

Figure 281—Cowl Flap Hydraulic System

d. Close the valve in the suction line and the accumulator service valve. Open valve leading to the fluid reservoir.

e. Operate the hand pump until clear fluid flows freely from the wheel brake flexible hoses.

f. Close the valve in the suction line and open the valve in the fluid reservoir line.

g. Circulate fluid with the auxiliary pump, using the auxiliary fluid supply, until fluid flows freely from the wheel brake flexible hoses.

h. Set the parking brake handle in "OFF" position.

i. Operate the brakes and circulate fluid with the auxiliary pump until fluid flows freely from the wheel brake flexible hoses.

j. Set the brakes in the "OFF" position and reconnect the wheel brake flexible hoses.

### 3. COWL FLAP LINES.

a. Disconnect the two flexible lines from the cowl flap cylinder of nacelle No. 1 and lead into the reservoir of the auxiliary apparatus.

b. Set the cowl flap control valve for nacelle No. 1 in the "OPEN" position and circulate fluid with

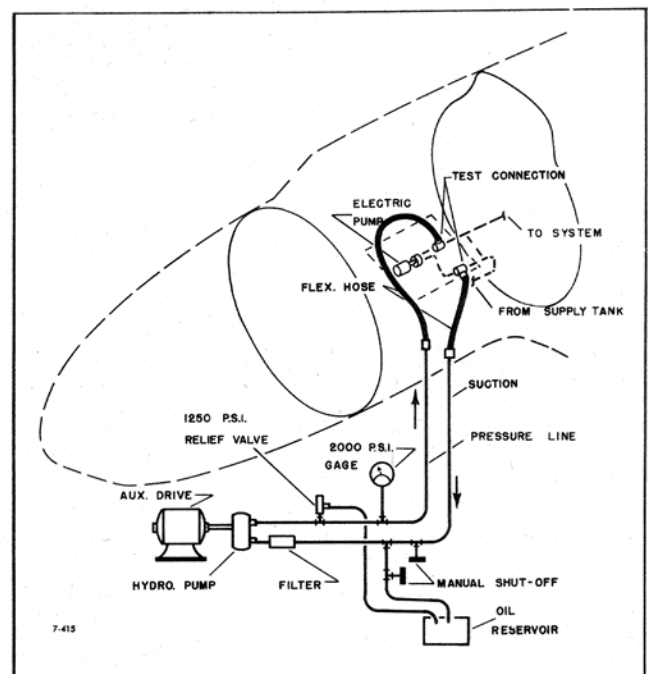


Figure 282—Auxiliary Power for Hydraulic System Test

the auxiliary apparatus, using the auxiliary fluid supply, until fluid flows freely from one line.

c. Without stopping the pump, turn the cowl flap control valve for nacelle No. 1 to "CLOSED" position. Fluid should flow from the opposite line.

d. Reconnect the cowl flap lines and repeat for nacelles Nos. 2, 3, and 4.

**(g) BLEEDING THE HYDRAULIC SYSTEM.**

1. An inherent feature in the design of this system is that displaced air in all tubes except the cowl flap lines will rise to the supply tank, which is vented to the atmosphere. After a new panel is installed and all lines are connected, the pump should be started and allowed to build up pressure in the accumulator. Since the supply tank is on a higher level than the pump, fluid will flow by gravity to the pump and the displaced air will rise into the supply tank. Allow the pump to build up pressure, then release by means of the accumulator service valve. This procedure should be repeated several times.

2. Trapped air in the brake system may be automatically bled to the supply tank by several complete applications and releases of the brakes.

3. In order to bleed the cowl flap cylinders move the flaps to the "CLOSED" position, loosen the left tube fitting at the cylinder, apply hydraulic pressure and allow the fluid to flow until it emerges free of bubbles. Tighten the tube fitting, allowing hydraulic pressure to open the cowl flaps. Repeat this operation for the tube fitting on the right end of the cylinder. Bleed each cowl flap cylinder as above and operate flaps from the "FULL OPEN" to the "FULL CLOSED" position several complete cycles by means of the control valve in the cockpit.

4. Bleed the hydraulic gun charger of the chin turret. With the hydraulic pressure supply system of the airplane operating automatically, loosen the hydraulic hose connections at the charger elbows slightly to bleed the air out of the system.

**CAUTION**

Do not hold the charger button depressed more than 30 seconds.

Depress the charging button. The gun bolts should move to the rear position. Release the charger button. Repeat the procedure several times until all the air is bled out of the system. Then retighten the hydraulic hose connections at the charger elbows. Operate the chargers several times by depressing the charging button. The charging action should be fast and smooth. If the charging action is slow or uncertain, the hydraulic system should again be bled. Swing the turret in azimuth several times while operating the chargers. Inspect the hydraulic connections, control valve, swivel gland, and chargers for hydraulic leaks. The charger control valve should open and close without lag, following operation of the charger button.

**(h) TESTS.**

**1. PRESSURE TEST OF THE HYDRAULIC SYSTEM.**

a. Disconnect the self-sealing coupling in the relief valve return line to prevent loss of hydraulic fluid. Disconnect the relief valve return line from the valve and plug the port.

b. At the deboost valves on shock absorber cylinders, disconnect the flexible hoses from the wheels, and attach a 0-300-pounds per square inch gage at the end of each of the hoses.

c. Close the accumulator service valve and set all cowl flap control valve levers in the "CLOSED" position.

d. Be sure that the supply tank has been completely drained from previous tests. Fill the tank with clean hydraulic fluid, Specification AN-VV-O-366.

e. Open the valve in suction line and close the valve in the fluid reservoir line.

f. Using the auxiliary pump and system supply, build the system pressure up slowly to 1200 pounds per square inch.

g. Operate the copilot's brake pedals until the gages on the flexible hoses register approximately 300 pounds per square inch pressure.

h. Check the system for leakage at all fittings, units and tubing.

i. Relieve the pressure to 800 pounds per square inch, turn the cowl flap control levers to the "OPEN" position and release the copilot's brakes.

j. Recheck the cowl flap lines and cylinders for leakage.

k. Bleed the system pressure to 0 pounds per square inch and arrange the system in its original form, leaving the auxiliary apparatus connected.

**2. FUNCTIONAL TEST—ELECTRICAL SYSTEM CONNECTED.**

**CAUTION**

Before connecting the electrical system, be sure the switch for the hydraulic pump is "OFF."

**Note**

Throughout the functional test, observe the pressure warning light on the pilots' instrument panel above the hydraulic pressure gage. The light should flash "ON" when the system pressure drops to between 550 and 500 pounds per square inch and should go "OUT" when the system pressure rises to 500 to 550 pounds per square inch. With no pressure in the system and with the electrical system connected, the light should be "ON."

**a. RELIEF VALVE.**

(1) Close accumulator service valve and the valve in the fluid reservoir line.

(2) Open the valve in the suction line.



(3) Be sure the system supply tank is filled.

(4) Build up the system pressure with the auxiliary pump until the relief valve opens at  $875 \pm 25$  pounds per square inch. No whistling or chattering should result from the relieving action.

(5) Stop the pump and note the pressure at which the relief valve closes. In no case should this pressure be lower than 850 pounds per square inch.

(6) Bleed the entire system to zero pounds per square inch and disconnect the auxiliary apparatus. Replace the caps on the test connections.

**b. PUMP AND BRAKE PEDAL.**

(1) Close the accumulator service valve.

(2) Set all levers on the cowl flap control valve in the "LOCKED" position.

(3) Bleed the hydraulic fluid (accumulated from previous tests) from the brakes and deboost valves and place a 0-300-pound per square inch gage in the line between the deboost and brake drum.

(4) Be sure that the system supply tank is filled with fluid.

(5) Turn the hydraulic pump switch to the "MANUAL" position and observe the gage for immediate indication of hydraulic pressure.

**CAUTION**

Running the pump dry for any appreciable length of time will seriously damage the pump bearings and gears.

(6) The pump should be cut off by the pressure switch when the system pressure reaches  $800 \pm 25$  pounds per square inch. When the pressure is bled to  $600 \pm 25$  pounds per square inch, the pressure switch should start the pump.

(7) Actuate the copilot's metering valves and observe the following:

(a) After several brake applications the air trapped between the deboost valve and the brake tube should escape back to the supply tank and out the vent. Complete bleeding of the air is indicated by zero pressure on the 300-pound per square inch gage with brakes "OFF."

(b) Observe the 300-pound per square inch gage for smooth operation of the brake. The return action, providing full brake release, should not exceed two seconds.

(c) Observe that the pressure switch cuts the pump motor in and out at the specified pressures.

(8) Adjust the parking brakes to maintain 125 to 135 pounds per square inch on the gage. The pressure should remain constant. A decreasing pressure indicates either insufficient hydraulic fluid or a leak in the brakes, brake lines, metering valve, or shuttle valve. A rising pressure indicates faulty deboost valving.

(9) Release the parking brakes.

(10) Remove the 300-pound per square inch gages.

(11) Replenish the hydraulic supply tank with hydraulic fluid, Specification No. AN-VV-O-366.

**c. COWL FLAPS.**

(1) With automatic electrical operation, actuate the cowl flaps through several cycles to displace any air in the lines.

(2) Turn the cowl flap control lever for nacelle No. 1 to the "OPEN" position and note the time required for the flaps to reach the "FULL OPEN" position.

(3) Repeat for nacelles Nos. 2, 3, and 4. Adjust the speed control on the control valves so that the average elapsed time between full closed and full open for each cowl flap is between two and three seconds.

(4) Turn the pump switch "OFF," and bleed the system pressure to zero pounds per square inch.

**3. FINAL TEST.**

a. Remove the drain plug and thoroughly clean the system filter.

b. Make sure all lines are reconnected properly.

c. See that the following units have been safety wired in the following positions:

(1) Supply tank drain cock "CLOSED."

(2) Accumulator service valve "CLOSED."

(3) Relief valve adjusting screw on cowl flap control valve—in place.

d. Air preload for the accumulator should be 350 pounds per square inch with zero pounds per square inch hydraulic pressure in the system.

e. Fill the supply tank as per instructions on the supply tank placard.

**(2) SPECIFIC HYDRAULIC UNITS.**

**(a) HYDRAULIC PANEL UNIT.**

1. GENERAL.—The function of the hydraulic panel is to supply and regulate the hydraulic pressure of the system.

2. REMOVAL.—The entire panel assembly, mounting the electric motor-driven pump, filter, pressure switch, check valve, relief valve, and accumulator service valve, may be removed from the airplane as a unit by disconnecting the self-sealing couplings, disconnecting leads to all electrical units, and removing the panel-mounting bolts.

**3. TESTS.**

a. Connect the electrical and hydraulic lines of the test set-up into the panel assembly. Leave the operating switch open.

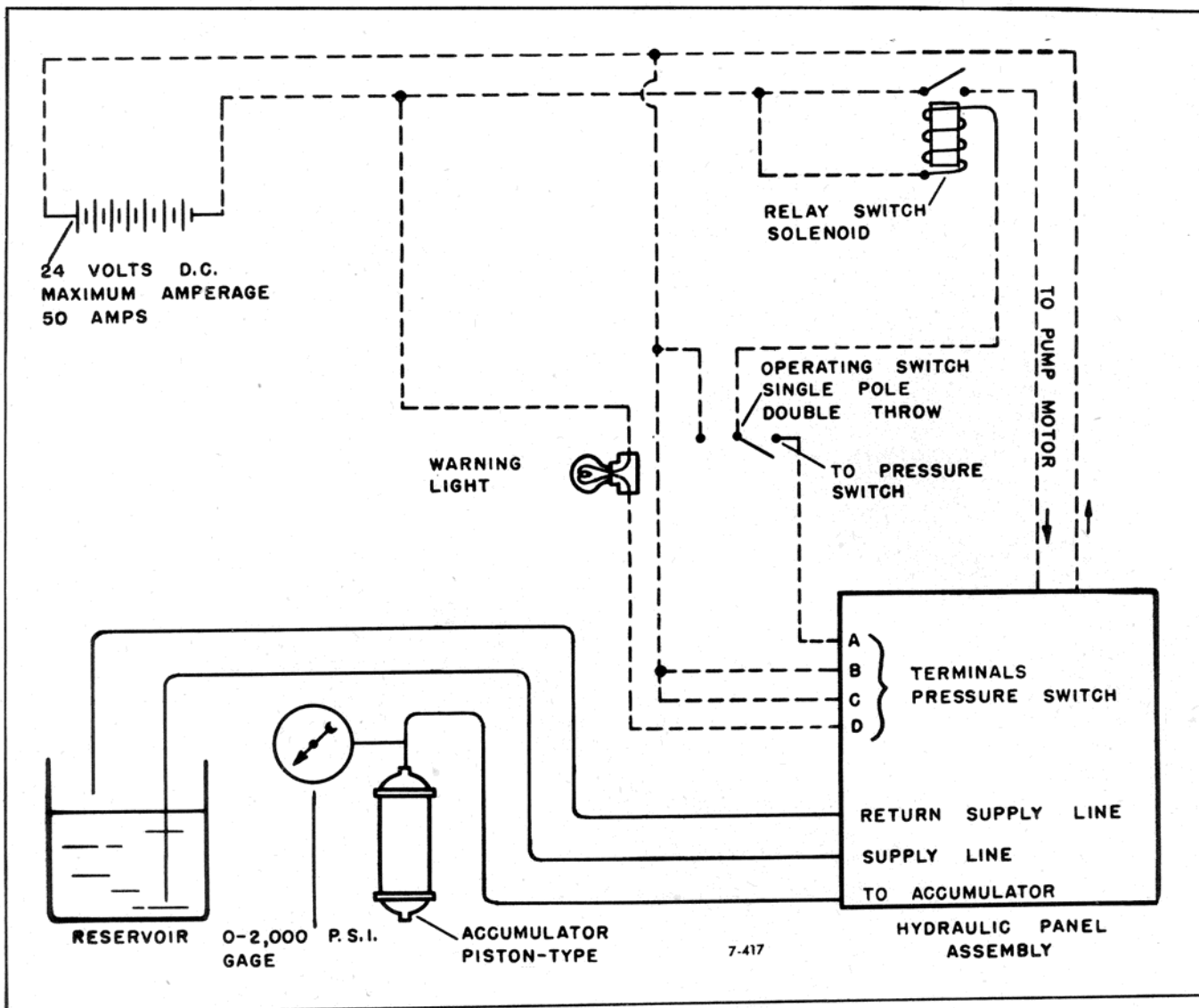


Figure 283—Functional Test—Hydraulic Panel

b. Close the accumulator service valve and disconnect the pressure switch hydraulic line at switch.

c. Operate the pump at zero pressure until fluid flows freely from the pressure switch line.

d. Reconnect pressure switch hydraulic line and operate motor until stopped by pressure switch; during this procedure check the following:

(1) Warning light shuts off at  $525 \pm 25$  pounds per square inch.

(2) Pump stops at  $800 \pm 25$  pounds per square inch.

e. Open the accumulator service valve and bleed the pressure down. The pump should begin to operate at  $600 \pm 25$  pounds per square inch.

f. Open the operating switch and bleed the pressure to zero. Note that the warning light comes on when pressure reaches  $525 \pm 25$  pounds per square inch. The pump should stop when the pressure drops to  $200 \pm 25$  pounds per square inch.

g. Close the accumulator service valve and operate the pump without the pressure switch control. The Kenyon relief valve should open at  $875 \pm 25$  pounds per square inch and pressure should not exceed 950 pounds per square inch with relief valve open.

h. Stop the pump and disconnect the hydraulic test lines to the panel. Cap the ports of the self-sealing couplings in the relief valve return line and the pressure line from the pump. Attach a hand pump with a gage to the Parker test connection next to the check valve in the pump outlet line. Pump pressure to 1200 pounds per square inch and check all fittings and units for leakage.

#### CAUTION

DO NOT USE THE PUMP ON THE PANEL ASSEMBLY FOR PRESSURE TESTING.

i. Attach a hand pump line at the self-sealing coupling in the pump suction line and apply 50 pounds per square inch. Check all fittings for leakage.



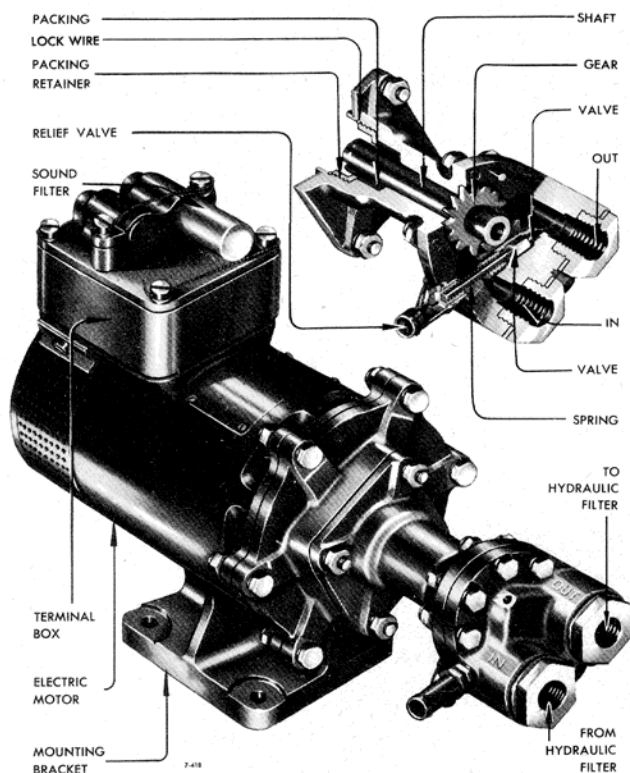


Figure 284—Hydraulic Pump

**CAUTION**

DO NOT APPLY MORE THAN 50 POUNDS PER SQUARE INCH TO PROTECT FLUID SEAL IN PUMP.

j. Disconnect all test apparatus and see that all units and fittings are assembled in accordance with figure 283.

(b) ELECTRIC MOTOR-DRIVEN PUMP.

1. GENERAL.—The hydraulic panel supports an Eclipse gear pump with a discharge capacity of 1.25 gallons per minute at 800 pounds per square inch. Shock mounting of the pump protects other units and tubing on the panel from vibrational wear.

2. MINOR REPAIR AND REPLACEMENT.

a. This pump should require little attention beyond a 50-hour inspection for leakage and proper seating of the check valve. A 200-hour check should be made for smooth, free operation of the gears and bearings. Due to close tolerances required in the manufacture of these pumps, questionable service items should be referred to a repair depot qualified for such overhaul procedure.

b. The brushes and electrical leads on the motor should be inspected each 50 hours for signs of deterioration or wear and replaced as required.

3. ADJUSTMENTS.—A relief valve is incorporated in the pump to protect the unit against high fluid pressures. At overhaul adjust the valve to relieve at 1100 pounds per square inch.

4. FLUSHING AND PRESSURE TEST.

a. Lubricate bearings, before running pump, by injecting fluid Specification No. AN-VV-O-366.

b. Connect the electric motor to a controllable voltage DC source of approximately 24 volts and check the pump for direction of flow as indicated by the part markings. Use electrical connector AN 3102-14-3P.

c. This pump should discharge a minimum of 1.25 gallons per minute against a pressure of 800 PSI with fluid temperature at approximately 21°C (70°F) and voltage at approximately 22 volts. Relief valve should start to open at  $1100 \pm 50$  PSI and pump discharge pressure should not be greater than 1200 PSI with the discharge line closed.

**CAUTION**

Do not operate the pump longer than 10 seconds with discharge line closed or with inlet fluid temperature greater than 26.7°C (80°F).

(c) HYDRAULIC ACCUMULATOR.

1. GENERAL.—A cylindrical accumulator, installed on the rear wall of the cockpit, is the source of hydraulic pressure while the pump is inoperative and also functions as a shock absorber for the system. A floating piston divides the assembly into two compartments. The air chamber carries an initial pressure of

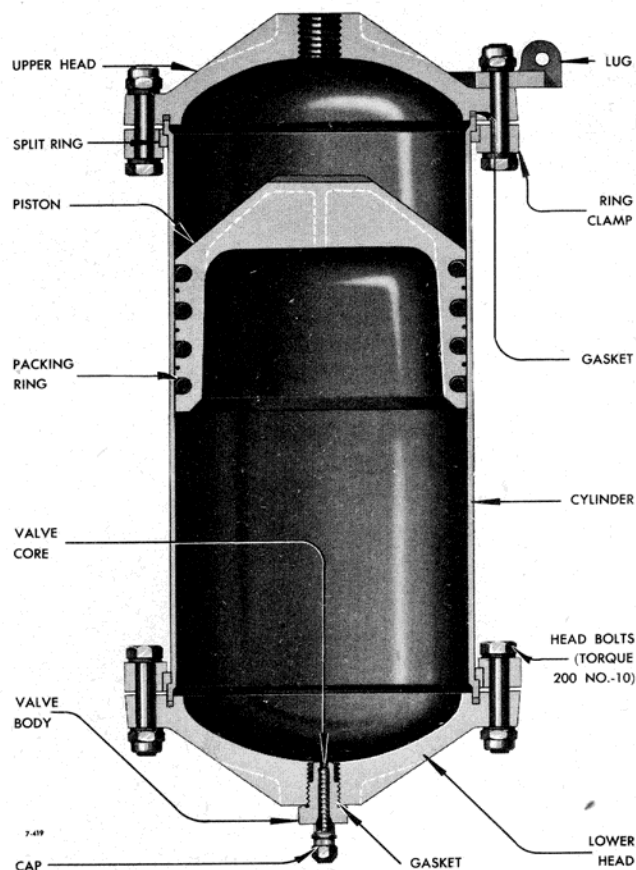


Figure 285—Hydraulic Accumulator

350 pounds per square inch, which increases as the hydraulic pressure forces the piston away from the fluid inlet, thus increasing the volume of the fluid chamber and decreasing the volume of the air chamber. Thus the chamber pressures are equal *after* the initial movement of the piston. The air and fluid seal is held by circular packing rings embedded in the periphery of the piston.

## 2. DISASSEMBLY.

### WARNING

TO AVOID SERIOUS DAMAGE OR ACCIDENTS TO PERSONNEL, BLEED ALL AIR PRESSURE FROM THE AIR VALVE IN THE LOWER END OF THE ACCUMULATOR BEFORE ATTEMPTING TO DISASSEMBLE THIS UNIT.

Remove the bolts attaching the head flanges and carefully slip the piston from the cylinder. Precautions should be taken to prevent damage to the hydraulic packing rings. Do not remove the head gasket from the groove unless visual inspection indicates that replacement is necessary.

## 3. MINOR REPAIR AND REPLACEMENT.

—Inspect packing rings on the piston and head gaskets for black spots, sponginess, foreign matter, or signs of general deterioration. Replace or repair as required. Install a new air valve (Dill 100-DBB, or Schrader-1939H) as a precautionary measure.

4. ASSEMBLY.—Carefully seat the packing rings in the piston, lubricate with hydraulic fluid Specification AN-VV-O-366 and insert the piston in the cylinder with the raised portion adjacent to the fluid chamber. Take special care not to damage the packing by contact with the sharp edges of the cylinder. Replace the head gasket when necessary and carefully press into the retaining slot, eliminating all twists or uneven portions. Slip the ring clamp over the cylinder end, insert the split rings and bolt the accumulator head in place. Insert two bolts temporarily with the heads toward the center of the assembly and check head alignment. To complete the assembly, replace all bolts and tighten evenly around the head flange.

## 5. TEST PROCEDURE.

a. Apply 350 pounds per square inch air pre-load to the air side of the accumulator. Immerse in water and check for leakage around air end, valve, and rings.

b. Build up hydraulic pressure to 1200 pounds per square inch and check for air leakage at air end and valve. Observe hydraulic gage and fluid end for indication of fluid leakage.

c. Bleed fluid and air pressure and replace port sealing plugs.

d. After completion of test retighten all head bolts evenly.

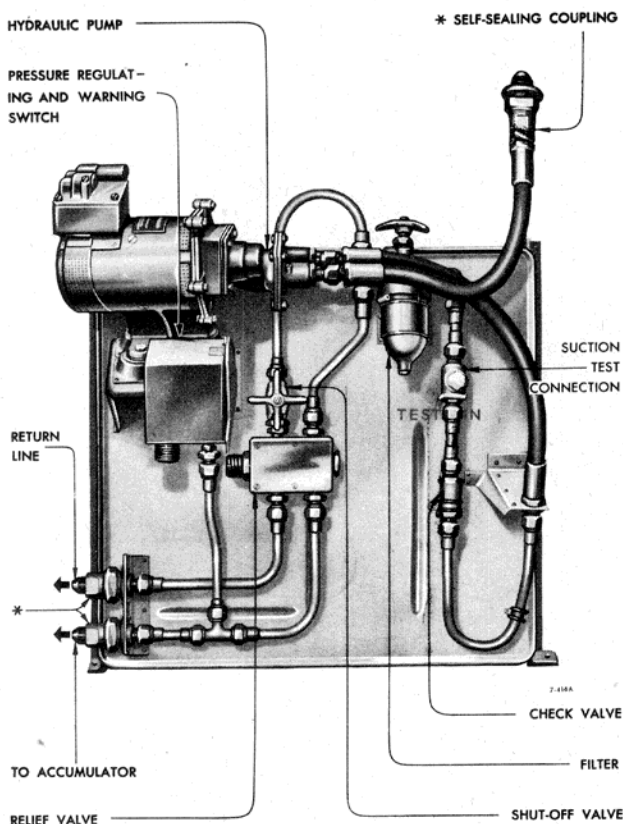


Figure 286—Hydraulic Panel

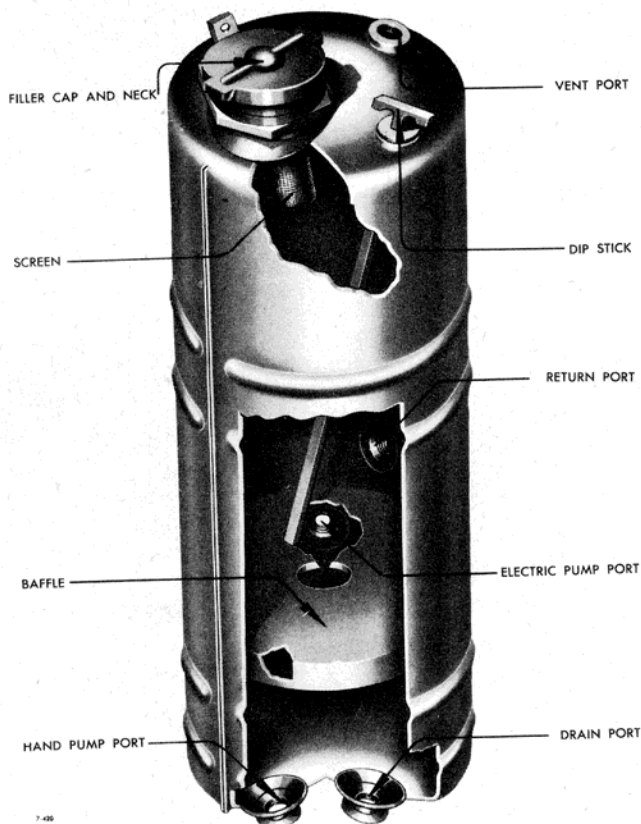


Figure 287—Hydraulic Supply Tank



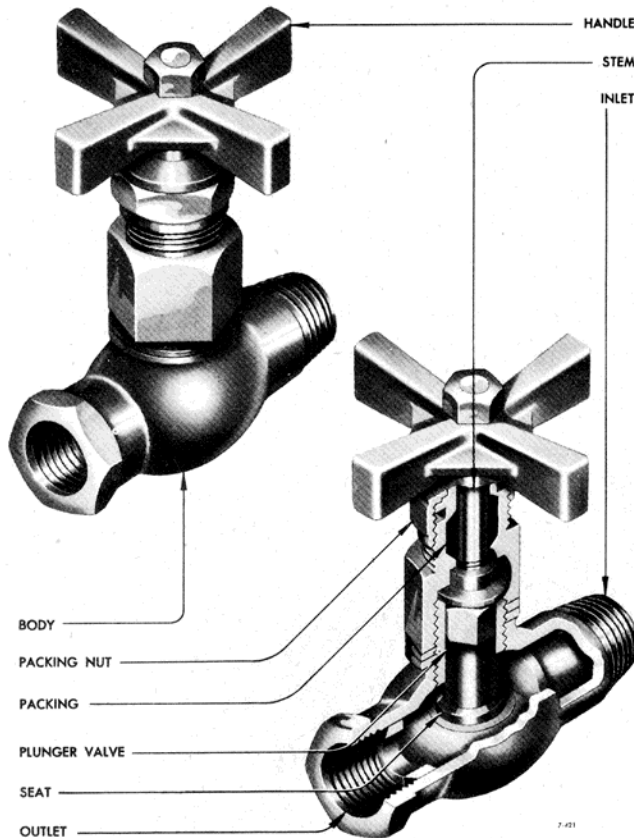


Figure 288—Manual Shut-Off Valve

(d) HYDRAULIC SUPPLY TANK.

1. GENERAL.—The supply tank, located on the rear left wall of the control cabin has a capacity of four U. S. (3.3 Imperial) gallons. Its use as a reservoir for the system is critical and the fluid level must be maintained carefully, since the pump is lubricated by the hydraulic fluid. A reserve supply of fluid is always available for the hand pump because its supply line is tapped into the tank below the outlet to the electrical pump. Use hydraulic fluid, AN-VV-O-366 (red color), and fill as indicated in section III, paragraph 2. *i.*

**Note**

The total fluid capacity of the hydraulic system is approximately 5.25 U. S. (4.37 Imperial) gallons for airplanes equipped with hydraulic gun chargers on the chin turret.

2. TESTS.

a. Plug all ports except one to be used for pressure inlet and gage connection.

b. Apply air pressure at 3 1/2 pounds per square inch and immerse in water. Check for leakage.

**CAUTION**

Use mercury manometer and *do not exceed specified pressure.*

(e) ACCUMULATOR SERVICE VALVE.—This manually-operated, globe-type valve is provided for re-

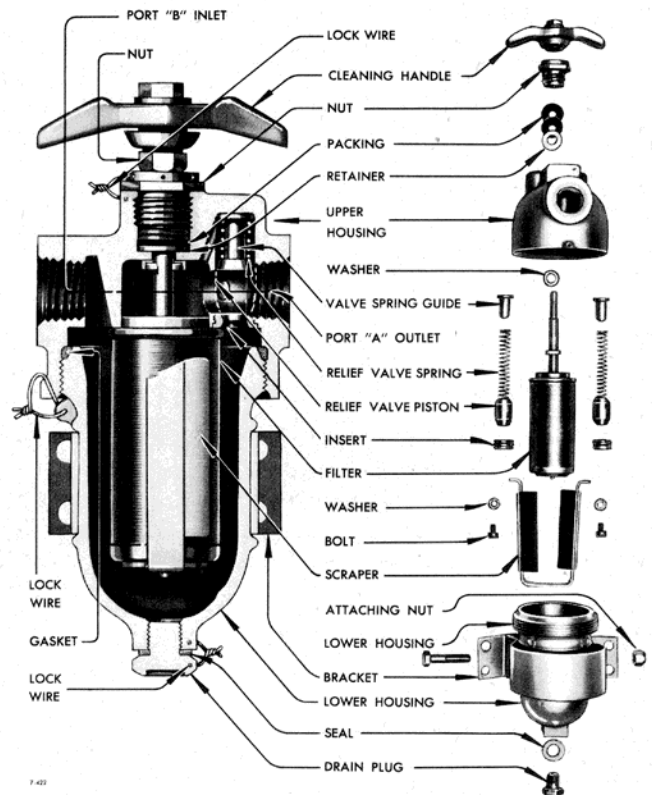


Figure 289—Hydraulic Filter

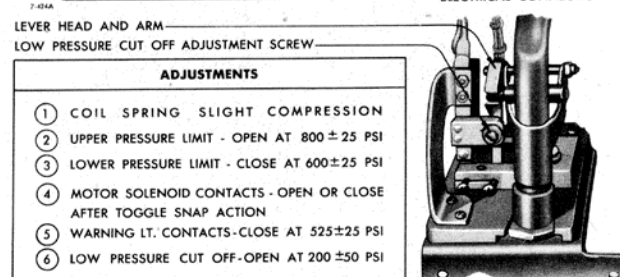
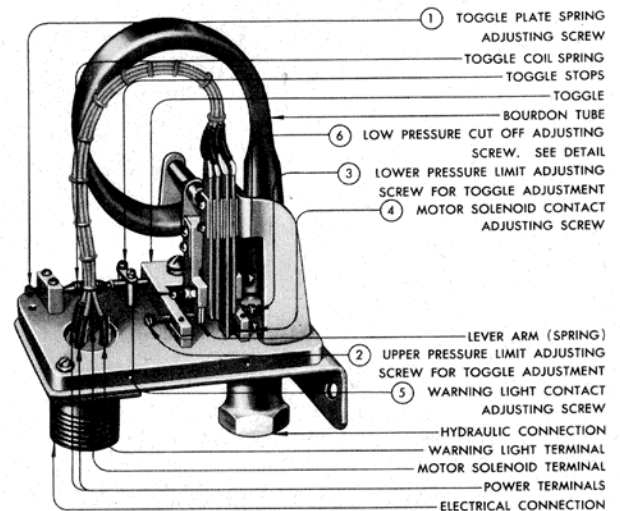


Figure 290—Hydraulic Pressure Regulating Switch

lieving the system of all pressure prior to service inspection or test. Normally it is closed, and when opened, permits the fluid in the accumulator to return to the supply tank, thus relieving the system of all hydraulic pressure.

(f) HYDRAULIC FILTER.

1. GENERAL.—All hydraulic fluid from the pump passes through a Purolator filter which removes all foreign matter. The filter is installed in the pressure line and is located on the removable panel. A relief valve, operating at a differential pressure of approximately 30 pounds per square inch is built integrally with the filter unit. Cleaning of the filter is accomplished by periodically rotating the cleaning handle on the top of the unit.

2. REMOVAL AND DISASSEMBLY.—It is unnecessary to disassemble the Purolator filter provided proper precautions have been taken in rotating the cleaning element periodically and draining foreign matter from the sediment bulb.

3. ADJUSTMENT.—The relief valve is set at the factory to open at a differential pressure of 28 to 30 pounds per square inch and should require no adjustment.

4. TEST PROCEDURE.—Plug inlet port and apply 1200 pounds per square inch pressure to outlet port. Check for leakage at bottom plug top plate, around manually-operated shaft and synthetic rubber seal.

(g) HYDRAULIC PRESSURE REGULATING SWITCH.

1. GENERAL.—The pressure cut-out switch automatically maintains the pressure in the accumulator between 600 and 800 PSI by closing the power circuit to the electric pump at the lower pressure, and breaking the power circuit at the higher pressure. In addition, the switch is provided with a low pressure cut-off contact which disconnects the motor when system pressure is below  $200 \pm 50$  PSI. The switch also opens and closes the circuit of a low pressure warning light when the pressure reaches  $525 \pm 25$  PSI. There is a manually operated toggle switch on the pilot's control panel which can be used to start the motor when the pressure is below  $200 \pm 50$  PSI, or in case of failure of the pressure cut-out switch. To turn the pressure switch off, either the 15-ampere hydraulic pump switch fuse in the station 4 fuse panel must be removed, or the electrical receptacle at the pressure switch must be disconnected.

2. REMOVAL AND DISASSEMBLY.—To remove the pressure regulating switch cover, the unit must be detached from its mountings. Bleed the pressure from the hydraulic system with the accumulator service valve, and loosen the connections at each end of the tubing leading into the pressure switch. Remove the switch mounting bolts, swing the unit around off the panel, and retighten the connections. Remove the cover to make adjustments to the setscrews.

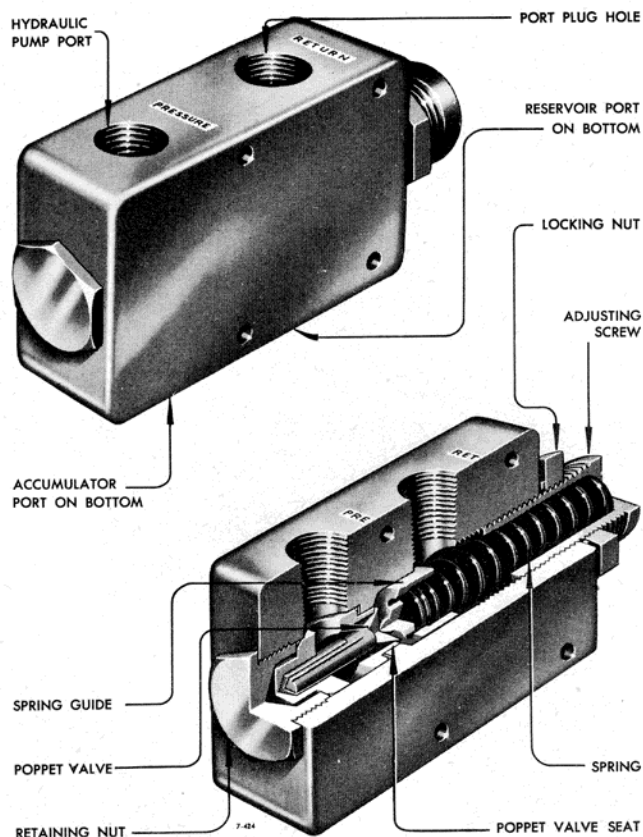


Figure 291—Hydraulic Relief Valve

**CAUTION**

DO NOT DAMAGE OR DEFORM THE CONNECTING TUBE. Bending or twisting the tubing will alter the position of the Bourdon tube in the pressure switch and change the settings, necessitating readjustment.

3. ADJUSTMENT.

**Note**

Do not attempt to readjust this switch until the necessity has been *definitely* determined, since adjustments are sensitive and time-consuming.

a. UPPER LIMIT.—Set the upper pressure limit adjusting screw to turn off the hydraulic pump motor at  $800 \pm 25$  pounds per square inch. Hold the toggle plate in the counterclockwise position if necessary to close the motor solenoid contacts, and run the pressure up to 800 pounds per square inch. The pressure switch in all airplanes may be turned on and off most conveniently during adjustment by inserting the electrical receptacle loosely in the pressure switch connection. Turn the switch off, loosen the lock screw, and back off the adjusting screw until the toggle plate may be snapped into the counterclockwise position. Turn the screw back in until the toggle plate snaps into the clockwise position. Bleed the pressure with the accumulator service valve to about 700 pounds per square inch. Reconnect the switch and pump the pressure up until



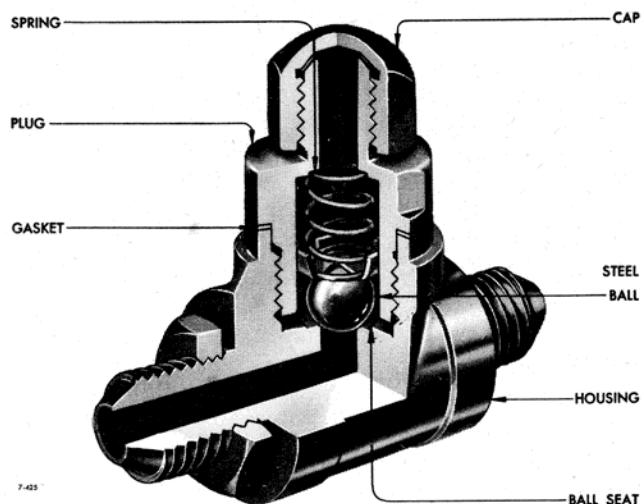


Figure 292—Hydraulic Test Connection

the toggle snaps off. Adjust the screw in approximately 1/8-turn increments to the pressure limit  $800 \pm 25$  pounds per square inch, preferably in the upper range. Tighten the lock screw and check the limit through several cycles.

b. **LOWER LIMIT.**—Set the lower pressure limit next, at  $600 \pm 25$  pounds per square inch, preferably in the upper range. Bleed the system pressure down to 600 pounds per square inch, holding the toggle plate in the clockwise position, if necessary, to prevent turning on the pump. Back off the adjusting screw until the toggle plate will remain in the clockwise position, and then turn the screw in until the toggle snaps to the counterclockwise position. Run the pressure up to about 700 pounds per square inch and bleed it back down through several cycles, as necessary, adjusting the lower pressure limit within the specified range with the set-screw. Tighten the lock screw and check through several cycles.

c. **MOTOR SOLENOID CONTACT GAP.**

(1) When the motor solenoid contact adjusting screw is turned in too far, it will cause the contact points to open at 800 pounds per square inch or close at 600 pounds per square inch before snap action of the switch has occurred, resulting in the switch operating over a pressure range of a few pounds instead of 600 to 800 pounds per square inch. The electric pump will therefore cut in and out rapidly without noticeable increase in pressure. If the screw is not in far enough, the contacts may not open at all.

(2) Run the pressure up until the toggle snaps to the clockwise position, and turn the current to the pressure switch off to prevent a short circuit. Adjust the setscrew so when the pressure is bled down, the contacts will not close until the toggle plate snaps to the counterclockwise position, nor open before the toggle plate snaps to the clockwise position when the pressure is built up. Adjusting this screw may alter the upper and lower limit settings. Recheck.

d. **LOW-PRESSURE CUTOUT.**—Build the system pressure up above 300 PSI, using the toggle switch on the pilot's control panel if necessary, until the pump turns on. Bleed the pressure back down a little faster than the pump can build it up, and adjust the low pressure cutout screw until the pump will turn off at  $200 \pm 50$  PSI. Bleed the pressure below 100 PSI and build it back up, using the toggle switch on the pilot's control panel. The pump must turn on automatically when the pressure rises to  $200 \pm 50$  PSI.

e. **WARNING LIGHT.**—The warning light contact adjusting screw should be set last. Disconnect the electrical receptacle at the hydraulic pump, bleed the system pressure down to 525 pounds per square inch, and adjust the setscrew until the contacts are just closed. The warning light should operate at  $525 \pm 25$  pounds per square inch. Check and adjust through several cycles after tightening the lock nut.

4. **TESTS.**—Check the operation of this switch during functional tests of panel assembly as prescribed in this section.

(b) **PRESSURE RELIEF VALVE.**

1. **GENERAL.**—A Kenyon relief valve is mounted on the removable panel as protection for the system in case the pressure switch fails to function, automatically relieving pressures above the design limit of 850 pounds per square inch.

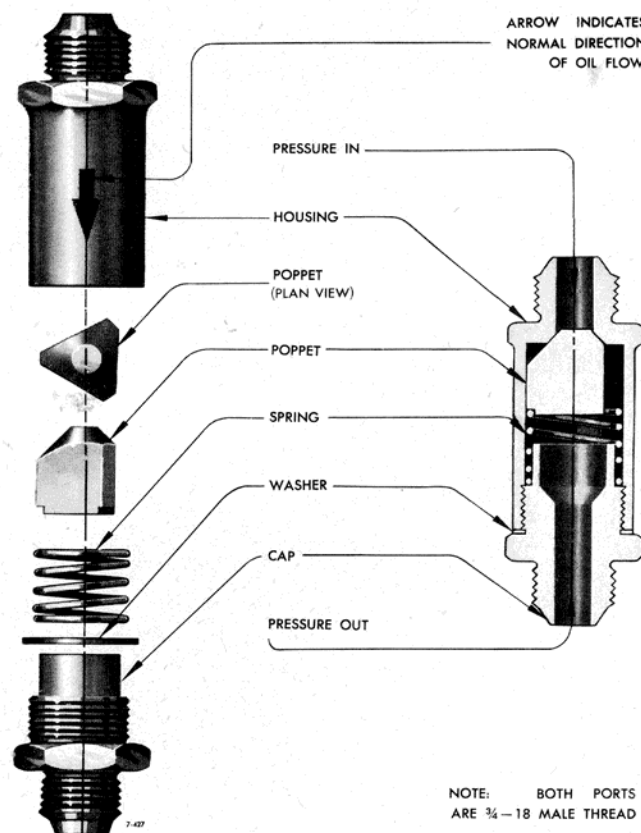


Figure 293—Hydraulic Check Valve

2. **ADJUSTMENT.**—Adjustment of this valve to 850 pounds per square inch is accomplished by rotating the screw on the upper portion of the valve housing.

### 3. TESTS.

a. Plug inlet port and apply pressure at inlet port until the valve opens, allowing fluid to flow from outlet ports. The relief pressure should be between 850 and 900 pounds per square inch. The valve should relieve without whistling or chattering and should permit a flow of three U. S. (2.5 Imperial) gallons per minute without the pressure rising above 950 pounds per square inch.

b. The valve should close when the pressure drops to a point between 900 and 850 pounds per square inch. No leakage will be allowed below 850 pounds per square inch pressure under any condition.

c. Plug reservoir port, accumulator port and return port. Apply 1200 pounds per square inch pressure at pressure port. Check for leakage around retaining nut and adjusting screw.

#### (i) PRESSURE TEST CONNECTION.

1. **GENERAL.**—The pressure line is provided with a Parker test fitting which provides a means of connecting the pressure line of the test equipment into the pressure line of the airplane hydraulic system without the necessity of relieving the pressure or draining the fluid from the airplane hydraulic system.

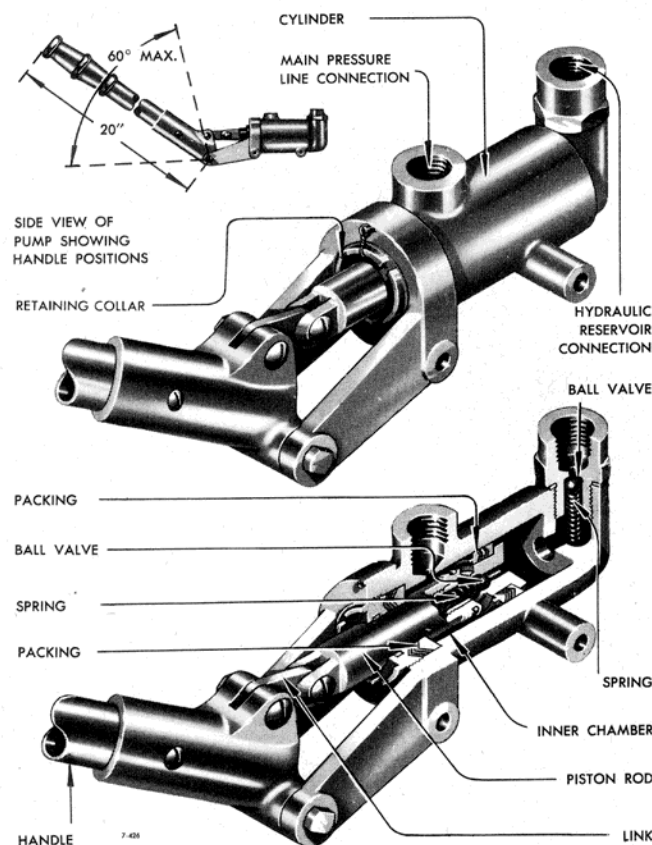


Figure 294—Hydraulic Hand Pump

2. **TESTS.**—With the test port open and one line port plugged, apply a pressure of 1200 pounds per square inch to the other line port. Check for leakage past the ball valve seat or gasket.

#### (j) CHECK VALVE.

1. **GENERAL.**—A Bendix check valve is located in the pressure line between the pump and the accumulator to prevent a reversal of flow.

#### 2. TEST PROCEDURE.

a. Apply 1200 pounds per square inch pressure to port "C" and check for leakage past gasket and cone seat.

b. Connect port "B" for normal direction of flow and apply pressure. Flow should occur between four and eight pounds per square inch pressure.

#### (k) HYDRAULIC HAND PUMP.

1. **GENERAL.**—An Adel hand pump, mounted on the right sidewall, is provided for developing system pressure for ground servicing when the electric pump is not available. The supply line to the hand pump is tapped into the bottom of the reserve tank and is thereby assured of a fluid reserve at all times.

#### 2. TESTS.

a. Plug outlet port, apply 1200 pounds per square inch pressure at inlet port, and check for leakage.

b. Check minimum capacity of  $1.5 \pm .2$  cubic inches per cycle. Handle loads should not exceed 50 pounds at the maximum operating pressure of 800

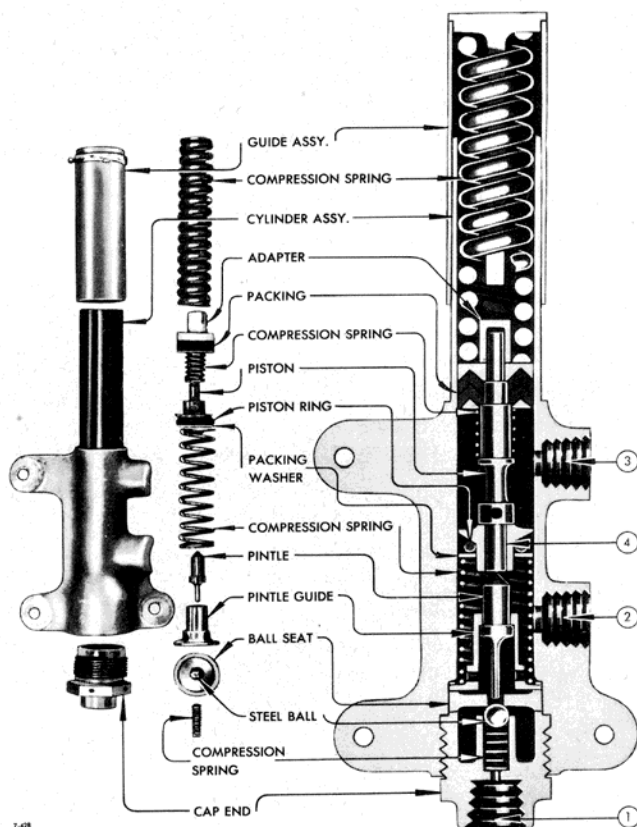


Figure 295—Brake Metering Valve



pounds per square inch when using hydraulic fluid Specification No. AN-VV-O-366 at approximately 21.1°C (70°F).

#### (1) BRAKE METERING VALVE.

1. **GENERAL.**—The brake metering valves are located on the rudder pedal stirrup supports. There are four valves, one for each foot pedal at both the pilot's and copilot's stations. The function of this valve is to meter the required fluid pressure to the brake. The brakes are controlled individually from either pair of valves, and the valve design is such that each valve on the copilot's side supplies the brake line through the corresponding valve on the pilot's side. This feature permits elimination of duplicate lines from the copilot's valves to the brake lines.

2. **DISASSEMBLY.**—The complete disassembly of the brake metering valve is accomplished by removal of the "cap end" and "guide assembly" (cross-head) parts. Care must be exercised to prevent the loss of the ball check and its seating spring. The piston and compression springs may be removed from either end of the assembly. Whenever the assembled valve is not installed in the airplane, apply a "keeper" to retain the guide assembly, and to avoid damage to the piston ring.

3. **MINOR REPAIR AND REPLACEMENT.**  
—Replace packing as required and observe ball check for proper seating.

#### 4. ASSEMBLY.

### WARNING

INSERT THE FLOATING PISTON FROM THE GUIDE (CROSSHEAD) END OF THE HOUSING. This is to prevent damage to the packing from the sharp shoulder at the opposite end of the cylinder.

a. Introduce the small compression spring, pintle assembly and ball seat from the cap end, and slide the piston to a position in which the ball seat is flush with the end of the valve body. Balance the ball on the seat and insert the ball check spring in its guide on the cap. Carefully bring the ball and spring in contact with enough pressure to hold the ball in place, and visually check for proper seating before screwing the cap into the housing. Seat the cap end with enough pressure to prevent leakage of the hydraulic fluid.

b. Complete the assembly by inserting the large compression spring and slipping the guide into place. The guide should be fastened to the housing by some temporary means to prevent loss before installing the unit at the brake pedal.

#### 5. TESTS.

a. Apply 1200 pounds per square inch fluid pressure at pressure port and check for leakage past ball check and around bottom cap.

b. With no pressure acting on valve, depress crosshead by hand and then release. Piston should return smoothly.

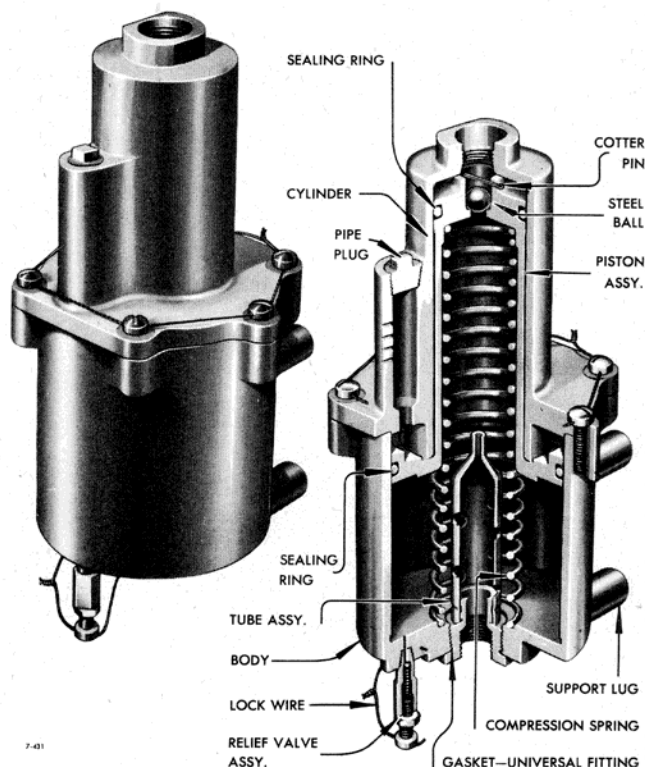


Figure 296—Brake Return Boost Valve

c. Plug outlet port and apply 1200 pounds per square inch at outlet port. Fully depress crosshead and check for leakage between pintle and piston and also past piston ring.

d. Plug outlet and return ports and check for leakage past packing rings by applying 1200 pounds per square inch at pressure port.

### CAUTION

CROSSHEAD SHOULD BE SECURED TO BODY AS APPROXIMATELY 530 POUNDS FORCE WILL BE EXERTED AGAINST IT.

6. **INSTALLATION.**—It is particularly important that the brake metering valve be installed with a distance of not less than 15/16 inch and not more than one inch between the open end of the guide assembly (crosshead) and the mating shoulder on the valve housing. This setting is made with the adjusting screw on the foot pedal and is necessary for smooth brake operation as well as elimination of dragging caused by incomplete brake release. Sufficient slack should be maintained in the metering valve to prevent inadvertent brake application. This may be checked by the "feel" of the brake pedals.

#### (m) HYDRAULIC PRESSURE GAGE.

1. **DESCRIPTION.**—The gage for indicating accumulator fluid pressure in the service system is mounted on the pilot's instrument panel. The dial is graduated in increments of 200 pounds per square inch and cannot be considered as accurately readable closer than  $\pm 25$  pounds per square inch.

2. **TEST PROCEDURE.**—Check entire pressure range (0-2000 pounds per square inch) with master calibrated gage as per Specification No. 94-27812-B.

(n) **BRAKE DEBOOST VALVE.**

1. **GENERAL.**—The deboost valves are mounted on the lower rear portion of the landing gear strut, one for each wheel. These valves have two functions: first, to reduce the pressure at the brake drums to 1/4 the value of that supplied by the brake metering valves; and second, to expedite brake release. The deboost valve is interchangeable between right and left brake assemblies.

2. **DISASSEMBLY.**—In disassembling the brake deboost valve, care must be taken to prevent the high-pressure housing from being forcibly ejected from the large cylinder when the high-pressure housing is unscrewed. The piston assembly and compression spring are then removed. The ball seat may be inspected by removing the ball guide from the piston assembly.

3. **MINOR REPAIR AND REPLACEMENT.**  
—Replace any questionable packing and check for proper seating of ball valves.

4. **ASSEMBLY.**—Assembling the high and low-pressure housing is best accomplished by inserting the piston and spring in the low-pressure housing, compressing the spring as far as possible, closing the outlet port to the brake with the thumb, and relieving the pressure on the spring. The vacuum created in the large low-pressure cylinder holds the spring compressed sufficiently to allow the housing to be screwed together.

5. **TESTS.**

a. Unscrew spring guide assembly and check for leakage past ball check and sealing ring by applying 1200 pounds per square inch at inlet port. Release pressure instantaneously and piston should return smoothly.

b. Tighten guide assembly and slowly apply pressure at top port. Ball should unseat when piston is fully depressed and fluid should flow freely at outlet or bottom port.

c. Plug top port and check for leakage around washer and sealing ring with 600 pounds per square inch at outlet port. Maintain this pressure for five minutes and check for leakage through the casting wall (porosity).

d. Inspect breather port for obstructions.

(o) **COWL FLAP CONTROL VALVE.**

1. **DESCRIPTION.**—The control valve for operating the cowl flaps is located in the cockpit immediately forward of the throttles. The valve is in reality a combination of valves providing individual control of each cowl flap assembly. A relief valve is incorporated as a protective measure against high pressures. To regu-

late the cowl flap operating time, a speed control is provided in the pressure line to the assembly.

2. **REMOVAL AND DISASSEMBLY.**

a. In removing the cowl flap control valve from the airplane it is necessary to use an 11/16-inch crowfoot wrench.

b. Special care must be exercised in disassembling this unit to retrieve the small actuating pins, poppet valves, and relief valve spring.

3. **MINOR REPAIR AND REPLACEMENT.**  
—Inspect the poppet valves for proper seating and thoroughly clean all parts. Repair or replace any parts found to be defective.

4. **ASSEMBLY.**—Replace poppet valves and all packing in the conventional manner. The activating pins mentioned in the disassembly procedure *must* be returned to their respective holes in order to reassemble the unit.

5. **TESTS.**

a. Apply fluid pressure to the pressure port and operate each of the control levers. Check to see that fluid flows from the proper port according to the port designations.

b. Check for leakage and flow as per the table below. (See figure 298.)

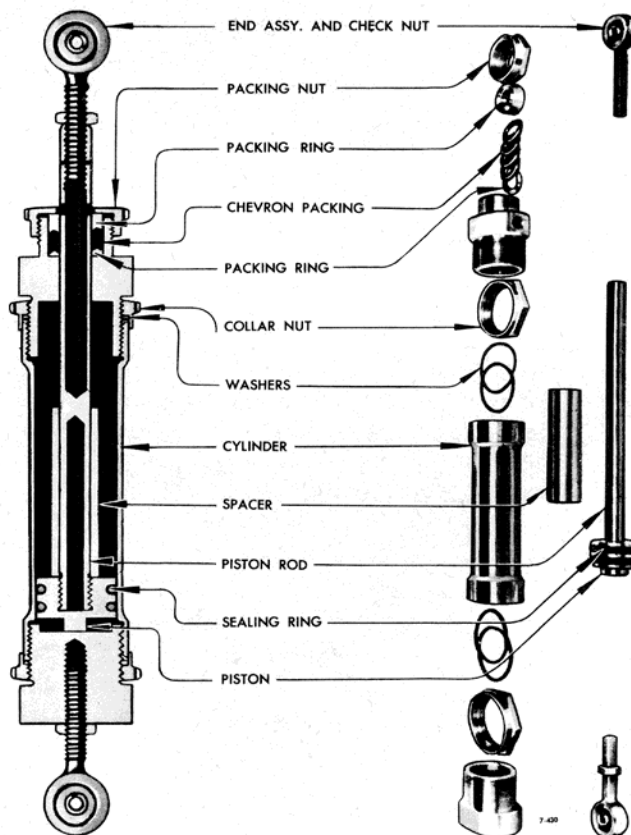


Figure 297—Cowl Flap Cylinder Assy.



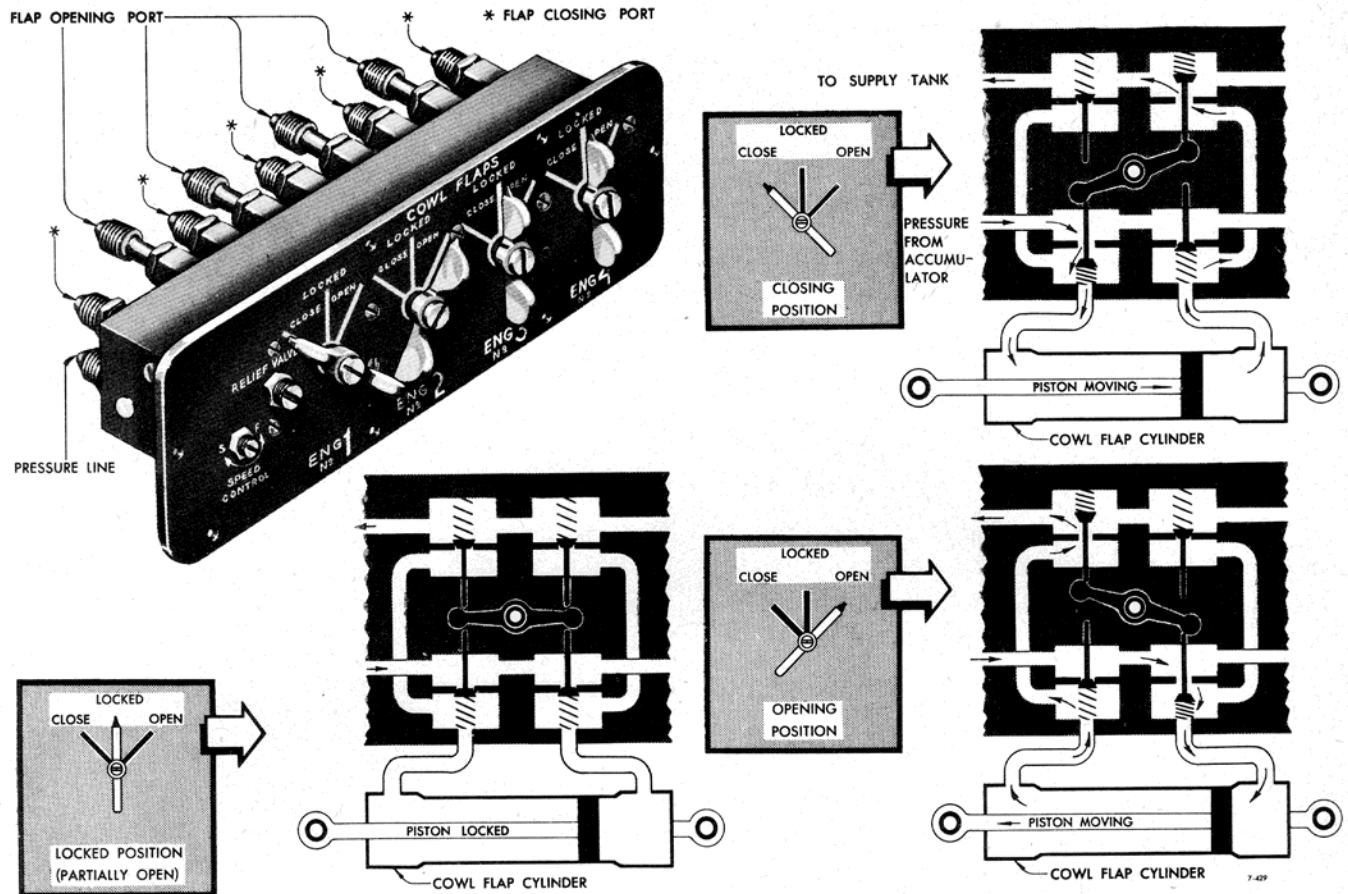


Figure 298—Cowl Flap Control Valve (Schematic)

Apply Pres.	Pres. lb./sq. in.	Plug Port	Lever Position	Max. Allow. Leakage	Flow	Handle Load
Port A	1000	None	Locked	None	None	
Port A	1200	None	Locked	*	*	
Port B	125	None	Locked	None	None	
Port A	1000	C&D		None		
			Open			
			Close			
			Lock			
Port A	800	None	Open	....	....	Max. 25 in.-lb.
			Close			

\*Relief valve open; flow from B

6. ADJUSTMENT.—Adjust the restrictor valve on the cowl flap control panel to obtain an operating time (for each individual flap) of two to five seconds.

(p) COWL FLAP OPERATING CYLINDER.

1. GENERAL.—This pressure cylinder is located immediately forward of the carburetor intake duct on the upper portion of the engine. The assembly consists of a piston and cylinder mechanism with provisions for introducing fluid under pressure to either side of the piston. Fluid pressure applied to the right side of the piston closes the flaps, while fluid from the left chamber flows back through the line. Opening of the flaps is accomplished by directing the pressure to the fluid chamber in the opposite end of the cylinder. Refer to section IV, paragraph 6. f. for further details.

2. TEST PROCEDURE.

a. Apply pressure to each port separately to 2000 pounds per square inch. Check for leakage past piston rings, at threads and past the rod packing gland.

b. Apply pressure to each port alternately at 20 to 40 pounds per square inch. Piston should travel through full cycle smoothly and quietly.

(q) SELF-SEALING COUPLINGS.

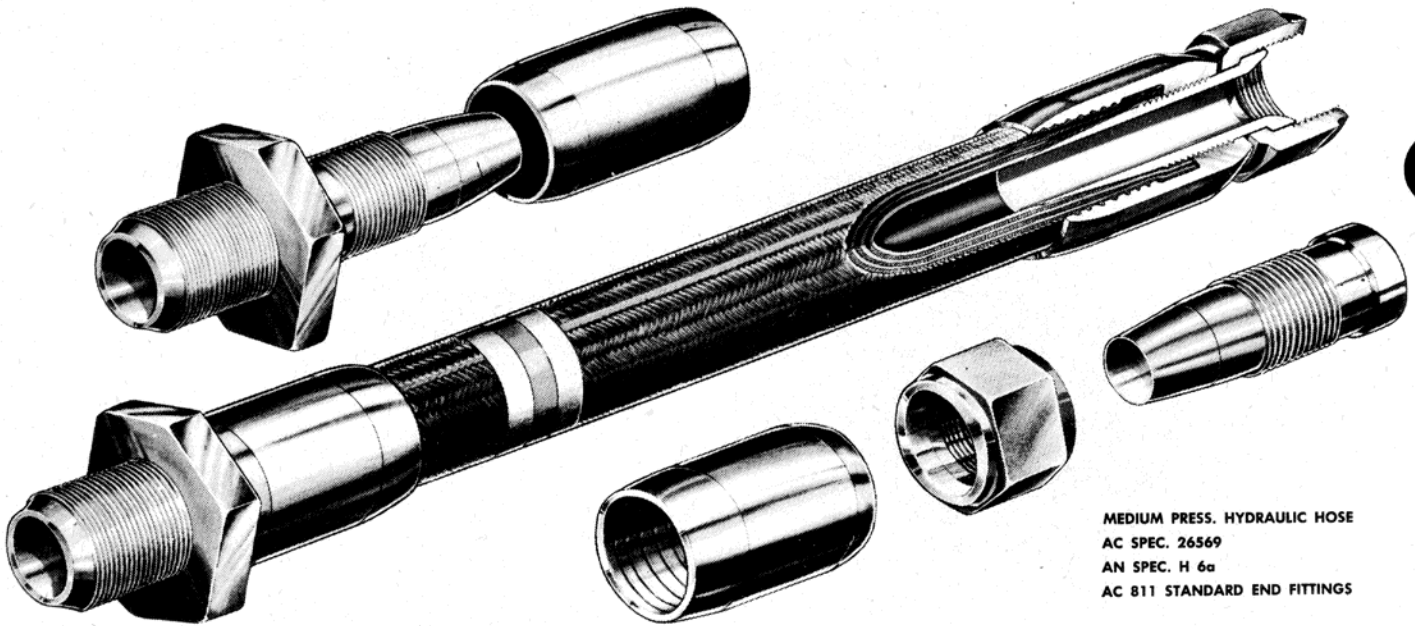
1. GENERAL.—Self-sealing couplings are provided to facilitate removal of the panel assembly. These couplings permit flow in either direction while connected, but loosening the coupling nut closes the valve automatically and prevents fluid leakage or entrance of air into the lines.

2. TEST PROCEDURE. (See figure 300.)

a. With the coupling completely assembled and port 2 plugged, apply a static pressure of 1200 pounds per square inch to port 1. Check for leakage around connecting nut and point 3.

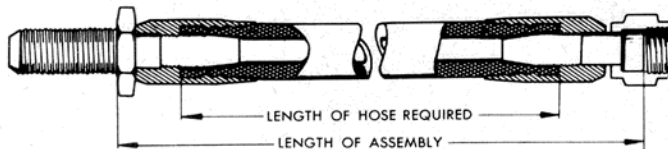
b. Disconnect the coupling with 10 pounds per square inch applied at each port and check for leakage around the face seals.

(r) HYDRAULIC GUN CHARGERS.—See section IV, paragraph 7, d. (3) (i) 2. c., for information.



