

description and operation of auxiliary equipment

section
IV



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HEATING AND VENTILATING SYSTEMS.

Ram ventilating air at heated or ambient temperatures is supplied to the main cabin, relief crew's compartment, and cockpit through ducts and is discharged through ceiling anemostats, cold air outlets, and foot-warmer outlets (*figures 4-1 and 4-2*). Heat is supplied by three combustion heaters. Fuel is supplied to the heaters from either the No. 2 or No. 3 main wing tank.

The cockpit heater, located in the nose section of the aircraft, also supplies heated air for the windshield de-icing and defrosting panels. (See thermal and pneumatic de-icing systems, this section.) The cockpit heater automatically maintains a preset discharge air temperature. Heat is regulated by a thermal limit

switch which remains closed when the heater air temperature output is below approximately 141°C. At this temperature, the thermal limit switch opens and stops the heater. The cockpit heater is protected by an overheat switch which opens the ignition circuit and shuts off the fuel supply to discontinue heater operation in case a temperature of approximately 177°C is reached. When the heater has cooled to the thermal limit switch setting of approximately 141°C, the ignition circuit is then closed and fuel is again supplied to the heater if the cockpit heater switch is in the ON position. No provision is made for manually cycling the heater. In flight, ram air is supplied to the heater through an intake duct in the nose of the aircraft. A 28-volt d-c ground blower is installed for ground operation of the cockpit heater or to provide ventilating air to the cock-

COCKPIT HEATING AND VENTILATING SYSTEM — Typical

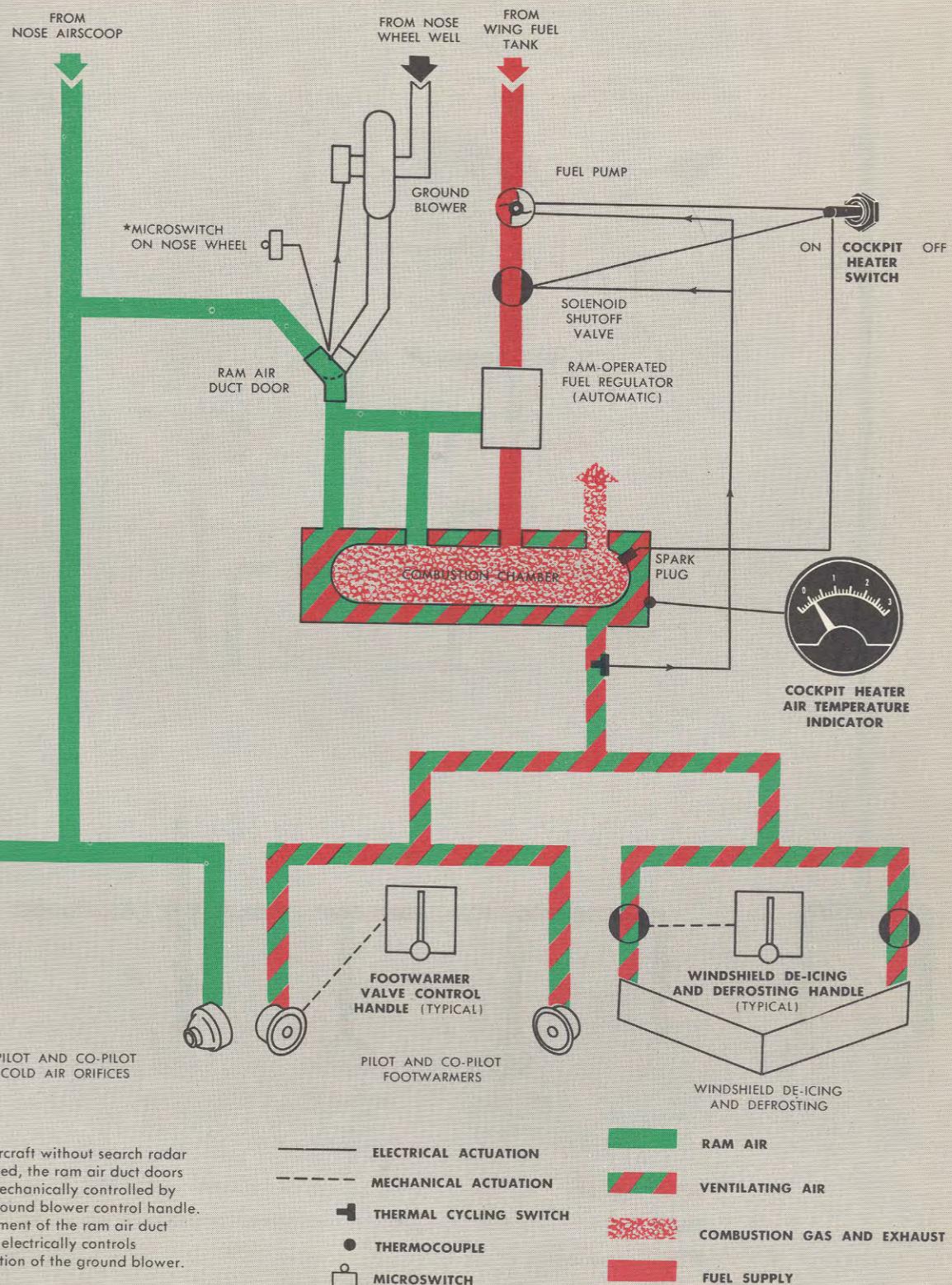


Figure 4-1

CABIN HEATING AND VENTILATING SYSTEM—Typical

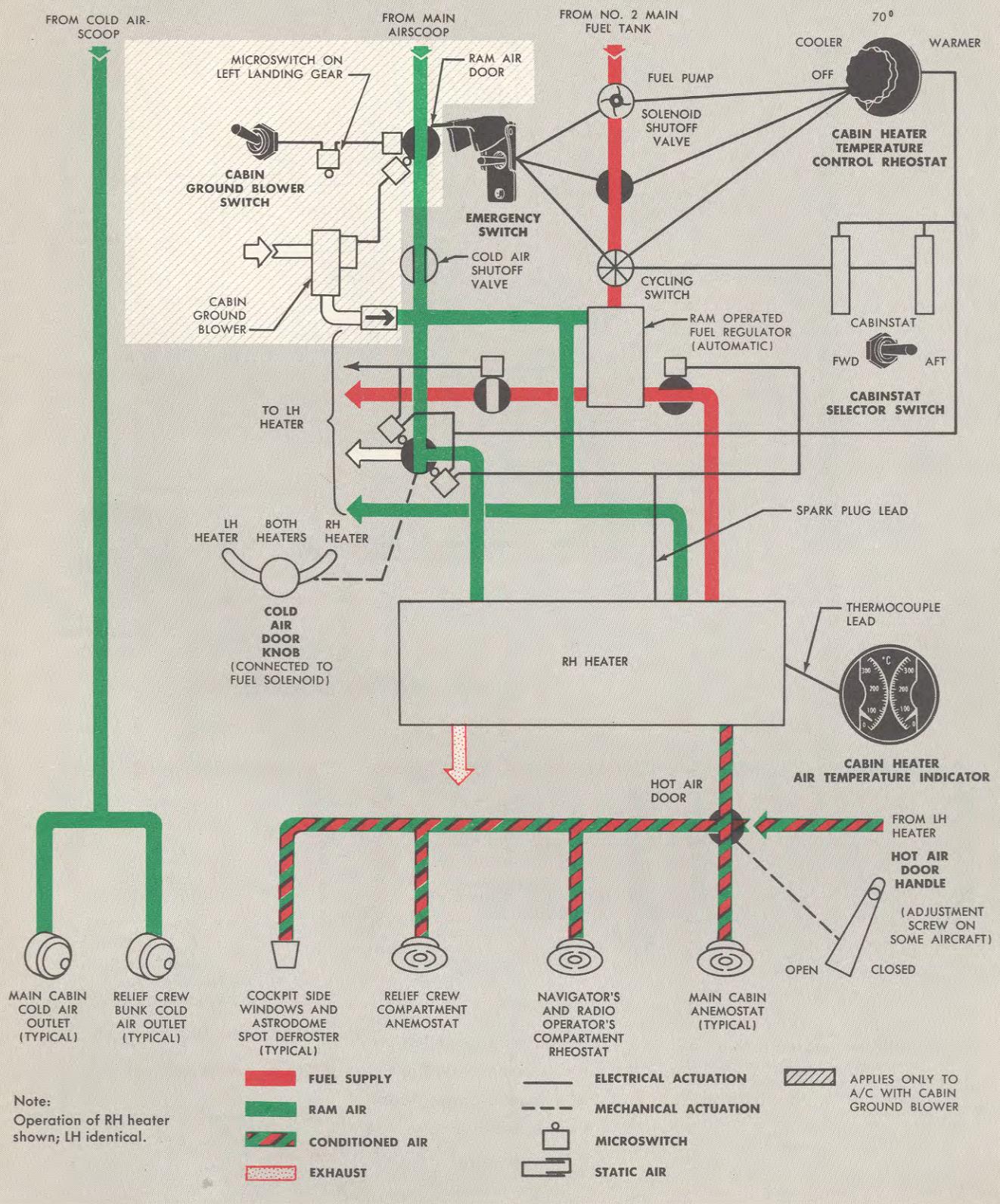


Figure 4-2

pit without turning on the heater. Footwarmer outlets control the flow of heated or ventilating air to the cockpit. Cold air for ventilation during flight is taken from the ram air intake of the cockpit heater.

Two cabin heaters, which operate as one unit, are installed in the ceiling of the relief crew's compartment and supply ventilating air at heated or ambient temperature for the main cabin (cargo compartment), relief crew compartment, and the radio operator's and navigator's stations only during flight. The cabin heaters also provide heated air to defrost the astrodome and cockpit side windows. (See thermal and pneumatic de-icing systems, this section.)

The cabin heaters are normally automatic in operation, but can be manually cycled to maintain adequate temperature. Automatic temperature control is accomplished by two cabinstats, which are connected to a 115-volt a-c amplifier circuit, and a heater cycling switch which cycles the heaters by opening or closing the heater fuel solenoid valve and the ignition circuit simultaneously. When temperature in the cabin or relief crew compartment fluctuates below the selected setting of the temperature control rheostat, the heaters are cycled on and continue to operate until the temperature rises to that of the rheostat switch setting. At this temperature, the cabinstats actuate the automatic temperature control system and discontinue heater operation. The heater cycling switch is set at approximately 110°C, which corresponds to the 70° position of the temperature control rheostat switch. The heaters are protected by an overheat switch which opens the electric circuit to all components of the automatic temperature control system and closes the heater fuel solenoid valve, thereby discontinuing heater operation in case a temperature of approximately 177°C is reached. When the heaters have cooled to the cycling switch temperature of approximately 110°C, the ignition circuit is closed and fuel is again supplied to the heaters.

A cold air door, installed in the duct forward of the cabin heaters, controls the flow of ram air into either or both heaters. A hot air door, located in the duct aft of the heaters, directs the flow of heated air from the main cabin to the relief crew compartment if required. A spring-loaded trap door located in the duct forward of the heaters permits the application of CO₂ by a hand-operated fire extinguisher in case of heater fire. Heated air is supplied to the cabin and the relief crew compartment through ducts installed in the cabin ceiling and is discharged through anemostats. An external aircoop, located on top of the fuselage to the left and aft of the astrodome, provides ram air for the heaters or cold air for the ventilating system when the heaters are not in operation. On some aircraft, a sep-

arate cold air ventilating system is installed which provides adjustable outlets at each set of cabin seats or litters, and each crew bunk. Cold ram air is supplied through an external aircoop installed on the right side of the fuselage. Ventilating exhaust ducts are installed in the main cabin paneling and in the lavatories. On some aircraft a ground blower is installed in the forward lower cargo compartment for ground operation of the cabin heaters or to supply ambient ventilating air to the main cabin, relief crew compartment, and the navigator's and radio operator's stations.

COCKPIT GROUND BLOWER.

A cockpit ground blower installed in the nose section of the aircraft supplies either cockpit ventilation, or when operated in conjunction with the cockpit heater, heats the cockpit when the aircraft is on the ground. The cockpit ground blower is automatically turned on by a microswitch connected to the nose gear uplatch when the nose gear is extended, and turned off when the gear is retracted. Power for the blower is supplied from the 28-volt d-c bus.

On aircraft without search radar installed, the blower must be manually controlled by a ground blower handle, placarded ON and OFF, and installed on top of the glareshield in front of the pilot's seat. Placing the handle in the ON position closes a door in the ram air duct and opens a door in the ground blower duct. Movement of the duct doors completes a 28-volt d-c circuit and energizes the cockpit ground blower motor. The blower should be turned OFF when above 105 knots (120 mph) IAS to prevent excessive wear on the blower motor.

COCKPIT HEATER SWITCH (C-54 AIRCRAFT ONLY).

A cockpit heater switch with ON and OFF positions, is installed under the glareshield to the right of the left emergency airbrake handle. Placing the switch in the ON position completes a 28-volt d-c circuit to the cockpit heater ignition system, opens the heater fuel solenoid valve, energizes the cockpit heater fuel pump, and starts the heater.

Extension of the nose gear automatically energizes the cockpit ground blower and provides air for ground operation of the cockpit heater. On aircraft without search radar installed, manual selection of the cockpit ground blower (by use of the ground blower handle) is necessary, and the cockpit heater switch is placarded:

DO NOT TURN ON HEATER IF INDICATED AIRSPEED IS LESS THAN 105 KNOTS (120 MPH) UNLESS THE BLOWER IS OPERATING.

Cockpit Heater Air Temperature Indicator.

A thermocouple-type cockpit heater air temperature indicator (*figures 1-10 and 1-18*), calibrated in degrees centigrade, is mounted on the overhead instrument panel and indicates the temperature of the heated air output directly aft of the heater.

FOOTWARMER HANDLES.

A footwarmer handle (*figure 4-5*) with OPEN and CLOSED positions is installed outboard of each pilot's seat. Each handle mechanically and individually regulates the volume of heated or ambient air delivered to the cockpit. The full OPEN position delivers maximum airflow. Full CLOSED shuts off the flow of air.

CABIN HEATER TEMPERATURE CONTROL RHEOSTAT.

A cabin heater temperature control rheostat, with OFF, COOLER, 70°, and WARMER positions, is installed on the cabin heater control panel (*figure 4-3*). The control rheostat may be placed in intermediate positions between OFF and WARMER. The temperature control rheostat controls the setting of either the FWD or the AFT cabinstat; this automatically cycles the heaters to regulate cabin temperature or relief crew compartment temperature. Power for the rheostat is the 28-volt d-c circuit.

CABINSTAT SELECTOR SWITCH.

A cabinstat selector switch with FWD and AFT positions is located on the cabin heater control panel (*figure 4-3*). Placing the cabinstat selector switch in the FWD position completes a 28-volt d-c circuit to actuate the cabinstat in the relief crew's compartment to automatically cycle the heaters and maintain the desired temperature as selected by the cabin heater temperature control rheostat. When the cabinstat selector switch is placed in the AFT position, the cabinstat located in the main cabin is actuated to automatically cycle the heaters and maintain the desired temperature as selected by the cabin heater temperature control rheostat.

CABIN HEATER EMERGENCY SWITCH.

A guarded cabin heater emergency switch with ON and OFF positions is mounted on the cabin heater control panel (*figure 4-3*) and may be used to operate the heaters if the automatic (a-c-powered) temperature control system fails to function. Positioning the heater emergency switch alternately to the ON and OFF positions

will manually cycle the heaters to maintain the desired temperature by bypassing the automatic temperature control system. Power is supplied from the 28-volt d-c bus.

Cold Air Doorknob (C-54 Aircraft Only).

A mechanically operated cold air doorknob (*figure 4-2*), with LH HEATER, BOTH HEATERS, and RH HEATER positions, is located under the forward wye duct of the two cabin heaters. The doorknob is normally set in the BOTH HEATERS position, which divides the flow of cold ram air equally to each cabin heater. Placing the doorknob in the LH HEATER position diverts the entire flow of cold ram air through the left heater, making the right heater inoperative. Placing the doorknob in the RH HEATER position diverts the entire flow of cold ram air through the right heater, making the left heater inoperative. When the doorknob is positioned to close the cold air door to either heater, the electrical circuit is opened and the fuel supply to the respective heater is shut off.

Cold Air Shutoff Valve.

On some aircraft a valve is located in the forward wye which may be positioned to the closed position, completely shutting off the supply of cold air to both cabin heaters.

Hot Air Door Handle.

On some aircraft, a mechanically operated hot air door handle (*figure 4-2*), with OPEN and CLOSED positions, is located in the hot air duct aft of the two cabin heaters. The door handle is normally set in the full OPEN position. Placing the door handle in the CLOSED position directs the flow of hot ventilating air to the relief crew's compartment and the radio operator's and navigator's stations, and shuts off the hot ventilating air supply to the cabin. The door may be closed to supply the crew with heated ventilating air in the case of insufficient heat output by the cabin heaters. On some aircraft, the hot air door handle is replaced by an adjustment screw located on the underside of the hot air duct aft of the two cabin heaters.

WARNING

With heaters operating at full capacity, the hot air door must be in the full OPEN position to avoid dangerous overheating conditions.

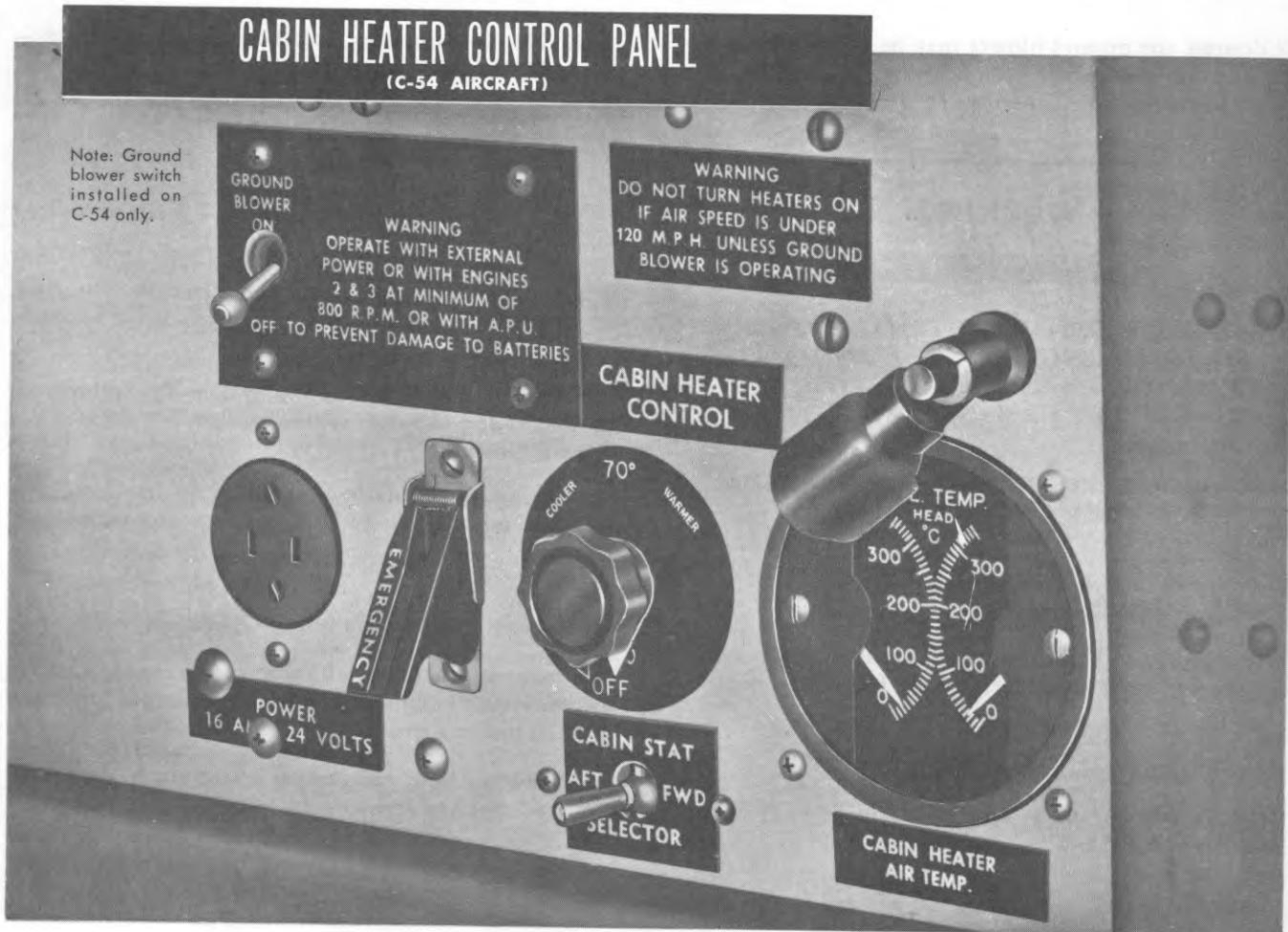


Figure 4-3

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Auxiliary Cold Air Duct Mixing Valve.

On some late aircraft, a valve is located in the hot air duct just aft of the anemostat in the crew compartment ceiling. This mixing valve is manually operated by a handle on the crew compartment ceiling and can be set to regulate the amount of cold or hot airflow, in any proportion, to the crew compartment and the radio operator's and navigator's stations.

Cabin Heaters Air Temperature Indicator.

A dual-indicating cabin heaters air temperature indicator is located on the cabin heater control panel (figure 4-3). The indicator is calibrated in degrees centigrade and indicates the temperature of the heated air output directly aft of the heaters. Power source for the indicator is the 28-volt d-c bus.

