32.5	Norm.	1680	205	178
2550	46.0	Norm.	4080	265	230	15000	2500	45.0	Norm.	3630	261	227	2400	42.0	Norm.	2820	250	217	2500	36.5	Norm.	2280	240	208	15000	2450	35.5	Norm.	1830	223	194
2550	44.0	Norm.	3540	254	221	10000	2550	44.0	Norm.	3540	254	221	2350	40.5	Norm.	2730	241	209	2250	39.0	Norm.	2190	230	200	10000	2050	35.5	Norm.	1740	213	185
2550	48.0	Norm.	4320	248	215	5000	2350	44.5	Norm.	3330	239	208	2250	43.0	Norm.	2640	232	201	2050	41.5	Norm.	2100	222	193	5000	1850	38.5	Norm.	1680	205	178
2550	48.0	Norm.	4200	235	204	S.L.	2400	45.0	Norm.	3150	226	196	2200	43.0	Norm.	2460	217	188	2050	41.0	Norm.	1980	207	180	S.L.	1800	39.0	Norm.	1590	192	167

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB (SEE FIG. A-2 or A-3) PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.

FUEL GRADE 115/145

EXAMPLE

AT 64000 LB. GROSS WEIGHT WITH 9600 lb. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 1398 lb) TO FLY 1165 STAT. AIRMILES AT 10000 FT. ALTITUDE MAINTAIN 2050 RPM AND 35.5 IN. MANIFOLD PRESSURE WITH MIXTURE SET: Normal, until Gross Weight is reduced to 55,000 lbs. Then refer to next chart (55,000-45,000 lbs) under Column V at 10,000 ft.

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
lb/hr : lb. PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL
F.R. : FULL RICH
A.R. : AUTO-RICH
A.L. : AUTO-LEAN
C.L. : CRUISING LEAN
M.L. : MANUAL LEAN
F.T. : FULL THROTTLE
NORM: Normal Mixture Setting

DATA AS OF 7-28-48 Rev 2-21-50 BASED ON: Estimates

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure A-4. Flight Operating Instruction Chart

AAFMC-528 4-1-48

AIRCRAFT MODEL(S)
C-119B, C-119C, and R4Q-1

ENGINE(S): R-4360-20 and R-4360-20W

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 55,000 TO 45,000 POUNDS

EXTERNAL LOAD ITEMS
NONE

NUMBER OF ENGINES OPERATING: 2

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL lb/hr
WAR EMERG.							
MILITARY POWER	2700	61.5	Low	Normal	30 Min.	249° C	2850

FOR DETAILS SEE POWER PLANT CHART (FIG. SECT. III)

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING[1] MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER POUND (MI./lb.) (NO WIND), POUNDS PER HR. (lb/hr) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND).[1] TO OBTAIN BRITISH IMPERIAL lb. (OR lb/hr): MULTIPLY U.S. lb. (OR lb/hr) BY 10 THEN DIVIDE BY 12.

COLUMN I		FUEL	COLUMN II		COLUMN III		COLUMN IV		FUEL	COLUMN V	
RANGE IN AIRMILES			RANGE IN AIRMILES		RANGE IN AIRMILES		RANGE IN AIRMILES			RANGE IN AIRMILES	
STAUTE	NAUTICAL	lb	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	lb	STATUTE	NAUTICAL
			SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING[1]								
		16020							16020		
865	750	15300	1205	1045	1545	1340	1905	1650	15300	2260	1960
815	705	14400	1135	985	1450	1255	1790	1550	14400	2125	1845
745	645	13200	1035	895	1330	1155	1635	1420	13200	1940	1685
680	590	12000	940	815	1205	1045	1485	1290	12000	1760	1525
610	530	10800	845	730	1080	935	1335	1155	10800	1580	1370
540	465	9600	750	650	960	830	1180	1025	9600	1400	1215
475	410	8400	655	565	840	725	1035	895	8400	1225	1060
405	350	7200	560	485	720	625	885	765	7200	1050	910
340	295	6000	470	405	600	520	740	640	6000	875	760
270	230	4800	375	325	480	415	590	510	4800	700	605
200	170	3600	280	240	360	310	440	380	3600	525	455
135	115	2400	185	160	240	205	295	255	2400	350	300
65	55	1200	90	75	120	100	145	125	1200	175	150