MEDIUM PRESS. HYDRAULIC HOSE  
AC SPEC. 26569  
AN SPEC. H 6a  
AC 811 STANDARD END FITTINGS

## ASSEMBLY INSTRUCTIONS



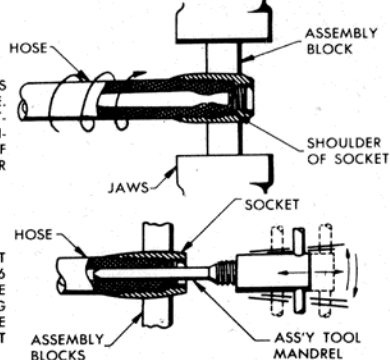
RIGID TUBE O.D. (REF.)	"P"	HOSE I.D.	RIGID TUBE O.D. (REF.)	"P"	HOSE I.D.	RIGID TUBE O.D. (REF.)	"P"	HOSE I.D.	RIGID TUBE O.D. (REF.)	"P"	HOSE I.D.
3/16	1.42	1/8	3/16	1.29	1/8	3/16	1.16	1/8	3/16	1.20	3/16
1/4	1.34	3/16	1/4	1.27	3/16	1/4	1.20	3/16	1/4	1.34	1/4
5/16	1.55	1/4	5/16	1.45	1/4	5/16	1.42	5/16	5/16	1.42	5/16
3/8	1.60	5/16	3/8	1.51	5/16	3/8	1.48	13/32	3/8	1.75	1/2
1/2	1.82	13/32	1/2	1.65	13/32	1/2	1.75	1/2	1/2	1.99	5/8
5/8	1.96	1/2	5/8	1.86	1/2	5/8	1.99	5/8	5/8	1.99	5/8
3/4	2.22	5/8	3/4	2.11	5/8	3/4	1.59	7/8	3/4	1.59	7/8
1	1.97	7/8	1	1.78	7/8	1	1.59	7/8	1	1.59	7/8

## STEP 1

TO OBTAIN "LENGTH OF HOSE REQUIRED" SUBTRACT DIMENSION "P" FROM "LENGTH OF ASSEMBLY." CUT HOSE END SQUARELY USING SHARP KNIFE. (WET BLADE WITH OIL OR WATER.) CLEAN I.D. OF HOSE BY WIPING OR WASHING. ASSEMBLE FITTINGS TO HOSE.

## STEP 2

PLACE SOCKET BETWEEN ASSEMBLY BLOCKS AND TIGHTEN BLOCKS IN BENCH VISE. SCREW HOSE COUNTER CLOCKWISE (LEFT-HAND SCREW MOTION) INTO SOCKET UNTIL HOSE BOTTOMS ON SHOULDER OF SOCKET. THEN BACK OFF ONE-QUARTER (1/4) TURN.

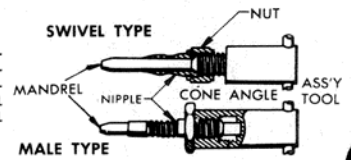


## STEP 3

OIL ASSEMBLY TOOL MANDREL USING LIGHT MOTOR OIL OR OIL PER SPEC. AN-VV-0-366 (AC-3801). INSERT MANDREL IN I.D. OF HOSE AND APPLY FLARING MOTION, WORKING MANDREL IN AND OUT TO ENLARGE HOLE IN HOSE. REPEAT UNTIL MANDREL DOES NOT BIND IN I.D. OF HOSE.

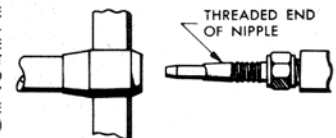
## STEP 4

INSTALL NIPPLE ON ASSEMBLY TOOL; TIGHTEN WITH WRENCH. IMPORTANT: BEFORE ATTACHING SWIVEL TYPE NIPPLE ON ASSEMBLY TOOL, WIPE ALL OIL FROM MANDREL AND BOTH NIPPLE AND ASSEMBLY TOOL CONE HINGES.



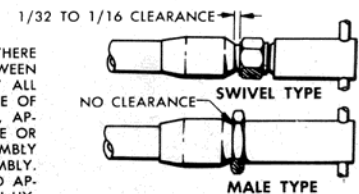
## STEP 5

APPLY OIL ON THREADED END OF NIPPLE AND TO END OF HOSE AND SOCKET ASSEMBLY. SCREW NIPPLE INTO SOCKET. (CARE SHOULD BE TAKEN THAT THREADS ARE NOT STRIPPED WHEN STARTING NIPPLE INTO SOCKET.) TO ELIMINATE POSSIBLE DIFFICULTY IN ASSEMBLY, IT IS SUGGESTED THAT NIPPLE BE SCREWED INTO SOCKET ONE-HALF (1/2) THE LENGTH OF THREADED PORTION, REMOVED, DIPPED IN OIL, AND THEN SCREWED INTO PROPER POSITION.



## STEP 6

SCREW SWIVEL TYPE NIPPLES IN UNTIL THERE IS A CLEARANCE OF 1/32 TO 1/16 BETWEEN BACK OF NUT AND SOCKET. SCREW ALL MALE NIPPLES UP SNUG AGAINST FACE OF SOCKET. TO REMOVE ASSEMBLY TOOL, APPLY WRENCH ON HEX OF MALE NIPPLE OR NUT, AND UNSCREW. REMOVE ASSEMBLY FROM VISE. PROOF TEST AFTER ASSEMBLY. PLUG OR CAP ONE END OF HOSE AND APPLY PRESSURE TO INSIDE OF HOSE WITH HYDRAULIC PUMP.



## STEP 7

IN DISASSEMBLING FITTINGS FROM HOSE, FOLLOW ASSEMBLY INSTRUCTIONS IN REVERSE ORDER. IN REMOVING MALE NIPPLES FROM ASSEMBLY, ASSEMBLY TOOL IS NOT REQUIRED. IN REMOVING SWIVEL TYPE NIPPLES FROM ASSEMBLY SO AS NOT TO MUTILATE PARTS, CARE MUST BE TAKEN TO REMOVE ALL OIL FROM ASSEMBLY TOOL MANDREL AND BOTH NIPPLE AND ASSEMBLY TOOL CONE ANGLES BEFORE INSERTING ASSEMBLY TOOL IN NIPPLE.

RIGID TUBE (O. D.) REF.	PROOF TEST PRESSURE
3/16	4250 P. S. I.
1/4	3500 P. S. I.
5/16	2875 P. S. I.
3/8	2500 P. S. I.
1/2	2125 P. S. I.
5/8	1875 P. S. I.
3/4	1625 P. S. I.
1	1250 P. S. I.

HOLD ABOVE PROOF PRESSURE FOR 30 SECONDS MINIMUM

Figure 299—Low Temperature Hydraulic Hose and Detachable Fittings



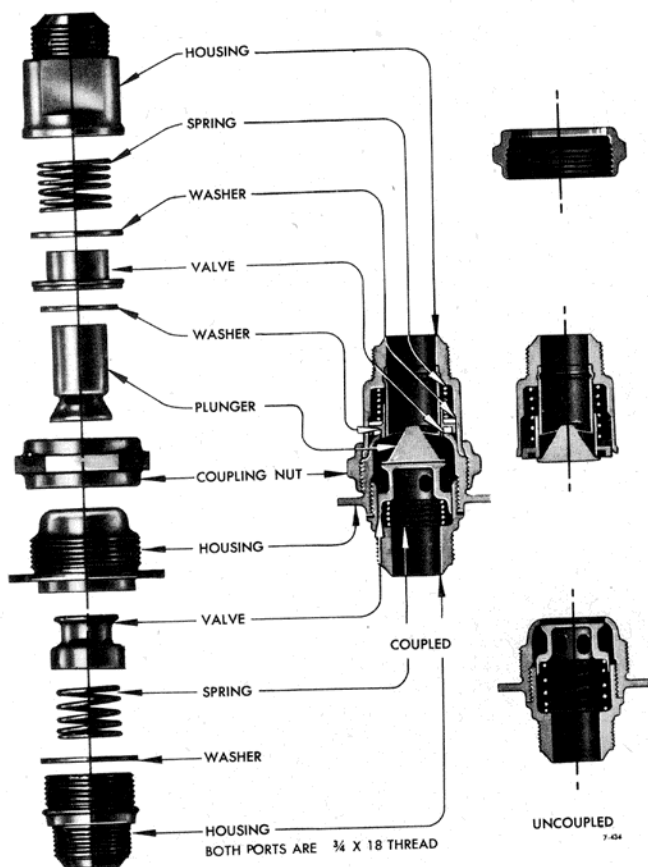


Figure 300—Self-Sealing Coupling

d. ELECTRICAL SYSTEM.

(1) GENERAL.

(a) The Model B-17G airplane is equipped with a 24-volt direct current electrical system. The primary sources of power are four engine-driven generators and three 24-volt batteries. The negative terminals of the batteries are grounded to the airplane structure and all circuits are single wire with ground return.

(b) Secondary power sources include two 400-cycle 115-volt AC inverters, a 3-volt AC transformer, and a portable auxiliary gasoline engine-driven DC generator unit which is plugged into the external power receptacle. (Refer to paragraph (b) 2.)

(c) The electrical system is divided into 16 different circuits, each of which is identified by a code letter. All wires are tagged at both ends with a reference number which consists of the code letter for that circuit and a serial number within that circuit. The wire is identified by a number between 1 and 650, and refers to that number in the electrical equipment table in this manual and in the last sheet of the master wiring blueprint in the airplane.

(d) Blueprints of the master wiring diagram and of each of the individual circuits are provided with each airplane and carried in a box on the back of the copilot's seat.

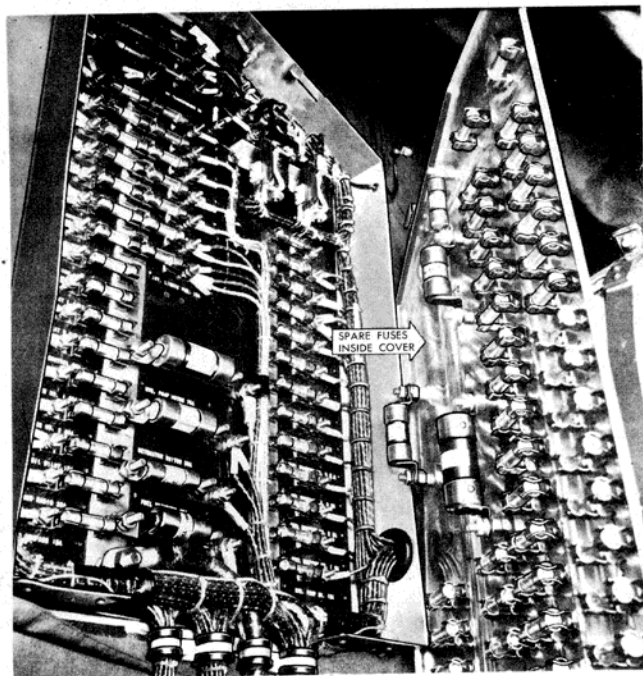


Figure 301—Fuse Panel

Note

THE ELECTRICAL WIRING DIAGRAMS IN THIS MANUAL ARE REPRESENTATIVE ONLY AND DO NOT INCLUDE MINOR VARIATIONS. BLUEPRINT DIAGRAMS IN EACH AIRPLANE MUST BE CONSULTED FOR SPECIFIC INFORMATION OF THE WIRING IN THAT AIRPLANE.

(e) Shields are provided where necessary to protect equipment or to eliminate radio interference. They are shown on the engineering wiring diagrams but do not appear in the specified diagrams contained in this Handbook.

(f) Conduit is provided only where necessary for electrical shielding or physical protection.

(g) All circuits except the starter motors, front landing gear motors, and the power turrets are protected by fuses.

(b) All fuses in the B-17G airplane are accessible in flight except fuses for landing lights, propeller feathering pump motors, and battery solenoid switches. These fuses are mounted in the nacelles due to the necessity of keeping the power leads in these circuits as short as possible.

1. Distribution for all other circuits except the top turret, which is fed directly from the left wing junction shield, is made from the two fuse panels at station 4 and station 6. The bottom turret is fed directly from the station 6 fuse panel bus and all other circuits are supplied through fuses from the busses in station 4 and station 6 panels, except the power lead for the liaison radio which connects directly to the bus in station



6 fuse panel. The power lead to the chin turret comes from the external power solenoid bus.

2. A receptacle and switch for the drift meter are located under the inboard edge of the navigator's table. The circuit is protected by a 15-ampere fuse in the AC fuse shield under the pilot's seat which also contains a fuse for the radio compass. Spare fuses are carried on the cover. In some airplanes the type B-3 drift meter is replaced by a type B-5 drift recorder on the right side-wall of the navigator's compartment. In these airplanes the drift meter receptacle and switch are removed and a panel light is mounted adjacent to the drift recorder.

3. See the fuse diagram, figures 312, 313, 314, for location and capacity of fuses. In addition to fuses shown, refer also to the instruction manuals for radio equipment and gun turrets. Fuses for the propeller feathering pump motor and the landing light are located in each outboard nacelle junction shield and fuses for the propeller feathering pump motor and the battery cut-out solenoid switch control circuits are located in each inboard nacelle junction shield.

(i) One replacement for each fuse is carried on the cover of the fuse panel shield.

(j) External power may be supplied to the airplane through a receptacle accessible through a hinged door in the skin immediately aft of the forward entrance door. Power is automatically controlled through a solenoid switch mounted on the aft end of the voltage regulator shield. An adaptor plug for use with British equipment is carried in the receptacle box.

## (2) POWER SYSTEM.

### (a) PRIMARY POWER.

#### 1. GENERATORS.

a. GENERAL.—A type P-1, 24-volt, 200-ampere generator is installed on each of the four engines.

b. REMOVAL.—Removal of the generator requires only removal of the AN electrical connector plug at the generator and removal of the nuts on the studs at the mounting flange.

#### c. MINOR REPAIRS AND REPLACEMENTS.

(1) LOW VOLTAGE OUTPUT WITH ENGINES OPERATING AT 1800 RPM.—When the engine is operated at 1800 RPM and there is no voltage output or the voltage is low, check generator circuit as follows:

(a) Remove regulators from the mounting base. Then disconnect the connector plug at the generator and examine it to see that contacts are clean and show no signs of burning. If clean, replace electrical connector plug and connect "B" terminal to "A" terminal on the voltage regulator base. With the generator switch in the "OFF" position, increase the engine speed slowly, and watch the voltmeter on the instru-

ment panel. If the voltage builds up to approximately 28 with an engine speed less than 1800 RPM, the generator is satisfactory and the regulator is probably faulty and should be replaced. *Do not increase engine speed to give a voltage of more than 30 volts.* Decrease the engine to idling speed and remove the lead between "A" and "B."

(b) When the generator fails to build up voltage during the above test, check voltmeter on instrument panel by connecting test voltmeter from "B" terminal on regulator to ground. If voltage is indicated, it shows that generator is operating correctly and voltmeter on instrument panel is defective. If no indication is given, and inspection of the generator brushes and commutator indicates that it is in a satisfactory

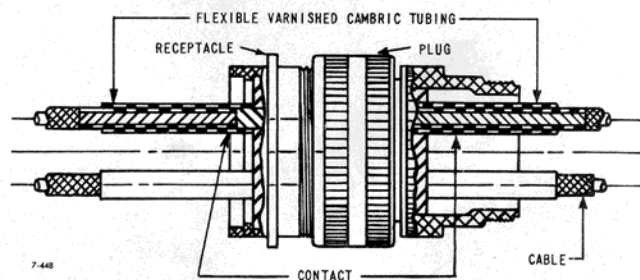


Figure 302—Tubing Installation—Cable Connections

condition, the cause may be due to loss of residual magnetism. It will be necessary to "flash" the field on the generator to restore the residual magnetism. This should be done with the regulator removed or disconnected. Locate a point in the terminal box where the battery voltage is available. This may be located using a voltmeter with the negative terminal connected to ground and the positive terminal used as a test lead. Operate the engine at 1800 RPM with the generator switch off; and with a length of No. 18 or larger cable connected to the battery voltage source, touch the hot battery lead to the "A" terminal on the voltage regulator mounting base. This should indicate a voltage reading on the instrument panel voltmeter. If no voltage is obtained, the

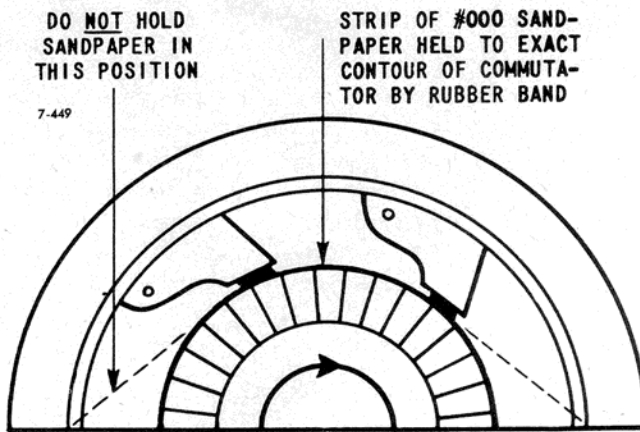


Figure 303—Seating Procedure—Generator Brushes



generator is faulty and should be replaced. When voltage is obtained, replace the regulator and see whether voltage is still obtained. If no voltage is then obtained, the voltage regulator is faulty and should be replaced. If voltage is obtained after flashing the field and replacing the voltage regulator, the difficulty was due to a loss of residual magnetism in the generator, and the system is again in operating condition. Should a generator repeatedly lose its residual magnetism, it must be replaced by a new generator.

**Note**

DO NOT "FLASH" THE GENERATOR BY MANUALLY CLOSING THE RELAY CONTACTS.

(2) HIGH VOLTAGE OUTPUT WITH ENGINE OPERATING AT 1800 RPM.—If engine is operated at 1800 RPM and high voltage is indicated, look for:

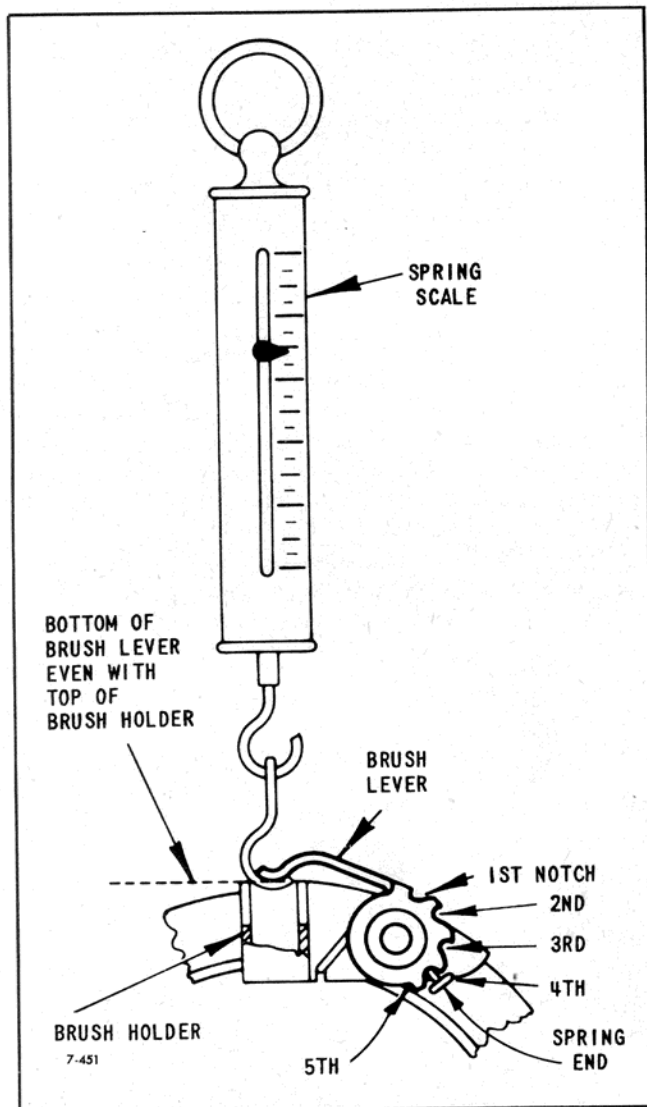


Figure 304—Spring Tension Adjustment—Generator Brushes

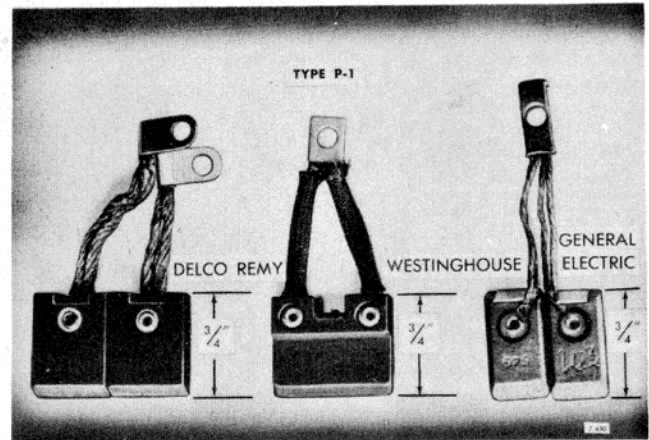


Figure 305—Type P-1 Generator Brushes

(a) Regulator out of adjustment. Readjust if possible. (Refer to paragraph 2.) If not, replace unit and send to depot for repair.

(b) Short circuit between generator cables. Examine electrical connector plug at generator. To prevent possible short circuit and subsequent failure of the generator, the current carrying cables within the plug, electrical connector, Specification No. AN-W-C-59, or Specification No. AN-9534, will be covered with varnished cambric insulating tubing, sizes 0.125, 0.250 or 0.500 as required.

(3) POSSIBLE REASONS FOR GENERATOR MALFUNCTIONING.

(a) WORN BRUSHES.

1. When replacing a brush, the new brush must be seated by inserting a strip of No. 000 sandpaper between the brush and the commutator with the sanded side next to the brush and pulling it in the

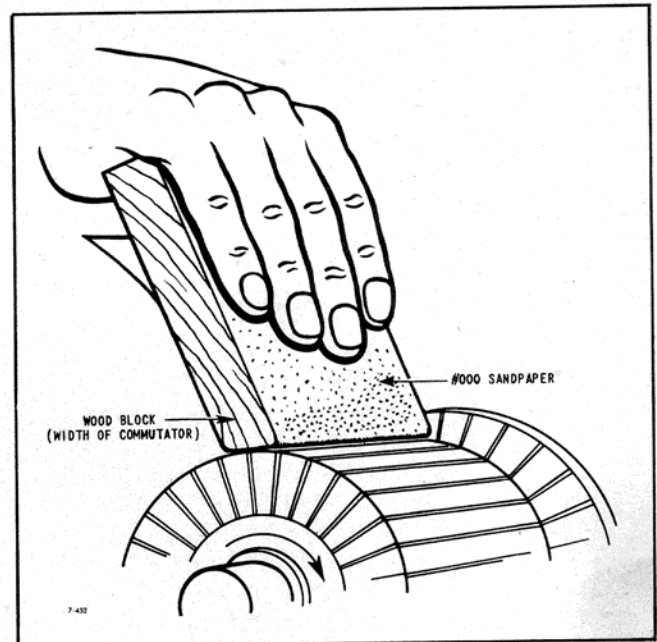


Figure 306—Smoothing Procedure—Generator Commutator



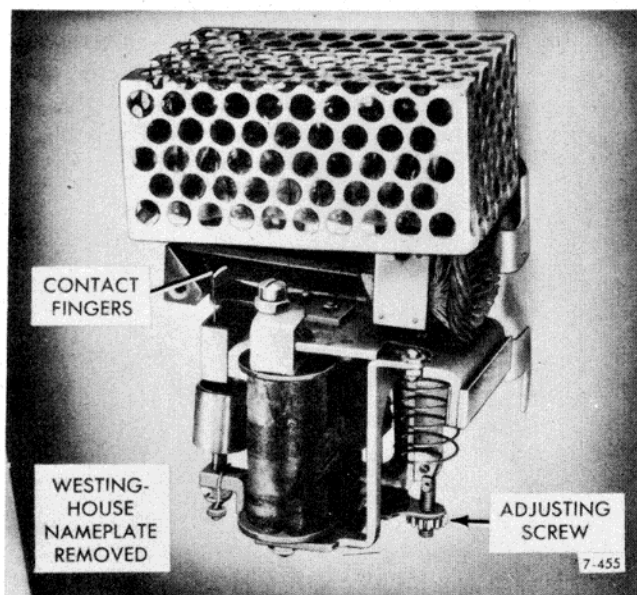
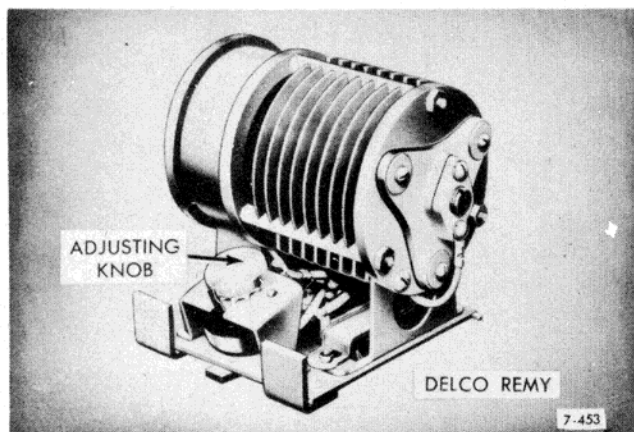


Figure 307—Voltage Regulators

direction of rotation, being careful to keep the sandpaper in the same contour as the commutator.

2. Generator brush wear in type P-1 generators: General Electric, Westinghouse, and Delco-Remy—replace at 3/4 inch over-all length.

**Note**

TO REDUCE POSSIBLE FAILURE OF GENERATOR BRUSHES DURING FLIGHT, AN INSPECTION OF THE GENERATOR BRUSHES WILL BE MADE AFTER EACH FLIGHT OF 20,000 FEET OR HIGHER. THIS INSPECTION IS NECESSARY SINCE BRUSH WEAR AT HIGH ALTITUDES IS VERY RAPID AND WILL CONTINUE UNTIL IMPROVED LONGER WEARING BRUSHES ARE DEVELOPED AND MADE AVAILABLE.

(b) EXCESSIVE ARCING.—Excessive arcing at generator brushes may be due to:

1. Brushes worn excessively. (Refer to paragraphs (3) (a) above.
2. Brushes binding. Remove and clean with a cloth moistened with *unleaded* gasoline.
3. Low brush spring tension. Type P-1: General Electric—16 oz. to 24 oz.; Westinghouse—26 oz. to 36 oz.; Delco-Remy—40 oz. to 52 oz. All tensions are *per brush spring*.

**Note**

If correct tension cannot be obtained by spring adjustment, replace generator.

4. Dirty or pitted commutator. Smooth with No. 000 sandpaper. Clean and polish with a clean dry cloth.
5. Rough, pitted, or eccentric commutator. Replace generator.
6. Voltage regulator out of adjustment.

(c) IMPROPER CONNECTIONS.—Connections between generator and voltage regulator should be checked with wiring diagram.

(d) OVERLOADING. — Overloading of any one generator will be indicated on the ammeters. Check and if necessary adjust voltage regulators. (Refer to paragraph (2) c.)

(e) DEFECTIVE ARMATURE OR FIELD WINDINGS.—Defective or damaged armature or field windings require depot repair. Grounded armature may be caused by brush dust collecting in the winding behind the commutator and often this type of ground may be eliminated by blowing out the dust with dry compressed air. Replace generator if it cannot be repaired.

(f) When generator throws solder, it may be due to excessive arcing at generator brushes or overloading of one generator or improper cooling.

d. INSTALLATION.—Before mounting a generator, check to see that gasket is in place on the mounting pad and is in good condition. Turn armature by hand to check for free rotation. Visually check commutator and brushes by removing brush band. Bolt the generator securely in place and connect the generator cable from the terminal connector to the generator control units. (See DC power circuit, figure 315.)

e. TESTS AFTER INSTALLATION.—The negative lead for the type P-1, 200-ampere generator should have a resistance of .0025 ohm. The resistance of the 50 milli-volt ammeter shunt (.000167 ohm) can be neglected.

**2. VOLTAGE REGULATORS.**

a. GENERAL.—Four type B-1 voltage regulators are mounted in a shield in the lower passageway aft of the forward entrance door. The purpose of the



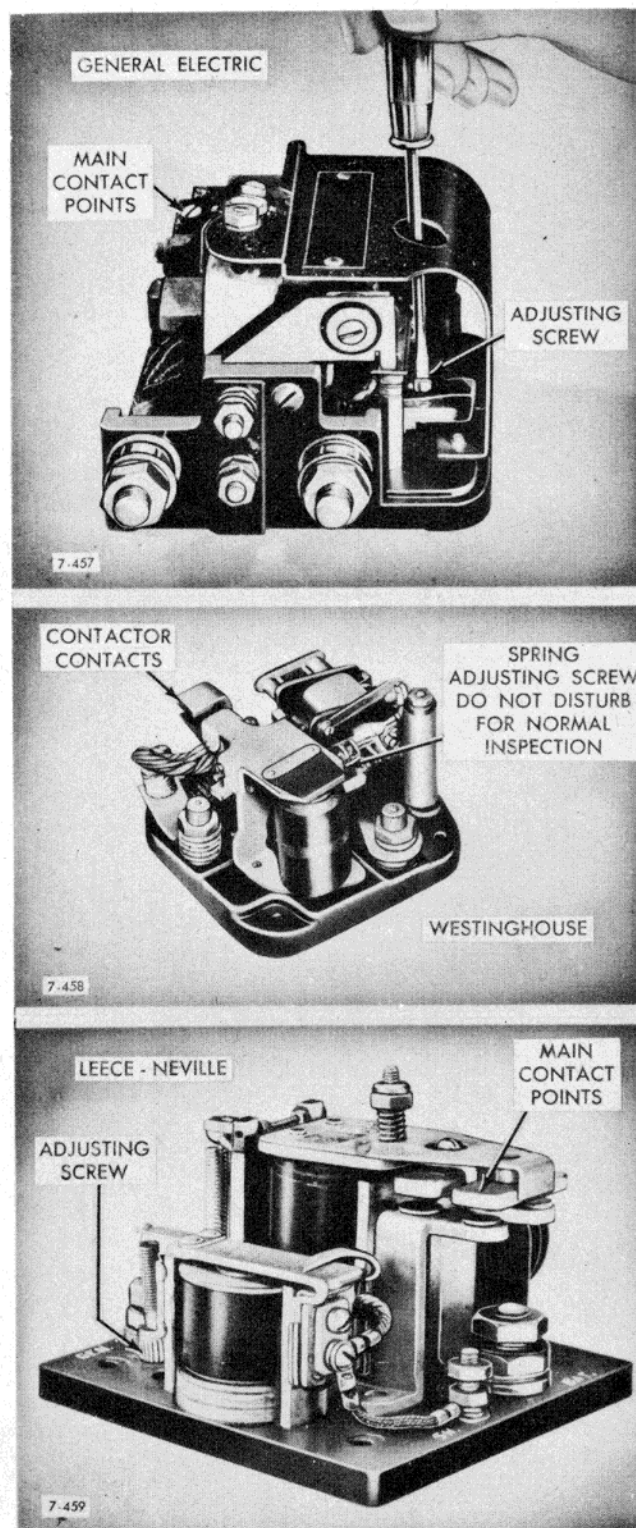
voltage regulator is to maintain the voltage of the electrical system constant regardless of variations in the speed of the generators and conditions of varying electrical loads. Constant voltage is necessary for much of the electrically operated equipment of the airplane, and to keep the battery charged. Voltage regulation is accomplished automatically by the voltage regulator by controlling the amount of resistance inserted into the field circuit of the generator.

**Note**

**HANDLE VOLTAGE REGULATORS WITH CARE** as close regulation of voltage is necessary. The voltage regulator is precision equipment and will not withstand rough treatment. **ONLY QUALIFIED PERSONNEL WILL ADJUST THE VOLTAGE REGULATORS.** The voltmeter installed on the pilot's control panel will *not* be used for adjusting the voltage regulators if testing equipment is available.

b. **REMOVAL.**—The voltage regulators are easily removed from their sockets by pressing downward and slipping the unit sidewise to disengage the clips on the side.

c. **ADJUSTMENT.**—To adjust the voltage regulator use a precision portable voltmeter (accuracy within one percent) with a 30-volt range connected from "B" terminal on regulator to ground and adjust each individual voltage regulator at "NO LOAD." Set to 28.5 volts unless specific instructions are issued for other settings. Increase the speed of one engine to 1800 RPM and adjust its regulator. Repeat this procedure for the remaining engines, being sure to set all regulators at exactly the same voltage. Place all generator main line switches in "ON" position and turn on electrical load of 75 to 100 amperes. With all engines running at 1800 RPM, note ammeter reading for each generator. If not more than 10 amperes difference in load is noted on the ammeters, no further voltage regulator adjustment will be made. In the event one or more generators are out of parallel more than 10 amperes, remove load from all generators and reset all voltage regulators at "NO LOAD," as outlined above. After resetting the voltage regulators, again observe the ammeter readings for paralleling. The load should now be equally distributed between the four generators. Precision voltmeters of the type required for this adjustment must be handled carefully as they will not maintain accuracy under conditions of mishandling or vibration and shock. These voltmeters are to indicate if the generator is producing correct voltage. Except in an emergency, the voltmeter located on the generator instrument panel of the airplane should never be used to adjust regulator as it is only put on the panel to indicate that the generator is producing voltage. (In the event a precision portable voltmeter is not available, a continuity testmeter may be used. Before using this continuity testmeter, be sure that it has been calibrated against a precision voltmeter for accuracy.) Satisfactory temporary accuracy is obtained by



**Figure 308—Relays**

calibrating accurately at 28 volts on the voltmeter scale. If this type meter is used, it should be recalibrated every 30 days in sub-depot or depot instrument shop, or in Service Group or Air Depot Group Instrument Shop.

d. **MINOR REPAIR AND REPLACEMENT.**—Contact fingers on regulators must be in-



spected every 50 hours to note any sign of sticking as a result of arcing or for accumulation of moisture and foreign matter deposited on the contacts. This condition will impair proper operation.

**Note**

In dusty areas, preflight inspection of regulators is essential and will be made. Any dust found on contact fingers will be blown out with dry compressed air.

e. **INSTALLATION.**—(Reverse the removal procedure.)

**3. REVERSE CURRENT RELAYS.**

a. **GENERAL.**—A reverse current relay is mounted in the generator relay and shunt shield in each nacelle. The relay closes the generator circuit when the voltage builds up to a value between 26.0 and 27.0 volts, or opens the circuit should the generator fall below rating and a current of 10 amperes or less flows in the reverse direction. The four type B-5A generator switches on the pilot's control panel control the relays. In the inboard nacelles the generator shield is mounted on the upper inboard side forward of the fire wall. In the outboard nacelles the shield is mounted on the front wing spar. The relay switches connect the generators to the electrical system when the generator voltage is sufficiently high to charge the batteries. However, the relays will close only when the generator switches on the generator instrument panel are closed. The relay switches also open automatically in case the generator voltage becomes lower than the battery voltage, causing a reverse current to flow, as happens when the engine speed is reduced to idling or the engine is off. Hence, the term sometimes used for the relay switch is "reverse current cut-out."

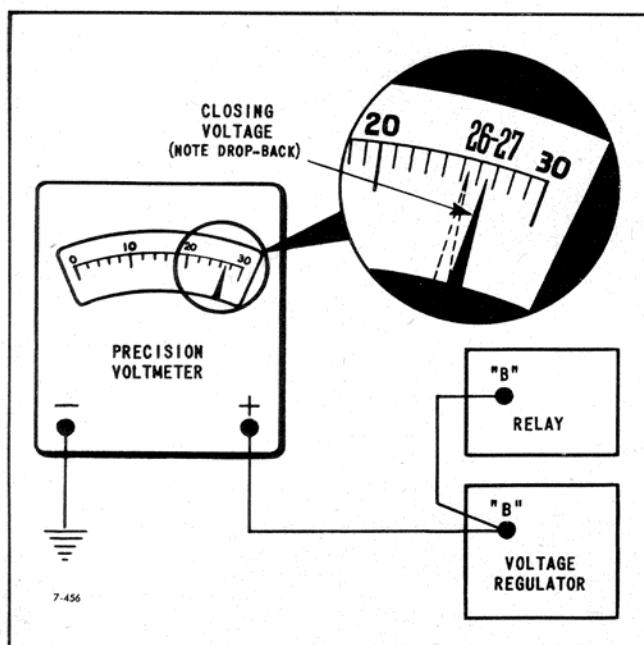


Figure 309—Relay Closing Voltage Test

**Note**

Never close the reverse current relay manually by pressing the contacts together, as serious damage to the relay, the electrical system, and to the individual closing the contact may result from the heavy current drawn from the batteries.

b. **REMOVAL.**—Relays are removed by disconnecting the wires and removing the mounting screws in the panel. In No. 2 nacelle, the relay is mounted on the forward side of the shield in order to obtain the proper position for the relay contacts. This relay is best removed by disconnecting the supporting bracket from the side of the box. It is important to replace relays in the same position as originally installed, to prevent erratic action due to vibration or gravitational effect on the armatures.

c. **MINOR REPAIR.**—Contactor points on relays must be inspected frequently to note any sign of sticking as a result of arcing, or for accumulation of moisture and foreign matter deposited on the contacts. This condition will impair operation.

**Note**

In dusty areas, preflight inspection of relays is essential and will be made. Any dust found on the contacts will be blown out with dry compressed air.

**d. ADJUSTMENT.**

(1) **GENERAL ELECTRIC RELAY, PART NO. 3GTR72A1A.**—Adjustment of the closing voltage is made by turning a small screw accessible through the hole in the cover plate. Turning the screw clockwise raises the closing voltage, and turning it counterclockwise lowers the closing voltage. Extreme care should be taken not to damage the pilot armature while adjustments are being made.

(2) **LEECE-NEVILLE RELAY, PART NO. 24552.**—Adjustment of the closing voltage is made by turning a small slotted nut near the generator terminal. This nut controls the tension on the small spring. Increasing the tension on the spring raises the closing voltage, and decreasing the tension lowers the closing voltage.

(3) **WESTINGHOUSE RELAY, PART NO. 1240224-A.**—Adjustment of the closing voltage is made by turning a small screw, with a screw driver, to adjust the position of the armature inside the small coil. Turning the screw *in* lowers the closing voltage and turning it *out* raises the closing voltage.

e. **INSTALLATION.**—Installation of the reverse current relay is the reverse of the removal procedure.

f. **TEST.**—Check the closing voltage of the relay with a precision portable voltmeter which has a 30-volt range and is connected from "B" terminal on regulator to ground after all the regulators have been adjusted to a voltage of 28 volts. (Refer to paragraph 2. c.



above for voltmeter instructions.) Place the generator switch on the instrument panel in the "ON" position. Slowly increase the speed of the engine on which the generator circuit is being checked until a current reading is noted on the ammeter on the instrument panel. The voltmeter reading will show a slight drop, as the relay closes. The voltage just before the relay closes is the relay closing voltage. This reading should be between 26 and 27 volts. If it is different from that value, adjust the relay as outlined in paragraph d. above. If the relay fails to close, increase the setting of the voltage regulator to not over 30 volts, and see if the relay will close on the high voltage. If it closes, only readjustment of the relay is necessary to make it close between 26 and 27 volts. If it does not close, the relay is defective, and will be replaced. *Be sure to readjust the voltage regulator to its normal setting following the above test.*

#### 4. BATTERIES.

##### a. GENERAL.

(1) Reserve power is supplied from three type G-1, 24-volt, 34-ampere hour batteries. Battery No. 1 is installed in the nose of the left wing at the inboard end. Batteries Nos. 3 and 4 are in a similar position in the right wing.

(2) Each installation is ventilated and the air stream, after passing over the battery, is directed into a jar containing a felt pad saturated with a solution of sodium bicarbonate.

(3) Most B-17G airplanes are equipped with fiber-glass covers for each installation to facilitate battery preheating prior to a cold weather engine start. Heating is accomplished by introducing the heater duct, from an auxiliary heating unit, through a small hand door in the battery access panel.

b. REMOVAL.—The batteries are accessible through doors in the wings above each battery installation. Doors are fastened with Dzus fasteners and are made weathertight by a rubber seal around the edges of the doors. To remove the battery, disconnect the vent tubes, disconnect the battery leads, and remove the connector box at the side of the battery. Remove the hold-down strap and lift the battery out by hand.

c. MINOR REPAIR.—External corrosion of terminals and leads is caused by spilled electrolyte, excessive gassing or overflow due to poor sealing. Remove with a wire brush, neutralize acid with a solution of baking soda (sodium bicarbonate), and rinse parts thoroughly with water. If baking soda and wire brush are not available, ordinary soap and water applied to the corroded parts with a bristle brush or cloth will be quite effective. Apply a light coating of vaseline to the terminals only.

#### CAUTION

When using a wire brush, battery should be removed from airplane as accidental shorting of terminals may cause a severe spark and constitutes a fire hazard.

#### d. TROUBLE SHOOTING.

##### (1) BATTERY WILL NOT HOLD ITS CHARGE.

(a) Battery is worn out. If no Air Forces approved battery capacity tester is available, and battery is suspected of being worn out, it can be checked as follows: remove battery and charge until two hydrometer readings, taken 2 hours apart, show no increase. Battery is worn out if, at the end of this charge: final hydrometer reading is not above 1.250; if final terminal voltage is not above 29 volts when charging at approximately normal charging rate; or if electrolyte temperature rises more than 8°C. (15°F.) above that of the surrounding air.

(b) Charging rate not set right. (Refer to instructions in paragraph 2 above.)

(c) Discharge too great to replace; therefore, use of starters, etc., on ground must be reduced. Use external power source wherever possible.

(d) Standing too long (hot climates). Batteries will require removal and charging if left in an unused airplane for one week or more in very hot climates.

(e) Equipment left "ON" accidentally.

(f) Short circuit (ground) in wiring.

Check wiring.

(g) Impurities put in electrolyte. Replace battery.

(h) Broken cell partitions. This is usually indicated by two *adjacent* cells running down continually, particularly if left standing a few days. Replace battery.

##### (2) BATTERY LIFE IS SHORT.

(a) Overcharge. (Refer to instructions in paragraph 2 above.)

(b) Level of electrolyte below tops of plates. Not low in specific gravity, but level  $\frac{3}{8}$  inch above plate baffle:

(c) Heavy discharges.

(d) Allowed to sulphate. This occurs only when battery is left in a discharged condition for a period of time.

(e) Impurities in electrolyte.

(f) Battery improperly stored prior to use.

##### (3) CRACKED CELL JARS.

(a) Holddown loose.

(b) Frozen battery. Newly added water on top or a low state of charge could cause this. In both of the above cases battery will have to be replaced.

##### (4) COMPOUND ON TOP OF BATTERY MELTS.

(a) Charging rate too high. (Refer to instructions in paragraph 2 above.)

(b) Temperature of battery compartment excessive, may be due to sun. (Generally high ambients.)

(5) **ELECTROLYTE RUNS OUT OF VENT PLUGS.**—Too much water added to battery.

(6) **EXCESSIVE CORROSION INSIDE CONTAINER.**

(a) Overcharging. (Refer to instructions in paragraph 2 above.)

(b) Spillage from overfilling, melted sealing compound or cracked jars.

(c) Vent lines leaking or clogged.

(7) **BATTERY FREEZES.**

(a) Discharged battery.

(b) Water added and battery not charged immediately. This is an important point as water should never be added in freezing weather when batteries are to be left standing for a period of 4 or 5 hours before charging. About half an hour charge will mix the water with the electrolyte and then the freezing will be in accordance with the table given in paragraph (e.) below.

(c) Leaking jar, water added and froze.

(d) Extreme cold. (Refer to table below.)

(e) In above cases it is almost always necessary to replace battery, although in case of a partial freezing, thawing in a warm room may save battery. It should be thoroughly checked in this case before use in an airplane.

#### **FREEZING POINTS**

<i>Specific Gravity</i>	<i>Freezing Point</i>
1.275	−85°F
1.250	−62°F
1.225	−35°F
1.200	−16°F
1.175	−4°F
1.150	+5°F
1.125	+13°F
1.100	+19°F

(8) **BATTERY POLARITY REVERSED.**

(a) Connected backwards on charger.

(b) Connected backwards on airplane. Such battery should be slowly discharged and recharged properly and tested. Refer to paragraph (1) (a) above as battery should be tested before use as it may be unserviceable.

(9) **BATTERY CONSUMES EXCESSIVE WATER.**

(a) Charging rate too high (if in all cells.) (Refer to instructions in paragraph 2. above.)

(b) If in one cell only—cracked jar, replace battery.

e. **INSTALLATION.**—Install batteries with the terminal cover in place in order to prevent accidental grounding. Then remove the terminal cover and connect the battery leads. Corrosion should not be expected at the battery connection terminals; however, a light coating of heavy gear oil or vaseline should be applied after the connection is properly tightened. Saturate the felt pads in the battery vent sump with baking soda (sodium bicarbonate) solution and connect the vent lines securely. The battery hold-down strap should be tight enough to prevent any vibration or shifting of the battery under any condition, but not so tight as to put an undue strain on the case which may cause breakage.

(b) **SECONDARY POWER.**

1. **INVERTER.**

a. **GENERAL.**—

(1) Two inverters, one under the pilot's and one under the copilot's seats, are used to convert 24-volt direct current from the airplane's electrical system to 26-volt 400-cycle alternating current for the flap position indicator and the warning signals 3-volt transformer. In addition, the inverters supply 115-volt 400-cycle alternating current for the radio compass and electronic turbosupercharger control system.

(2) Control of the inverters is provided by a toggle switch on the pilot's control panel. In the "NORMAL" position the switch turns on the inverter under the pilot's seat; in the "ALTERNATE" position, the inverter under the copilot's seat is on. Do *not* switch from one inverter to the other to equalize the wear. *Use the "NORMAL" inverter at all times and keep the "ALTERNATE" inverter in reserve. Switch to the "ALTERNATE" inverter only when the "NORMAL" unit fails!* With the electronic turbosupercharger control system installed, the inverters become one of the most vital units in the entire airplane. Should the inverters fail, all control of all four turbosuperchargers is immediately lost with consequent disastrous results. Therefore it is absolutely imperative that the alternate inverter be in good condition, so that it can be depended upon in an emergency.

#### **CAUTION**

Never turn the inverters "OFF" while the engines are running.

(3) The inverter consists of a governor controlled DC motor, two AC field windings and a radio interference filter pack. The governor cuts a resistance in and out of the DC field to maintain the AC frequency at 400 cycles. One AC winding ("B" terminal) provides 26-volt, single-phase, 250-volt-ampere, alternating current. The other AC winding ("A" terminal) supplies the 115-volt 400-cycle alternating current. A "HI-LO" switch on the inverter in the "LO" position cuts off part of the 115-volt winding if the load is less than 75 percent of 250 volt-ampere rating. The switch is safety wired in the "LO" position on the B-17G airplane.



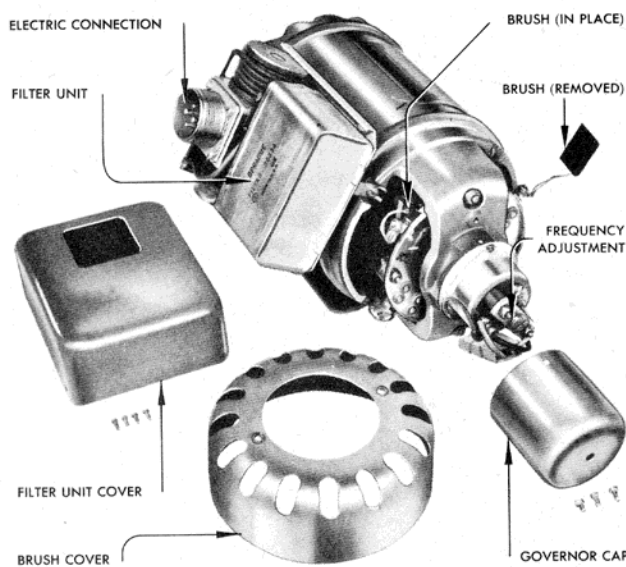


Figure 310—Inverters

**CAUTION**

Do not attempt to adjust the governor controls. This is a major depot adjustment.

b. **REMOVAL.**—The inverters are removed by removing the mounting bolts in the floor and disconnecting the plug and ground strap.

c. **MINOR REPAIRS AND REPLACEMENT.**—If inverter fails to operate or output is low, look for:

(1) **BRUSHES BINDING IN THE BRUSH BOXES.**—Wipe brushes with a cloth moistened with unleaded gasoline.

(2) **WORN BRUSHES.**—Brushes should be replaced when worn to a length of 5/16 inch. Install new brushes with leads next to the brush board, in the same relative position as the original brushes. Replacement brushes are contoured to permit immediate installation. *Do not use coarse sandpaper or emery cloth on brushes, commutator, or slip ring.* Final seating of new brushes can best be accomplished by placing a strip of No. 8-0 garnet paper around the commutator or slip ring, with sanded side next to the brushes and with both ends of the paper led out opposite the brush to be seated. Pull the paper so as to rotate the armature in the proper direction.

**CAUTION**

When pulling the paper to rotate the armature and seat the brushes, be careful not to pull against one side of the brush as one edge of the brush will be cut away and that brush will not seat. Pull paper at a tangent to the commutator but at right angle to the brush.

(3) **BRUSHES NOT PROPERLY SEATED.**—Reseat as instructed in paragraph (2) above.

(4) **IMPROPER SPRING TENSION.**—A force of 13½ ounces should be required to lift the

spring off the top of a new DC brush, and 9 ounces should be required for AC brush springs. Replace spring if these requirements are not met.

(5) **DIRTY COMMUTATOR.**—Wipe with a clean, dry cloth. *Do not use sandpaper or emery cloth.*

(6) **INTERNAL FAULTS.**—Cannot be corrected except at depot.

d. **ADJUSTMENTS.**—Do not attempt to adjust the governor controls. This is a major depot adjustment.

e. **INSTALLATION.**—Mount the inverter with four bolts through mounting bracket. Connect the plug and ground strap, and safety-wire the cover screws. (See figure 228.)

2. **AUXILIARY GENERATOR UNIT (DC).**

a. **GENERAL.**

(1) A direct current generator unit AAF type C-10 is provided as fly-away equipment on B-17G airplanes. The unit is intended to be used as an external power source, but in some airplanes it is installed opposite the main entrance door, ready to operate. The unit consists of a one-cylinder air-cooled, two-cycle engine (3200-3700 RPM) and a DC generator (28.5 volts, 70 amperes, 2000 watts). An automatic voltage regulator, General Electric Model No. 36BD2B11, is mounted on the generator yoke and a control box containing switches, voltmeter and radio filters is mounted beneath the yoke. A one-gallon fuel tank manual starting rope, and a 20-foot electrical connection cable are also included with each unit. The assembly, which weighs 115 pounds, may be manually transported using the handles attached to either side of the mount.

(2) On some airplanes the unit is to be used externally only, being placed near the external receptacle at station 3H. Manual starting is necessary when the unit is used externally, because the power relay in the external power circuit can only be operated by external power. On other airplanes changes have been made so that the unit may be operated inside the airplane as installed, the exhaust being dumped overboard and the proper electrical connections made. A 1/8-inch tube vents the carburetor. These units are started electrically from the airplane batteries.

b. **OPERATING INSTRUCTIONS.**—The following instructions for the generator unit should be observed:

(1) **PREPARATIONS.**—On airplanes which require removal of the unit for use, place on a hard level surface within reach of the external power receptacle and insert connector plug.

(2) **FUEL AND OIL.**

**WARNING**

THE CONTAINER FOR FUELING THE AUXILIARY POWER PLANT MUST BE GROUNDED TO THE POWER PLANT



PRIOR TO AND DURING THE FILLING  
OPERATION.

(a) Fuel and oil must be thoroughly mixed. Use Specification No. AN-VV-F-776 or AN-VV-F-781 fuel (90-100 octane) and Specification No. AN-9532 Grade 1065 oil (SAE-30). Pour 1/2 pint of oil into a one-gallon measure. To measure the oil fill the fuel tank cap four times (cap capacity 1/8 pint). Pour one to two quarts of fuel into the measure and stir with a clean stick until it foams. Then fill the measure with fuel and stir again. Pour the mixed fuel into the tank. This is the only lubrication required. SAE 40, 50, or 60 oil can be used, but best results will be obtained with SAE 30 oil. Do not use below 90 octane fuel. One gallon of gasoline is sufficient to maintain 1 1/2 hours of operation.

(b) The generator end requires no lubrication.

(3) STARTING.

(a) On airplanes with units which operate inside the airplane, turn the auxiliary generator switch on the left side wall above the auxiliary generator to the "ON" position.

(b) On all airplanes see that the equalizer switch on the control box is in the "OFF" position unless the main engines are running.

(c) Turn the shut-off valve on top of the fuel container to the "ON" position.

(d) To choke—Pull the plunger button at the top of the air cleaner on the priming pump all the way up, and release. Repeat two or three times. In cold weather operate plunger five to eight times.

(e) Depress the starting switch on the control box and release as soon as the engine starts. Units which are used outside must be started manually. Wind the starting rope on the starter plate in the direction of the arrow. Brace one hand on the unit and pull the rope hard enough to give the engine a quick spin. Repeat until the engine starts.

(f) If the engine falters after it starts in cold weather, it may become necessary to keep operating the carburetor priming pump at short intervals. In one minute the engine should be warm enough to run smoothly.

(g) If the engine doesn't start within 10 seconds after following the above procedure, it may be flooded. To relieve this condition expel the raw gas by opening the drain cock on the crankcase and turning the engine over for a few seconds by depressing the starter switch or by using the starting rope. Close the drain cock and repeat the starting procedure.

(h) Summarized, the starting procedure is as follows:

1. Prepare fuel and oil mixture.
2. Pour fuel mixture into fuel container.

3. Turn auxiliary generator switch to "ON" position.

4. Set equalizer switch.

5. Turn shut-off valve into "ON" position.

6. Choke.

7. Depress starting switch or start with rope manually.

(4) OPERATION.—After starting, the unit should require no attention other than refueling and setting the equalizer switch to "ON" position, if it is desired to charge batteries in parallel with the airplane engine generators while the engines are running. If engines are not running, keep equalizer switch in "OFF" position. Correct voltage is maintained automatically by a voltage regulator mounted above the generator yoke. The voltmeter will normally register approximately 28.5 volts, but if batteries are under a heavy load, a lower voltage will be registered.

(5) STOPPING.

(a) To stop, turn shut-off valve on top of fuel container to "OFF." The unit will run for approximately 1/2 minute until the fuel in the carburetor and the sump, on the bottom of the fuel container, is used.

(b) For emergency stopping, or if unit is to be restarted soon, press red stop button on magneto starter plate and hold firmly until engine stops.

c. REMOVAL AND DISASSEMBLY.

(1) REMOVAL.—The generator unit is removed from the airplane by loosening the four mounting bolts. On airplanes which have provisions for internal operation of the unit, the electrical connecting plug and the flexible steel exhaust hose have to be disconnected first. Care must be taken to avoid damage to tubing, wiring, and body structure on removing unit.

(2) DISASSEMBLY.—Disassembly of the unit will not be attempted without approval of the resident engineering officer. In the absence of technical information concerning the repair procedure, the equipment will be referred to the proper repair depot for dismantling.

d. MINOR REPAIR AND REPLACEMENTS.—Minor repair and replacements will be confined to such activities as cleaning the carburetor and air cleaner, removing excess oil and dirt from the assembly, inspecting fuel and oil lines for leakage, checking electrical leads for faulty insulation, and the replacement of minor parts which do not require disassembly of the unit.

e. ASSEMBLY AND INSTALLATION.—In reassembly of the unit in the airplane, be sure the four mounting bolts are tight and all caps are securely in place. Airplanes which have provisions for operating the units on the inside must have the flexible exhaust line connected to the auxiliary muffler tail pipe, and the



plug from the airplane electrical system connected to the receptacle on the unit. On some airplanes the electrical connecting cable is stowed in the lower portion of the left side gunner's ammunition box.

### (3) OPERATING SYSTEMS AND UNITS.

(a) **STARTERS.**—This airplane is equipped with type G16, or JH-3R starters, and type C-1 electric solenoid-operated meshing mechanisms.

#### CAUTION

Do not attempt to accelerate these starters either manually or electrically while the starter and engine jaws are engaged.

A double throw toggle switch for each engine starter is installed on the auxiliary panel forward of the copilot. The switches are operated upward for spinning the inertia starter and downward for meshing. The meshing position is of the momentary contact type and the switch will return to "OFF" when released. Refer to section IV, paragraph 6. e., for complete information on the starting system.

(b) **INDUCTION VIBRATORS.**—An induction vibrator, American Bosch type VJR 24B5 (or interchangeable General Electric type 70G7), mounted on the aft side of the firewall in each nacelle converts 24-volt DC into low voltage pulsating current for starting the engines. The pulsating current is transformed in the primary and secondary windings of the right magneto and distributed as high tension current to the front spark plugs. The induction vibrator is energized only when the starter "MESH" switch is on.

(c) **PROPELLER FEATHERING PUMP.**—Feathering of the propellers is automatically accomplished by means of an electric motor-driven hydraulic pump mounted on the forward side of the fire wall in each nacelle. Operation of this pump draws oil from the engine oil supply and forces it under high pressure through the governor to the propeller, where it overrides the constant speed governing action and produces full propeller feathering. Unfeathering may be accomplished by a renewed application of the pump output. Four magnetic control switches mounted on the pilot's instrument panel provide individual control for each propeller. Refer to section IV, paragraph 6. d.

#### (d) OIL SYSTEM.

1. **OIL IMMERSION HEATERS.**—Some airplanes are equipped with oil immersion heaters in each oil tank for warming the oil before starting in extremely cold weather. The heater is connected to a plug under a small cover plate on the side of the nacelle and 110-volt power is supplied from an external source. Immersion heaters should be cleaned periodically to remove scale, etc., that may cause overheating.

#### CAUTION

Do not operate oil heater with less than 30 gallons of oil in tank. The heater must be completely immersed to prevent burning out the elements.

2. **OIL DILUTION VALVES.**—A solenoid-operated oil dilution valve is connected between the oil "in" line and the carburetor and is mounted on the front side of the fire wall in each nacelle. Its function is to provide dilution of the engine oil at the end of a run in order to permit easier cold weather starting. The solenoids are controlled by four B-6B switches on the auxiliary control board.

#### (e) FUEL SYSTEM.

1. **FUEL SHUT-OFF VALVES.** (Electromatic Corp. No. 2660.)—Solenoid-operated fuel shut-off valves are installed in the fuel lines, between the tanks and the engines, to provide a means of quickly stopping fuel flow in case of a severed or broken line. The valves for the inboard tanks are mounted on the lower wing panel, just forward of the rear spar near wing station 2. The valves for the outboard tanks are mounted forward of the front spar near wing station 8, and are normally open, but close when the circuits are closed. They are controlled by four B-5A switches on the central control board.

#### 2. FUEL QUANTITY INDICATOR.

a. A liquidometer indicator is located on the right side of the copilot's control panel for determining the available fuel supply. A six-position switch directly below the indicating dial closes the electrical circuit to any one of the six main fuel tanks. Only the quantity in that tank is shown.

3. **FUEL BOOSTER PUMPS.** (Thompson Products, Inc. TFD 8100.)—Electric motor driven fuel booster pumps are installed at the outlets of the engine fuel tanks. They are used at take-off and at high altitudes primarily to eliminate vaporization of fuel, but also are necessary for starting the engines. Type B-5A control switches for each of the pump motors are located on the central control panel.

#### 4. FUEL TRANSFER PUMP. (Romec RG 4420.)

a. The fuel transfer pump is located under the forward step in the bomb bay and is driven by a reversible motor. The control switch is mounted on the front side of bulkhead 4, below the left side of the door, and consists of a B-9A and C-9A switch with handles linked together. The B-9A switch connects power to the motor in either position. The C-9A switch reverses armature current to change direction of rotation. Center position of the switches is "OFF." Do not start the motor with either valve in the "BOMB BAY" position when the bomb bay tanks are not installed.

b. In series, with the power lead to the motor, are two micro switches which are part of the two selector valve assemblies. Switches are closed only when selector valves are open. Selector valve controls are on the front side of bulkhead 4 below the door.

#### (f) ELECTRONIC TURBOSUPERCHARGER CONTROLS.



**Note**

For detailed description see section IV, paragraph 6. c. (1).

1. The turbosupercharger control consists of the Minneapolis-Honeywell equipment and wiring. The components of the system are the turbo boost selector, induction system pressuretrols, turbosupercharger governors, turbo waste gate motors, turbo control amplifiers and main and nacelle junction boxes. The required power of 67 volt-amperes (.8 power factor) is supplied from the airplane inverter (115 volt, 400 cycle alternating current) through a 20 ampere fuse in the AC fuse shield under the pilot's seat.

a. The turbo boost selector is located on the pilot's control stand.

b. Four pressuretrols, one in each nacelle, are the primary automatic controls. (See figure 150.) This pressure sensing device contains a syphon bellow-actuated potentiometer which is responsible to changes in carburetor inlet pressure. Two mechanically connected bellows, one evacuated, and the other connected to the pressure source, actuate a wiper arm across the potentiometer winding.

c. The waste gate motor (4303A) is a reversible induction motor.

d. Four amplifiers, one for each nacelle unit, are installed on shock mounted racks in the radio compartment. The amplifier is a three stage unit consisting of two voltage amplifier stages and one discriminator stage. The tubes used are one 7Y4, as a rectifier, one 7F7 duo-triode as a voltage amplifier, and two 7C7 tubes as discriminators. A one ampere fuse in the amplifier protects the power transformer and motor line field windings. A spare amplifier is carried on the floor between the spare liaison tuning units and the fuselage sidewall.

e. A junction box in each nacelle contains the bridge transformer for the pressuretrol, turbo governor, and waste gate motor bridge circuits for that nacelle, as well as the condenser and protective resistors of the waste gate motor circuits. The terminal board provides ready servicing and test connections for the circuit.

f. A main junction box is located under the radio compartment floor. The box contains a terminal panel for interconnection of the circuit wiring.

**(g) ELECTRICAL INSTRUMENTS.**

1. AUTOSYN INSTRUMENTS.—The only autosyn instrument in the B-17G airplane is the flap position transmitter in the left wing and the indicator on the pilot's instrument panel. The autosyns receive 26-volt 400-cycle alternating current from either of the two inverters.

**2. TEMPERATURE INSTRUMENTS.**

a. A type AN5525-1 electric resistance thermometer bulb is mounted in the right wing fillet just

below the center of the leading edge to measure the outside air temperature. The bulb is connected to the type AN5790 indicator on the copilot's instrument panel and receives power through a 15 ampere fuse in the station 4 fuse shield.

b. A type AN5525-2 electric resistance thermometer bulb in the engine oil line just below the nacelle oil tank transmits oil inlet temperature to one of the two Type AN5795 dual indicators on the pilot's instrument panel.

c. A resistance bulb (AN-5525-2) is mounted in each carburetor air duct just forward of the fire wall to measure carburetor air inlet temperature. Two type F-10 dual indicators are located in the lower right corner of the pilot's instrument panel.

**CAUTION**

**DISCONNECT POWER BEFORE REMOVING ANY OUTSIDE AIR, CARBURETOR AIR, OR OIL TEMPERATURE BULB.** If the temperature bulb is disconnected while the power is on, the Wheatstone bridge circuit of the temperature instruments causes a surge of current through the indicator which will burn it out.

d. Type B-11 iron-constantin thermocouples are attached to the top cylinder of each engine and are connected to two dual indicators on the right-hand side of the pilot's instrument panel.

e. A type C-13A direct-reading free air thermometer is mounted in the Plexiglas nose for the bombardier.

3. GYRO FLUX GATE COMPASS.—The B-17G airplane is equipped with the Pioneer gyro-stabilized flux gate compass system. For complete information on this system, see section IV, paragraph 7. (26).

(b) HYDRAULIC SYSTEM.—The electric hydraulic pressure pump and Starbird pressure regulating switch are mounted on the hydraulic panel in the right rear portion of the control cabin. The Bourdon tube type pressure switch operates contacts to start the pump motor at 600 pounds per square inch and break the circuit at 800 pounds per square inch. The pressure switch has a low-pressure cut-out which stops the pump motor whenever the system pressure falls below  $200 \pm 50$  PSI. The pressure switch also lights a warning lamp on the pilot's instrument panel should the pressure in the service system drop below 525 pounds per square inch. The pressure switch receives power through a 15-ampere fuse on the station 4 fuse panel and controls the motor solenoid on the right sidewall above the hydraulic panel. In some airplanes the type B-5A "ON-OFF" toggle switch on the pilot's control panel must be "ON" to maintain hydraulic pressure automatically. In other airplanes power is supplied to the automatic pressure switch regardless of the position of the "AUTO-MANUAL" toggle switch. Should the automatic pressure switch fail to function, pressure may be restored by holding the hydraulic pump switch in the



"MANUAL" position. With battery power on, the pressure switch can be turned off only by disconnecting the receptacle at the pressure switch or by removing the 15-ampere hydraulic pump switch fuse in the station 4 fuse panel. The hydraulic pump motor is protected by a 70-ampere fuse in the same panel.

(i) ARMAMENT.—See section IV, paragraph 7. *l* and *m*, for information concerning electrically operated bombing and gunnery equipment.

(j) DEICER DISTRIBUTOR.—The Eclipse type 574, model 2 deicer distributor valve and motor assembly is installed in the right wing gap. The control switch for the motor is part of the deicer control valve assembly and is controlled automatically by operation of the control valve. The control valve handle is on the sidewall at the pilot's left. The circuit is closed when the valve is turned on.

(k) PITOT HEATERS.—Resistor-type pitot heaters in the pitot heads are controlled by a C-5A switch on the pilot's control panel.

(l) PROPELLER ANTI-ICER PUMPS.—The propeller anti-icer system is operated by two motor driven pumps located under the floor of the radio compartment, accessible through the camera pit door. The motors' speed is controlled by two rheostats in the floor behind the pilot's seat. A B-5A switch on the left sidewall above the rheostats controls power to both rheostats. Rheostats also have an "OFF" position. The left pump serves the inboard propellers. The right pump serves the outboard propellers.

#### (m) RETRACTING MOTORS.

##### 1. GENERAL.

a. All retracting motors are reversible and each is controlled by two solenoid switches, one for each direction of rotation. Each motor unit includes a solenoid clutch engaging only when the motor is turned on, and an adjustable clutch set to slip at a running torque load low enough to prevent damage in case of jamming. Retracting motor characteristics are as follows:

UNIT	Approx. Operating Time (Seconds)	Clutch Setting Breakaway Torque
<b>MAIN LANDING GEAR</b>		
Eclipse Type 1073	raise—45	1200 pound-inches
G.E. Type 5BA50FJ2B	raise—45	1050 pound-inches
Eclipse Type 785	raise—45	850 pound-inches
G.E. Type 5BA50FJ2A	raise—45	850 pound-inches
<b>TAIL GEAR</b>		
Eclipse Type 1227-1	raise—45	400 pound-inches
G.E. Type 5BA50FJ3A	raise—45	400 pound-inches
<b>BOMB DOORS</b>		
Eclipse Type 1073-1	raise—25	1200 pound-inches
G.E. Type 5BA50FJ4A	raise—25	1200 pound-inches
<b>WING FLAPS</b>		
Eclipse Type 786-1	raise—45	600 pound-inches
G.E. Type 5BA50FJ4A	raise—45	600 pound-inches

NOTE: The dash number following the type number for the Eclipse motors refers to the model designation.

There are three types of limit switches used on the landing gear: the type B-15 switch, the Micro Switch type WZ-3RW2, and the Micro Switch type WZ-R31.

#### Note

Operating time is based on battery voltage while under charge (28.5 volts) and this must be considered when checking with engines stopped or with ground batteries.

b. All retracting motors have up and down limit switches which open the control circuit to the solenoid switches at the end of travel.

c. One set of spare brushes is supplied with each airplane for each retracting motor. Replace the motor brushes when worn to the extent of reducing brush tension by two-thirds of the original amount.

2. LANDING GEAR MOTORS.—The time required for retracting the landing gear should be approximately 45 seconds, operating on 28.5 volts. A longer operating time indicates clutch slippage. The actuating motor is in the forward end of the main landing gear retracting well. The main landing wheels and the tail wheel are controlled together by one toggle switch, type B-9A, on the central control panel. The switch handle is protected by a hinged guard to prevent its being pushed on accidentally. Solenoid switches for the front landing wheels are in the inboard nacelle junction shields on the front wing spar. Tail wheel motor solenoid switches are on the tail wheel motor bracket at station 7-A. The limit switches for the front landing gear are on the retracting screws. The "up" limit switch for the tail wheel motor is on the tail gear support channel in the top of the fuselage. The "down" limit switch is on the motor bracket. Warning switches for front landing gear are in the shields with the "down" limit switches. The warning switch on the tail wheel is mounted adjacent to the "down" limit switch. A centering switch in series with the "up" control circuit of the tail wheel is a micro switch operated by a cam at the top of the treadle. The switch closes the circuit when the wheel is centered for retracting.