Cabin Ground Blower and Switch.

On some aircraft a cabin ground blower is installed in the forward lower cargo compartment for ground operation of the cabin heaters or to supply ambient ventilating air to the main cabin, relief crew compart-

ment, and the navigator's and radio operator's stations. A cabin ground blower switch, with ON and OFF positions (figure 4-3), is located on the cabin heater control panel. When the switch is placed in the ON position, a 28-volt d-c circuit is completed to the ground blower motor, and a damper motor that is installed on the ram air duct is energized to close a damper in the ram air duct forward of the cabin heaters. Air pressure from the blower opens a pressure-actuated door in the ground blower duct, and ambient air is supplied either for ventilating or, in conjunction with the cabin heaters, for heating the main cabin, the relief crew compartment, and the navigator's and the radio operator's stations when the aircraft is on the ground. A microswitch, located on the left landing gear, automatically controls operation of the blower motor and the damper motor when the ground blower switch is in the ON position. When the main gear wheels leave the ground, the damper motor is energized to open the damper in the ram air duct and the blower motor is deenergized. When the main gear wheels touch down, the damper motor is energized to close the damper in the ram air duct, and the blower motor is energized.

If desired, the ground blower may be turned off on the ground by placing the ground blower switch on the cabin heater control panel to the OFF position.

WARNING

OPERATE WITH EXTERNAL POWER OR WITH ENGINES NO. 2 AND 3 AT MINIMUM OF 800 RPM OR WITH APU TO PREVENT DAMAGE TO BATTERIES.

HEATING AND VENTILATING SYSTEM NORMAL OPERATION (C-54 AIRCRAFT).

Cockpit Heating and Ventilating System Operation on the Ground.

The cockpit can be ventilated and heated while on the ground by the performance of the following steps:

1. Power supply — ON.
2. Cockpit ground blower — ON.
3. No. 2 or No. 3 main fuel tank booster pump switch — LOW; OFF when heater fuel pump takes over.
4. Cockpit heater switch — ON (if heat required).
5. Footwarmer handles — OPEN.

Cockpit Heating and Ventilating System Operation in Flight.

The cockpit can be ventilated or heated while in flight by the performance of the following steps:

1. Cockpit ground blower control handle (if installed) — OFF (after attaining a minimum indicated airspeed of 105 knots [120 mph] IAS).
2. No. 2 or No. 3 main fuel tank booster pump switch — LOW; OFF when heater fuel pump takes over.
3. Cockpit heater switch — On (if heat required).
4. Footwarmer handles — As desired.

Cabin Heating and Ventilating System Operation on the Ground (Aircraft with Cabin Ground Blower).

The main cabin, relief crew compartment, and navigator's and radio operator's stations can be heated or ventilated while on the ground by the performance of the following steps:

1. Hot air door handle (on some aircraft, hot air door adjustment screw) — Full OPEN.

2. No. 2 main fuel tank booster pump switch — LOW; OFF when heater fuel pump takes over.
3. Cold air doorknob — BOTH HEATERS.
4. Ground blower switch — ON.
5. Cabin heater control rheostat — Turn to desired temperature (if heat required).
6. Cabinstat selector switch — Place in the AFT or FWD position, as desired (if using heaters).

Cabin Heating and Ventilating System Operation on the Ground (Aircraft without Cabin Ground Blower).

No heating or ventilating operation on the ground is provided on aircraft without a cabin ground blower installed.

Cabin Heating and Ventilating Operation in Flight.

The main cabin or relief crew compartment can be heated or ventilated while in flight by the performance of the following steps:

1. Hot air door handle (early aircraft, hot air door adjustment screw) — full OPEN.
2. No. 2 or No. 3 main fuel tank booster pump switch — LOW; OFF when heater fuel pump takes over.
3. Cold air doorknob — BOTH HEATERS.
4. Cabin heater control rheostat — Turn to desired temperature (if heat required).
5. Cabinstat selector switch — Place in the AFT or FWD position as desired (if using heaters).

HEATING AND VENTILATING SYSTEM EMERGENCY OPERATION.

Cabin Heater Emergency Operation.

1. In case one cabin heater fails, close the cold air door to that heater.
2. If the automatic temperature control system fails to function, turn the EMERGENCY switch ON. (Heat output may be reduced by closing the cold air door to either one of the heaters, which will allow only one heater to operate, or by alternately positioning the EMERGENCY switch to OFF and ON.)

Cockpit Heater Emergency Operation.

No emergency operation of the cockpit heater is provided.

Heater Fuel Valve Switches (R5D Aircraft).

Fuel flow to the heaters is controlled by two spring-loaded heater fuel valve switches marked A and B and installed on the cabin heater control panel (figure 4-4). The A switch has a momentary-contact OPEN position and the B switch has a momentary-contact CLOSED position. Both switches control a 28-volt d-c solenoid-operated shutoff valve located in the heater fuel line. The fuel valve may be opened by holding the A switch in the OPEN position until the amber indicating light illuminates. The fuel valve is closed when the B switch is held in the CLOSED position and the amber light illuminates.

Fuel Preheater Switch (R5D Aircraft).

A fuel preheater switch, with a placarded ON position and spring-loaded to any up (OFF) position, is installed on the cabin heater control panel (figure 4-4). Fuel preheating is required if outside air temperature is below -18°C . When the preheater switch is held on the ON position, a 28-volt d-c circuit is completed to the fuel preheater coils in the heater combustion chambers.

Temperature Control Selector Switch (R5D Aircraft).

A 3-position temperature control selector switch (marked D on the placard) is located on the cabin heater control panel (figure 4-4), and selects either automatic or manual temperature control of the heaters. Placing the switch in the AUTOMATIC position closes a 26-volt a-c amplifier circuit to two cabinstats, which automatically regulate the heaters to maintain constant temperatures. In the center (OFF) position, the heater electrical circuit is disconnected. If the automatic control system fails to function, the MANUAL (d-c powered) position may be used to bypass the amplifier and provide continuous heater operation. Heater output with the switch in MANUAL position may be regulated by use of the fuel regulator valve switches.

Fuel Regulator Valve Switches (R5D Aircraft).

Two 3-position fuel regulator valve switches, marked E and F, are located on the cabin heater control panel (figure 4-4), and may be used to govern the output of the heaters by regulating fuel flow to the heater combustion chambers. Two solenoid valves in the heater fuel lines are controlled by each fuel regulator valve switch. One of the solenoids is located in a free flow heater fuel line, the other in a restricted flow heater fuel line. Placing either switch in HIGH position completes a 28-volt d-c circuit to the valve in the unrestricted line to allow maximum fuel flow to the respective heater combustion chamber. Placing either switch in LOW position completes a 28-volt d-c circuit to the valve in the restricted line to allow approxi-

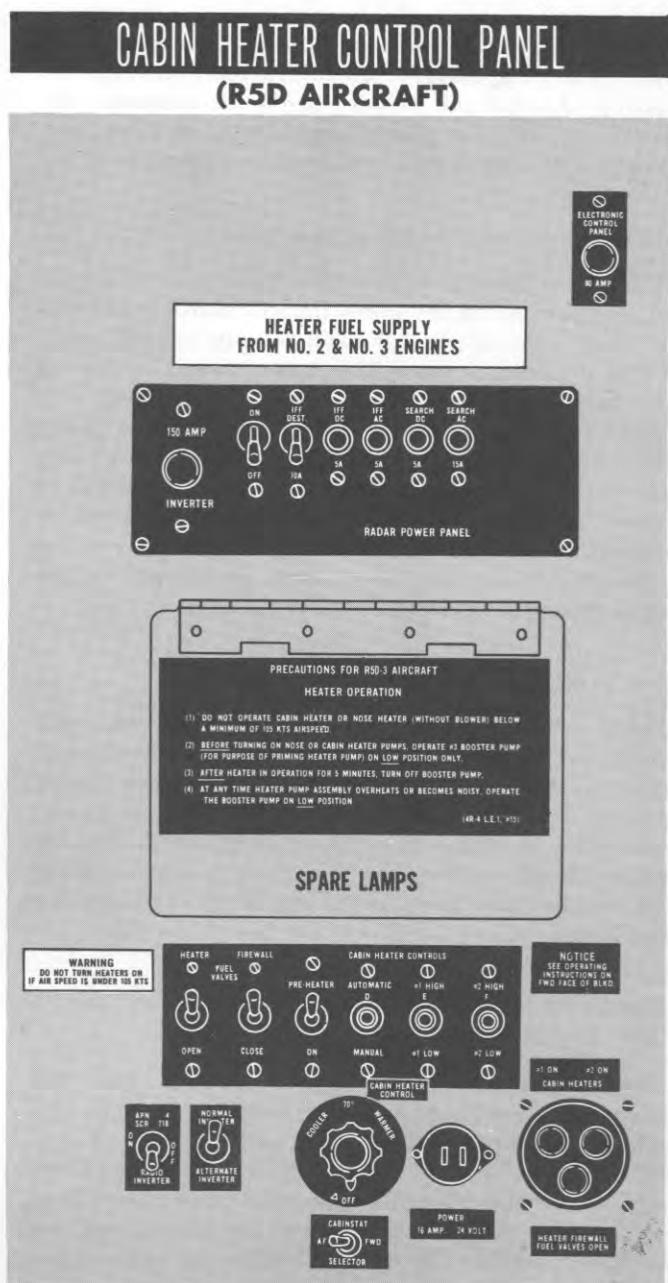


Figure 4-4

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mately three-quarters of maximum fuel flow to the heater combustion chamber. When the switches are in the center (OFF) position, both valves remain closed, restricting all fuel flow.

Cabin Heater Temperature Control Rheostat (R5D Aircraft).

A cabin heater temperature control rheostat, with OFF, COOLER, 70° , and WARMER positions, is installed on the cabin heater control panel (figure 4-4). The rheostat may be placed in intermediate positions between OFF and WARMER. Placing the rheostat in

the desired position varies resistance in a 26-volt a-c amplifier circuit to maintain constant heater temperature. The temperature control rheostat governs the setting of either the forward or the aft cabinstat; this automatically cycles the heaters to regulate cabin temperature or relief crew compartment temperature.

Cabinstat Selector Switch (R5D Aircraft).

A cabinstat selector switch with FWD and AFT positions is located on the cabin heater control panel (figure 4-4). Placing the cabinstat selector switch in the FWD position closes a 28-volt d-c circuit to actuate the cabinstat in the relief crew compartment. The cabinstat automatically cycles the heaters and maintains the desired temperature as selected by the cabin heater control rheostat. When the selector switch is placed in the AFT position, the cabinstat located in the main cabin is actuated to cycle the heaters and maintain the desired temperature as selected by the cabin heater temperature control rheostat.

Heater Indicator Lights (R5D Aircraft).

Three heater indicator lights, one amber and two green, are installed on the cabin heater control panel (figure 4-4). The amber light illuminates when fuel at proper operating pressure has reached the fuel regulator valves. A green light for each heater illuminates when the respective heater is operating and its output has reached a temperature of above 43°C. Power for the heater indicator lights is the 28-volt d-c bus.

Cockpit Heater Manual Control Switch (R5D Aircraft).

A manual heater control switch with ON and OFF positions is installed under the glareshield on the left side of the flight compartment. Since all heater fuel flow is controlled by the A and B heater fuel valve switches on the cabin heater control panel, the A fuel valve switch must be used to open the valve before the cockpit heater may be operated. After the amber light on the cabin heater control panel illuminates and an indicated airspeed of 96 knots (110 mph) IAS is reached (or blower is operating), the cockpit heater manual control switch may be placed in the ON position, completing a 28-volt d-c circuit to the heater spark plugs.

HEATING AND VENTILATING SYSTEM NORMAL OPERATION (R5D AIRCRAFT).

Heating and Ventilating System Operation on the Ground.

The cockpit can be ventilated and heated while on the ground by the performance of the following steps:

1. Power supply — ON.

2. Cockpit ground blower control handle (if installed) — OPEN.
3. Heater fuel valve switch A — OPEN.
4. Cockpit heater manual control switch — ON.
5. No. 2 or No. 3 main fuel tank booster pump switch LOW; OFF when heater fuel pump takes over.

The following steps may be performed before takeoff for cabin heater operation (the cabin heaters will begin operating when 105 knots [120 mph] IAS is reached):

1. Power supply — ON.
2. Hot air door adjustment screw — full OPEN.
3. Cold air damper — BOTH HEATERS ON.
4. Heater fuel valve switch A — OPEN.
5. Temperature control selector switch D — AUTOMATIC.
6. Cabin heater control rheostat — Turn to desired temperature.
7. Fuel regulator valve switches E and F — HIGH or LOW, according to temperature table on control panel placard.

Heating and Ventilating System Operation in Flight.

The cockpit can be ventilated and heated while in flight by the performance of the following steps:

1. Heater fuel valve switch A — OPEN.
2. Cockpit heater manual control switch — ON.

The cabin heaters will begin operating when 96 knots (110 mph) IAS is reached if outside air temperature is above -18°C. If outside temperature is below -18°C, hold fuel preheater switch ON.

CAUTION

Never hold fuel preheater switch on for more than 2 minutes, as preheater coils may burn out.

Note

If automatic operation fails, place switch D in MANUAL position.

ALCOHOL ANTI-ICING SYSTEM.

Ice is prevented from forming or is removed from the propellers, carburetors, and windshield by an alcohol anti-icing system incorporating a 40-gallon supply tank (18, figure 1-40) and three alcohol pumps located in the aft lower cargo compartment. Two 28-volt d-c-powered metering pumps, installed under the alcohol supply tanks, pump alcohol to the four propellers. One pump supplies anti-icing fluid to propellers No. 1 and 4. The other pump supplies anti-icing fluid to propellers No. 2 and 3. On R5D aircraft, each pump can supply all four propellers. Each pump supplies alcohol at a rate of from 2 to 10 quarts per hour per propeller, depending upon the setting of the propeller anti-icing rheostat switch. Alcohol is pumped from the supply tank to slinger rings on the aft side of each propeller hub and is distributed over the blades by centrifugal force. Alcohol for the carburetors and the windshield is supplied by the same 28-volt d-c-powered pump installed under the supply tank. The rate-of-flow to each carburetor is approximately 4 gallons per hour. Alcohol is pumped from the supply tank to two manifolds in each carburetor aircoop and is sprayed in the carburetor airstream through four jet nozzles. Windshield anti-icing fluid is pumped from the alcohol supply tank through an adjustable needle valve to distribution lines on the bottom and top of each windshield panel. The anti-icing fluid sprays out into the air and is then blown back onto the surface of the windshield (see figure 1-40 for fluid specification).

Propeller Anti-Icing Rheostat Switches (C-54 Aircraft).

Two propeller anti-icing rheostat switches placarded PROP ANTI-ICER, with OFF, ON, and DECREASE FLOW positions, are mounted on the top right section of the electrical control panel (figure 1-11). When a rheostat is turned to the ON position, a 28-volt d-c circuit is closed to the respective anti-icing pump motor and alcohol is pumped to the selected propellers. The speed of the pump motor regulates the rate of alcohol flow to the propellers. Turning the rheostat clockwise will decrease the volume of anti-icing fluid delivered to the propellers.

Propeller Anti-Icing Rheostat Switches (R5D Aircraft).

Two propeller anti-icing rheostat switches placarded PROP ANTI-ICER, with OFF, ON, and DECREASE FLOW positions, are mounted on the top right section of the electrical control panel (figure 1-11). Rotating a rheostat to the ON position completes a 28-volt d-c circuit to the respective anti-icing pump motor, and alcohol is pumped through four flowmeter needle valves to the propellers. The speed of the pump motor regulates the rate of alcohol flow to the propellers. Rotating the rheostat clockwise will decrease the volume of anti-icing fluid delivered to the propellers.

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Propeller Anti-Icing Flowmeter Needle Valves and Gages (R5D Aircraft).

Four flowmeter needle valves located on the upper aft bulkhead of the navigator's station (2, figure 4-13) control propeller anti-icing fluid flow from the anti-icing pump motors to the respective propellers. The needle valves must be opened before the system may be operated. Four direct-reading fluid flowmeter gages, calibrated in quarts per hour, are mounted in the unit with the needle valves. A light switch, placarded PROP ANTI-ICER, with ON and OFF positions, is mounted below the unit.

Carburetor Anti-Icing Switches.

Four carburetor anti-icing switches, one for each engine, with ON and OFF positions are mounted on the top right section of the electrical control panel (figure 1-11). Each switch is spring-loaded to the OFF position. When an anti-icing switch is held in the ON position, a 28-volt d-c circuit is closed to the anti-icing pump motor and alcohol is pumped to the selected carburetor.

Windshield Anti-Icing Switch.

A windshield de-icing switch with ON and OFF positions is mounted on the top center section of the electrical control panel (figure 1-11). When the switch is placed in the ON position and the alcohol control knob is opened, a 28-volt d-c circuit is closed to the anti-icing pump motor and alcohol is pumped to the windshield, provided that the windshield alcohol control knob is turned counterclockwise to permit the flow of alcohol through the system.

Windshield Alcohol Control Knob.

A windshield alcohol control knob (figure 1-8) is located outboard of the copilot's seat. When the control knob is turned counterclockwise, a needle valve is mechanically opened which will regulate the flow of alcohol to the windshield, provided the windshield anti-icing switch is ON.

Windshield Alcohol Pump Indicator Light.

An amber windshield alcohol pump indicator light is mounted on the top center of the electrical control panel (figure 1-11). When the windshield anti-icing switch is in the ON position, the 28-volt d-c alcohol pump indicator circuit is energized and the light is illuminated indicating that the windshield anti-icing pump is operating.

WINDSHIELD DE-ICING AND FOOTWARMER HANDLES

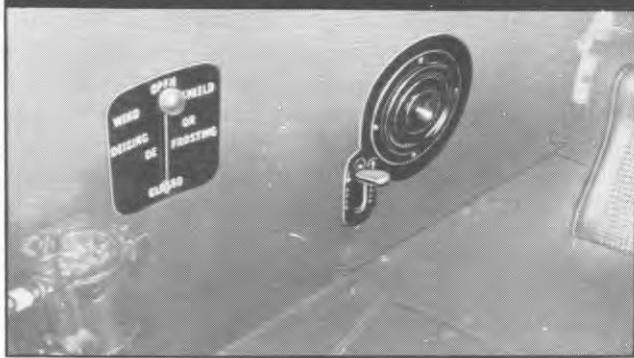


Figure 4-5

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Anti-icing Fluid Quantity Gage.

An anti-icing fluid quantity gage calibrated in gallons is located on the right side of the upper instrument panel (figure 1-11). The fluid quantity gage indicates the amount of alcohol in the supply tank. Power source is 28-volt d-c bus.

THERMAL AND PNEUMATIC DE-ICING SYSTEMS.

WINDSHIELD DE-ICING AND DEFROSTING SYSTEM.

On some aircraft, windshield ice accretion is prevented or removed and defrosting is accomplished by heated air supplied from the cockpit heater. The hot air flows through ducts (figure 4-1) and is distributed between the windshield and removable de-icer panels. The panels may be stowed under the relief crew lower bunk when not in use. On some aircraft, the de-icer panels are permanently installed and serve primarily as a means of defrosting the windshield, since other provisions for ice removal are installed. (See the paragraph on alcohol anti-icing systems, this section.) The clearview corner windows are de-iced or defrosted by hot air supplied through the same duct that directs heated air to the windshield.

Windshield De-icing and Defrosting Control Handles.

A windshield de-icing and defrosting control handle (figure 4-5) with OPEN and CLOSED positions is located outboard of each pilot's seat. Each control handle mechanically regulates the volume of air delivered to the windshield and the clearview corner window for de-icing or defrosting. The full OPEN position permits maximum air flow. The full CLOSED position shuts off the flow of air.

Astrodomed and Side Window Defrosting System.

Two flexible air ducts (figure 1-14), one located behind each pilot's seat, supply heated air from the flight compartment anemostat for spot defrosting of the astrodome and the pilots' side windows. Heated air is available only when the cabin heaters are in operation.

WING AND EMPENNAGE DE-ICER SYSTEM.

Ice accretion on the leading edges of the wing and empennage surfaces is eliminated in flight by the operation of the wing and empennage de-icer system (figure 4-6). The system consists of expanding boots installed along the leading edge of each wing, each horizontal stabilizer, and the vertical stabilizer. The boots are inflated and deflated intermittently in sequence by air pressure from the exhaust side of four engine-driven vacuum pumps, one on each engine. The pumps on the inboard engines also provide vacuum pressure for the operation of the flight instruments. The air pressure from the four pumps flows through individual oil separators mounted in each engine nacelle, to a regulating oil separator installed in the fuselage accessories compartment, and passes through an air filter to an air distributor valve which directs the flow of air to the wing and empennage de-icer boots. The oil separators remove oil and moisture from the air. Check valves located in the individual pressure lines from each engine-driven pump prevent the loss of air pressure in case of pump failure. Each wing de-icer boot has three cells. Each empennage de-icer boot has one cell. One complete de-icing cycle is completed every 40 seconds. Each cycle consists of five 8-second pressurizing periods. The first period: air inflates the center tubes on the right and left outboard de-icer boots. Second period: the upper and lower tubes on the right and left outboard boots are inflated. Third period: the center tubes in the right and left inboard boots are inflated. Fourth period: the upper and lower tubes in the right and left inboard boots are inflated. Fifth period: both tubes in each of the three stabilizer boots are inflated. This pulsing action cracks ice formations on the boots, and the air-stream blows the ice off. The distributor valve is controlled by a 28-volt d-c motor which opens or closes the port in the distributor valve unit. Operation of the electric motor is controlled from the cockpit. A pressure relief valve in the air filter regulates the pressure in the system.