MAXIMUM CONTINUOUS						PRESS	(.078 STAT. (.068 NAUT.) MI./lb.)						(.10 STAT. (.086 NAUT.) MI./lb.)						(.123 STAT. (.106 NAUT.) MI./lb.)						PRESS	.146 MAXIMUM AIR RANGE .126					
R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. lb/hr	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. lb/hr	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. lb/hr	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. lb/hr	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. lb/hr	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.
						40000																			40000						
						35000																			35000						
						30000																			30000						
						25000																			25000						
						20000	2550	42.0	Norm.	2820	270	234	2500	41.0	Norm.	2640	264	229	2350	37.0	Norm.	2010	247	214	20000	2000	29.0	Norm.	1380	203	176
2550	46.0	Norm.	4080	270	234	15000	2450	44.0	Norm.	3330	262	228	2300	40.5	Norm.	2490	248	215	2350	34.0	Norm.	1890	234	203	15000	1950	28.0	Norm.	1380	203	176
2550	44.0	Norm.	3540	258	224	10000	2500	43.0	Norm.	3240	254	221	2300	39.5	Norm.	2370	238	207	2100	36.5	Norm.	1800	221	192	10000	1800	31.5	Norm.	1350	198	172
2550	48.0	Norm.	4320	250	217	5000	2350	44.0	Norm.	3060	240	208	2150	42.0	Norm.	2310	230	200	1850	38.5	Norm.	1710	212	184	5000	1650	33.0	Norm.	1230	182	158
2550	48.0	Norm.	4200	237	206	S.L.	2350	44.0	Norm.	2910	227	197	2150	42.0	Norm.	2160	215	187	1800	39.0	Norm.	1590	197	171	S.L.	1400	35.5	Norm.	1200	175	152

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB (SEE FIG. A-2 or A-3) PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.

FUEL GRADE 115/145

EXAMPLE

AT 50,000 LB. GROSS WEIGHT WITH 2400 lb. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 2058 lb TO FLY 240 STAT. AIRMILES AT 20,000 FT. ALTITUDE MAINTAIN 2500 RPM AND 41.0 MANIFOLD PRESSURE WITH MIXTURE SET: Normal.

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
lb/hr : lb. PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL
F.R. : FULL RICH
A.R. : AUTO-RICH
A.L. : AUTO-LEAN
C.L. : CRUISING LEAN
M.L. : MANUAL LEAN
F.T. : FULL THROTTLE
NORM: Normal Mixture Setting

DATA AS OF 7-28-48, Rev 2-21-50 BASED ON: Estimates

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure A-5. Flight Operating Instruction Chart

AAFMC-526 8-1-48 WP-2-21-50-10M

AIRCRAFT MODEL(S)
C-119B, C-119C, and R4Q-1

ENGINE(S): R-4360-20 and R-4360-20W

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 45,000 TO 40,000 POUNDS

EXTERNAL LOAD ITEMS
NONE

NUMBER OF ENGINES OPERATING: 2

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL lb/hr
WAR EMERG.							
MILITARY POWER	2700	61.5	Low	Normal	30 Min.	249° C	2850

FOR DETAILS SEE POWER PLANT CHART (FIG. SECT. III)

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING[1] MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER POUND (MI./lb) (NO WIND), POUNDS PER HR. (lb/hr) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND).[1] TO OBTAIN BRITISH IMPERIAL lb. (OR lb/hr): MULTIPLY U.S. lb (OR lb/hr) BY 10 THEN DIVIDE BY 12.

COLUMN I		FUEL	COLUMN II		COLUMN III		COLUMN IV		FUEL	COLUMN V	
RANGE IN AIRMILES			RANGE IN AIRMILES		RANGE IN AIRMILES		RANGE IN AIRMILES			RANGE IN AIRMILES	
STAUTE	NAUTICAL	lb	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	lb	STATUTE	NAUTICAL
			SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING[1]								
340	295	6000	480	415	620	535	760	660	6000	905	785
270	230	4800	380	330	495	430	605	525	4800	720	625
205	175	3600	285	245	370	320	455	395	3600	540	465
135	115	2400	190	165	245	210	300	260	2400	360	310
65	55	1200	95	80	120	100	150	130	1200	180	155