3. BOMB DOOR MOTOR. (Refer also to section IV, paragraph 4.) —The bomb door motor is mounted near the forward end of the catwalk truss. On airplanes with mechanical controls a B-9A control switch is mounted just forward of the bombardier's panel and is controlled by a lever. A lock switch in series with the "up" control circuit of the bomb doors is mounted on the lower left side at station 2 and controlled by a trigger attached to the bomb racks control rod. This switch is closed when the bomb release mechanism is locked. The limit switches are on the left rear bomb door retracting screw mechanism. On airplanes with the All-Electric bomb control system, the Bombardier and Copilot have momentary contact type B-11 switches to control the bomb doors. The bomb doors may also be opened and closed with a crank which is stowed in the radio compartment.



4. WING FLAP MOTOR. (Refer to section IV, paragraph 7 b.)—The wing flaps are operated by a single motor mounted in the rear inboard end of the left wing, and are accessible through a door in the bottom of the wing. The motor shield and screw enclosure (containing limit switches) are pressurized by means of a scoop in the lower surface of the wing. The solenoid switches are under the floor of the radio compartment, accessible through the camera pit door. A type B-14 switch on the central control panel controls the solenoid switches. Limit switches are operated by the motor drive unit. Flap position is indicated by autosyn instruments. The transmitter is attached to the inboard flap hinge on the left wing flap, and the indicator is on the copilot's portion of the instrument panel.

5. CARBURETOR AIR FILTER MOTOR.—The valves in each of the four carburetor air intake ducts are operated by a small, reversible motor mounted adjacent to each filter. A reduction gear is incorporated in each motor assembly, together with one fixed and one adjustable limit switch by which the travel of the output lever may be set for a range of 75° to 105°. Approximately 30 seconds' time is required for full travel of the vanes in either direction. Each motor is protected by a 15-ampere fuse located in a shield beside the station 4 fuse panel. A four-pole double-throw relay in the shield directs power to the motors and is controlled by a type B-5A switch on the copilot's instrument panel. When the switch is in the "OPEN" position, four amber lamps are lighted, which indicates that filtered air is being delivered to the supercharger. With the switch in the "CLOSED" position, four green lamps indicate that *unfiltered* air is being drawn into the supercharger. Failure of any lamp to light shows that the output lever has not reached the full limit of travel.

(n) LIGHTING SYSTEM.

1. INSTRUMENT LIGHTING.

a. Uniform floodlighting of the instrument panels is obtained with type C-5 fluorescent light projectors. One light is installed over the pilot's instrument panel, one on each control column, and one on the cockpit ceiling to illuminate the compass panel. In the navigator's compartment, one light is attached to the shelf over the navigator's table and one to the forward edge of the table to light the bombardier's instruments. This light may be pulled out of its socket and snapped into a headband worn by the bombardier. Power (24 volts DC) for the fluorescent lights is obtained from the station 4 fuse shield. Switches are located adjacent to the light.

b. Two types of illumination are available for the instruments: floodlighting with visible fluorescent light, or ultra-violet (invisible light) activation of the luminous paint on the instruments.

c. To utilize the fluorescent floodlighting feature, rotate the shutter to the left until the visible light falls on the instrument panel. Ultra-violet illumi-

nation is obtained by rotating the shutter in the opposite direction approximately one-quarter turn. This method of illumination eliminates objectionable window glare and reflections, since only the luminous instrument markings are visible.

2. INTERIOR LIGHTING.

a. COCKPIT LAMPS.—Nine type A-6 cockpit lamps are used for general panel illumination, with switches adjacent to the lamps.

b. DOME LAMPS.—Type A-5 dome lamps, illuminated by type S-8 bulbs, are installed as follows:

(1) One at station 11-F, tail gunner's compartment, with switch adjacent to the lamp.

(2) One on each side of the top of the bomb bay, with a switch for each light on the front side of bulkhead 5 to the right of the door.

(3) One on the pilots' floor support bulkhead in the lower fuselage with switch adjacent.

(4) One in the step at the front end of the catwalk with two control switches, one in station 4 fuse shield and one on the rear side of bulkhead 5 to the right of the door.

c. REFLECTOR LIGHTS.—Three shaded lamps, with switches on the lamp assemblies, are installed as follows: one over the radio table, one on the upper left sidewall above the liaison transmitter, and one over the navigator's table.

d. MISCELLANEOUS LIGHTS.

(1) A type A-6 hooded lamp and control switch are mounted beside the drift recorder.

(2) A type C-3 portable signal lamp and its supporting bracket is attached to the back side of the pilot's seat frame. The lamp may be plugged in at the 24-volt outlet on any of the suit heater receptacles.

e. SPARE LAMPS.—Spare lamps are carried in each compartment of the airplane, either in boxes with hinged covers or included in the fuse shields. In the pilots' compartment two extra fluorescent lamps are carried behind the central control panel or behind the copilot's seat. Spare lamps for the bomb load indicator are carried in the indicator panel behind the removable cover.

3. EXTERIOR LIGHTING.

a. LANDING LIGHTS.—Two landing lights, one in the nose of each wing, outboard of each outboard nacelle, are controlled by a relay in each outboard nacelle junction shield. The relays are controlled by switches on the central control panel. Hinged access doors are installed in the wings above the lights.

b. PASSING LIGHT.—A passing light with red lens is installed in the same aperture with the left landing light. The control switch is on the pilot's control panel.

c. FORMATION LIGHTS.—Seven body formation lights are installed, three on the center line



of the top of the fuselage and two on the upper surface of each horizontal stabilizer. They are controlled by a rheostat on the pilot's control panel, which has an "OFF" position.

d. POSITION LIGHTS.—Type A-8 position lights are installed on each wing tip and on each side of the upper section of the vertical stabilizer. Position lights on the left wing tip have red lenses, those on the right wing tip have green lenses. The tail position lights are white. Some B-17G airplanes have two position lights on each wing tip, one on the upper surface and one on the lower surface. Later B-17G airplanes have one position light only at the extreme tip of each wing. The position lights are controlled by two AN3018 single-pole, double-throw switches. The switches have "OFF", "DIM" and "BRIGHT" positions. One switch controls the wing tip lights, the other controls the tail position lights.

e. RECOGNITION LIGHTS.

(1) A white identification light is installed at the forward end of the dorsal fin. Three lights, red, green, and amber, approximately 15 inches apart, are installed along the bottom of the fuselage to the rear of the ball turret. Four type B-9 control switches and one keying switch (40A5553) are located on the central control panel.

(2) Some airplanes have a white light on the top and only one white light on the bottom of the fuselage. One type B-1B, one type B-5A, and one keying switch (40A5553) on the central control panel operate the lights on these airplanes.

(o) WARNING SIGNAL SYSTEM.

**Note**

The vacuum, hydraulic pressure, marker beacon, and bomber call warning lights on the pilot's instrument panel, and the pilot call warning light on the bombardier's instrument panel are the "Salt and Pepper" type lights (AC Drawing 42B3593) which may be dimmed for night flying by rotating the lens. The light must be turned on full for daylight operation.

1. LANDING GEAR DOWN.—The green "LANDING GEAR DOWN" lamp on the instrument panel is controlled by the landing gear indicator relay on station 4 fuse panel. The relay operating coil is in series with the landing gear warning switches and the circuit to the lamp is closed only when all landing gear is down.

2. TAIL WHEEL LOCK.—The red "TAIL WHEEL LOCK" lamp on the instrument panel is controlled by a micro "RRS" switch which is operated by the tail wheel locking pin. The lamp is off when the wheel is locked.

3. BOMB WARNING LAMPS.—The amber bomb rack indicator lamps on the bombardier's panel are connected together on one side and to the three-volt tap on the transformer through a type G rheostat on the bombardier's control panel. The other terminals

of the lamps are individually grounded through switches in the release units on the bomb racks. The switches close the circuit when the station is cocked and open the circuit when the bomb is released. Two amber external bomb indicator lights are located beside the four rack selector switches on the bombardier's panel and are connected in the same manner as the internal bomb indicator lights.

4. PHONE CALL.—One B-5A switch on the pilot's control panel controls 24-volt DC power to four amber phone call lamps, one on the bombardier's control panel, one above the radio table, one at lower gunner's interphone set (station 6-E), and one at the tail gunner's interphone set at station 11 to station 11-C (upper left side).

5. PILOT CALL.—A B-6B switch on the bombardier's control panel controls power from the three-volt tap on the transformer to an amber signal lamp on the pilot's instrument panel.

6. BOMBARDIER CALL.—A B-6B switch on the pilot's control panel controls power from the warning signals circuit to a three-volt amber "call" lamp on the bombardier's panel.

7. VACUUM WARNING.—A red vacuum warning lamp on the lower left portion of the instrument panel is controlled by a vacuum warning switch attached to the vacuum line on the forward side of the instrument panel. The switch closes when the vacuum is less than  $3.00 + .50 - .00$  inches Hg.

8. HYDRAULIC PRESSURE WARNING.—An amber warning lamp on the pilot's instrument panel is lighted by the Starbird pressure switch when the pressure in the service hydraulic system falls below 525 pounds per square inch.

9. OXYGEN WARNING LAMPS.—An amber warning lamp (T-3¼, 28-volt, single contact, bayonet base) is located on the A-12 oxygen system instrument panel at each of the thirteen stations except the tail gunner's which, on some airplanes is above his rear windshield. A type G-1 oxygen pressure warning switch for each of the four separate oxygen systems turns on all the lights of that system when the oxygen pressure drops below  $100 \pm 5$  lbs./per sq. in. The lamps are provided with a rotating lens cap to limit the intensity of the light.

10. ALARM BELLS.—A type B-5A switch on the pilot's control panel controls three emergency alarm bells, one under the navigator's table, one above the radio table, and one in the lower gunner's compartment at station 7-A.

(p) CAMERA.

1. POWER SUPPLY.—A receptacle for camera power is installed on right side of the camera pit.

(q) SUIT HEATERS.—Ten suit heater receptacles provide regular 26-volt direct current at the following stations: bombardier, navigator, pilot, copilot, top gunner, radio compartment (two stations), left and right side gunners, and tail gunner. The heat output

**RESTRICTED**  
**AN 01-20EG-2**

(4) CIRCUITS, DIAGRAMS, TABLES, AND CHARTS.

55-7332 Electrical Equipment Installation  
Sheet 1, Fuselage  
Sheet 2, Wings  
Sheet 3, Material List  
(including conduit)

Blueprints of the master wiring diagrams and the individual circuit diagrams, complete and up to date for the airplane in which they are installed, are contained in a box on the back of the copilot's seat.

Due to frequency of minor changes, the electrical wiring diagrams, equipment, and wire tables in this Handbook will not be kept up to date. For specific information the blueprint wiring diagrams in the airplane *must* be consulted.





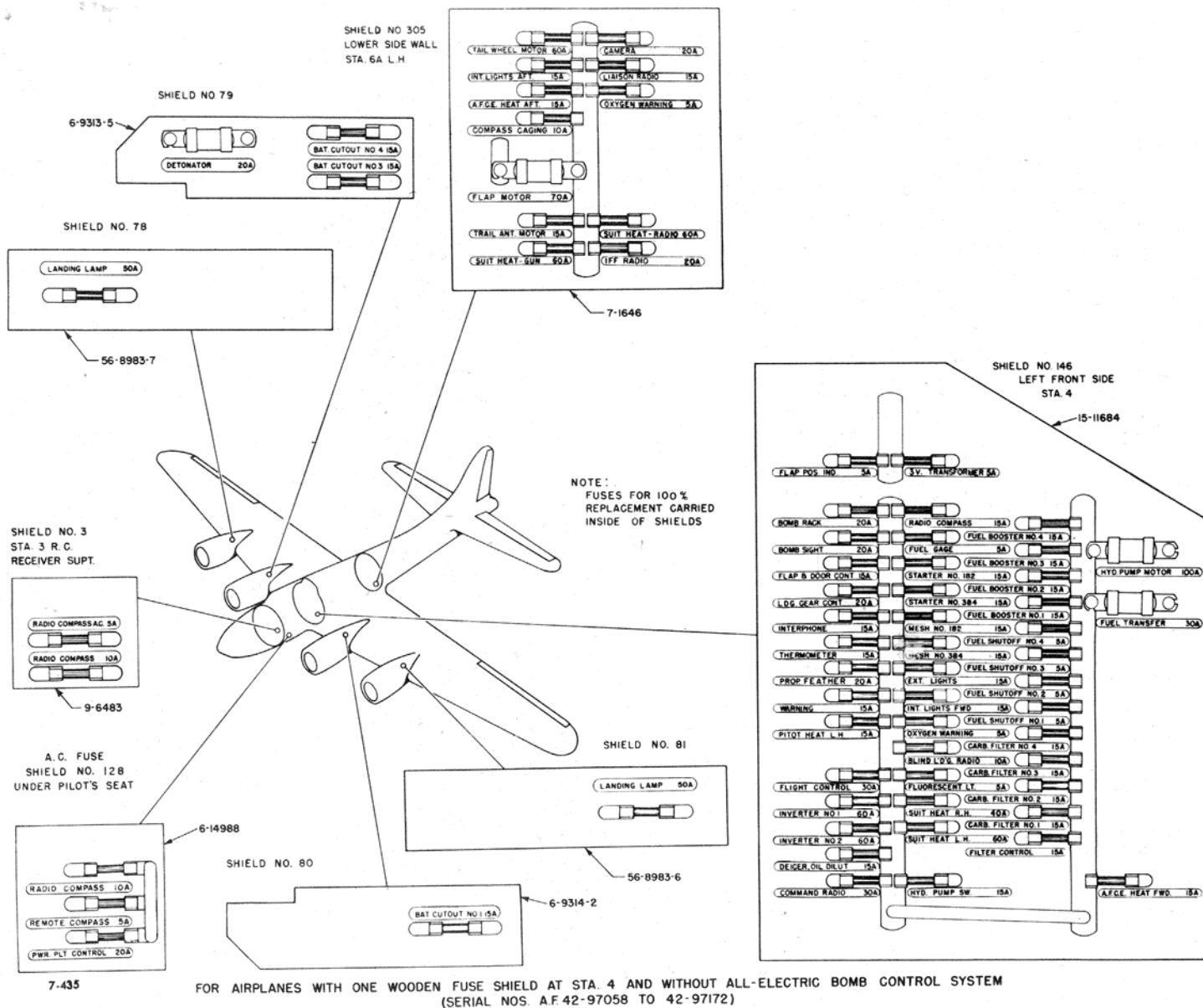


Figure 312—Fuse Location Diagram

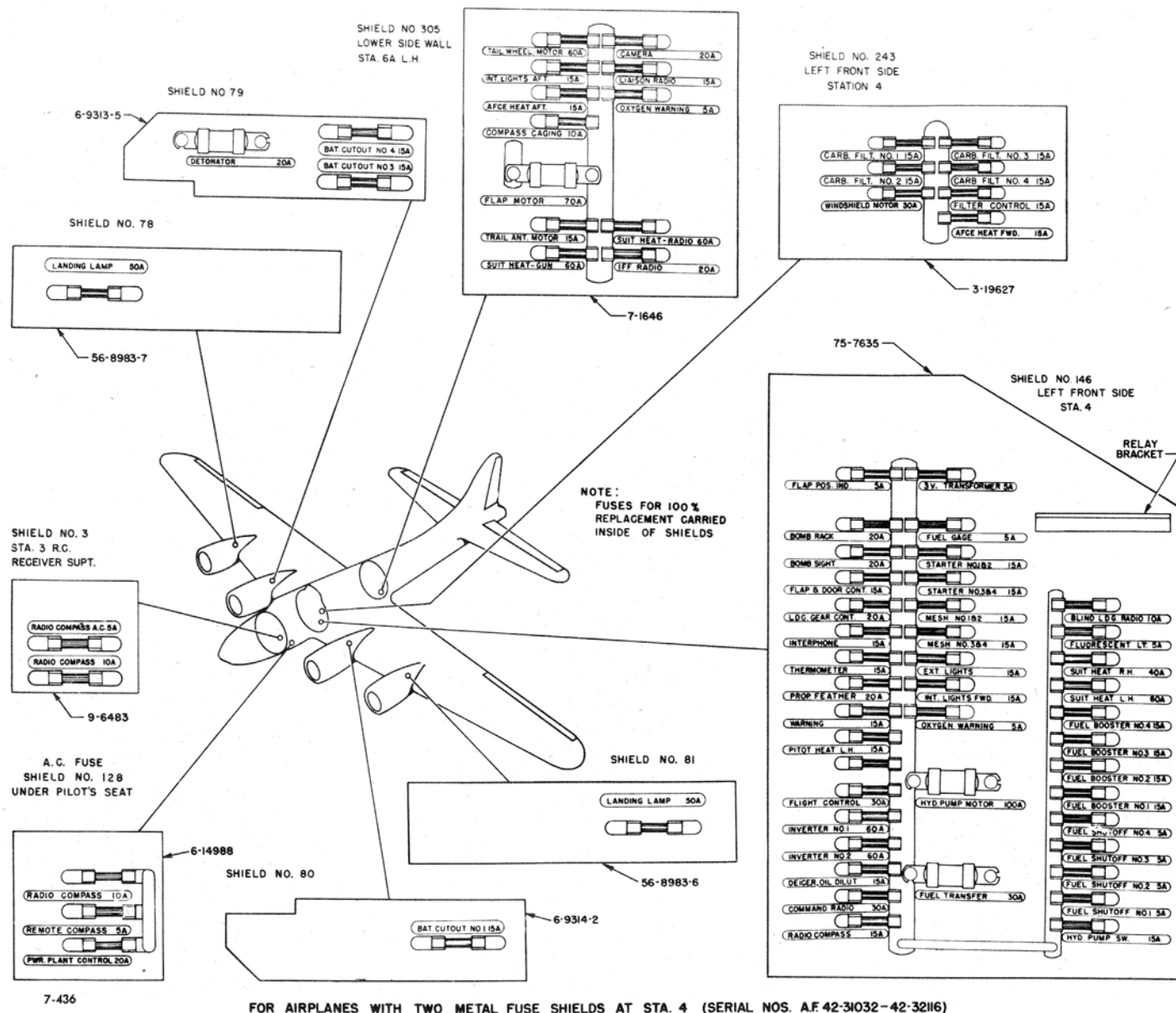
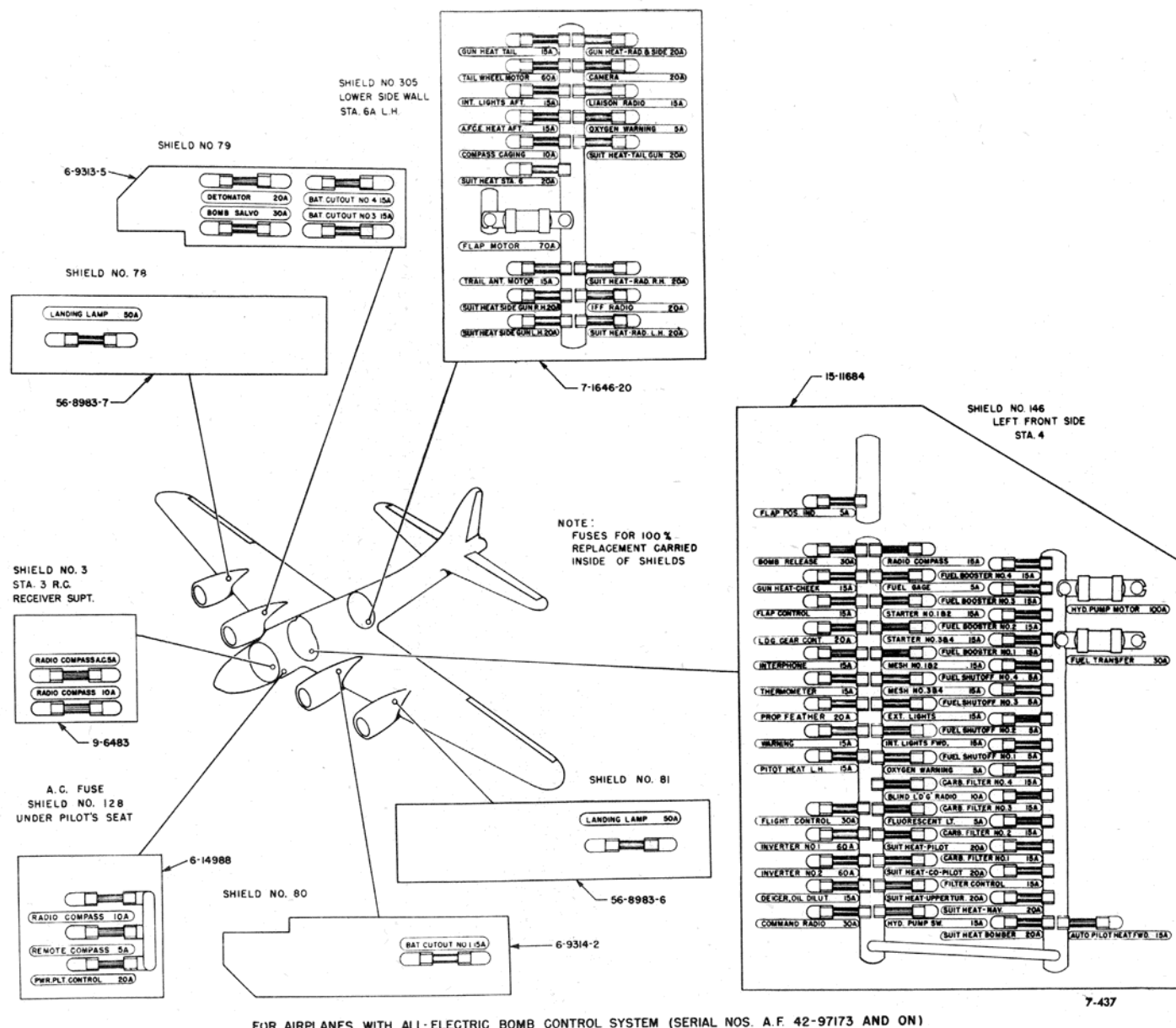
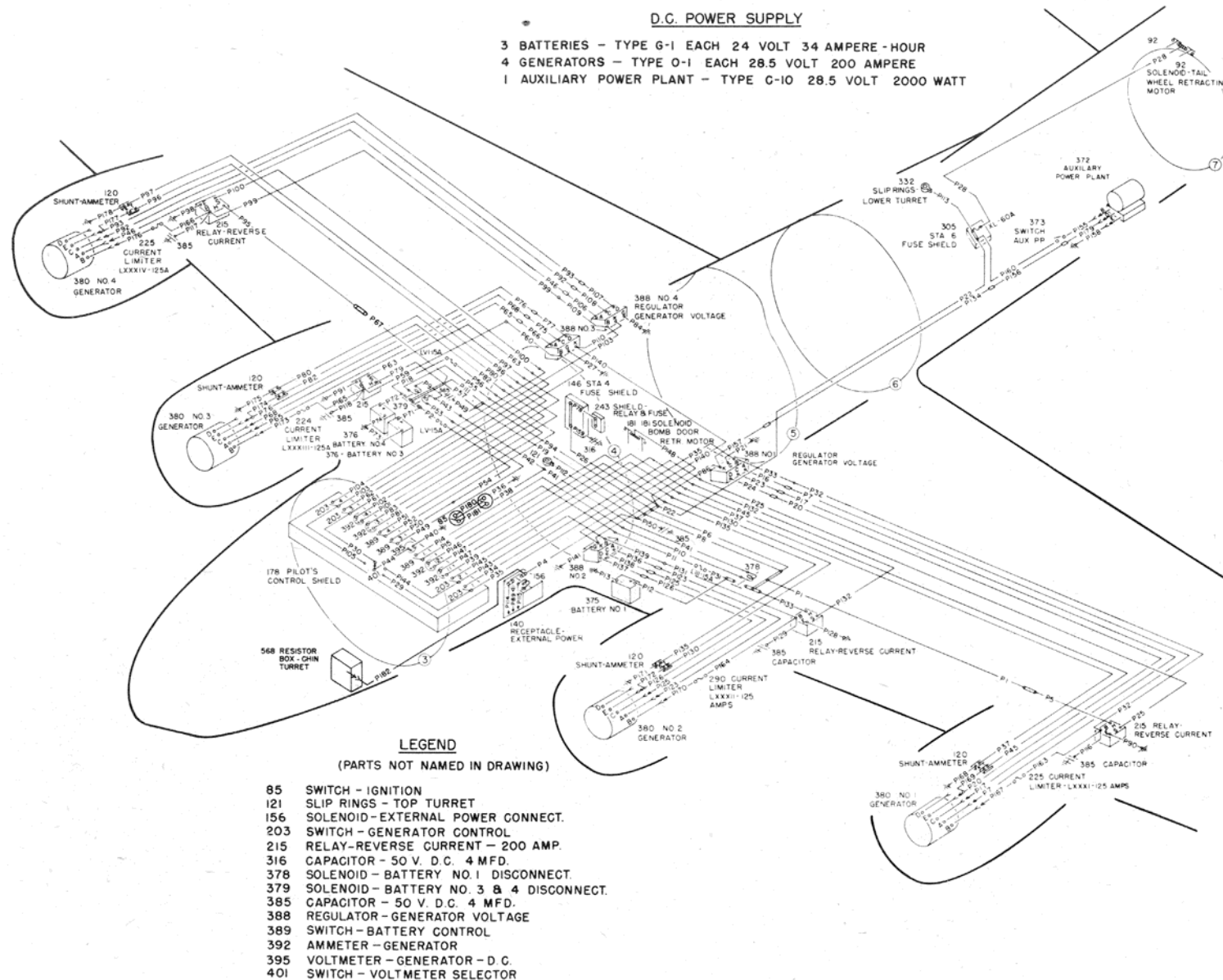


Figure 313—Fuse Location Diagram





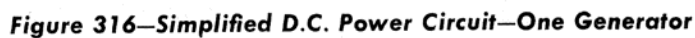
**Figure 314—Fuse Location Diagram**



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Figure 315—D.C. Power Circuit (P)







**Figure 318—Retracting Motors Circuit (R)**



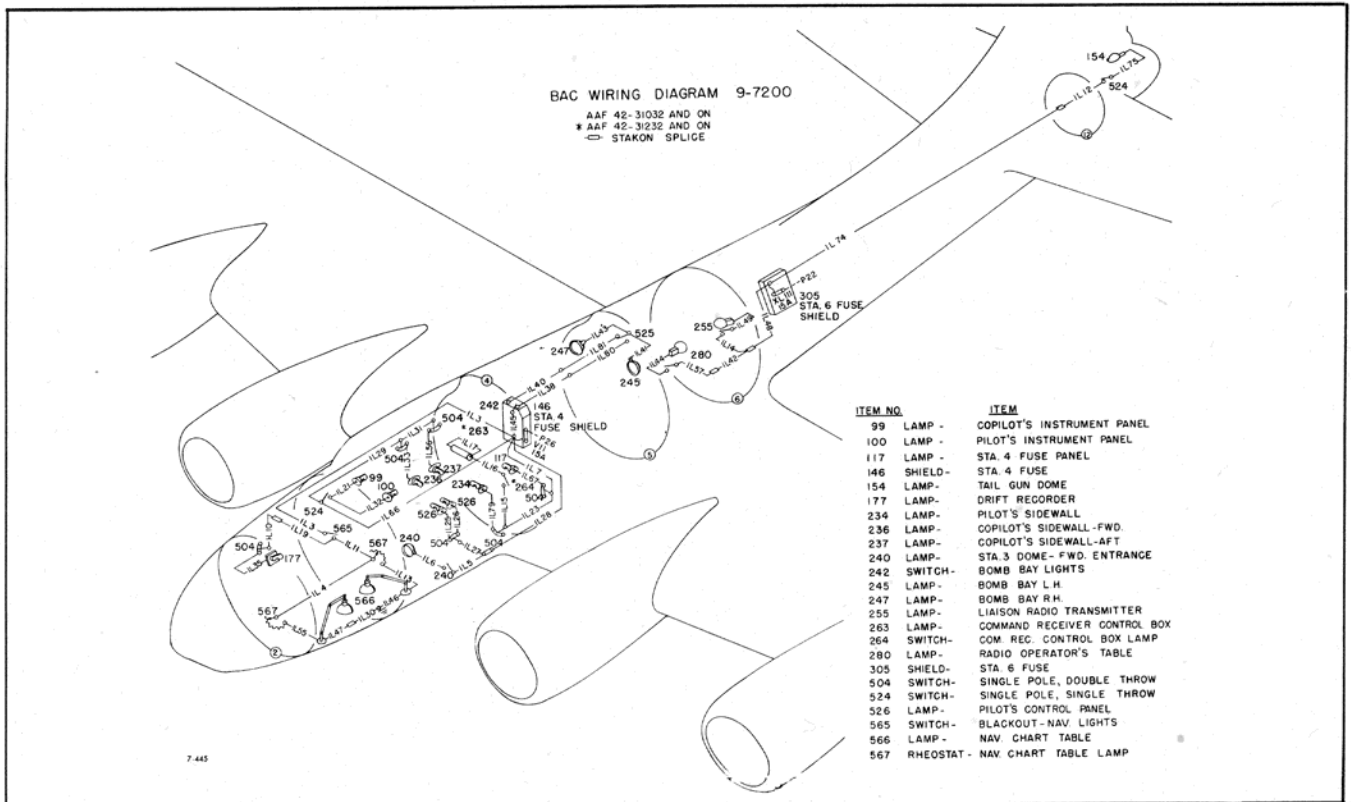


Figure 319—Interior Lighting Circuit (IL)

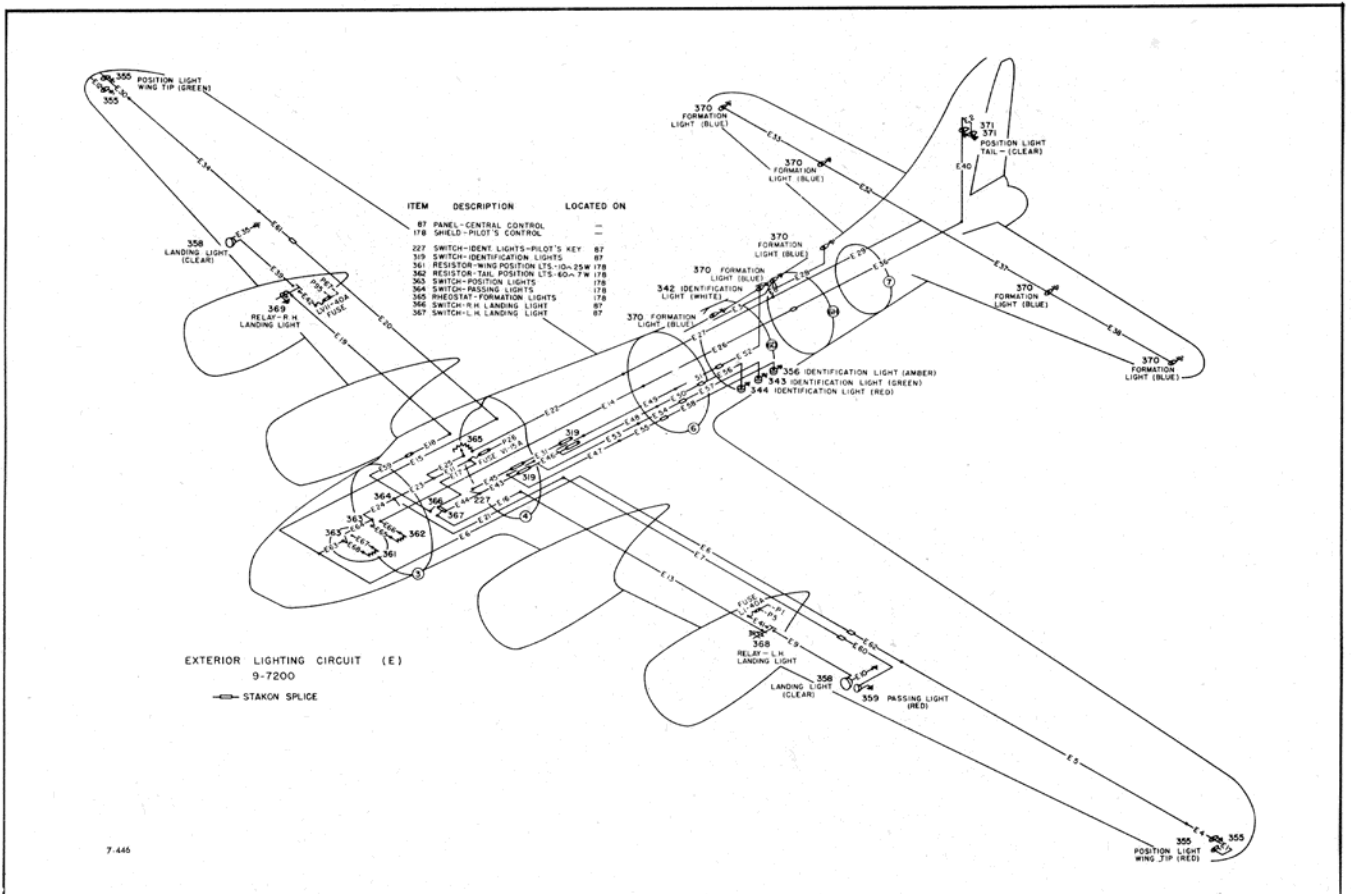
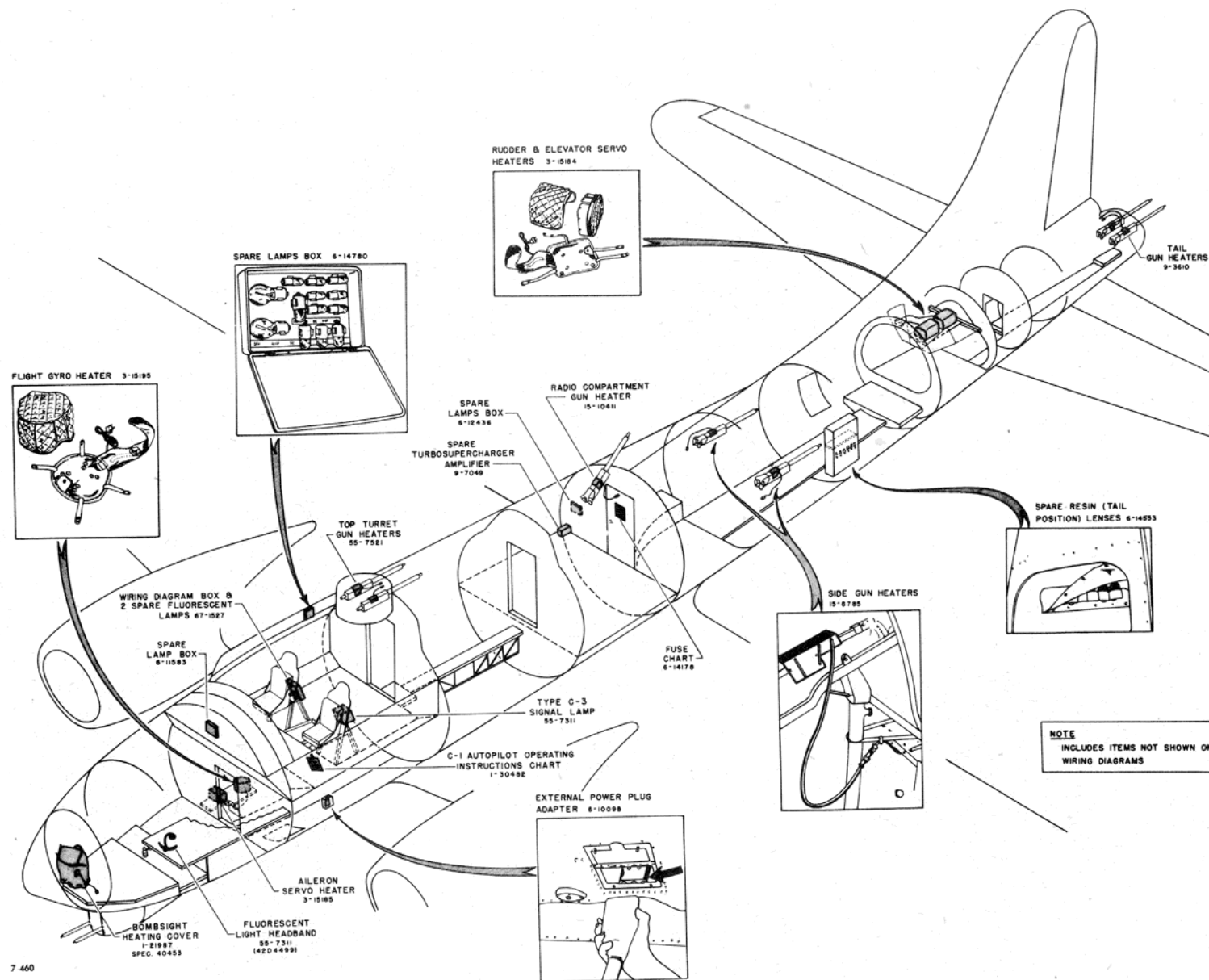


Figure 320—Exterior Lighting Circuit (E)



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Figure 321—Miscellaneous Electrical Equipment



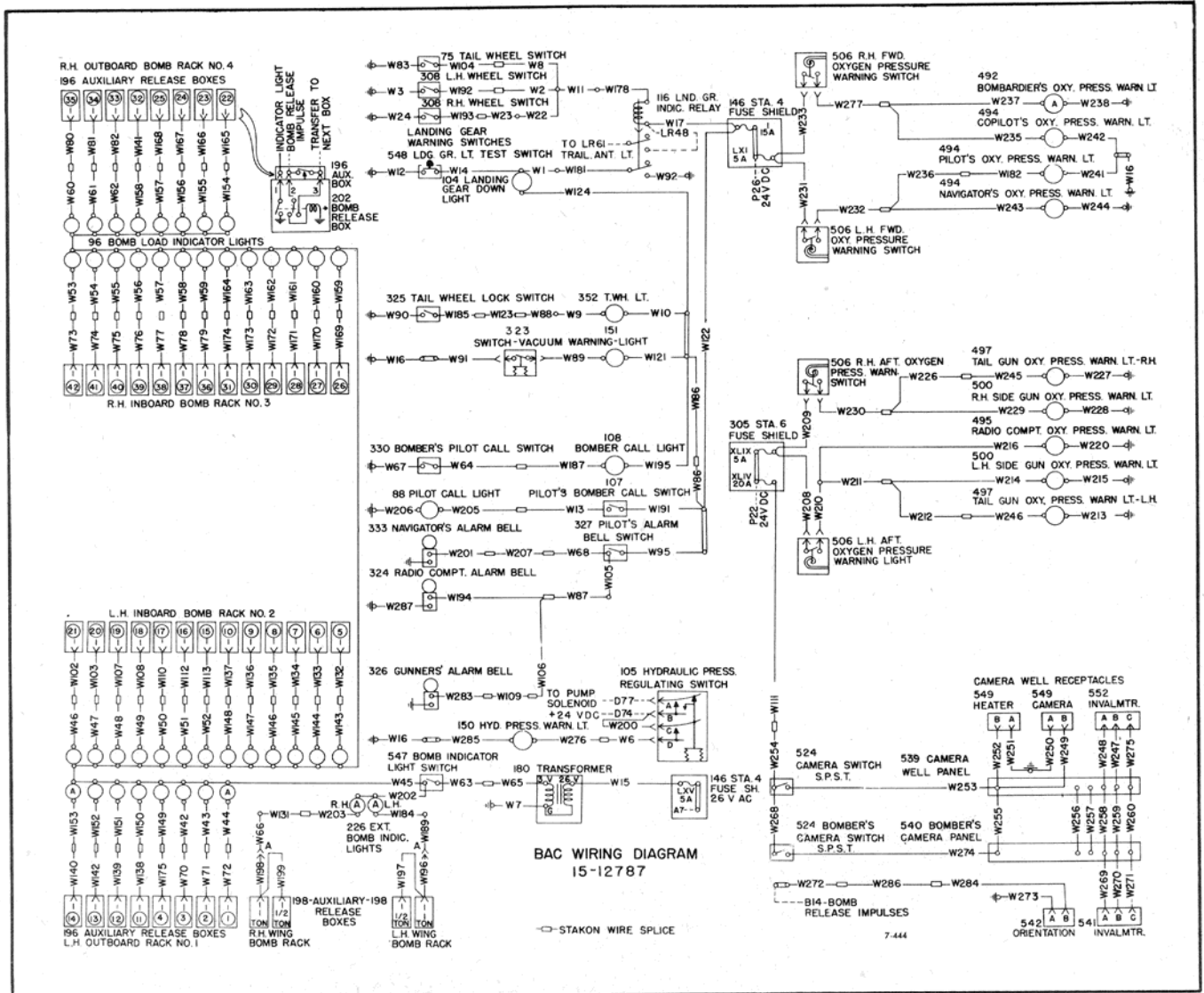


Figure 322—Warning Signals Circuit (W)

LIST OF ELECTRICAL EQUIPMENT

Ref. No.	Description	Type	Part No.	Inst. Dwg.
61	Magneto	Bosch	SF9LU3	65-7359
62	Plug—Fuel Booster Pump	PB	AN3108-12-5S	55-7332
63	Plug—Low Tension Ignition	PA	AN3106-20-6S	55-7332
64*	Resistor—Bomb Ind. Lights	Ohmite	0700A	55-7351
65*	Switch—Bomb Ind. Lights	Mallory	TLS-26	6-12609
66	Pump—Fuel Booster Inboard	TFD12000	6-8955-7	55-7332
67	Pump—Fuel Booster Outboard	TFD12000	6-8955-7	55-7332
68*	Switch—Bomb Ind. Lights Test	Cutler-Hammer	8715	6-12609
69	Rcpt—Low Tension Ignition—Outbd.	RB	AN3102-20-6P	9-6602
70*	Switch—Bomb Salvo—Bombers	C-1	39A2511	6-12609
71	Angle—Starter Conn.—Outbd.	BAC	3-20783	46-8335
72*	Lamp—Bombers Bomb Salvo—Red	Drake	275	6-12609
73	Shield—Ignition Junction—RH	BAC	41-9981-1	54-1946-1
74	Shield—Ignition Junction—LH	BAC	41-9981-1	54-1946
75	Switch—Tail Gear Warning	Micro	WZ-R31	6-13928

\*Used only on airplanes with all-electric bomb control system

\*\*Not used on airplanes with all-electric bomb control system

LIST OF ELECTRICAL EQUIPMENT (Cont.)

Ref. No.	Description	Type	Part No.	Inst. Dwg.
76	Shield Ignition Wing Junction—RH	BAC	21-8364-4	6-7889-1
77	Shield Ignition Wing Junction—LH	BAC	21-8364-4	6-7889
78	Shield—No. 4—Nacelle Junction	BAC	6-7538	58-1215-1
79	Shield—No. 3—Nacelle Junction	BAC	9-4649-12	15-9270-1
80	Shield—No. 2—Nacelle Junction	BAC	9-4649	15-9270
81	Shield—No. 1—Nacelle Junction	BAC	6-7538	58-1215
82	Shield—Wing Junction—RH	BAC	6-9325	14-2072-1
83	Shield—Wing Junction—LH	BAC	6-9325	14-2072
84	Plug—Generator (No. 2, No. 3, No. 4)	PB	AN3108-32-1S	6-11997
85	Switch—Ignition	B-5	Briggs & Stratton 85788	7-1961
86	Shield—Ignition Switch	BAC	15-7382-2	15-7382
87	Panel—Central Control	BAC	7-1961	15-7382
88	Lamp Pilot Call—Amber	39A 3906-2	40A7419	55-7352
89**	Sector Panel			
90*	Shield—Bomb Salvo Relays	BAC	6-7625	15-13871
91	Lamp Assy.—Filter Control—Green	T-3¼ Clear	42B3593-3	59-1847
92	Solenoid—Tail Gr. Retr. Motor	D-1	Spec. 94-32181	6-9474
93*	Relay—Salvo Ext. & Int. Bombs	Guardian	34464	15-13871
94*	Relay—Bomb Salvo Light	Square D	A631	15-13871
95	Release—Interval	B-3	Spec. 93-24717	6-9216
96	Lamp—Bomb Indicator	39A 3906-2	40A7419	55-7351
97**	Panel—Bombers	BAC	56-7194	84-1611
98**	Lamp—Bomb Release (Amber)	T-3¼ Clear	42B3593-2	84-1611
99	Lamp—Co-Pilot Panel	T-4½ Clear	38A1762	6-11572
100	Lamp—Pilot Panel	T-4½ Clear	38A1762	6-11572
101	Indicator—Pilots Air Therm.		AN-5790-6	65-7380
102	Switch—Bomb Salvo—Pilot	C-1	39A2511	9-6073
103	Lamp—Bomber Call	T-3¼ Clear	42B3593-2	65-7380
104	Lamp—Landing Gear Down	T-3¼ Clear	42B3593-2	65-7380
105	Switch—Oil Pressure Regulating	.....	3-14685-1	15-7989
106	Plug Interval Release	PA	AN3106-14S-7S	55-7332
107	Switch—Bombers Call	B-6B	AN3016	14-3281
108	Lamp—Pilots Compass Fluor.	C-5	1-22746	6-11567
109**	Capacitor—Windshield Wipe Motor	Mallory 4 MFD	CA275X	15-9761
110	Lamp—Bombers Instr. Fluor.	C-5	1-22746	6-11312
111	Lamp Assy.—Filter Control—Amber	T-3¼ Clear	42B3593-2	59-1847
112	Inverter—26/115V.-400—LH	Spec. 32270	8-1280-2	8-1280
113	Inverter—26/115V.-400—RH	Spec. 32270	8-1280-2	8-1280-1
114	Capacitor—Fuel Booster	Mallory 1 MFD	A-205019 Part No. 8	6-8955
115*	Lamp—Pilots Bomb Salvo—Red	Drake	275	9-6073
116	Relay Landing Gear Indicator	ZQA	SC-C-324-D	55-7538
117	Bracket—Sta. 4 Fuse Panel Lt.	BAC	3-19022	6-13137

\*Used only on airplanes with all-electric bomb control system

\*\*Not used on airplanes with all-electric bomb control system



LIST OF ELECTRICAL EQUIPMENT (Cont.)

Ref. No.	Description	Type	Part No.	Inst. Dwg.
118	Switch—Fuel Booster Pump	B-5A	AN3015	7-1961
120	Shunt—Ammeter—50 MV-300 Amp.	.....	Spec. 94-32204	.....
121	Turret—Top Gun	Sperry	645473E	55-7521
122*	Release—Interval	B-2A	Spec. 93-24630	55-7351
123	Bulb—Air Temp. Therm.—RH	.....	AN5525-1	6-9402-1
124	Switch—Fuel Trans. Lock—LH	Micro	YZ-R31	9-3663
125	Switch—Fuel Trans. Lock—RH	Micro	YZ-R31	9-3663-1
126	Switch—Fuel Trans. Starting	B-9A	AN3018	6-9450
127	Switch—Fuel Trans. Reverse	C-9A	310594 Navy	6-9450
128	AC Fuse Shield	BAC	6-10492	6-10493
129	Switch—Hydraulic Pump	B-6B	AN3016	14-3281
130	Angle—Gen. Conn. (Nac. No. 3)	BAC	3-19867-1	6-11447
131	Angle—Gen. Conn. (Nac. No. 1)	BAC	3-19867	6-11445
132	Angle—Gen. Conn. (Nac. No. 4)	BAC	3-19867	55-8535
133	Capacitor (Fuel Transfer)	Mallory 4 MFD	CA275X	3-14080
134**	Panel—Sta. 9 Junction	BAC	1-17244	1-17565-1
135	Plug—Oil Pressure Switch	PA	AN3106-18-4S	55-7332
136	Plug—Prop. Anti-icer Pump	PA	AN3106-12-5S	
137	Pump—Fuel Transfer	REMCO RG-4430-2	1-18708	9-3668
138	Sh—Generator Wing Br.—LH	BAC	41-9981-1	6-9509
139	Sh—Generator Wing Br.—RH	BAC	41-9981-1	6-9509-1
140	Receptacle—Ext. Power		6-10098	55-7332
141	Relay Assy.—Rack Selector	Mallory RS-2	B-134045	9-5877
142	Plug—Relay Rack Selector	PA	AN3106-22-20S	55-7332
143	Fuel Quantity Indicator	Liquidometer BA-47W9C	3-14211	65-7380
144	Panel—Bomber's Control	BAC		55-7351
145*	Switch—Bomb Door Control—Pilots	B-11	AN3019	9-6073
146	Shield—Sta. 4 Fuse	BAC	54-2079	55-7538-404
147	Plug—Fuel Quantity Tank Units	PA	AN3106-14S-1S	
148	Voltmeter—Autosyn	Weston 5-15172	Model 517	65-7380
149	Control Box—Pilot's A.F.C.E.	Minn. Honeywell	XC-24755	14-3002-0
150	Lamp—Oil Pres. Main Sys.—Warn.	T-3 1/4	42B3593-1	65-7380
151	Lamp—Vacuum Warning	T-3 1/4	42B3593-1	65-7380
152	Flight Control "J" Box	BAC	9-6617	14-3006
153	Plug—P.D.I.	PA	AN3106-12S-3S	55-7332
154	Lamp—Tail Gunner's Dome	S8	37B4983	3-15137
155	Plug—External Bomb "J"	PA	AN3106-16S-8P	15-9774
156	Solenoid—Ext. Pwr. Pl. Connect	B-4	Spec. 94-32324	15-7985
157*	Shield—Pilots Bomb Control	BAC	41-9981	9-6073
158	Relay—Filter Control	Leach 2028	3-16974	6-12625
159	Pilot Director	D-12	Spec. C-24580-D	65-7380
160	Plug—Fuel Quantity Indicator	PA	AN3106-2D-1S	55-7332
161	Shield—Ext. Pwr. Recept.	BAC	15-7943-1	15-7943
162*	Panel—Crew Salvo	BAC	6-15576	55-7330
163	Plug—Stabilizer Recept.		SK-C16-23-5/8 AC	55-7332
164*	Switch—Bomb Salvo—Crew	C-1	39A2511	6-15200

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LIST OF ELECTRICAL EQUIPMENT (Cont.)

Ref. No.	Description	Type	Part No.	Inst. Dwg.
165	Motor Assy. Filter Control	Barber Colman Aylc 5091	3-16943	15-9784
166	Rotary Converter	Minn. Honeywell	G1025A3CA2	3-15185
167	Plug—Motor Filter Control	PA	AN3106-18-4S	55-7332
168	Plug Converter	PA	AN3106-14S-5S	55-7332
169	Recept.—External Bomb "J"	RB	AN3102-16S-8S	6-11942
170	Rheostat Fluorescent Light	C-5	1-22746-1	65-7380
171	Control—Bomb Arming	A-1	Spec. 24753	15-9774
172	Plug—Bomb Arming	PA	AN3106-10S-2S	15-9774
173*	Lamp—Crew Bomb Salvo—Red	Drake	275	6-15200
174	Plug Inverter	PA	AN3106-22-4S	55-7332
175*	Plug—B-2A Interval Release	Cannon	GK-MS-21- $\frac{5}{8}$ AC	55-7332
176	Aux. Control Board	BAC	56-4251-505	59-1847
177	Drift Recorder Light		38A1762	6-13937
178	Shield—Pilot's Control	BAC	54-2358-403	14-3281
179	Lamp—Bomb Rel. Ind.—Pilot	T-3 $\frac{1}{4}$	42B3593-2	65-7380
180**	Transformer Assy. Power Supply	Thordarson T-46914	3-15180	9-4604
181	Bomb Door Solenoid	D-1	Spec. 94-32181	3-19530
182	Switch—Bomb Door Limit	Micro WZ-R31	6-11999-1	65-4127
183*	Switch—Bomb Door Limit	Micro	WZ-RQ41	9-5259
184	Plug—Autosyn	PA	AN3106-14S-2S	55-7332
185	Plug—Fuel Transfer Pump		AN3108-18-4S	9-3668
186*	Switch Inst.—Bomb Door Limit		9-5259	15-13091
187	Switch Inst.—Bomb Rack	B-5A	AN3015	6-14117
188	Plug—Air Therm. Ind.	PA	AN3106-14S-2S	55-7332
189	Plug—Air Therm. Bulb	PA	AN3106-12S-3S	55-7332
191	Switch—Fuel Shut-Off Valve	B-5A	AN3015	7-1961
193	Signal—Formation Bomb Rel.	G-16 $\frac{1}{2}$	37D4865-1	9-3581
194	Signal—Formation Bomb Door	G-16 $\frac{1}{2}$	37D4865-1	9-3581
196	Box—Auxiliary Bomb Release	AX-5	P. R. Mallory B-134002	.....
198	Box—Aux. Bomb Release	Mallory B-134299	AX-7	15-9774
199	Valve—Fuel Shut-off—Inbd.	Electromatic 2660	3-14653	6-10131
200	Valve—Fuel Shut-Off—Outbd.	Electromatic 2660	3-14653	6-10132
201	Plug—Fuel Shut-Off Valve	PA	AN3106-12S-4S	55-7332
202	Releasing Assy.—Bomb	A-2	P. R. Mallory B-134008	.....
203	Switch—Generator Control	B-5A	AN3015	14-3281
208	Plug—Oil Temp. (Nac. 1 & 4)	PA	AN3106-12S-3S	55-7332
209	Lamp—Copilots Fluorescent	C-5	1-22746	G-11315-1
210	Plug—Oil Temp. (Nac. 2 & 3)	PA	AN3108-12S-3S	55-7332
212	Lamp—Fluorescent—Compass	C-5	1-22746	9-5525
213	Lamp—Fluorescent Pilot	C-5	1-22746	6-11315
214	Shield—Generator Relay No. 1 Nac.	BAC	6-8991	7-1958-16
215	Relay—Generator 200 Amp.	.....	Spec. 94-32278	.....
216	Switch—Bomb Door Safety	B-6B	AN3016	3-13374

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LIST OF ELECTRICAL EQUIPMENT (Cont.)

Ref. No.	Description	Type	Part No.	Inst. Dwg.
217	Switch—Bomb Release	B-11	AN3019	3-12921
218	Generator Relay Shield LH No. 2 Nac.	BAC	6-8991	9-4918-6
219	Angle—Gen. Conn. (Nac. No. 2)	BAC	3-19867-1	6-11446
221	Shield—Generator Relay RH No. 3 Nac.	BAC	6-8991	9-4919-9
222	Shield—Generator Relay RH No. 4 Nac.	BAC	6-8991	7-1958-15
223	Sector Panel Connector "X"	PA	AN3106-14S-1S	55-7332
224	Current Limiter Nac. No. 3	Brundy	FLS125	6-13505
225	Current Limiter Nac. No. 1 & 4	Brundy	FLS125	6-13503
226**	Lamp—Bomb Indicator—Ext.	.....	40A7419	6-12609
227	Switch—Pilot Ident. Light Key	Micro	40A5553	7-1961
228	Sector Panel Plug	PA	AN3106-10S-2S	55-7332
229**	Windshield Wipe Motor—Pilots	Acrotorque	D-12364	15-9761
230	Lamp—Bomb Door Signal—Red	T-3¼	42B3593-1	84-1611
231**	Bracket—Bomb Door Lock Sw.	BAC	6-13677	15-10626
232**	Stabilizer Receptacle	.....	.....	.....
234	Shield—Pilot Cockpit Lamp	BAC	41-9981-1	6-13175
235	Lamp—Bomb Arming—Red	T-3¼	42B3593-1	6-12609
		Clear		
236	Panel—Copilot's Cockpit Light Fwd.	A-6	38A1762	6-13180
237	Panel—Copilot's Cockpit Light Aft	A-6	38A1762	6-13175
238	Switch—Turret Disconnect (Lower)	B-16	Spec. 94-32227-B	3-24561
239	Switch—Turret Disconnect (Upper)	B-16	Spec. 94-32227-B	6-16278
240	Lamp—Station 3 Dome	S-8	37B4983	6-11570
242	Switch Sta. 4 Bomb Bay Lts.	B-18	AN3014	55-7538
243**	Box Inst.—Relay & Fuse	BAC	6-12624	6-12625
245	Lamp—Bomb Bay—LH 21 C.P.	S-8	37B4983	3-10826
247	Lamp—Bomb Bay—RH	Clear S-8	37B4983	3-10826-1
248	Motor Deicer Distributor	Eclipse 574-2	1-17360	49-3133
249	Lamp—Bomb Door Open—Pilot	T-3¼	42B3593-1	65-7380
		Red		
250	Solenoid—Flap Motor	D-1	Spec. 94-32181	6-14948
251	Pump—Inbd. Prop. Deicer	Eclipse 744-6	1-17359	65-5660
252	Pump—Outbd. Prop. Deicer	Eclipse 744-6	1-17359	65-5660
254	Flight Gyro	Minn. Honeywell	G1021A3CA2	3-15195
255	Lamp—Radio Trans.—21 C.P.	Clear S-8	6-7734-1	56-7758-1
257	Sector Panel Plug—Conn. "Y"	PA	AN3106-16S-1S	55-7332
258	Plug—Amplifier Conn. "X"	PA	AN3106-20-1S	55-7332
259	Plug—Flight Gyro	PA	AN3106-20-1S	55-7332
261	Amplifier—A.F.C.E.	Minn. Honeywell	G1024A2CA2	3-15195
262	Dial Light Comm.—Radio	BAC	6-11564	55-7789
263	Lamp—Dial Light	T-3¼	AN3034-2	6-11564-6
264	Switch Comm. Radio Dial Light		AN3021-6	6-11564
265	Plug—Glide Bombing		AN3106-12S-4S	55-7332
266	Plug—Prop. Press Co. Switch	PB	AN3106-12S-4S	55-7332
267	Sw. Inst.—Tail Wheel Center	Micro	6-9356-2	6-9356

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LIST OF ELECTRICAL EQUIPMENT (Cont.)

Ref. No.	Description	Type	Part No.	Inst. Dwg.
268**	Plug—Windshield Wipe Motor	PA	AN3108-12S-4S	55-7332
269	Shield—Tailwheel Lock Switch	BAC	3-13371	6-9355
272**	Panel Inst.—Bomber Oxygen	BAC	3-19876	7-2014
273	Shield—Gen. Volt Regulator	BAC	14-2870	15-7985
277	Motor—Tailwheel Retracting	Eclipse 1227	1-17361	55-7622
279	Amplifier Plug Connector "Y"	PA	AN3106-20-1S	55-7332
280	Lamp—Radio Table	S-8	6-7734	56-7758
282	Fluor. Light Rheostat—Compass	C-5	1-22746-1	6-11567
283	Amplifier Plug Connector "Z"	PA	AN3106-16S-1S	55-7332
284	Panel—Rear Wing Junction	BAC	3-13370	3-13626
286	Bulb—Carb. Temp. Therm. (Outbd.)		AN5525-2	55-7332
287	Bulb—Carb. Temp. Therm. (Inbd.)		AN5525-2	55-7332
288	Indicator—Carb. Temp. LH		ANAN5795-6	65-7380
289	Indicator—Carb. Temp. RH		ANAN5795-6	65-7380
290	Current Limiter No. 2 Nac.	Brundy	FLS125	6-13504
291	Plug—Carb. Temp. Bulb	PA	AN3108-12S-3S	55-7332
292	Plug—Carb. Air Temp. Indicator	PA	AN3106-14S-5S	55-7332
294	Heater—Pitot—LH	G-2	Spec. 27389	9-6784
295*	Plug—Vacuum Warning SW	PA	AN3106-12S-3S	55-7332
296	Rheostat Prop. Deicer Cont. I. B.	567-1 Eclipse	1-17359-1	6-7899-2
297	Rheostat Prop. Deicer Cont. O.B.	567-1 Eclipse	1-17359-1	6-7899-2
298**	Panel—Pilots Windshield Deicer	BAC	3-19894	6-13656
299	Switch—Deicer Distributor	Eclipse 577-2	41-9748	15-7515
300	Board—Pilots & Copilots Instr.	BAC		65-7380
301	Switch—Prop. Deicer	B-5A	AN3015	6-7899
302	Switch—Pitot Heater	B-5A	AN3015	14-3281
305	Shield—Sta. 6 Fuse	BAC	7-1535	69-3659
306	Switch—Inverter	C-2	39A2512	14-3281
307	Shield—Ldg. Gear Limit Switch	.....	3-11996-15	3-12000-4
308	Switch—Ldg. Gear Warning & Limit	.....	3-11996-15	3-12000-4
309	Shield—Ldg. Gear Limit Switch	.....	3-11996-15	3-11999-2
310	Plug—Generator No. 1	PA	AN3106-92-1S	6-11997
311	Aileron Servo	Minn. Honeywell	G1020A7CA2	3-15185
312	Plug—Aileron Servo	PA	AN3106-16S-1S	55-7332
313	Resistor Card—2-1000	.....	407229B	14-3006
314	Shield—Starter Connector Nac. 2	BAC	3-12106	46-8339
315	Resistor Card—2-300	.....	407220A	14-3006
316	Capacitor—50VDC 4 MFD	Mallory	CA-275X	3-19599
319	Switch—Identification Lights	B-9A	AN3018	7-1961
323	Unit—Vacuum Warning	Pioneer 3112-A	41-9773	65-7590
324	Bell—Signal—Radio Compt.	Edwards	Spec. 50291	46-9346
325	Switch—Tailwheel Lock	Micro RRS	6-9355-1	6-9355
326	Bell—Gunners Alarm	Edwards	Spec. 50291	6-8944
327	Switch—Alarm Bell	B-5A	AN3015	14-3281
330	Switch—Pilot Call	B-6B	AN3016	55-7351
332	Turret—Lower Gun	Sperry	645849J	55-7521
333	Bell—Navigators Alarm	Edwards	Spec. 50291	6-8954

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LIST OF ELECTRICAL EQUIPMENT (Cont.)

Ref. No.	Description	Type	Part No.	Inst. Dwg.
336*	Lamp—Pilots Dome	A-5	37B4983	6-10690
337	Suit Heat Rheostat	Q-1A	Spec. 94-32357	15-8773
340	Shield—Bomb Rack Indicator	BAC	56-7180	55-7351
342	Recog. Lamp—Upper (White)	.....	AN3097-2	6-10437
343	Recog. Lamp—Lower (Green)	.....	AN3096-6	14-3004
344	Recog. Lamp—Lower (Red)	.....	AN3096-5	14-3004
345	Plug—Hyd. Pump Motor	PA	AN3106-14-3S	55-7332
346	Motor—Hyd. Pump	Pesco	7-2077	15-7989
		IE-678		
347	Solenoid—Hyd. Pump Motor	B-4	Spec. 94-32324-A	6-10671
348	Plug—Rudder Servo	PA	AN3106-16S-1S	55-7332
349	Motor—Rudder Servo	Minn.	G1020A17CA2	3-15184
		Honeywell		
350	Motor—Elev. Servo	Minn.	G1020A17CA2	3-15184
		Honeywell		
351	Plug—Elev. Servo	PA	AN3106-16S-1S	55-7332
352	Lamp—Tail Wheel Lock	T-3 1/4	42B3593-1	65-7380
353	Bomber Fluor. Light Rheostat	C-2	1-22746-1	55-7351
354**	Shield—Wing Tip Running Light	BAC	49-1777-409 -410	75-3590
355	Lamp—Wing Tip Running—6 C.P.	A-8	37B4962	49-1777-409 -410
356	Recog. Lamp—Lower (Amber)	.....	AN3096-4	14-3004
357	Junction—Wing Tip	BAC	3-13452	75-3590
358	Lamp—Landing	8"	1-21458	55-7607
359**	Lamp—Passing	B-3	37D-4865	55-7607
360	Panel—Sta. 19 Wing	BAC	41-5123	3-13551
361	Resistor—Position Light 10 25 Watt	Ohmite	0200B	14-3281
		Acker		
362	Resistor—Position Light 60 7 Watt	International	14-3281-2	14-3281
		MW-2		
363	Switch Position Lights	B-9A	AN3018	14-3281
364**	Switch—Passing Lights	B-5A	AN3015	14-3281
365	Rheostat Formation Lights	Ohmite	No. 5543	14-3281
366	Switch—Ldg. Light—RH	B-5A	AN3015	7-1961
367	Switch—Ldg. Light—LH	B-5A	AN3015	7-1961
368	Relay—LH Ldg. Light	Cutler-Hammer	6041H57	58-1215
369	Relay—RH Ldg. Light	Cutler-Hammer	6041H57	58-1215
370	Lamp Assy—Formation	A-8-Blue	37B4962-7	3-12999
371	Lamp Assy—Tail Position	A-8-Clear	37B4962-5	3-12999-1
372**	Auxiliary Power Plant	C-10	Spec. 32313	15-7983
373**	Switch—Aux. Power Plant	Cutler-Hammer	8851	6-14926
374**	Plug—Aux. Power Plant	PA	AN3106-28-5S	55-7332
375	Battery No. 1—LH	G-1	Spec. X-32234	14-1945
376	Battery No. 3 & 4 RH	G-1	Spec. X-32234	14-1945-1
377	Panel Conn.—Prop. Anti-icer	BAC	3-21395-1	55-7332
378	Solenoid—No. 1 Battery Disconn.	Eclipse	Spec. 94-32324	15-9270
		B-4		
379	Solenoid—No. 3 & 4 Battery Disconn.	Eclipse	Spec. 94-32324	15-9270
		B-4		
380	Generator—200 Amp.	P-1	Spec. 95-32275	65-7359
381*	Rcpt. Prop. Press Firewall Outbd.	R-B	AN3102-16S-4S	
382	Plug—Prop. Press Cut-out Firewall	PA	AN3106-16S-4P	55-7332
383	Receptacle-Prop. Press Firewall	R-B	AN3102-16S-4S	

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LIST OF ELECTRICAL EQUIPMENT (Cont.)

Ref. No.	Description	Type	Part No.	Inst. Dwg.
384	Capacitor—200 V.5 MFD	B-1	Spec. 50131-C	.....
385	Capacitor—50 V 4 MFD	Mallory	CA275X	
386	Caging Sw.—Fluxgate Compass		Pioneer QQ-1	6-13919
387	Plug—Caging Sw.	PB	AN3108-14S-2S	15-10429
388	Regulator Gen. Voltage		Spec. X-32277	15-7985
389	Switch—Battery Disconnect	B-5A	AN3015	14-3281
390	Remote Caging Motor		Pioneer CM-2	15-10438
391	Plug—Caging Motor	PB	AN3108-14S-2S	15-10429
392	Ammeter—Generator	E-1	Spec. 94-32173A	14-3281
393	Compass—Gyro Fluxgate		Pioneer 12002	15-10438
394	Plug—Gyro Fluxgate	PB	AN3108-16S-1S	15-10429
395	Voltmeter D.C.	B-1	Spec. 94-32172	14-3281
396	Amplifier—Compass		Pioneer 12003-1	6-13913
397	Plug—Amplifier	PB	AN3108-16S-4S	15-10429
398	Plug—Amplifier	PA	AN3106-16S-1S	15-10429
399	Plug—Amplifier	PA	AN3106-20-1S	15-10429
400	Plug—Amplifier	PA	AN3106-14S-2S	15-10429
401	Switch—Voltmeter Selector	Yaxley	3215J	14-3281
402	Secondary Ind.—Pilot		Pioneer 10061-1E	65-7380
403	Plug—Secondary Indicator	PA	AN3106-14S-2S	15-10429
404**	Sw. Bomb Lock	CH	8218	6-13677
408	Oil Temp.—Res. Bulb		AN5525-2	55-7332
412	Oil Temp.—Res. Bulb		AN5525-2	65-7363
414	Master Ind.—Compass		Pioneer 12001-0	9-5895
415	Plug—Master Ind.	PB	AN3108-20-1S	15-10429
416	Rcpt.—Wing Junct.	RA	AN3100-14S-2P	15-10429
417	Rcpt.—Wing Junct.	RA	AN3100-16S-1P	15-10429
418	Plug—Wing Junct.	PA	AN3106-14S-2S	15-10429
419	Gage—RH Feeder Tank	Liquidometer EA-15-11	3-20681	15-10408
420	Gage—Inbd. Tank Eng. No. 2	EA-15-12	3-20681	15-10408
421	Gage—Main Tank Eng. No. 1	Liquidometer EA-15-10	3-20681	15-10408
422	Gage—Main Tank Eng. No. 4	Liquidometer EA-15-10	3-20681	15-10408
423	Gage—Inbd. Tank Eng. No. 3	EA-15-12	3-20681	15-10408
424	Gage—LH Feeder Tank	EA-15-11	3-20681	15-10408
425	Flap Position Autosyn Trans.	Pioneer	4550-2	6-9214
426**	Sw.—Pilots Windshield Wiper	B-9A	AN3018	6-13656
427**	CCT Brkr. Sw. Pilots Wiper	Klison 20A	C-6363-2-20A	6-13656
428*	Rheostat—Radio Gun Sight	O-1C	Spec. 94-32229D	9-6882
429*	Rheostat—Side Gun Sight	O-1C	Spec. 94-32229D	15-13096
430	Plug—Wing Junct.	PA	AN3106-16S-1S	15-10429
431	Flap Position—Autosyn Ind.	Pioneer	3-13442	65-7380
432*	Plug—N-8A Gunsight	PA	AN3106-10S-2S	9-6882
433*	Plug—N-8A Gunsight	PA	AN3106-10S-2S	15-13096
436	Oil Temp.—No. 3 & 4 Ind.		AN5795-6	65-7380
437	Oil Temp.—No. 1 & 2 Ind.		AN5795-6	65-7380
440	Tachometer—No. 3 & 4 Ind.		AN5530-2	65-7380

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LIST OF ELECTRICAL EQUIPMENT (Cont.)