WARNING

Do not land or takeoff with the wing de-icer boots in operation because of the resultant disturbance of airflow over the wing.

WING AND EMPENNAGE DE-ICING SYSTEM

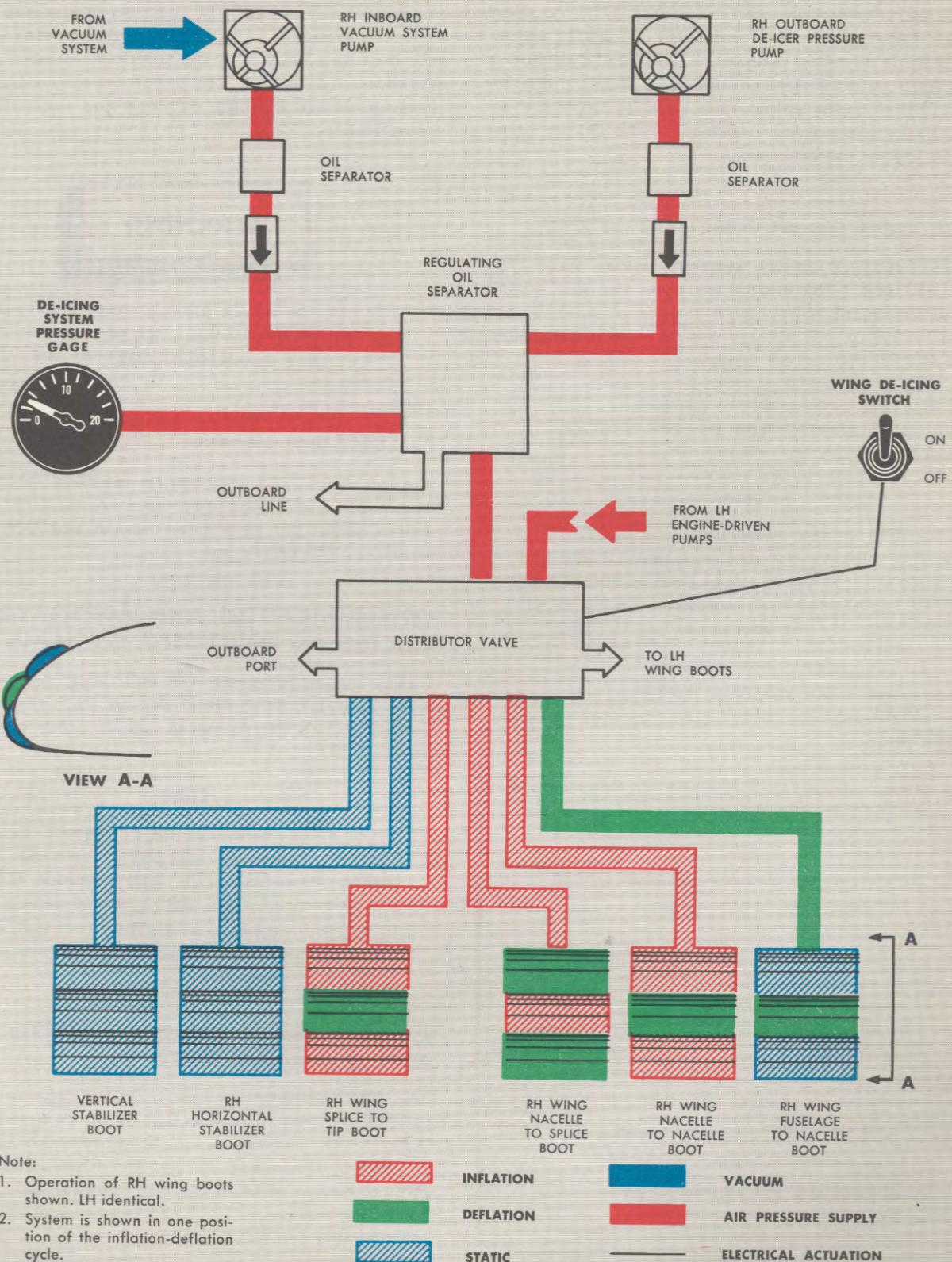


Figure 4-6

Wing De-icer Control Switch.

A wing de-icer control switch with ON and OFF positions is located on the top section of the electrical control panel (figures 1-11 and 1-16). When the switch is placed in the ON position, a 28-volt d-c circuit is completed to an electric motor that operates the de-icer air distributor valve. This valve controls the sequence of inflation and deflation of the de-icer boots on the wings and empennage.

De-icer System Pressure Gage.

A direct-reading de-icer system pressure gage (figures 1-10 and 1-18) located on the right side of the main instrument panel in front of the copilot's seat is calibrated in psi. De-icer system pressure is taken from the regulating oil separator.

WING AND EMPENNAGE DE-ICER SYSTEM OPERATION.**Note**

For best results, wait until ice has formed before starting the de-icer system. If the ice is too thin, it will crack in small patterns and will not have enough weight and body to be blown off by the slipstream.

Set the wing and empennage de-icer system in operation by turning the wing de-icer control switch to the ON position.

1. Make certain the surface de-icer boots function properly by observing the pulsation of the de-icer boots.
2. De-icer system pressure — Check within limits.

Note

When the system is operating, the gage will not give a constant recording of 8 psi because of the fluctuation of air pressure; however, it must reach 8 psi at the peak of each inflation to properly inflate the individual tubes in each boot.

Pitot Head Heat and Ventilating Airscoop De-icing Switches.

Two pitot head heat and ventilating airscoop de-icing switches, one for the left pitot head circuit and one for the right pitot head and ventilating airscoop circuits, have ON and OFF positions and are mounted on

the upper instrument panel (figures 1-11 and 1-16). When the switches are placed in the ON position, a 28-volt d-c circuit is completed to the heating elements in the pitot heads and the ventilating airscoop to prevent the accumulation of ice. The left switch controls the heating elements in the pilot's pitot head and the ventilating airscoop. The right switch controls the heating elements in the copilot's and the navigator's pitot head.

WARNING

Do not operate the pitot heaters for extended periods on the ground; lack of a cooling air-stream will result in damage to the pitot heads.

Pitot Head Heat Ammeter.

A pitot head heat ammeter is installed on the left upper instrument panel (figures 1-11 and 1-16) and indicates when the pitot head heaters are ON. Power source is a 28-volt d-c bus.

COMMUNICATION AND ASSOCIATED ELECTRONIC EQUIPMENT (TYPICAL).

Unless otherwise noted, the following equipment is typical for all C-54 and R5D aircraft. Each aircraft must be checked to determine the exact radio equipment installed.

Note

Only transmissions of an emergency nature will be made on emergency (distress) frequency channels. This will preclude transmission of messages which might falsely be interpreted as actual emergency messages, and keep the frequencies open for actual emergencies.

AN/ARC-3 VHF COMMAND TRANSMITTER-RECEIVER (C-54 AIRCRAFT).

The VHF command set is operated from a control panel located on the aft section of the control pedestal (figure 1-9). The equipment is short-range VHF and is used as a two-way system for air-to-air or air-to-ground communication within a frequency range of 100 to 156 megacycles. Eight crystal-controlled channels are available for transmission and reception. To place the VHF command radio in operation, move the VHF power switch to the ON position. To turn off the set, move the switch to the OFF position. Power source is a 28-volt d-c bus.

COMMUNICATION AND ASSOCIATED ELECTRONIC EQUIPMENT - Typical

TYPE	DESIGNATION	USE	OPERATOR	RANGE	LOCATION OF CONTROLS
VHF COMMAND	AN/ARC-3 OR AN/ARC-49	2-WAY VOICE COMMUNICATION	PILOT CO-PILOT	LINE OF SIGHT	CONTROL PEDESTAL
UHF COMMAND	AN/ARC-27	2-WAY VOICE COMMUNICATION	PILOT CO-PILOT RADIO OPERATOR	LINE OF SIGHT	CONTROL PEDESTAL OR RADIO OPERATOR'S STATION
UHF HOMING ADAPTER	AN/ARA-25	HOMING	PILOT CO-PILOT	LINE OF SIGHT	CONTROL PEDESTAL
HF COMMAND	18S-4	2-WAY VOICE COMMUNICATION	PILOT CO-PILOT	200-2500 MILES	CONTROL PEDESTAL
HF LIAISON	AN/ARC-8	LONG RANGE, 2-WAY CODE AND VOICE COMMUNICATION	RADIO OPERATOR	200-2500 MILES	RADIO OPERATOR'S STATION
LF RECEIVER	BC 453 B	MONITOR LF RANGE SIGNALS	PILOT CO-PILOT		CONTROL PEDESTAL
VHF NAV	AN/ARN-14	OMNI AND LOCALIZER	PILOT CO-PILOT	LINE OF SIGHT	CONTROL PEDESTAL
GLIDE SLOPE RECEIVER	AN/ARN-5B	INSTRUMENT APPROACH	PILOT	25 MILES	CONTROLLED BY VHF NAV EQUIPMENT ON CONTROL PEDESTAL
AUTOMATIC RADIO COMPASS	AN/ARN-7	RECEPTION OF VOICE OR CODE COMMUNICATIONS; POSITION FINDING, HOMING	PILOT CO-PILOT NAVIGATOR	20-200 MILES	CONTROL PEDESTAL AND NAVIGATOR'S STATION
LONG RANGE (LORAN)	AN/APN-9 OR AN/APN-4	RECEPTION OF RADIO NAVIGATION SIGNALS	NAVIGATOR	700 MILES (DAY) 1400 MILES (NIGHT)	NAVIGATOR'S STATION
SEARCH RADAR (IF INSTALLED)	AN/APS-42 OR AN/APS-42A	NAVIGATIONAL AID	PILOT NAVIGATOR	LINE OF SIGHT	PILOT'S STATION NAVIGATOR'S STATION
INTERPHONE	AN/AIC-3 OR RC-36	INTER-CREW COMMUNICATION		WITHIN THE AIRCRAFT	CREW MEMBER STATIONS, MAIN CABIN NEAR CARGO DOOR, NOSE WHEEL WELL
MARKER BEACON	RC-193A	RECEPTION OF MARKER BEACON SIGNALS FROM INSTRUMENT APPROACH STATIONS	PILOT CO-PILOT	3 MILES	
IFF	AN/APX-6	IDENTIFICATION	RADIO OPERATOR	LINE OF SIGHT	RADIO OPERATOR'S STATION
RADIO ALTIMETER (LOW RANGE)	AN/APN-1	ABSOLUTE ALTITUDE ZERO TO 4000 FT	PILOT CO-PILOT		MAIN INSTRUMENT PANEL
RADIO ALTIMETER (HIGH RANGE)	SCR-718	ABSOLUTE ALTITUDE ZERO TO 40,000 FT	NAVIGATOR		NAVIGATOR'S STATION OR RADIO OPERATOR'S STATION
EMERGENCY TRANSMITTER	SCR-578	EMERGENCY RESCUE		100-500 MILES	STOWED IN FLIGHT: FORWARD OF MAIN CABIN ENTRANCE DOOR
EMERGENCY TRANSCIEVER	AN/URC-4	EMERGENCY RESCUE		LINE OF SIGHT	STOWED IN FLIGHT: FORWARD OF MAIN CABIN ENTRANCE DOOR

Figure 4-7

COMMUNICATION AND ASSOCIATED ELECTRONIC EQUIPMENT—Typical

(R5D
AIRCRAFT)

The following equipment is typical for R5D aircraft. Each aircraft must be checked to determine the exact equipment installed.

TYPE	DESIG-NATION	USE	OPERATOR	RANGE	LOCATION OF CONTROLS
VHF COMMAND	AN/ARC-1	TWO-WAY VOICE COMMUNICATION	PILOT CO-PILOT	LINE OF SIGHT	OVERHEAD BETWEEN PILOTS
UHF COMMAND	AN/ARC-27	TWO-WAY VOICE COMMUNICATION	PILOT CO-PILOT RADIO OPERATOR	LINE OF SIGHT	CONTROL PEDESTAL AND RADIO OPERATOR'S STATION
HF COMMAND	AN/ART-13	LONG-RANGE VOICE AND CODE TRANSMISSIONS	PILOT CO-PILOT RADIO OPERATOR	200-2500 MILES	OVERHEAD BETWEEN PILOT'S AND RADIO OPERATOR'S STATIONS
LIAISON RECEIVER	BC-348	LONG-RANGE VOICE AND CODE RECEPTION	RADIO OPERATOR	200-2500 MILES	RADIO OPERATOR'S STATION
COMMAND	SCR274N	TWO-WAY VOICE COMMUNICATION	PILOT CO-PILOT	200-1000 MILES	CONTROL PEDESTAL
OMNI-VAR AND LOCALIZER	AN/ARN-14	NAVIGATION AND APPROACH	PILOT CO-PILOT	LINE OF SIGHT	OVERHEAD IN FRONT OF PILOT
ILS LOCALIZER RECEIVER	RC-103	INSTRUMENT APPROACH	PILOT CO-PILOT	25 MILES	OUTBOARD PILOT'S SEAT
ILS GLIDE SLOPE RECEIVER	AN/ARN-5 SCR570	INSTRUMENT APPROACH	PILOT CO-PILOT	25 MILES	OUTBOARD PILOT'S SEAT
ILS GLIDE SLOPE RECEIVER	AN/ARN-18	INSTRUMENT APPROACH	PILOT CO-PILOT	25 MILES	OVERHEAD IN FRONT OF PILOT
AUTOMATIC RADIO COMPASS (GREEN)	SCR-269G	RECEPTION OF VOICE OR CODE COMMUNICATIONS; POSITION FINDING, HOMING	PILOT CO-PILOT NAVIGATOR	20-200 MILES	CONTROL PEDESTAL
AUTOMATIC RADIO COMPASS (RED)	AN/ARN-7	RECEPTION OF VOICE OR CODE COMMUNICATIONS; POSITION FINDING, HOMING	PILOT CO-PILOT NAVIGATOR	20-200 MILES	OVERHEAD BETWEEN PILOTS
LORAN	AN/APN-4	RECEPTION OF RADIO NAVIGATION SIGNALS	NAVIGATOR	700 MILES (DAY) 1400 MILES (NIGHT)	NAVIGATOR'S STATION
SEARCH RADAR (IF INSTALLED)	AN/APS-42	NAVIGATIONAL AID	PILOT CO-PILOT NAVIGATOR	LINE OF SIGHT	OVERHEAD BETWEEN PILOTS
INTERPHONE	AN/AIA-2C	FLIGHT CREW AND GROUND CREW COMMUNICATIONS		WITHIN AIRCRAFT	CREW STATIONS, MAIN CABIN NEAR CARGO DOOR, NOSE WHEEL WELL
MARKER BEACON	AN/ARN-8	RECEIVE VISUAL AND AURAL 75 MEGACYCLE SIGNALS	PILOT CO-PILOT	3 MILES	CONTROLLED BY TURNING ON GREEN AUTOMATIC RADIO COMPASS
IFF	AN/APX-6	IDENTIFICATION	CO-PILOT	LINE OF SIGHT	OVERHEAD IN FRONT OF CO-PILOT
RADIO ALTIMETER	AN/APN-1	ABSOLUTE ALTIMETER	PILOT	LOW RANGE 0-4000 FEET	PILOT'S MAIN INSTRUMENT PANEL
RADIO ALTIMETER	SCR/718A	ABSOLUTE ALTIMETER	NAVIGATOR	HIGH RANGE 0-40,000 FEET	RADIO OPERATOR'S STATION
EMERGENCY TRANSMITTER	SCR/578 AN/CRT-3	EMERGENCY RESCUE	ANYONE IN DISTRESS	100-500 MILES	STOWED OVERHEAD FORWARD OF MAIN CABIN DOOR
EMERGENCY TRANSCEIVER	AN/URC-4	EMERGENCY RESCUE	ANYONE IN DISTRESS	LINE OF SIGHT	STOWED MAIN CABIN FORWARD OF MAIN CABIN DOOR

Figure 4-8

AN/ARC-49 VHF COMMAND TRANSMITTER-RECEIVER (C-54 AIRCRAFT).

On some aircraft the AN/ARC-49 VHF command set is installed in lieu of the AN/ARC-3. The set has 48 crystal-controlled channels in the frequency range of 100 to 156 megacycles. It provides air-to-air or air-to-ground communication over line-of-sight distances and receives power from a 28-volt d-c bus. To put the equipment into operation:

1. Aircraft power supply — ON.
2. VHF power switch — ON.
3. Rotate the two channel selector switches on the VHF control panel to the desired channel and allow approximately 30 seconds for the radio to warm up. When the audio tone heard in the headset stops, the radio is ready for operation.
4. Microphone selector switch — COMM VHF.
5. Adjust the volume for desired output.

To turn the equipment off:

1. Position the VHF power switch to OFF.

VHF COMMAND TRANSMITTER-RECEIVER (R5D AIRCRAFT).

The VHF command set is operated from a remote control panel mounted aft of the electrical control panel. The equipment is short-range VHF and is used as a two-way system for air-to-air or air-to-ground communication within a frequency range of 100 to 156 megacycles. Nine preset frequencies and a fixed guard channel frequency are provided on the control panel. A 3-position selector switch placarded GUARD, BOTH, and MAIN T/R provides for guard channel, main channel, or simultaneous guard and main channel operation. A 2-position switch with ON and OFF positions is located on the left side of the panel and provides power for the VHF command set from a 28-volt d-c bus.

UHF COMMAND TRANSMITTER-RECEIVER.

The UHF command radio provides voice communication between aircraft or between aircraft and ground stations within the frequency range of 225.0 to 399.9 megacycles. The UHF command radio, which is also used in conjunction with the automatic direction finder, operates on any one of twenty preset channels, plus a guard channel, or any one of 1750 manually selected frequency channels. The UHF command radio consists essentially of a transmitter-receiver, a UHF command control panel (4, figure 1-9), and an UHF antenna (figure 4-14). Power source is a 28-volt d-c bus.

UHF Command Transmitter-Receiver Controls.

The UHF command control panel (4, figure 1-9), on the control pedestal contains a function switch with OFF, T/R, T/R + G, and ADF positions; a preset channel selector knob with 1 to 20, G, and M positions; three manual frequency selector knobs to select any frequency from 225.0 to 399.9 megacycles; and a volume control knob. If the pilot desires a frequency that is not included in the twenty preset frequencies, the preset channel selector knob must be rotated to the M position to enable selection of the desired frequency by use of the manual frequency selector knobs.

UHF Command Transmitter-Receiver Operation.

1. Function Switch — T/R + G.

CAUTION

Allow at least one minute for the set to warm up before operating to preclude damage to the equipment.

2. Channel Selector Switch — Desired channel.
3. To Stop, Function Switch — OFF.

UHF HOMING ADAPTER (C-54 AIRCRAFT).

The UHF homing adapter equipment utilizes an amplifier (figure 1-10) and an antenna (figure 4-14), and is controlled from the UHF radio control panel (figure 1-9) on the control pedestal. The power source is 28-volt d-c and 115-volt a-c. The function of the equipment is to provide UHF static-free signals for air-to-air or air-to-ground homing. To operate the equipment, turn the UHF radio function switch clockwise to ADF. To turn off the equipment, rotate the function switch counterclockwise to OFF.

Microphone Transfer Switch.

The microphone transfer switch (figure 1-9), mounted on the control pedestal, selects either the VHF or the UHF command transmitter-receiver.

TRANSCEIVER, 618S-1.

The transceiver provides a means for two-way communication between aircraft or between aircraft and ground stations within the frequency range of 2.0 to 25.0 megacycles. The transceiver, employing a highly flexible system, permits the selection of any one of 144 crystal controlled frequencies incorporating the use of a common crystal for transmitting and receiving on any one channel. Two modes of operation, VOICE and CW, as selected on the transceiver control panel, are provided. Normally, the transceiver is used with an automatic antenna tuner providing automatic tuning and matching operations, after a grounding

pulse is received through operation of the channel selector knob. Tuning is completely automatic; therefore, whenever a new channel is selected, the transmitter-receiver circuits are automatically tuned to the desired frequency. Essentially, the equipment consists of a transceiver (6, figure 4-10), a transceiver power supply (5, figure 4-10), an automatic antenna tuner located on the radio rack, a transceiver control panel (6, figure 1-9) on the control pedestal, and a transceiver antenna (figure 4-14). The transceiver receives 28-volt d-c and 115-volt a-c power through circuit breakers on the radio circuit protector panel (figure 1-31).

Transceiver Operation.

1. Primary power circuit breaker — ON.
2. To start, function switch — PHONE.

Note

Allow at least 10 minutes for the transceiver to warm up before operating.

3. Channel selector knobs — Desired frequency.
4. Volume control knob — As desired.
5. Function switch — CW.
6. Channel selector knobs — As desired.

CW signals should be heard on the selected channels.

Note

When operating the channel selector knobs, allow 5 to 15 seconds for the channeling mechanism to operate.

7. Beat frequency oscillator knob — As desired.
8. Volume control knob — As desired.

Note

If operating conditions or tactical restrictions make radio silence desirable or necessary prior to actual communications, when using the automatic antenna tuner modified for "radio silence" operation, do not close the microphone button or key immediately after selecting a new channel. When tactical restrictions permit, close the microphone button or key for a brief interval to start the tuning cycle in the automatic antenna tuner. Check the complete system by two-way communication with a ground station or other aircraft. The panel indicator light should remain on during the tuning cycle.