MAXIMUM CONTINUOUS						PRESS	(.08 STAT. (.07 NAUT.) MI./lb)						(.03 STAT. (.09 NAUT.) MI./lb)						(.12 STAT. (.11 NAUT.) MI./lb)						PRESS	.15 MAXIMUM AIR RANGE .13					
R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. lb/hr	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. lb/hr	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. lb/hr	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. lb/hr	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. lb/hr	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.
						40000																			40000						
						35000																			35000						
						30000																			30000						
						25000	2550	42.0	Norm.	2820	275	239	2500	41.0	Norm.	2580	268	233	2300	35.5	Norm.	1980	251	218	25000	2050	30.0	Norm.	1470	225	195
						20000																			20000						
2550	46.0	Norm.	4080	272	236	15000	2450	44.0	Norm.	3300	265	230	2500	36.5	Norm.	2460	253	220	2350	34.0	Norm.	1890	239	208	15000	2000	29.0	Norm.	1410	215	187
2550	44.0	Norm.	3540	260	226	10000	2450	42.5	Norm.	3210	256	222	2350	40.5	Norm.	2310	240	208	2050	35.5	Norm.	1770	225	195	10000	1800	31.5	Norm.	1350	205	178
2550	48.0	Norm.	4320	251	218	5000	2300	43.5	Norm.	3000	240	208	2100	41.0	Norm.	2220	230	200	1850	38.5	Norm.	1710	216	188	5000	1550	33.0	Norm.	1260	190	165
2550	48.0	Norm.	4200	238	207	S.L.	2300	43.5	Norm.	2850	228	198	2100	41.0	Norm.	2070	215	187	1750	39.0	Norm.	1560	199	173	S.L.	1400	36.0	Norm.	1170	179	155

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB (SEE FIG. A-2 or A-3) PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.

FUEL GRADE 115/145

EXAMPLE

AT 44,000 LB. GROSS WEIGHT WITH 3600 lb. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 10501b) TO FLY 540 STAT. AIRMILES AT 5000 FT. ALTITUDE MAINTAIN 1550 RPM AND 33.0 MANIFOLD PRESSURE WITH MIXTURE SET: Normal.

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
lb/hr: lb. PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL
F.R. : FULL RICH
A.R. : AUTO-RICH
A.L. : AUTO-LEAN
C.L. : CRUISING LEAN
M.L. : MANUAL LEAN
F.T. : FULL THROTTLE
NORM: Normal Mixture Setting

DATA AS OF 7-28-48 Rev 2-21-50 BASED ON: Estimates

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure A-6. Flight Operating Instruction Chart

AAFNC-528 6-1-48

AIRCRAFT MODEL(S)
C-119B, C-119C, and R4Q-1

ENGINE(S): R-4360-20 and R-4360-20W

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 65,000 TO 55,000 POUNDS

EXTERNAL LOAD ITEMS
NONE

NUMBER OF ENGINES OPERATING: 1

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL lb/hr
WAR EMERG.							
MILITARY POWER	2700	61.5	Low	Normal	30 Min.	249° C	2850

FOR DETAILS SEE POWER PLANT CHART (FIG. SECT.III)

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING[1] MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER POUND (MI./lb.) (NO WIND), POUNDS PER HR. (lb/hr) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND).[1] TO OBTAIN BRITISH IMPERIAL lb. (OR lb/hr): MULTIPLY U.S. lb. (OR lb/hr) BY 10 THEN DIVIDE BY 12.

COLUMN I		FUEL	COLUMN II		COLUMN III		COLUMN IV		FUEL	COLUMN V	
RANGE IN AIRMILES			RANGE IN AIRMILES		RANGE IN AIRMILES		RANGE IN AIRMILES			RANGE IN AIRMILES	
STAUTE	NAUTICAL	lb	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	lb	STATUTE	NAUTICAL
					SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING[1]						
		16020							16020		
~~1105~~	~~960~~	~~15300~~			~~1300~~	~~1045~~			~~15300~~	1305	1135
1035	900	14400			1120	970			14400	1205	1050
945	820	13200			1010	875			13200	1075	935
850	740	12000			900	780			12000	945	820
~~760~~	~~660~~	~~10800~~			~~790~~	~~685~~			~~10800~~	815	710
670	580	9600			685	595			9600	700	610
585	510	8400			600	520			8400	615	535
500	435	7200			515	445			7200	525	455
~~420~~	~~365~~	~~6000~~			~~430~~	~~370~~			~~6000~~	440	380
335	290	4800			340	295			4800	350	305
250	215	3600			255	220			3600	260	225
165	145	2400			170	145			2400	175	150
~~80~~	~~735~~	~~1200~~			~~85~~	~~745~~			~~1200~~	~~85~~	~~75~~

MAXIMUM CONTINUOUS						PRESS	(STAT. (NAUT.) MI./ lb.)						.071 (STAT. (.081 NAUT.) MI./ lb.)						(STAT. (NAUT.) MI./ lb.)						PRESS	.073 MAXIMUM AIR RANGE .083					
R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. lb/hr	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. lb/hr	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. lb/hr	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. lb/hr	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. lb/hr	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.
						40000																			40000						
						35000																			35000						
						30000																			30000						
						25000																			25000						
						20000																			20000						
						15000																			15000						
						10000																			10000						
						5000																			5000						
2550	48.0	Norm.	2100	147	128	S.L.							3550	47.0	Norm.	2019	141	123							S.L.	2450	46.5	Norm.	1960	137	119

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB (SEE FIG. A-2 or A-3) PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.