Ref. No.	Description	Type	Part No.	Inst. Dwg.
441	Tachometer—No. 1 & 2 Ind.		AN5530-2	65-7380
442	Junction Box—Turbo Outbd.	Minn. Honeywell	G1065A-1CA1	9-5898
443	Junction Box—Turbo Inbd.	Minn. Honeywell	G1065A-1CA1	916623
444	Governor—Turbo Outbd.	Minn. Honeywell	G1057A-3CA1	15-11618
445	Governor—Turbo Inbd.	Minn. Honeywell	G1057A-3CA1	15-11662
446	Motor—Waste Gate Nac. 1	Minn. Honeywell	G303A-Y2CA1	15-11667
447	Motor—Waste Gate Nac. 2	Minn. Honeywell	G303A-Y2CA1	14-3704
448	Motor—Waste Gate Nac. 3	Minn. Honeywell	G303A-Y2CA1	14-3706
449	Motor—Waste Gate Nac. 4	Minn. Honeywell	G303A-Y2CA1	15-11671
450	Selector Assy.—Turbo	Minn. Honeywell	6-15229	15-11676
451	Rcpt. Low Tension—Ignition Inbd.	PA	AN3102-20-6P	9-6603
452	Shield—Bomb Release	BAC	3-12023	3-12921
453	Junction Box—Main Turbo	Minn. Honeywell	G1066A-1CA1	6-14768
454	Relay Inst.—Time Delay	BAC	43-11520-402	9-5877
455	Relay—Time Delay (Agastat)	American Gas Accumu- lator	NC-28; 24V	43-11520
457	Rheostat—Copilot Fluor. Light		1-22746-1	59-1847
458	Motor—Ldg. Gear Retracting	Eclipse 1073-2 & 3	6-13174-0 & -1	15-6345
459	Shield—Flap Motor	BAC	53-6388	7-1335-1
460	Motor—Flap	Eclipse	3-12781	7-1335-1
461	Motor—Bomb Door	Eclipse	3-15155	9-2938-1
463	Shield—Flap Limit Switch	BAC	6-8325	49-2631
464	Switch—Ldg. Gear Limit—Up		3-11996-15	3-11999
465*	Switch Ldg. Safety	Micro	WZE7RNTN	15-13885
466	Solenoid—Retracting Motor	D-1	Spec. 94-32181	.....
467	Switch—Flap Limit	Cutler-Hammer	8909-K-520	6-8325
468	Rcpt. Inst.—A.F.C.E. Heat Fwd.	Hubbell	7540	6-14424
469	Rcpt. Inst.—A.F.C.E. Heat Aft	Hubbell	7540	6-14425
470	Switch—Bomb Door Control	Cutler-Hammer	8905-K-618	6-13677
471	Switch—Wing Flap Control	B-14	AN3020	7-1961
472	Switch—Ldg. Gear Control	B-9A	AN3018	7-1961
473	Pressuretrol Inst.—Turbo Outbd.	Minn. Honeywell	G16A-2CA1	15-11619
474	Pressuretrol Inst.—Turbo Inbd.	Minn. Honeywell	G16A-2CA1	15-11604
475	Amplifier Inst.—Turbo (Nac. 2 & 3)	Minn. Honeywell	G403A-1CA1	9-6473
476	Amplifier Inst.—Turbo (Nac. 1 & 4)	Minn. Honeywell	G403A-1CA1	9-6048
477	Plug—Turbo Amplifiers	PB	AN3108-22-24S	15-11177
478	Plug—Waste Gate Motor	PA	AN3106-28-4S	15-11177
479	Plug—Selector Control	PB	AN3108-16S-1S	15-11177

\*Used only on airplanes with all-electric bomb control system

\*\*Not used on airplanes with all-electric bomb control system

LIST OF ELECTRICAL EQUIPMENT (Cont.)

Ref. No.	Description	Type	Part No.	Inst. Dwg.
480	Plug—Pressuretrol	PA	AN3106-14S-1S	15-11177
481	Plug—Turbo Governor	PA	AN3106-16S-1S	15-11177
482	Switch—Tailwheel Limit Down	Micro	WZ-R31	6-13928
483	Switch—Tailwheel Centering	Micro	Type G-R	6-9356
484	Switch—Tailwheel Limit Up	Micro	WZ-R31	3-20754
490	Indicator Thermocouple Temp.	B-11	Spec. 94-27971A	65-7380
491	Thermocouple Unit		AND10200	65-7359 (Ref)
492	Lamp—Bomber Oxy. Pres. Warn.		42B3593-2	7-2014
494	Lamp—Pilots & Copilots Oxy. Supply Warn.		42B3593-2	65-7380
495	Lamp—Radio Comp. Oxy. Pres. Warn.		42B3593-2	6-12633
496	Lamp—Nav. Oxy. Pres. Warn.		42B3593-2	6-13839
497	Lamp—Tailgun Oxy. Pres. Warn.		42B3593-2	6-14518
498	Plug—Thermocouple	PA	AN3106-16-13S	55-7322
499	Receptacle—Thermocouple	RB	AN3102-16-13P	
500	Lamp—Side Gun Oxy. Pres. Warn.		42B3593-2	6-12648
501*	Rcpt.—Starter (Outbd.)	RB	AN3102-24-1S	
502	Starter	G-6	Spec. 95-32304	65-7359
503	Receptacle Starter	RB	AN3102-24-1S	
504	Switch—S.P.D.T.	B-7A	AN3017	
505	Solenoid—Starter	Eclipse B-4	Spec. 94-32324	
506	Signal Assy.—Oxy. Pres.	G-1	Spec. 32376	55-7365
507	Switch—Starter	B-11	AN3019	59-1847
508	Plug—Signal Assy. Oxy. Pres.		AN3106-10SL-4S	55-7332
509	Plug—Starter	PB	AN3108-24-1P	55-7332
510*	Rcpt. Thermocouple (Outbd.)	RB	AN3102-16-13P	
515	Motor—Prop. Feath. Pump	Hamilton Std.	54772-2	15-9470
516	Governor—Prop.	Hamilton Std.	Model 4G8-66C	65-7359
517	Solenoid—Feath. Motor	Eclipse D-1	Spec. 94-32181	.....
518	Switch—Feath. Control	General Electric	65-7380-521	65-7380
520	Solenoid—Oil Dilutor Valve Nac. 2	Air Associates M441-M2	1-17363	43-11714
521	Solenoid—Oil Dilutor Valve Nac. 3	Air Associates M441-M2	1-17363	43-11714-1
524	Switch—S.P.S.T.	B-5A	AN3015	.....
525	Switch—S.P.S.T. Bomb Bay	B-1B	AN3014	6-13372
526	Lamp—Panel	A-6	38A1762	.....
527	Filter—Deicer Dist. Motor	Mallory 4MFD 200V DC	DL-445	49-3133
529	Switch—Oil Dilution Valve	B-6B	AN3016	59-1847
530	Solenoid—Oil Dilution Valve	.....	37D6210	53-11715
533	Plug Gun Heaters Upper Turret	Hubbell	7545	55-7521
534	Rcpt. Gun Heater Upper Turret	J-1	Spec. 24864	55-7521
535	Shield—Starter Conn. Inbd. RH	BAC	3-12106	46-8339
536	Rcpt.—Gun Breech Heater Upper	J-1	Spec. 24864	15-10411

\*Used only on airplanes with all-electric bomb control system

\*\*Not used on airplanes with all-electric bomb control system



LIST OF ELECTRICAL EQUIPMENT (Cont.)

Ref. No.	Description	Type	Part No.	Inst. Dwg.
537	Rcpt. Gun Breech Heater—Side	J-1	Spec. 24864	15-8785
538	Rcpt.—Gun Breech Heater—Rear	J-1	Spec. 24864	9-3610
539	Rcpt. Inst.—Camera Equip.	BAC	6-12851	55-7332
540	Panel—Intervalometer	BAC	9-5502	9-5501
541	Rcpt.—Intervalometer	RB	AN3102-16S-6S	9-5502
542	Rcpt. Orientation	RB	AN3102-14S-9S	9-5502
544	Resistor—Bomb Formation Light	International ET	55-7351-2	55-7351
545	Switch—Bomb Formation Lights	C-2	39A2512	6-12609
546	Lamp Assy. Bomb Formation Ind.	T-3¼ Amber	42B3593-2	6-12609
547**	Switch—Bomb Ind. Lights	B-5A	AN3015	6-12609
548	Switch—Ldg. Test Light	Edward of Hetherington	No. 624 KSGO	65-7380
549	Rcpt.—Camera & Heater Equip.	RB	AN3102-16-11S	6-12851
552	Rcpt.—Intervalometer	RB	AN3102-16S-6P	6-12851
553	Rcpt.—Pitot Heater		AN3115-1	9-6784
554	Plug—Tachometer	PA	AN3106-14S-1S	55-7332
555	Gen. Tachometer		AN5531-2	65-7359
556	Shield—Induction Vibrator Outbd.		9-6602-1	9-6602
557	Induction Vibrator Outbd.	Bosch	VJR24B3	9-6602
558	Induction Vibrator Inbd.	Bosch	VJR24B3	9-6603
559	Shield Induction Vibrator Inbd.		9-6603-1	9-6603
561	Control Inst.—Fluor. Lamp—Nav.		1-22746-1	3-20128
562**	Fluorescent Lamp—Nav.	C-5	1-22746	6-15258
565**	Switch—Blackout Nav.	B-5A	AN3015	3-20228
566	Lamp Inst.—Chart Table	A-11	Spec. 94-32372	6-11489
567	Rheostat—Chart Table Light	C-1	Spec. 94-32009	6-11489
568	Resistor Box—Chin Turret	Bendix	82280	9-6774
569	Plug—Chin Turret Res. Box	PA	AN3106-20-2S	55-7332

ELECTRIC WIRES

Autosyn Wire No.	Size	Autosyn Wire No.	Size	Bomb Control Wire No.	Size
A1 .....	10	A19 .....	20	B6 .....	18
A2 .....	10	A20 .....	20	B7 .....	18
A3 .....	10	A21 .....	20	B8 .....	18
A4 .....	18	A22 .....	20	B9 .....	16
A5 .....	16	A23 .....	22	B10 .....	16
A6 .....	16	A24 .....	22	B11 .....	18
A7 .....	18	A25 .....	22	B12 .....	12
A8 .....	18	A26 .....	22	B13 .....	18
A9 .....	18	A27 .....	22	B14 .....	18
A10 .....	18	A28 .....	22	B15 .....	18
A11 .....	10	A29 .....	20	B16 .....	18
A12 .....	10	<i>Bomb Control</i>		B17 .....	18
A13 .....	10	<i>Wire No.</i>	<i>Size</i>	B18 .....	18
A14 .....	10	B1 .....	16	B19* .....	16
A15 .....	18	B2* .....	18	B20 .....	18
A16 .....	16	B3 .....	18	B21 .....	18
A17 .....	10	B4 .....	18	B22 .....	18
A18 .....	20	B5 .....	18	B23 .....	12

\*Used only on airplanes with all-electric bomb control system

\*\*Not used on airplanes with all-electric bomb control system

**Section IV**  
**Paragraph 7**

**RESTRICTED**  
**AN 01-20EG-2**

**ELECTRIC WIRES (Cont.)**

<i>Bomb Control</i> <i>Wire No.</i>	<i>Size</i>
B24 .....	18
B25 .....	18
B26 .....	18
B27 .....	12
B28* .....	16
B29 .....	18
B30 .....	18
B31 .....	18
B32 .....	16
B33 .....	12
B34 .....	18
B35 .....	18
B36 .....	18
B37 .....	16
B38 .....	18
B39 .....	18
B40 .....	16
B41 .....	12
B42 .....	16
B43 .....	18
B44 .....	18
B45 .....	16
B46* .....	18
B47 .....	18
B48 .....	16
B49* .....	18
B50 .....	18
B51 .....	16
B52 .....	16
B53 .....	12
B54* .....	18
B55* .....	18
B56* .....	18
B57 .....	16
B58* .....	16
B59* .....	18
B60 .....	18
B61 .....	18
B62 .....	18
B63 .....	16
B64 .....	18
B65 .....	18
B66* .....	16
B67* .....	16
B68 .....	16
B69* .....	16
B70* .....	16
B71 .....	16
B72 .....	16
B73 .....	16
B74 .....	16
B75* .....	18
B76* .....	16
B77 .....	16

<i>Bomb Control</i> <i>Wire No.</i>	<i>Size</i>
B78* .....	18
B79* .....	16
B80 .....	16
B81* .....	16
B82* .....	16
B83 .....	12
B84 .....	12
B85 .....	16
B86* .....	18
B87* .....	16
B88 .....	16
B89* .....	18
B90* .....	16
B91 .....	16
B92* .....	18
B93* .....	18
B94 .....	16
B95 .....	18
B96 .....	18
B97 .....	16
B98 .....	16
B99 .....	16
B100 .....	16
B101 .....	16
B102 .....	16
B103 .....	16
B104 .....	16
B105* .....	18
B106* .....	18
B107* .....	18
B108* .....	18
B109* .....	18
B110* .....	18
B111* .....	18
B112* .....	18
B113* .....	18
B114* .....	18
B115 .....	16
B116 .....	16
B117 .....	16
B118 .....	16
B119* .....	18
B120 .....	16
B121 .....	16
B122 .....	16
B123 .....	16
B124* .....	18
B125* .....	18
B126 .....	16
B127 .....	16
B128 .....	16
B129 .....	16
B130 .....	16
B131 .....	16

<i>Bomb Control</i> <i>Wire No.</i>	<i>Size</i>
B132 .....	16
B133 .....	16
B134 .....	16
B135 .....	16
B136* .....	18
B137 .....	16
B138 .....	16
B139 .....	16
B140 .....	16
B141 .....	16
B142* .....	18
B143* .....	16
B144* .....	12
B145* .....	12
B146* .....	12
B147* .....	12
B148* .....	18
B149* .....	18
B150* .....	16
B151* .....	18
B152* .....	16
B153* .....	16
B154* .....	16
B155* .....	18
B156* .....	16
B157* .....	16
B158* .....	16
B159* .....	16
B160* .....	18
B161* .....	18
B162* .....	12
B163* .....	12
B164* .....	12
B165* .....	12
B166* .....	12
B167* .....	18
B168* .....	18
B169* .....	18
B170* .....	12
B171 .....	16
B172 .....	16
B173 .....	16
B174 .....	18
B175 .....	12
B176 .....	16
B177 .....	18
B178 .....	18
B179 .....	16
B180 .....	18
B181* .....	18
B182* .....	18
B183 .....	16
B184 .....	16
B185 .....	16

\*Used only on airplanes with all-electric bomb control system

\*\*Not used on airplanes with all-electric bomb control system



**ELECTRIC WIRES (Cont.)**

<i>Bomb Control</i>	
<i>Wire No.</i>	<i>Size</i>
B186	18
B187**	18
B188	18
B189	16
B190	16
B193**	18
B194**	18
B195*	18
B196*	18
B197*	18
B198*	18
B199*	18
B200*	18
B201*	18
B202*	18
B203*	18
B204*	18
B205*	18
B206*	18
B207*	12
B208*	18
B209*	12
B210*	16
B211*	16
B212*	16
B213*	18
B214*	12
B215*	16
B216*	18
B217*	16
B218*	16
B219*	12
B220*	16
B221*	16
B222*	16
B223*	18
B224*	18
B225*	16
B226*	16
B227*	16
B228*	18
B229*	18
B230*	16
B231*	18
B232*	16
B233*	18
B234*	18
B235*	18
B236*	18
B237*	18
B238*	18
B239*	18
B240*	18
B241*	18

<i>Bomb Control</i>	
<i>Wire No.</i>	<i>Size</i>
B242*	18
B243*	18
B244*	18
B245*	16
B246*	18
B247*	18
B248*	18
B249*	18
B250*	18
B251*	18
B252*	16
B253*	16
B254*	16
B255*	16
B256*	16
B257*	16
B258*	16
B259*	18
B260*	18
B261*	18
B262*	18
B263*	18
B264*	18
B265*	18
B266*	18
B267*	18
B268*	18
B269*	18
B270*	18
B271*	18
B272*	18
B273*	18
B274*	12
B275*	12
B276*	16
B277*	16
B278*	18
B279*	18
B280*	18
B281*	18
B282*	18
B283*	18
B284*	18
B285*	16
B286*	18
B287*	18
B288*	18
B289*	16
B290*	16
B291*	18
B292*	18
B293*	18
B294*	18
B295*	18

<i>Bomb Control</i>	
<i>Wire No.</i>	<i>Size</i>
B296*	16
B297*	16
B298*	16
B299*	12
B300*	18
B301*	18
B302*	18
B303*	18
<i>Compass</i>	
C1	22R
C2	22G
C3	22Y
C4	22G
C5	22Y
C7	22G
C8	22Y
C9	22G
C10	22Y
C12	22Y
C13	22G
C14	22Y
C15	22
C16	22
C17	22
C18	22
C27	18
C28	18
C29	18
C30	18
C31	18
C32	18
C33	18
C34	18
C35	18
C36	22G
C37	22Y
C38	22G
C39	22Y
C40	22R
C41	22G
C42	22Y
C43	22G
C44	22Y
C45	22G
C46	22Y
C47	22R
C48	22G
C49	22Y
C50*	20
C51*	20
C52	18
C53*	20

\*Individually Shielded

\*Used only on airplanes with all-electric bomb control system

\*\*Not used on airplanes with all-electric bomb control system

**ELECTRIC WIRES—Continued**

<i>Deicer Wire No.</i>	<i>Size</i>
D1 .....	18
D2 .....	18
D3 .....	14
D4 .....	18
D5 .....	18
D6 .....	14
D7 .....	18
D8 .....	18
D9 .....	18
D10 .....	18
D11 .....	18
D12 .....	18
D13 .....	18
D14 .....	18
D15 .....	14
D16 .....	18
D17 .....	18
D18 .....	18
D19 .....	18
D20 .....	18
D21 .....	18
D22 .....	14
D23 .....	14
D24 .....	18
D25 .....	18
D26 .....	14

<i>Deicer Wire No.</i>	<i>Size</i>
D27 .....	14
D28 .....	14
D29 .....	18
D30 .....	18
D31 .....	14
D32 .....	20
D33 .....	20
D34 .....	20
D35 .....	20
D36 .....	20
D37 .....	20
D38 .....	20
D39 .....	20
D40 .....	20
D41 .....	20
D42 .....	20
D43 .....	20
D44 .....	18
D45*	
D46*	
D47 .....	14
D48 .....	14
D49 .....	14
D50 .....	14
D51 .....	14
D52 .....	14

<i>Deicer Wire No.</i>	<i>Size</i>
D53 .....	14
D54 .....	14
D55 .....	14
D56 .....	14
D57 .....	14
D58 .....	14
D59 .....	18
D60 .....	18
D61 .....	18
D62 .....	18
D63 .....	18
D64 .....	18
D65 .....	18
D66 .....	18
D67 .....	18
D68 .....	18
D69 .....	18
D70 .....	18
D71 .....	18
D72 .....	16
D73 .....	18
D74 .....	18
D75 .....	6
D76 .....	6
D77 .....	18
D78 .....	10
D79 .....	14
D80 .....	18
D81 .....	18
D82 .....	10
D83 .....	10
D84 .....	10
D85*	18
D86 .....	20
D88 .....	10
D89 .....	10
D90 .....	10
D91 .....	10
D92 .....	20
D93 .....	10
D94 .....	10
D95 .....	10
D96 .....	14
D97 .....	10
D98 .....	14
D99 .....	10
D100 .....	18
D101 .....	10
D102 .....	18
D103 .....	18
D104 .....	18
D105 .....	18
D106 .....	18
D107 .....	18

<i>Deicer Wire No.</i>	<i>Size</i>
D108 .....	18
D109 .....	18
D110 .....	18
D111 .....	18
D112 .....	18
D113 .....	18
D114 .....	18
D115**	14
D117 .....	18
D118 .....	18
D119**	14
D120**	14
D121**	14
D122**	14
D148**	14
D149**	14
D158**	10
D161 .....	10
D162 .....	10
D164 .....	10
D167 .....	18

*Exterior Light*

<i>Wire No.</i>	<i>Size</i>
E1**	20
E2 .....	18
E3 .....	18
E4 .....	18
E5 .....	18
E6 .....	18
E7**	18
E8 .....	18
E9 .....	8
E10 .....	8
E11 .....	18
E12**	20
E13 .....	18
E14 .....	18
E15 .....	18
E16 .....	18
E17 .....	18
E18 .....	18
E19 .....	18
E20 .....	18
E21**	18
E22 .....	18
E23 .....	18
E24**	18
E25 .....	18
E26 .....	18
E27 .....	18
E28 .....	18
E29 .....	18
E30 .....	18
E31 .....	18

\*Used only on airplanes with all-electric bomb control system

\*\*Not used on airplanes with all-electric bomb control system



**ELECTRIC WIRES (Cont.)**

<i>Exterior Light</i> Wire No.	Size
E32 .....	18
E33 .....	20
E34 .....	18
E35 .....	8
E36 .....	18
E37 .....	18
E38 .....	20
E39 .....	8
E40 .....	18
E41 .....	8
E42 .....	8
E43 .....	18
E44 .....	18
E45 .....	18
E46 .....	18
E47 .....	18
E48 .....	18
E49 .....	18
E50 .....	18
E51 .....	18
E52 .....	18
E53 .....	18
E54 .....	18
E55 .....	18
E56 .....	18
E57 .....	18
E58 .....	18
E59 .....	18
E60** .....	18
E61 .....	18
E62 .....	18
E63 .....	18
E64 .....	18
E65 .....	18
E66 .....	18
E67 .....	18
E68 .....	18

<i>Flight Control</i> Wire No.	Size
FL1 .....	20
FL2 .....	20
FL3 .....	20
FL5 .....	20
FL6 .....	20
FL8 .....	14
FL9 .....	16
FL12 .....	20
FL13 .....	20
FL14 .....	20
FL15 .....	20
FL16 .....	20
FL17 .....	20
FL18 .....	20
FL19 .....	14

<i>Flight Control</i> Wire No.	Size
FL22 .....	20
FL23 .....	20
FL24 .....	20
FL25 .....	14
FL26* .....	20
FL27 .....	20
FL28 .....	20
FL29 .....	20
FL30 .....	20
FL31* .....	20
FL32* .....	20
FL34 .....	20
FL35 .....	20
FL36 .....	20
FL37 .....	20
FL38 .....	20
FL39 .....	20
FL41 .....	16
FL42 .....	20
FL43 .....	16
FL44 .....	20
FL45 .....	14
FL46 .....	20
FL49 .....	20
FL50 .....	20
FL51 .....	20
FL52 .....	14
FL53 .....	20
FL54 .....	20
FL55 .....	20
FL56 .....	14
FL57 .....	20
FL58 .....	20
FL59 .....	14
FL60 .....	20
FL61 .....	20
FL62 .....	20
FL63 .....	20
FL64 .....	20
FL65 .....	20
FL66 .....	12
FL67 .....	12
FL69 .....	14
FL70 .....	20
FL71 .....	20
FL72 .....	20
FL73 .....	14
FL74 .....	16
FL75 .....	20
FL76 .....	20
FL77 .....	20
FL78 .....	20
FL79 .....	20
FL80 .....	20

<i>Flight Control</i> Wire No.	Size
FL81 .....	20
FL82 .....	20
FL83 .....	20
FL84 .....	20
FL85 .....	20
FL86* .....	20
FL87* .....	20
FL88 .....	20
FL89 .....	20
FL90 .....	20
FL91 .....	20
FL92 .....	20
FL93 .....	20
FL94 .....	20
FL96 .....	20
FL97 .....	20
FL98 .....	20
FL99 .....	20
FL100 .....	20
FL101 .....	20
FL102 .....	20
FL103 .....	20
FL104 .....	20
FL105 .....	12
FL114 .....	20
FL115 .....	20
FL116 .....	20
FL117 .....	20
FL118 .....	20
FL119 .....	20
FL121 .....	20
FL122 .....	20
FL123 .....	20
FL124 .....	20
FL125 .....	20
FL126 .....	20
FL127 .....	20
FL128 .....	20
FL129 .....	20
FL130 .....	14
FL131 .....	14
FL132 .....	14
FL133 .....	14
FL134 .....	20
FL135 .....	20
FL136 .....	20
FL137 .....	20
FL138 .....	20
FL139 .....	20
FL140 .....	20
FL141 .....	20
FL142 .....	20
FL143 .....	20

\*Used only on airplanes with all-electric bomb control system  
\*\*Not used on airplanes with all-electric bomb control system

\*Individually Shielded

**ELECTRIC WIRES (Cont.)**

*Flight Control*

Wire No.	Size
FL144	20
FL154	20
FL176	20
FL177	14
FL178	20
FL179	20
FL180	14
FL181	20
FL182	14
FL183	14
FL184	14
FL185	14
FL186	20
FL187	20
FL188	20
FL189	20
FL190	20
FL191	20
FL192	20
FL193	20
FL194	20
FL195	20
FL196**	14
FL197**	20
FL198	20
FL210	20
FL211	20
FL212	20
FL213	20
FL214	20
FL217	20
FL218	20
FL219	20
FL220	20
FL229	20
FL230	20
FL235	20
FL236	20

*Ignition*

Wire No.	Size
I3	16
I4	16
I5	18
I7	18
I8	16
I11	16
I12	18
I15	16
I16	16
I18	18
I25	16
I26	16
I27	16
I28	16

*Ignition*

Wire No.	Size
I29	16
I30	16
I31	16
I32	16
I33	16
I34	16
I35	16
I36	16
I37	16
I38	16
I39	16
I40	16
I41	16
I42	16
I43	16
I44	16
I45	16
I46	16
I47	16
I48	16

*Instr. Lighting*

Wire No.	Size
IB1**	Black
IB2**	White
IB3**	18
IB4	18
IB5**	Black
IB6**	White
IB7	Braid
IB10**	Black
IB11**	Black
IB12	18
IB13**	White
IB19**	Black
IB20	18
IB21	18
IB22**	White
IB23**	Braid
IB24**	Braid
IB25**	Braid
IB26**	White
IB27**	Braid
IB28	18
IB29	18
IB30	18
IB31	18
IB32	18
IB33	18
IB34	18
IB35	18
IB36	18
IB37	18
IB38	18
IB39	18

*Instr. Lighting*

Wire No.	Size
IB40	18
IB41	18
IB42**	18
IB43***	White
IB44**	Black
IB45***	Braid

*Interior Lighting*

Wire No.	Size
IL3	18
IL4**	18
IL5	18
IL6	18
IL7	18
IL10	18
IL11	18
IL12	18
IL13**	
IL14	18
IL15	18
IL16	18
IL17	18
IL19	18
IL21	18
IL22	18
IL23	18
IL25	18
IL26	18
IL27	18
IL28	18
IL29	18
IL30**	18
IL31	18
IL32	18
IL33	18
IL35	18
IL38	18
IL40	18
IL41	18
IL42	18
IL43	18
IL44	18
IL45	18
IL46**	
IL4***	
IL48	18
IL49	18
IL50*	18
IL51*	18
IL52*	18
IL53*	18
IL55***	
IL56	18
IL57	18
IL58*	18

\*\*\*Furnished With Equipment

\*Used only on airplanes with all-electric bomb control system

\*\*Not used on airplanes with all-electric bomb control system



Wire No.		Wire Size	Length Resistance		Terminals
			Inches	Ohms	
M-1	I	2-No. 20	53 + 6	.5 ± .05	One end soldered to plug Type PA, AN3106-12S-6S Other end to fit thermocouple, Wright dwg. No. 68326 One end to solder to receptacle, Type RB, AN3102-12S-6P Other end washer type
M-2	C	1-No. 19	— 0		
M-7	I				
M-8	C				
M-9	I	2-No. 20	360 + 36	3.5 ± .05	Washer type at both ends
M-10	C	1-No. 19	— 0		
M-21	I				
M-22	C				
M-11	I	2-No. 20	402 + 40	4 ± .05	Same as M-1, M-2, M-7, M-8
M-12	C	1-No. 19	— 2		
M-15	I				
M-16	C				
M-3	I	1-No. 16	53 + 6	.6 ± .05	One end washer type Other end soldered to receptacle Type RB, AN3102-16S-4P
M-4	C		— 0		
M-5	I				
M-6	C				
M-13	I	1-No. 16	264 + 26	3.4 ± .05	Washer type at both ends
M-14	C		— 0		
M-17	I				
M-18	C				
M-19	I	3-No. 22	246 + 50	4 ± .05	
M-20	C		— 0		
M-23	I				
M-24	C				

I—Iron; C—Constantan

Interior Lighting	
Wire No.	Size
IL59*	18
IL61*	18
IL62*	18
IL63*	18
IL64*	18
IL65*	18
IL66*	18
IL67	18
IL74	18
IL75	18
IL79	18
IL80	18
IL81	18

Engine Instruments	
Wire No.	Size
M27	16
M28	16
M29	16
M33	20
M35*	20
M42	20
M43	20
M44	20
M45	20
M46	20
M47	20
M48	20

Engine Instruments	
Wire No.	Size
M49	20
M50	20
M51	20
M52	20
M53	20
M54	20
M55	20
M56	20
M60	20
M61	20
M62	20
M63	20
M64	20
M65	20
M66	20
M70	20
M72	16
M73	18
M74	18
M75	18
M76	18
M77	18
M78	18
M79	18
M80	18
M81	18
M82	18

Engine Instruments	
Wire No.	Size
M83	18
M84	18
M85	18
M86	18
M87	18
M88	18
M89	18
M90	16
M92	18
M93	18
M94	18
M95	18
M96	18
M97	18
M98	18
M99	18
M100	18
M101	18
M102	18
M103	18
M104	18
M105	18
M106	18
M107	18
M108	18
M110	18
M111	18

\*Used only on airplanes with all-electric bomb control system  
\*\*Not used on airplanes with all-electric bomb control system

\*\*Furnished With Equipment

ELECTRIC WIRES (Cont.)

Engine Instruments

Wire No.	Size
M112 .....	18
M122 .....	20
M123 .....	20
M124 .....	20
M125 .....	20
M126 .....	20
M127 .....	20
M128 .....	20
M129 .....	20
M130 .....	20
M131 .....	20
M132 .....	20
M133 .....	20
M134 .....	20
M135 .....	20
M136 .....	20
M137 .....	20
M138 .....	20
M139 .....	20
M140 .....	20
M141 .....	20
M142 .....	20
M143 .....	20
M144 .....	20
M145 .....	20
M146 .....	20
M147 .....	20
M148 .....	20
M149 .....	20
M150 .....	20
M151 .....	20
M152 .....	20
M153 .....	20
M154 .....	20
M155 .....	20
M156 .....	20
M157 .....	20

D. C. Power

Wire No.	Size
P1 .....	0
P2 .....	18
P3 .....	2
P4 .....	0
P5 .....	0
P6 .....	0
P7 .....	14
P8 .....	0
P9 .....	18
P10 .....	18
P11 .....	18
P12 .....	2
P13 .....	2
P14 .....	18
P15 .....	18

D.C. Power

Wire No.	Size
P16 .....	14
P17 .....	16
P18 .....	18
P19 .....	0
P20 .....	12
P21 .....	16
P22 .....	0
P23 .....	16
P24 .....	12
P25 .....	16
P26 .....	0
P27 .....	16
P28 .....	6
P29 .....	18
P30 .....	18
P31 .....	18
P32 .....	12
P33* .....	12
P34 .....	12
P35 .....	16
P36 .....	16
P37 .....	18
P38 .....	12
P39 .....	18
P40 .....	12
P41 .....	18
P42 .....	18
P43 .....	18
P44 .....	18
P45 .....	18
P46 .....	12
P47 .....	14
P48 .....	12
P49 .....	2
P50 .....	18
P51 .....	18
P52 .....	18
P53 .....	18
P54 .....	18
P55 .....	18
P56 .....	18
P57 .....	0
P59 .....	12
P60 .....	12
P61 .....	16
P62 .....	16
P63 .....	16
P65 .....	14
P66 .....	14
P67 .....	0
P68 .....	16
P71 .....	2
P72 .....	2
P73 .....	2

D. C. Power

Wire No.	Size
P74 .....	2
P75 .....	16
P76 .....	12
P77 .....	12
P78 .....	4
P79 .....	0
P80 .....	12
P81 .....	12
P82 .....	12
P83 .....	12
P84 .....	16
P86 .....	16
P89 .....	2
P90 .....	16
P91 .....	16
P92 .....	16
P93 .....	12
P94 .....	0
P95 .....	0
P96 .....	12
P97 .....	12
P98 .....	16
P99 .....	12
P100 .....	16
P101 .....	12
P102 .....	12
P103 .....	16
P104 .....	16
P105 .....	18
P106 .....	14
P107 .....	12
P108 .....	16
P109 .....	12
P110 .....	16
P111 .....	0
P112 .....	2
P113 .....	2
P114 .....	2
P115 .....	18
P116 .....	20
P117 .....	20
P118 .....	20
P123 .....	14
P125 .....	16
P126 .....	12
P128 .....	16
P129 .....	20
P130 .....	12
P131 .....	12
P132 .....	16
P133 .....	0
P134** .....	14
P135 .....	12
P136 .....	14

\*Used only on airplanes with all-electric bomb control system

\*\*Not used on airplanes with all-electric bomb control system



ELECTRIC WIRES (Cont.)

<i>D. C. Power</i>	
<i>Wire No.</i>	<i>Size</i>
P137	12
P138	16
P139	12
P140	16
P141	16
P143	16
P144	18
P145	16
P146	12
P147	12
P148	2
P149	20
P150	20
P155**	2
P156**	14
P157**	14
P158**	2
P159	16
P160**	2
P163	0
P164	0
P165	0
P166	0
P167	0
P168	2
P169	2
P170	0
P171	2
P172	2
P173	0
P174	2
P175	2
P176	0
P177	2
P178	2
P179**	14
P180	18
P181	18
P182	0
P183	18
<i>P. P. Control</i>	
<i>Wire No.</i>	<i>Size</i>
PC1★	20
PC2	20
PC3	20
PC4★	20
PC5	20
PC6	20
PC7★	20
PC8	20
PC9	20
PC10★	20
PC11	20
PC12	20

<i>P. P. Control</i>	
<i>Wire No.</i>	<i>Size</i>
PC13★	20
PC14	20
PC15	20
PC16★	20
PC17	20
PC18	20
PC19★	20
PC20	20
PC21	20
PC22★	20
PC23	20
PC24	20
PC25	20
PC26★	20
PC27	20
PC28★	20
PC29	20
PC30	20
PC31★	20
PC32	20
PC33★	20
PC34	20
PC35	20
PC36★	20
PC37	20
PC38★	20
PC39	20
PC40	20
PC41★	20
PC42	20
PC43★	20
PC44	20
PC45	20
PC46	20
PC47	20
PC48	20
PC49	20
PC50	20
PC51	20
PC52★	16
PC53	16
PC54	20
PC55★	20
PC56	20
PC57★	20
PC58	20
PC59	20
PC60★	20
PC61	20
PC62★	20
PC63	20
PC64	20
PC65★	20
PC66	20

<i>P. P. Control</i>	
<i>Wire No.</i>	<i>Size</i>
PC67★	20
PC68	20
PC69	20
PC70★	20
PC71	20
PC72★	20
PC73	20
PC74	20
PC75★	20
PC76★	20
PC77	20
PC78	20
PC79★	20
PC80	20
PC81	20
PC82	20
PC83	20
PC84	20
PC85	20
PC86	20
PC87	20
PC88	20
PC89	20
PC90★	20
PC91★	20
PC92	20
PC93	20
PC94★	20
PC95	20
PC96	20
PC97	20
PC98	20
PC99	20
PC100	20
PC101	20
PC102	20
PC103	20
PC104	20
PC105★	20
PC106★	20
PC107	20
PC108	20
PC109★	20
PC110	20
PC111	20
PC112	20
PC113	20
PC114	20
PC115	20
PC116	20
PC117	20
PC118	20
PC119	20

\*Used only on airplanes with all-electric bomb control system  
\*\*Not used on airplanes with all-electric bomb control system

\*Individually Shielded

**ELECTRIC WIRES (Cont.)**

*P. P. Control*

Wire No.	Size
PC120*	20
PC121*	20
PC122	20
PC123	20
PC124*	20
PC125	20
PC126	20
PC127	20
PC128	20
PC129	20
PC130	30
PC131	20
PC132	20
PC133	20
PC134	20
PC135	20
PC136	20
PC137	20
PC138	20
PC139	20
PC140	20
PC141	20
PC142	20
PC143	20
PC144	20
PC145*	16

*Prop. Feathering*

Wire No.	Size
PF1	18
PF2	18
PF3	18
PF4	18
PF5	18
PF6	18
PF7	18
PF8	18
PF9	16
PF10*	18
PF11*	18
PF12*	18
PF13*	18
PF14	18
PF15	18
PF16	18
PF17	18
PF19	18
PF20	18
PF22	2
PF23	18
PF24	18
PF25	18
PF26	18
PF27	18
PF28	18

*Prop. Feathering*

Wire No.	Size
PF35	2
PF36	2
PF37	2
PF40	18
PF41	18
PF42	18
PF43	18

*Retracting Motors*

Wire No.	Size
R1**	18
R2**	18
R3*	18
R4**	18
R5	18
R6	18
R12**	18
R13**	18
R14	2
R15	2
R16	16
R17	12
R18	18
R19	18
R20	18
R21	14
R22	14
R23	18
R24	18
R25	18
R26	18
R27	18
R28	18
R29	18
R30	2
R31	2
R32	18
R33	18
R34	18
R35	16
R36	18
R37	18
R38	18
R39	18
R40	8
R41	18
R42	18
R43	18
R44	18
R45	18
R46	18
R47	18
R48	18
R49	18
R50	10

R51	10
R52	16
R53	18
R54	18
R55	18
R56	18
R57	2
R58	2
R59	18
R60	8
R61	18
R62	18
R63	16
R64	18
R65	18
R66	18
R67	18
R68	18
R69	8
R70	8
R71	16
R72	18
R73	18
R74	18
R75	18
R76	8
R77	18
R78	18
R79	18
R80	18
R81	18
R82	18
R83	18
R84	18
R85	18
R86	18
R87	18
R88	18
R89	18
R90	18
R91	18
R92	18
R93	18
R94	18
R95	18
R96	18
R97	18
R98	18
R99	18
R100	18
R101	18
R102	18
R103	18
R104	18
R105	18
R106	18

*\*Individually Shielded*

*\*Used only on airplanes with all-electric bomb control system*

*\*\*Not used on airplanes with all-electric bomb control system*



ELECTRIC WIRES (Cont.)

*Retracting Motors*

Wire No.	Size
R107	18
R108	18
R109	18
R110	18
R111**	18
R112**	18
R113 **	18
R114**	18
R115**	18
R116**	18
R117**	18

*Starter Control*

Wire No.	Size
S1	18
S2	18
S3	18
S4	18
S5	14
S6	18
S7	14
S8	18
S9	14
S10	14
S11	14
S12	14
S13*	18
S14*	18
S17	18
S18	14
S19	14
S20	14
S21	14
S22	18
S23	18
S24	2
S25	2
S26	14
S27	14
S28	2
S29	14
S30	14
S31	2
S32	14
S34	2
S35	14
S36	14
S37	2
S38	18
S39	14
S40	2
S41	18
S43	2
S44	18

*Warning Signals*

Wire No.	Size
W1	18
W2	18
W3	18
W6	18
W7**	18
W8	18
W9	18
W10	18
W11	18
W12	18
W13	18
W14	18
W15**	18
W16	16
W17	18
W22	18
W23	18
W24	18
W42**	20
W43**	20
W44**	20
W45**	18
W46**	20
W47**	20
W48**	20
W49**	20
W50**	20
W51**	20
W52**	20
W53**	20
W54**	20
W55**	20
W56**	20
W57**	20
W58**	20
W59**	20
W60**	20
W61**	20
W62**	20
W63**	18
W64	18
W65**	18
W66**	18
W67	18
W68	18
W69**	18
W70**	20
W71**	20
W72**	20
W73**	20
W74**	20
W75**	20
W76**	20
W77**	20

*Warning Signals*

Wire No.	Size
W78**	20
W79**	20
W80**	20
W81**	20
W82**	20
W83	18
W86	18
W87	18
W88	18
W89	18
W90	18
W91	18
W92	18
W95	18
W102**	20
W103**	20
W104	18
W105	18
W106	18
W107**	20
W108**	18
W109	20
W110**	20
W111	12
W112**	20
W113**	20
W121	18
W122	18
W123	18
W124	18
W131**	18
W132**	20
W133**	20
W134**	20
W135**	20
W136**	20
W137**	20
W138**	20
W139**	20
W140**	20
W141**	20
W142**	20
W143**	20
W144**	20
W145**	20
W146**	20
W147**	20
W148**	20
W149**	20
W150**	20
W151**	20
W152**	20
W153**	20
W154**	20

\*Used only on airplanes with all-electric bomb control system

\*\*Not used on airplanes with all-electric bomb control system

Section IV  
Paragraph 7

RESTRICTED  
AN 01-20EG-2

ELECTRIC WIRES (Cont.)

Warning Signals

Wire No.	Size
W155**	20
W156**	20
W157**	20
W158**	20
W159**	20
W160**	20
W161**	20
W162**	20
W163**	20
W164**	20
W165**	20
W166**	20
W167**	20
W168**	20
W169**	20
W170**	20
W171**	20
W172**	20
W173**	20
W174**	20
W175**	20
W178	18
W181	18
W182	20
W183**	20
W184**	18
W185	18
W186	18
W187	18
W189**	18
W191	18
W192	18
W193	18
W194	18
W195	18

Warning Signals

Wire No.	Size
W196	18
W197	18
W198	18
W199	18
W200	18
W201	18
W202**	18
W203**	18
W204**	18
W205	18
W206	18
W207	18
W208	20
W209	20
W210	20
W211	20
W212	20
W213	20
W214	20
W215	20
W216	20
W220	20
W225**	20
W226	20
W227	20
W228	20
W229	20
W230	20
W231	20
W232	20
W233	20
W235	20
W236	20
W237	20
W238	20

Warning Signals

Wire No.	Size
W241	20
W242	20
W243	20
W244	20
W245	20
W246	20
W247	16
W248	16
W249	12
W250	12
W251	12
W252	12
W253	12
W254	12
W255	12
W256	16
W257	16
W258	16
W259	16
W260	16
W268	12
W269	16
W270	16
W271	16
W272	16
W273	16
W274	12
W275	16
W276	18
W277	20
W283	18
W284	16
W285	18
W286**	16
W287	18

ELECTRICAL FUSE

Fuse No.	Amp.
I	15
II	20**30*
III	20**30*
IV	15
V	20
VI	15
VII	15
VIII	60
IX	60
X	30
XI	15
XIII	15
XIV	15
XV	15
XVI	15
XVII	15

Type
Spec. 94-40002
Spec. 94-40002
Spec. 94-40002
Spec. 94-40002
Spec. 94-40002
Spec. 94-40002
Spec. 94-40002
Spec. 94-40002
Spec. 94-40002
Spec. 94-40002
Spec. 94-40002
Spec. 94-40002
Spec. 94-40002
Spec. 94-40002
Spec. 94-40002
Spec. 94-40002

Circuit

Warning
**Bomb Rack *Bomb Release
**Bomb Sight *Bomb Salvo
Flap & Door Control
Lwr. Gear Control
Ext. Lights
Int. Lights Fwd.
Inverter No. 1
Inverter No. 2
Flight Control
Pitot Heater L.H.
Fuel Booster No. 1
Fuel Booster No. 2
Fuel Booster No. 3
Fuel Booster No. 4
Start No. 1 & No. 2

\*Used only on airplanes with all-electric bomb control system

\*\*Not used on airplanes with all-electric bomb control system



ELECTRICAL FUSE (Cont.)

<i>Fuse No.</i>	<i>Amp.</i>	<i>Type</i>	<i>Circuit</i>
XVIII	15	Spec. 94-40002	Start No. 3 & No. 4
XIX	15	Spec. 94-40002	Start-Mesh No. 1 & No. 2
XX	15	Spec. 94-40002	Start-Mesh No. 3 & No. 4
XXI	5	Spec. 94-40002	Fuel Gage
XXII	15	Spec. 94-40002	Radio-Compass
XXIV	5	Spec. 94-40002	Fluorescent Lamp
XXV	5	Spec. 94-40002	Flap Position Ind.
XXX	15	Spec. 94-40002	Thermometer
XXXI	30	Spec. 94-40002	Command Radio
XXXII	30	Spec. 32084-C	Fuel Transfer Pump
XXXIII	15	Spec. 94-40002	Deicer & Oil Dilut.
XXXIV	20	Spec. 94-40002	Prop. Feather No. 4
XXXV	5	Spec. 94-40002	Fuel Shut-off No. 1
XXXVI	15	Spec. 94-40002	Interphone
XXXVII	5	Spec. 94-40002	Fuel Shut-off No. 2
XXXVIII	5	Spec. 94-40002	Fuel Shut-off No. 3
XXXIX	5	Spec. 94-40002	Fuel Shut-off No. 4
XL	60	Spec. 94-40002	Tailwheel Motor
XLI	70	Spec. 32272	Flap Motor
XLII	15	Spec. 94-40002	Liaison Radio
XLIII	15	Spec. 94-40002	Int. Lights—Aft
XLIV	20	Spec. 94-40002	Camera
XLV	15	Spec. 94-40002	Trail Ant. Motor
XLVI	20	Spec. 94-40002	IFF Radio
XLVII	60	Spec. 94-40002	Suit Heat—Aft.
XLIX	5	Spec. 94-40002	Oxygen Warning Aft.
LI	60	Spec. 94-40002	Landing Lamp L.H.
LII	15	Spec. 94-40002	Battery Cut-out No. 1
LIII	15	Spec. 94-40002	Battery Cut-out No. 3
LVI	15	Spec. 94-40002	Battery Cut-out No. 4
LVIII	60	Spec. 94-40002	Landing Lamp R.H.
LIX			SCR 521 Radio
LX	60	Spec. 94-40002	Suit Heat—Aft
LXI	5	Spec. 94-40002	Oxygen Warning Fwd.
LXII	10	Spec. 32271	Radio Compass D.C.
LXIII	5	Spec. 32271	Radio Compass A.C.
LXIV**	30	Spec. 94-40002	Pilots Windshield MTR
LXV**	5	Spec. 94-40002	Transformer
LXVII	10	Spec. 94-40002	Radio Compass A.C.
LXIX	100	Spec. 32084	Hyd. Pump Motor
LXX	15	Spec. 94-40002	Hyd. Pump Motor S.W.
LXXI	60	Spec. 94-40002	Suit Heat—L.H.
LXXII	40	Spec. 94-40002	Suit Heat—R.H.
LXXIV	20	Spec. 32084-C	Detonator Switch
LXXV	10	Spec. 94-40002	Blind Landing Radio
LXXVI	15	Spec. 94-40002	Filter Control
LXXVII	15	Spec. 94-40002	Carb. Filter No. 1
LXXVIII	15	Spec. 94-40002	Carb. Filter No. 2
LXXIX	15	Spec. 94-40002	Carb. Filter No. 3
LXXX	15	Spec. 94-40002	Carb. Filter No. 4
LXXXI	125	Brundy FLS 125	Gen. Nac. 1
LXXXII	125	Brundy FLS 125	Gen. Nac. 2
LXXXIII	125	Brundy FLS 125	Gen. Nac. 3
LXXXIV	125	Brundy FLS 125	Gen. Nac. 4
LXXXIX	10	Spec. 94-40002	Compass—Gaging
XC	5	Spec. 94-40002	Compass—Remote A.C.
XCI	20	Spec. 94-40002	Power Plant Control A.C.
XCI	15	Spec. 94-40002	Auto Pilot Heat Fwd.
XCIII	15	Spec. 94-40002	Auto Pilot Heat—Aft.

\*Used only on airplanes with all-electric bomb control system

\*\*Not used on airplanes with all-electric bomb control system

e. COMMUNICATIONS EQUIPMENT.

(1) GENERAL.

(a) The B-17G airplane is equipped with a radio and interphone system, providing communications between crew members within the airplane; between the airplane and ground stations or other airplanes; reception of all weather, range, and marker beacon signals; ground and interplane identification; ASV equipment; blind landing control; and absolute terrain indication.

1. The system includes the following circuits, which are identified on the diagrams by code letters:

Command radio	CR	Marker beacon	MB
Liaison radio	LR	Interphone	IN
Radio compass	RC		

2. Special radio equipment provided includes IFF, ARR, and ASV sets.

3. The wiring diagrams show only the wiring

installed by the manufacturer for the operation and control of the equipment. Wire numbers as shown on the diagrams are attached to both ends of each wire. Wire color codes are employed in certain equipment. Blueprints of the master wiring diagrams and individual circuits are furnished with each airplane, and are located in a box on the back of the copilot's seat.

**Note**

THE RADIO WIRING DIAGRAMS IN THIS MANUAL ARE REPRESENTATIVE ONLY AND DO NOT INCLUDE MINOR VARIATIONS. BLUEPRINT DIAGRAMS IN EACH AIRPLANE MUST BE CONSULTED FOR SPECIFIC INFORMATION OF THE WIRING IN THAT AIRPLANE.

(b) COMMAND RADIO SET (TYPE SCR-274-N).—The command radio provides ground and plane contact on several bands by two transmitters and three receivers in the radio compartment, operated by

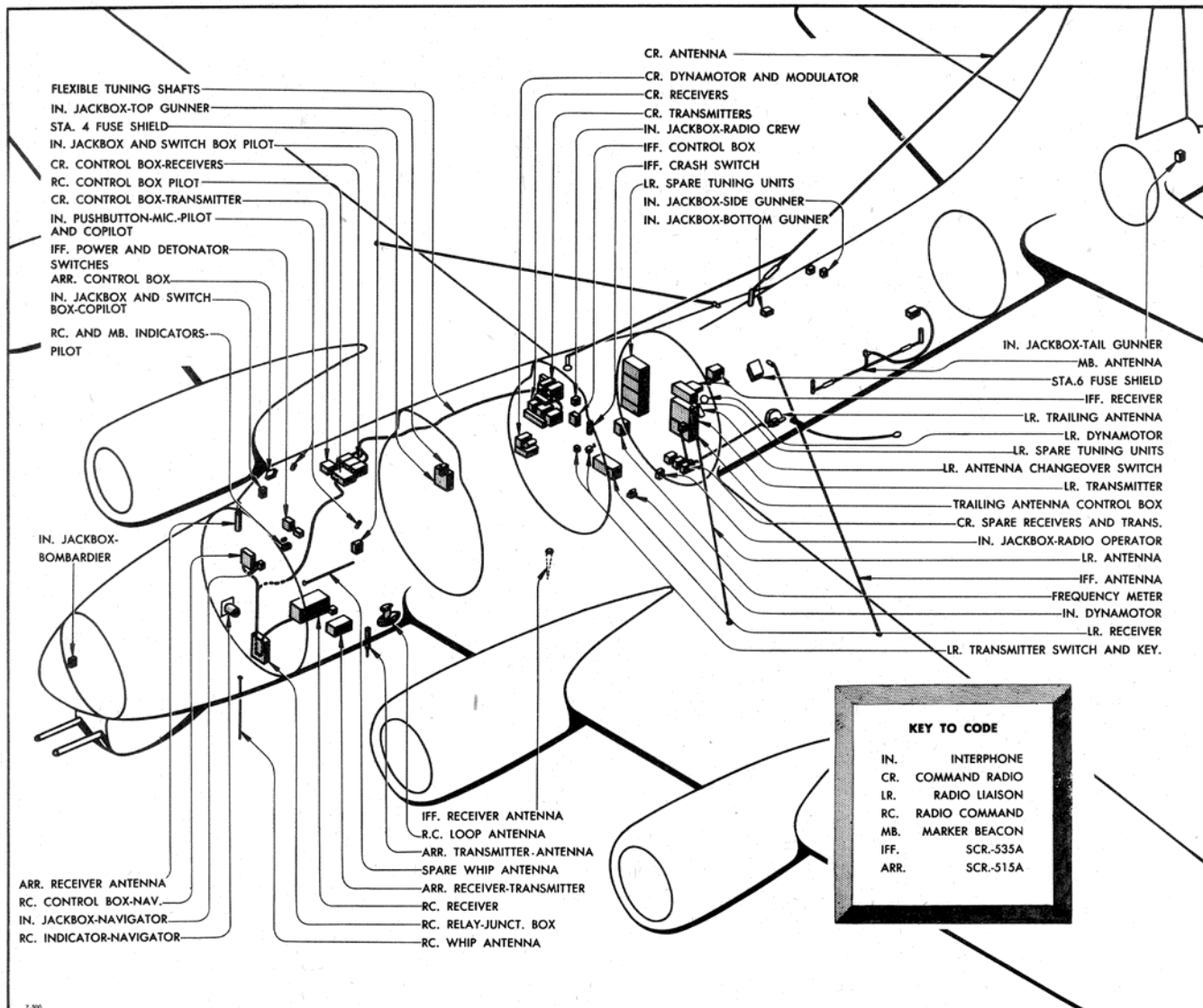


Figure 323—Communication Equipment Diagram



the remote control unit on the cockpit ceiling.

1. TRANSMITTERS.—Two type BC-457-A transmitters or, in some airplanes, one type BC-458-A and one type BC-459-A transmitter, are installed on the rear side of the station 5 bulkhead in the radio compartment, mounted on a rack above and to the right of the doorway.

2. RECEIVERS.—Three receivers, types BC-453-A, BC-454-A, and BC-455-A, are installed directly below the transmitters.

3. CONTROLS.—The antenna switching relay, type BC-442-A, is mounted on the under side of the transmitter rack. The receiver control box, type BC-450-A, and transmitter control, type BC-451-A, are grouped with the radio compass control on the cockpit ceiling.

4. DYNAMOTORS.—The receiver dynamotors, type DM-32-A, are mounted on the rack directly behind each receiver. The transmitter dynamotor, type DM-33-A, is mounted, together with the command transmitter modulator, type BC-456-A, against the right side wall on the floor at station 5A.

5. ANTENNA.—The antenna for the command set is a span of wire, approximately 37 feet long, from the top of the vertical stabilizer through a mast at station 6A to the upper right side of the fuselage, just forward of station 5. The lead-in connects near the forward end at an insulator in the right side of the cockpit fairing.

(c) LIAISON RADIO SET (TYPE SCR-287-A).—The liaison radio provides code or modulated contact with ground stations and, to a limited extent, communications between planes.

1. TRANSMITTER.—A type BC-375-C or later transmitter is mounted on the left rear bulkhead of the radio compartment. Tuning units for the transmitter are plug-in type. In addition to the one in the transmitter, five spare tuning units are stowed on the right rear bulkhead of the radio compartment and one on the left side under the transmitter.

2. RECEIVERS.—A type BC-348-H or later receiver is mounted on the left end of the radio table, at station 5.

3. CONTROLS.—A type B-5A transmitter control switch is mounted on the top of the radio table at the inboard end, and controls the relay in the dynamotor unit. A type J-37 telegraph key is mounted on the inboard end of the radio table, and a type C-1B monitor switch is mounted on the junction shield on the side wall to the left of the radio operator's seat. The liaison antenna tuning unit is installed on bulkhead 6 above the transmitter. A type BC-221-A frequency meter is part of the radio equipment in each airplane. This is a portable unit and no fixed installation is provided.

4. DYNAMOTOR.—A type PE-73B dynamotor is mounted on the left rear side of bulkhead 6

and furnishes high voltage direct current for the transmitter. The dynamotor unit also contains the motor relay and transmitter fuses. Refer to the radio instrument manuals for details.

#### 5. ANTENNAE.

a. The liaison set employs either of two antennae. The trailing antenna is held on a reel, type RL-42, mounted on the lower left side wall at station 6D. It is operated by a 24-volt DC motor controlled by a type BC-461 control box on the upper left side wall at station 5F. A counter on the box indicates the amount of wire extended, and a warning lamp lights when both the landing gear and the antenna are extended. The antenna fair-lead may be detached and drawn up inside the airplane to replace the antenna weight in flight.

b. The skin of the airplane serves as an antenna for the liaison set with a lead-in connected to the left wing at the main tank gage cover and brought through an insulator in the upper left side of the fuselage just forward of station 5G. Both liaison antennae are connected to the antenna changeover switch through which either antenna may be connected to the set. The antenna switch is on the upper left side wall at station 5G.

(d) RADIO COMPASS RECEIVER (TYPE SCR-269-G).—The radio compass set permits the pilot to follow any desired radio beam. A whip antenna is used to tune in the selected station. The loop antenna will then be constantly directed toward that station and operate the indicators accordingly.

1. RECEIVER.—The radio compass receiver, type BC-433-A, is mounted at the right of the walk below the pilot's floor. A flexible tuning shaft connects the receiver to the two control units. A CW-VOICE switch on the shelf above the navigator's table turns on the modulator unit in the receiver for the reception of unmodulated code signals.

2. INDICATORS.—The master bearing indicator, type 1-82-A, is suspended from the shelf above the navigator's table. A remote indicator, type 1-81-A, is mounted in the pilot's instrument panel.

3. CONTROLS.—Two type BC-434-A remote control units contain tuning dials and cranks, volume control, and loop antenna switches. One control unit is mounted on the ceiling above the pilots. The other is on the forward side of bulkhead 3 above the navigator's table. The radio compass relay, type BK-22-A, is mounted in a shield under the navigator's table, and is accessible after removing the terminal and fuse panel in the front of the shield.

4. ANTENNAE.—The loop antenna, type LP-21A, is enclosed in a streamlined housing on the bottom of the fuselage forward of the bomb bay doors. A whip antenna extends through the bottom of the fuselage just behind the chin turret. A spare whip antenna is stowed beneath the pilots' floor and is replaceable in flight.



(e) **MARKER BEACON RECEIVER (TYPE RC-43).**—The marker beacon receiver energizes a solenoid operating a shutter which provides visual indication of the airplane position relative to the landing field.

1. **RECEIVER.**—The marker beacon receiver, type BC-357-A, is installed on the left side wall at station 6I. It receives power through the radio compass receiver and is turned "ON" or "OFF" by the switch on the radio compass receiver.

2. **INDICATOR.**—The marker beacon indicator is an amber lamp on the pilot's instrument panel controlled by a relay in the marker beacon receiver. The light is "ON" when a signal is being received.

3. **ANTENNA.**—The marker beacon antenna, 75.5 inches long, is mounted between two short masts on the lower side of the fuselage. The lead-in connects near the center and extends straight upward through the fuselage at station 6I into a concentric transmission line which leads to the receiver.

(f) **IFF RECEIVER**—(TYPE SCR-595 OR SCR-695).

1. **RECEIVER.**—The IFF receiver is mounted on the left side of the bulkhead forward of the lower ball turret. Suspended on the rack below the receiver is the destructor indicator. The two red lamps on the indicator are lit when there is voltage at the destructor plug (PL-177) terminals.

#### CAUTION

The destructor plug (PL-177) must be disconnected from the receiver at all times except when the airplane is on a mission over enemy territory. Insert the plug PL-177 only after take-off and remove it before landing. Never insert the plug PL-177 if the red indicator lamps are on.

2. **RADIO OPERATOR'S CONTROLS.**—A power control box, a selector control box, the power socket, and the inertia destructor switch are mounted on the bulkhead above the radio operator's table. The power control box contains a power "ON-OFF" toggle switch, an "ON-OFF" emergency toggle switch protected by a hinged guard, a phone jack, and three receptacles. The selector control box has a six position selector switch and a five prong receptacle. The inertia destructor switch will be tripped by a shock of sufficient force in the horizontal plane of the airplane, and explodes the destructor unit in the receiver. The power control box is connected to airplane power through the power socket by inserting plug PL-178 in the power socket and plug PL-183 in the power control box receptacle. Power is received through a 20-ampere fuse in the station fuse shield. The destructor circuit receives power through a 20-ampere fuse in the No. 3 nacelle junction shield.

3. **PILOT'S CONTROLS.**—A power "ON-OFF" toggle switch, an emergency toggle switch protect-

ed by a hinged guard tied with string, and a dual push button destructor switch are mounted on the ledge over the pilot's instrument panel. Both destructor pushbuttons must be depressed to close the destructor circuit.

4. **ANTENNA.**—The IFF antenna projects 13 inches below the fuselage immediately aft of the bomb bay doors.

(g) **ARR SET (TYPE SCR-515-A).**—The ARR set is similar in operation to the IFF radio described in the preceding paragraph.

1. **RECEIVER-TRANSMITTER.**—The type BC-645-A receiver-transmitter unit is mounted on the left of the airplane beneath the pilots' compartment. The set, which is fused internally, draws current from the battery side of the external power plug solenoid.

2. **DYNAMOTOR AND CODER.**—The dynamotor and coder unit, type PE-101-A, is mounted on the circumferential stiffener immediately below and to the left of the receiver-transmitter.

3. **ANTENNAE (TYPE AN-40-A).**—The receiver antenna extends approximately 18 inches above the fuselage at station 2D directly in front of the cockpit windshields. The transmitter antenna extends from the bottom of the fuselage at station 3F, slightly to the left of the center line.

4. **CONTROLS.**—The type BC-646-A control box and type SW-181 push button, momentary break switch are mounted together between the top and forward windows in front of the copilot. The IFF switch panel, type BC-765, also controls this set.

(h) **ASV RADIO (TYPE SCR-521-A).**

1. **RECEIVER.**—The ASV receiver, type BC-701, is installed on the rear side of bulkhead 5.

2. **TRANSMITTER.**—The type BC-702 transmitter is mounted below the receiver.

3. **CONTROL.**—A type BC-703 control unit is mounted to the right of the receiver.

4. **INDICATOR.**—The visual indicator, type 6, is supported on a hinged floor stand, and is operated from the radio compartment auxiliary seat.

5. **ANTENNAE.**—Provisions are made for the installation of right-angle rod antennae on the sides of the fuselage forward of the wing leading edge, and crossbar rod antenna from the nose of the fuselage and the lower surface of each wing just outboard of the outer wing joint. Wire antennae may be installed on each side of the fuselage below the side gun windows and on top of the dorsal fin aft of the radio compartment.

(i) **PORTABLE FREQUENCY METER.**—A type BC-221 portable frequency meter is carried in each airplane and is usually strapped to the support of the radio compartment rear auxiliary seat.

(j) **EMERGENCY TRANSMITTER.**—A completely independent emergency transmitter, type SCR-578, and accessories are carried in some airplanes. The



two units are strapped to the right side of the bulkhead forward of the lower gun turret.

(k) INTERPHONE (TYPE RC-36).

1. GENERAL.—The interphone system consists of equipment for intercommunication between crew members by means of head sets and throat microphones at nine stations in the airplane. On some airplanes additional jack boxes have been added for bombardier and two side gunners with the ball turret gunner's jack box moved to the top of the fuselage above the ball turret. The interphone stations are as follows: forward gunner, navigator, pilot, copilot, top gunner, radio operator, radio crew, lower gunner, and tail gunner. The system is wired to give the following communications: With any selector switch in the "CALL" position, that station may be heard at all other stations, regardless of the position of their selector switches. With all switches adjusted to "INTERPHONE," any station may be heard at all other stations. Any station may listen to the liaison, command, or radio compass receiver by adjusting the selector switch to those respective positions. Any station can modulate the command radio transmitter. Modulation of the liaison transmitter is provided only for pilot, copilot, navigator, and radio operator.

2. DYNAMOTOR.—Power is obtained from the main batteries through a dynamotor, type PE-86-A, (input 28 volts at 1.25 amperes, output 250 volts at 0.060 amperes) located under the radio operator's table on the left side wall, and protected by fuses in the station 4 fuse shield. It is turned on only by the main battery switches, or whenever the external battery source is connected.

3. AMPLIFIER.—The interphone amplifier, type BC-347, receiving power from the dynamotor, is located on the left side wall below the radio operator's table.

4. JACK BOX.—A jack box, type BC-366, at each station contains the jacks for head set and microphone, and a selector switch and volume control which afford limited control of head set volume.

5. MICROPHONE RELAYS.—Two type ZQA relays in the forward radio junction shield, on the left side of the control cabin floor at station 3H, are operated by push buttons on the control wheels. These relays serve to connect the pilot's and copilot's microphones to the interphone system.

6. MICROPHONES.—All stations are provided with type T-30 throat microphones which, with the exception of those for the pilot and the copilot, are controlled by "PUSH TO TALK" switches on type CD-318 cords. They are connected to the jack boxes by means of extension cords for greater freedom of movement.

7. RADIO FILTER.—Type FL-3 filters at the pilot's and copilot's stations permit selection of voice or

range signals when both are received simultaneously through the radio compass receiver.

8. FUSES.—The interphone system is protected by the fuses in the station 4 fuse shield.

(2) REMOVAL AND DISASSEMBLY.

(a) GENERAL.—Radio transmitters and receivers are equipped with shock mounts and their removal consists of disconnecting the connector plugs and removing the mounting pans at the supports. The radio compass relay shield is mounted on the radio compass support, and the relays are mounted on the back side of the panel in the shield. For access to the relays, the entire panel may be removed after disconnecting all wires in the shield.

(b) DYNAMOTORS.—Liaison dynamotor fuses are contained in the dynamotor connector shield, and the supply line from the main bus at station 6 fuse panel is not fused. The battery power from either the airplane batteries or the battery cart must be "OFF" before disconnecting a dynamotor; otherwise, structural damage may result from accidental grounding of these leads.

(c) RADIO COMPASS LOOP.—In removing the radio compass loop, disconnect the dehydrator tube of the silica gel cartridge and remove the four bolts through the mounting plate in the floor. To prevent the loop housing from falling off, support the loop from outside before removing the mounting bolts.

(d) WHIP ANTENNA.—The replaceable whip antenna is accessible through a small door in the navigator's floor. In some airplanes the antenna is supported on an insulating bracket attached with screws. In other airplanes the antenna may be removed by rotating the handle counterclockwise and withdrawing from the socket. The spare whip antenna is carried beneath the pilots' floor in the lower passageway. The trailing antenna fair-lead is attached by three Dzus fasteners and two wing nuts so it can be readily removed in flight to replace the weight. A spare weight and a spare antenna reel are carried in some airplanes in the right side gun ammunition box.

(3) MINOR REPAIRS.

(a) Marker beacon relay contacts must be held to a gap of .002 inch in order to obtain a reliable signal.

(b) Splicing of the liaison trailing antenna is not recommended because of the close fit at the bend of the fair-lead. When replacing with a new wire, form a slight curve in the end of the wire and thread it through the fair-lead from the outside.

(4) ASSEMBLY AND INSTALLATION.

(a) At all tuning shaft connectors, electrical connectors, and the radio compass bearing indicator shaft couplings, use thread lubricant to prevent seizure. At the command radio tuning shaft, in particular, be careful to mesh the spline before tightening the nut.

Section IV  
Paragraph 7

RESTRICTED  
AN 01-20EG-2

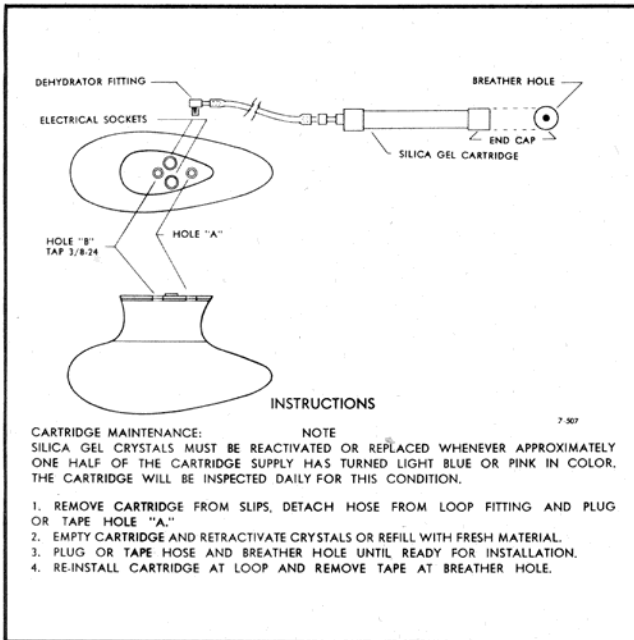


Figure 324—Radio Compass Loop Dehydration Diagram

(b) Maintenance of the radio compass loop must be accomplished in accordance with instructions given in figure 324.