CAUTION

- Under the above operating conditions, do not speak into the microphone or use the key until the tuning cycle is complete, when making the first transmission after changing channels. Operate the microphone button or key briefly as described; wait approximately 20 seconds, then use the microphone or key as desired. Subsequent transmissions on the same channel may be made without waiting.
- The maximum duty cycle of the automatic antenna tuner is 5 minutes "R-F ON" and 5 minutes "R-F OFF." To insure reliable operation, do not exceed this cycle when operating the equipment.
- 9. To stop, function switch — OFF.

The transceiver may also be operated from radio rack after the class of service and channel have been selected on the transceiver control panel and power has been applied. The microphone may then be used to produce voice signals and the key used for CW operation, depending upon the type of service selected previously at the remote control position.

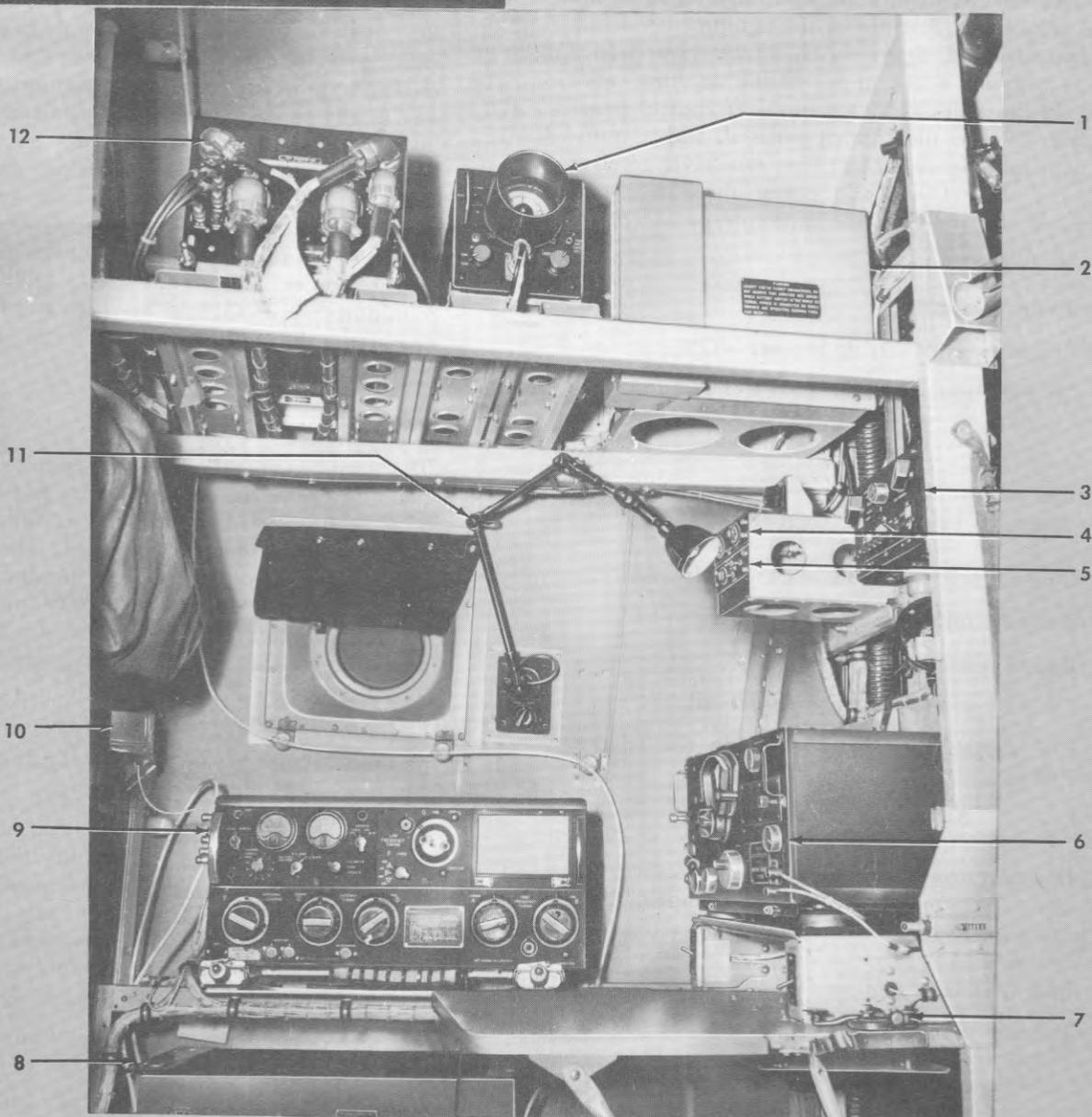
Transceiver Emergency Operation.

If the transceiver fails to operate during flight, the following procedures should be employed in an attempt to restore communications.

1. Check the 28-volt indication on the meter switch to determine whether adequate power is being applied to the equipment. Check switches, fuses, circuit breakers, and connections in the primary power supply lines, and the power supply.
2. Attempt operation on a different frequency by selecting another channel.
3. Attempt operation from both the pilots' stations and the radio rack.
4. Replace microphone, key, or headset, as necessary with similar equipment from another operating position.
5. Make certain that all external connections are securely in place, and that cables and connectors are not broken.
6. Check to see that the antenna is not shorted to the aircraft skin or carried away. Should tune-up of the automatic antenna tuner take more than 45 seconds, a thermal time delay relay will open and prevent further operation of the automatic antenna tuner. Allow at least 45

RADIO OPERATOR'S STATION-Typical

(C-54 AIRCRAFT)



- 1. RADIO HIGH ALTIMETER INDICATOR
- 2. SEARCH RADAR JUNCTION BOX
- 3. INTERPHONE CONTROL PANEL
- 4. S/F CONTROL PANEL
- 5. IFF TRANSPONDER CONTROL PANEL
- 6. HF LIAISON RADIO RECEIVER
- 7. TRANSMITTER KEY
- 8. ANTENNA LOADING COIL
- 9. HF LIAISON RADIO TRANSMITTER
- 10. ANTENNA COUPLER
- 11. TABLE LIGHT
- 12. SEARCH RADAR SYNCHRONIZER

Figure 4-9

seconds for restoration of the relay before attempting to change channels. Check the antenna for faults.

COMMAND TRANSMITTER-RECEIVER.

The command radio equipment is controlled from a transmitter control panel and a receiver control panel (figure 1-17), mounted on the control pedestal. The equipment uses two transmitters with ranges of 4.0 to 5.3 megacycles and 5.3 to 7.0 megacycles respectively, and three receivers with ranges of 3.0 to 6.0 megacycles, 190 to 550 kilocycles, and 6.0 to 9.1 megacycles respectively. Self-contained dynamotors furnish high-voltage d-c power for operation. The equipment provides two-way voice or code air-to-ground communication. It is also used for reception of low-frequency radio range signals for navigational purposes. To turn on either transmitter, place the transmitter power switch in the ON position. To turn off either transmitter, move the transmitter power switch to OFF. To turn on a receiver, place the CW-OFF-MCW switch of the selected receiver to CW or MCW as required. To turn off a receiver, move the CW-OFF-MCW switch to OFF. Power source is the 28-volt d-c bus.

VHF and Command Radio Transfer Control Switch.

The VHF and command radio transfer control switch, mounted on the control pedestal, selects either the COMMAND or the VHF command transmitter-receiver.

HF LIAISON TRANSMITTER AND RECEIVER (C-54 AIRCRAFT).

The HF liaison transmitter and receiver are controlled from the radio operator's station (figures 4-9 and 4-10) and are operated by power from the 28-volt d-c bus. The HF liaison equipment provides long-range two-way code and voice communication. A key for the operation on CW (figure 4-9) is mounted on the radio operator's table. To turn on the transmitter, rotate the emission selector switch clockwise to VOICE, CW, or MCW as required. To turn off the transmitter, place the emission selector switch in the OFF position. To turn on the receiver, move the function selector switch to either MVC or AVC as desired. To turn off the receiver, place the function selector switch in the OFF position.

HF LIAISON RECEIVERS (R5D AIRCRAFT).

Two HF liaison receivers, a pilot's receiver and a radio operator's receiver, are installed in the radio operator's station (figure 4-11). The receivers provide air-to-air and air-to-ground reception, and receive power from the 28-volt d-c bus. An HF transmitter interconnected with the receivers makes break-in transmission available. A power switch, placarded OFF, CW, OSC, and

ON, is mounted on the front of the receiver. No provision is made for remote control of either receiver.

LF RECEIVER.

The LF receiver is operated by power from the 28-volt d-c bus and is controlled from the LF receiver control panel (figure 1-9) mounted on the control pedestal. The equipment is used to monitor low-frequency radio range signals. To turn on the receiver, place the function selector switch to either CW or MCW as required. To turn off the receiver, place the function selector switch in the OFF position.

NAVIGATIONAL SYSTEM (TACAN) AN/ARN-21

The Tacan radio is designed to operate in conjunction with a surface navigation beacon transponder. The Tacan radio provides a radio navigation system that enables the crew to obtain continuous indications of bearing and distance from any selected surface beacon located within a line-of-sight distance from the aircraft up to 195 nautical miles. The navigational system consists essentially of a Tacan receiver-transmitter (3, figure 4-10), a bearing indicator (1A, figure 4-12), a phase detecting network, a range indicator (15, figure 1-10) located on the pilots' instrument panel, a control panel located at the top of the electrical control panel (figure 1-11), and a Tacan radio antenna (figure 4-14). The Tacan radio receives 28-volt d-c and 115-volt, single phase a-c power through circuit breakers on the radio circuit protector panel (figure 1-31).

Navigational System Operation.

1. To start, navigational instrument selector switch — TACAN.
2. Selector switch — As desired.
3. Channel selector knob — Desired frequency.
4. Volume control knob — As desired.
5. To stop, selector switch — OFF.

OMNI-RANGE AND LOCALIZER RECEIVER AND GLIDE SLOPE RECEIVER.

This equipment is controlled from the VHF NAV radio control panel (figure 1-14) on the control pedestal. Its power source is the 28-volt d-c bus and 115-volt a-c bus. Omni-range and instrument landing system localizer frequencies in megacycles are selected by actuating the outer ring of the frequency control,

and the decimals (tenths) of megacycles are selected by actuating the small concentric switch handle located on top of the frequency control unit. Glide slope frequencies are automatically paired with their respective localizer frequencies. Omni-range courses are selected on the course indicator located on the main instrument panel. The function of the equipment is radio navigation and instrument landing. To turn on the equipment, place the VHF NAV POWER switch in the ON position. To turn off the equipment, turn the VHF NAV POWER switch OFF.

WARNING

During a VOR or ILS instrument approach, turn the Tacan set OFF at the Tacan control panel. This will prevent an automatic switch-over to Tacan in the event of a VOR or ILS power failure during a VOR or ILS approach.

AUTOMATIC RADIO COMPASS.

The automatic radio compass is controlled from the automatic radio compass control panel (figures 1-9

and 1-17) mounted on the control pedestal and at the navigator's station (figure 4-12) in C-54 aircraft, and overhead aft of the electrical control panel and at the navigator's station in R5D aircraft. The function of the equipment is to receive voice or code communication, to determine the position of the aircraft in relation to ground communication stations transmitting on a frequency of from 100 to 1750 kilocycles, and homing. To turn on the radio compass, place the function selector switch to the COMP, ANT, or LOOP position as required. To turn off the radio compass, place the function selector switch in the OFF position. R5D aircraft have two radio compasses installed (red and green); some compass ranges are limited to 200-1750 kilocycles. Power sources for the radio compass are the 28-volt d-c and 115-volt a-c busses.

LORAN (RADAR LONG-RANGE) NAVIGATION EQUIPMENT.

The loran equipment (figures 4-12 and 4-13) is controlled from the navigator's station. The function of the loran radio is reception of long-range radio navigation signals to determine the geographic position of the aircraft. To turn on the equipment, turn the receiver gain switch clockwise from the POWER OFF position. To turn off the equipment, turn the receiver gain switch counterclockwise to the POWER OFF position. Power source is 115-volt a-c bus.

RADIO RACK—Typical

(C-54 AIRCRAFT)

1. VHF COMMAND RADIO POWER JUNCTION BOX
2. INTERPHONE AMPLIFIER
3. TACAN RECEIVER-TRANSMITTER
4. RADIO JUNCTION BOX
5. TRANSCEIVER POWER SUPPLY
6. TRANSCEIVER
7. VHF COMMAND RADIO RECEIVER
8. VHF COMMAND RADIO TRANSMITTER
9. DELETED
10. RADIO ALTIMETER (HIGH-RANGE) RECEIVER — TRANSMITTER
11. UHF HOMING AMPLIFIER
12. GLIDE SLOPE RECEIVER
13. AUTOMATIC RADIO COMPASS UNIT
14. C-1 COMPASS SIGNAL POWER AMPLIFIER

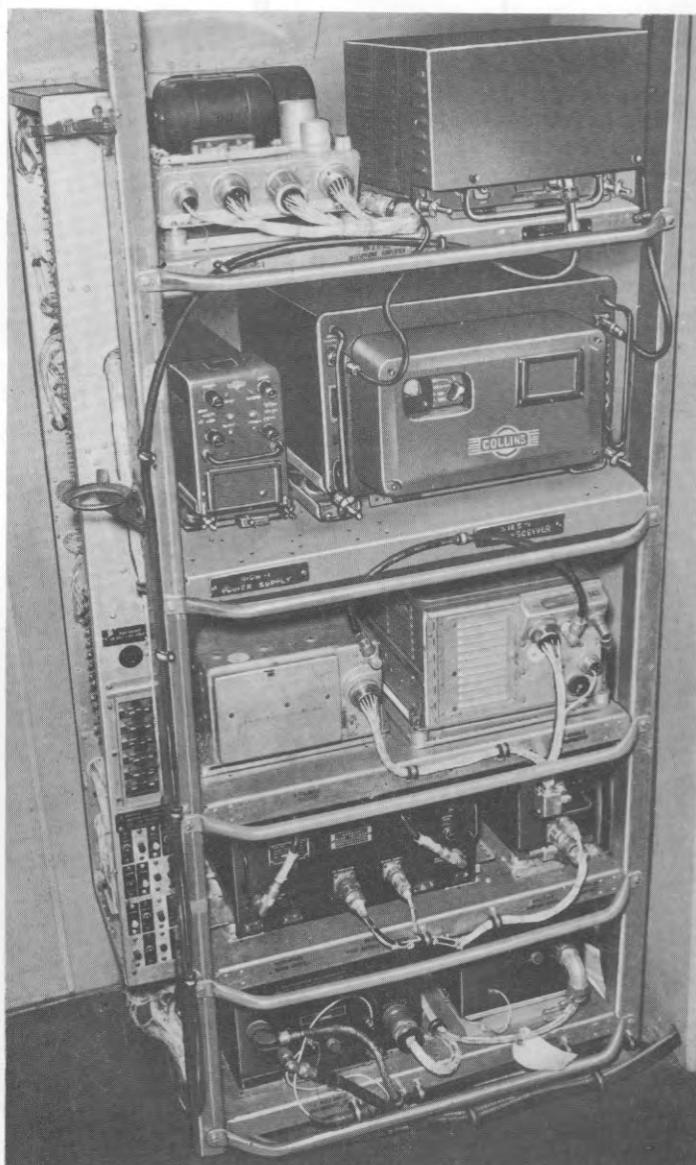
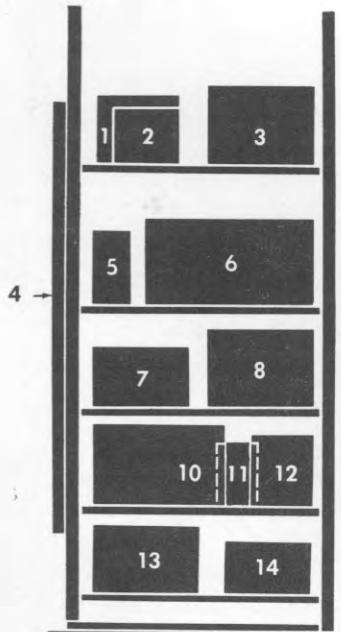


Figure 4-10

RADIO RACK—Typical

(R5D AIRCRAFT)

1. VHF COMMAND RADIO POWER JUNCTION BOX
2. INTERPHONE AMPLIFIER
3. LOADING UNIT
4. HF COMMAND RADIO TRANSMITTER-RECEIVER
5. VHF COMMAND RADIO TRANSMITTER
6. GLIDE SLOPE RECEIVER
7. C-1 COMPASS SIGNAL POWER AMPLIFIER
8. AUTOMATIC RADIO COMPASS UNIT
9. RADIO HIGH ALTIMETER RECEIVER-TRANSMITTER
10. DELETED
11. VHF COMMAND RADIO RECEIVER
12. LF COMMAND RADIO RECEIVER
13. RADIO JUNCTION BOX
14. UHF HOMING AMPLIFIER

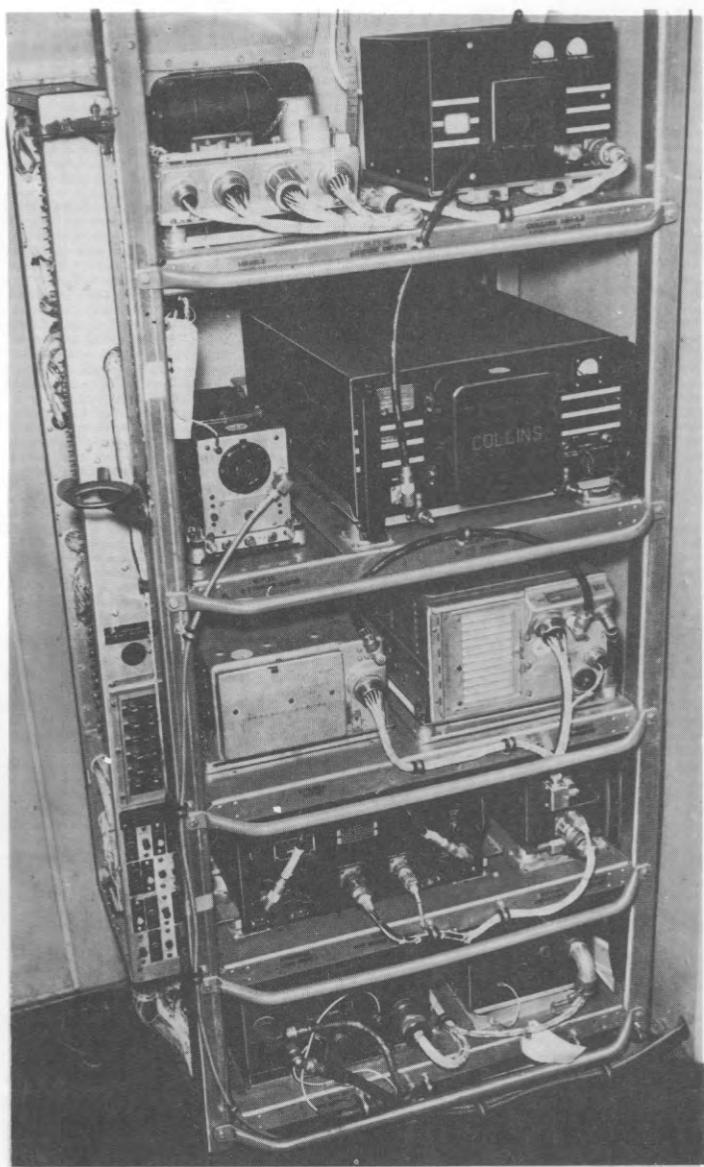
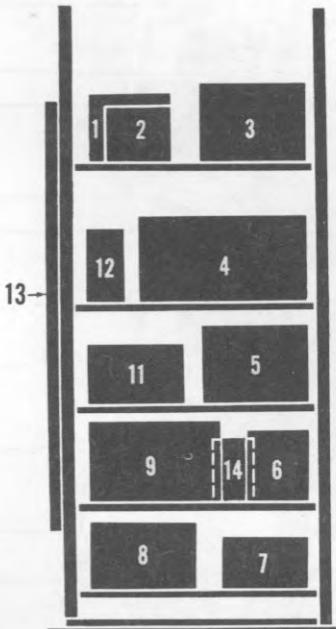


Figure 4-11

NAVIGATOR'S STATION - Typical

(C-54 AIRCRAFT)
(SEARCH RADAR INSTALLED)

1. LORAN RECEIVER INDICATOR
- 1A. BEARING INDICATOR
2. SEARCH RADAR CONTROL PANEL
3. OXYGEN REGULATOR
4. PRESSURIZATION CONTROL PANEL
5. PRESSURIZATION CONTROL
PANEL LIGHTS RHEOSTAT
6. TABLE LIGHT (2)
7. AIRSPEED INDICATOR
8. ALTIMETER (BAROMETRIC)
9. FLUX GATE COMPASS
MASTER DIRECTION INDICATOR
10. BEARING CONVERTER INDICATOR
11. RADIO MAGNETIC INDICATOR
12. INTERPHONE CONTROL PANEL
13. RADIO COMPASS CONTROL PANEL
14. SEARCH RADAR SCOPE
15. INSTRUMENT LIGHT CONTROL PANEL
16. TABLE LIGHT SWITCHES
17. DRIFTMETER SWITCH