FUEL GRADE 115/145

DATA AS OF 7-28-48 Rev 2-21-50 BASED ON: Estimates

EXAMPLE

AT 60,000 LB. GROSS WEIGHT WITH 15300 lb OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF lb.) TO FLY 1200 STAT. AIRMILES AT S.L. FT. ALTITUDE MAINTAIN 2550 RPM AND 47.0 MANIFOLD PRESSURE WITH MIXTURE SET: Normal, until Gross Weight is reduced to 55,000 lbs. Then refer to next chart (55,000 - 45,000 lbs.) and use Column III

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
lb/hr : lb. PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL
F.R. : FULL RICH
A.R. : AUTO-RICH
A.L. : AUTO-LEAN
C.L. : CRUISING LEAN
M.L. : MANUAL LEAN
F.T. : FULL THROTTLE
NORM: Normal Mixture Setting

RED FIGURES ARE PRELIMINARY. DATA SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure A-7. Flight Operating Instruction Chart

AAFMC-528 4-1-48

AIRCRAFT MODEL(S)
C-119B, C-119C, and R4Q-1

ENGINE(S): R-4360-20 and R-4360-20W

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 55,000 TO 45,000 POUNDS

EXTERNAL LOAD ITEMS
NONE

NUMBER OF ENGINES OPERATING: 1

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.
WAR EMERG.							
MILITARY POWER	2700	61.5	Low	Normal	30 Min.	249° C	2850

FOR DETAILS SEE POWER PLANT CHART (FIG. SECT. III)

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING[1] MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER POUND (MI./lb.) (NO WIND), POUNDS PER HR. (lb/hr) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND)[1]. TO OBTAIN BRITISH IMPERIAL lb. (OR lb/hr): MULTIPLY U.S. lb. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

COLUMN I		FUEL	COLUMN II		COLUMN III		COLUMN IV		FUEL	COLUMN V	
RANGE IN AIRMILES			RANGE IN AIRMILES		RANGE IN AIRMILES		RANGE IN AIRMILES			RANGE IN AIRMILES	
STAUTE	NAUTICAL	lb.	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	lb.	STATUTE	NAUTICAL
			SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING[1]								
		16020							16020		
1190	1030	15300			1500	1300			15300	1835	1590
1115	970	14400			1400	1215			14400	1705	1480
1020	885	13200			1265	1100			13200	1535	1335
925	805	12000			1135	985			12000	1365	1185
830	725	10800			1005	870			10800	1195	1035
735	635	9600			880	760			9600	1040	900
640	555	8400			770	665			8400	910	790
550	475	7200			660	570			7200	780	675
460	395	6000			550	475			6000	650	560
365	320	4800			440	380			4800	520	450
275	240	3600			330	285			3600	390	335
180	160	2400			220	190			2400	260	226
90	80	1200			110	100			1200	130	110

MAXIMUM CONTINUOUS						PRESS	(STAT. (NAUT.) MI./ lb.)						(STAT. (NAUT.) MI./ lb.)						(STAT. (NAUT.) MI./ lb.)						PRESS	MAXIMUM AIR RANGE					
R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. lb/hr	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. lb/hr	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. lb/hr	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. lb/hr	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. lb/hr	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.
						40000																			40000						
						35000																			35000						
						30000																			30000						
						25000																			25000						
						20000																			20000						
						15000																			15000						
2550	44.0	Norm	1980	167	145	10000							2500	43.0	Norm	1800	166	144							10000	2400	41.5	Norm	1380	150	130
2550	48.0	Norm	2160	169	147	5000							2400	45.0	Norm	1770	162	141							5000	2300	43.5	Norm	1440	156	135
2550	48.0	Norm	2100	161	140	S.L.							2350	45.0	Norm	1680	154	134							S.L.	2300	43.5	Norm	1380	148	129

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB (SEE FIG. A-2 or A-3) PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.