**CAUTION**

Loop and bearing indicator plugs are not offset enough to accomplish complete polarization and care must be taken to make connections properly.

(5) CIRCUITS, DIAGRAMS, TABLES, AND CHARTS.

(a) INDIVIDUAL CIRCUIT DIAGRAMS.—

Blueprints of the master wiring diagrams and the individual circuit diagrams, complete and up to date for the airplane in which they are installed, are contained in a box on the back of the copilot's seat.

**Note**

Due to frequency of minor changes, the electrical wiring diagrams, equipment, and wire tables will not be kept up to date. For specific information the blueprint wiring diagram in the airplane *must* be consulted.

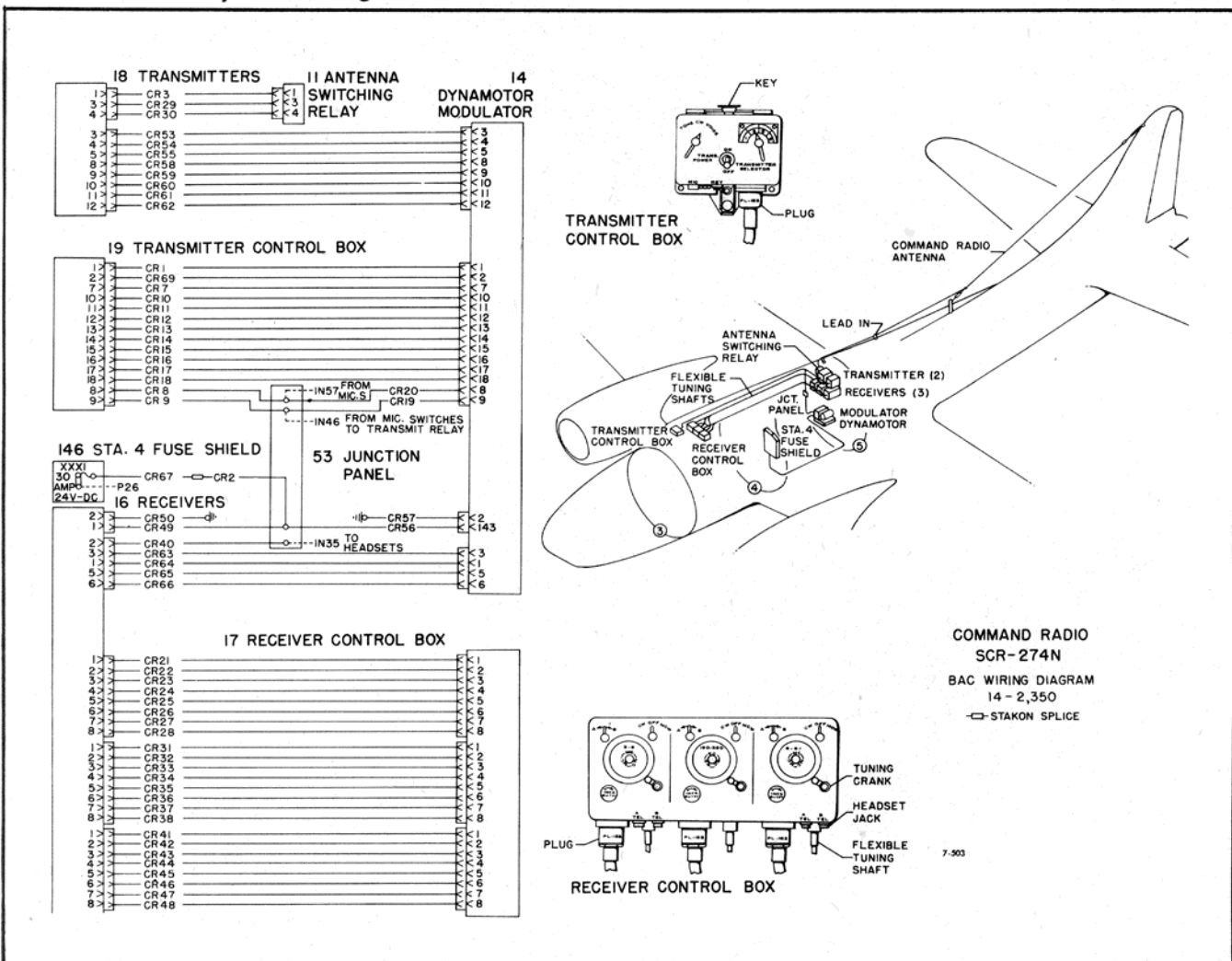


Figure 325—Command Radio Circuit (CR)



# LIAISON RADIO SCR-287-A

BAC WIRING DIAGRAM  
9-5817

STAKON SPLICE

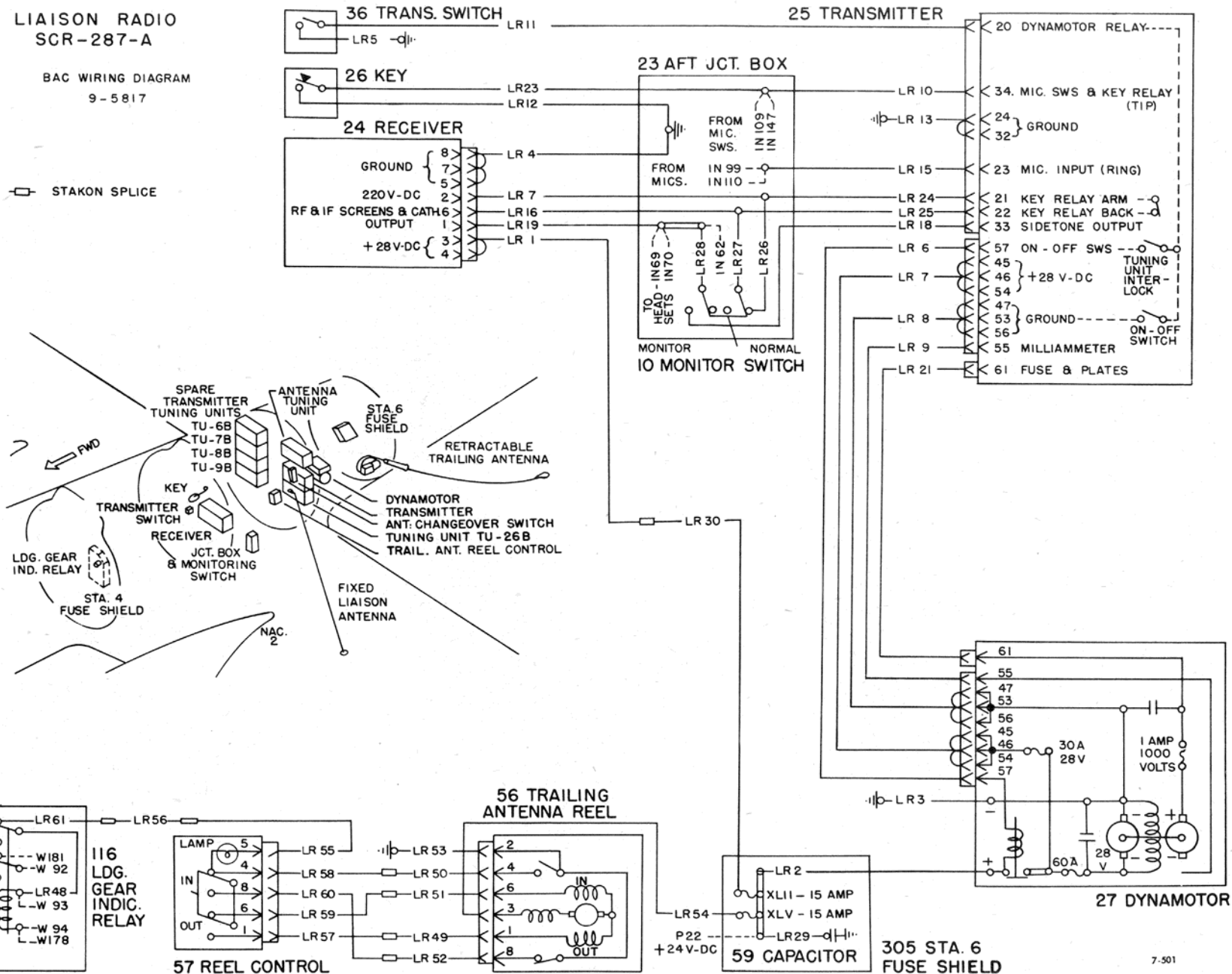


Figure 326—Liaison Radio Circuit (LR)

RESTRICTED  
AN 01-20EG-2

Section IV

RESTRICTED

323

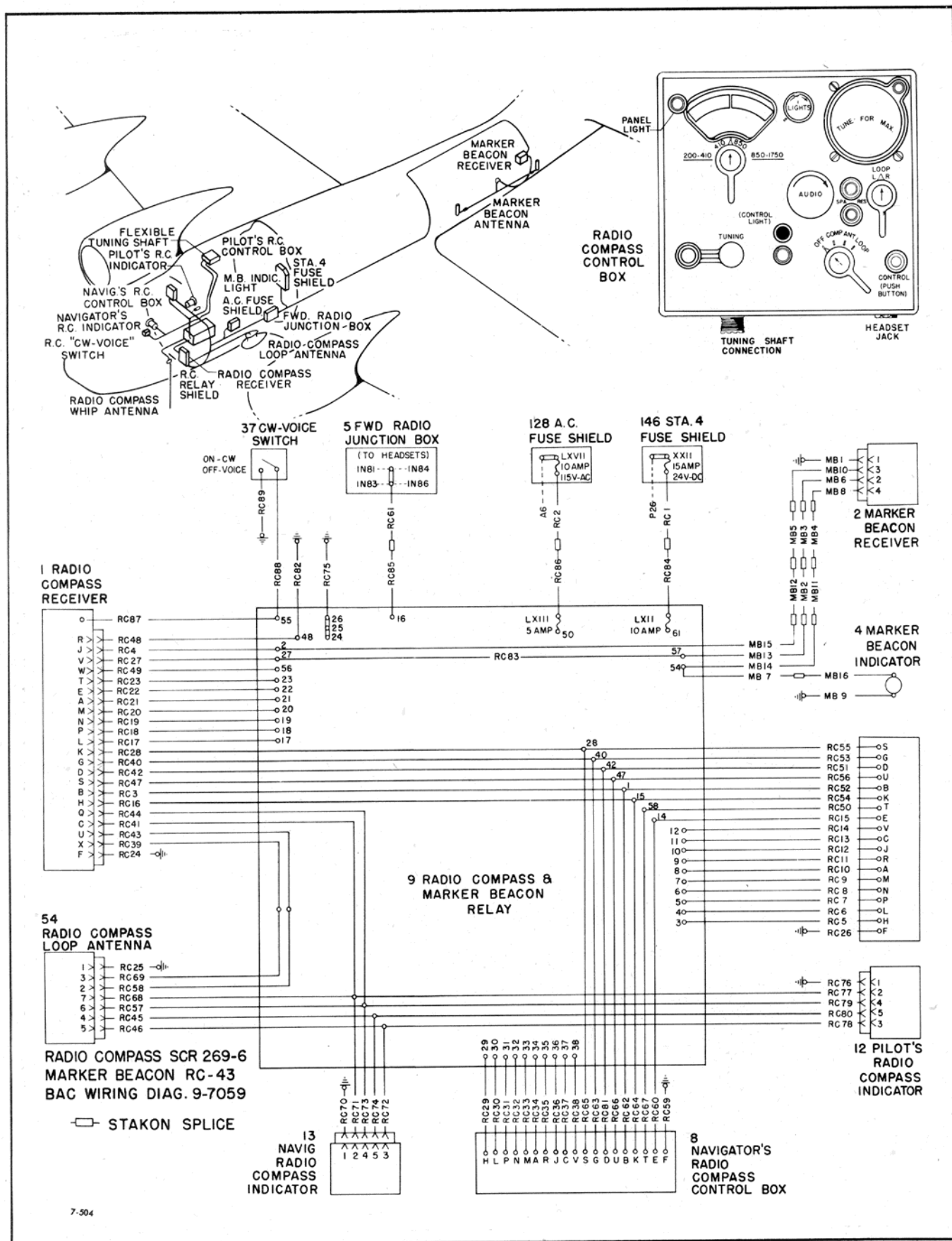
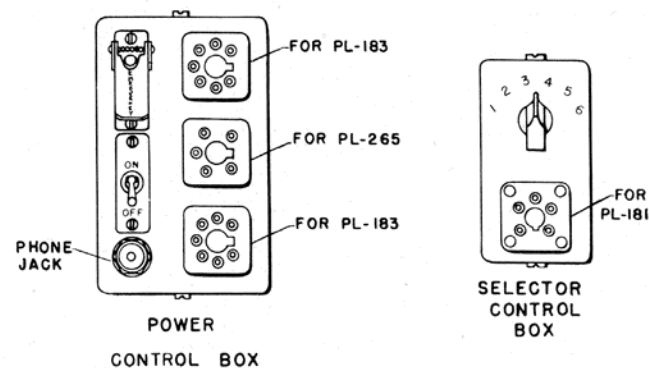
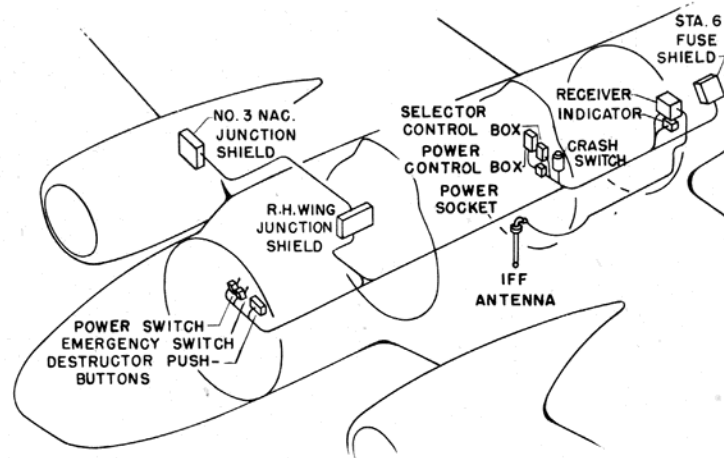
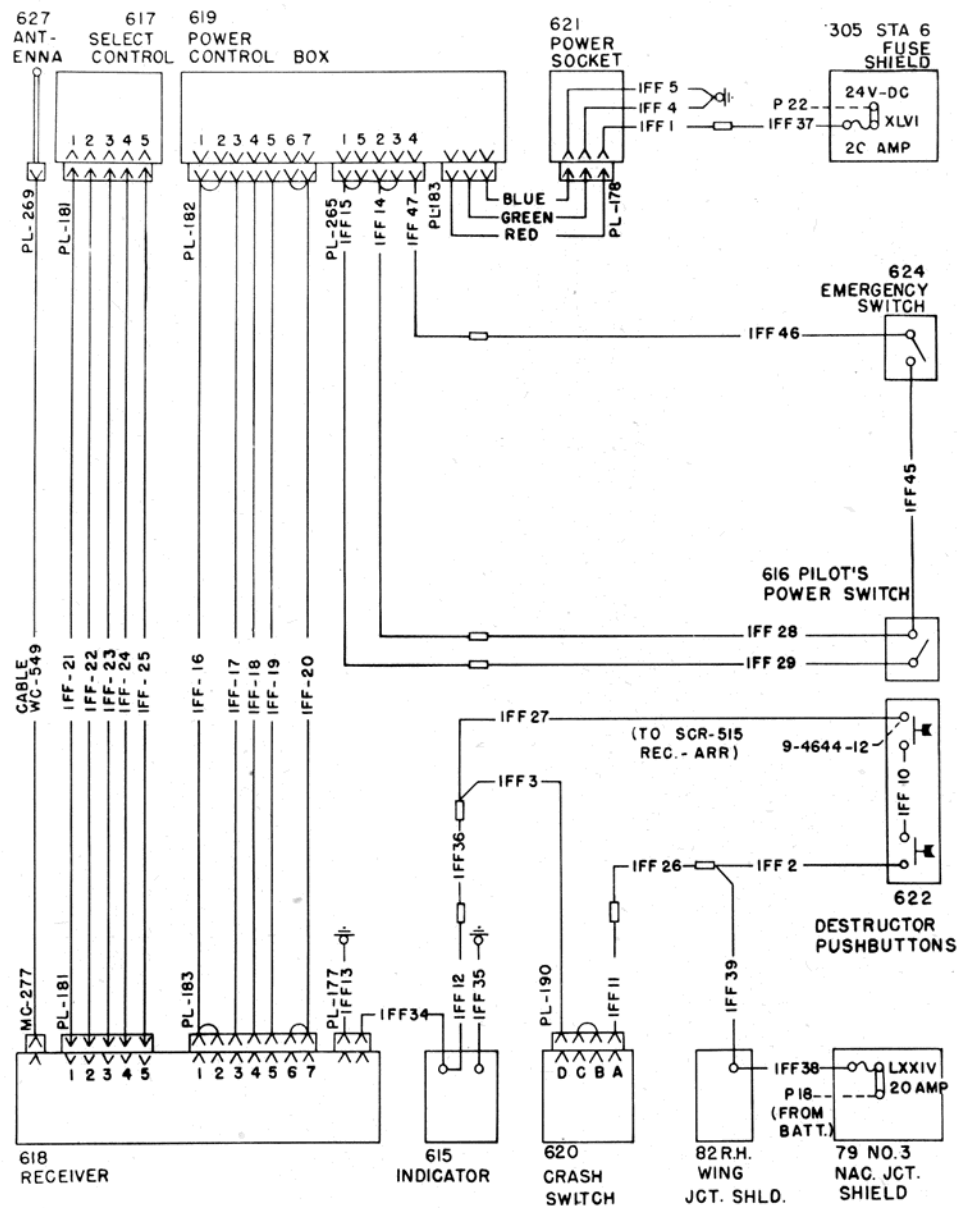


Figure 327—Radio Compass and Marker Beacon Circuit (RC)





BAC WIRING DIAGRAM 9-6471

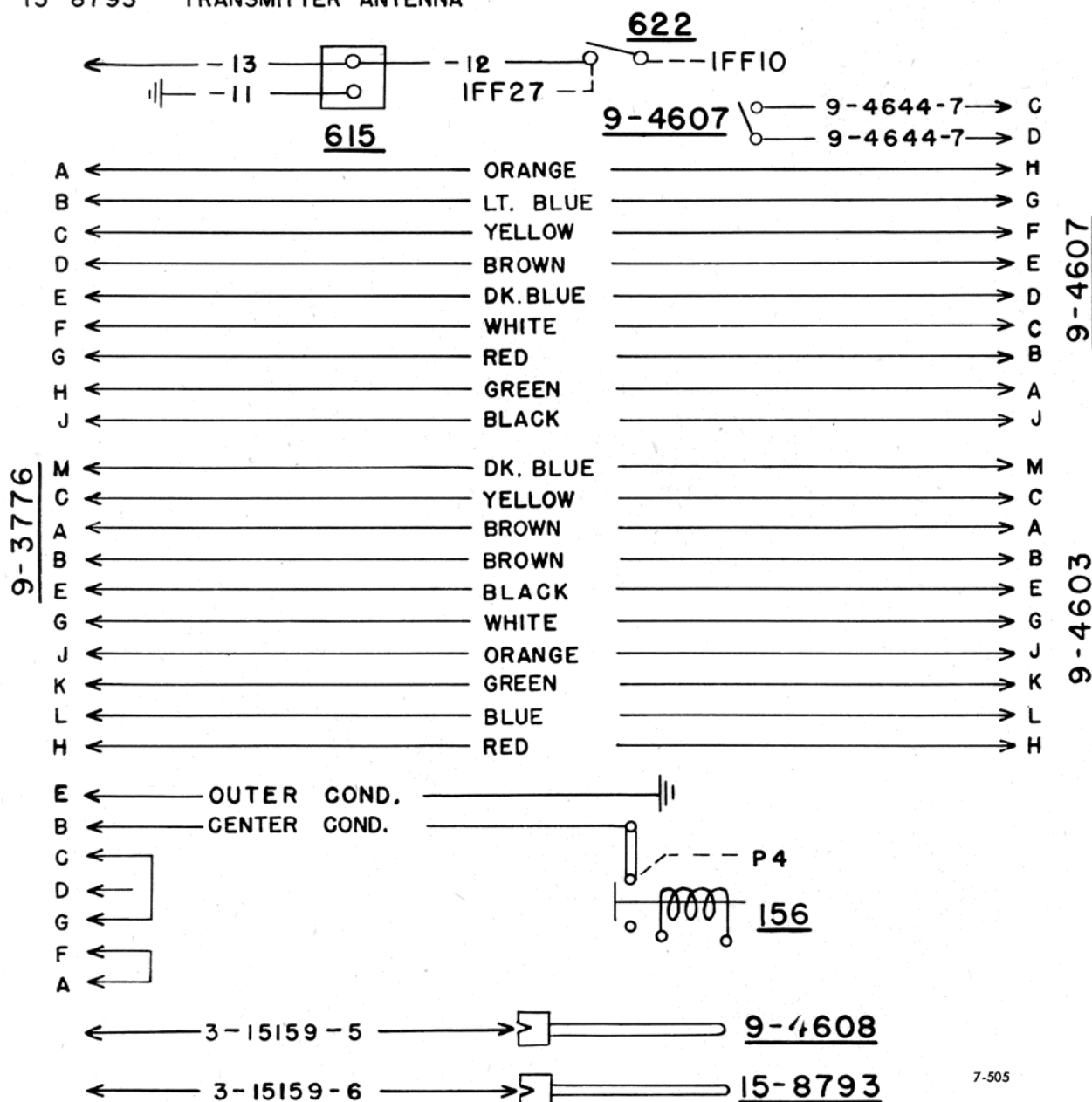
— STAKON SPLICE  
— WIRE RUN

7-506

Figure 328—IFF Radio Circuit

## LEGEND

156	SOLENOID - EXT. PWR. CONN.	615	INDICATOR - SCR 535-A
9-3776	RECEIVER - TRANSMITTER	622	SWITCH - DETONATOR
9-4603	DYNAMOTOR & CODER		TYPE SCR - 515-A
9-4607	CONTROL & SWITCH		
9-4608	RECEIVER ANTENNA		9-4644
15-8793	TRANSMITTER ANTENNA		



**Figure 329—ARR Radio Circuit**





LIST OF COMMUNICATIONS EQUIPMENT

Ref. No.	Description	Type	Part No.	Inst. Dwg.
1	Receiver—Radio Compass	BC-433-G	H41D7017	9-6459-1
2	Receiver—Marker Beacon	BC-357-B	H41G10187	9-3612
3	Shield—R. C. & M. B. Relay	BAC	43-12785	9-6483
4	Indicator—Pilots M. B.	T-3-1/4 Clr	42B3593-2	65-7380
5	Shield—Fwd. Radio Junction	BAC	6-9354	9-3646
6	Control Box—Pilots—R. C.	BC-434G	H40D3229	6-11564
8	Control Box—Navigators—R. C.	BC-434G	H40D3229	46-8833
9	Relay—Radio Compass & M. B.	BK-22-G	H41B7016	9-6483-1
10	Switch—Monitor	C-1B	310590	56-7583
11	Relay—Antenna Switching	BC-442-A	H41G5076	55-7789
12	Indicator—Pilots—R. C.	I-81-G	H41D7019	65-7380
13	Indicator—Navigators—R. C.	I-82-A	SC-D-3255	9-5895
14	Modulator—Command Radio	BC-456-A	H41G5076	55-7789
15	Dynamotor—Interphone	PE-86-A	H41D3926	6-9708
16	Receiver—Command Radio	BC-459A	H41G5077	55-7789
		BC-454A		
		BC-455A		
17	Control Box—Command Rec.	BC-450-A	H41G5077	6-11564
18	Transmitter—Command Radio	BC-458-A	H41G5076	55-7789
		BC-459-A		
19	Control Box—Command Trans.	BC-451-A	H41G5076	6-11564
20	Amplifier—Interphone	BC-347	H50D3165	6-7582
21	Relay—Copilots Microphone	ZQA	SC-C-324-D	9-3646
22	Jack Box—RH Side Gunners	BC-366	H40D2226	15-10404
23	Shield—Aft Liaison Radio Jct.	BAC	6-7625	56-7583
24	Receiver—Liaison Radio	BC-348B	H40D3166	6-8826
25	Transmitter—Liaison Radio	BC-375-E	36D5854	6-7189
26	Key—Operators—Liaison	J-37	H39B3362	41-7511
27	Dynamotor—Liaison Radio	PE-73-B	36B5856	15-10622-4
28	Jack Box—Bombers	BC-366	H40D2226	8-2567
29	Jack Box—Navigators	BC-366	H40D2226	49-3362
30	Jack Box—Pilots	BC-366	H40D2226	64-1741
31	Jack Box—Copilots	BC-366	H40D2226	59-2916
32	Jack Box—Top Gunners	BC-366	H40D2226	46-9333
33	Jack Box—Radio Operators	BC-366	H40D2226	59-2875
35	Jack Box—LH Side Gunners	BC-366	H40D2226	15-10404
36	Switch—Liaison Trans.	B-5A	AN3015	3-20689
37	Switch—C. W. & Voice	B-5A	AN3015	9-5895
38	Jack Box—Tail Gunners	BC-366	H40D2226	48-1293
40	Push Button—Throat Mic.	KSGO	1-21510-1	6-11306
41	Wheel-Slip Rings		1-17911	15-8538
45	Cord—Interphone Headset		1-20535	
47	Filter—Copilot	FL-8	59-2916	59-2916
48	Filter—Pilot	FL-8	64-1741	64-1741
49	Relay—Pilots Microphone	ZQA	SC-C-324-D	9-3646

\*Used only on airplanes with all-electric bomb control system

\*\*Not used on airplanes with all-electric bomb control system



LIST OF COMMUNICATIONS EQUIPMENT (Cont.)

Ref. No.	Description	Type	Part No.	Inst. Dwg.
53	Shield—Command Radio Jct.	BAC	3-13946	55-7789
54	Loop—R. C.	LP-21-G	H41G7018	6-9705
55	Microphone—Throat	T-30	1-23534	
56	Reel Assy.—Antenna	RL-42-A	SC-F-3451	15-8529-4
57	Control Assy.—Antenna	BC-461	H41G4446	15-8529-7
58	Jack Box—Lower Turret	BC-366	H40D2226	9-5884
59	Capacitor—Sta. 6 Fuse Shield	Type CA275X		69-3659
60	Capacitor—Interphone Dynam.	Type CA275X		6-9708
602	Cord Assy—Plug-In (Upper)		1-20537-66	55-7789
603	Cord Assy—Plug-In (Upper)		1-20536-66	55-7789
606	Cord Assy—Plug-In (Lower)		1-20537-35	55-7789
607	Cord Assy—Plug-In (Lower)		1-20536-35	55-7789
610	Cord Assy—Pilot's Throat Mic.		1-20539-60	55-7789
611	Cord Assy—Pilot's Throat Mic.		1-20536-16	55-7789
612	Cord Assy—Copilot's Throat Mic.		1-20539-60	55-7789
613	Cord Assy—Copilot's Throat Mic.		1-20536-26	55-7789
614	Cord Assy—Throat Mic.	CD-318	H42G2346	
615	Indicator—IFF	BC-767	H42B10635	15-10622-3
616	Switch—IFF	B-5A	AN3015	9-5058
618	Receiver Assy—IFF Radio	BC-647A	H42G3779	15-10622-1
619	Control Assy—Selector IFF	BC-648A	H42G3780	9-4611
620	Switch Assy—SCR-535A	BC-706-A	H42D8070	9-4616
621	Socket	SO-158-A	H42G3780	9-4611
622	Detonator—Switch	BC-765	H42D7544	9-5058

COMMUNICATION WIRES

Command Radio Wire No.	Size	Command Radio Wire No.	Size	Command Radio Wire No.	Size
CR1 .....	20	CR25 .....	20	CR47 .....	20
CR2 .....	12	CR26 .....	18	CR48 .....	20
CR3 .....	20	CR27 .....	20	CR49 .....	16
CR7 .....	18	CR28 .....	20	CR50 .....	18
CH8 .....	20	CR29 .....	20	CR53 .....	20
CR9 .....	18	CR30 .....	20	CR54 .....	18
CR10 .....	20	CR31 .....	18	CR55 .....	18
CR11 .....	20	CR32 .....	20	CR56 .....	12
CR12 .....	20	CR33 .....	20	CR57 .....	12
CR13 .....	20	CR34 .....	18	CR58 .....	20
CR14 .....	20	CR35 .....	20	CR59 .....	20
CR15 .....	18	CR36 .....	18	CR60 .....	20
CR16 .....	20	CR37 .....	20	CR61 .....	20
CR17 .....	20	CR38 .....	20	CR62 .....	20
CR18 .....	18	CR40 .....	20	CR63 .....	18
CR19 .....	18	CR41 .....	18	CR64 .....	20
CR20 .....	20	CR42 .....	20	CR65 .....	18
CR21 .....	18	CR43 .....	20	CR66 .....	18
CR22 .....	20	CR44 .....	18	CR67 .....	12
CR23 .....	20	CR45 .....	20	CR69 .....	20
CR24 .....	18	CR46 .....	18		

\*Used only on airplanes with all-electric bomb control system

\*\*Not used on airplanes with all-electric bomb control system

COMMUNICATION WIRES—Continued

SCR-535-A  
Wire No.

Size

Interphone  
Wire No.

Size

Interphone  
Wire No.

Size

IFF1	12
IFF2	16
IFF3	16
IFF4	12
IFF5	12
IFF10	16
IFF11	16
IFF12	16
IFF13	16
IFF14	14
IFF15	14
IFF16	12
IFF17	18
IFF18	18
IFF19	18
IFF20	12
IFF21	18
IFF22	18
IFF23	18
IFF24	18
IFF25	18
IFF26	16
IFF27	16
IFF28	12
IFF29	12
IFF39	16
IFF34	16
IFF35	18
IFF36	16
IFF37	12
IFF38	16

Interphone  
Wire No.

Size

IN21	20
IN23	20
IN24	20
IN25	20
IN26	18
IN27	20
IN29*	20
IN30*	20
IN31*	20
IN32*	20
IN33*	20
IN34*	20
IN35*	20
IN36*	20
IN37*	20
IN38*	20
IN39	18
IN40	18
IN41	18
IN42	18
IN43	18
IN44	18
IN45	18
IN46	18
IN47	18
IN48	18
IN49	18
IN50	13
IN51	20
IN52	20
IN53	20
IN54	20
IN55	20
IN56	20
IN57	20
IN58	20
IN59	20
IN60	20
IN61*	20
IN62*	20
IN63*	20
IN64*	20
IN65*	20
IN66*	20
IN67*	20
IN69*	20
IN70*	20
IN71*	20
IN72	18
IN74	18
IN76	18
IN78	20
IN80	20

IN81*	20
IN82*	20
IN83*	20
IN84*	20
IN85*	20
IN86*	20
IN88*	20
IN89*	20
IN90*	20
IN92	20
IN93	20
IN94	20
IN95	20
IN96	20
IN97	20
IN98	20
IN99	20
IN100	20
IN102	18
IN103	20
IN109	18
IN110	20
IN112	20
IN113	18
IN119*	20
IN120	20
IN121*	20
IN122	20
IN123	20
IN124	18
IN125*	20
IN126	20
IN127	20
IN128	20
IN130	20
IN131	20
IN132	20
IN133	18
IN134	20
IN135	20
IN136	18
IN138	20
IN139	20
IN140	20
IN141	20
IN142	20
IN143*	20
IN144	18
IN145*	20
IN146	20
IN147	18
IN148*	18

\*Used only on airplanes with all-electric bomb control system

\*\*Not used on airplanes with all-electric bomb control system



COMMUNICATION WIRES—Continued

<i>Interphone Wire No.</i>	<i>Size</i>
IN149 .....	18
IN150* .....	20
IN151 .....	20
IN152 .....	20
IN153* .....	20
IN154 .....	18
IN155* .....	20
IN156 .....	20
IN157 .....	18
IN158* .....	18
IN159* .....	20
IN160 .....	20
IN161 .....	20
IN170 .....	20
IN171 .....	20
IN172 .....	20
IN173 .....	20
IN174* .....	20
IN175 .....	18
IN176* .....	20
IN177 .....	20
IN178* .....	20
IN179 .....	20
IN180 .....	20
IN181 .....	20
IN182* .....	20
IN183 .....	18
IN184 .....	20
IN185* .....	20
IN186 .....	18
IN187 .....	20
IN188* .....	20
IN189 .....	20
IN190* .....	20
IN191 .....	20
IN192 .....	20
IN193 .....	20
IN194* .....	20
IN195 .....	18
IN196* .....	20
IN197 .....	20
IN198* .....	20
IN199 .....	20
IN200 .....	20
IN201 .....	20
IN202* .....	20
IN203 .....	18
IN204* .....	20
IN221 .....	18
IN222 .....	20
IN223 .....	20
IN224 .....	20
IN225 .....	20

<i>Interphone Wire No.</i>	<i>Size</i>
IN226 .....	20
IN227 .....	20

<i>Liaison Radio Wire No.</i>	<i>Size</i>
LR1 .....	16
LR2 .....	6
LR3 .....	6
LR4 .....	16
LR5 .....	16
LR6 .....	18
LR7 .....	14
LR8 .....	14
LR9 .....	20
LR10 .....	18
LR11 .....	16
LR12 .....	16
LR13 .....	16
LR15 .....	20
LR16 .....	20
LR17 .....	20
LR18 .....	20
LR19 .....	20
LR21 .....	HT
LR24 .....	20
LR25 .....	20
LR26 .....	20
LR27 .....	20
LR28 .....	20
LR29 .....	16
LR30 .....	16
LR48 .....	18
LR49 .....	18
LR50 .....	18
LR51 .....	18
LR52 .....	18
LR53 .....	18
LR54 .....	18
LR55 .....	18
LR56 .....	18
LR57 .....	18
LH58 .....	18
LR59 .....	18
LR60 .....	18
LR61 .....	18

<i>Marker Beacon Wire No.</i>	<i>Size</i>
MB1 .....	18
MB2 .....	18
MB3 .....	18
MB4 .....	20
MB5 .....	20
MB6 .....	20

<i>Liaison Radio Wire No.</i>	
MB7 .....	20
MB8 .....	20
MB9 .....	20
MB10 .....	20
MB11 .....	20
MB12 .....	20
MB13 .....	18
MB14 .....	20
MB15 .....	20

<i>Radio Compass Wire No.</i>	<i>Size</i>
RC1 .....	18
RC2* .....	18
RC3 .....	20
RC4 .....	20
RC5 .....	20
RC6 .....	20
RC7 .....	20
RC8 .....	20
RC9 .....	20
RC10 .....	20
RC11 .....	20
RC12 .....	20
RC13 .....	20
RC14 .....	20
RC15 .....	18
RC16 .....	20
RC17 .....	20
RC18 .....	20
RC19 .....	20
RC20 .....	20
RC21 .....	20
RC22 .....	20
RC23 .....	20
RC24 .....	18
RC25 .....	20
RC26 .....	20
RC27 .....	18
RC28 .....	20
RC29 .....	20
RC30 .....	20
RC31 .....	20
RC32 .....	20
RC33 .....	20
RC34 .....	20
RC35 .....	20
RC36 .....	20
RC37 .....	20
RC38 .....	20
RC39 .....	20
RC40 .....	20
RC41 .....	20

\*Used only on airplanes with all-electric bomb control system  
\*\*Not used on airplanes with all-electric bomb control system

COMMUNICATION WIRES (Cont.)

<i>Radio Compass</i> Wire No.	<i>Size</i>
RC42 .....	20
RC43 .....	20
RC44 .....	20
RC45 .....	20
RC46 .....	20
RC47 .....	20
RC48 .....	18
RC49 .....	18
RC50 .....	20
RC51 .....	20
RC52 .....	20
RC53 .....	20
RC54 .....	20
RC55 .....	20
RC56 .....	20
RC57 .....	20

<i>Radio Compass</i> Wire No.	<i>Size</i>
RC58 .....	20
RC59 .....	20
RC60 .....	18
RC61* .....	20
RC62 .....	20
RC63 .....	20
RC64 .....	20
RC65 .....	20
RC66 .....	20
RC67 .....	20
RC68 .....	20
RC69 .....	20
RC70 .....	20
RC71 .....	20
RC72 .....	20
RC73 .....	20

<i>Radio Compass</i> Wire No.	<i>Size</i>
RC74 .....	20
RC75 .....	18
RC76 .....	20
RC77 .....	20
RC78 .....	20
RC79 .....	20
RC80 .....	20
RC81 .....	20
RC82 .....	18
RC83 .....	18
RC84 .....	18
RC85* .....	20
RC86* .....	18
RC87 .....	18
RC88 .....	18
RC89 .....	18

\*Used only on airplanes with all-electric bomb control system

\*\*Not used on airplanes with all-electric bomb control system

\*Individually Shielded

COMMUNICATION FUSES

<i>Fuse No.</i>	<i>Amps.</i>
XXII	15
XXXI	30
XXXVI	15
XLII	15
XLV	15
XLVI	20
LXII	10
LXIII	5
LXVII	10
LXXIV	20

<i>Fuse Table</i>
Spec. 94-40002
Spec. 94-40002
Spec. 94-40002
Spec. 94-40002
Spec. 94-40002
Spec. 94-40002
Spec. 94-32271
Spec. 94-32271
Spec. 94-32271
Spec. 94-40002

<i>Circuit</i>
Radio Compass—DC
Command Radio
Interphone
Liaison Radio
Trailing Ant. Motor
SCR-535-A-Radio
Radio Compass—DC
Radio Compass—AC
Radio Compass—AC
Detonator Switch

f. FUSELAGE FURNISHINGS.

(1) PERSONNEL ACCOMMODATIONS.

(a) SEATS.

1. GENERAL.—The pilot's and copilot's "Bucket" type seats are supported on stands bolted to the floor and are adjusted both horizontally and vertically. The cushions for the "Bucket" seats are useable for life preservers. On early B-17G airplanes at the navigator's station, a removable "Posture Chair" is strapped to a ring in the floor. An additional ring is provided under the navigator's table for anchoring the seat in its stowed position. The bombardier's and radio operator's seats are also the "Posture Chair" type with a vertical adjustment. The tail gunner's "Saddle" type is mounted on rails for fore and aft adjustment; it may also be tipped from a horizontal position to either of two sloping positions.

2. REMOVAL.

a. BOMBARDIER'S SEAT.—The bombardier's seat may be removed by removing the bolts at the base of each leg.

b. PILOTS' SEATS.—Ordinarily, a pilot's seat should not be removed with armor plate attached because of the difficulty in handling. The seat and support may be removed as a unit by removing the bolts in the terminals at the floor. The inboard terminals are accessible from the cockpit and the outboard terminals are accessible from below the floor. To remove the bucket from the pilot's seat support, run the seat to the full upward position and remove one bolt at the bottom fitting and two bolts at the top fitting on each side. If it is desired to remove the fittings and the carriage, slip the shock cord off the hooks before removing the bolts at the bottom terminal.

c. RADIO OPERATOR'S SEAT.—The removal of this seat requires only the releasing of the "HOLD DOWN" strap.

d. TAIL GUNNER'S SEAT.—Removal of the tail gunner's seat requires removal of both rails. It will be necessary to remove the stop at the aft end of the left-hand rail to facilitate removal of the screws holding the rails. If desired, the bottom screw at the aft end of each rail may be loosened and left in place so that the



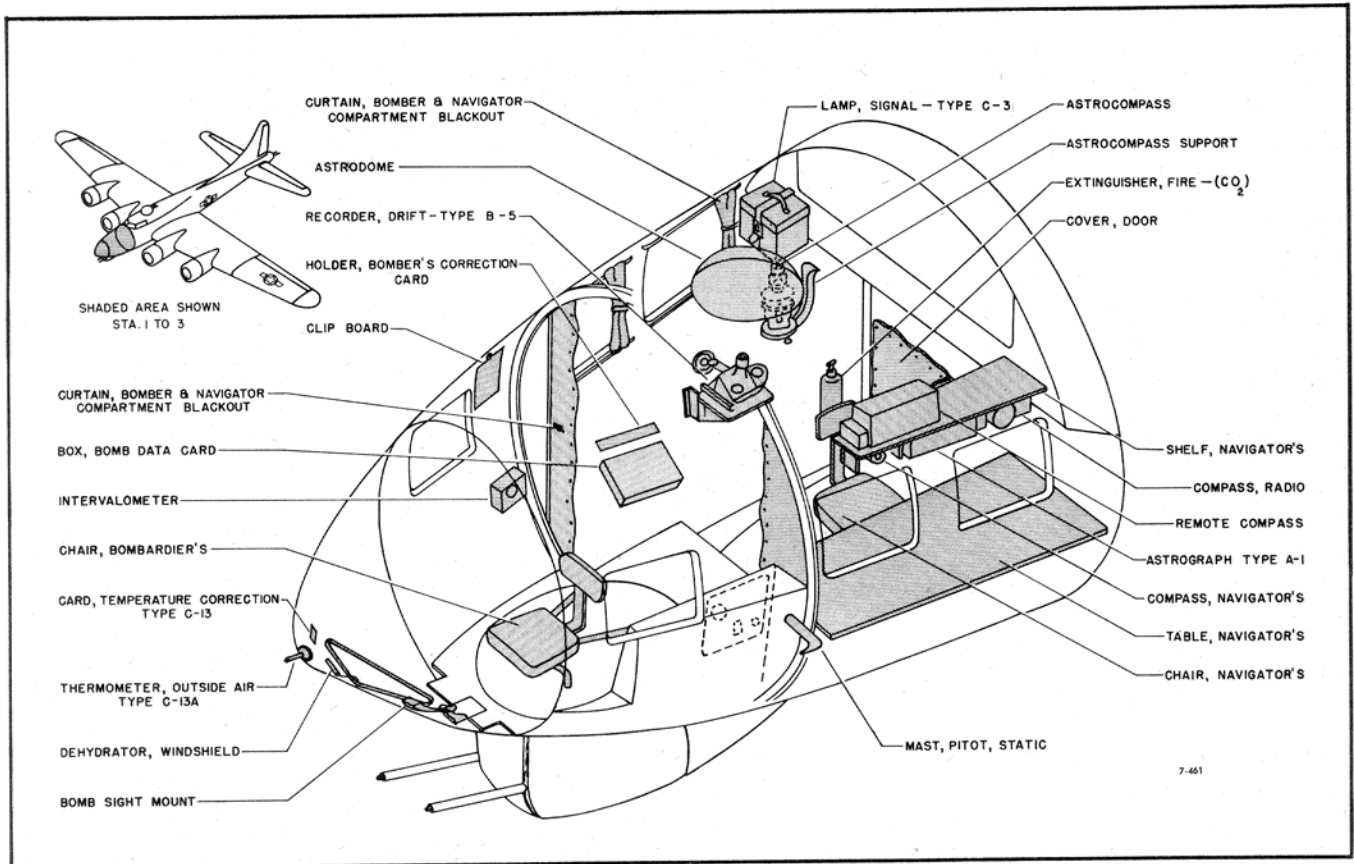


Figure 331—Equipment Diagram—Station 1 to 3

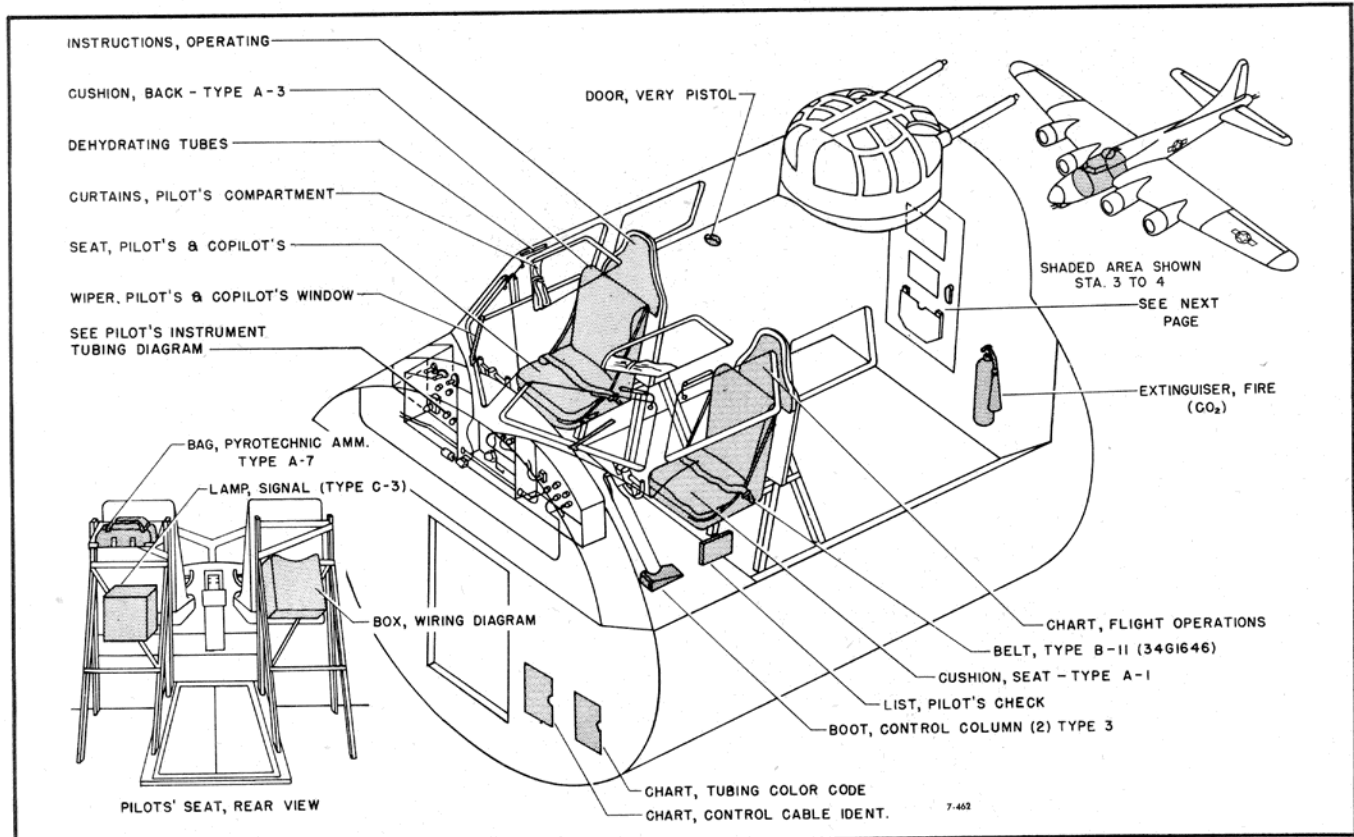
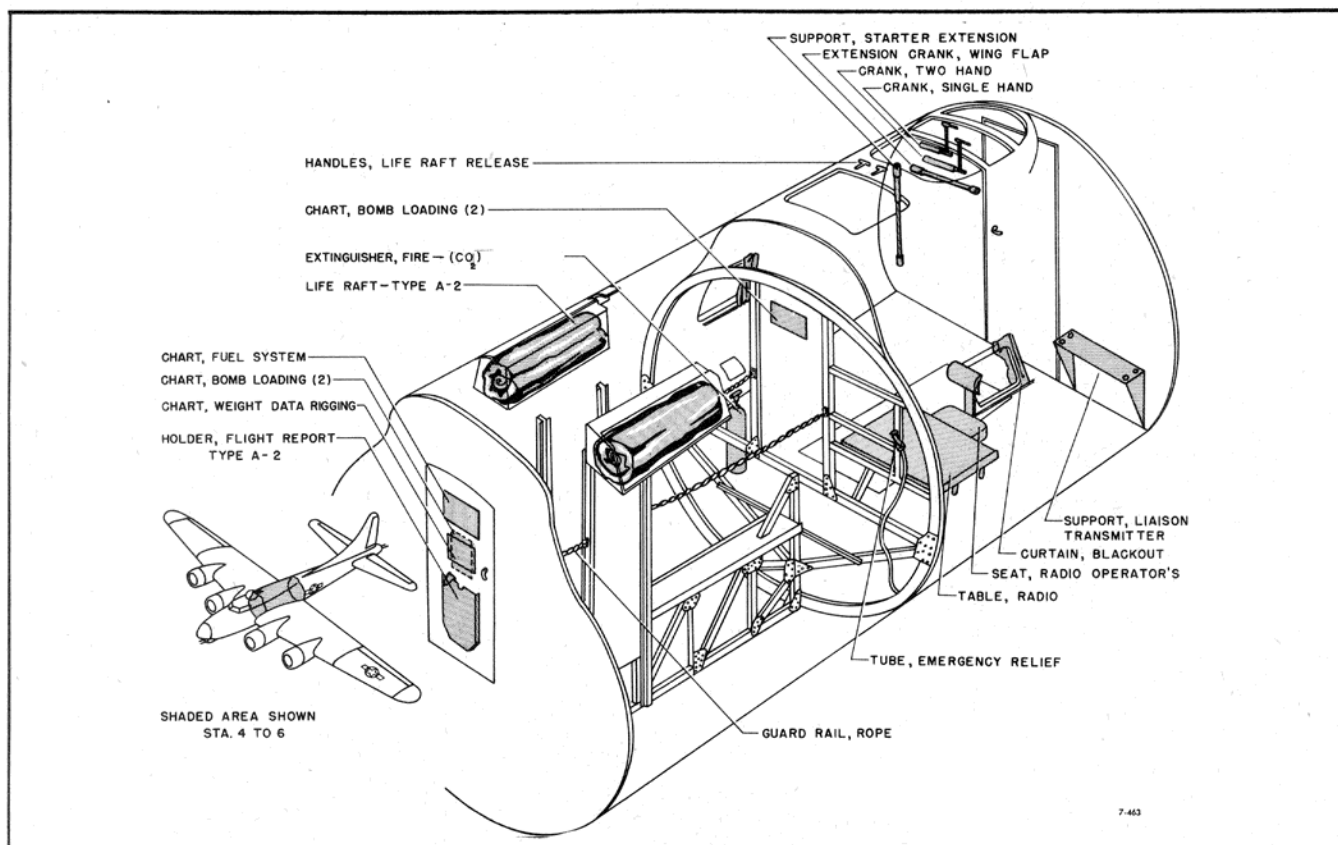
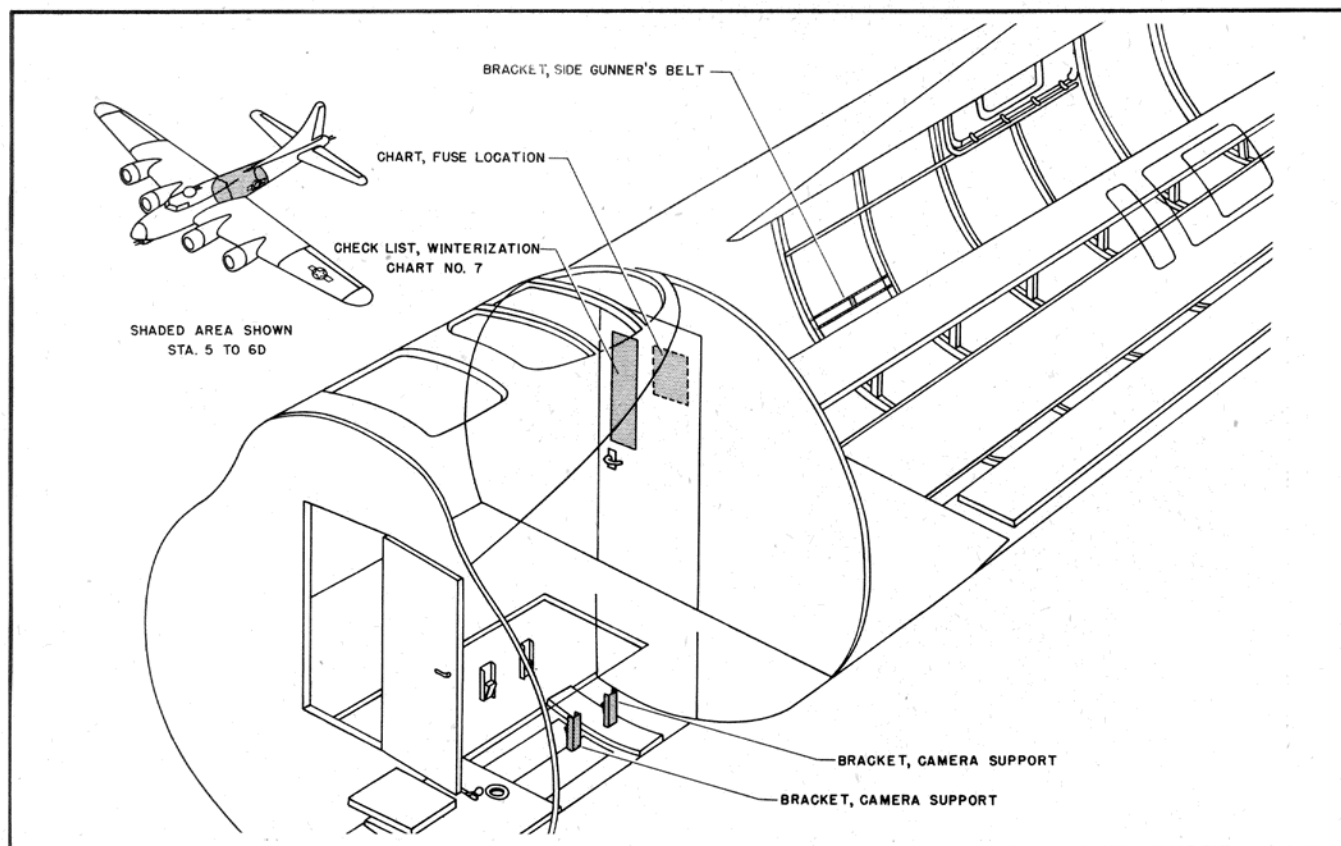


Figure 332—Equipment Diagram—Station 3 to 4

RESTRICTED  
AN 01-20EG-2



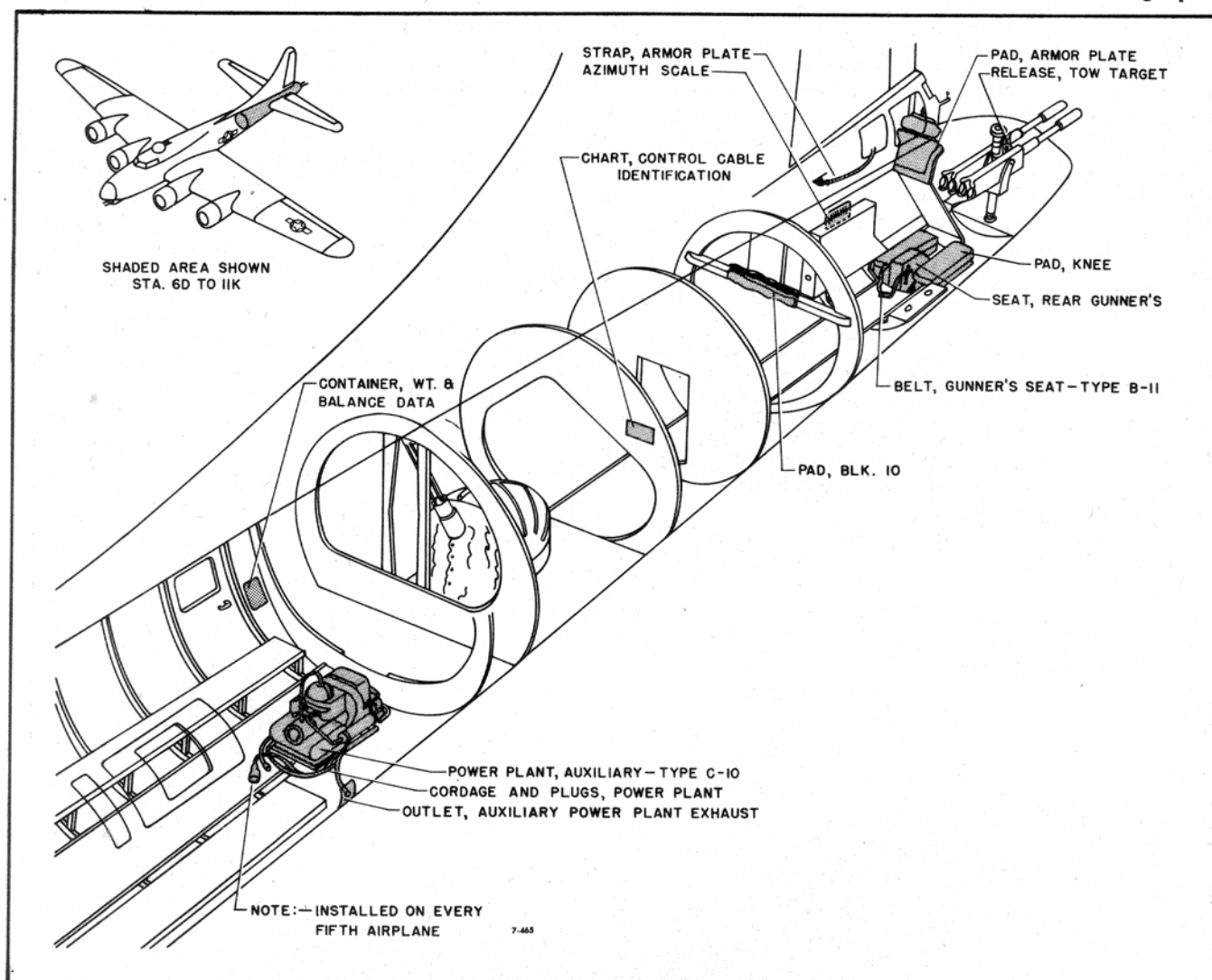
**Figure 333—Equipment Diagram—Station 4 to 6**



**Figure 334—Equipment Diagram—Station 5 to 6D**

RESTRICTED





**Figure 335—Equipment Diagram Station 6D to 11K**

seat may be tipped and moved forward without completely removing the rails.

### 3. MINOR REPAIR AND REPLACEMENT.

—The shock cords balancing the pilots' seats may be repaired or replaced as the situation demands. However, do not shorten the cord so much that overbalancing of the pilots' weight occurs.

4. ASSEMBLY AND INSTALLATION.—To install the seats, reverse the removal procedure.

#### (b) TABLES.

1. GENERAL.—Two tables are provided, one for the navigator in the left rear corner of the nose compartment and one for the radio operator at the left front corner of the radio compartment. The navigator's table is fitted with a shock-mounted top, supported by an aluminum-alloy frame. The radio operator's table is not shock-mounted.

2. REMOVAL.—Removal of the navigator's table top may be accomplished by removing the four

bolts in each of the four shock mount attaching brackets. The radio compass tuning shaft and antenna lead must be disconnected and withdrawn through the holes in the table top, and the bearing indicator shafts must be disconnected at the indicator. If desired, the table support may also be removed by removing the bolts at its attachment to the structure. The radio table may be removed after removal of the liaison receiver and disconnection of the transmitter key.

(c) MISCELLANEOUS EQUIPMENT.—A key case located on the sidewall at the copilot's right contains two keys which fit all door locks of the airplane. A tail gun azimuth scale, used with the British drift recorder, is stowed above the ammunition box on the right sidewall of the tail gunner's compartment. A target tow hook is attached to the vertical tube which supports the tail guns. The hook is ringed and has a spring-loaded handle for releasing the target cable.

#### (2) EMERGENCY EQUIPMENT.

(a) GENERAL.—Emergency equipment includes an engine fire extinguisher system and three hand fire



extinguishers, located in the navigator's compartment, pilots' compartment, and radio compartment. First aid kits are located in the navigator's compartment, on the back of the copilot's seat, on the rear bulkhead of the radio compartment, and on the bulkhead forward of the ball turret. Two type A-2 automatic ejector life rafts are carried in the cockpit enclosure above the bomb bay. These are released by two pull handles at the roof of the radio compartment.

(b) ENGINE FIRE EXTINGUISHER SYSTEM.

1. GENERAL.—Remotely controlled equipment is installed in some airplanes to permit the copilot to discharge CO<sub>2</sub> in the engine accessory compartments. A selector valve for directing the CO<sub>2</sub> to any one of the four engines, and two pull handles for release of the two CO<sub>2</sub> cylinders, are mounted in the auxiliary control panel in front of the copilot.

a. Two 7¼-pound CO<sub>2</sub> cylinders are installed in the right-hand wing gap just forward of the rear spar. The individual cylinder outlet tubes "tee" into a single line and feed the selector valve in the cockpit. The safety disc outlet from each cylinder is led through a tube to an inspection disc located on the bottom surface of the body fairing aft of the right rear spar. From the selector valve, four single lines extend to perforated rings encircling the accessory drive case at each engine.

b. Control for release of CO<sub>2</sub> from the cylinders is accomplished for each cylinder individually by means of two flexible cables extending from the two pull handles in the cockpit to the valves on the cylinders. The cables are guided, by pulleys and fair-leads, to the front spar where they are spliced to bowdenite cables from the front spar to the cylinders. Springs are attached between the cable splices and the structures at the front

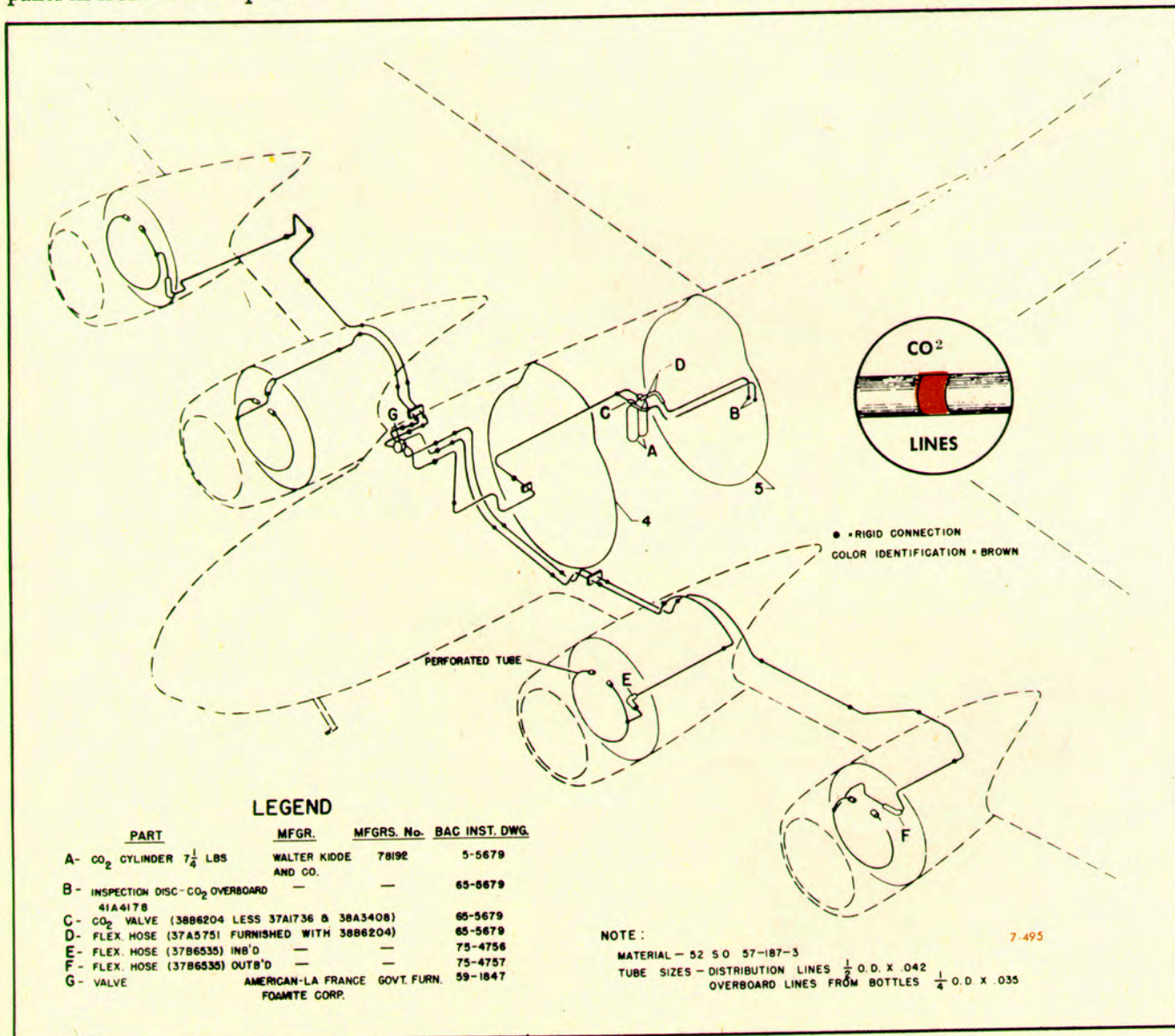


Figure 336—Fire Extinguisher System



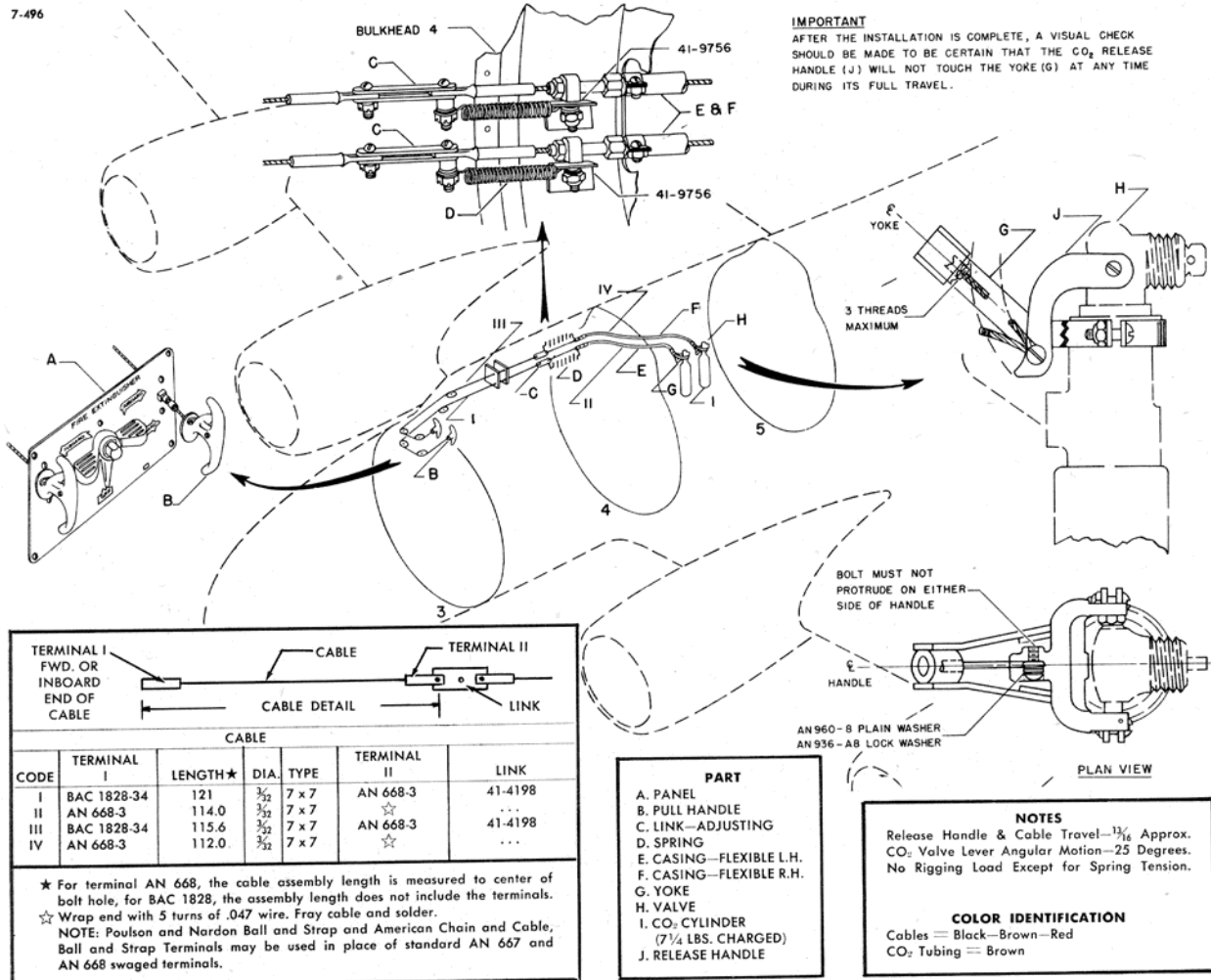


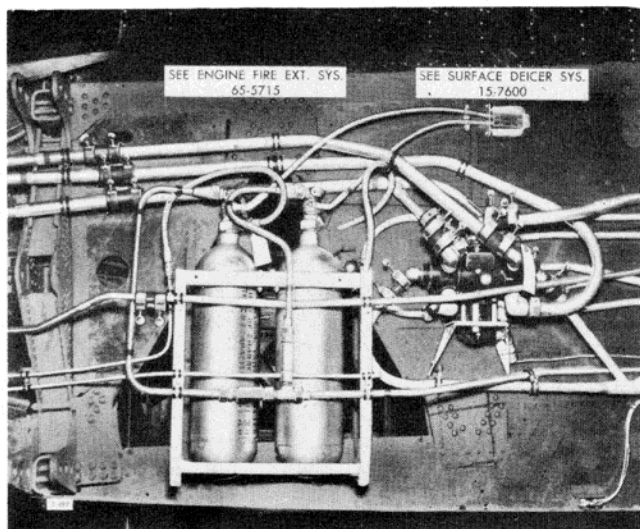
Figure 337—Engine Fire Extinguisher Control System

spar, as illustrated in the fire extinguisher control system diagram, figure 337, in order to maintain tension on the cable from the pull handles to the bowdenite cable.