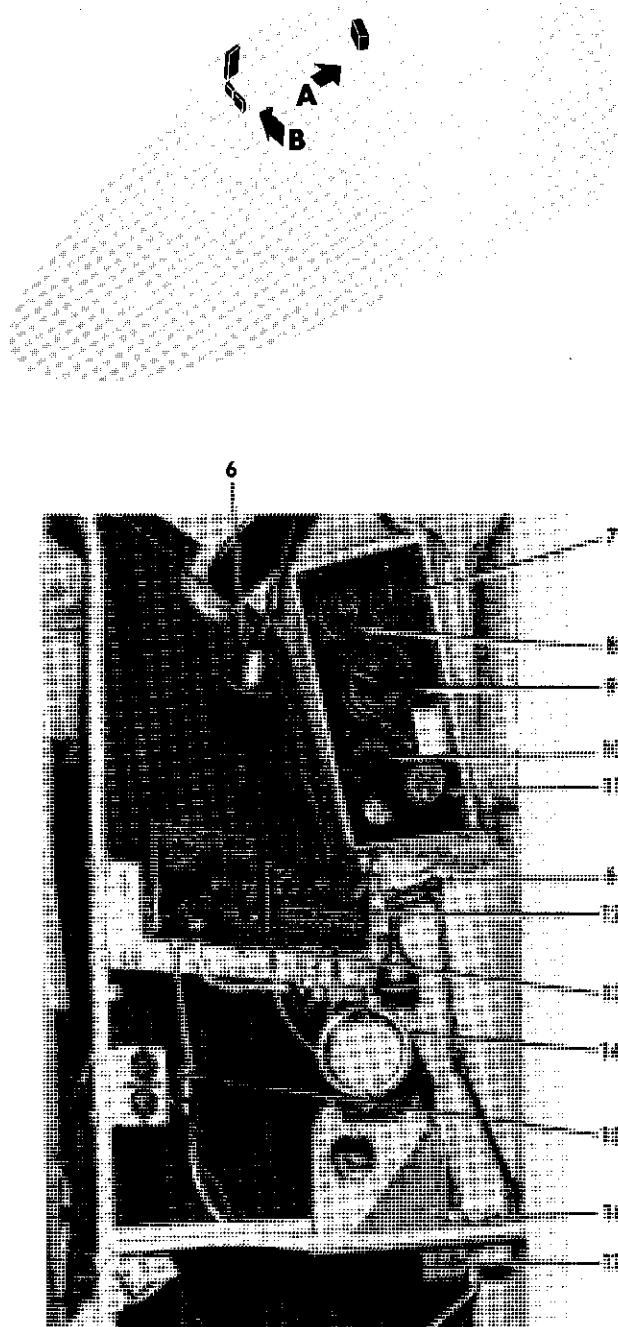
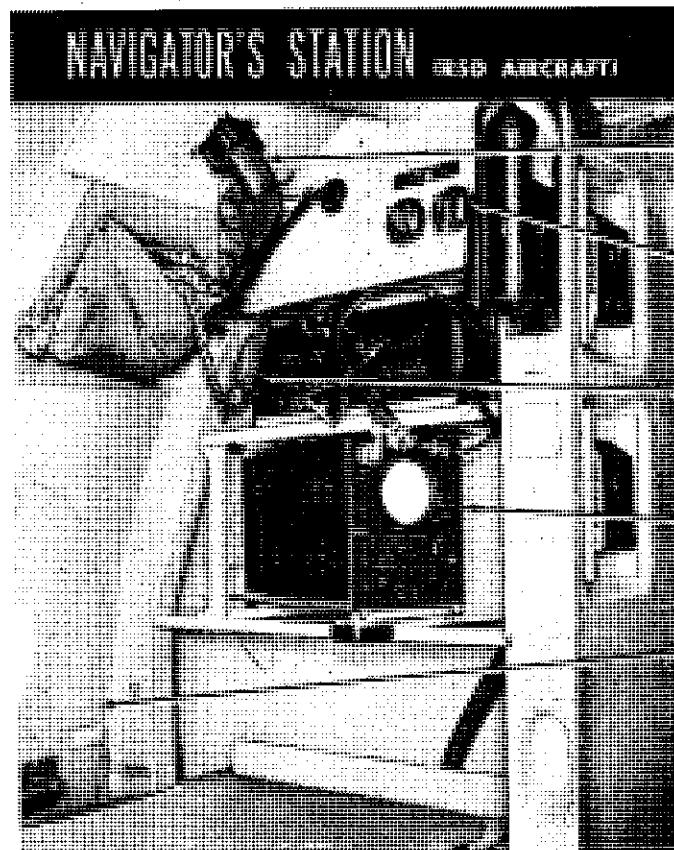
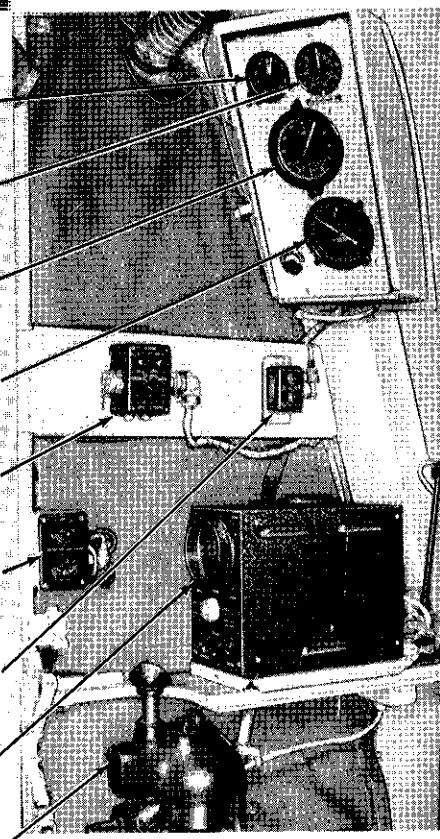


Figure 4-12



VIEW A

1. VERY PISTOL
2. PROPELLER ANTI-ICING NEEDLE VALVES AND GAGES
3. ESCAPE ROPE
4. LORAN RECEIVER
5. EMERGENCY GROUND EXIT
6. ALTIMETER
7. AIRSPEED INDICATOR
8. FLUX GATE COMPASS MASTER DIRECTION INDICATOR
9. RADIO COMPASS
10. INTERPHONE STATION BOX
11. INSTRUMENT LIGHT CONTROL PANEL
12. FLUX GATE COMPASS REMOTE SWITCH BOX
13. ENGINE ANALYZER
14. DRIFTMETER



VIEW B

Figure 4-13

21,036

RADIO ANTENNAS—Typical

(C-54 AIRCRAFT)

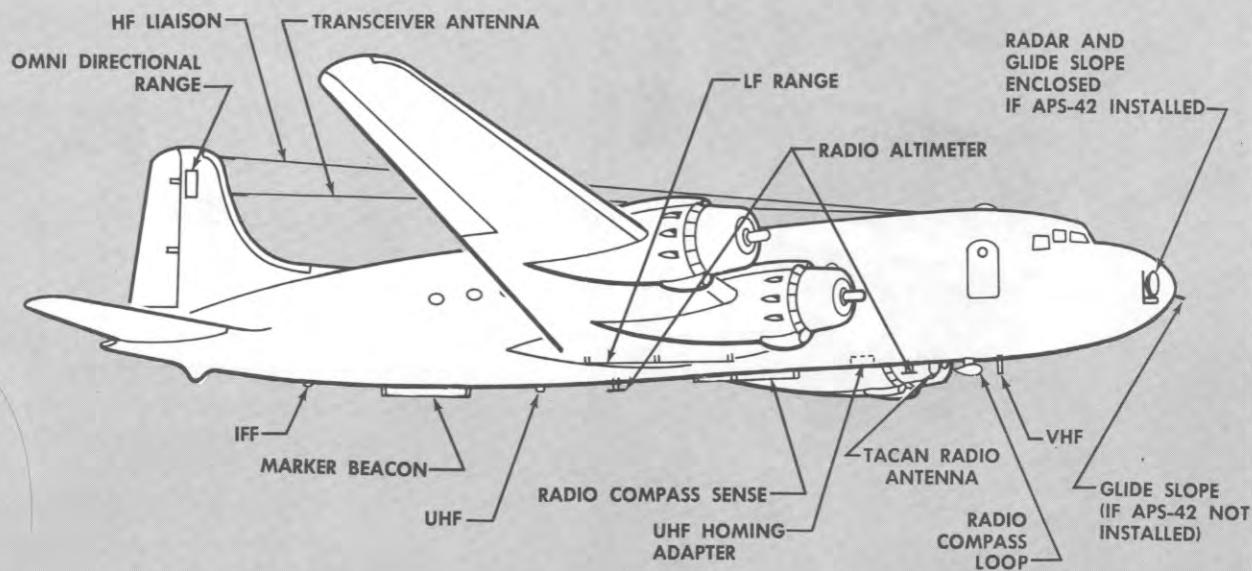


Figure 4-14

SEARCH RADAR (IF INSTALLED).

The search radar equipment is powered by 28-volt d-c and 115-volt a-c power and is controlled from the navigator's station. Two scopes are provided, one for the pilot (figure 1-6) and one for the navigator (figure 4-12). The equipment is designed for use as a navigational aid, as well as an anticollision warning device. To turn the equipment on, place the power switch in the ON position and the inverter switch in the NORMAL position. If the inverter switch is in the EMER position, the search radar equipment will not operate. (See electrical system, Section I.) To stop the equipment, turn the power switch OFF.

CAUTION

Turn control knobs on both scopes full counterclockwise before turning on equipment.

INTERPHONE SYSTEM (C-54 AIRCRAFT).

Multiple interphone control panels are located in the flight compartment adjacent to each crew member's station (except the crew engineer's). Headsets and hand microphones are provided for the radio operator and the navigator. The pilot and copilot are provided

with headsets that have boom-type microphones attached to the headset; the microphone press-to-talk buttons are installed on the top of the outboard horn of each control column wheel. The interphone equipment provides communication facilities between all crew members and enables the flight compartment crew members to use the VHF, UHF, and HF command sets, the liaison set, the automatic radio compass, VHF NAV, LF receiver, and the marker beacon. Interphone boxes are also installed in the main cabin forward of the main cargo door and in the nosewheel well. On some aircraft, the interphone system restricts transmission and reception through the SCR-274-N command radio from any interphone control panel to channel A only, since this is the only channel connected to the COMMAND position of the interphone control panel. With this type of equipment the navigator is not provided with an interphone control panel, but is provided with a headset extension cord wired into the radio operator's interphone control panel, and can receive radio compass signals only. Also, there is no interphone box installed in the nosewheel well. To operate either type of interphone equipment, connect the aircraft external power supply, or place the master battery switch in the ON position and check the radio master switch and interphone circuit breakers to make certain they are in the ON position. No provisions are made for turning the interphone equipment off separately. The power source is the 28-volt d-c bus.

RADIO ANTENNAS

(R5D AIRCRAFT)

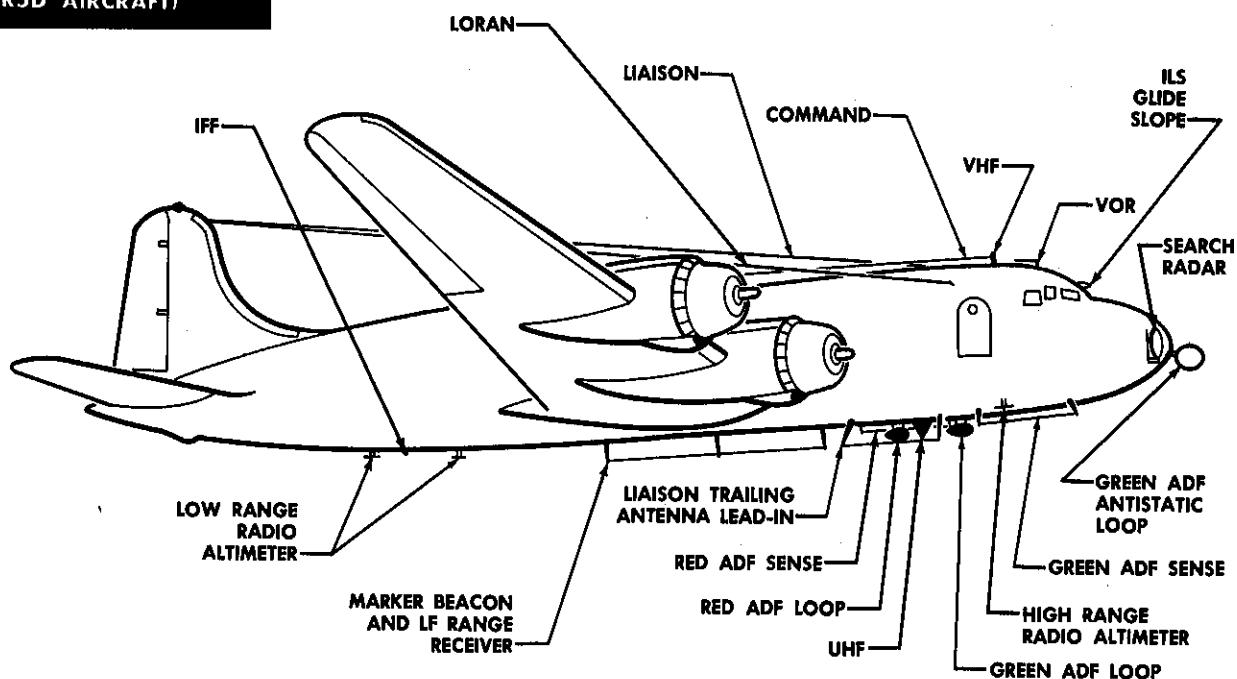


Figure 4-15

INTERPHONE SYSTEM (R5D AIRCRAFT).

Interphone system control panels are located in the flight compartment adjacent to the pilot's, copilot's, and radio operator's station. A navigator's station box is installed on the navigator's shelf, behind the copilot's seat. A crew-station box is located near the passenger-cargo door in the main cabin. In addition, a jack box installed in the nosewheel well is provided for the crew engineer. Power source for the interphone system is a 28-volt d-c bus. The system provides communication facilities between all crew members and enables the flight compartment crew members to select UHF, VHF, command, liaison receiver, red and green radio compass, and marker beacon. The interphone equipment may be turned off by placing the ICS switch in the OFF position.

MARKER BEACON LIGHTS.

Two amber marker beacon lights (figure 1-13) are located on the main instrument panel. One light is incorporated with the pilot's course indicator, and the other light is mounted in front of the copilot. When the aircraft is within the radiation pattern of a 75-

megacycle marker beacon transmitter, the marker beacon lights illuminate and an aural signal is received. The marker beacon receiver has no controls but is energized when power is supplied to the main d-c bus. The lights are energized by a 28-volt d-c circuit. On some C-54 aircraft and on R5D aircraft, the marker beacon receiver is energized when the automatic radio compass is turned ON.

IFF TRANSPONDER, AN/APX-25.

The IFF transponder (receiver-transmitter) is a signaling device for radar echo identification. The receiver turns on the transmitter momentarily each time coded challenges are received from suitably equipped surface or airborne radar. The reply from the transmitter accomplishes the display of associated echo on the indicators of the challenging radar, thereby identifying the echo. The transponder, operating in the Mark X and selective identification feature (SIF) systems, is used primarily for military air traffic control and interception purposes. Simultaneous operation in both the SIF and normal Mark X systems is not possible, and the system of operation is determined by a preset switch, with NORMAL and MOD positions, in the transponder. The IFF transponder consists essentially of a receiver-transmitter and a coder located in the tail compartment, a SIF control panel

(4, figure 4-9) and an IFF transponder control panel (5, figure 4-9) located at the radio operator's station, and an IFF antenna (figure 4-14). Primary power for operation of the transponder is supplied by the 28-volt d-c system and the 115-volt, single-phase a-c system through circuit breakers on the circuit protector panel (figure 1-29).

IFF Transponder Operation.

Note

No transmission will be made on emergency (distress) frequency channels, except for emergency purposes in order to prevent transmission of messages that could be construed as actual emergency messages.

1. To start, transponder master switch — STDBY.

While the equipment is warming up, set operational codes on the SIF control panel for modes 1 and 3. Codes for mode 2 are set up on the coder by maintenance personnel.

CAUTION

Allow at least one minute for set to warm up before operating to preclude damage to the equipment.

Note

The SIF control panel is effective only when operating in the SIF system, therefore, it is unnecessary to set up operational codes for modes 1 and 3 if operating in the Mark X system.

2. Transponder master switch — As desired.

Place the transponder master switch in the desired position of operation. In the LOW position, the receiver sensitivity is low and operates only when strong interrogating signals are received, while in the NORMAL position, the receiver is operating at full sensitivity and provides maximum performance. The EMERGENCY position provides full sensitivity and when operating with the Mark X system replies to any interrogated mode. When operating with the SIF system, using the KY-95 coder, replies are made to mode 1 interrogations and when using the KY-95A coder, replies are made to mode 1 and 3 interrogations. A red button, located to the left and below the transponder master switch, must be manually pushed in before the transponder master switch may be positioned to the EMERGENCY position.

3. Mode 2 switch — As desired.

The mode 2 switch has OUT and MODE 2 positions. In the OUT position, the transponder replies to normal mode 1 interrogations for Mark X operation or, for SIF operation, coded mode 1 replies are made to mode 1 interrogations but in this position, no replies are made to mode 2 interrogations. In the MODE 2 position, the mode 1 operations are retained and in addition, normal mode 2 replies for Mark X operation and coded mode 2 replies for SIF operation are available.

4. Mode 3 switch — As desired.

The mode 3 switch has OUT and MODE 3 positions. In the OUT position, the transponder operates in mode 1 as described in step 3. In the MODE 3 position, mode 1 operations are retained and in addition, normal mode 3 replies for Mark X operation and coded mode 3 replies for SIF operation are available.

5. I/P-MIC switch — As desired.

The I/P-MIC switch has I/P, OUT, and MIC positions. When the switch is held in the spring-loaded I/P position the transponder replies to mode 2 interrogations with mode 2 replies during Mark X operation. During SIF operation, using the KY-95 coder, the transponder replies to mode 1 interrogations with 2 coded mode 1 replies. When using the KY-95A coder, replies are made to mode 1 interrogations as described and also transmits 2 coded mode 3 replies to mode 3 interrogations. In the MIC position, I/P replies are transmitted when the pilot's microphone button is depressed.

6. To stop, transponder master switch — OFF.

Note

Consult Joint Army, Navy, and Air Force Publication 160 and supplements thereto for latest changes.

IFF EQUIPMENT (R5D AIRCRAFT).

Power for the identification radio equipment is provided by the 28-volt d-c bus and the 115-volt a-c bus. A 5-position rotary switch provides selection of desired operation. The destructor is energized by simultaneously depressing two destructor buttons. An inertia switch is provided for automatic destruction when the equipment sustains a shock.

CAUTION

Do not push the destructor buttons except when it is necessary to destroy the equipment.

RADIO ALTIMETER (LOW RANGE).

This equipment is controlled from the main instrument panel. Power for operation is supplied from the 28-volt d-c bus. The function of the set is to provide a positive altitude reading of the aircraft above the existing terrain or the surface of the water. The range of the equipment is from 0 to 4000 feet. An altitude limit switch (*figure 1-10*) presets the desired altitude to be maintained. A radio altitude indicator (*figure 1-10*) provides positive measurement of altitude.

Three indicator lights installed immediately to the right of indicator (*figure 1-10*) function as follows:

- RED — Indicates flight below the preset altitude.
- AMBER — Indicates flight at the preset altitude.
- GREEN — Indicates flight above the preset altitude.

Note

The AMBER and GREEN lights are installed on C-54 aircraft only.

The radio high altimeter is inoperative when the radio low altimeter is turned on because only one set of antennas is used for both the high and low altimeters. To turn on the equipment, rotate the switch, incorporated on the altitude indicator, clockwise to ON. To turn the equipment off, rotate the switch on the altitude indicator to the OFF position.

WARNING

The high range of the AN/APN-1 altimeter cannot be relied upon below 500 feet over water and 600 feet over land. Below these altitudes, when on the high range, the indicator will usually read high and may fail to read below 400 feet no matter how close to the terrain the aircraft may be flying. Therefore, when flying under conditions of poor visibility, the AN/APN-1 indicator should always be on the low range.

RADIO ALTIMETER (HIGH RANGE).

A radio altimeter (high range) (*figure 4-13*) is installed at the navigator's station. If search radar equipment is installed, the radio altimeter is located above the

radio operator's seat (1, *figure 4-9*). The function of the equipment is to provide a positive altitude reading of the aircraft above the existing terrain or surface of the water. Range is from 0 to 40,000 feet. To turn on the equipment, rotate the receiver gain control clockwise from the OFF position. To turn off the equipment, turn the receiver gain control to OFF. The radio altimeter receives power from the 115-volt a-c bus.

EMERGENCY RADIO TRANSCEIVER.

All aircraft are equipped with emergency UHF-VHF radio transceivers.

EMERGENCY RADIO TRANSMITTER.

All aircraft are equipped with an emergency radio transmitter.

LIGHTING SYSTEM.

All lights are wired to the 28-volt d-c power supply through their respective circuit breakers and switches.

EXTERIOR LIGHTING.**Landing Lights and Switches.**

An electrically actuated landing light is installed on the underside of each outer wing panel. Each light is controlled by a switch (*figures 1-11 and 1-16*) with EXTEND & ON, OFF, and RETRACT positions, that is installed on the electrical control panel. When either switch is placed in the EXTEND & ON position, the respective landing light motor is energized and the extension and retraction mechanism is actuated to lower the landing light. An automatic switch in the light assembly turns the light on when the landing light extends beyond 10 degrees of the fully retracted position. Placing the switch in the OFF position stops the landing light motor to permit intermediate positioning of the light. Placing the switch in the RETRACT position energizes the motor and retracts the light. The automatic switch turns the light off. Some aircraft have separate EXTEND, OFF, RETRACT, and ON-OFF filament switches, and landing lights may be turned on when retracted.