FUEL GRADE 115/145

EXAMPLE

AT 55,000 LB. GROSS WEIGHT WITH 9600 lb. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF lb.) TO FLY 880 STAT. AIRMILES AT 10,000 FT. ALTITUDE MAINTAIN 2500 RPM AND 43.0 IN. MANIFOLD PRESSURE WITH MIXTURE SET: Normal

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
lb/hr : lb. PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL
F.R. : FULL RICH
A.R. : AUTO-RICH
A.L. : AUTO-LEAN
C.L. : CRUISING LEAN
M.L. : MANUAL LEAN
F.T. : FULL THROTTLE
NORM: Normal Mixture Setting

DATA AS OF 7-28-48 Rev 2-21-50 BASED ON: Estimates

RED FIGURES ARE PRELIMINARY. DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure A-8. Flight Operating Instruction Chart

AAFMC-528 6-1-48

AIRCRAFT MODEL(S)
C-119B, C-119C, and R4Q-1

ENGINE(S): R-4360-20 and R-4360-20W

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 45,000 TO 40,000 POUNDS

EXTERNAL LOAD ITEMS
NONE

NUMBER OF ENGINES OPERATING: 1

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL lb/hr
WAR EMERG.							
MILITARY POWER	2700	61.5	Low	Normal	30 Min.	249° C	2850

FOR DETAILS SEE POWER PLANT CHART (FIG. SECT. III)

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING[1] MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER POUND (MI./lb.) (NO WIND), POUNDS PER HR. (lb/hr) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND).[1] TO OBTAIN BRITISH IMPERIAL lb. (OR lb/hr): MULTIPLY U.S. lb. (OR lb/hr) BY 10 THEN DIVIDE BY 12.

COLUMN I		FUEL	COLUMN II		COLUMN III		COLUMN IV		FUEL	COLUMN V	
RANGE IN AIRMILES			RANGE IN AIRMILES		RANGE IN AIRMILES		RANGE IN AIRMILES			RANGE IN AIRMILES	
STAUTE	NAUTICAL	lb.	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	lb.	STATUTE	NAUTICAL
			SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING[1]								
480	415	6000			675	585			6000	935	815
385	335	4800			525	455			4800	680	590
285	250	3600			395	340			3600	510	443
190	165	2400			260	225			2400	340	295
95	80	1200			130	115			1200	170	145

.08 MAXIMUM CONTINUOUS .07						PRESS	(STAT. (NAUT.) MI./lb .)						(.11 STAT. (.095 NAUT.) MI./lb .)						(STAT. (NAUT.) MI./lb .)						PRESS	.14 MAXIMUM AIR RANGE .12					
R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. lb/hr	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. lb/hr	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. lb/hr	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. lb/hr	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES	MIX-TURE	APPROX. TOT. lb/hr	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.
						40000																			40000						
						35000																			35000						
						30000																			30000						
						25000																			25000						
						20000																			20000						
2550	46.0	Norm.	2040	184	160	15000							2350	41.0	Norm.	1560	173	150							15000	2300	40.5	Norm.	1200	168	146
2550	44.0	Norm.	1980	179	155	10000							2450	42.0	Norm.	1590	174	151							10000	2300	39.5	Norm.	1200	167	145
2550	48.0	Norm.	2160	177	154	5000							2300	43.5	Norm.	1530	168	146							5000	2150	41.5	Norm.	1110	158	137
2550	48.0	Norm.	2100	168	146	S.L.							2300	43.5	Norm.	1440	158	137							S.L.	2150	41.5	Norm.	1050	150	130

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB (SEE FIG. A-2 or A-3) PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.

FUEL GRADE 115/145

EXAMPLE

AT 45,000 LB. GROSS WEIGHT WITH 4800 lb OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF lb.) TO FLY 680 STAT. AIRMILES AT 10,000 FT. ALTITUDE MAINTAIN 2300 RPM AND 39.5 M. MANIFOLD PRESSURE WITH MIXTURE SET: Normal

LEGEND

ALT. : PRESSURE ALTITUDE	F.R. : FULL RICH
M.P. : MANIFOLD PRESSURE	A.R. : AUTO-RICH
lb/hr: lb. PER HOUR	A.L. : AUTO-LEAN
TAS : TRUE AIRSPEED	C.L. : CRUISING LEAN
KTS. : KNOTS	M.L. : MANUAL LEAN
S.L. : SEA LEVEL	F.T. : FULL THROTTLE

NORM: Normal Mixture Setting

DATA AS OF 7-28-48 Rev 2-21-50 BASED ON: Estimates

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

Figure A-9. Flight Operating Instruction Chart