2. REMOVAL AND DISASSEMBLY.—Access to the CO<sub>2</sub> cylinders may be gained through the right wing gap cover or through removable panels at the rear of the right body compression strut. To remove the cylinders, disconnect the cables, clamps and tubing, remove the retaining straps, and lift the cylinders out. For removal of the control assembly, remove the fabric panel

at the forward side of the instrument panel and disconnect the cable and the tubing. Then remove the mounting screws from the cockpit side of the panel. To remove the cables, remove pulleys and fair-leads. A feeder line should be attached when removing cables, in order to facilitate assembly.

3. MINOR REPAIR AND REPLACEMENTS.—No service or maintenance operations should be necessary on this system other than normal cable maintenance and replacement of empty cylinders. No



**Figure 338—Engine Fire Extinguisher Cylinder Installation**

repairs will be attempted on cylinders nor will body bushings or valve bodies, threaded directly into cylinders, be removed. Unless empty, CO<sub>2</sub> cylinders should not be exposed to direct rays of the sun or other sources of heat in excess of 54°C (130°F).

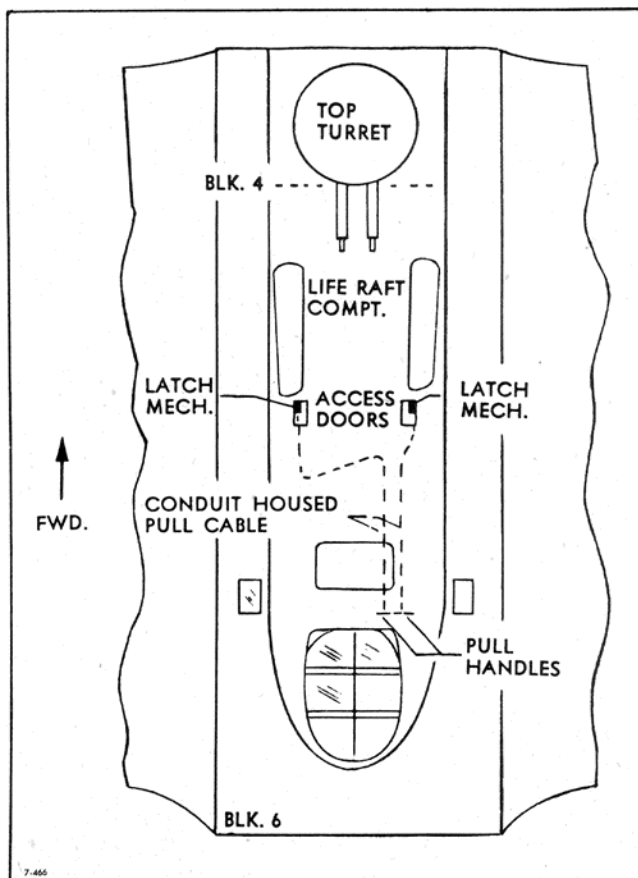
4. ASSEMBLY AND INSTALLATION.—Install all equipment as indicated in the fire extinguisher system diagram and the fire extinguisher control system diagram. Check for free operation of the bowdenite cables before making the connections at the cylinders. Install the red inspection discs in holder assembly installed in skin of airplane and take care to seat their retaining rings properly so that the discs will not be lost except through rupture of the safety discs in the cylinder valve assemblies.

5. RECHARGING CO<sub>2</sub> CYLINDERS.—The amount of gas contained in a CO<sub>2</sub> cylinder is determined by weight, the correct charge for each cylinder being stamped on the valve body. Equipment for charging all types of CO<sub>2</sub> cylinders has been furnished Army Air Forces depots. Except when recharging facilities are made available at the station, cylinders that are discharged or found defective will be replaced and returned for recharging.

(c) LIFE RAFTS.

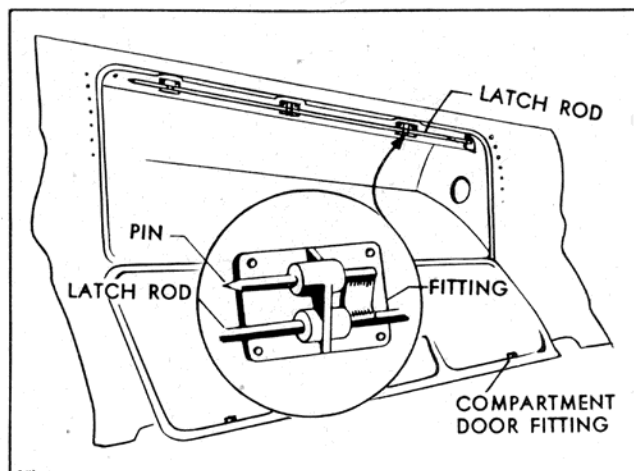
1. GENERAL.

a. A type A-2 automatic ejector life raft is carried in each of the two life raft compartments located in the top of the airplane aft of the top turret. The rafts are controlled by two pull handles, located at the top of the radio compartment, just forward of the removable top window. These two handles are clipped into a rack and safety wired into place so as to avoid their being pulled inadvertently. Complete release of a raft is accomplished by pulling a handle hard, out about 12 inches. The two handles attach to cables which run forward to the aft side of each life raft compartment, where they attach to two life raft door latch mechanisms.



**Figure 339—General Arrangement of the Life Raft Equipment**

b. The latch mechanism has two functions: to keep the life raft compartment door from opening at the wrong time, and to insure its opening at the right time. A latch rod at the top of the life raft compartment protrudes through the aft bulkhead of the compartment. When this latch rod is pushed forward, its forward end and the two pins attached to it engage fittings on the compartment door and on the compartment door frame to latch the door closed. Aft movement of the



**Figure 340—Life Raft Compartment Door Latch Rod and Fittings**



latch rod disengages the pins and permits the door to open.

c. A spring clip bolted to the aft bulkhead of the compartment hooks around the end of the latch rod to hold the rod forward. The clip is held to the rod by the collar assembly and the compression spring (figure 341).

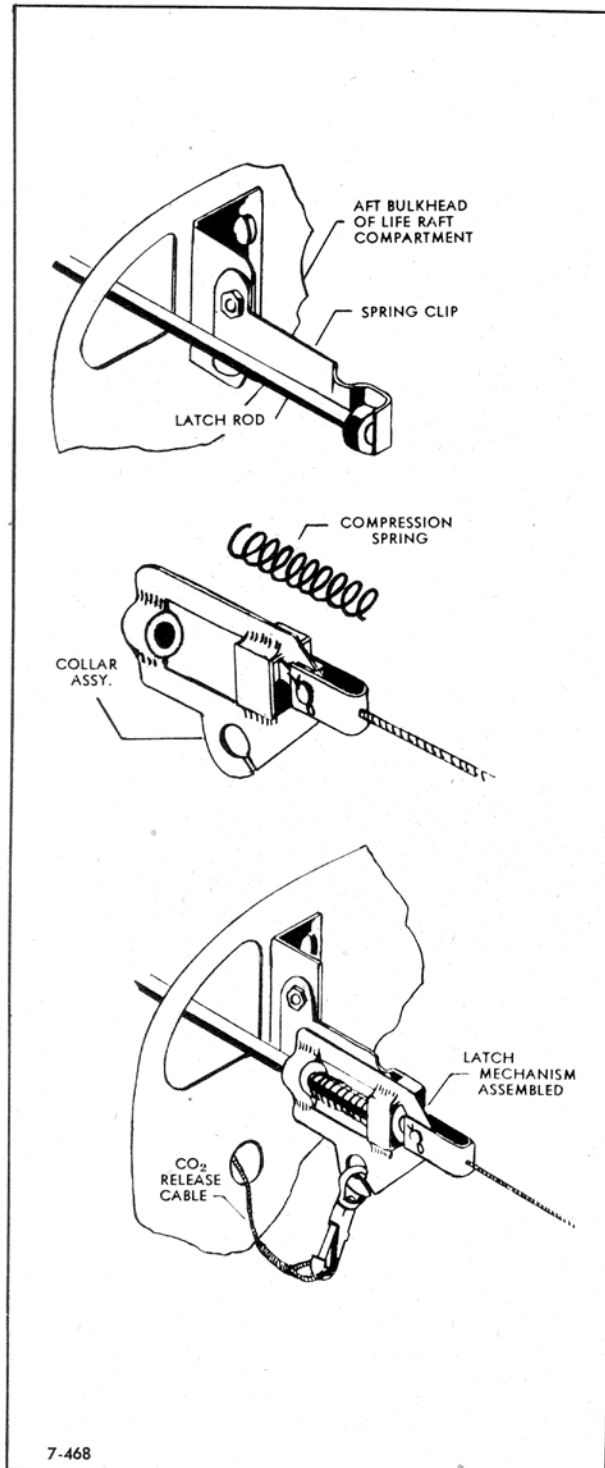


Figure 341—Latch Mechanism

d. Discharge of the CO<sub>2</sub> into the raft is accomplished by attaching one end of a cable to the latch mechanism and the other end to the valve on the CO<sub>2</sub> bottle. The flexible conduit through which the CO<sub>2</sub> release cable travels serves not only to prevent the cable from being fouled, but also insures that pulling the cable actually operates the CO<sub>2</sub> bottle valve instead of merely dragging the CO<sub>2</sub> bottle through the compartment. Approximately two inches of slack in the CO<sub>2</sub> release cable assure that the door latch will move far enough to open the door before CO<sub>2</sub> is discharged into the raft.

e. Since the CO<sub>2</sub> release cable is connected positively to the airplane, it must disconnect from the CO<sub>2</sub> bottle valve, when the raft inflates, in order to permit the bottle and raft to float free of the airplane. This disconnection is automatically accomplished within the CO<sub>2</sub> bottle valve housing as soon as the CO<sub>2</sub> is discharged into the raft. A drift line on the inside of the door is attached to the raft so as to keep the raft from drifting away from the airplane after it is inflated. This line will break before it will pull the raft down when the airplane sinks.

2. REMOVAL.—Removal of either life raft without automatic inflation requires disconnection of the CO<sub>2</sub> release cable from the door latch mechanism by means of the harness snap. This will necessitate removal of the access door at the rear of the life raft compartment. After disconnecting the cable, pull the life raft control handle in the radio compartment to release the door latches. Be prepared to restrain the door action and retain the raft by hand, as a properly installed raft will tend to unroll when the door is released. Disconnect the CO<sub>2</sub> bottle flexible conduit from the life raft compartment flexible conduit, at the junction, and disconnect the CO<sub>2</sub> release cables. Disconnect the mooring line from the raft life line. Remove the raft.

### 3. MINOR REPAIR AND REPLACEMENTS.

a. Rafts not installed in the airplane will, when facilities permit, be unfolded and stored away from the light in a cool, dry location.

b. At least once every six months each raft will be removed from its compartment, inflated, and inspected as follows:

(1) Inflate by operating the automatic inflation system, or if no replacement CO<sub>2</sub> cylinders are available, the raft may be inflated with compressed air, provided extreme care is used and the pressure is not permitted to exceed 2½ pounds per square inch. If CO<sub>2</sub> is used, allow approximately 15 minutes for the gas to fully expand.

(2) Allow the raft to stand for six hours, at the end of which time the pressure in the raft will be checked for variation. If a reduction in pressure greater than 10 percent is noted, the bladder will be deflated, removed from the casing, and inspected for defects. If

the defects cannot be readily found, inflate and immerse in a vat of clean water.

(3) Cylinder connections, manifolds, and topping-off valves will likewise be checked for leakage and repaired or replaced as necessary.

(4) The date of each six months raft inspection will be stenciled in indelible ink to the right of the inspection patch (as viewed from end of the raft on which the CO<sub>2</sub> cylinder is attached) using letters and figures approximately 1/2 inch high.

c. No repairs will be made to rubberized fabric or latex bladders other than the patching of small holes. Such repairs will be made by cold patching, using three coats of rubber cement. Large tears, rips, and severely chafed areas will be cause for condemnation. Normally, maintenance repairs and inspection requiring inflation tests will be performed by the station parachute repair personnel.

#### 4. INSTALLATION.

a. Remove the access door located aft of raft compartment door.

b. Detach the CO<sub>2</sub> release cable from the latch mechanism (figure 341).

c. Pull the handle in the radio compartment to operate the latch mechanism and open the life raft compartment door.

d. Unroll the raft and lay out flat on a clean surface. (When no clean floor space is available, use the top surface of the wing.) Insure that it is completely deflated by either rolling it tight or by using a deflation pump (figure 342). If a CO<sub>2</sub> bottle is not already attached to the raft, put a fully charged bottle in the raft pocket and screw the wing nut of the raft manifold

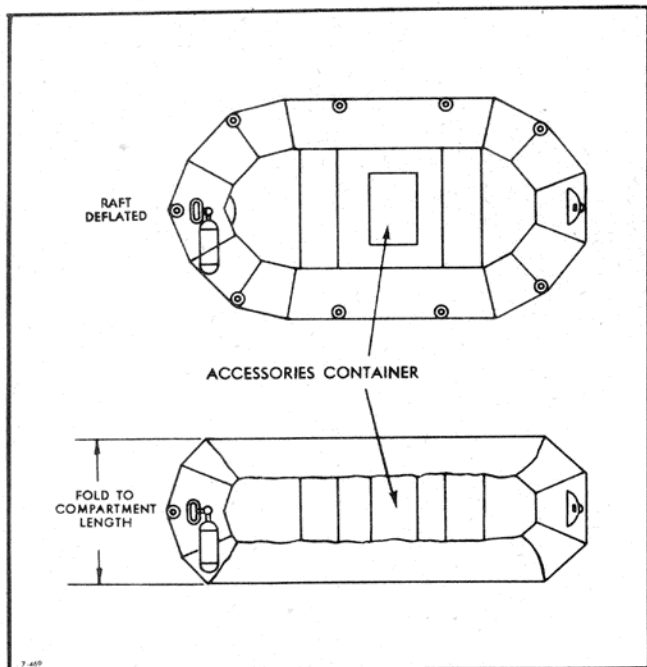


Figure 342—Folding Raft for Stowage

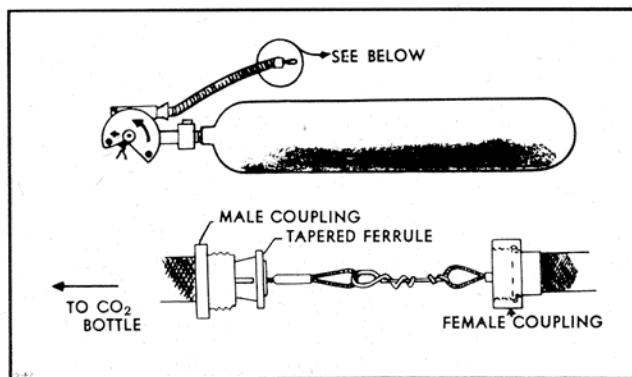


Figure 343—CO<sub>2</sub> Release Cable Connection and Conduit Coupling

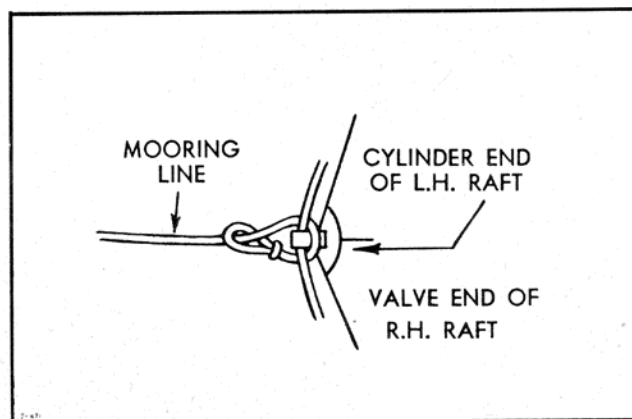


Figure 344—Attachment of Mooring Line

assembly to the CO<sub>2</sub> bottle valve boss. Snap on the cover flap for the raft manifold. Fold the sides of the raft in toward the middle so that the raft will be slightly less wide than the raft compartment is long.

e. Connect the CO<sub>2</sub> release cable to loop on cylinder valve cable. Then connect the two cable housings together by means of the housing coupling.

f. Fasten one end of the mooring line to raft life line at webbing loop on cylinder end of raft and fasten the other end securely to the compartment.

g. Stow the raft into the compartment with an accordion fold. Make sure that the mooring line cannot foul.

h. Close raft compartment door and engage latch rod in door fittings. Set latch mechanism as shown

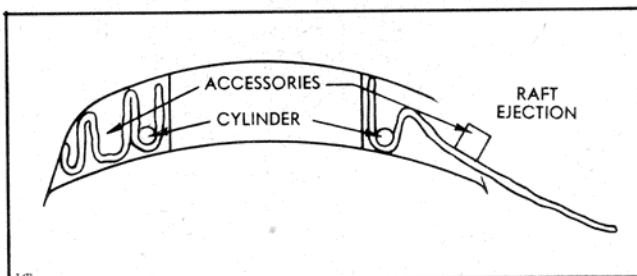


Figure 345—Life Rafts Stowed



in figure 341. Pull collar assembly aft and place spring clip over aft end of latch rod. Push collar assembly forward so that collar encloses spring clip and latch rod.

**Note**

A life raft door latch instruction placard is located on the outside of the compartment at the cable connection.

i. Connect CO<sub>2</sub> release cable to the door latch assembly, then close access door and secure in place with the fasteners provided.

j. Install .020-inch diameter soft copper wire, 11-pound break, Specification QQ-W-341, on the raft release handle in the radio compartment.

g. **HEATING AND VENTILATING EQUIPMENT.**

(1) **GENERAL.**

(a) This airplane is equipped with a heating system in which heat is transferred to the ventilating air from the glycol system, installed on a No. 2 engine, as shown on the heating system diagram (see figure 347). The glycol circulates continuously and, therefore, it must be continuously cooled. Air from the intercooler air inlet passes through the radiator, installed in the wing-gap between spars on the left-hand side of the airplane, and absorbs heat from the glycol. This warm air is then conducted into the cabin when the damper control, located on the left sidewall of the pilots' compartment, is in the "HOT" position. If this air is not desired for heating the cabin, moving the damper control to the "COLD" or "OFF" position will spill the heated air overboard. During ground operation, the damper control should be in the "COLD" or "OFF" position to prevent the glycol from boiling away. In either of these positions, the heated air does not have to be forced through the cabin air ducts, and, therefore, a greater volume of air will flow through the radiator. With the control in the "COLD" position, cold air from the carburetor air inlet is conducted into the cabin while no ventilating air at all enters the cabin when the control is in the "OFF" position.

(b) For best heat distribution the pilot's and copilot's air controls should be one-fourth open. Defroster air for the windshield is controlled by means of a red knob in the "V" of the windshield. The bombardier's defroster control is located near the outlet in the bombardier's air duct and the radio compartment air control is located on top of the duct near the outlet.

(2) **HEATING SYSTEM.**

(a) **GENERAL.**

1. The heating system fluid obtains its heat from the heaters mounted in the exhaust stack of No. 2 engine and then gives it up in the cooling radiator. The approved glycol fluid is a solution of 55 percent diethylene glycol and 45 percent ethylene glycol by weight. Reserve fluid is stored in the 1.3 U. S. (1.1 Imperial) gallon supply tank located in the top of the No. 2 engine nacelle. A vent from the supply tank to the atmosphere allows for expansion. The glycol flows from

the tank to the engine-driven pump, which circulates the fluid at a rate of 55 to 60 U. S. (46 to 50 Imperial) gallons per hour. The pump is of the positive displacement type with sliding vanes in a spindle and depends upon the glycol for lubrication. The flow is directed from the pump to the Purolator filter.

**Note**

It is important that the filter handle be turned daily and that the filter be disassembled and cleaned after every 50 hours of flying time to prevent total restriction of the flow to the heater units due to carbonization of the glycol fluid. Any temperatures higher than 177°C (350°F) will cause carbonization of the glycol and consequent malfunctioning of the system.

2. A bypass relief valve is installed between the pump and filter and the supply line to prevent the building up of high pressure in the system when operating the system in very cold weather. The relief valve is set to operate at 325 pounds per square inch and when starting at low temperatures, the glycol is bypassed for a short time until it heats up sufficiently to pass through the filter. The glycol is then pumped through the filter to the heaters. Either two or three heaters may be used, the center heater being replaced with a plate for summer operation.

3. The glycol fluid passes into the heaters through the spiral thread where it absorbs heat, then through the radiator, where it transfers its heat to air

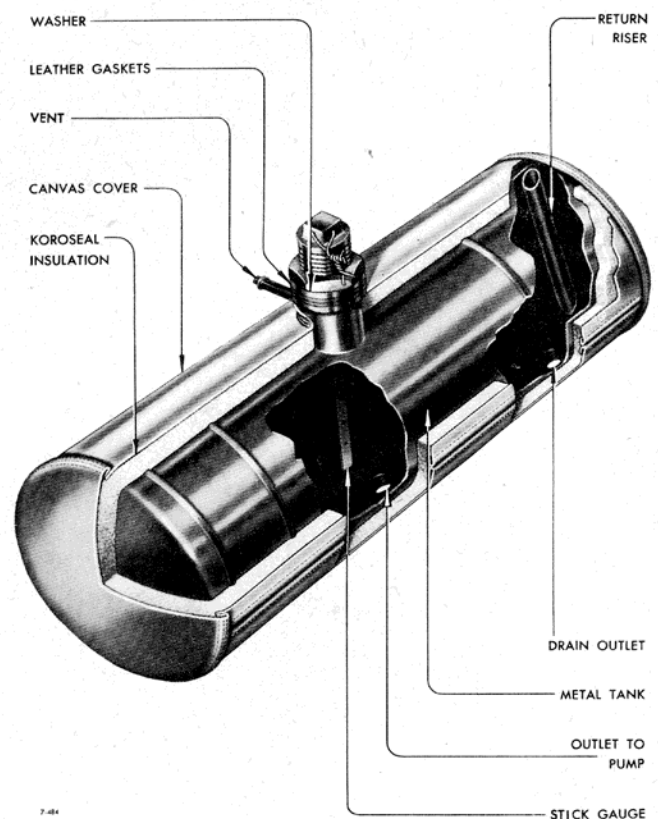


Figure 346—Glycol Tank

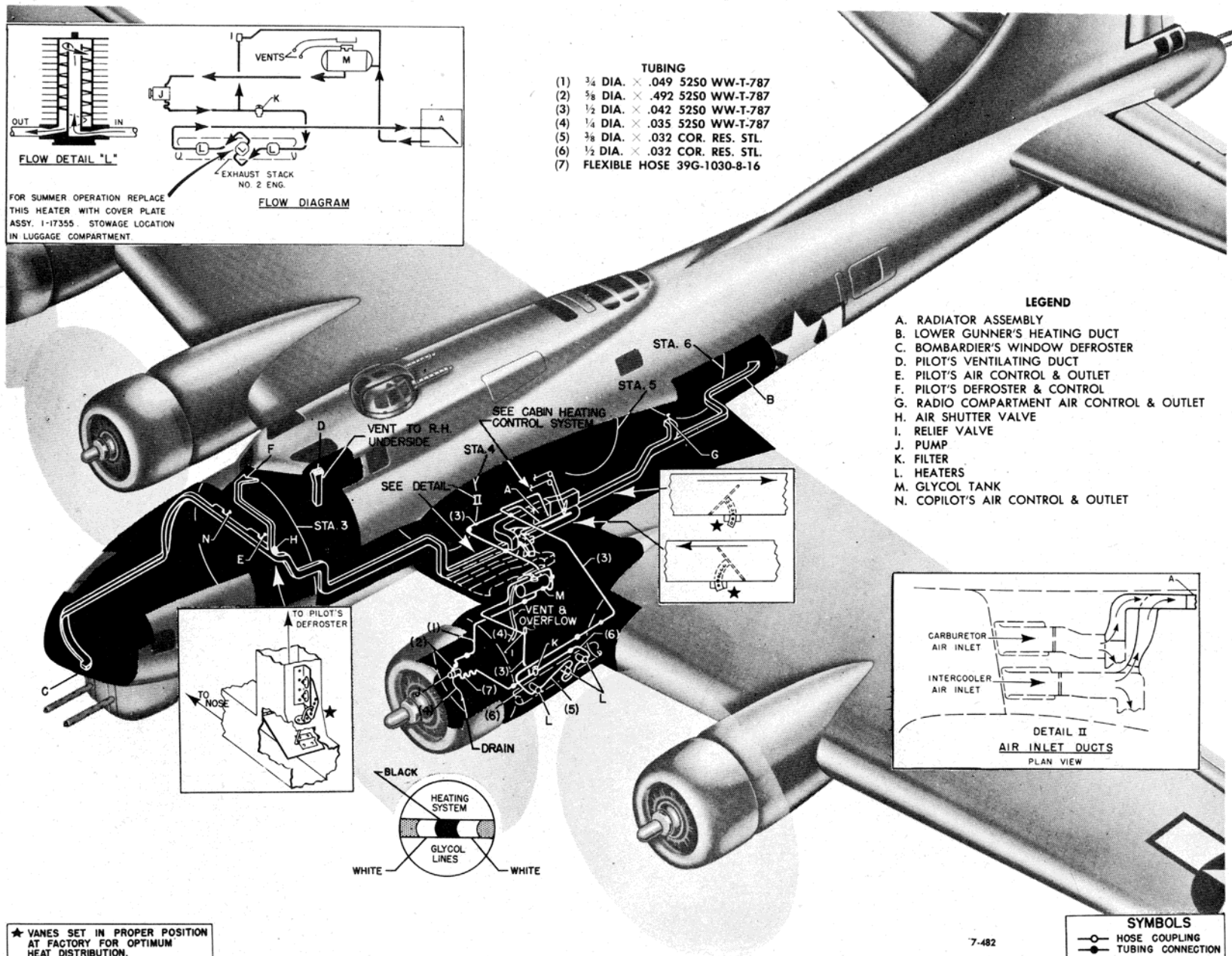


Figure 347—Heating and Ventilating System



TERMINAL I—FWD OR INBOARD END OF CABLE		TERMINAL II TURNBUCKLE		INSTALL TRNBKLS. WITH R.H. THREADS UP, TO THE REAR OR TO THE RIGHT EXCEPT AS NOTED	
TERMINAL I	CABLE LGT*	CABLE DIA.	TYPE	TERMINAL II	TURNBUCKLE
I		108.0			AN155-16L
II	BAC 1828-34	120.0	3/32	7 x 7	AN669-13LH
III		49.4			AN155-16L
IV		58.0			

\* FOR TERMINAL AN669, THE ASSEMBLY LENGTH INCLUDES FULL LENGTH OF TERMINALS, FOR BAC 1828, ASSEMBLY LENGTH DOES NOT INCLUDE TERMINALS.

LEGEND			
Part	Mfr.	Mfr's. No.	Inst. No. BAC
A SECTOR	BAC	41-8064	9-3705
B HANDLE ASSY.	BAC	41-8065	9-3705
C FLEXIBLE CASING (BOWDENITE NO. 13 86.30 LONG)	BAC	55-6705-402	65-6705
D TUBE	BAC	55-6705-401	65-6705
E RADIATOR ASSY.	McQUAY	1928-E	65-6705
F UNIT ASSY., CABIN AIR CONTROL	BAC	55-6704	65-6705

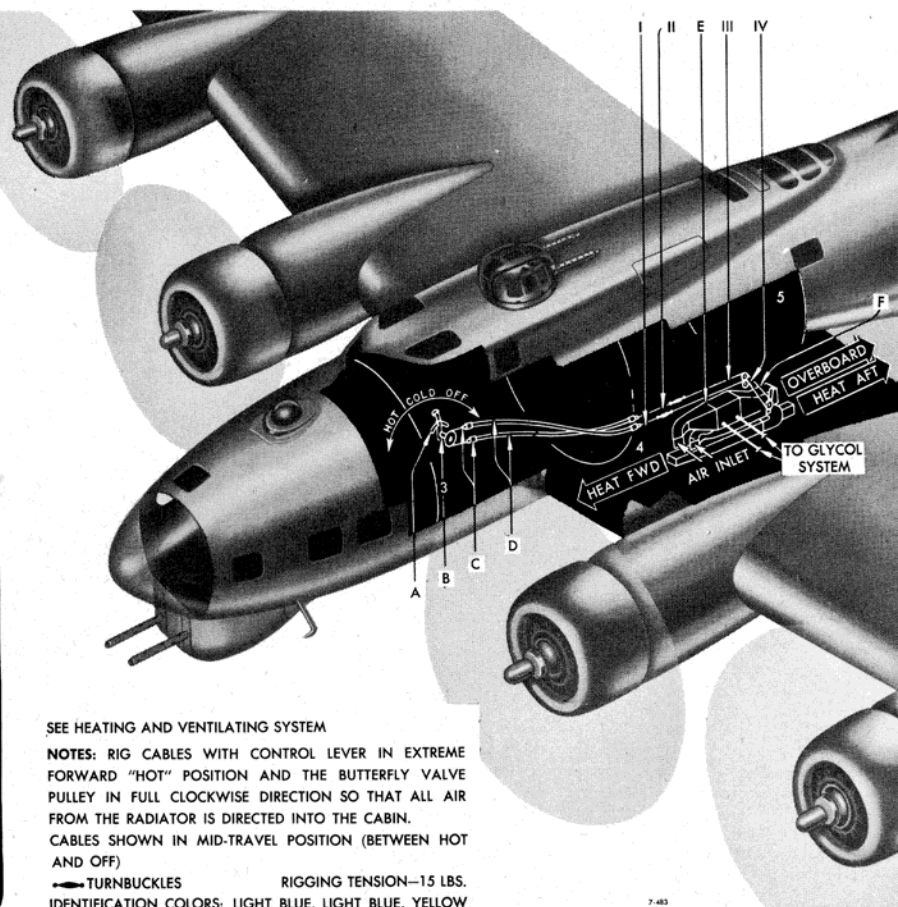


Figure 348—Cabin Heating Control System

tapped off the intercooler air intake duct, and thence back to the supply tank. Each heater is capable of transferring approximately 30,000 BTU per hour at glycol temperatures ranging from 93°C to 149°C (200°F to 300°F). Thus, with three heaters, 90,000 BTU per hour are available at the radiator for absorption into the cabin heating air. The glycol lines from the pump to the radiator are insulated to reduce loss of heat. Because of variations in line losses accompanying variations in glycol temperatures, the pump outlet pressure normally ranges from 50 to 100 pounds per square inch.

#### (b) REMOVAL AND DISASSEMBLY.

1. The glycol supply tank is located in the No. 2 nacelle. The glycol tank may be removed through the wheel well.

2. The glycol heaters are in the No. 2 engine exhaust stack for the heating system. The heaters are held in place by a stud in the rear and castlenuts lock-wired together in front. As the heaters are subjected to very high temperatures the studs may tend to fuse and care must be taken in removal of the heaters so that the stack will not be damaged by twisting or wrenching.

3. It is possible to remove the radiators from the wing gap if a special tool is made to hold the nuts on the flanges between the radiator and the inlet and outlet ducts. This wrench should be approximately 14 inches long and quite thin. It should have a spring for holding

the nut in its jaws for the reassembly job. If such a wrench is obtainable, the first step will be to remove the inboard fuel tank. Next remove the wing gap covers and remove the outlet duct from the radiator. This duct is pulled aft about six inches. The inlet duct is disengaged from the radiator and the radiator is pulled slightly aft and lowered through the wing gap.

#### (c) MINOR REPAIR AND REPLACEMENT.

1. GENERAL.—Overhaul of the glycol system should include disassembly of the heaters installed in the exhaust stack of No. 2 engine. Flushing the system will accomplish thorough cleaning of all parts except the heaters and the filter. Heaters are exposed to exhaust temperatures up to approximately 870°C (1600°F); however, the flow of glycol through the system is designed to keep the cores of the heaters below 177°C (350°F). The greatest part of the sludge that accumulates will be found in the heaters and in the filter. At each 50-hour period, remove the core from each heater and thoroughly clean and flush both the heater housing and the cores. Reassemble each heater tightly to prevent leakage, paying particular attention to the pin that retains the core. If this pin is not in place, the core will shift its position and prevent flow of the glycol. The filter handle should be turned after every flight. At each 50-hour period the filter should be disassembled and cleaned thoroughly.



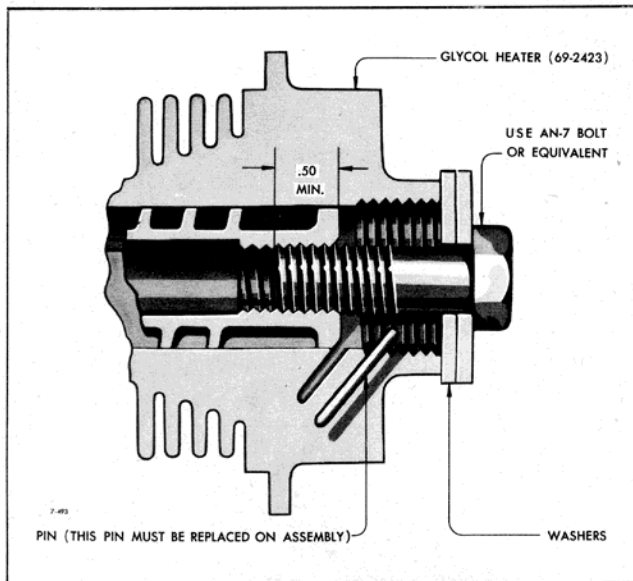


Figure 349—Heater Core Removed

2. **CLEANING.**—Clean the glycol system according to diagram 350 every 100 hours, and change the fluid.

a. **PREFERRED CLEANING PROCEDURE.**

(1) Drain old fluid from system at filter and pump.

(2) **IF GLYCOL SYSTEM HAS BEEN INOPERATIVE:** Remove pump from engine pad and check for a sheared shaft. Remove heaters from stack and clean cores and chambers with a wire brush. If the inlets and outlets are plugged, they may be drilled out. Do not attempt to remove pipe fittings (Parker 6FT-SS), unless damaged so that they require replacing. Install the heaters without cores but attach end caps before steam cleaning line.

(3) **IF GLYCOL SYSTEM IS FUNCTIONING:** The cores may be removed from the heaters without removing heaters from stack. (See figure 349.) Clean heaters and replace end caps, leaving out cores.

(4) Clean purolator filter as follows: Plug inlet connection. Remove the cleaning plug on the bottom. Apply pressure (steam or air) to the outlet port, at the same time turning the filter handle.

(5) Apply steam pressure to the return line from radiator at the supply tank. (See figure 350.) Direct steam through radiator until a good, clean, steady flow exists from connection to filter. This is done to avoid clogging the radiator with any loose carbon.

(6) Remaining lines shall be blown out with air pressure unless the system is badly clogged; steam may then be used. Excessive temperatures are detrimental to flexible hose, therefore, do not pass steam through hose unless absolutely necessary. Blow out entire system with air pressure to prevent dilution of glycol fluid.

(7) Install cores in heaters. Reconnect units using "oildag" at all tube fittings. Fill system with clean glycol fluid as prescribed in section III, and carefully check all lines for leakage.

(8) No. 2 engine should be started and the glycol pump allowed to circulate the fluid. When the engine is stopped, check the tank and add glycol to obtain proper fluid level.

b. **EMERGENCY CLEANING PROCEDURES.**

(1) Follow preferred method of cleaning system, except hot water may be pumped through the line in place of steam.

(2) When no auxiliary equipment for cleaning is available, clean as follows: Drain glycol and reconnect lines. The return line from radiator to tank should be disconnected. (Shown on figure 350 as "Apply Steam.") The system is flushed by running the engine at warm-up speed and at the same time constantly adding water to the glycol tank.

**WARNING**

**UNDER NO CIRCUMSTANCES SHOULD THE ENGINE BE RUN WITH THE GLYCOL TANK EMPTY.** When exhaust water is flowing clean, stop engine and drain the water from system. When possible, blow lines out with air pressure, then connect all lines. Clean heaters and the filter and add fresh, clean glycol to system as noted in preferred procedure.

3. **PRESSURE TEST.**

a. The line between the pump and the heaters should be subjected to a hydrostatic pressure of 750 pounds per square inch without leaking.

b. The entire glycol system should be pressure tested as follows:

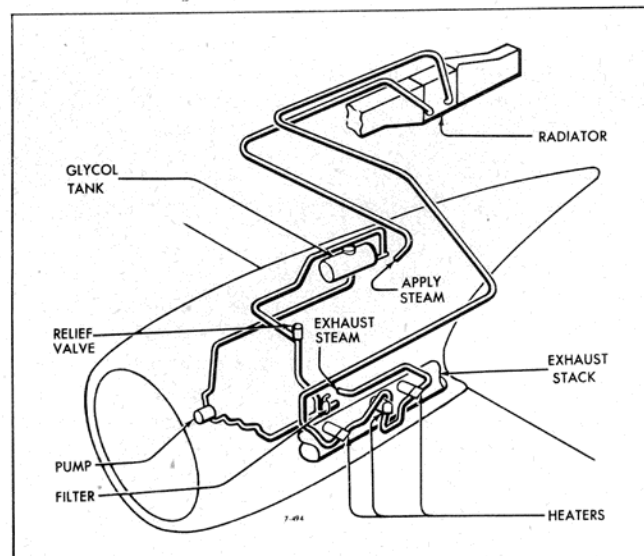


Figure 350—Glycol System



- (1) Drain the supply tank.
- (2) Disconnect and close the tank inlet line at the tank.
- (3) Disconnect the pump discharge line at the pump.
- (4) Connect an auxiliary source of pressure to the pump discharge line.

**Note**

Auxiliary fluid supply must be same as that specified for the tank.

- (5) Apply 100 pounds per square inch pressure and observe the system for leaks.

**4. DRAINING AND REFILLING.**

**Note**

The following operations should be carried out after pressure testing and flushing operations are completed:

- a. With the pump supply line disconnected at the pump, and with the bypass line disconnected immediately above the relief valve, inject air in the line after the filter until liquid is blown from the system.
- b. Drain any liquid left in tank by use of drain plug. (See drawing 6-8647.)
- c. Reopen supply tank vent.
- d. Remove and clean filter.
- e. Reconnect system completely.
- f. Refill system with liquid mixture of 55 percent diethylene glycol and 45 percent ethylene glycol by weight as follows:
  - (1) Remove tank filler cap on top of No. 2 nacelle and fill tank.
  - (2) Operate system pump until lines are full.
  - (3) Refill tank to full mark on stick gage.

**(d) ASSEMBLY AND INSTALLATION.**

1. The two air flow valves (restrictors), located one forward and one aft of the main control valve, are designed to control the proportion of the air flow to the fore-and-aft parts of the airplane. The forward of the two flow valves should be adjusted by inserting the pin in the outermost hole, while the aft flow valve should be adjusted by inserting the pin in the second from the outermost hole. The valves set in this position will provide best regulating characteristics for the entire heating system. Rig the control valve cables so that the dampers are fully seated to direct all the heated air into the cabin and all the cold air overboard with the control lever in the cockpit in the full "HOT" (forward) position. The rigging tension for the control cables is 15 pounds.
2. In replacing the glycol heaters take special precautions to insert the guide tip in its retaining socket on the opposite side of the exhaust stack from the

mounting boss. Failure to do so will result in misalignment of the mounting studs, distortion of the stack, and danger of vibrational failure.

3. Install the glycol pump on its mounting pad on the rear accessory cover of No. 2 engine with the name plate of the pump *upside down*. If the pump is installed with the name plate rightside up, one of the cut-outs in its mounting face overlaps the lubrication hole in the mounting pad permitting oil leakage. This does not occur if the pump is properly installed with the name plate *upside down*.

**(3) VENTILATING SYSTEM.**

(a) GENERAL.—The duct splitter valve settings indicated in the heating system diagram have been determined by actual flight test and should provide satisfactory distribution for all normal conditions. The splitter valves cannot be adjusted in flight and any changes contemplated should be made in small increments and flight tested for results.

**(b) MINOR REPAIR AND REPLACEMENTS.**

1. The heating system ducts are constructed of soft aluminum and secured with a Pittsburgh lock along one edge. The ducts in the wing gap are covered with a 1/2-inch nominal thickness of kapok to reduce radiation to a minimum. Kapok, 1/4-inch thick, also covers the ducts under the pilots' floor and the duct to the pilots' windshield defroster unit. The ducts are originally jointed by using 2-1/4-inch wide pinked tape, grade "A" airplane fabric, which is wrapped around each joint approximately 2-1/2 times and cemented with Eagle Brand Cement or EC676 cement produced by Minnesota Mining and Manufacturing Company. If neither the Eagle Brand or the EC676 cement are available, either water glass (sodium silicate) or shellac will give reasonably satisfactory results. However, both of these materials tend to become brittle at elevated temperatures and will probably require more frequent renewal of the tape at the joints. It is recommended that this method of joining the ducts be used in repair or replacement operations. All bearings used in the control valves and the damper control are prelubricated, sealed bearings and require no lubrication or servicing after installation.

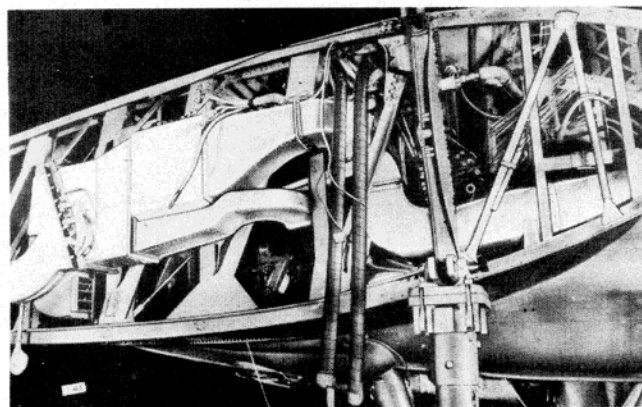


Figure 351—Heating and Ventilating Ducts Installation (Wing)



**Figure 352—Heating and Ventilating Ducts**



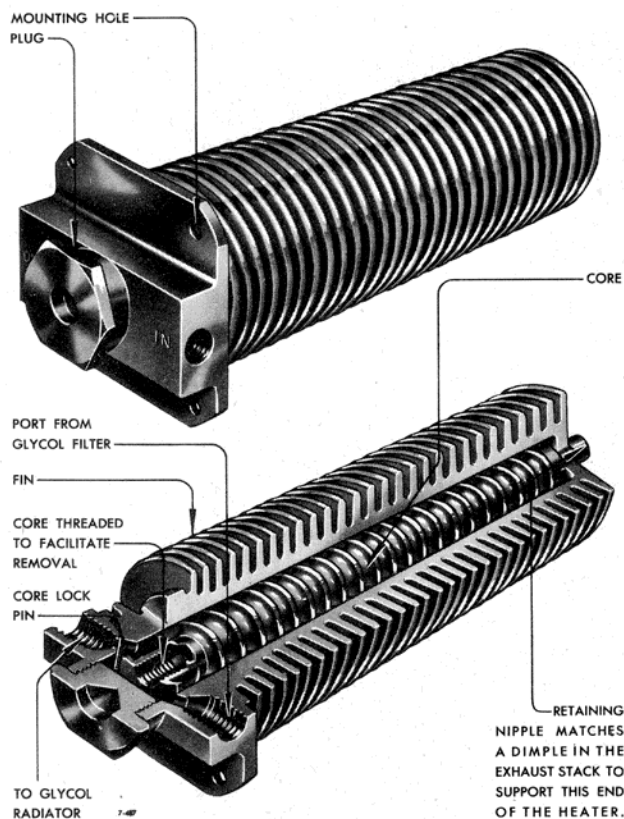


Figure 353—Glycol Heater

## 2. GLYCOL HEATERS.

a. At each 50-hour period, remove the core from each heater and thoroughly clean and flush both the heater housing and the cores. Reassemble each heater tightly to prevent leakage, paying particular attention to the pin that retains the core. If this pin is not in place, the core will shift its position and prevent the flow of glycol.

b. If the glycol heaters are damaged, as evidenced by broken or deteriorated fins, or by excessive vibrational wear on the guide tip (on the inner end of the heater assembly), they should be replaced. *Do not attempt to repair or patch them*, as hazards from leakage or broken pieces are greater than any savings accomplished thereby.

c. Warm weather will prevent sufficient cooling of the glycol with three heaters installed and will result in breaking down the chemical composition of the fluids. With ground temperatures in excess of 70°F, only two heaters should be used; the center heater being removed and the hole capped by Boeing Plate No. 1-17355. If in doubt, check the temperature of the glycol in the supply tank during ground runs and if it reaches 177°C (350°F), remove the center heater and install the cover plate. For all ground operations when temperatures are in excess of 50°F with either two or three heaters installed, the cabin air control should be placed in either "COLD" or "OFF" position. This condition will supply sufficient air to radiator to prevent boiling and resultant loss of fluid.

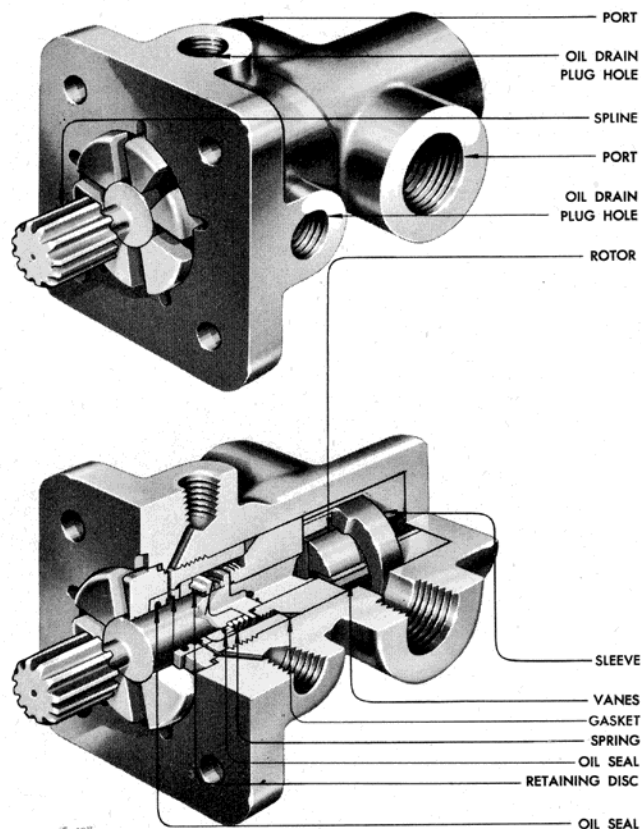


Figure 354—Glycol Pump

3. GLYCOL PUMP.—The Romec glycol pump should not require servicing unless it is operated without fluid in the system. The coupling shaft is provided with a deeply grooved section which should shear before the pump or drive gears are actually damaged in case dry operation does occur. Pump failure will result if the glycol heating system is not properly maintained. After any such failure the system must be completely flushed out, as described in paragraph (c) 2 a., and filled with fresh fluid.

## b. DEICER AND ANTI-ICER EQUIPMENT.

### (1) DEICER SYSTEM.

#### (a) GENERAL.

1. Deicer shoes are provided in two sections for each wing and one section each for the horizontal stabilizers and the fin. Inflation of the shoes is accomplished by exhaust air from both vacuum pumps, and deflation is accomplished by suction from one or the other of the vacuum pumps. Exhaust pressure from each vacuum pump is led through an oil separator, a pressure relief valve, and a check valve to a junction exhaust, which supplies approximately eight PSI air pressure beneath the pilots' floor. From this junction the pressure may be directed through the control valve to the deicer distributor valve (Eclipse type 574, model 2), located in the right wing gap; or the exhaust may be discharged overboard. An additional oil separator is installed between the deicer control valve and the distributor valve. Built integrally with this oil separa-

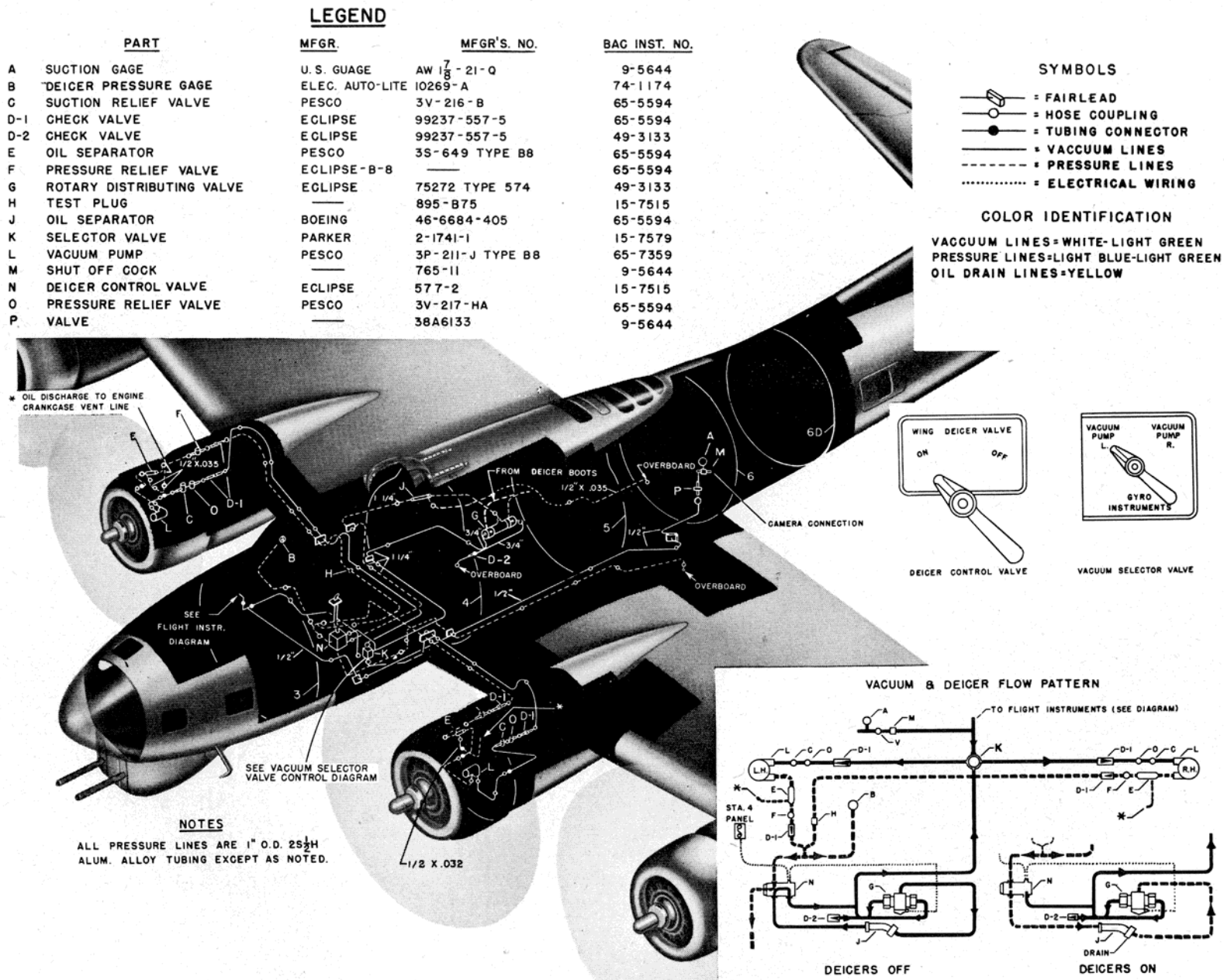


Figure 355—Vacuum and Deicer System



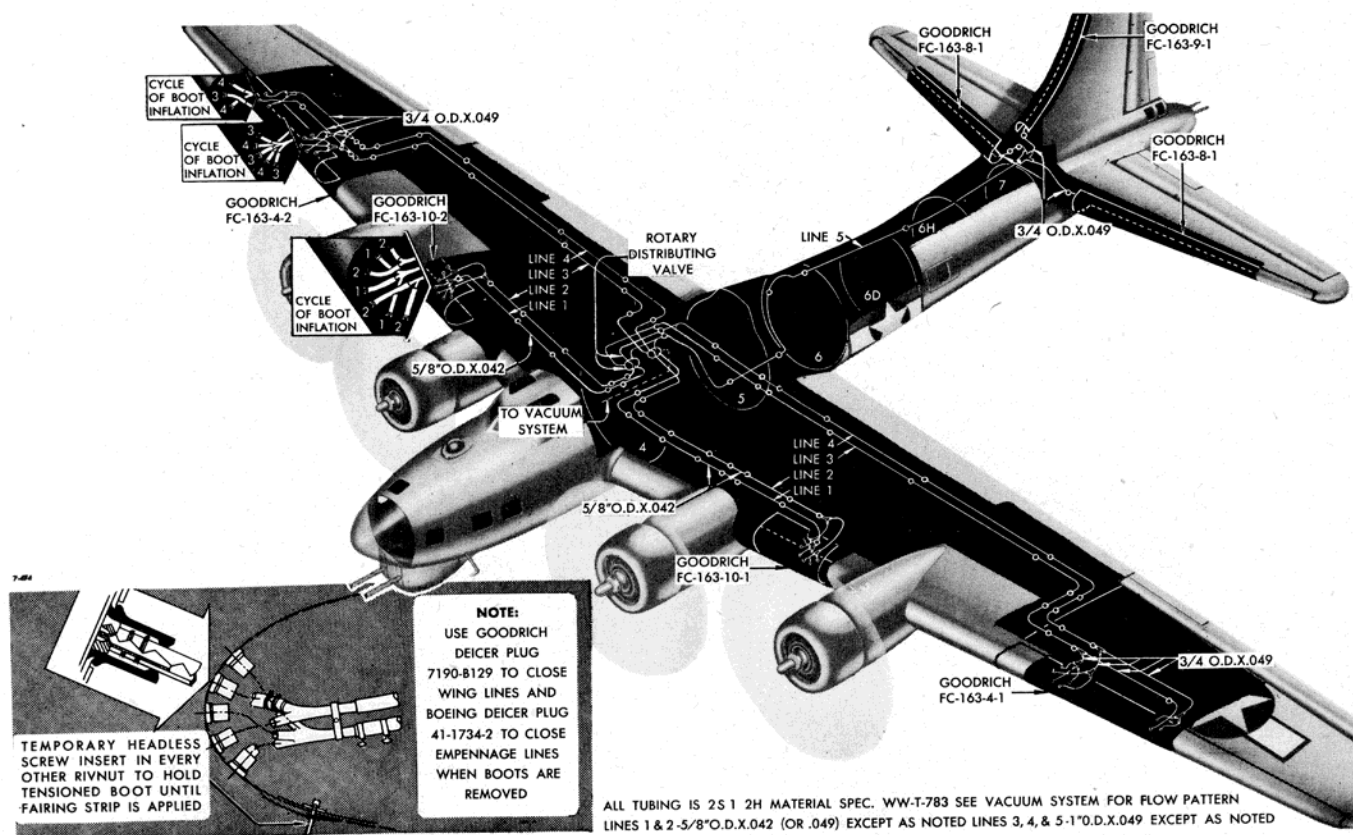


Figure 356—Surface Deicer Tubing Diagram

tor is a pressure relief valve, adjusted to relieve pressure above 16 inches Hg or 8 PSI as read on the deicer pressure gage. The distributor valve is a multiple port rotary type valve driven by an electric motor and alternately connects and disconnects the air pressure line to the shoe distribution lines. A capacitor is in the circuit of the deicer distributor valve motor. This filter, a Mallory type DL445, is placed in series with the valve motor, and attached to the supporting angle just below the valve.

2. The suction line of each vacuum pump includes a suction relief valve, a pressure relief valve and a check valve, and is led to the vacuum selector valve located on the left side wall beneath the cockpit floor. This valve has only two positions, and connects the suction line of either pump to the deicer distributor and control valves, while the suction line of the other pump is connected to the remainder of the vacuum-operated equipment in the airplane. Thus, the relative functions of the suction side of the two vacuum pumps may be interchanged as required. Suction from the vacuum pump selected for the deicer system is alternately connected and disconnected to the deicer distribution lines when the distributor valve is rotating. In this manner, the expander tubes in the deicer shoes are alternately inflated by pressure from both vacuum pump exhausts, and deflated by suction from one vacuum pump intake. With deicers "ON," the vacuum line to the control valve terminates at the valve; but with deicers "OFF," the vacuum line is connected to the distributor valve

pressure line so that all distributor valve ports provide suction for retaining the deicer shoes in the deflated condition.

3. Control of the surface deicer system is accomplished solely by the deicer control valve, which is located beneath the pilots' floor. The control valve is equipped with an integral electrical switch, automatically controlling the distributor valve motor. Operation of the vacuum selector valve has no effect on the deicer system other than changing the source of the suction. This may improve deicer operation if one vacuum pump has failed, but will render the vacuum-operated gyro instruments and camera equipment completely inoperative.

#### Note

If the deicers become worn or badly abraded they must be sprayed with Deicer Conductive Cement (Stock No. 6600-106400 or 6600-106350) to prevent the accumulation of static charges on the leading edge during flight.

4. SURFACE DEICER SYSTEM.—Refer to figure 355 for complete information on location and identification of equipment. Refer to the surface deicer tubing diagram for location and sequence of connections of the distribution lines from the distributor valve to the deicer shoes. Connect the equipment as indicated in the diagrams, giving particular attention to the location and types of relief valves, and the direction of flow of check valves. At installation of the vacuum pumps, the oil drain passage to the engine crankcase will be



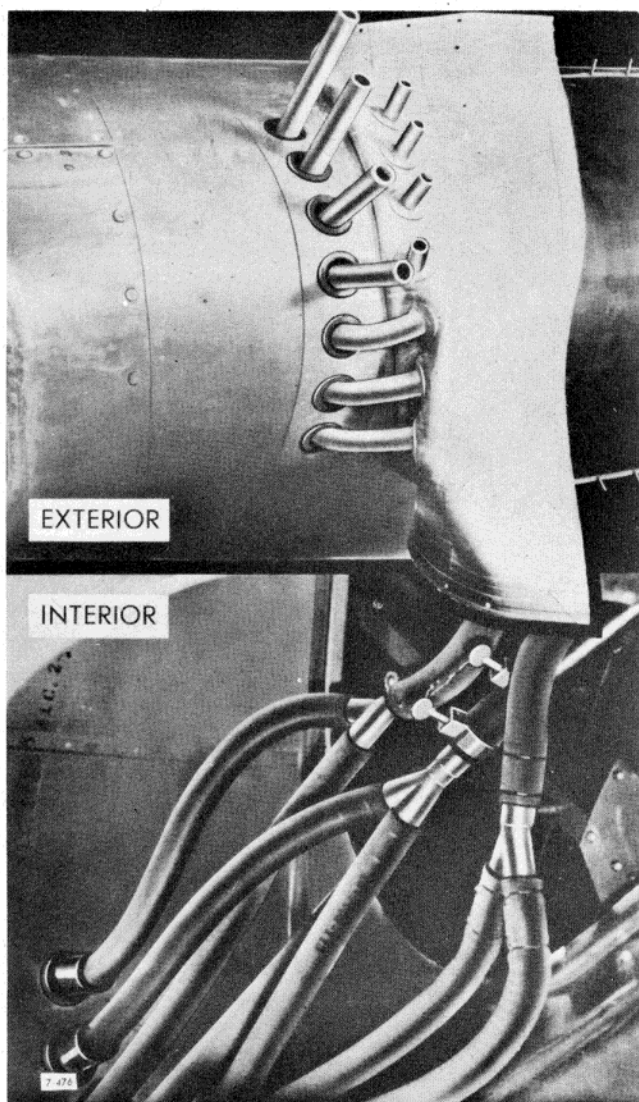


Figure 357—Typical Deicer Shoe Connections

plugged, and the oil supply hole under the pump flange will be open. The oil drain passage must be plugged at the entrance from within the drive case, and also at the entrance at the bottom edge of the pad. Connect the deicer control and distributor valves as indicated on the diagrams.

(b) DEICER SHOES.

1. REMOVAL.

a. Work solvent under the edge of the flap and peel back.

b. Unscrew the attaching screws and remove the fairing strip and deicer shoe, pulling the rubber tubing through the holes in the wing a sufficient distance to permit disconnection.

c. If the airplane is to be flown without the deicer shoes installed, the open ends of the rubber tubing must be plugged as indicated on the surface deicer tubing diagram (see figure 356) and the cover plate must be moved over to the adjacent set of rivnuts.

2. MINOR REPAIR.

a. PUNCTURES.—A small puncture, cut, or tear not exceeding 3/4-inch in length and not across direction of stretch, may be repaired by cleaning the surface, buffing, applying cement, and rolling on a cold patch after cement is dry. (Refer to instructions with B. F. Goodrich repair kit.) If the hole exceeds 3/4 inch in length or is across direction of stretch, proceed according to the following instructions.

(1) Clean the surface in the vicinity of the damage with soap and water and allow it to dry.

(2) Determine the size of the patch needed and select a template or buffing shield of corresponding size.

(3) Place the shield over the hole so that the cut-out portion exposes the area to be patched and retain the shield in place throughout the following operations:

(a) Rub with a cloth soaked in benzol to soften and remove the prenite-graphite surface. Be careful that the cut or tear does not spread.

(b) Roughen the surface with a wire buffer.

(c) Smooth out with an emery buffer so the surface has been removed approximately .003 inch.

(d) Wash with benzol and allow to dry.

(e) Brush on one coat of Goodrich No. 1 cement and allow to dry.

(4) Remove starched fabric from patch and apply a light coat of Goodrich No. 1 cement to the surface so exposed. Keep tacky surface of patch clean while allowing to dry.

(5) Apply patch to deicer shoe. Stick center or one edge of patch lightly and work down so as not to trap air between surfaces. Roll patch down securely with metal roller or handle of wire buffer. Make certain edges are down firmly; recement and allow to dry before resticking if necessary.

(6) Allow to stand 10 to 15 minutes; then wipe patch and surrounding area lightly with benzol.

(7) Apply a coat of prenite-graphite cement to restore conductive surface.

**Note**

Since inflation pressure on the shoes does not exceed eight pounds per square inch, the patch is not critical from the inflation standpoint; however, the shoe is exposed to the air stream and is subjected to extremely high loads at high speeds, therefore it is essential that the outside edges of the patch be applied with special care.

b. SPLICING DEICER SHOES.

**CAUTION**

Splicing will be done only in extreme emergency.



(1) Install parts to be spliced onto wing or stabilizer with the ends overlapped.

(2) Cut through both layers across the overlapped ends. Care must be taken to avoid injury to the skin.

(3) Free the cut ends enough to allow the roughening of an area three inches wide on the underside of each part. Remove the debris.

(4) Apply a uniform coat of Goodrich cement to both of the roughened surfaces, and the fayed side of a rubberized fabric strip allowing the cement to dry to the "tack free" stage (about two hours).

(5) Repeat the procedure prescribed in preceding paragraph (4) above.

(6) Place the rubberized fabric directly against the skin with the center in line with the splice, and the cemented side out. Do not stretch fabric while applying.

(7) Roll down the ends of the shoes with a metal roller and seal the splice with a two-inch sealing strip according to instructions included with the "prenite-graphite service kit." Care must be taken to seal the spaces between the bladders when the splice is across a section of shoe that has more than one bladder, as a leak at this point will decrease or prevent effective operation of the shoe.

#### c. CLEANING DEICER SHOES.

(1) Remove oil and dirt by washing with a neutral soap and water solution.

(2) When necessary, a clear (unleaded) hi-test gasoline may be used. Wipe dry immediately to prevent penetration into the rubber.

#### CAUTION

Rub lightly; do not injure or remove the deicer conductive cement surface.

#### d. RESURFACING DEICER SHOES.

(1) Resurface abraded or cracked deicer shoes as follows:

(a) Scrub the surface vigorously with a clean cloth soaked in butyl acetate, isopropyl acetate, or benzol.

(b) Mask off along the edge of the deicer shoe to shield the skin while spraying.

(c) Spray two light coats of deicer conductive cement, allowing a 15-minute drying time between coats.

(d) Avoid contacting the surface after coating until the material is completely dry.

(e) If possible, the airplane should remain in a warm place, such as in the blast of a heater, for several hours after application.

#### Note

Isopropyl acetate is preferable as a scrubbing solvent in cold weather.

### 3. ASSEMBLY AND INSTALLATION.

a. If the airplane has been in use without the shoes installed, the cover plate over the connection holes in the leading edges of the surfaces must be removed and replaced on the adjacent set of rivnuts in order to expose the holes.

b. Camouflage paint on the leading edge must be removed before installation of the shoes because it is extremely granular and, if left on the skin, would chafe the shoes to the extent of wearing completely through the rubber. Wash off the areas to be covered by the shoes, brush on a suitable paint remover, and clean surface with a rag, fine steel wool, or a wire brush. *Do not scratch the skin.* Remove the mask and rub surface clean and dry.

c. Attach the shoe and fairing strip along the lower edge, inserting screws in all rivnuts.

d. Apply a liberal amount of talc on the inside surface of the shoe, and on the skin of the surface to which the shoe is being attached. This permits easier elongation and greater elasticity. Then attach tubes to the deicer lines and wire securely.

e. Insert a short stud with 6-32 thread in every other rivnut on the upper surfaces. Stretch the shoe over the leading edge and hook it over the studs. As the rubber is pulled over each stud, it should be immediately pushed down against the skin to lessen the strain on the stud.

f. Place the fairing strips over the studs and insert screws in the empty rivnuts. Replace the studs with screws and tighten.

g. The vertical stabilizer shoe is installed in a similar manner. Attach one side, connect the tubes; then, starting at the bottom, attach the other side.

h. Test installation by operating the engine-driven vacuum pumps, turning the deicer system "ON" and noting the inflation cycle of the shoes.

i. When reinstalling old shoes, the electrical conductivity of the outer surface will be checked after installation by the use of an ohmmeter and a contact block applied to all shoes at the middle and near each end. As the upper surfaces of the shoes are subject to rapid deterioration due to the effect of the sun's rays, particular attention will be given to such areas. If the ohmmeter indicates a resistance of more than 15,000 ohms, two coats of deicer conductive cement will be sprayed on the outer surface. Ohmmeter, Weston model No. 697, supplied with the C-1 instrument testing set, part No. 37H5800 (or any other suitable ohmmeter which may be on hand) will be used in connection with a contact block, part No. 39B3458, for determining the resistance of the deicer shoes.

#### Note

Deicer shoes form a part of the contour of the airfoils on which they are installed, and the aerodynamic characteristics of the airfoils may be seriously affected, and a distinct flying haz-

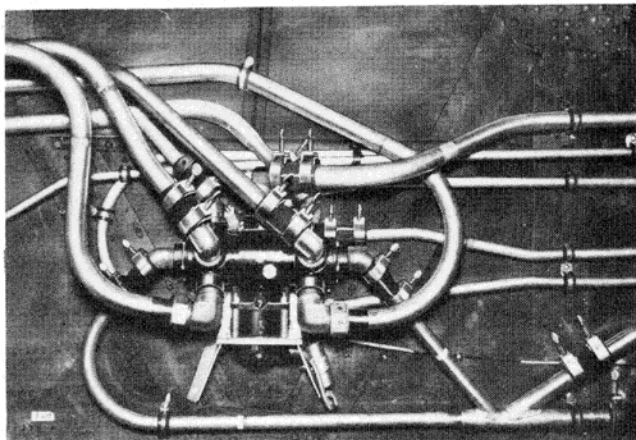


Figure 358—Deicer Distributor Valve Installation

and produced, should any rupture of the rubber take place in flight. If at any time pronounced deterioration is in evidence, a thorough inspection will be made to determine whether the shoes should be repaired or replaced.

(c) DISTRIBUTION VALVE.—The deicer control valve is accessible for removal from beneath the pilot's floor on the left side of the airplane. The distributor valve is installed in the right wing gap between the front spar and the fire extinguisher bottles. Partial access may be gained through the forward of the two removable panels in the right compression strut, and further access requires removal of the bottom wing gap cover on the right side.

#### (d) SUCTION RELIEF VALVE AND VARIABLE ORIFICE.

1. ADJUSTMENTS.—The following procedures are to be attempted only in case of obvious malfunctioning of the units or after replacement of damaged parts. The factory adjustment will ordinarily be sufficient for the life of the unit.