Navigation Position Lights and Switch.

The navigation position lights consist of a green light on the right wing tip, a red light on the left wing tip, and a white light in the tail cone tip. A navigation lights switch with STDY., FLASH, and OFF position is installed on the electrical control panel (*figure 1-11*).

When the switch is placed in the STDY. position, the navigation lights are illuminated continuously. When the switch is placed in the FLASH position, the light circuit is connected to a flasher mechanism and the navigation lights are automatically flashed on and off. Placing the switch in the OFF position opens the navigation lights circuit.

Red Tail Light and Switch.

A red tail light is installed in the tail cone tip below the white navigation light. The light is controlled by a 3-position toggle switch located on the electrical control panel (*figure 1-11*) with BRIGHT, DIM, and OFF positions. The switch is placarded: RED TAIL LIGHT MUST BE OFF WHEN USING NAVIGATION LIGHTS. When the switch is placed in the BRIGHT position current is supplied directly to the light from the main bus. When the switch is placed in the DIM position the light intensity is reduced through a dimming resistor. Placing the switch in the OFF position opens the circuit to the light.

Recognition Lights and Switches.

Three colored recognition lights, red, green and amber, located on the bottom of the fuselage aft of the rear cargo door, are operated from the recognition light control panel (*figures 1-9 and 1-17*), mounted on the aft section of the control pedestal. An individual switch for each light has STEADY, OFF, and KEY positions. When any switch is in the KEY position, the keying button on the control panel may be used to operate the respective recognition light. On some early aircraft, an additional white recognition light is installed on the top of the fuselage and is controlled from the recognition light control panel.

Rotating Navigation (Anticollision) Light and Switch.

A red rotating anticollision light is installed on the tip of the vertical stabilizer. The light is actuated by an ON, OFF switch installed on the electrical control panel (*figure 1-11*). When the switch is placed in the ON position, current is supplied to the light element and the driving motor. The light rotates at 40 rpm and has a 4000-candle-power bulb on one side of the reflector and a 1000-candle-power bulb on the other side of the reflector.

Note

The rotating anticollision light should be turned OFF during flight through conditions of reduced visibility where the pilot could experience vertigo as a result of the rotating reflections of the light against the clouds. In addition, the light would be ineffective as an anticollision light during these conditions since it could not be observed by pilots of other aircraft.

INTERIOR LIGHTING.

Cockpit Lights Master Switch.

A cockpit lights master switch located on the electrical control panel must be turned ON before any of the lights controlled by the ten rheostat switches on the electrical control panel will be operative. These rheostat switches are: instrument panel floodlights, center instrument panel lights, upper instrument and pedestal lights, compass light, cockpit floodlight (two switches), accessory lights (two switches), and instrument panel lights (two switches). (*See figure 1-11.*)

Instrument Panel Red Floodlights and Switch.

Four shielded instrument red floodlights are installed above the main instrument panel just below the glare-shield. The intensity of the lights is controlled by a rheostat switch placarded OFF-BRIGHT, located on the electrical control panel. The cockpit lights master switch must be ON before the rheostat is operative.

Center Instrument Panel Lights and Switch.

The center instrument panel is provided with individual red (eyebrow-type) lighting for each instrument. The intensity of the lights is controlled by a rheostat switch placarded OFF-BRIGHT, located on the electrical control panel. The cockpit lights master switch must be ON before the rheostat is operative.

Upper Instrument Panel and Control Pedestal Lights and Switch.

A rheostat switch placarded OFF-BRIGHT and UPPER INST-OV'HD SW & PEDESTAL LIGHTS controls intensity of individual instrument red (eyebrow-type) lighting for the upper instrument panel, edge lighting for the electrical control panel, and shielded red flood lighting for the aft face of the control pedestal. The cockpit lights master switch must be ON before the rheostat is operative.

Compass Light and Switch.

A compass light installed above the window in the magnetic compass provides illumination of the compass card. A rheostat switch placarded OFF-BRIGHT, located on the electrical control panel, controls intensity of the light. The cockpit lights master switch must be ON before the rheostat is operative.

Cockpit Floodlights and Switches.

Two cockpit floodlights, one installed above and aft of each side window, may be used for high intensity illumination of the cockpit, as desired. Intensity of the left light is controlled by a rheostat switch, placarded

OFF-BRIGHT, located on the left side of the electrical control panel. Intensity of the right light is controlled by an identical rheostat switch located on the right side of the electrical control panel. A 3-position toggle switch, placarded RED-OFF-WHITE, located adjacent to each rheostat, allows selection of either red or white flood, or turns the light off. The cockpit lights master switch must be ON before either the rheostat switches or the toggle switches are operative.

Accessory Lights and Switches.

Illumination of the pilot's and copilot's side panels is provided by two shielded red floodlights mounted on each side panel. Intensity of the pilot's side panel is controlled by a rheostat switch, placarded OFF-BRIGHT, located on the left side of the electrical control panel. Intensity of the copilot's side panel is controlled by an identical rheostat switch located on the right side of the electrical control panel. The right rheostat switch also controls the intensity of red (eye-brow-type) lighting of the main hydraulic pressure gage, brake hydraulic pressure gage, and emergency airbrake pressure gage. The cockpit lights master switch must be ON before either of the rheostat switches are operative.

Instrument Panel Lights and Switches.

The main instrument panel is provided with red (eye-brow-type) lighting of each individual instrument. Intensity of the pilot's instrument panel lights is controlled by a rheostat switch, placarded OFF-BRIGHT, located on the left side of the electrical control panel. Intensity of the copilot's instrument panel lights is controlled by an identical rheostat switch located on the right side of the electrical control panel. The cockpit lights master switch must be ON before either rheostat switch is operative.

Nurse's Intercall Lights and Switches (Some Aircraft).

Two nurse's intercall lights that serve as signal devices between crew members in the cockpit and main cabin have pushbutton switches and are located as follows: one light and switch on the electrical control panel in the cockpit, and one light and switch on the cabin electrical control panel. When the switch on either electrical control panel is depressed, a 28-volt d-c circuit is completed to illuminate both intercall lights.

FASTEN SEAT BELT and NO SMOKING Signs.

An electrically illuminated FASTEN SEAT BELT sign and a NO SMOKING sign are located in the main cabin, above the entrance door to the relief crew's compartment. A switch for each sign is located on the electrical control panel in the cockpit (figure 1-11). When either switch is in the ON position, the respective sign will be illuminated.

Pilot's Compartment Dome Light and Switches.

An anemostat-type dome light installed in the ceiling forward of the astrodome provides illumination of the aft part of the cockpit and the radio operator's and the navigator's stations. The dome light can be controlled by either of two switches. One is located on the electrical control panel (figure 1-11) and the other is located aft of the crew entrance door at the navigator's station.

Pilots' Map Reading Lights and Switches.

Two adjustable map reading lights, one mounted above and aft of each pilot's side window, provide illumination for the pilot and copilot. The lights are individually controlled by a rheostat that is an integral part of the light assembly.

Control Pedestal Spotlight and Switches.

A control pedestal spotlight located in the ceiling of the cockpit provides illumination for the top section and aft face of the control pedestal. The light is controlled by a toggle switch on the aft face of the control pedestal, or by a momentary switch button on each control wheel. The momentary switches on the control wheels are spring-loaded to OFF.

Radio Control Panel Edge Lighting and Switch.

The radio control panel on the control pedestal (figure 1-9) is provided with red edge lighting which illuminates only the placarded markings of the radio switch controls. A rheostat switch located on the aft lower face of the control pedestal controls the intensity of the light and turns it OFF.

Door-Open Light.

A door-open amber light installed on the upper instrument panel (figure 1-11) is illuminated when any one of the following doors is open: main cargo door, lower cargo doors or the crew entrance door. The light is energized by a 28-volt d-c circuit.

Radio Operator's Table Light and Switch.

A flexible table light (11, figure 4-9), installed at the radio operator's station, is equipped with a dimming rheostat.

Navigator's Table Lights and Switches.

Two flexible table lights are installed at the navigator's station as follows: one on the forward outboard side of the navigator's chart table and one on the aft bulkhead above the loran indicator. Each light is equipped with a dimming rheostat that is located at the base of the forward light.

Navigator's Fluorescent Instrument Lights and Switches.

Two adjustable fluorescent lights that provide illumination for the navigator's instrument panel are located as follows: One is mounted above the instrument lights switch control panel that is aft of the copilot's seat, and one is installed above the crew entrance door. Each light is controlled by a rheostat switch, with START, ON, DIM, and OFF positions, that is located on the instrument lights switch control panel.

Navigator's Red Instrument Lights and Switch.

The navigator's instruments are provided with red eyebrow lighting on each instrument (master compass indicator, UHF and ADF compass, altimeter, airspeed indicator, and clock). Intensity of the lights is controlled by a rheostat switch on the instrument lights switch control panel aft of the copilot's seat.

Relief Crew Compartment Lights and Switches.

The relief crew compartment is provided with an anemostat-type dome light and integral switch with ON-OFF positions. Two mirror lights are controlled by an ON-OFF switch located above the washbowl.

Cabin Dome Lights and Switches.

Six anemostat-type lights are installed in the ceiling of the main cabin. The lights are controlled by either one of the two switches; one located on the main cabin forward bulkhead and one installed on the cabin electrical control panel located forward of the main cargo door. Two lights installed over the main cargo doors are controlled by a switch on the cabin electrical control panel.

Lavatory Dome Lights and Switches.

A dome light is installed in the relief crew compartment lavatory and is controlled by an integral ON-OFF switch. A dome light and integral ON-OFF switch is installed in the main cabin lavatory.

Lower Cargo Compartment Lights and Switches.

The forward and aft lower cargo compartments are each provided with three lights. A switch located on the center light box in each compartment controls the respective lights.

Spare Light Bulbs and Resin Lens Boxes.

Spare light bulbs are contained in a box located above the cabin heater control panel. Colored resin lenses for the recognition lights are contained in a box located on the aft bulkhead of the navigator's station.

OXYGEN SYSTEM.

A gaseous oxygen system with a normal operating system pressure of 100 to 400 psi is installed. The complete system may be filled through a single filler valve located in the lower aft cargo compartment (15, figure 1-40) on most aircraft. However, on some aircraft, the oxygen filler valve is located in the lower forward cargo compartment (9, figure 1-40), or below the cargo doors on the exterior surface of the fuselage.

Note

As an aircraft ascends to high altitudes where the temperature is normally quite low, the oxygen cylinders become chilled. As the cylinders grow colder, the oxygen gage pressure is reduced, sometimes rather rapidly. With a 37.9°C decrease in temperature in the cylinders, the gage pressure can be expected to drop 20 percent. This rapid fall in pressure is occasionally a cause for unnecessary alarm. All the oxygen is still there. As the aircraft descends to warmer altitudes, the pressure will tend to rise again, so that the rate of oxygen usage may appear to be slower than normal. A rapid fall in oxygen pressure while the aircraft is in level flight, or while it is descending, is not ordinarily due to falling temperature, of course. When this happens, leakage or loss of oxygen must be suspected.

CREW OXYGEN SYSTEM.

The oxygen system installed may be one of two types. On most aircraft a diluter-demand system is provided for the pilot and crew, using three interconnected oxygen cylinders. Two type G-1 cylinders provide oxygen for the pilot and one type J-1 cylinder provides oxygen for the copilot, crew engineer, radio operator, and navigator. Check valves, for safety in combat areas, are installed between the pilot's section and the crew's section. Some aircraft have a continuous-flow system installed utilizing either a single type J-1 cylinder or three interconnected cylinders (two type G-1 cylinders supply the pilot, and one type J-1 cylinder supplies the crew). If the latter type is installed, check valves in the filler lines of the cylinders prevent loss of oxygen in the event either the pilot or crew oxygen systems are damaged. The approximate duration of both the diluter-demand system and the continuous-flow system is given in figure 4-16.

Oxygen Regulators.

The diluter-demand system regulator, type A-12, is installed at each crew member's station and at each relief crew bunk. The regulator automatically supplies a proper mixture of air and oxygen when the AUTO

OXYGEN DURATION TABLE

CREW OXYGEN DURATION — MAN HOURS

CABIN ALTITUDE — FEET	GAGE PRESSURE — P.S.I.								Emergency — Descend to altitude not requiring oxygen.
	400	350	300	250	200	150	100	100	
30,000	36.4	31.2	26.0	20.8	15.6	10.4	5.2	5.2	Emergency — Descend to altitude not requiring oxygen.
25,000	44.0	38.0	31.6	25.2	18.8	12.8	6.4	6.4	
20,000	52.4	45.2	37.6	30.0	22.4	15.2	7.6	7.6	
15,000	62.0	53.2	44.4	39.6	26.8	12.6	8.8	8.8	
10,000	72.8	62.4	52.0	41.6	31.2	20.8	10.4	10.4	

Cylinders: 1 Type J-1

Crew: 4

PASSENGER, TROOP, OR LITTER PATIENT
OXYGEN DURATION — MAN HOURS

CABIN ALTITUDE — FEET	GAGE PRESSURE — P.S.I.								Emergency — Descend to altitude not requiring oxygen.
	400	350	300	250	200	150	100	100	
30,000	98.0	84.0	70.0	56.0	42.0	28.0	14.0	14.0	Emergency — Descend to altitude not requiring oxygen.
25,000	106.0	91.0	76.0	61.0	46.0	30.0	15.0	15.0	
20,000	117.0	100.0	84.0	67.0	50.0	33.0	17.0	17.0	
15,000	130.0	111.0	93.0	74.0	56.0	37.0	19.0	19.0	
10,000	146.0	125.0	104.0	83.0	63.0	42.0	21.0	21.0	

Cylinders: 2 Type J-1

CONTINUOUS FLOW REGULATOR
OXYGEN DURATION TABLE
(SOME AIRCRAFT)

PILOT OXYGEN DURATION — MAN HOURS

CABIN ALTITUDE — FEET	GAGE PRESSURE — P.S.I.								Emergency — Descend to altitude not requiring oxygen.
	400	350	300	250	200	150	100	100	
30,000	8.6	7.4	6.1	4.9	3.7	2.5	1.2	1.2	Emergency — Descend to altitude not requiring oxygen.
	8.8	7.6	6.3	5.0	3.8	2.5	1.3	1.3	
25,000	6.5	5.6	4.7	3.7	2.8	1.9	0.9	0.9	Emergency — Descend to altitude not requiring oxygen.
	8.3	7.2	6.0	4.8	3.6	2.4	1.2	1.2	
20,000	5.0	4.3	3.6	2.9	2.2	1.4	0.7	0.7	Emergency — Descend to altitude not requiring oxygen.
	9.4	8.1	6.7	5.4	4.0	2.7	1.3	1.3	
15,000	4.0	3.5	2.9	2.3	1.7	1.2	0.6	0.6	Emergency — Descend to altitude not requiring oxygen.
	11.5	9.8	8.2	6.6	4.9	3.3	1.6	1.6	
10,000	3.2	2.3	2.3	1.9	1.4	0.9	0.5	0.5	Emergency — Descend to altitude not requiring oxygen.
	15.2	13.0	10.9	8.7	6.5	4.3	2.2	2.2	

Black Figures Indicate Diluter Lever "NORMAL"

Red Figures Indicate Diluter Lever "100%"

Cylinders: 2 Type G-1

Crew: 1

DILUTER DEMAND REGULATOR
OXYGEN DURATION TABLE
(MOST AIRCRAFT)Copilot, Flight Engineer,
Radio Operator and Navigator
OXYGEN DURATION — MAN HOURS

CABIN ALTITUDE — FEET	GAGE PRESSURE — P.S.I.								Emergency — Descend to altitude not requiring oxygen.
	400	350	300	250	200	150	100	100	
30,000	36.8	31.6	26.4	21.2	15.6	10.4	5.2	5.2	Emergency — Descend to altitude not requiring oxygen.
	37.6	32.4	26.8	21.6	16.0	10.8	5.2	5.2	
25,000	28.4	24.4	20.4	16.4	12.0	8.0	4.0	4.0	Emergency — Descend to altitude not requiring oxygen.
	36.0	30.8	25.6	20.4	15.6	10.4	5.2	5.2	
20,000	21.6	18.4	15.6	12.4	9.2	6.0	3.2	3.2	Emergency — Descend to altitude not requiring oxygen.
	40.4	34.4	28.8	23.2	17.2	16.6	5.6	5.6	
15,000	17.2	14.8	12.4	10.0	7.6	4.8	2.4	2.4	Emergency — Descend to altitude not requiring oxygen.
	48.8	42.0	34.8	28.0	20.8	14.0	6.8	6.8	
10,000	14.0	12.0	10.0	8.0	6.0	4.0	2.0	2.0	Emergency — Descend to altitude not requiring oxygen.
	64.8	55.6	46.4	37.2	28.0	18.4	8.8	8.8	

Black Figures Indicate Diluter Lever "NORMAL"

Red Figures Indicate Diluter Lever "100%"

Cylinders: 1 Type J-1

Crew: 4

DILUTER DEMAND REGULATOR
OXYGEN DURATION TABLE
(MOST AIRCRAFT)

Figure 4-16

X1-123

MIX lever is in NORMAL oxygen position, and 100 percent oxygen when it is in 100% OXYGEN position. The continuous-flow system regulator, a manually controlled type A-9A, is installed at each crew member's station. The regulator must be manually adjusted to provide the proper mixture of air and oxygen at different cabin altitudes.

Oxygen Regulator Auto-Mix Lever (Diluter-Demand System).

An AUTO-MIX lever is provided on each type A-12 regulator to select NORMAL OXYGEN for all normal usage or to select 100% OXYGEN for emergency use. When the lever is placed in the NORMAL OXYGEN position, the air inlet valve is opened so that the regulator automatically supplies a proper mixture of air and oxygen to the mask at all altitudes. When the lever is placed in the 100% OXYGEN position, the air inlet valve is closed and the regulator supplies 100 percent oxygen to the mask.

Oxygen Regulator Flow Adjustment Knob (Continuous-Flow System).

An oxygen regulator flow adjustment knob is provided on each type A-9A regulator. Manual adjustment of the knob controls the flow of oxygen to correspond with the cabin altitude.

Oxygen Regulator Emergency Valve (Diluter-Demand System).

The emergency valve of the oxygen regulator is for use in the event the demand oxygen regulator becomes inoperative. The valve is always safetywired in the closed position and should be opened only in an emergency. The valve provides a means of manually supplying oxygen pressure to the mask in the event of regulator failure.

Portable Oxygen Cylinders and Recharger Assemblies.

Four portable oxygen cylinders (3, figure 1-3) are located as follows: one on the bulkhead aft of the pilot's seat, one at right of the copilot's seat, one at the radio operator's station, and one in the relief crew compartment. Two portable oxygen cylinder recharger assemblies are located as follows: one outboard of the copilot's seat and one in the radio operator's compartment. Additional recharger assemblies may be located as follows: one outboard of the pilot's seat, one in the relief crew compartment lavatory, one in the relief crew compartment, and one in the aft lavatory.

Oxygen Pressure Gages.

An oxygen pressure gage that indicates system pressure is installed at the pilot's and copilot's stations on their respective oxygen system indicator panels. Additional pressure gages may be installed at each crew member's station.

Oxygen Flow Indicators.

An oxygen blinker-type flow indicator is installed at each crew member's station.

OXYGEN SYSTEM NORMAL OPERATION.

Note

If the diluter-demand system is installed, each crew member should check his oxygen regulator with the diluter valve, first at the NORMAL OXYGEN position and then at the 100% OXYGEN position as follows: Remove the mask and blow gently into the end of the oxygen regulator hose as during normal exhalation. If there is a resistance to blowing, the system is satisfactory. Little or no resistance to blowing, indicates a faulty demand diaphragm or diluter air valve, or a leak in the mask-to-regulator tubing. Use only a demand oxygen mask. For normal operation of the diluter-demand system, set the AUTO-MIX lever to the NORMAL OXYGEN position. For normal operation of the continuous-flow system, turn the flow adjustment knob counterclockwise until the flow indicator needle corresponds to the cabin altitude.

OXYGEN SYSTEM EMERGENCY OPERATION.

Diluter-Demand System.

- With the first symptoms of hypoxia, accomplish the following:
 - Break safety wire and open the emergency valve by turning the red emergency knob counterclockwise.
 - After determining that a sufficient amount of oxygen is being received, set AUTO-MIX lever to the 100% OXYGEN position and the emergency knob to the CLOSED position.
 - If 100% oxygen is adequate, check equipment to determine if the normal oxygen position may again be used. If conditions permit, set AUTO-MIX lever to the NORMAL OXYGEN position.
- If smoke or fumes should enter the cabin, accomplish the following:
 - Set AUTO-MIX lever in the 100% OXYGEN position.
 - After the emergency condition has been corrected, set the AUTO-MIX lever in the NORMAL OXYGEN position.

Continuous-Flow System.

- With the first symptoms of hypoxia or if smoke or fumes enter the cabin, turn the flow adjustment knob on the regulator counterclockwise to the full open position (100% OXYGEN).

CAUTION

Use of 100% OXYGEN or opening of the emergency valve exhausts the oxygen supply very rapidly. After the emergency condition has been corrected, turn the emergency flow off and AUTO-MIX lever to the NORMAL OXYGEN position. If the continuous-flow system is used, adjust the flow adjustment knob on the regulator to correspond with the cabin altitude. If for any reason the AUTO-MIX lever must be left in the 100% OXYGEN position, the emergency valve must be left open, or the adjustment knob (on the continuous-flow regulator) must be left in the full open position, the pilot will be notified so that he may descend to a lower altitude. During all oxygen system emergency operations, the oxygen pressure will be monitored closely.

TROOP, PASSENGER, OR LITTER PATIENT OXYGEN SYSTEM.

A continuous-flow gaseous oxygen system is provided for passengers or litter patients, using two type J-1 oxygen cylinders (installed only when required). Three type A-11 continuous-flow oxygen regulators are installed on each side of the main cabin and are connected to 44 oxygen outlets for troop use. Four type A-9A oxygen regulators are installed on the forward right main cabin wall for ambulance patients requiring oxygen for treatment. The continuous-flow regulators automatically supply the proper amount of oxygen required with altitude. An oxygen outlet coupling is provided for each seat or each ambulance patient and for the cabin lavatory compartment. The coupling automatically opens to supply oxygen when a mask bayonet is inserted. Continuous-flow oxygen masks must be used. The approximate duration of the passenger or litter patient oxygen system is given in figure 4-16.

Troop, Passenger, or Litter Patient Oxygen System Pressure Gage and Line Valve.

A passenger or litter patient oxygen system pressure gage is installed on the aft right main cabin wall. An oxygen line valve located above the oxygen pressure gage must be closed if the passenger or litter patient oxygen cylinders are removed.

PASSENGER OXYGEN SYSTEM EMERGENCY OPERATION.

If the passengers' continuous-flow regulators should become inoperative, descend to an altitude not requiring oxygen.

AUTOPILOT - A3-A SYSTEM.

The type A3-A autopilot is a gyroscopically controlled, hydraulically actuated system which automatically operates the flight-control cable systems to maintain a desired magnetic heading and a normal stabilized attitude. Hydraulic fluid for the autopilot system is supplied by the main hydraulic system. An engine-driven autopilot hydraulic pump (*figures 1-32 and 1-33*) mounted on the No. 2 engine provides autopilot system pressure. Bypass valves in the servo units are operated by the servo unit handles. Relief valves in each servo unit permit manual overpowering of the autopilot in the event of an emergency by limiting the oil pressure in each servo cylinder. An autopilot control panel (*figure 4-17*), installed on the main instrument panel, contains the controls necessary for actuating the autopilot in maneuvering and trimming the aircraft.

AUTOPILOT OIL SHUTOFF HANDLE.

An autopilot oil shutoff handle (*figure 1-8*) with ON and OFF positions is located outboard of the copilot's seat. It mechanically controls the power to the hydraulic units of the autopilot system. When the shutoff handle is placed in the ON position, oil pressure is permitted to flow from a pressure regulating valve to three balanced oil valves on the autopilot control unit. Placing the shutoff valve in the OFF position bypasses the oil pressure from the pressure regulating valve to the hydraulic reservoir.

AUTOPILOT SERVO UNIT HANDLES.

Three autopilot servo unit handles (*figures 1-9 and 1-17*), mounted on the aft section of the control pedestal, have ON and OFF positions. When the handles are pushed to the ON position, hydraulic fluid pressure is admitted to the servo cylinders and operates the autopilot. Pulling the handles to the OFF position permits the hydraulic fluid to bypass the servo cylinders and return to the hydraulic reservoir.

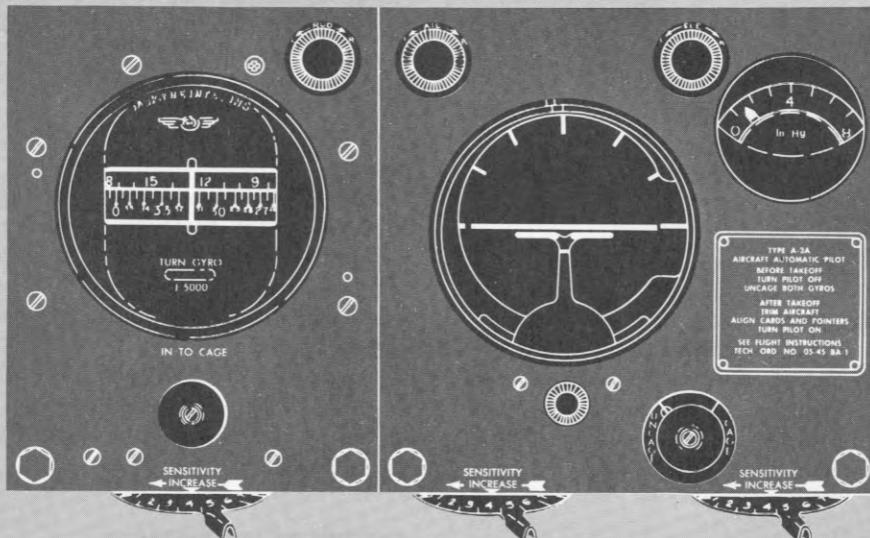
CAUTION

Trimming the aircraft should not be accomplished with the autopilot engaged.

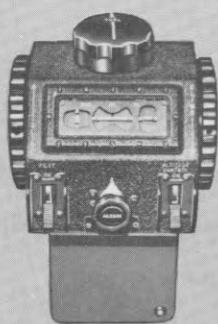
ELEVATOR KNOB.

The elevator knob, located on the autopilot control panel (*figure 4-17*), controls the aircraft in pitch attitude. Rotating the knob counterclockwise results in a nose-up attitude; rotating the knob clockwise produces a nose-down attitude.

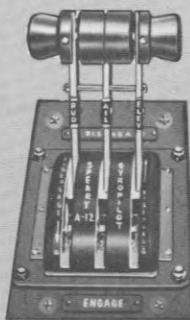
AUTOPILOT CONTROL PANEL



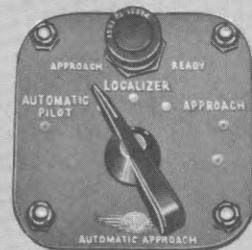
**AUTOPILOT CONTROL PANEL
A3-A SYSTEM**



1. AUTOMATIC PILOT CONTROLLER



2. AUTOMATIC PILOT
MECHANICAL ENGAGING LEVERS



3. AUTOMATIC APPROACH
SELECTOR SWITCH AND READY LIGHT

**AUTOPILOT CONTROLS
E-4 SYSTEM**

Figure 4-17

RUDDER KNOB.

The rudder knob, located on the autopilot control panel (*figure 4-17*), controls the aircraft about the vertical axis. Rotating the knob clockwise produces a right turn; rotating the knob counterclockwise results in a left turn.

AILERON KNOB.

The aileron knob, located on the autopilot control panel (*figure 4-17*), controls the aircraft about the roll axis. Turning the knob toward the high wing will bring the aircraft to a level attitude.

Autopilot Indicators.

A directional indicator and an attitude indicator are incorporated in the autopilot control panel (*figure 4-17*) to provide visual indication of the autopilot signal in each axis. If the needles diverge more than one pointer width from the respective index, an excessive out-of-trim condition exists and should be corrected.

Vacuum Gage.

A direct-pressure-operated vacuum gage, installed on the autopilot control panel (*figure 4-17*), indicates the vacuum pressure of the autopilot system in inches of Hg. Vacuum pressure indication is taken directly from the vacuum manifold. The normal vacuum pressure limits are 3.75 to 4.25 inches Hg.

Autopilot Oil Pressure Gage.

A pressure-operated autopilot oil pressure gage (*figures 1-10 and 1-18*), mounted on the right side of the main instrument panel in front of the copilot's station, indicates the system oil pressure. Normal operating pressure of the autopilot system is 125 (± 5) psi.

Caging Knobs.

Caging knobs for the autopilot gyro instruments are installed on the autopilot control panel (*figure 4-17*). The limit of the gyro turn unit is 55 degrees from vertical in bank, glide, or climb. The limit of the attitude gyro unit is 50 degrees from vertical in bank, glide, or climb. Any maneuver that exceeds these limits will result in gyro spill or tumble causing the instruments to give incorrect indication. Pushing the gyro turn caging knob to the IN position, and turning the attitude caging knob clockwise to the CAGE position will mechanically set the gyro gimbal rings of each unit in their proper positions. After resetting the

gyro units for proper heading and indication, the gyro turn caging knob may be pulled to full OUT, and the attitude caging knob may be turned counterclockwise to the UNCAGE position for gyro operation of both units.

Note

Instruments should be uncaged at all times, except during maneuvers which exceed their operational limits.

Sensitivity Dials.

Three sensitivity dials with settings 0 through 9 are installed on the autopilot control panel (*figure 4-17*); a dial for each surface control permits mechanical selection of the desired autopilot control response. The sensitivity dials mechanically control the amount of airflow through an air relay valve that is connected to a balanced oil valve in each servo unit. Sensitivity may be increased by turning the dials clockwise toward higher numbers, which increases the airflow and stimulates quicker control response.

AUTOPILOT OPERATION.**Preflight Ground Test.**

To perform an autopilot preflight ground test, proceed as follows:

1. Autopilot oil shutoff handle — ON.
2. Fluid level in hydraulic reservoir — Check.
3. Gustlock — OFF.
4. Autopilot servo unit handles — OFF (up).
5. Operate engines at approximately 1000 rpm.
6. Autopilot vacuum gage — Within limits.
7. Autopilot oil pressure gage — Within limits.
8. Uncage the attitude gyro unit.
9. Set the directional indicator to desired heading and uncage.
10. Flight controls — Neutral.
11. Set the rudder followup card to match the gyro turn card, set the aileron followup index to match the bank index, and set the elevator followup index to match the elevator alignment index.
12. Set each sensitivity dial to position 3.
13. Autopilot servo unit handles — Push ON.

14. Check autopilot operation by turning each trimmer knob.
15. Check the overpower valves by operating the flight controls against the autopilot.

Note

If the flight controls are moved too far from the automatic control position when overpowering the autopilot, they will not return automatically when released because the indexes of the autopilot gyro instruments will be moved out of alignment and the signal response from the flight control surfaces to the autopilot followup cable system will be disrupted. Disengage the autopilot, align the indexes, and reengage the autopilot.

16. Disengage the autopilot by pulling the autopilot servo unit handles OFF (up).

In Flight.

1. Trim the aircraft to fly hands off.
2. Autopilot oil shutoff handle — ON.
3. Select the desired aircraft heading and align the followup cards and indexes on the control panel.
4. Autopilot servo unit handles — Push ON.
5. Trim the aircraft in the axis indicated by the gyro indexes with the autopilot in operation.

AUTOPILOT — E-4 SYSTEM.

The Sperry E-4 autopilot is a gyroscopically controlled, electrically actuated system which automatically operates the flight control cable systems to maintain any desired magnetic heading and a normal stabilized attitude. In addition the system provides constant altitude control, coordinated turn control, automatic elevator trim compensation for changes in weight distribution, and automatic approach control for instrument landing operation. The electrical controls for nonautomatic actuation of the autopilot in maneuvering and trimming the aircraft are grouped on the controller unit on the control pedestal. Power is supplied to the autopilot equipment by the aircraft 28-volt d-c and 115-volt a-c systems.

Note

After electric power is supplied to the autopilot, it will take approximately 2 minutes for the gyros to complete the erection process.

POWER (PILOT) SWITCH.

The autopilot ON-OFF power switch (figure 4-17) controls the power to the electronic units of the autopilot system. An interlock system prevents the power switch from being placed in the ON position or, if the power switch is ON, will return it to OFF position if any of the following conditions exists:

1. The aircraft a-c or d-c power supply exceeds or falls below operating limits.
2. A-c power has not been applied to the autopilot for a minimum of 2 minutes.
3. Engaging levers are not in the DISENGAGE position.
4. Turn control is not centered.
5. The electrical release buttons have been pushed or are not in the OUT position.
6. The automatic approach switch is in LOCALIZER or APPROACH position.

PITCH CONTROL KNOB.

The aircraft is controlled in pitch attitude by either of the two pitch control knobs (figure 4-17). Rotating the pitch control knobs toward the nose of the aircraft results in a nose-down attitude; rotating the knobs aft, or away from the nose, produces a nose-up attitude. As the pitch control knobs are magnetically coupled to a signal potentiometer, they need not be centered when engaging the autopilot, as they will automatically be centered within their control range. The pitch control knobs are inoperative when the altitude control switch is ON.

TURN CONTROL KNOB.

The turn control knob (figure 4-17) produces coordinated turns of the aircraft at any airspeed. The knob must be in the centered position before engaging the autopilot, as otherwise the power switch cannot be turned ON and the autopilot cannot be operated.

AILERON TRIM CONTROL KNOB.

The attitude of the aircraft about the roll axis is controlled by the aileron trim control knob. Turning the knob toward the high wing will bring the aircraft to a level attitude, the magnitude of reaction being proportional to the amount of knob rotation.

ALTITUDE CONTROL SWITCH.

The altitude of the aircraft can be automatically maintained at any barometric pressure by placing the altitude control switch ON. Altitude will also continue

to be maintained during turns with the unit in operation. An interlock system prevents operation of the altitude control switch when the autopilot mechanical engaging levers are not in the ENGAGE position.

MECHANICAL ENGAGING LEVERS.

The autopilot servos are mechanically engaged with the control surface cable systems by the interconnected ELEV, AIL, and RUD engaging levers on the control pedestal. The levers have two positions, ENGAGE and DISENGAGE, and may operate as a single control. The elevator trim servo is connected to the elevator servo and is automatically operated with the ELEV lever. An interlock system prevents turning the pilot switch ON when any servo is engaged. Disengaging the mechanical levers while the altitude control switch is ON will automatically return the altitude control switch to the OFF position.

Note

The mechanical engaging levers are spring-loaded and will not remain in any intermediate position. The autopilot can be disengaged by placing the levers in the DISENGAGE position, leaving the electronic units of the autopilot operating.

ELECTRICAL RELEASE BUTTONS.

The autopilot can be electrically deenergized instantly by depressing the autopilot electrical release button on each control wheel. Depressing either button automatically returns the pilot, altitude control, and servo switches to the OFF positions.

AUTOMATIC APPROACH SELECTOR SWITCH.

A 3-position automatic approach selector switch (figure 4-17) and an approach ready light are mounted on the control pedestal for use in coordinated operation of the autopilot and the localizer and glide slope equipment for instrument landing. The switch should remain in the AUTOMATIC PILOT position at all times that automatic approach operation is not desired. The LOCALIZER position causes the autopilot to respond to localizer signals. The APPROACH position is used when the horizontal needle is centered and the aircraft has been trimmed to fly the glide slope, when using the control on a known glide slope frequency.

AUTOPILOT INDICATORS.

Three autopilot signal indicators are incorporated in the pedestal controller to provide visual indication of autopilot signals in each axis. A constant deflection of the indicator needle in any axis indicates that the

autopilot is correcting an out-of-trim condition. While the needles need not be exactly centered, a divergency of more than one pointer width indicates an excessive out-of-trim condition that should be corrected by retrimming in that axis. The elevator (EL) axis is automatically trimmed by the elevator trim tab servo, but the aileron (AIL) must be trimmed with the aileron trim control knob on the pedestal controller, and the rudder (RUD) trimmed with the rudder trim wheel on the glareshields. Trimming may be accomplished with the autopilot engaged. The autopilot will hold the aircraft substantially to its course in the event of engine failure, but the rudder and aileron must be trimmed out until the respective trim meters are centered.

AUTOPILOT OPERATION.

Turning on Autopilot.

WARNING

The pilot or copilot shall monitor the controls continuously when flying with the E-4 autopilot engaged. If an autopilot malfunction results in a hardover rudder action, the pilot shall apply force to the rudder pedal that is in the forward position, before releasing the autopilot. This prevents the rudder from abruptly returning to neutral when the autopilot is disengaged. After disengaging the autopilot, the rudder shall be allowed to return to neutral slowly.

1. Trim aircraft to fly hands off.
2. Make certain that the turn control knob is in the centered position.
3. Mechanical engaging levers — DISENGAGE.
4. Automatic approach selector switch — AUTOMATIC PILOT.

Note

Allow 2 minutes for the gyros to erect before engaging the autopilot.

5. Power switch — ON.
6. Mechanical engaging levers — ENGAGE.

- Altitude control switch — ON, to maintain a constant pressure altitude.
- Trim the aircraft in the axis indicated by the signal indicators with the autopilot engaged.

CAUTION

Internal adjustments of the autopilot system must be made by qualified personnel only.

Turning Off Autopilot.

- Pilot switch — OFF.
- Mechanical engaging levers — DISENGAGE.

Note

In an emergency, the autopilot can be electrically deenergized by depressing either autopilot electrical release button. However, if an erratic stick or rudder motion occurs, the autopilot should be turned off by means of the pilot switch, rather than by attempting to catch the moving control column to depress the electrical button. Excessive nose-down or nose-up stick motion should be controlled by grasping the control wheel before releasing autopilot.

AUTOMATIC APPROACH EQUIPMENT.

Automatic approach equipment is installed and is used in conjunction with the autopilot to provide a means of instrument guidance whereby the autopilot responds to radio signals and maintains an on-course flight path through interpretation of localizer and glide slope radio beam signals. For approach procedure using this equipment see Section IX.

NAVIGATION EQUIPMENT.

For instrument approach equipment, see communication and associated electronic equipment, this section. For instrument approach procedures, see Section IX. Provisions are made for the installation of the following navigational equipment; driftmeter, astrocompass, and a flux gate remote-indicating compass.



Figure 4-18

X1-26

NAVIGATOR'S STOOL.

The navigator's stool incorporates an upholstered seat cushion, a safety belt, a foot support ring, and a height adjustment. The stool is also used as a stand for taking navigation sights through the astrodome.

DRIFTMETER.

A driftmeter is used by the navigator to measure drift and azimuth (figure 4-19). The instrument obtains direct indications of drift, relative bearing angle of a fixed object on the earth, and data for calculating ground speed. The driftmeter is installed so that it may be rotated through 360 degrees in azimuth without mechanical interference. A gyro incorporated in the driftmeter should be caged at all times when not in use.

DRIFTMETER

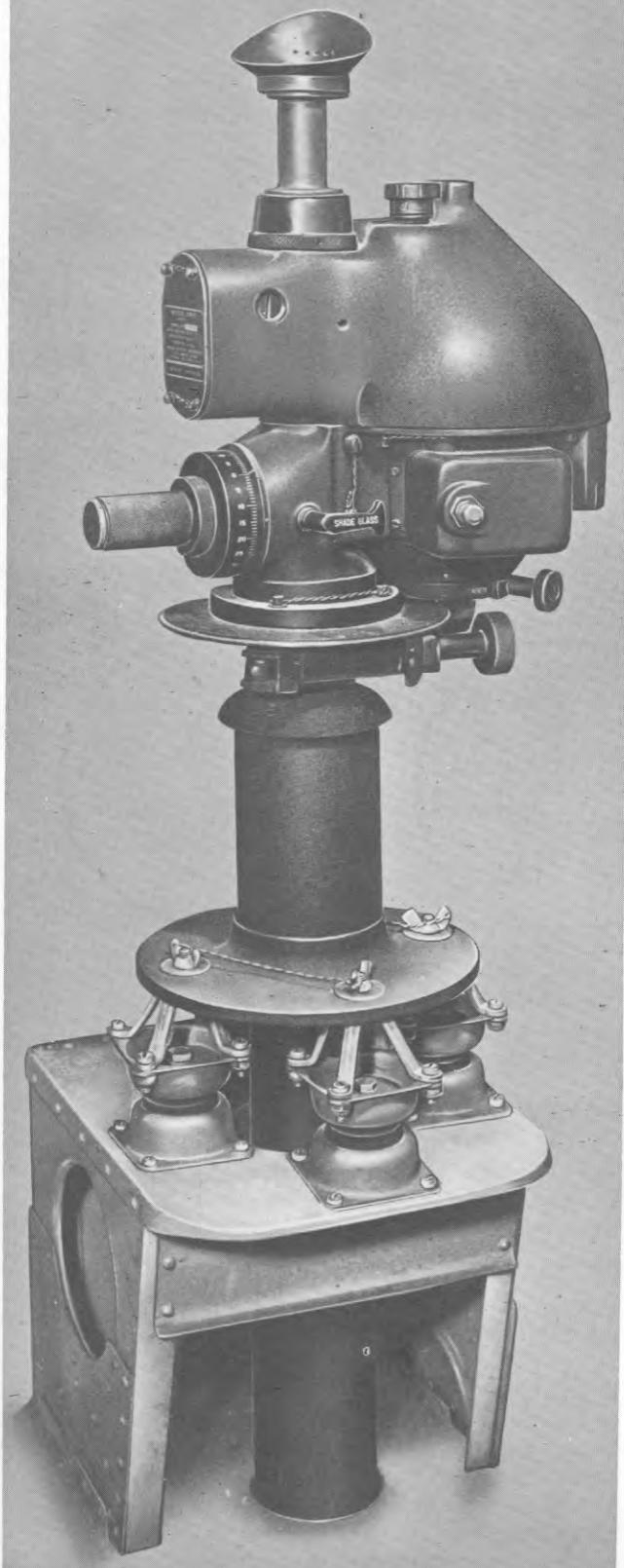


Figure 4-19

X1-27

ASTROCOMPASS.

Provisions for mounting an MK II astrocompass are located under the astrodome. On some aircraft, the astrocompass is stowed in the navigator's map compartment.

FLUX GATE REMOTE-INDICATING COMPASS.

The flux gate remote-indicating compass is an electrically actuated magnetic direction indicator. The system uses a master direction indicator (figure 4-12) installed at the navigator's station, and a compass repeater indicator (figure 1-10) located on the main instrument panel. Power source is the 115-volt a-c bus. Power for the remote-indicating compass caging motor and switch box is derived from the 28-volt d-c bus.