2. Close completely the variable orifice restricting the flow from the turn and bank indicator to avoid overspeeding the gyro unit during the adjustment. With the engine running at approximately 1500 R.P.M., adjust the relief valve in the nacelle until a value of  $4.0 \pm .25$  inches Hg is observed on the instrument panel suction gage. The adjustment is accomplished by loosening the lock nut and turning the adjusting nut clockwise to decrease and counterclockwise to increase the gage reading. Set the lock nut and safety wire.

3. Attach a suction gage to the 1/8-inch pipe plug on forward lower portion of the turn and bank indicator case. The gage on the instrument panel may be used for this purpose with the aid of a flexible hose if a spare gage is not available. In this case the line disconnected from the panel gage must be plugged. With the engine turning at 1500 R.P.M., open the variable orifice until a reading of 1.9 plus .15 or minus .10

inches Hg is obtained and lock wire the adjusting nut at that point.

4. Restore the original tubing connections and check the reading on the suction gage. If not within the limits of  $4.0 \pm .25$  inches, readjust the relief valve in the nacelle.

### WARNING

DO NOT OVERHEAT THE ENGINE BY CONTINUOUS OPERATION DURING THIS ADJUSTMENT.

#### (e) PRESSURE RELIEF VALVE (PRESSURE AND SUCTION) ADJUSTMENTS.

1. PRESSURE RELIEF VALVE (SUCTION LINE).—This valve is adjusted at the factory to relieve at four inches Hg pressure and further attention is unnecessary.

2. PRESSURE RELIEF VALVE (PRESSURE LINE).—This valve is factory set to relieve at 18 inches Hg (nine pounds per square inch pressure, as indicated by the deicer pressure gage on the instrument panel). Pressure is varied by the addition or removal of shims controlling the spring tension. The setting may be checked by the following method:

a. Plug the bypass line in the lower surface of the left wing near the gap cover.

b. Turn the deicer control valve "OFF."

c. Run the No. 2 engine at 1500 R.P.M. and observe the deicer pressure gage reading. This valve indicates the setting of the valve in No. 2 nacelle.

d. Run engine No. 3 at 1500 R.P.M. and observe the deicer pressure gage reading. This valve indicates the setting of the valve in No. 3 nacelle.

3. PRESSURE RELIEF VALVE—OIL SEPARATOR. (*Located in right wing gap.*)—With either engine No. 2 or No. 3 running at 1500 R.P.M., adjust valve to relieve at approximately eight pounds pressure as observed on the deicer pressure gage. The setting is obtained by the addition or removal of shims regulating the spring load.

#### Note

With the deicer "ON" the pressure should be relieved by this valve rather than by those in the nacelles. This is essential since the valve utilizes the pressure relief feature to expel residual oil collected by the separator.

#### (2) PROPELLER ANTI-ICER SYSTEM.

(a) GENERAL.—The propeller anti-icer system is designed to prevent the formation of ice on the propeller blades by directing a stream of anti-icer fluid along the leading edge of each blade. Two electric motor-driven gear pumps, with a 40 to 1 speed ratio, are located beneath the radio compartment floor at the forward end of the camera pit. Fluid is supplied from a 20 U. S. (16.7 Imperial) gallon tank located beneath the



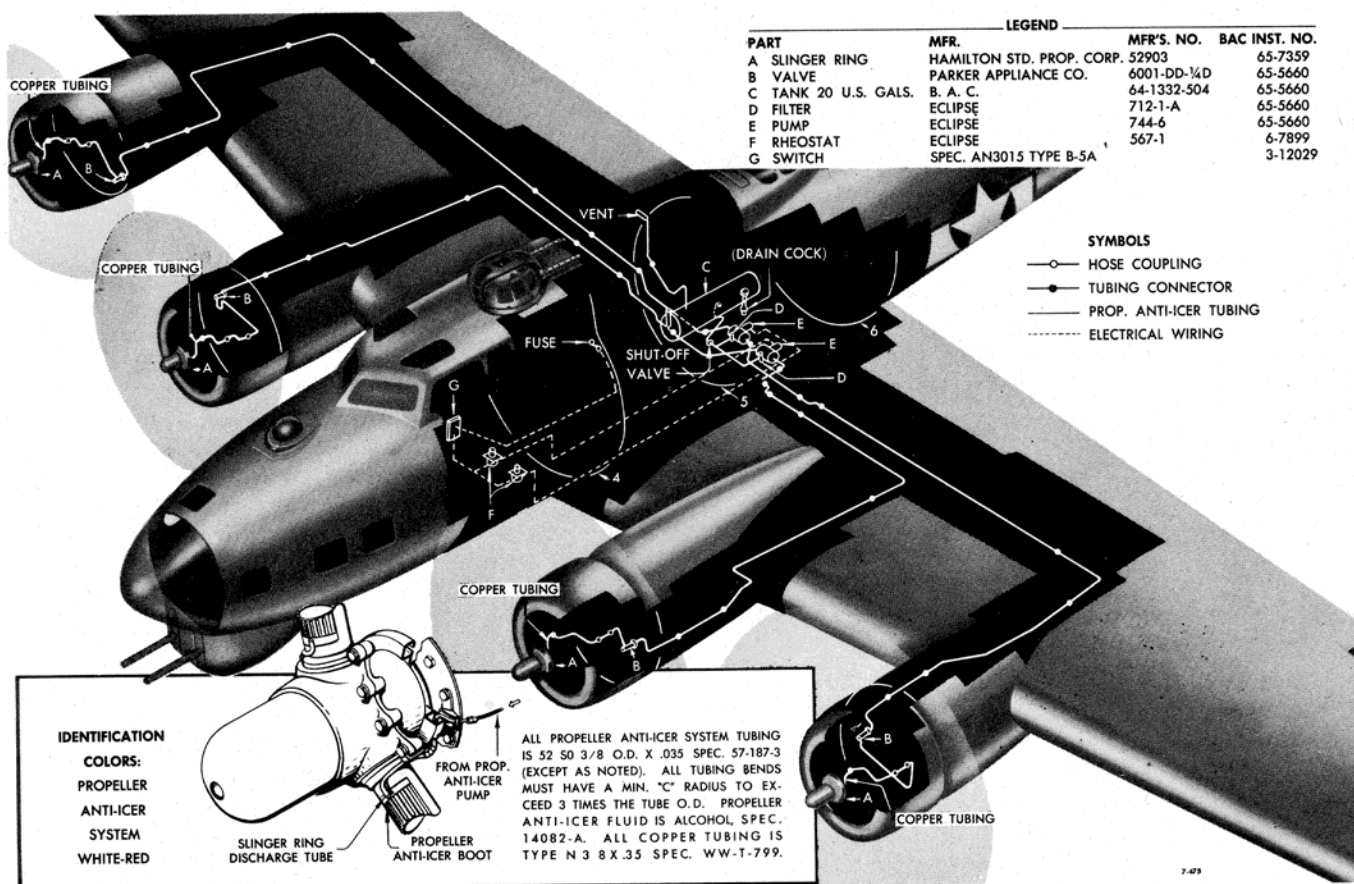


Figure 359—Propeller Anti-Icing Diagram

radio compartment floor to the right of the camera pit. Each pump draws fluid through a filter and forces it to the slinger rings on two propellers. The left-hand pump supplies fluid for the outboard propellers. A relief valve is installed in the line on the forward side of each fire wall. A toggle switch controls the power for both motors while a rheostat for each motor regulates the pump output. The switch and the rheostats are located below the switch on the floor panel at the pilot's left. The output of each pump may be regulated by the rheostat to permit a flow of approximately one to two gallons per hour. Normally, the rheostats should be set for a predetermined rate of flow and both motors controlled simultaneously by the toggle switch. It is best to rotate the propeller until one blade points downward and then collect the fluid as it drops from the slinger ring outlet. Collect the output for a 15-minute period and compute the hourly flow. Adjust the rheostat if necessary and check the flow again. Fluid for use in this system must be Specification AN-F-13, isopropyl alcohol.

(b) REMOVAL.—The electric motor-driven pumps are accessible from the camera pit, either from within the airplane or through the camera doors. The supply tank is accessible after removing the floor on the right side of the radio compartment. To remove this floor, it will be necessary to dismantle the two auxiliary seats and the bottom radio tuning unit at bulkhead 6. Remove the aileron cable cover at the forward end of the

radio compartment and then remove the floor panel on the right side.

#### (c) REPAIR.

1. Keep the pump motor commutators free from oil by wiping with a clean cloth moistened with carbon tetrachloride. Avoid using sandpaper if possible. If absolutely necessary, the commutator may be smoothed with a strip of No. 0000 sandpaper folded over the end of a finger. Do not use a screw driver or other hard object. Never use emery cloth. Brushes that have been worn to a length of 1/4 inch will be replaced. Clean the brushes with a cloth moistened with carbon tetrachloride or, if brushes are coated with any substance that resists cleaning, dress them carefully with a piece of fine sandpaper, taking care not to destroy their flatness.

2. Slinger rings are furnished with the propellers, and must be handled according to propeller instructions. If airplane operation requires frequent use of the anti-icer equipment, constant replenishment should maintain satisfactory fluid conditions. Settling of the glycerine from the fluid in the supply tank may be detected by draining a portion of the fluid from the tank. Draining and refilling of the tank with the same fluid may be sufficient in some cases to maintain satisfactory fluid conditions, but if fluid flow becomes too sluggish and the pumps run too hot, the tank must be



drained. Flush with alcohol and run the pumps only until the alcohol begins to drip from the slinger ring. Check pumps frequently for overheating while running the alcohol, as alcohol affords very poor lubrication and the pumps may seize. Drain the alcohol from the tank, refill with anti-icer fluid, and run the pumps until anti-icer fluid appears at the slinger ring.

(d) **ADJUSTMENT OF PRESSURE RELIEF VALVE.**—This valve is factory set at 1-1/2 pounds per square inch and further attention should not be required.

(e) **ASSEMBLY AND INSTALLATION.**

1. The anti-icer shield and feeder tube assembly must be mounted on the front section of the engine before the propeller is mounted on the shaft. Install the fixed bracket for the feeder tube through the cut-out in the shield, over the two upper studs near the top of the shield. Then install the feeder tube through the cut-out

in the shield, and secure to the fixed bracket. After the propeller is mounted, adjust the feeder tube sliding bracket until the feeder tube clears the slinger ring by 1/32 inch. Install the cover plate over the shield and safety wire it into place.

2. Assemble the tubing and equipment as shown on the propeller anti-icer system diagram (see figure 359). In mounting the pump tighten the bolts evenly in order to prevent distortion of the aluminum bracket. Fill the supply tank with fluid as described in section III. Turn each propeller so that a blade is pointing straight downward, and provide a container at the outlets from the slinger rings. After checking and correcting for leaks as required, adjust the rheostats to control the pump speed for the desired output.

(3) **WINDSHIELD WIPERS.**

(a) **GENERAL.**—Windshield wipers are on early B-17G airplanes. On later B-17G airplanes the pilot's windshield wipers were replaced by two hinged knock-out panels. The pilot's and copilot's windshield wipers are driven by an electrical motor in the pilot's instrument panel and flexible shafts to the gear box and wipers. The windshield wiper motor switch is mounted on a bracket on the left sidewall above the pilot's control panel. A circuit breaker switch on the same bracket and a 30-ampere fuse in the station 4-fuse shield protect the circuit.

**Note**

The wipers must not be operated on dry glass.

(b) **REMOVAL.**—The converter and window units for the windshield wipers are removed intact with the drive assembly after the wiper arm, motor connection, and all mounting bolts are removed.

(c) **MINOR REPAIR AND REPLACEMENT.**—The pressure of the wiper blade should be approximately 1.5 pounds, and is governed by an adjusting screw on the wiper arm. The wiper stroke is governed in the converter by a cam held in position with two screws. Adjusting the cam will give various wiper strokes. The blade stroke is adjusted at the factory and service attention should not be necessary.

i. **OXYGEN EQUIPMENT.**

(1) **GENERAL.**

(a) This airplane is provided with four low-pressure oxygen systems operating at a pressure of 400 pounds per square inch. Each system supplies a portion of the crew and is separate from all other systems. This eliminates the possibility of complete failure of the oxygen supply under combat conditions.

(b) The oxygen supply is stored in a series of 18 type G-1 fixed cylinders. Early B-17G airplanes also have two type F-1 auxiliary cylinders in the ball turret. The locations of the cylinders in the fuselage as shown on figure 361 and the stations served are as follows:

Group I—Navigator, pilot and top gunner: five cylinders behind the pilot.

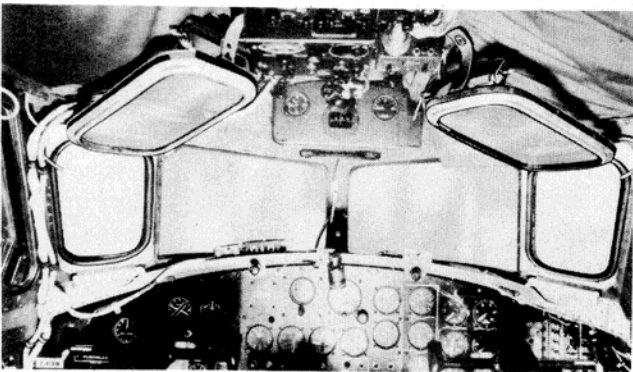
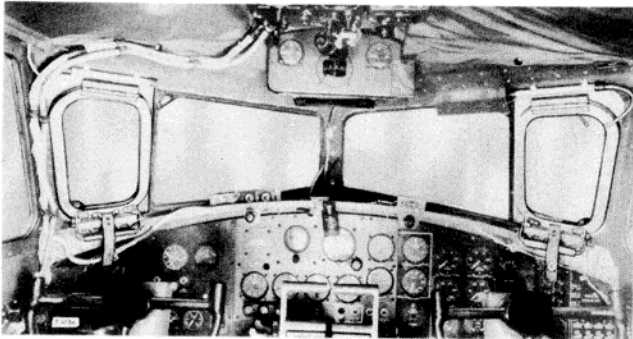
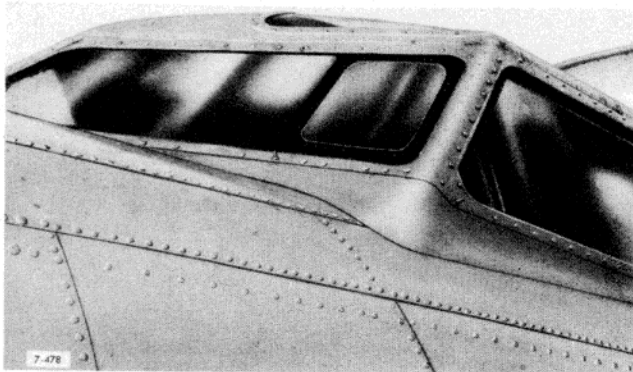
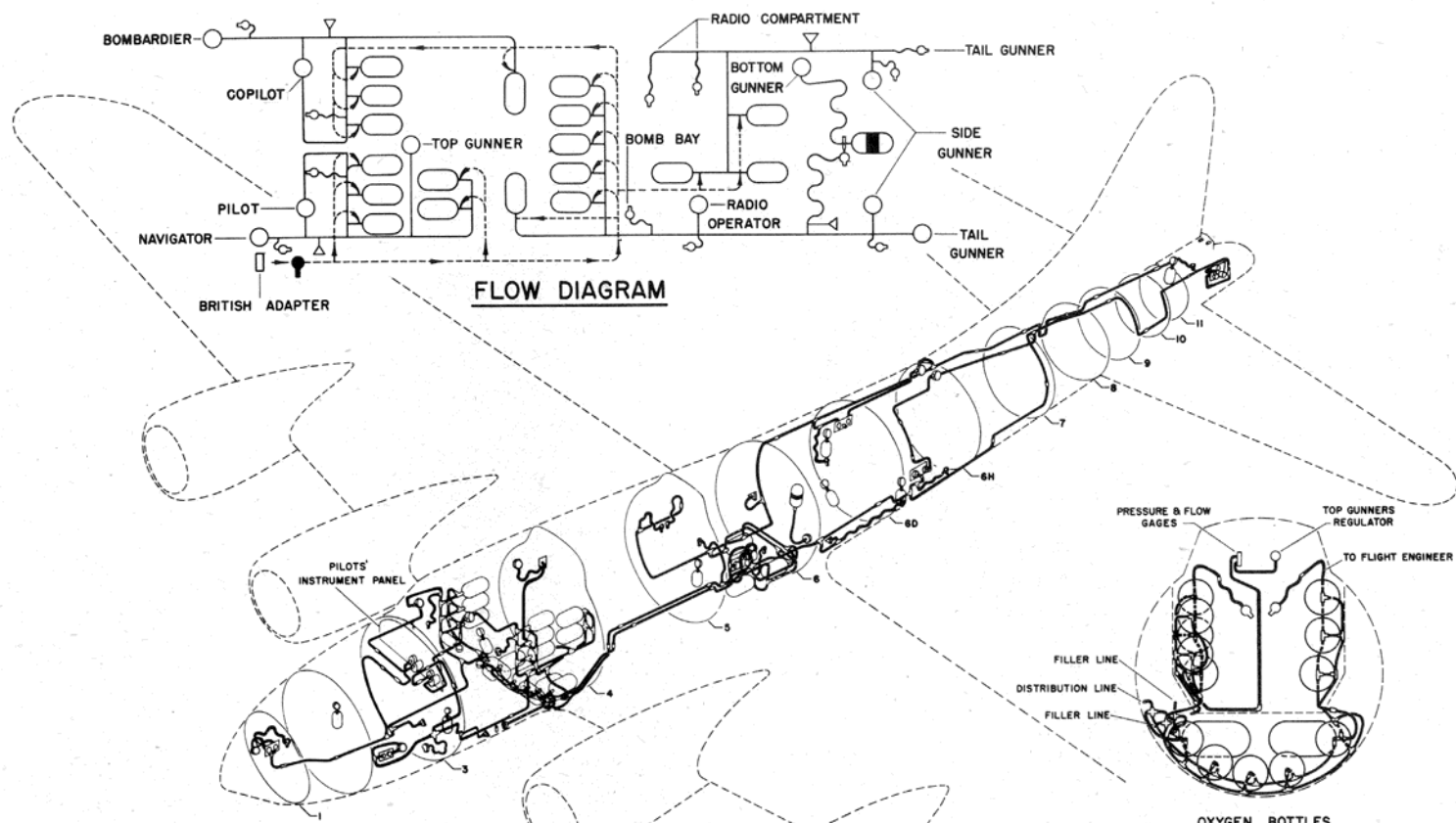


Figure 360—Windshield "Knockout" Panels





# NOTES

TUBING IS  $\frac{3}{16}$  O.D. X .035 ALUM. ALLOY SPEC. 57-187-3  
 TEST SYSTEM TO 425 PSI  
 FILL SYSTEM TO A PRESSURE OF 400 PSI

# COLOR IDENTIFICATION

DISTRIBUTION LINES - LIGHT GREEN  
 FILLER LINES - LIGHT GREEN, YELLOW, LIGHT GREEN

# SYMBOLS

— DISTRIBUTION LINE  
 — SYSTEM FILLER LINE  
 ~ FLEXIBLE FILLER LINE

\* GOVERNMENT FURNISHED  
 \*\* REGULATOR ADAPTER AT EACH REGULATOR VALVE  
 \*\*\* CHECK VALVE AT EACH JUNCTION OF FILLER AND DISTRIBUTION LINES

# LEGEND

PART	MFGR.	MFGR'S. NO.	B.A.C. INST. DWG.
○ OXYGEN BOTTLE (TYPE G-1) *		SPEC. 94-40321	15-7522
◐ OXYGEN BOTTLE (TYPE F-1) *		SPEC. 94-40330	55-7365
◑ PORTABLE OXYGEN BOTTLE (TYPE A-4) *		4205357	55-7365
○ WITH REGULATOR (TYPE A-13) *	BENDIX		55-7365
○ REGULATOR (TYPE A-12) *	BENDIX		55-7365
⚠ WARNING LIGHT			55-7365
⚙ FILLER VALVE (MAIN SYSTEM)	SHRADER	1660	55-7365
⚙ FILLER VALVE (PORTABLE UNITS)	SHRADER	1660-197	55-7365
△ OXYGEN PRESSURE SIGNAL *		SPEC. 94-32376	55-7365
— CHECK VALVE ***	SHRADER	2181	55-7365
— REGULATOR ADAPTER **	PARKER	2-1941-16	55-7365

Figure 361—Oxygen System Diagram

Group II—Bombardier and copilot: three cylinders behind the copilot and one under the cockpit floor.

Group III—Bomb bay, radio operator, side gunner, and tail gunner: six cylinders under the cockpit floor.

Group IV—Radio compartment (two stations) side gunner and tail gunner (auxiliary supply): three cylinders under the radio compartment floor.

(c) The duration of each type G-1 cylinder is approximately 4-1/2 hours for one man at 30,000 feet altitude; and for an F-1 cylinder, two hours under the same conditions. Check valves are located at each cylinder outlet to prevent loss of system pressure should the cylinder be destroyed.

(d) The main supply is replenished through a single filler system which connects all type G-1 cylinders. The filler valve is located in the lower passageway immediately aft of the forward entrance door. The type F-1 turret cylinders are refilled through a filler valve on a shielded flexible hose connected to the supply system.

(e) The airplane is equipped with a type A-12 demand oxygen regulator at each crew station. The power turret is provided with a type A-9 regulator. A panel containing an oxygen flow indicator, an oxygen pressure gage, and an oxygen supply warning lamp, which lights when the system pressure is below 100 PSI, is near each regulator. Supplementing the main oxygen supply are 13 type A-4 portable units, one at each crew station. These units consist of a small cylinder, containing six to 12 minutes supply of oxygen, and a type A-13 demand regulator, to which is attached a suspension clamp, a recharging valve, a pressure gage, and a mask hose coupling. The portable units may be replenished at the recharging valves located at the crew stations or from the turret filler valve.

## (2) REMOVAL AND DISASSEMBLY.

### WARNING

Oil must not, under any condition, be used at any place on the oxygen system, as spontaneous combustion and explosion are certain to occur. Hands and clothing must be free of oil and grease when working with this equipment.

(a) The oxygen system is so arranged that different parts may be removed, while the system is under pressure, without loss of oxygen from the rest of the system. All cylinders and regulators are easily accessible with the exception of the cylinders below the pilot's floor forward of bulkhead 4. In order to gain access to either of the side cylinders nearest bulkhead 4, one of the two cylinders in front must be removed. Whether or not the system is empty of oxygen, care must be taken when removing only a portion of the equipment to avoid loosening the connections of the remaining equipment. Take care in removing any cylinder from the system, to avoid possible injury or damage to the equip-

ment, caused by sudden release of oxygen under pressure. Remove the two supporting straps and with cylinder gripped *firmly* in both hands unscrew it slowly, making sure that the disconnection occurs between the graduated nipple and the tee.

### WARNING

Loosen the connection only until oxygen escapes readily. Wait until the cylinder is completely discharged before actually removing it.

## (3) ASSEMBLY AND INSTALLATION.

(a) All tubing, valves, fittings, etc., must be thoroughly cleaned and free from oil and other foreign matter. Anti-seize and sealing compound, Specification AN-C-86, should be used as a lubricant on all threads.

(b) Replace all support clamps and clean the surfaces in contact at tube, clamp, and structure to assure a good electrical ground. If it should become necessary to re-locate a supporting clamp, do not move any clamp farther than four inches from any fitting or from the filler or relief valve.

(c) Upon completion of the installation, coat all connections with a solution of castile soap and water

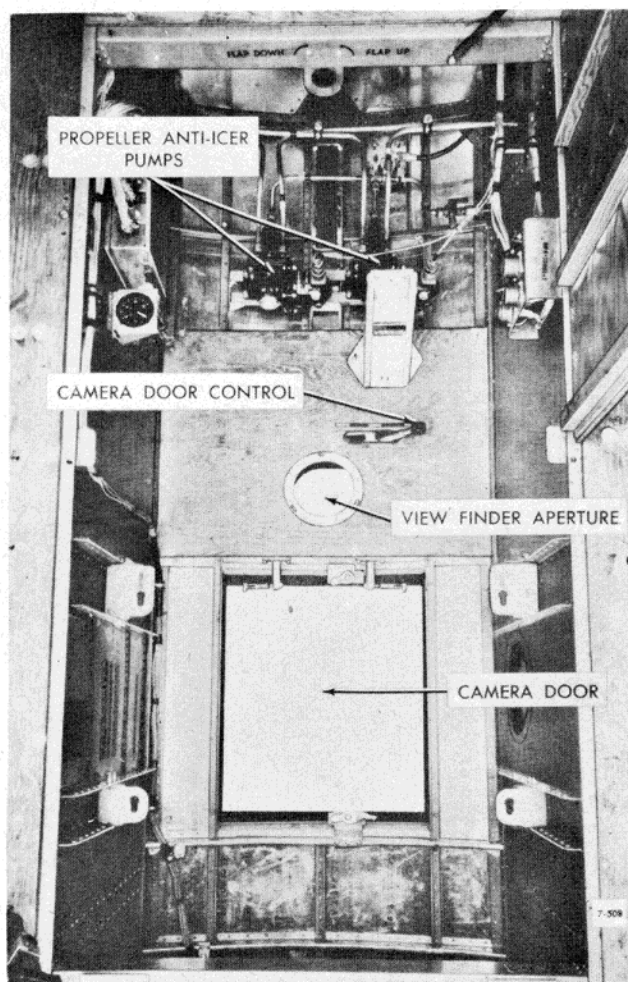


Figure 362—Camera Pit



and pressure test with oxygen at  $400 \pm 25$  pounds per square inch. No visible leakage will be allowable. For replenishing the system see section III, paragraph 2. i. (7).

(4) SERVICE INFORMATION.

(a) ADJUSTMENTS.—The normal working pressure of the system is 400 pounds per square inch. However, the pressure relief valve, used on some airplanes, is adjusted to operate at 400 to 450 pounds per square inch. No adjustments, other than the factory setting, should be necessary.

(b) MINOR REPAIR AND REPLACEMENTS.—All oxygen system tubing is 5/16-inch OD—.035-inch 52SO, except the flex lines at the turret filler valves, which are 5/16-inch OD flexible hose with bronze wire braid cover.

**CAUTION**

Operate all oxygen valves carefully during cold weather, opening and closing them slowly. A rapid opening may cause a sudden surge of pressure which may result in an explosion.

j. PHOTOGRAPHIC EQUIPMENT.

(1) GENERAL.—A camera pit is located between bulkheads 5 and 6 in the radio compartment floor and is covered by a hinged hatch. Provisions are made for the installation of K-series cameras. The camera doors and the viewfinder aperture open outwards in the bottom of the fuselage and are operated simultaneously by the camera door control handle. Camera doors are provided with latches which must be released manually before attempting to use the control handle. Supporting brackets for the camera are located on each side of the pit above the camera doors. A DC power outlet for the intervalometer is located on the right side of the camera pit. The vacuum system outlet is on the left side of the well, aft of the camera supporting bracket.

(2) REMOVAL.

(a) CAMERA MOUNTS.—The camera mount may be detached from the camera brackets by removing the four adjusting pins, two on each bracket. The camera doors are on piano wire hinges, and can be removed only by stripping the rivets or by removing the piano wire. In case of damage to the door operating mechanism, it is necessary to remove the floor to make the mechanism accessible. The floor is fastened with Phillips head screws.

(3) ADJUSTMENTS.—Four camera brackets, two on each side, are adjustable to four different heights by removable pins, two on each bracket.

k. PYROTECHNIC EQUIPMENT.—On some airplanes a type M-8 pyrotechnic pistol and holder is stowed on a shelf on the back of the copilot's seat. The pistol is mounted for use in a receptacle in the roof of the pilot's compartment.

l. BOMBING EQUIPMENT.

(1) GENERAL.

(a) Three different types of bomb control systems are used on B-17G airplanes. Early B-17G airplanes have an electrical normal release system, and mechanical control of the racks. Salvo or emergency release is accomplished mechanically. One type of mechanical control system uses push-pull rods; the other type uses cables and a co-ordinating unit.

(b) Beginning with serial No. (Boeing) AAF No. 42-97173 and on (Vega) AAF No. 44-6001 and on (Douglas) AAF No. 42-98036, the all-electric bomb control system is installed and the rod and cable controls eliminated. Detailed information on both the rod or cable and on the all-electric system are contained in the following paragraphs.

(2) AIRPLANES WITH ROD OR CABLE CONTROL SYSTEMS.

(a) GENERAL.—Some items of equipment which are identical for all three systems are omitted in the following discussion of the rod and cable control systems. For installation, removal and servicing of the following items of equipment, refer to the all-electric bomb control system, paragraph (3):

Intervalometer,  
Rack selector relays,  
Agastat time delay relay,  
A-1 nose arming solenoids, and  
Bomb shackles.

1. SWITCHES.

a. SAFETY SWITCHES.

(1) The type B-6B bomb door safety switch is mounted near the hinge of the left bomb door and is operated by a striker on the hinge. The switch controls power to the rack selector switches for the internal racks and prevents electrical release of internal bombs unless bomb doors are fully open. The switch also illuminates a red light on the bombardier's panel and an amber light on the pilots' instrument panel when the bomb doors are open. The switch is adjusted to close when the bottom of the door is four inches from the fully opened position.

(2) A switch operated by the internal rack control lever at the bombardier's station and another switch operated by the external rack control lever are bussed together in parallel so that when either lever is moved to the SELECT position, power is applied to the external rack selector switches, formation lights, bomb arming switch, bomb release switch, and bomb-sight release circuit.

b. BOMB RELEASE SWITCH.—The type B-11 bomb release switch is mounted on the forward edge of the bombardier's control panel and is equipped with a hinged guard to prevent its accidental operation. When the switch is closed, power is supplied to the interval release control unit which in turn supplies power to the release units on the bomb rack as determined by the setting of its controls.



**Figure 363—Bomb Control Circuit (B)**



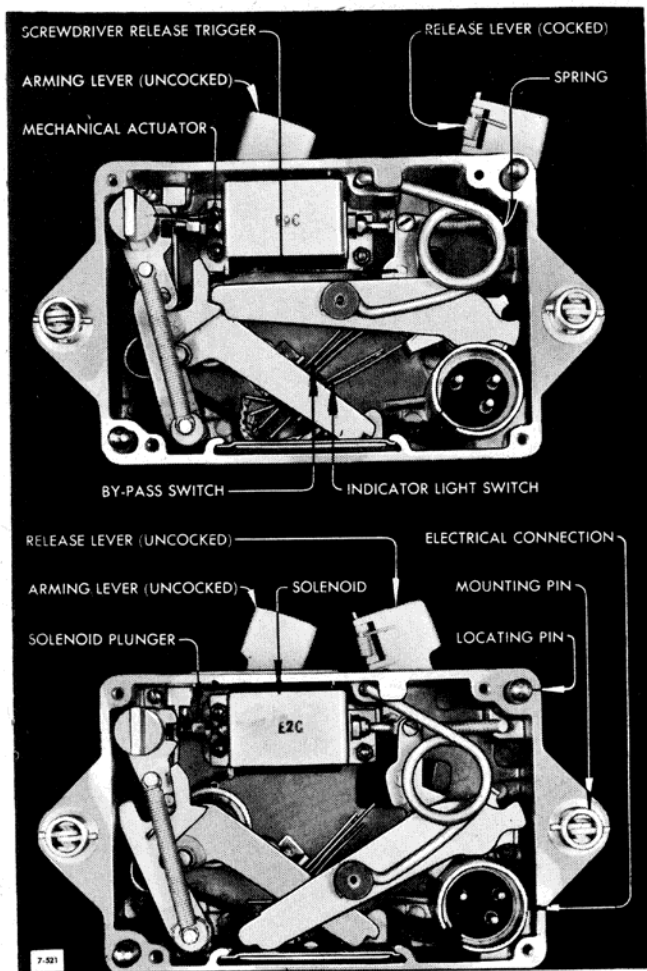


Figure 364—A-2 Bomb Release Box

c. RACK SELECTOR SWITCHES.

(1) Four type B-5A rack selector switches on the bombardier's panel control the rack selector relays which determine the bomb release sequence. The switches for the internal racks receive power through the bomb door safety switch, and the switches for the external racks receive power through the bomb door lock switch so that the bomb release lever must be in the "SELECTIVE" position to drop any bomb electrically.

(2) Two additional switches on the bomb rack junction shields in the bomb bay are connected in series with the rack selector switches on the bombardier's panel. A few airplanes have *no* rack selector switches on the bombardier's panel but have a three-position switch in the bomb bay. The switch permits selection of either or both internal bomb bays.

2. BOMB RACKS AND CONTROLS.

a. GENERAL.

(1) The bomb racks provide for use of type A-2 release units at each of the 42 bomb stations. The release unit plugs into a receptacle in the type AX-2 auxiliary box and fastens to the bomb rack with an insert fastener at either end. As the unit is plugged in,

its tripping solenoid is inserted into the circuit. In case one or more stations are unloaded, power is shunted through skip switches in the auxiliary boxes to the release unit of the next loaded station in the series. When a bomb is dropped, the release unit automatically opens the circuit through its own tripping solenoid and closes the circuit to the solenoid of the next loaded station in sequence, and so on until the train is complete. Each release unit also contains a switch controlling its corresponding light on the bomb indicator panel. The light is "ON" when the station is cocked and is switched "OFF" when the unit is tripped. A light on the pilot's instrument panel flashes for each bomb that is released.

(2) Most B-17G airplanes are equipped with removable fittings and mechanical and electrical controls for an external bomb rack suspended from each wing between the inboard nacelle and the fuselage. The rack is designed to carry 1,000, 1,600, 2,000, or 4,000 pound bombs. Two type A-2 release units, two type AX-8 auxiliary boxes, and a type A-1 bomb arming solenoid are provided in each rack and are connected into the bomb release circuit by a detachable plug and receptacle on the lower surface of the wing. All electrical controls are located at the bombardier's station. The mechanical bomb release lever and emergency release handles operate the external and internal racks simultaneously. Two hoisting drums, two sets of hoist support brackets and four hoisting pulleys which are used with either rack assembly are provided. A type B-7 bomb shackle is used with the 1,000 or 1,600 pound bomb, and a type D-7 or D-8 shackle with the 1,600, 2,000, or 4,000 pound bomb. The type D-7 or D-8 shackle is preferred for the 1,600 pound bomb.

(3) The racks are right hand or left hand only, and contain a right or left-hand type A-2 release unit, respectively, when a type D-7 or D-8 shackle is used. When a type B-7 shackle is used, the left-hand release unit is shifted to the right-hand beam and the right-hand unit to the left-hand beam, as shown in figure 416. When the type B-7 shackle is used, the forward shackle support is swung from the horizontal position to the vertical position and secured. In addition, two of the three pairs of sway brace attaching angles for each beam must be installed as detailed on figure 417. Care must be taken to select the proper angles since they vary in increments of only two degrees or three degrees and their locations are not easily determined.

(4) The bomb release lever must be in the "SELECTIVE" position to release any bombs electrically, and the lever cannot be moved in the "SALVO" position until the bomb doors are fully open because of the mechanical interlock in the bomb bay. (The emergency release drops all bombs safe after the bomb-bay doors reach the full "OPEN" position, depending on A-1 arming control installations.)

**Note**

It is impossible to drop the internal bombs on the bomb-bay doors unless the doors are re-



tracted manually while the bomb release lever is in the "SELECTIVE" position. The bombs might then be accidentally released electrically or by pushing the bomb release lever through to "SALVO." (The "UP" control circuit of the bomb door retracting motor is connected through the bomb door lock switch so that the doors cannot be retracted electrically unless the bomb release lever is in the "LOCK" position.)

b. **ROD CONTROLS.**—Forward of the bombardier's control panel, two handles provide control of the bomb doors and the bomb racks. The bomb door control lever operates a switch for control of the bomb door retracting motor and has three positions: "OPEN," "OFF," and "CLOSED." The bomb release control lever operates through a rod and bell crank system to control the type A-2 bomb release units. A bomb door lock switch is installed beneath the control rod cover and is operated by the bomb release control rod. This switch holds the bomb door retracting motor control circuit open, except when the bomb release handle is in the "LOCK" position. The three positions are: "LOCK," "SELECTIVE," and "SALVO."

(1) In the "LOCK" position the release unit is locked in the cocked position and bombs cannot be released electrically.

(2) In the "SELECTIVE" position the release units are unlocked and electrical release may be accomplished either automatically or by means of the bombardier's release switch.

(3) Placing the lever in the "SALVO" position mechanically releases all bombs unarmed, unless "A" arming control units are installed. The bomb bay doors must be open before the bomb release lever can be moved from the "SELECTIVE" to the "SALVO" position.

#### c. CABLE CONTROLS.

(1) Forward of the bombardier's control panel, three handles and a rewind wheel provide control of the bomb doors and bomb racks. Separate lever and cable systems operate the internal and the external racks, making possible the release of bombs from wing (external) racks without opening the bomb doors. Each lever has three positions: "SAFE," "SELECT," and "SALVO." In the "SAFE" position, the rack release units are locked in the cocked position and the bombs cannot be released electrically. In the "SELECT" position, the release units are unlocked and may be tripped electrically with the bombardier's release switch or through the bombsight. Placing either rack lever in the "SALVO" position mechanically releases all the bombs in those racks, unarmed, unless the nose arming solenoids on the external racks have been turned on by the switch on the bombardier's panel. Two switches, one mounted under each lever, are connected in parallel so that when either lever is in the "SELECT" position, power is applied to the external rack selector switches,

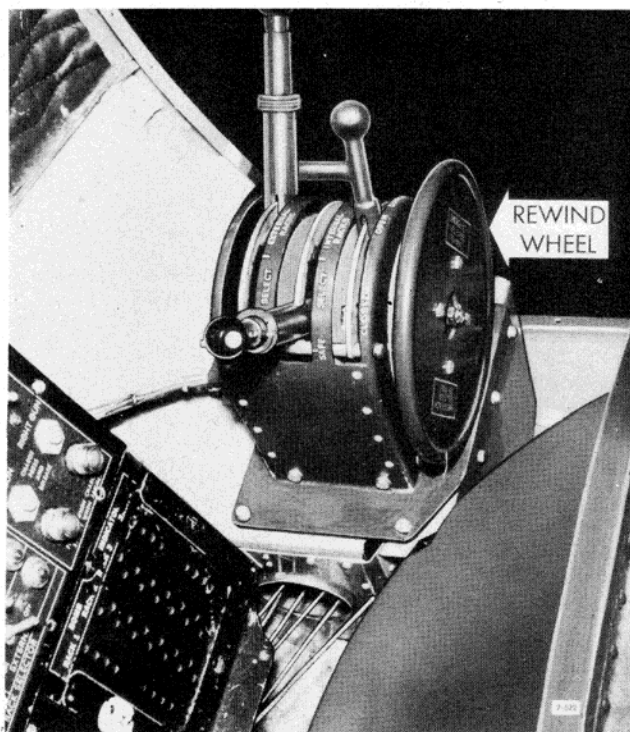


Figure 365—Bomb and Bomb Door Control Stand

formation lights, bomb arming switch, bomb release switch and bombsight release circuit.

(2) The third lever operates the bomb doors by actuating a double throw switch under the lever which controls the bomb door motor up and down solenoids. The switch has no "OFF" position, so the doors may not be stopped in an intermediate position except by pulling a fuse, turning off the master ignition switch, or turning off the battery and generator switches. An extension on the bomb door lever prevents movement of the internal rack lever into the "SELECT" position until the bomb doors are open, and prevents closing the doors until the internal rack lever is returned to the "SAFE" position.

(3) A cable system forward of the bomb bay replaces the rod linkages, and a coordinating unit beneath the pilots' floor replaces the former "dog leg" mechanism. While the internal and external rack controls are separated from normal operation, they are functionally coordinated for proper sequence of action in emergency release. In order to close the doors after an emergency release of bombs, the coordinating unit must be reset with the rewind wheel on the side of the bombardier's control stand. Rotation of the wheel returns the gear train in the coordinating unit to the original position and permits engagement of the bomb door release latches. The doors may then be closed electrically by moving the door control lever to "OPEN" until the motor stops, then moving the lever to "CLOSE."

3. **BOMBARDIER'S CONTROL PANEL.**—The bombardier's control panel mounted on the left



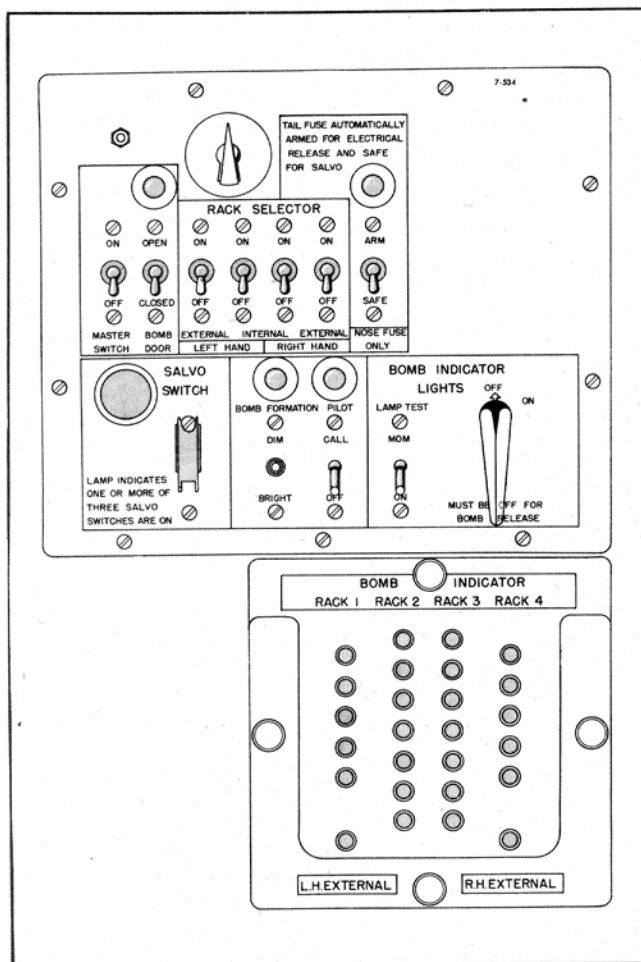


Figure 366—Bombardier's Control Panel

sidewall of the bombardier-navigator compartment consists of a switch panel, the bomb load indicator panel, a shock mounted instrument panel and the bomb interval release control unit. The switch panel contains switches and rheostats for necessary lights and bomb control. The bomb load indicator panel contains 42 amber lights, each corresponding to an internal bomb station. The instrument panel contains an altimeter, air-speed and air-temperature indicators, a clock and lights for the bomb doors and bomb release. Visible and ultra-violet lighting are provided for the panels.

**4. EMERGENCY BOMB RELEASE MECHANISM.**—Two handles, one on the sidewall near the pilot's left foot and one under a cover at the forward end of the bomb bay catwalk, permit unarmed release of all bombs, internal and external, in an emergency.

a. **ROD CONTROL SYSTEM.**—A hinged link in the bomb rack control rod, between stations 2 and 3, provides for emergency bomb release. Through operation of the emergency release control, this hinged link may be "upset" in the manner of a "dog leg," so that the aft portion of the rack control linkage may be operated while the forward portion remains fixed. The load at the "dog leg" is applied through a slide mechanism, which operates the door release before operating

the rack release. A spring return on the hinged section of the bomb rack operating rod, automatically returns the entire mechanism to the "NORMAL" position after emergency use. The "dog leg" and the slide are accessible through a hinged door in the bottom of the fuselage, below the pilots' floor.

b. **CABLE CONTROL SYSTEM.**—The emergency bomb release handles are connected by cables to the coordinating unit under the pilots' floor, which through a series of intermittent gears, release in sequence the external bombs, the bomb doors, and the internal bombs. Before the doors can be retracted, the coordinating unit must be reset with the rewind wheel on the bombardier's control stand.

#### 5. BOMB DOORS AND CONTROLS.

a. Each door is operated by means of two retracting screws, one mounted on bulkhead 4 at the forward end of the door and one mounted on bulkhead 5 at the aft end of the door. Torque is applied to the operating shaft, extending between the two forward retracting screws, by an electric motor-driven unit mounted on the left side of the bomb truss. A shaft from the forward gear unit extends rearward along the bomb truss to supply torque for the two retracting units mounted on bulkhead 5. The screw and traveling nut which operate the limit switches are installed in the coupling shaft between the front and rear operating shafts. See figures 84, 85, 86, 87.

b. A link at the front end of the left door operates a mechanical interlock on the bomb release control mechanism, to assure retention of the bomb release mechanism in the "LOCK" position until the bomb doors are open. On airplanes equipped with external bomb racks, the bomb release lever can be moved from "LOCK" position to "SELECTIVE," allowing electric release of the external bombs without opening bomb bay doors.

c. The retracting screws are connected at the bomb doors by means of a latch which permits disconnection at this point for emergency opening of the doors. The latches are operated by cables connected to the emergency bomb release mechanism.

#### 6. SIGNAL LIGHTS.

a. Formation bomb signal lights, one red and one white, are mounted in the tail below the guns and, when lighted, are visible from the rear of the airplane. They are controlled by a time delay relay on the forward leg of the navigator's table. The white light is illuminated when the bomb doors are opened. Operation of the electrical bomb release circuit energizes the time delay relay which turns off the white light and turns on the red light. The relay is set for five seconds delay and upon return, opens the circuit to the red light and turns on the white light. Two 50 ohm, type M-1 rheostats on the bombardier's panel control the intensity of the lights.

b. A red light on the bombardier's instrument panel and an amber light on the pilot's instrument

panel are controlled by the bomb door safety switch and are "ON" when the bomb doors are open.

c. Amber bomb release lights, one on the bombardier's instrument panel and one on the pilots' instrument panel, are lighted when power is applied to the release units on the bomb rack. These lights flash each time a bomb is released.

#### (b) REMOVAL AND DISASSEMBLY.

##### 1. ROD CONTROL SYSTEM.

a. For removal of the bomb release handle, disconnect the control rod at the handle and remove the bolt through the shaft. Remove two bolts through the handle quadrants and lift the handle out. If it is necessary to remove the support, remove the three bolts connecting the support to the panel bracket and retrieve the three spacers. The spacer for the middle bolt at the bottom of the support is very nearly hidden, and a special effort must be made to prevent its loss.

b. The bomb control rods may be removed from the handle all the way back to and including the racks. Five bomb rod covers must be removed to gain access to the rods and bell cranks. Start at the forward end, under the navigator's table, in removing the covers. Removal of the floor panel covering and bomb rods, at the entrance to the bombardier-navigator compartment, will require disconnection of the whip antenna lead and removal of the conduit. Access to the conduit connection may be gained through a small panel in the floor. At the right side of the entrance to the bombardier-navigator

compartment, remove the bomb rod cover and then remove the floor panel at the doorway. The rods are not covered from station 3 back to the bomb racks, except for a hinged door which covers the emergency bomb release mechanism between stations 3 and 4.

##### 2. CABLE CONTROL SYSTEM.

a. To remove either the bombardier's control stand or the bomb coordinating unit, first disconnect the turnbuckles in the shield above the forward entrance door. The control stand and base may be removed as a unit. The coordinating unit is suspended by four bolts.

b. The bottom cover of the coordinating unit is held on by eight bolts. Do not damage the gasket. Note the relative position of the gears before removing the axle bolts.

#### Note

It is recommended that a feeder line be attached, when removing cables, to facilitate re-assembly.

##### 3. BOMB RACKS.

a. If necessary, the bomb racks may be removed from the airplane by removing the bolts at the top and bottom after the bomb rods and electrical wires have been disconnected. However, the bomb rails are structural members and the airplane must never be flown without them. The external racks are not structural members and should be removed when not in use. Disconnect the electrical plug and mechanical release quick connect joint. Extract the safety pins from the sway brace attachment and the fore-and-aft beams supports, lowering the beam to the ground. Remove the pulley bracket at the aft beam support bracket. Unbolt all the support brackets and angles from the lower surface of the wing. *Replace all the attaching bolts in the wing terminals to prevent loss and corrosion.*

b. Disassembly of the bomb racks for most purposes may be accomplished without removal of the rail from the airplane. If the bomb rack assemblies have been removed from the airplane, avoid complete disassembly, if possible, in order to maintain alignment of the rails. After disconnection of the control rods and electric wires, remove and replace the station panels one at a time.

##### 4. BOMBARDIER'S CONTROL PANEL.

a. In the control group the three panels and the interval release control are easily removable. In removing the interval release control unit, disconnect electrical connector plug and remove mounting screws.

b. The control panel is attached to the support by means of Dzus fasteners. The unfastened panel may be swung outward and allowed to hang from the wires if desired. For complete removal of the panel, disconnect the wires at the equipment. All connections are made by means of lugs, except those on the formation bomb release lamp rheostats, which must be unsoldered.

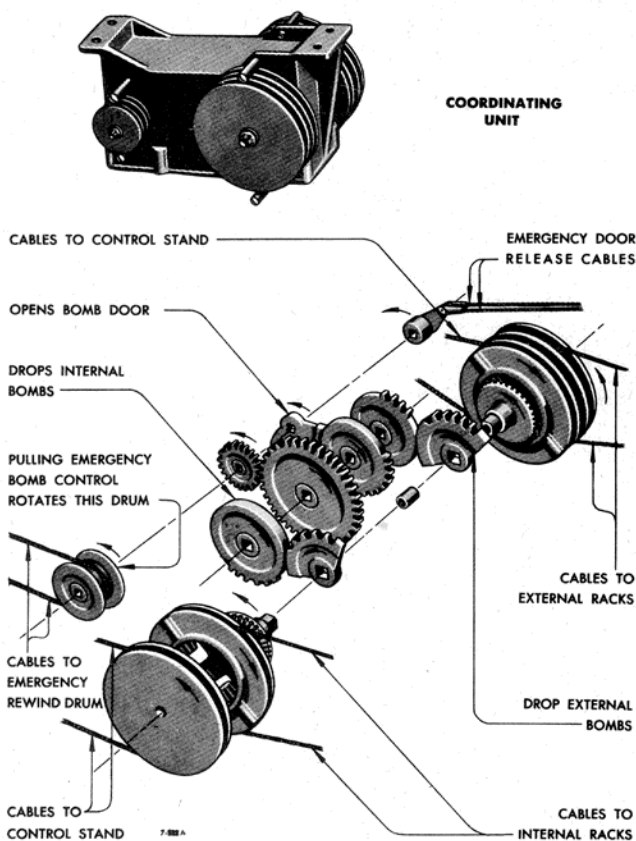
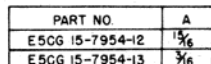
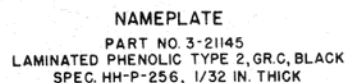


Figure 367—Coordinating Unit—Gear Arrangement





PROTRACTOR GUAGE  
5CG-15-7954



FOR INITIAL ADJUSTMENT OF BOMB RELEASE BAR, DISCONNECT CONTROLS AT BOMB RACK BELLCRANK AND WITH BAR IN LOWEST POSSIBLE POSITION ADJUST POINTER TO THE -20° LOCKED LINE.

THEREAFTER THE BOMB RACK WILL FUNCTION PROPERLY IF POINTER FALLS IN WHITE AREAS OF LOCKED AND SELECTIVE POSITIONS AND BELOW THE +18° SALVO LINE WHEN THE BOMBARDIER'S CONTROL HANDLE IS IN THE ABOVE RESPECTIVE POSITIONS.

DECAL

PART NO. 3-21144 (INSTALL ON SHEAR PLATE)

FRONT VIEW

LEFT SIDE VIEW

L.H. INT. INB'D RACK  
R.H. INT. OUTB'D RACK

7-519

**Figure 368—Bomb Rack Adjustment Indicator and Protractor**

For removal of the instrument panel, see section IV. 7.  
a. (24) (d).

(c) MINOR REPAIRS AND REPLACEMENTS.

—The bombing equipment is of rugged construction throughout, and minor repairs in general are not anticipated. Straightening of bent or deformed rods may be accomplished if the deformation is slight. Replacement rods must be equal to the original equipment, and replacement of bell cranks should be made with standard parts. The bomb coordinating unit will ordinarily be replaced as a unit. The unit is lubricated at the factory and has Oilite bearings, so no further lubrication is necessary.

(d) ADJUSTMENT.

1. ROD CONTROL SYSTEM.

a. INTERNAL RACKS.

(1) ADJUSTMENT.

(a) At assembly of the bomb racks, adjust the connecting rods between the release unit cranks for equal spacing. It has been determined that the variation in manufacturing tolerances on the release unit makes it impractical to attempt to gain progressive firing from the bottom stations up. The adjustment should therefore be simplified to the extent of setting all cranks for simultaneous operation. The adjustment of the push rod bomb control system is based on four positions for the bomb control handle ("LOCKED," "SELECTIVE," midtravel, and "SALVO"); three positions for the bomb control internal rack slide bars ("LOCKED," "SELECTIVE," and "SALVO"); one position for the bell cranks ("NORMAL"); and two positions for the mechanical bomb control interlock ("LOCKED" and "SELECTIVE"). In the "LOCKED" position, with the A-2 release box mechanical coupling 18 to 20 degrees off the vertical, the bomb release bar is either bottomed against, or within 1/16 inch of, the roller at the lowest inboard station. Check each A-2 release by placing a screw driver in the screw head and turning in the direction the arrow points. The release should not trip.

**CAUTION**

Do not use excessive pressure as it will cause bending of the solenoid plunger.

(b) The position of the bomb release bar cam track with respect to the roller riding in this track is the determining factor in locating the "SELECTIVE" position. There are three ways of determining this position for the bomb release bar:

1. By the pointer on the bottom of the slide bar, if the airplane is so equipped. See figure 368, by which an indicator may be constructed, if desired.

2. By the bomb release bar, having moved vertically upward a distance of  $.93 \pm .20$  inch from the "LOCKED" position. Locate this point accurately, as the tolerance applies to the adjustment of the rack, not the location of the point.

3. By visually inspecting the position of the bottom station cam roller in its cam track in the bomb release bar. This can be mechanically checked by testing each A-2 release, by placing a screw driver in the screw head and turning in the direction the arrow points, which should release the unit.

**CAUTION**

Do not use excessive pressure, as bending of the solenoid plunger will result if racks are not in adjustment. For the external rack, "SELECTIVE" is determined by the vertical position of the A-2 release box's mechanical coupling. A machinist's square held against the rack edge is also of value in determining this alignment. On airplanes equipped with the bomb rack adjustment indicator, if the decal is missing or the pointer does not agree with the position shown on the decal, mark the beam for future reference. (See figure 368.) Other reference marks may be employed on airplanes lacking this indicator. *It is of prime importance that this be done accurately.* With the bomb doors closed, the interlock should allow the rack slide bars and bomb control handle to go to the "SELECTIVE" position.

(c) The midtravel position is used only for rigging the push rods and bell cranks, and is determined by a position of the bomb control handle, which is clamped midway between "LOCKED" and "SALVO." The position of the bolt in the emergency bomb release mechanism (with the bomb release bars attached) should be center. (See figure 368.)

(d) In the "NORMAL" position for a bell crank and push rod, a 90-degree angle is formed between the push rod axis and a center line through the pivot bolts.

(e) In the "SALVO" position the bomb control handle is in its extreme forward position. The bomb release bars are a minimum of 3.02 inches up from their "LOCKED" position.

(f) ALTERNATE PROCEDURE. (See figure 369.)

1. Open bomb bay doors and disconnect rods 22L and 22R at "J," and rods 16L and 16R at "K."

2. Clamp the bomb control handle in the midtravel position.

3. Rig all bell cranks from the bomb release quadrant through "K" in normal position. Locate pivot bolt for "15" and "J" in the outer position of its slot. Adjust rods "7" and "8" so that the bolt through the slot in the emergency bomb release dogleg is centered in the slot. Place bomb control handle in selective, and mark the position of this bolt or screw with relation to its position in the emergency bomb release mechanism.



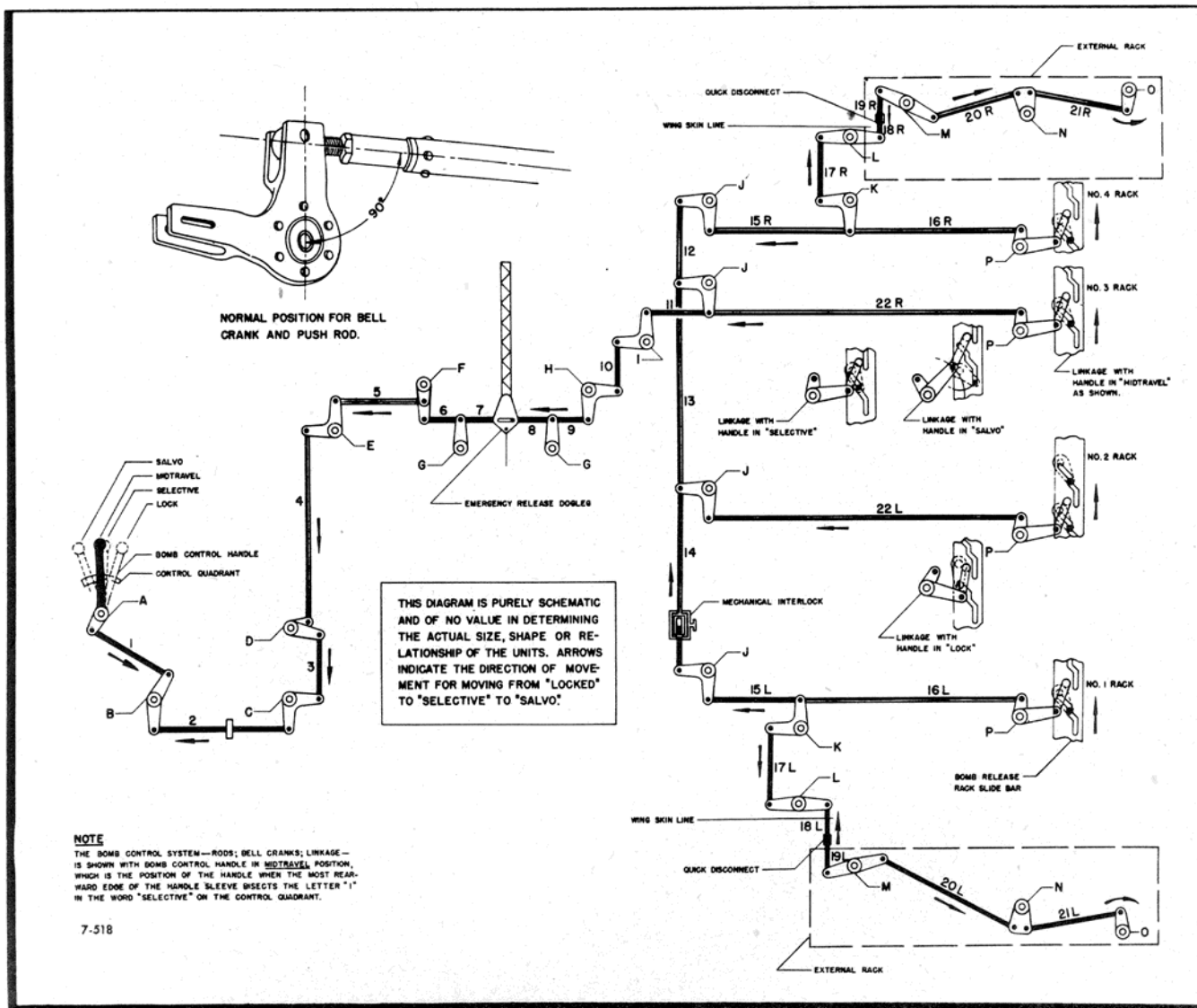


Figure 369—Bomb Control Diagram (Schematic)

4. Place the bomb control handle in "LOCKED" position and by adjusting the length of rods 16L, 22L, 22R and 16R, adjust the bomb release bars to their "LOCKED" position. The bolt in the slots at bell cranks "J" should be in the extreme outer position in the slots. If 22R and 22L do not connect without force, rod "11" can be disconnected from "J" and shortened as much as four turns.

5. Place bomb control handle in "SELECTIVE" and adjust the length of rod "5" sufficiently to return bolt or screw in the slot of the emergency bomb release mechanism to the marked position as noted in step (f) 3. above.

6. Check the synchronization of the bomb control handle and the racks, making sure that they are in complete synchronization at all points. If they are not, they can be brought into harmonization by adjusting the lengths of rods 16L, 22L, 12R and 16R accordingly. After the bomb control handle is syn-

chronized with the rack slide bars and a functional test reveals the malfunction of any particular station, it is probable that the defect is in the rack proper. Eliminate a possibly defective A-2 release box by repeating the test with additional release boxes. If the trouble persists, the mounting bolts for the A-2 salvo coupling actuator should be loosened, and the actuator shifted sufficiently to bring the individual station into adjustment. Great care must be exercised in doing this, and it should be definitely determined that the trouble lies in that particular station before attempting to change its adjustment. With this method of adjustment there should be 3/4 inch of travel of the bomb control handle from "SELECTIVE" position to where "SALVO" is effected at the lowest stations. To obtain this adjustment, increase the movement at the quadrant by lengthening rods 16L, 22L, 22R, and 16R as necessary.

7. Close the doors sufficiently to allow the mechanical bomb control lock to operate. If the

movement allowed by the mechanical bomb control interlock is insufficient to allow the racks full "LOCK" to "SELECT" movement, it will be necessary to alter the interlock socket, part number 41-236-1, and its mating brass plunger. The socket opening can be lengthened to 1-5/64 inches over-all with equal material left at each end of the socket. Additional necessary movement may be obtained by removing material from the brass plunger.

#### CAUTION

Be careful to file the plunger in such a manner that it does not catch on the extension stroke. If the interlock was re-worked, repeat preceding procedure from (f) 4. on.

#### (2) FUNCTIONAL TEST.

(a) Open the bomb doors electrically by means of the door control handle.

(b) With the bomb control handle in "LOCKED" position, mechanically test the A-2 releases to insure positive locking. Refer to paragraph (1) (a).

(c) Place the bomb control handle in the "SELECTIVE" position.

(d) Check the "dogleg" of the emergency release mechanism to insure that it is in its normal position.

(e) Test the electrical and mechanical operation of the A-2 releases on the racks. Refer to paragraph (2) (b).

(f) Check to see that all internal stations "salvo" when the bomb control handle is placed in that position. This should be accomplished to effect a rapid train release, and in order to do so it may be necessary to switch or change individual A-2 release units, due to discrepancies in manufacture.

#### Note

If this examination reveals that any one inboard rack is out of step with the rest of the system, this should be corrected by adjusting the length of rod 16L for rack 1, 22L for rack 2, 22R for rack 3 and 16R for rack 4. If all the racks, inboard and outboard, work together but are out of step with the bomb control handle, rod 11 should be adjusted. When sufficient adjustment to correct the trouble is not available at these rods, it is necessary to re-adjust the entire system, as detailed in paragraph (f). If either or both of the external racks show a lack of synchronization with the bomb control handle, adjust according to the detailed instructions given in paragraph b. following. In order to adjust the length of any push rod, it is necessary to remove the pivot bolt from either end and screw both of the adjustable ends into or out of the tube an equal amount, keeping an equal amount of thread in each end of the tube. If a system has given persistent trouble and has proved very difficult to

rig, the trouble might be in the quadrant for the bomb control handle. For B-17F and B-17G's proper quadrant is part number 6-10133 or 6-10133-1. A quadrant numbered 6-8960 is for the B-17E's and cannot be used on this airplane. Should the word "OPERATE" appear on the quadrant, instead of "SELECTIVE," it is a B-17E part.

#### b. EXTERNAL RACKS.

(1) With the bomb control system in the midtravel position, adjust bell crank "L" to normal. Place the pivot bolt for "7" and "K" as far in its slot as it can go and still not rub on the compression strut in the rib at station 1. Check this clearance for the entire control range.

(2) Screw the upper end of the quick disconnect coupling into its fitting until it bottoms.

(3) With "SELECTIVE" marked on the beam, install the racks complete with A-2 release boxes. (Do not connect the quick disconnect coupling.) The adjustment of the external beams is based on the particular A-2 release boxes used and, therefore, if new boxes are installed the adjustment should be checked.

(4) By adjusting the length of rod "21," synchronize the two stations on each beam.

(5) Adjust the length of rod "20" to within  $17.90 \pm .03$  inches center to center of holes.

(6) Loosen the pivot bolt for "20" and "M" and resecure in its slot, in such a way that "N" will reach its full backward swing position ("SALVO") when "20" and "M" form a straight line. This joint must not bind.

(7) Connect the quick disconnect coupling and place the bomb control handle in the "LOCKED" position.

(8) With the pivot bolt for "19" and "M" approximately centered, adjust the length of rods 19L and 19R in such a way that the stations are brought to the "LOCKED" position (full forward swing of "N"). *Note this position.*

(9) Place the bomb control handle in "SELECTIVE" and slide the pivot bolt for "19" and "M," such as to bring the stations to "SELECTIVE."

(10) Check back to the "LOCKED" position. If the pointer returns to or within 1/16 inch of "LOCKED," the system can then be given a final check. Mark this final "LOCKED" position on the beam.

(11) Check all positions against the necessity of making final adjustments.

(12) When the rack is adjusted with a bomb attached, due to additional weight it is necessary to connect the mechanical controls to the airplane's bomb control system, and then readjust the length of rod "19," to bring the pointer back to the final "LOCKED" position.



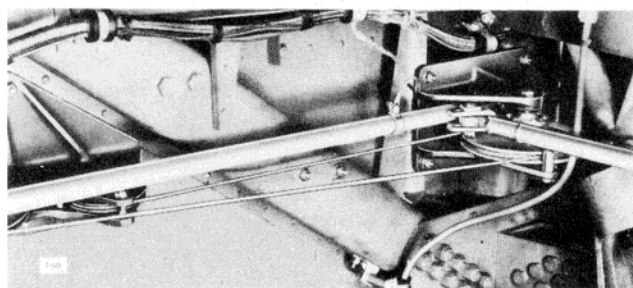


Figure 370—Cable Controls to Internal Bomb Racks

## 2. CABLE CONTROL SYSTEM.

### a. INTERNAL RACKS.

#### (1) ADJUSTMENT.

(a) Disconnect each of the four internal rack connecting rods from the bell cranks at the front of the bomb bay.

(b) Connect the cables aft of the coordinating unit and adjust with the turnbuckles until the arms of the No. 2 bell crank (left inboard) are normal (at 90 degrees) to the rods when the internal rack control handle is clamped in the midtravel position.

(c) Adjust the three transverse rods to the other three bell cranks at the front of the bomb bay so each bell crank is normal to the connecting rods.

(d) Close the bomb door at least eight inches from the full open position. Move the internal rack handle to "SAFE." The mechanical interlock at the left front corner to the bomb bay should engage so that the handle cannot be moved back to "SELECT." If it does go into the "SELECT" notch, return the handle to "SAFE," and turn the rod through the mechanical interlock until the handle will not go into "SELECT" with the interlock engaged. If there is not yet enough adjustment in the rods, return the handle to midtravel and adjust the turnbuckles on the internal cables aft of the coordinating unit until the transverse arm of the No. 2 bell crank is not more than 1/16 inch forward of the normal position. (See step (b).) The handle must not go into "SELECT" when the mechanical interlock is engaged. This condition must be correct before the internal racks are connected. Check to insure freedom of movement.

(e) Open the bomb door to disengage the mechanical interlock. Set the control handle in "SAFE." Take the slack out of the system by pushing inboard on the mechanical interlock rod and push back on the No. 2 rack (left inboard) connecting rod. Adjust the length of the No. 2 rod so that when it is connected to the serrated bell crank at the front of the bomb bay, the bolt goes into the inner end of the slot, nearest the pivot. Tighten the bolt.

(f) Push back on each of the other three rack connecting rods, adjust the length and attach with the bolt in the inner end of the bell crank slot.

(g) Move the handle to "SELECT." Check to see that the bottom station cam roller is in the middle of the vertical leg of the slot in the bomb rack slide bar. If the cam roller in any rack is above the middle of the vertical slot, return the handle to "SAFE," loosen the connecting bolt on the serrated arm, and shorten the bar so the bolt moves outward from the center of the bell crank one or two serrations. Tighten the rod and the bolt, and check by moving the handle to "SELECT."

(h) Install 24 type A-2 bomb release units at the following stations. (See figure 418.)

Left Outboard—1, 3, 4, 12, 14

Left Inboard—5, 7, 9, 15, 17, 19, 21

Right Inboard—26, 28, 30, 36, 38, 40, 42

Right Outboard—22, 24, 25, 33, 35

(i) Cock the release arm of all 24 units. Move the internal rack handle slowly to "SALVO." All units should trip. There must be at least 1/2 inch overtravel of the handle after the last unit trips. If there is less than 1/2 inch overtravel, loosen the serrated bolt and shorten the rack connecting rod for the last rack to trip to increase the rack travel.

(j) Check the arms for clearance in "SALVO."

#### (2) FUNCTIONAL TEST.

(a) Cock both arms of all 24 release units. Set the internal rack handle in "SAFE." Try to trip each unit with a screw driver as indicated on the face of the unit. None must trip.