N-1 COMPASS SYSTEM.

On some aircraft the N-1 compass system is installed to replace the flux gate remote-indicating compass system. It is designed to furnish the directional signals that control the azimuth (yaw) axis of the autopilot system, and supply the pilot, copilot, and navigator with the directional indications used in navigating the aircraft. The N-1 compass system is designed for use at all latitudes. It may be operated as a slaved magnetic compass or as a compensated directional gyro where the magnetic field of the earth is not suitable for accurate indications of magnetic headings. The master indicator is mounted at the navigator's station. A bearing indicator repeater is mounted on the pilot's main instrument panel.

AUXILIARY POWER PLANT.

An auxiliary power plant, installed in the forward lower cargo compartment (9, figure 1-3), provides a source of electrical power that is independent of a ground power supply. The power plant is provided for ground operation only, and is a 2-cylinder, 4-cycle, V-type gasoline engine with a self-contained oil supply. Fuel is supplied from either the No. 2 or No. 3 main wing tank. Fire detectors are installed in the immediate area of the APP and are interconnected with the forward lower cargo compartment fire warning system. At constant speed, the APP generator will supply an electrical output of 0 to 175 amperes at 27 (± 0.5) volts. The generator is also used as starter for the APP engine.

Note

Should fire develop in the auxiliary power plant, the fire detectors in the forward lower cargo compartment will be actuated and the appropriate fire warning light will illuminate.

Throttle Lever.

A mechanical throttle lever, with CHOKE, IDLE, and RUN positions is located below the APP control panel (figure 4-18). The CHOKE position uses the richest fuel mixture and is used as the initial starting position with temperatures below 10°C. The IDLE position is used after the engine has started, and provides a slow speed for engine warmup. The RUN position is used after the engine has warmed up thoroughly (approximately 5 minutes), and provides high engine speed for maximum power output.

Ignition Switch and Indicator Light.

An ignition switch with the positions FUEL IGNITION and FUEL SHUT-OFF, is located on the APP control panel (figure 4-18). When the switch is placed in the FUEL IGNITION position, a 24- to 28-volt d-c circuit from the main bus is closed to the cabin heaters fuel solenoid valve on the No. 2 or No. 3 main wing tank to supply fuel to the APP, and the grounding circuit of the magneto is opened, which permits the magneto to generate current for the two APP spark plugs. Placing the switch in the FUEL SHUT-OFF position closes the fuel solenoid valve and grounds the magneto. A press-to-test indicator light, located on the APP control panel, is illuminated when the ignition switch is in the FUEL IGNITION position.

Generator Field and Generator Armature Switches.

Two spring-loaded switches, one a generator field switch and the other a generator armature switch, are bussed together; they have the positions START and OFF and are located on the APP control panel (figure 4-18). When the switches are held in the START position, 24- to 28-volt d-c power from the main bus energizes the generator field and armature through relays, causing the generator to act as a starting motor for the APP engine. When the switches are released to the OFF position after the APP engine has started, these relays are deenergized, permitting the generator to energize the main bus when the load switch is in LOAD position.

Load Switch.

A load switch with LOAD and OFF positions is located on the APP control panel (figure 4-18). When the switch is placed in the LOAD position, a 28-volt d-c relay is closed to tie the isolated APP generator output to the main bus. Placing the switch in the OFF position isolates the APP generator.

Voltmeter and Switch.

A voltammeter calibrated in volts and amperes is located on the APP control panel (figure 4-18). Voltage output of the APP generator is indicated when the

APP is in operation. A pushbutton located on the face of the instrument, when depressed, will provide an indication of amperage output of the APP generator.

Cylinder Head Temperature Indicator.

A cylinder head temperature indicator calibrated in degrees C is located on the APP control panel (figure 4-18); it provides an indication of the cylinder head temperature of the APP engine. The power source is the 28-volt d-c bus.

APP Fire Warning Lights and Test Switch.

Two fire warning lights are located on the APP control panel (figure 4-18). When any of the six thermocouple fire detectors that are installed adjacent to the APP are actuated, the two fire warning lights on the APP control panel and the front lower cargo compartment warning light on the fire extinguisher control panel will be illuminated. A test switch located on the APP control panel may be used to test operation of the APP fire detectors by holding it against spring tension until the fire warning lights illuminate. The power source is the 28-volt d-c bus.

STARTING APP ELECTRICALLY.

To start the APP by electrical cranking, proceed as follows:

1. Aircraft battery switch - ON.
2. Throttle lever - Between IDLE and RUN positions.

Note

Operation of the CHOKE can be determined by experience. Little or no choke will be necessary with temperatures above 10°C.

3. Ignition switch - FUEL IGNITION position; check indicator light to be illuminated.
4. Generator field and armature switches - Hold in START position until engine starts, then release to OFF.
5. After the engine has warmed up (approximately 5 minutes at IDLE), move the throttle lever to the RUN position and place the load switch to LOAD position.

CAUTION

The throttle lever must not be moved to the RUN position until after the engine has warmed up.

STARTING APP MANUALLY.

The APP may be started manually by means of a pull cord.

STOPPING APP.

Stop the APP as follows:

1. Load switch — OFF.
2. Throttle lever — IDLE for 5 minutes.
3. Ignition switch — FUEL SHUT-OFF.

DISINSECTION SYSTEM.

The disinsection system installed on some aircraft provides a spray of aerosol insecticide through dispensers to all areas in the aircraft fuselage and landing gear wheel wells. This destroys all insects that might cause disease in plant or animal life. The system is automatic in operation when energized, and includes two stainless steel aerosol cylinders, a pressure gage, filter, solenoid valve, plumbing, dispensers, a cycle recorder and timing device, supercycle control panel, normal cycle switch, signal bell, and indicator lights. Complete disinsection of the aircraft is accomplished with two cycles of aerosol spray: a supercycle dosage to be used before any personnel board the aircraft, and a normal cycle dosage to be used after takeoff with the landing gear retracted or at least 30 minutes before arrival at the destination airport. The supercycle dosage is controlled from a supercycle control panel which is located under a cover plate on the exterior of the aircraft in front of the forward cargo door. The normal cycle dosage is controlled by a switch which is located on the electrical control panel in the cockpit. Quarantine regulations require all doors and windows to the exterior to be closed and the aircraft ventilating systems to be turned off for at least 3 minutes after the spraying of insecticide has stopped.

SUPERCYCLE KEY SWITCH.

A supercycle key switch (*figure 4-20*), with positions ON and OFF, is located on the supercycle control panel on the exterior of the aircraft. The switch functions as a protective device to prevent inadvertent operation of the disinsection system. Two keys are provided to actuate the switch. When a key is inserted in the switch and turned to the ON position, the supercycle switch may be held in the ON position momentarily, which will energize the disinsection system to provide a supercycle dosage of insecticide spray. Placing the switch in the OFF position deenergizes the disinsection system. The power source is the 28-volt d-c bus.

SUPERCYCLE SWITCH.

A spring-loaded supercycle switch (*figure 4-20*) with positions ON and OFF, is located on the supercycle control panel on the exterior of the aircraft. Holding the switch in the ON position momentarily energizes a 28-volt d-c circuit to a holding relay in the timing and cycling controller which initiates the supercycle dosage of insecticide spray when the supercycle key switch is in the ON position. After the cycling has begun, the switch may be released to the OFF position; the spray will continue until the cycle is completed. During the supercycle dosage, insecticide is sprayed from dispensers located as follows: one in the relief crew compartment, one in the crew lavatory, four in the main cabin, and one in the cabin lavatory.

SUPERCYCLE INDICATOR LIGHT.

A supercycle indicator light (*figure 4-20*) is located on the supercycle control panel. When the supercycle key switch is in the ON position and the supercycle switch is held in the ON position momentarily, a 28-volt d-c circuit is closed and the light is illuminated, indicating that the disinsection system has been energized. The light is turned off automatically when the timing and cycling controller relays open on completion of the spraying cycle.

SUPERCYCLE SIGNAL BELL.

A supercycle signal bell (*figure 4-20*) is located on the supercycle control panel. When the supercycle key switch is in the ON position and the supercycle switch is held in the ON position, a 28-volt d-c circuit is completed to the timing and cycling controller relays, causing the signal bell to ring until the disinsection system is energized, at which time the bell is deenergized. When the timing and cycling controller relays open on completion of the spraying cycle, the bell will ring until the supercycle key switch is turned to the OFF position.

NORMAL CYCLE SWITCH.

A normal cycle switch, with a placarded ON position, is spring-loaded to a center or off position and is located on the electrical control panel in the cockpit. When the aircraft is in flight with the landing gear retracted and the normal cycle switch is held in the ON position, a 28-volt d-c circuit is energized, causing a holding relay to close in the timing and cycling controller. This initiates the normal cycle dosage of insecticide spray. During the normal cycle dosage, insecticide is sprayed from dispensers located as follows: one in the relief crew compartment, one in the crew lavatory, four in the main cabin, one in the cabin lavatory, one in the tail section aft of the main cabin rear bulkhead, one in each lower cargo compartment, and one in each landing gear wheel well.

DISINSECTION SYSTEM CONTROLS

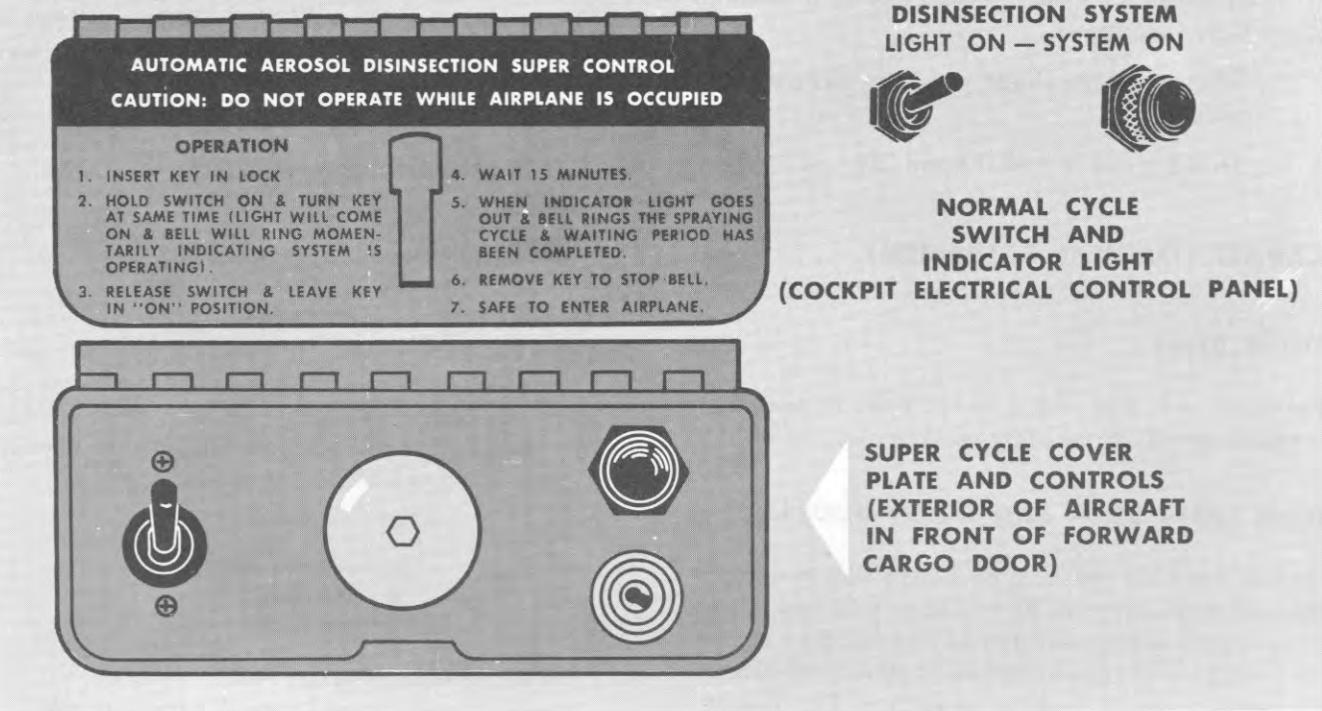


Figure 4-20

X1-29

NORMAL CYCLE INDICATOR LIGHT.

A normal indicator light is located on the electrical control panel in the cockpit. When the normal cycle switch is depressed to energize the disinsection system, a 28-volt d-c circuit causes the light to illuminate. When the relays in the timing and cycling controller open to deenergize the system, the light goes out.

CYCLE RECORDER.

A cycle recorder that is installed in the wall forward of the cargo doors in the main cabin maintains a cumulative record of both super and normal cycle dosages of aerosol spray.

DISINSECTION SYSTEM CIRCUIT BREAKERS.

Two disinsection system circuit breakers are located on the cabin electrical control panel. One is placarded DISP., the other POWER. Both circuit breakers must be depressed before the disinsection system can be energized. After each normal cycle dosage of insecticide spray, the circuit breakers should be pulled out to prevent inadvertent operation of the system.

DISINSECTION SYSTEM SUPERCYCLE OPERATION.

For supercycle operation of the disinsection system, proceed as follows:

1. Aircraft battery switch — ON.
2. POWER and DISP. circuit breakers — ON.
3. Ground blowers — OFF.
4. All exterior windows and doors — CLOSED.
5. Supercycle key switch — ON.
6. Supercycle switch — Hold ON until indicator light illuminates and bell rings momentarily.
7. When light goes out and bell rings continuously, turn supercycle key switch OFF and remove key.
8. Ventilate aircraft.

DISINSECTION SYSTEM NORMAL CYCLE OPERATION.

For normal cycle operation of the disinsection system in flight, proceed as follows:

1. Obtain answer from flight nurse that POWER and DISP. circuit breakers are ON and that litter patients are prepared for application of aerosol spray.

2. Landing gear — Retracted.
3. Ventilating systems — OFF.
4. Normal cycle switch — Hold ON until indicator light illuminates.
5. When indicator light goes out, ventilate aircraft.
6. Record cycles in AFTO Form 781.

CARGO LOADING EQUIPMENT.

BOOM HOIST.

Provisions are made for a boom hoist in the cargo compartment aft of the aft cargo door.

MAIN CABIN DOOR AND CARGO DOORS.

Double doors are mounted on hinges that permit the doors to open outward. Each door is provided with a trigger latch mechanism that secures the door against the fuselage in the open position, to allow unobstructed passenger or cargo loading operations. The forward door is a cabin door used as a passenger entrance and exit door when the aircraft is on the ground. It can also be jettisoned by an emergency release mechanism during flight to serve as an emergency exit (*figure 3-6*). The forward door can be opened or closed from either side by a handle. The aft portion is a cargo door and can be opened or closed from the main cargo compartment only; it is secured in the closed position by four latch bolts. With both doors fully open, dimensions of the main cargo entrance are 95 $\frac{3}{4}$ inches wide by 67 inches high. However, each corner of the entrance is rounded by a 8 $\frac{1}{8}$ inch radius, which slightly restricts the clear opening. Two lower cargo compartment doors are mounted on hinges that permit the doors to swing inward to the open position. A handle installed on the exterior of each door serves to either lock or unlock the door latch assembly.

TROOP AND CASUALTY CARRYING PROVISIONS.

Troop carrying equipment consists of folding canvas benches and safety belts installed along the sides of the main cabin, to accommodate 35 to 49 persons. As an ambulance transport, 28 to 36 litters can be installed in horizontal tiers. On some aircraft, 40 to 44 removable commercial-type passenger seats are installed in the main cabin (*figure 4-21*).

CREW ACCOMMODATIONS.

Accommodations for a relief crew are provided aft of the rear bulkhead at the radio operator's and the navigator's stations (*figure 1-4*). Facilities available to the relief crew include two crew bunks, a crew lavatory, and a wash basin.

MISCELLANEOUS EQUIPMENT.

WINDSHIELD WIPERS AND CONTROL KNOBS.

A hydraulically actuated windshield wiper unit is installed on each windshield panel. The wiper units are controlled by knobs located on the outboard side of each pilot's seat. Turning the knob counterclockwise mechanically opens a needle valve which increases the speed of windshield wiper action.

CAUTION

To avoid scratching the windshield, do not operate the windshield wiper blades when the windshield is dry.

RADIO OPERATOR'S SEAT.

A radio operator's seat is provided, with a safety belt. No provisions are made for adjustment of the seat.

ENTRANCE LADDER.

On some aircraft, a ladder is provided for leaving and gaining entrance to the aircraft.

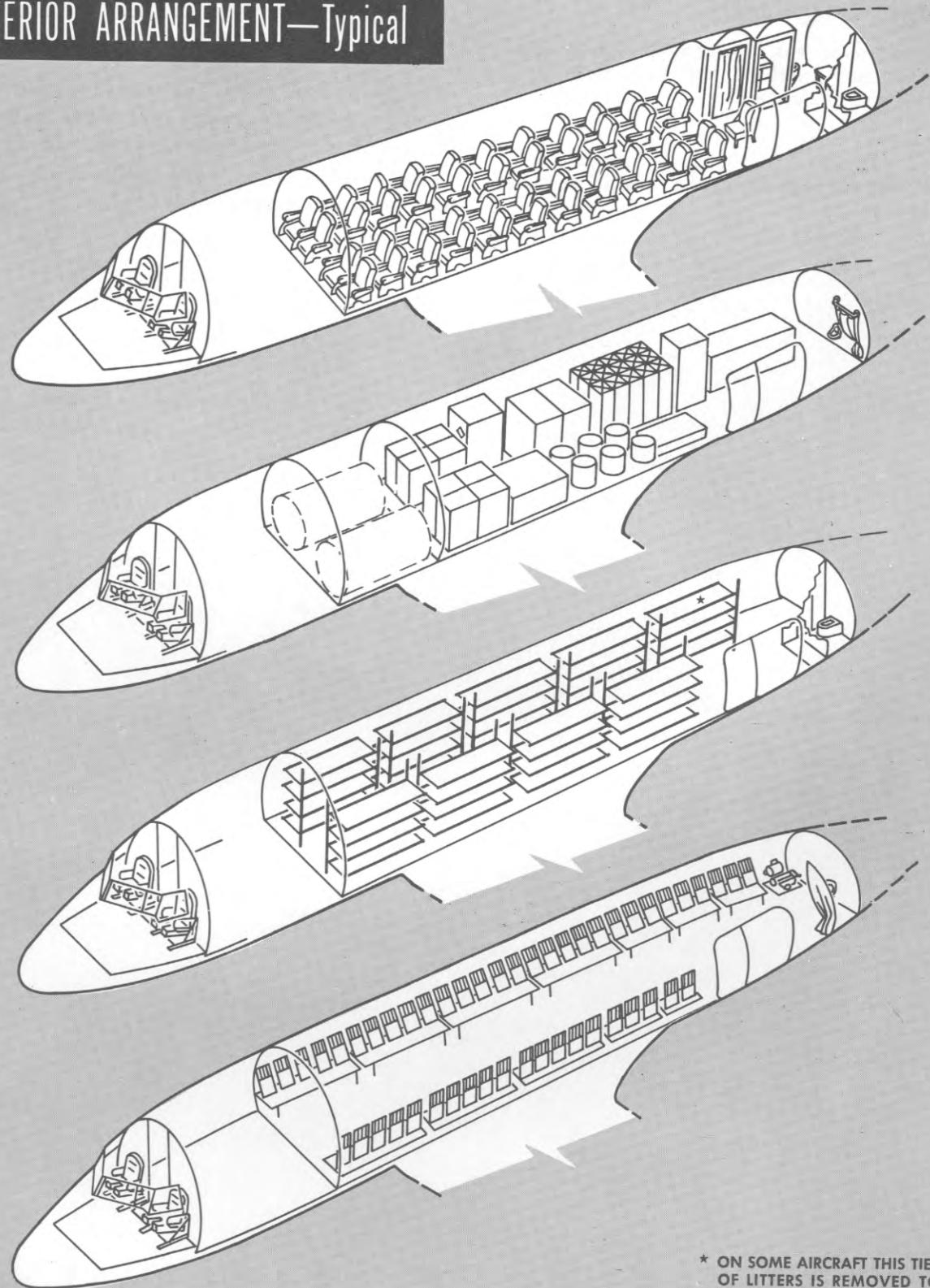
SUIT HEATER RHEOSTATS.

An electric suit heater rheostat is installed at each pilot's station and two are mounted on the bulkhead aft of the navigator's station, to be used by the radio operator and the navigator. Power source is the 28-volt d-c bus.

BUFFET.

On some aircraft, a buffet (16, *figure 1-3*), operating off the 28-volt d-c bus, is installed in the main cabin. It contains a hot and cold food storage box, beverage containers, two electrically operated hot cups, three 1 gallon thermos jugs, and a food storage cabinet.

INTERIOR ARRANGEMENT—Typical



* ON SOME AIRCRAFT THIS TIER OF LITTERS IS REMOVED TO PROVIDE FOR A BUFFET.

Figure 4-21

MAIN CABIN WATER TANK.

A 10.5 gallon water tank (18, *figure 1-3*) is installed aft of the lavatory bulkhead. On the C-54 M, a 23 gallon water tank is installed.

MAP CASES.

Two map cases are installed in the cockpit, one outboard of each pilot's seat.

TAIL SUPPORT STAND.

A tail support stand is stowed under the cargo equipment in the main cabin. The support stand is secured to the tail skid to prevent inadvertent lowering of the tail to the ground during loading or unloading operations. The support stand is adjustable to compensate for various ground-to-tail heights.