#### CAUTION

Do not use too much force or the solenoid plunger may bend.

(b) Move the control handle to "SELECT." The release arm only of each unit should now be tripped by the screw driver.

(c) Cock all the units and slowly push the handle through to "SALVO." The release arm only on all units must trip, and the control handle must have at least 1/2 inch overtravel after the last unit trips.

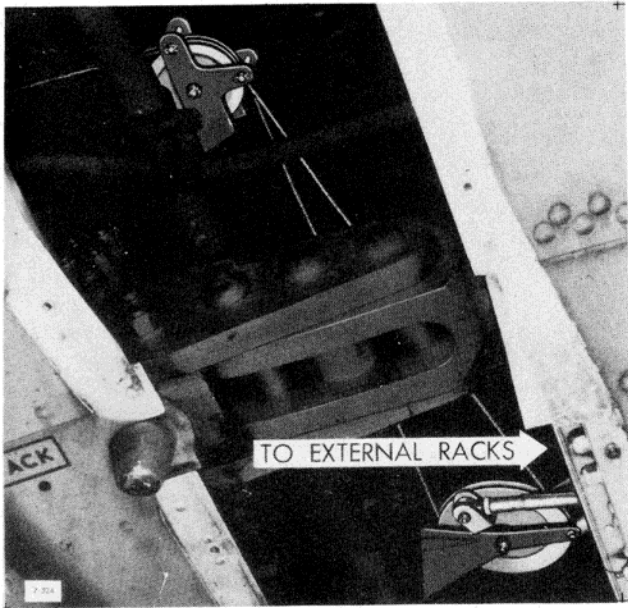
(d) Set the handle in "SELECT" and cock all release units. Turn on the airplane electricity. Hold the bomb doors fully open.

(e) Set the SELECT-TRAIN switch on the bombardier's bomb interval release unit to "TRAIN." Set the BOMBS-TO-BE-RELEASED dial for 24 bombs. Set the spacing dial for 100 MPH and 750 feet interval. Allow one minute to warm up.

(f) Turn on the bomb load indicator light switch, the internal rack selector switches, and the bomb formation signal light switch. The white formation light in the tail should be on.

(g) Station someone in the bomb bay and someone at the tail. Lower the guard on the bomb release switch forward of the bombardier's panel and





**Figure 371—Cable Controls to External Bomb Racks**

press the switch either way. The bomb release lights on the bombardier's and pilot's instrument panels will blink on for each bomb release, the bomb load indicator lights will go off in sequence, the formation signal light at the tail will turn to red and will remain red until five seconds after the last bomb release unit trips, and the bomb release units will trip (both arms) in the sequence listed in Column 2, figure 418.

#### b. EXTERNAL RACKS.

##### (1) ADJUSTMENT.

(a) With the coordinating unit adjusted, connect the external rack cables aft of the coordinating unit.

(b) Set the external rack control handle in "SAFE" and adjust the cables so the arms on the pulley sheaves have a 1/16 inch clearance from the pulley bracket in the "SAFE" position. (The pulley sheaves are in the inboard end of the wing forward of the inboard fuel tank, and are accessible after removing the tank access doors. See figure 3.) Adjust the left sheave first with the *turnbuckles forward* of the splices, and maintain a tension of  $30 \pm 5$  pounds. Adjust the right sheave second with the turnbuckles *aft* of the splice, and maintain a tension of  $30 \pm 5$  pounds. Check the left pulley and readjust as necessary. Check that the 1/16 inch clearance remains. Lockwire the turnbuckles and check for freedom of movement.

(c) Clamp the external handle at the midtravel position and screw the push rod until the push rod and pin rod are normal (at 90 degrees) to the bell crank outboard of the pulley sheaves. Check for freedom of movement of the pushrods.

(d) Screw the upper end of the quick disconnect fitting into the pin rod until it bottoms. In-

stall the external rack, without a bomb and without A-2 release units, but do not connect the quick disconnect fitting.

(e) Set the rods in the external rack so the actuating arm of the forward box is at right angles to the edge of the rack (use a machinist's square). Mark the position of the pointer below the arm, or the centerline of the arm with a pencil. Do not scratch the metal.

(f) Adjust the rod between the forward and rear stations so that the actuating arm of the rear station is at  $12\frac{1}{2}$  degrees forward of the perpendicular to the edge of the rack when the forward coupling is at 90 degrees. In this position, the rod will be normal (at 90 degrees) to the rear actuating arm.

(g) Swing an arc with the pointer, measure a 13/16 inch chord on each side of the vertical mark, and mark for the "SAFE" ("LOCKED") and "SALVO" positions.

(h) Adjust the rod between the forward station and the bell crank until the pointer is at the rear ("SALVO") mark when the rod and bell crank are in a straight line (maximum extension).

(i) Connect the quick disconnect fitting, set the external rack control handle on "SELECT," and adjust the quick disconnect fitting with the check nut until the pointer is on the vertical mark.

(j) Move the handle to "SAFE" and adjust the quick disconnect rod at the forward end of the serrated bell crank until the pointer is at the forward ("LOCKED" or "SAFE") mark.

(k) Set the handle to "SELECT," re-adjust the quick disconnect check nut to set the pointer on the vertical ("SELECT") mark, and readjust the ends of the bell crank until the pointer does not exceed the end marks when the handle is moved to "SAFE" and "SALVO."

(l) Remove the rack, attach the bomb, securely lock the rod system in the "SAFE" position, hoist and install the rack as instructed in figure 417, and connect the electrical receptacle and quick disconnect fitting with the control handle in the "SAFE" position. Adjust the pointer to the "SAFE" mark with the quick disconnect check nut. Remove the rod system lock, and slowly move the control handle to "SELECT," at the same time adjusting the quick disconnect check nut so that the pointer does not pass the vertical mark on the rack, and is on the mark when the handle latches in "SELECT."

(m) To remove the rack with a bomb attached, return the handle to "SAFE," lock the rack rod system, and detach the bomb and rack.

##### (2) FUNCTIONAL TEST.

(a) Install both external racks without bombs, and with both forward and rear A-2 release units in place. Adjust quick disconnect check nut so pointer is on vertical mark with handle on "SELECT."



(b) Move control handle to "SAFE." Check that the pointer falls on the forward mark. Turn the screw on the face of the A-2 release unit in the direction the arrow points. The screw should not turn nor the arm trip.

**CAUTION**

Do not use excessive force or the solenoid plunger may bend.

(c) Move the control handle to "SALVO." The release lever, but not the arming lever, should trip on all four boxes. The pointer should at least reach the "SALVO" (rear) mark, but may not pass it and may even return a little.

(d) Move the control handle to "SELECT." Cock both arms of all four boxes.

(e) Turn the airplane electrical power on.

(f) On the bomb interval release unit at the bottom of the bombardier's panel, set the SELECT-TRAIN switch to "TRAIN," set the BOMBS-TO-BE-RELEASED dial to 4, and set the INTERVAL-BETWEEN-BOMBS dial at 750 feet for 100 MPH. Allow one minute for warm-up.

(g) Turn the external rack selector switches on. The two lights beside the switches should go on.

(h) Turn the bomb formation signal light switch to "BRIGHT." The warning lamp beside the switch and the white light in the tail should go on.

(i) Turn the nose arming switch to "ARM." The warning light should go on. The arming solenoid in each external rack must hold a 100-pound load suspended by a standard arming wire when the solenoid is energized. When the switch is turned to "SAFE," the solenoid must hold a 3-pound load, but must release a 4-pound load.

(j) Station someone at each external rack, and at the tail. Lower the guard on the bomb release switch forward of the bombardier's panel and press the switch either way. The external release units should trip (both arms) in the following sequence: Left forward, right forward, left rear, right rear. The red tail light should go on when the first release trips and should remain on five seconds after the last release trips.

**c. BOMB CONTROL MECHANISM.**

(1) GENERAL.—The bomb control system can be checked and separate adjustments made to the various items without disassembling the entire system, or complete readjustments can be made by the following procedures. The adjustment of the bomb control mechanism is based on four positions of the bomb rack control handles ("SAFE," "SELECT," mid-travel, and "SALVO"), three positions of the internal bomb rack slide bars and the external rack release unit coupling ("SAFE," "SELECT," and "SALVO"), two positions for the bomb door mechanical interlock (engaged and disengaged) and one position for the bell cranks (normal).

(2) SAFE POSITION.—The bomb control handle is in the "SAFE" position when latched aft. The internal rack slide bar in "SAFE" is bottomed against a cam roller, and the pointer is on "LOCKED" on the decal below the slide bar. In the external racks the "SAFE" position is determined after the "SELECT" position is found. Measure, forward of the "SELECT" position, a 13/16 inch chord of the arc described by the pointer (radius 2.4 inches), or the centerline of the actuator arm on the forward release unit, to locate the "SAFE" position. The bomb door mechanical interlock is engaged until the left door is 2 to 4 inches from full open.

(3) SELECT POSITION.—The bomb rack control handles are in "SELECT" when in the second notch forward, or approximately vertical. The internal rack slide bars are in "SELECT" when the cam roller of the bottom station actuating arm is in the middle of the vertical leg of the cam slot in the slide bar, or the slide bar is  $.90 \pm .00 - .05$  inch above the bottomed ("SAFE") position. The pointer below the slide bar should be in the "SELECT" area. The "SELECT" position for the external racks is determined by the vertical position of the A-2 release unit actuator arm. A machinist's square held against the rack edge will aid the check. Mark the "SELECT" position below the pointer on the rod joint at the forward release actuator arm so the "SAFE" and "SALVO" positions may be determined. The bomb door mechanical interlock is disengaged when the left door is two to four inches from full open and the rod through the interlock is unlatched.

(4) SALVO POSITION.—The bomb rack control handles are in "SALVO" when pushed full forward. The internal rack slide bars are a minimum of 3.02 inches up from the absolute bottomed or "SAFE" position when in "SALVO," and the slide pointer is on or beyond "SALVO" on the decal below. The "SALVO" position of the external rack releases is determined in the same way as the "SAFE" position. Measure, *aft* of

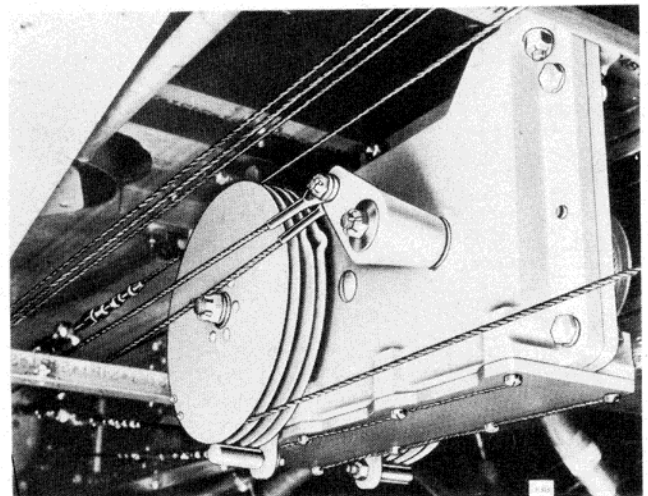


Figure 372—Coordinating Unit Installation



the "SELECT" mark, a 13/16-inch chord of the arc described by the pointer (radius 2.4 inches) at the forward release unit.

(5) MIDTRAVEL POSITION.—In the midtravel position the bomb rack control handle is half way between the "SAFE" and the full "SALVO" positions, and all bell cranks are normal (at a 90-degree angle) to the push rods.

d. CONTROL STAND—COORDINATING UNIT.

(1) ADJUSTMENT.

(a) Disconnect the cable turnbuckles aft of the coordinating unit to the internal and external racks.

(b) Latch the internal and external handles in "SAFE" and adjust the cable turnbuckles at a tension of  $40 \pm 10$  pounds so that when the handles are unlatched and pulled aft, there is a 1/16 to 1/8-inch overtravel before the handle stops.

(c) Move the handles between "SAFE" and "SALVO" several times to check that there is no drag, pulleys turn freely, and the cables are not binding.

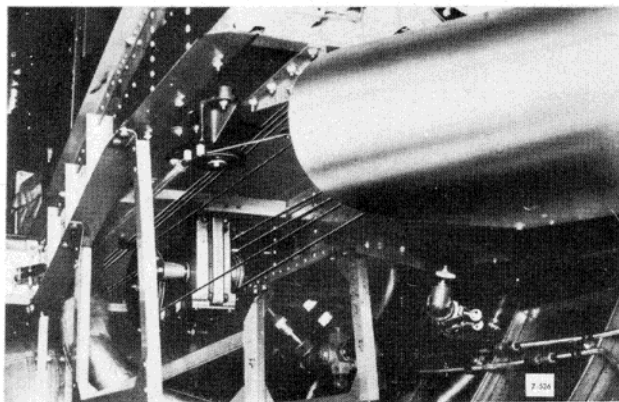


Figure 373—Control Cables and Coordinating Unit

(d) Turn the handwheel to rewind, and adjust the turnbuckle so the clip (over the forward entrance door) is fully seated. Adjust the alignment of the clip with the turnbuckle so the clip lines up with the catches before seating.

(e) Turn the handwheel to release until it stops, and check to see that the forward cable is not striking the sides of the hole through the control stand base. If it is striking, shift the turnbuckles until a clearance is obtained when the handwheel stops in release.

(f) Adjust the emergency release cable turnbuckle so the cables are just taut when the clip is seated.

(g) Lockwire all turnbuckles forward of the coordinating unit.

(2) FUNCTIONAL TESTS.

(a) Move the internal and external handles to check for freedom of operation and that the handles slip into "SAFE" freely.

(b) Move the handles to "SAFE" and check for 1/16 to 1/8-inch overtravel beyond the latching position.

(c) Turn the handwheel to release, and check the clearance of the forward cable through the hole in the control stand base.

(d) Turn the handwheel to rewind and observe that the cable clip over the forward entrance door enters the catches and seats fully.

(e) Check the lockwiring on all turnbuckles.

e. BOMB DOOR EMERGENCY RELEASE.

(1) ADJUSTMENT.

(a) Pull either emergency release handle. Hold the bomb doors in the full open position.

(b) Rig each of the two bomb door release cables from the horn on the inboard side of the coordinating unit for 30 pounds tension. The adjustment is made at the two turnbuckles above the hinge of each door. The cable for each turnbuckle will then have approximately 15 pounds tension, depending upon what is necessary to trip the retracting screw latches.

(2) FUNCTIONAL TEST.

(a) Rewind the emergency release cables. Latch and close the bomb doors.

(b) Pull either emergency bomb release handle. Both doors must drop.

(c) Run the retracting screws down manually, then close the doors electrically. All four door latches must catch.

f. MECHANICAL INTERLOCK.

(1) ADJUSTMENT.

(a) Cock both arms of the bottom release unit in each internal rack, (stations 1, 5, 26, 22).

(b) Close the left door approximately eight inches from the full open position.

(c) Pull on either emergency release handle and swing the left door open slowly. The bottom stations must fire when the door is between two and four inches from the full open position. If it does not, adjust the rod connecting the mechanical interlock on the left door. Rewind the cables with the handwheel on the bombardier's stand, and check the adjustment.

(2) FUNCTIONAL TEST.

(a) Close the bomb doors, cock both arms of all 24 internal release units, and set the internal and external handles in "SAFE."

(b) Station someone at the left bomb door to swing the door fully open when it falls. Pull the pilot's emergency release handle and check to see that both doors open and the release arm only of all A-2 release units trip.

(c) Repeat (a) and (b), pulling the bomb bay emergency release handle.



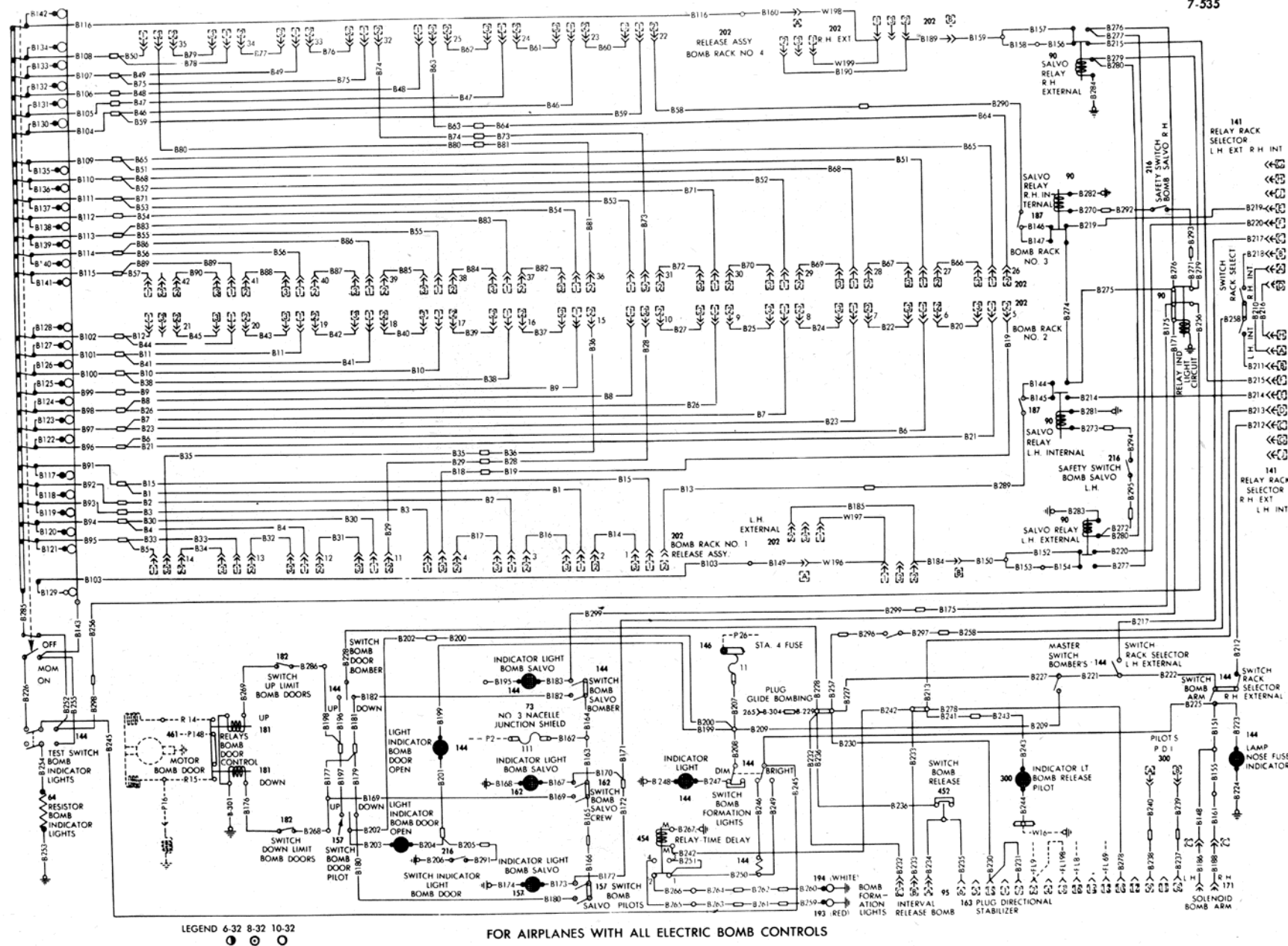


Figure 374—All-Electric Bomb Control System—Circuit Diagram

(3) AIRPLANES WITH ALL-ELECTRIC  
BOMB CONTROL SYSTEM.

(a) GENERAL.—The all-electric bomb control system differs from the systems with rod or cable controls in that emergency (salvo) release of the bombs is accomplished electrically. All mechanical controls have been eliminated in the all-electric system. Normal bomb release procedure is essentially the same except for control of the bomb doors, which in the all-electric system are controlled by toggle switches at the bombardier's and pilots' stations. The bombardier's control stand has been eliminated. Salvo switches are provided in three different locations in the airplane accessible to the bombardier, pilot and copilot, and to the crew. Closing of any one of these switches opens the doors electrically and salvos the bombs. In the all-electric system the A-2 release unit is replaced by the A-4 unit containing a rotary solenoid and plunger which make it possible to drop armed bombs in the normal manner or to salvo the bombs unarmed.

1. NORMAL BOMB RELEASE. Power for the normal bomb release circuits is taken from the station 4 fuse shield through a 30 ampere fuse. All power for the normal bomb controls goes through the bombardier's master switch except the power for the pilots' bomb door control switch, for the bomb door open lights, and for the bomb formation signal lights indicator light on the bombardier's panel.

a. In the normal release procedure from both the internal and external racks, the bombardier first sets the intervalometer for the number and spacing of bombs to be released. Next the bomb formation signal light switch is set to either "BRIGHT" or "DIM" as desired and the amber indicator light goes on, but the white tail light does not go on until the bombardier's master switch is closed.

b. The bombardier should then turn on the P.D.I. switch and the bombsight switch on the bombsight stabilizer, and if the autopilot is to be used, the servo and stabilizer switches.

c. When the master switch on the bombardier's panel is turned on next, the white bomb formation signal light at the tail and the amber indicator light on the intervalometer will go on, and the P.D.I. on the pilot's panel will respond to movement of the bombsight stabilizer autopilot clutch. The bombsight gyro, the stabilizer servo, and, if the stabilizer switch is on, the stabilizer gyro will run.

d. The bomb door switch is then held at "OPEN," energizing the bomb door motor solenoid switches to run the motor. When the doors are open, the bomb door open light switch at the left hand door will turn on the red lights on the bombardier's and the pilot's panels, and the normal circuit safety switch on the right hand door will close to complete the circuit up to the two internal rack selector switches.

e. The four rack selector switches (or any combination, depending on the desired release se-

quence) on the bombardier's panel are turned "ON" next, energizing the rack selector relays to direct the bomb release impulses to the proper racks.

f. The NOSE FUSE ONLY switch should be moved to "ARM" or "SAFE," depending on whether it is desired to arm the nose of the external bombs. The bombardier should then test the bomb load indicator lights by momentarily holding the lamp test switch to "MOM" to see that all bulbs illuminate and may then turn the indicator light switch handle to "ON" momentarily to see which stations are loaded.

**WARNING**

The indicator light switch must be off and the lamp test switch on during bomb release. The bombs will drop unarmed as long as either switch is held in the momentary position during a train release.

g. If the light on the intervalometer has been on for *one minute*, when the SELECT TRAIN switch is on "TRAIN," the bomb release switch may be pressed, or the bombsight actuated to start the release sequence.

h. Current from the bomb release switch or bombsight starts the intervalometer which sends out measured impulses of current. Each impulse blinks an amber light on the pilot's panel, actuates the formation signal light time delay relay (Agastat) to turn on the red tail light, and operates the rack selector relays to direct the impulses to the proper rack as determined by the bomb release sequence.

i. The release impulse energizes a rotary solenoid in the Type A-4 bomb rack release which trips the triggers and allows both cocked arms to snap to the uncocked position, actuating the levers on the bomb shackle to arm and drop the bomb. The external bombs may be dropped without opening the bomb doors.

2. EMERGENCY (SALVO) RELEASE.—All internal and external bombs can be released unarmed by throwing any one of the three salvo switches. A light beside each switch indicates that one or more of the three switches is closed. Power for the salvo circuit is taken directly from the batteries through a 30-ampere fuse in the nacelle 3 junction shield. Closing of any one of the three salvo switches instantly energizes the bomb door motor solenoid switches, closing the circuit which provides power to the bomb door motors, and the doors open electrically.

**Note**

Twelve seconds are required for the doors to open.

a. Closing of the salvo switch also instantly energizes the indicator light relay, which closes the circuit to the four rack salvo relays and to the salvo solenoids in all the Type A-4 bomb rack releases through the bomb indicator light switch. The salvo solenoid extends a locking pin which prevents the rotary sole-



noid from making the complete travel, thus allowing only the release arm to trip, dropping the bomb unarmed.

b. The two external rack salvo relays close instantly when a salvo switch is closed and energize the rotary solenoid to drop the bomb immediately. The two internal rack salvo relays, however, receive power through the indicator light relay and through the bomb door salvo safety switches so that they are not energized until the doors are fully open. The power to the internal rack releases must also pass through the bomb bay safety switches. The entire salvo release will require about 15 seconds from the time the salvo switch is closed.

(b) INSTALLATION.

1. INTERVALOMETER.—Either the B-2A or B-3 intervalometer may be used with the all-electric bomb control system. The function and operation of either unit is identical, the only difference being in the electrical connection receptacle on the back of the unit. This difference makes it impossible to interchange a B-2A intervalometer in an airplane wired for a B-3 intervalometer and vice versa. A more detailed description of the intervalometer will be found in paragraph (d) following.

2. SWITCHES.

a. MASTER SWITCH.—The master switch is an "ON-OFF" single-pole, double-throw toggle switch located on the bombardier's control panel. All units of the normal bomb control system except the pilot's bomb door control are wired through this switch.

b. BOMB DOOR SWITCHES.—There are two bomb door switches, one mounted on the bombardier's control panel and one mounted over the pilot's instrument panel. The switches are type B-11 toggle switches of the momentary contact type and are labeled "OPEN" and "CLOSED." The switches are normally off in the center position and to operate the doors, the switch must be manually held in either the "OPEN" or "CLOSED" position until the doors reach their limit of travel. A red indicator light above the switch goes on when the bomb doors are fully open. In closing the doors, the switch must be held in the "CLOSED" position until the bomb door motor stops or until the doors are observed to be fully closed. This should take approximately 20 seconds.

c. RACK SELECTOR SWITCHES.—The four rack selector switches are "ON-OFF," type B-5A single-pole, double-throw toggle switches, mounted on the bombardier's control panel. These switches make it possible to select the rack from which bombs are to be dropped and control the left hand external, left hand internal, right hand internal, and right hand external racks. Power for the rack selector relays goes through these switches; therefore, when bombs are released they will drop in proper sequence from all racks whose selector switches are "ON" (with bomb bay safety switches closed).

d. NOSE FUSE SWITCH.—The nose fuse switch, located on the bombardier's control panel, controls the type A-1 nose fusing solenoid on the external bomb racks and makes it possible to drop the external bombs with the nose either armed or unarmed. The switch is a single-pole, double-throw type B-5A toggle switch, and has two positions, labeled "ARM" and "SAFE." In the "ARM" position, the red indicator light above the switch goes on regardless of whether external racks or bombs are actually installed or not.

e. SALVO SWITCHES.—Three salvo switches are provided in the airplane; one installed on the bombardier's control panel, one over the pilot's instrument panel accessible to the pilot and copilot, and one mounted in the bomb bay on the forward upper left sidewall, accessible to the crew. The switches are type C-1 toggle switches with a red plastic, hinged guard which must be lifted to throw the switch, thus minimizing the possibility of accidental operation. The red light adjacent to each switch goes on to indicate when any one of the three switches has been closed.

f. BOMB FORMATION SWITCH.—The bomb formation switch controls the bomb formation signal light located in the tail of the airplane. The switch is a type C-2 double-pole, double-throw toggle switch mounted on the bombardier's control panel. In the center position, the switch is off; moved to the "BRIGHT" position, the light in the tail will be bright; in the "DIM" position, a resistor is included in the circuit to lessen the intensity of the light. The amber indicator light above the switch goes on immediately when the switch is moved to either position, but the signal light in the tail of the airplane does not go on until the master switch is closed.

g. BOMB INDICATOR LIGHT SWITCHES.—The two switches which control the bomb indicator lights are mounted on the bombardier's control panel directly above the lights.

(1) The lamp test switch is a momentary contact toggle switch with a "MOM" and "ON" position. When held in the "MOM" position it closes a separate circuit to the indicator lights and provides a ground which is independent of the ground in the indicator lights circuit of the A-4 release units on the bomb racks. Thus it illuminates *all* the bomb indicator lights and makes it possible to check and see that all the lights are operating.

(2) The other bomb indicator switch has a handle for turning the switch from the "OFF" to the "ON" position for checking loaded bomb stations. All 26 indicator lights are wired through this switch but the ground for each light circuit is provided by cocked A-4 release units installed on the bomb racks. Therefore, when the bomb indicator light switch is turned to "ON," an indicator light will illuminate for each circuit which includes a *cocked* A-4 release unit, showing at a glance the bomb loading in the bomb bay. The salvo solenoids in the A-4 release units are energized



through the indicator lights circuit; closing either switch while bombs are being released will actuate the solenoids and cause the bombs to drop unarmed.

h. **BOMB RELEASE SWITCH.**—Bombs may be dropped when the bomb release point is reached, either automatically by the bombsight or by manually closing the bomb release switch. The switch, installed on a small shield mounted on the sidewall above and forward of the bombardier's instrument panel, is a modified type B-11 single-pole, double-throw toggle switch with a hinged guard to prevent accidental operation. After swinging the guard clear, the switch may be thrown in either direction to release the bombs.

i. **BOMB BAY SAFETY SWITCHES.**—The two bomb bay safety switches are located in the bomb bay, one on each sidewall. They are type B-5A single-pole, single-throw toggle switches installed on small mounting panels bearing a label which indicates the "ON" and "OFF" positions. One switch controls the left hand internal racks, the other controls the right hand internal racks. Throwing a switch to the "OFF" position breaks the circuit to that rack, excluding it from the release sequence should the bomb release switch or a salvo switch be closed. *These switches should always be turned "OFF" when bombs are being loaded* to protect personnel against accidental release of bombs. The switches must be "ON" in order to drop bombs, either normally or in salvo. The switch must be turned off on racks on which bomb bay fuel tanks are installed to prevent the possibility of dropping the fuel tanks during bomb release. The switches must be turned "ON" before the tanks can be jettisoned. No safety switches are provided for the external racks; instead, the electrical connector should be left disconnected during bomb loading.

j. **BOMB DOOR SAFETY SWITCHES AND BOMB DOOR LIGHT SWITCH.**—Four type YZ-R31 Micro switches, two on each side, are mounted at the center hinges of the bomb doors. The two aft switches on each side are the bomb salvo safety switches. When a salvo switch is thrown, they close the circuit to the salvo relays *when the bomb doors are fully open*. The forward switch on the right hand side is the normal bomb door safety switch. It closes the circuit through the rack selector switches to the rack selector relays when the doors are fully open during normal bomb release. The function of both the normal and salvo bomb door safety switches is to prevent bombs being dropped until the doors are open. The forward switch on the left hand side is the bomb door indicator light switch. It closes the circuit to turn on the bombardier's and pilot's bomb door indicator lights when the door reaches the open position. All four switches should be set at installation to close when the bomb doors are  $3 \pm 1$  inch from the fully open position.

3. **INDICATOR LIGHTS.**—There are two bomb door indicator lights (red), one on the bombardier's control panel and one above the pilot's instru-

ment panel. Both lights are installed adjacent to their respective switches. The nose arm indicator light is located directly above the nose fuse switch on the bombardier's control panel.

a. A red bomb salvo light is located next to each salvo switch. One light is mounted on the bombardier's control panel, one on the small mounting panel over the pilot's instrument panel and one in the bomb bay. The amber bomb formation light is installed on the bombardier's control panel, above the bomb formation switch.

b. The 26 bomb indicator lights are located on a small panel installed in the lower right hand section of the bombardier's control panel. The lights are labeled and arranged to correspond to the 24 stations on the four internal bomb racks and the two external racks. All the lights should go on when the lamp test switch is held in the "MOM" position, and a light should go on for each loaded bomb station (or cocked A-4 release unit) when the bomb indicator light switch is turned to "ON."

c. The amber bomb release indicator light on the pilot's instrument panel receives impulses from the intervalometer causing it to flash on each time a bomb is dropped.

4. **RACK SELECTOR RELAYS.**—The two rack selector relays are mounted on the forward leg of the navigator's table by means of AN520 bolts. The braid bonding jumper and strip should be installed under the proper bolt. The two relays are connected in series and electrical connection is made by inserting the AN plug in the receptacle on the relay.

5. **TIME DELAY RELAY.**—The time delay relay (AGASTAT) type NC-28 is mounted on the forward leg of the navigator's table.

#### 6. BOMB RACKS AND CONTROLS.

a. **INTERNAL RACKS.**—Each of the four internal bomb racks consists of two rails and backing plate which are bolted to the fuselage structure in the bomb bay. The two inboard racks have 13 stations each and the two outboard eight each, making a total of 42 stations, of which 24 may be loaded at any one time. Each station has a pair of hooks from which the bomb shackle is suspended. A type A-1 auxiliary release box is installed behind the backing plate at each station so that its electrical receptacle is flush with the front face of the bomb rack. The plug on the A-4 bomb release unit fits into this receptacle when the unit is bolted to the rack.

b. **EXTERNAL RACKS.**—A detachable bomb rack is suspended below each wing between the fuselage and the inboard nacelle to carry a 1000-, 1600-, 2000-, or 4000-pound bomb. The rack has two stations, the forward station used with 4000- and 2000-pound bombs and the rear for 1600- and 1000-pound bombs. Each station has shackle hooks and a type AX-7 recep-



tacle into which the bomb rack releases are plugged. In the all-electric system the rod and bell crank mechanism is not used and it must be clamped solidly so that it cannot move when the type A-4 release units are installed. Adjustable sway braces on each rack are used to steady the external bomb. Illustrations and additional information on the bomb racks will be found in section V under "BOMB LOADING."

c. A-4 BOMB RACK RELEASE UNITS.—The type A-4 bomb release unit must be used with the all-electric bomb control system. The units are installed at each bomb station by bolting them to the rack with AN-3 bolts. This automatically inserts the electrical connecting plug into the receptacle of the auxiliary box on the rack, and includes the unit in the circuit. The unit need then only be cocked and it is ready for operation. The type A-4 release unit can be installed on external racks which were designed to use the A-2 unit by a slight re-work of the mounting holes. The wiring fits both type releases.

d. A-1 AUXILIARY RELEASE BOXES.—An A-1 auxiliary release box is installed at each station on the internal racks. The boxes are mounted on the back of the panel on each rack and are an integral part of the rack.

e. AX-7 AUXILIARY RELEASE BOXES.—A type AX-7 auxiliary release box is installed at each station on the external racks, and provides the electrical connection receptacle into which the A-4 release units are plugged.

f. A-1 NOSE ARMING SOLENOIDS.—A type A-1 nose arming solenoid (bomb arming control box) is installed at the forward end of each external bomb rack to provide separate electrical control of nose fusing of the external bomb. Electrical connection to the nose arming solenoid is made by inserting the plug connector in the receptacle on the unit.

g. BOMB SHACKLES.—Hooks are provided at each station on the bomb racks for holding the

bomb shackle. The two levers on the shackle fit in the arms of the A-4 release unit when the shackle is suspended from the rack.

h. BOMB DOORS AND CONTROLS.—For installation of bomb doors, retracting mechanisms and limit switches, see section IV, paragraph 4.

(c) REMOVAL.

1. GENERAL.—No particular difficulty should be encountered in the removal of any of the units of the all-electric bomb control system. Removal in all cases can be accomplished by merely reversing the installation procedure and in most cases will involve nothing more difficult than simply disconnecting the electrical connector and removing the mounting screws or bolts used to install the equipment.

(d) MAINTENANCE.

1. INTERVALOMETER.—No repairs other than replacement of the bulb should be attempted in servicing the system. If the unit is not functioning prop-

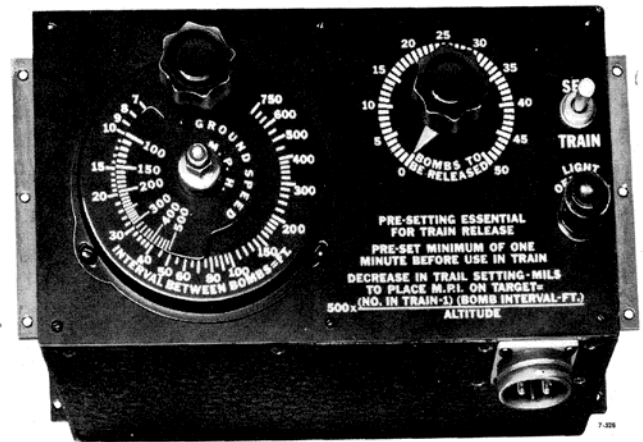


Figure 376—Intervalometer—Front View (Mallory)

erly it should be replaced. Low or irregular voltage may cause malfunctioning of the counter solenoid, and erratic unpredictable release. If this trouble is encountered, check the voltage of the airplane electrical system before replacing the unit. B-17G airplanes may have either the type B-2A or B-3 intervalometer installed. The function and operation of both types is the same, but the electrical receptacle is different. Because of this difference the two types cannot be interchanged unless the plug connector which fits into the receptable is also changed.

a. The function of the intervalometer is to permit the release of a predetermined number of bombs at predetermined time and space intervals the instant the bombsight or bomb release switch is closed. The desired number of bombs in a train is selected by setting the counter dial, labeled BOMBS TO BE RELEASED and moving the SELECT-TRAIN switch to "TRAIN." With the switch in the "SELECT" position, only one bomb will be released each time the bombsight or bomb release switch is closed. The ground

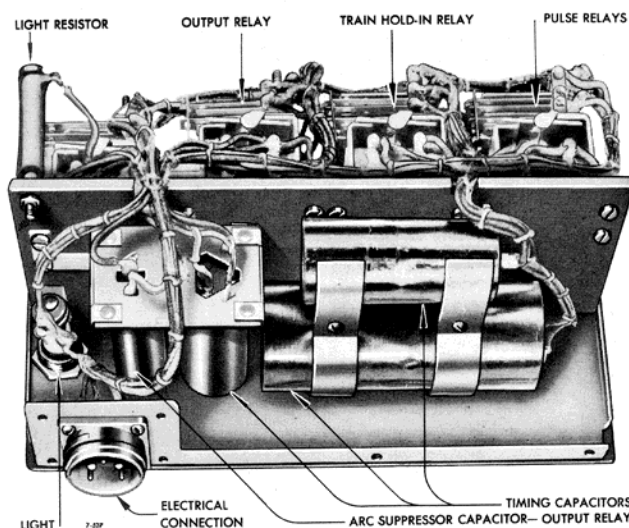


Figure 375—Intervalometer—Rear View (Mallory)



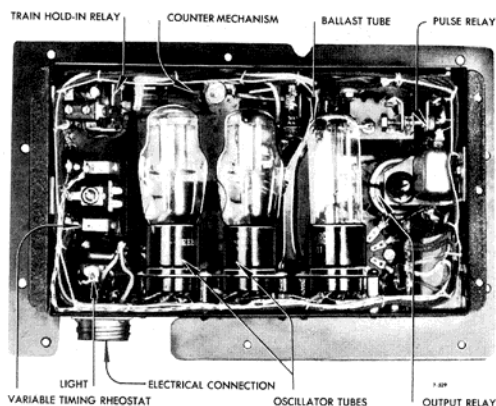


Figure 377—Intervalometer—Rear View (Seeburg)

spacing in feet of the bombs is selected by setting the **INTERVAL BETWEEN BOMBS** knob which controls a variable resistor wired in series with capacitors to send out electrical impulses at accurately spaced intervals. A ratchet wheel actuated by a solenoid, returns the **BOMBS TO BE RELEASED** knob toward zero, one notch for each impulse from the intervalometer. At zero the impulses cease. It is possible to extend a train release beyond the number of bombs originally selected by manually holding back the counter knob. A train release may be stopped at any point during the release by manually turning the counter dial to zero or throwing the switch to "SELECT."

b. The pilot light on the face of the intervalometer is on only when the switch is on "SELECT" or the **BOMBS TO BE RELEASED** dial is set away from zero with the switch on "TRAIN." When not in use leave the switch on "TRAIN" and dial at zero to prevent pilot light and tube current drain. The tubes in the intervalometer require one minute to warm up before the unit can be operated.

2. **SWITCHES.**—With the exception of the safety switches mounted at the bomb door hinges, no servicing of switches should be necessary other than checking for security of mounting and good electrical connection. Defective switches should be replaced. Hold down cords on the salvo switches should be checked and replaced if broken or missing. The four Micro switches at the center hinges of the bomb door should be adjusted to close when the bomb doors are  $3 \pm 1$  inch from the fully open position. To adjust: loosen the switch mounting screws, open the doors fully and close it exactly three (3) inches at the bottom edge. Slide the Micro switch in the slotted mounting holes to depress the plunger until the switch clicks or a test light across the terminal goes on. Tighten the mounting screws and check the adjustment by opening and closing the door and noting the position of the door at the point where the switch clicks on and off. The two rear switches on each side operate the two salvo relays, the forward right hand switch closes the normal release circuit and the forward left hand switch closes the bomb door indicator light circuit.

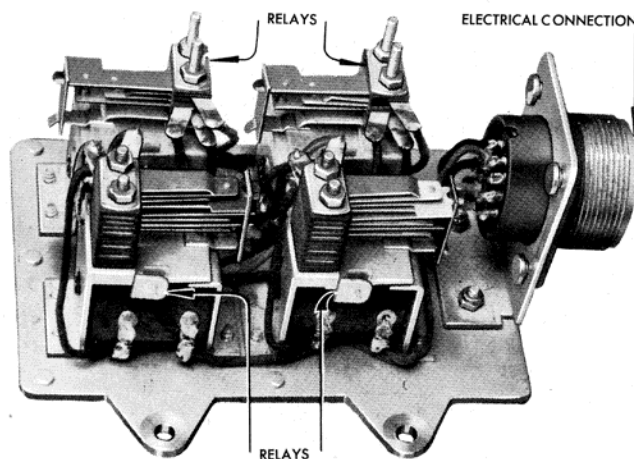


Figure 378—Rack Selector Relay

3. **INDICATOR LIGHTS.**—The only servicing necessary of indicator lights is checking for security of mounting and good electrical connection and replacement of burned out bulbs. The bomb indicator lights on the bombardier's control panel should be checked by holding the lamp test switch above the lights in the "MOM" position.

4. **RACK SELECTOR RELAY.**—The two RS-2 rack selector relays distribute the bomb release impulses from the intervalometer among the four racks so that "layer" release of the bombs is accomplished with a minimum disturbance of the equilibrium and center of gravity of the airplane. The two relays, connected in series, transfer the release impulses from one bomb rack to another in the following sequence:

Left internal bay  
Right external rack  
Right internal bay  
Left external rack  
Left internal bay  
Right internal bay

This continues alternately between the left and right internal bays going progressively to upward higher stations on the racks. When each rack is empty or when a bomb fails to release, the relay automatically excludes that rack from the circuit. This prevents any "dead" impulses and assures a full train of bombs even though the release sequence may include empty racks or racks where bombs have failed to release. It also prevents bombs above from releasing onto bombs below whose release mechanisms have failed.

a. Each of the four rack circuits can be turned off separately by its switch on the bombardier's control panel. After a "train" is released, the first impulse of the next "train" can be directed into circuit No. 1 (or the first cocked bomb station in the original circuit) by turning off *all four* rack selector switches. Otherwise, the next "train" will resume with the next station in the normal release sequence.



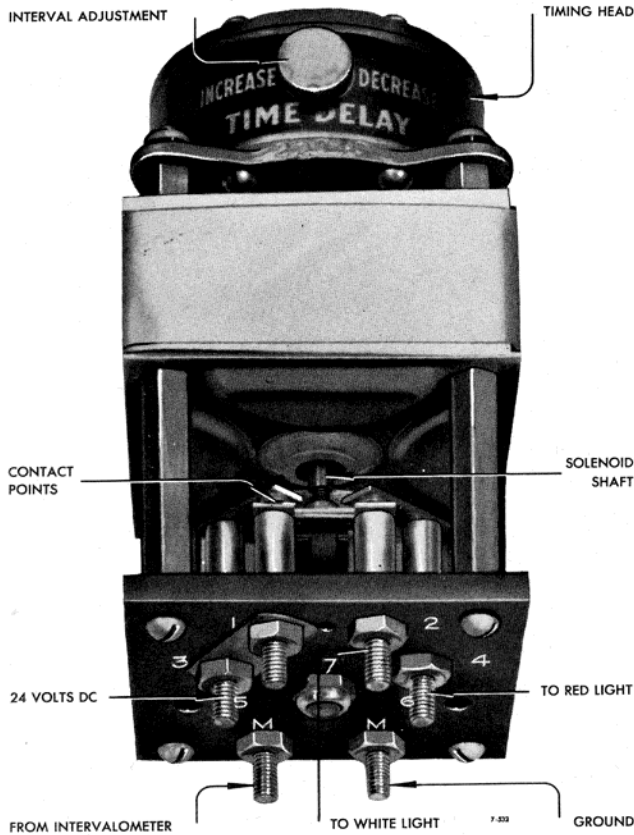


Figure 379—Time Delay Relay (Agastat)

b. The rack selector relays should *not* be lubricated. If erratic operation is experienced with the relay operating one cycle and skipping one, the contact points may be dirty. They may be cleaned *very carefully* with carbon tetrachloride. Loose or broken wires may be repaired or replaced. No servicing other than these should be attempted. The importance of the function of the rack selector relays warrant them being replaced if there is any indication of possible faulty operation.

5. TIME DELAY RELAY (AGASTAT).—The time delay relay controls the red and white formation bomb signal lights in the tail of the airplane which inform trailing airplane of the bombardier's actions. When the bombardier's bomb formation light switch and master switch are on, the relay turns on the white tail light. Each impulse from the intervalometer energizes the relay coil, causing the core to make a downward stroke. This compresses a spring and transfers the snap action switch to turn off the white tail light and turn on the red light. When the impulse ceases, de-energizing the relay coil, the compression spring acting against a diaphragm in the timing head moves the core back up to its original position. The length of time it takes to return to its original position is determined by the adjustment of the timing knob, which controls the size of the hole through which the air must escape. The timing knob is set to provide five seconds time delay. If the relay is energized again before the five seconds

elapse, the core makes another complete travel downward starting another complete five-second interval. Thus if the impulses are being sent out at less than five-second intervals, the red light will go on with the first impulse, remain on during the entire release sequence, and change over to the white light again five seconds after the last release impulse. A chamois diaphragm in the top of the timing head filters the air drawn into the relay.

6. BOMB RACKS AND CONTROLS.—Servicing of the internal and external racks requires a visual check to assure good electrical connection to all the electrical units installed on the bomb racks and a functional test to check the operation of the equipment.

a. FUNCTIONAL TEST OF INTERNAL AND EXTERNAL RACKS.—Install A-4 bomb rack release units at each bomb station. Cock both the arm and release levers of all release units on both the internal and external racks. Close the bomb bay safety switches, the bombardier's master switch, and all four rack selector switches. After the intervalometer has been allowed one minute to warm up, set the "SELECT-TRAIN" switch to "TRAIN" and the BOMBS TO BE RELEASED knob to 50. Close the bomb door switch and open the doors. Check the bomb indicator lights by momentarily holding the lamp test switch at "MOM." Turn the bomb indicator light switch to "ON." All lights should go on. With both indicator light switches returned to their normal positions, press the bomb release switch. When the release impulses cease, all release units should have fired. Check to see that both the arm and release levers on all units have snapped to the uncocked position. Check to see that all the indicator lights are out. Repeat the procedure, cocking only every other A-4 release unit.

(1) Cock several release units at random. With the "SELECT-TRAIN" switch on the intervalometer at "SELECT," press the bomb release switch. Only one release unit should fire each time the switch is closed.

(2) To check the salvo release system, cock all A-4 release units, close bomb doors, turn rack selector switches off. Lift the hinged guard and press one of the three salvo switches. The bomb doors should open and the *release lever only* on all release units should fire.

(3) In these tests, if a release unit fails to operate properly, replace the unit. If this does not correct the trouble, the fault is probably in the auxiliary release box or wiring, which should be checked. If an entire bay or rack fails to fire in the test of normal release, check the rack selector switches, rack selector relays and the bomb door safety relay.

b. A-4 RELEASE UNIT.—The purpose of the A-4 bomb rack release unit is to provide instantaneous arming and release of the bomb by actuating the levers on the bomb shackle. The release units are plugged in automatically to the receptacle in the aux-

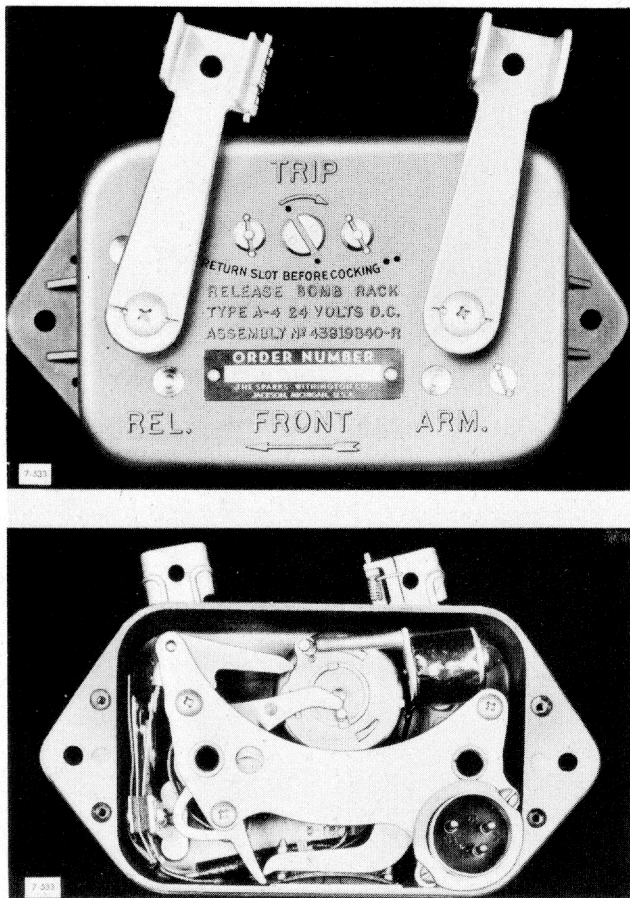


Figure 380—Bomb Release Box—Type A-4

iliary release box on the bomb rack when the unit is bolted to the rack. A release unit is installed at each station where bombs are to be loaded.

(1) The electrical impulse from the intervalometer energizes the rotary solenoid in the unit which trips first the release lever, and then, a fraction of a second later, the arming lever and the transfer switch. This slight time delay assures that the bomb is released before it is armed and since the transfer switch does not close to the next release unit until the release lever has fired, it assures that only one unit will fire for each impulse.

(2) The time required to trip the levers and transfer the switch is not more than 0.062 of a second. When the release lever trips, it breaks the circuit to the indicator light for that station, thus showing on the bomb indicator light panel which stations are not loaded.

(3) In cocking the unit, always cock the arming lever before the release lever. The levers can be tripped by turning the screw on the face as marked. Return the screw to its original position before attempting to cock the levers. A hinged ear on the release lever permits the bomb to be released in case the box jams by prying the shackle arm out of the fork with a screwdriver or similar implement.

(4) Do *not* lubricate the release. Clean externally with a *dry* clean cloth. Do not use cleaning fluids as they will damage the solenoids. The box is sealed against dirt and moisture. Do not attempt to repair faulty units. Replace with another release and send the defective unit to the proper depot for repair.

c. A-1 NOSE ARMING SOLENOID.—The type A-1 nose arming solenoid (bomb arming control box) provides separate electrical control of external bomb nose fusing, so that the bomb may be released armed or unarmed, during either normal or salvo release. The box contains a spring-loaded, notched plunger which presses against an adjustable stop. A solenoid, when electrically energized, inserts a locking bar in the plunger notch to prevent the plunger from moving.

(1) The swivel loop on the bomb arming wire is inserted into the ball catch formed by the plunger and the stop. If the solenoid is not energized when the bomb is released, the arming wire pulls out of the catch and falls with the bomb, which is then unarmed and will not explode (providing the tail fuse is unarmed also). If the solenoid is energized, the plunger retains the arming wire which pulls out of the bomb nose fuse and allows the bomb to explode on contact. The solenoid is controlled by the "NOSE FUSE ONLY" switch on the bombardier's control panel.

(2) Before each bombing flight the nose fusing solenoid should be tested for the following load characteristics with a standard fuse arming wire and a spring scales or suitable weights.

(a) The solenoid plunger must hold a 100-pound load on the arming wire with the solenoid energized, ("NOSE FUSE ONLY" switch "ON").

(b) Must hold a 3-pound load with the solenoid de-energized, (switch "OFF").

(c) Must *not* hold a 4-pound weight with the solenoid de-energized.

(3) Adjust as follows: Loosen the adjusting screw lock nut at the opposite end of the plunger. Turn the tension screw clockwise to increase the pull-out force or counterclockwise to decrease the pull-out force. After adjustment, tighten the lock nut and coat with lacquer A.A.F. Specification No. 3-86 or a similar sealing compound or enamel. If the 100-pound test fails, replace the unit. No lubrication is required.

7. BOMB DOORS AND CONTROLS.—For servicing information on the bomb doors, bomb door retracting motors and limit switches see Section IV, paragraph 4.

#### m. GUNNERY EQUIPMENT.

(1) GENERAL.—There are three power turrets with twin .50-caliber guns, three single .50-caliber flexible guns, and one twin .50-caliber flexible gun installation in the airplane. Later B-17G airplanes have a single



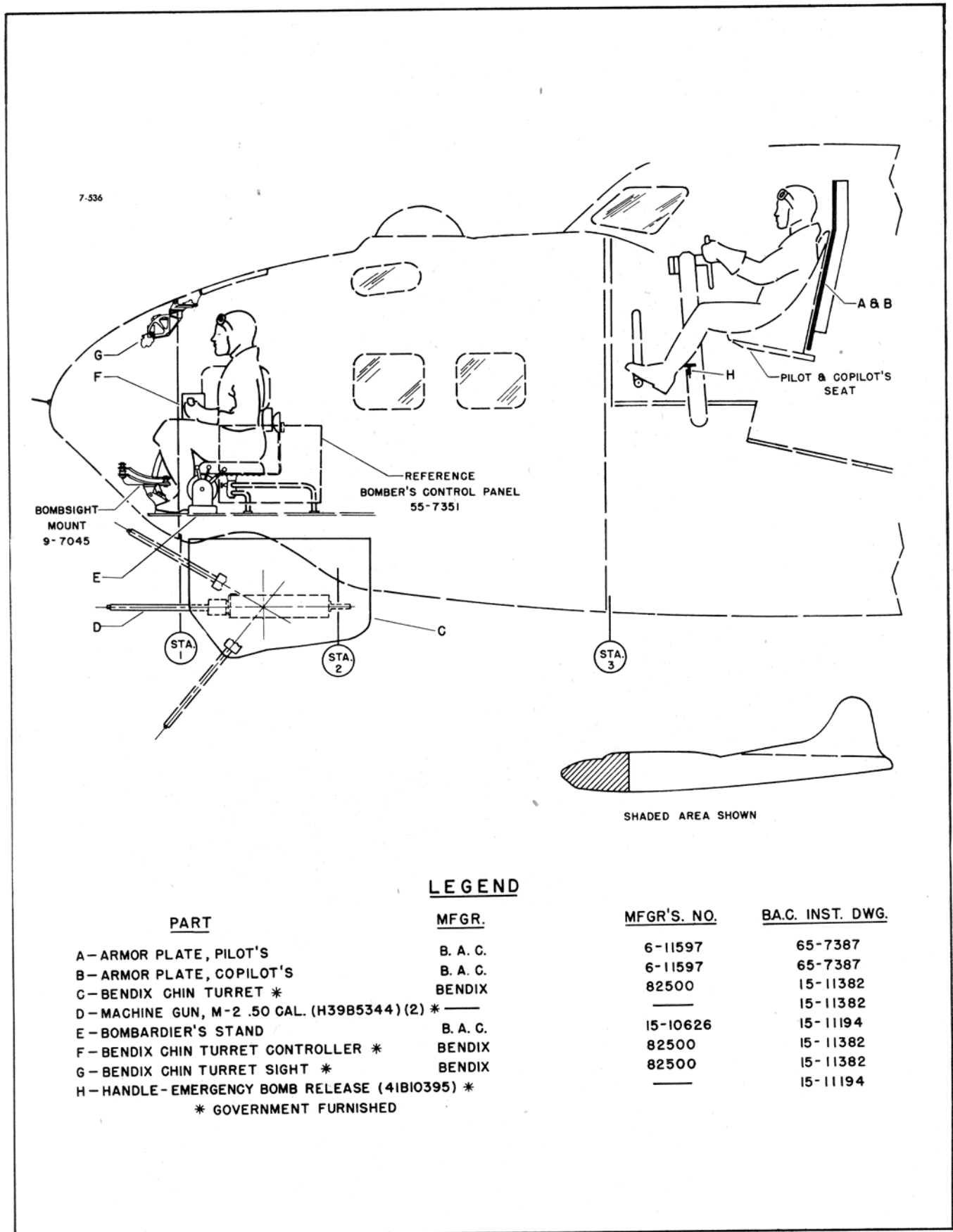


Figure 381—Armament Diagram (Sheet 1 of 4)

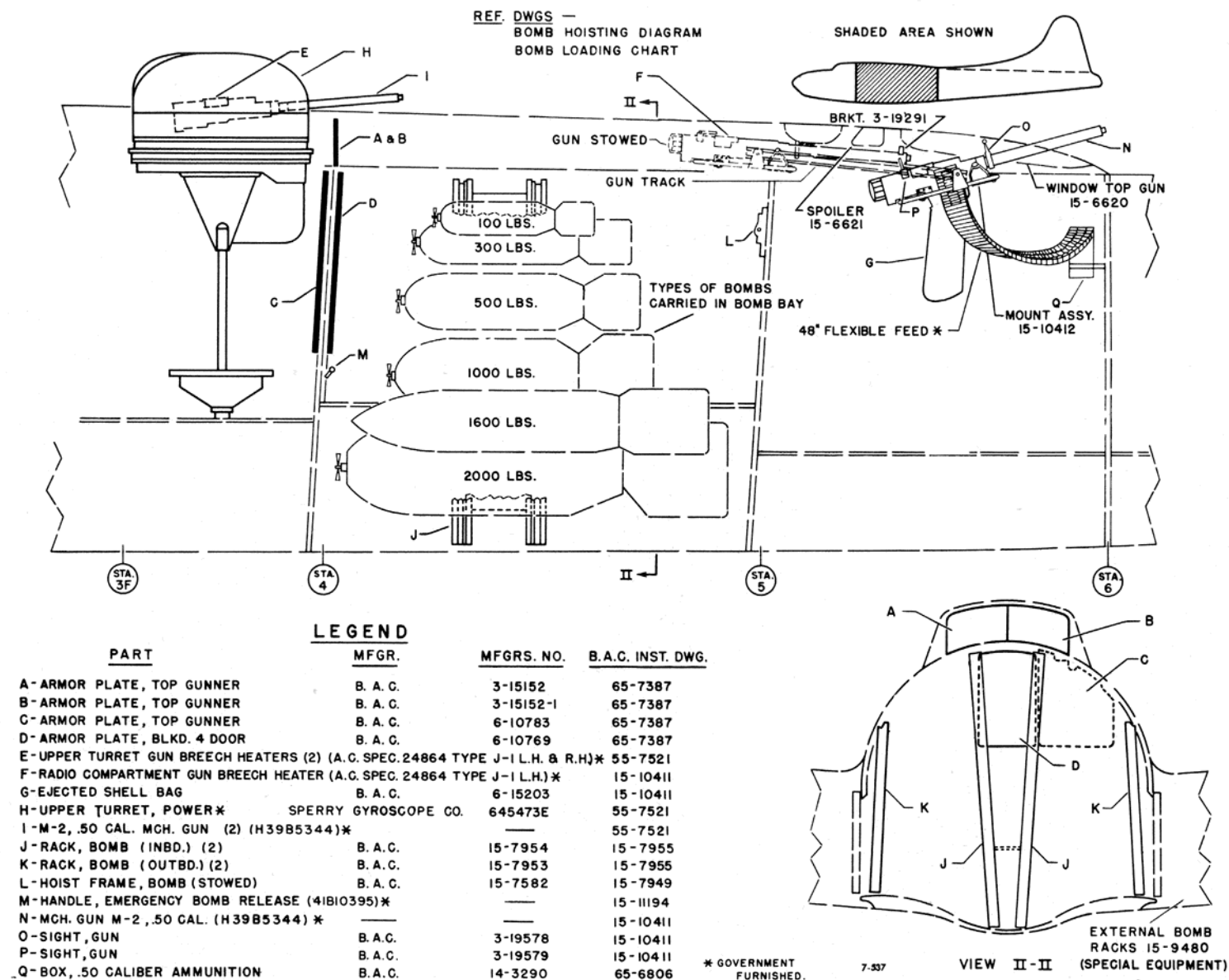
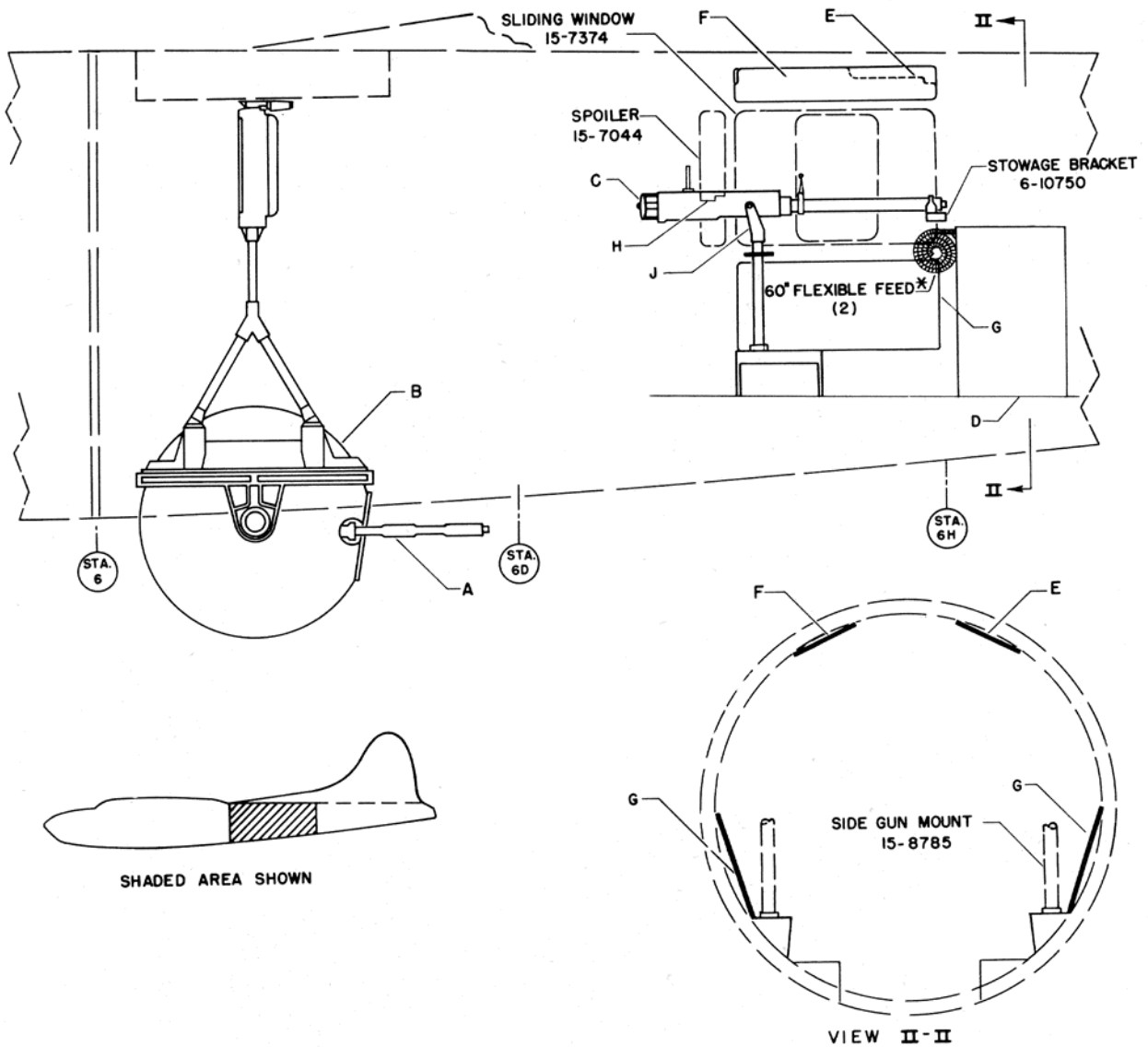


Figure 381—Armament Diagram (Sheet 2 of 4)





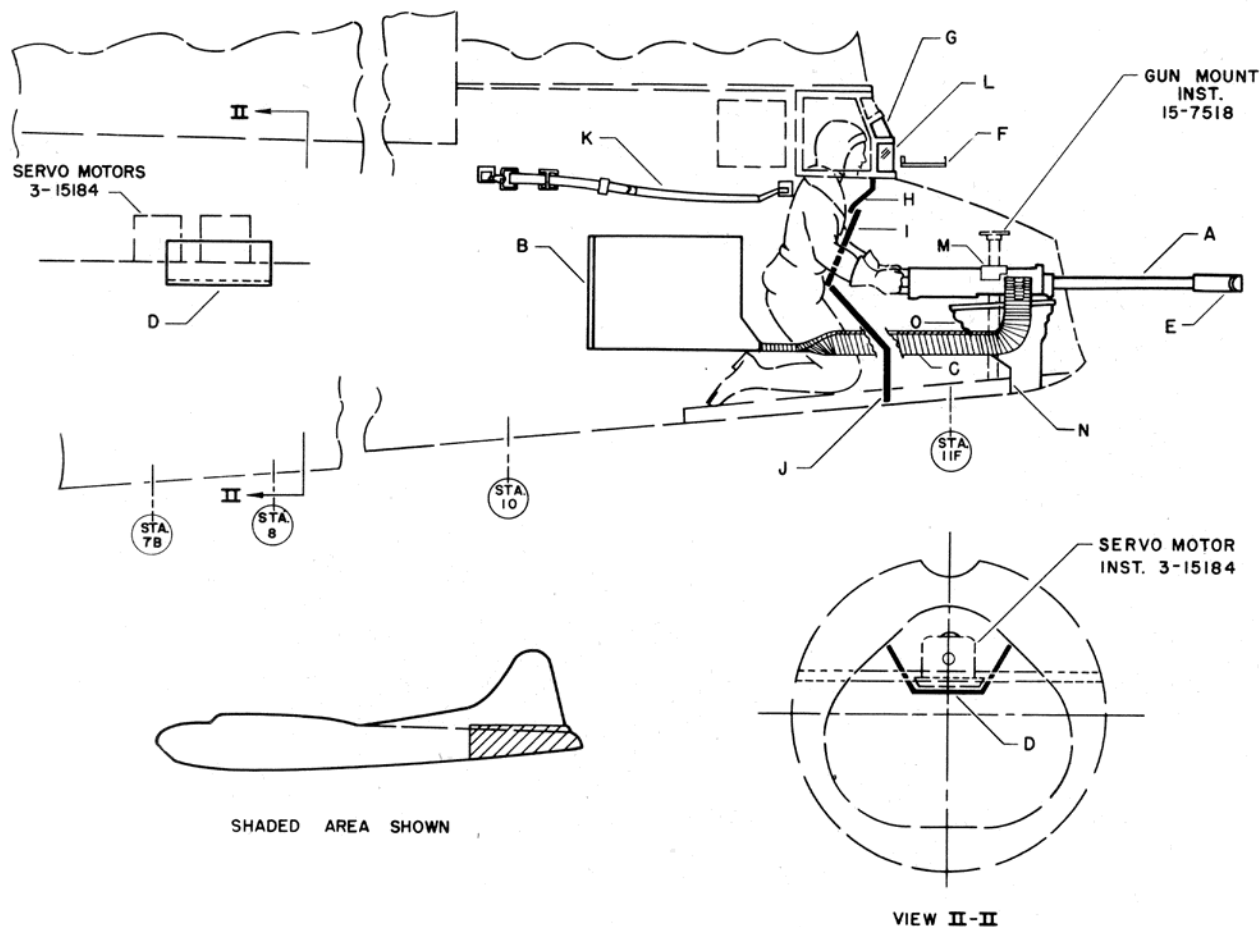
**LEGEND**

PART	MFGR.	MFGRS. NO.	BAC INST. DWG.
A- MACHINE GUN, M-2 .50 CAL.(H39B5344) (2) *	—	—	55-5721
B- TURRET, LOWER SPHERICAL *	SPERRY GYROSCOPE CO.	645849J	55-7521
C- MACHINE GUN, M-2 .50 CAL.(H39B5344) (2) *	—	—	15-8785
D- AMMUNITION BOX (2), SIDE GUN	B.A.C.	15-10606	65-6806
E- ARMOR, SIDE GUN	B.A.C.	3-16151	15-9472
F- ARMOR, SIDE GUN	B.A.C.	3-16152	15-9472
G- ARMOR, SIDE GUN (2)	B.A.C.	3-16147	15-9472
H- SIDE GUN BREECH HEATER (2) A.C. SPEC. 24864, TYPE J-1) *	—	—	15-8785
J- YOKE ASSY. (2)	B.A.C.	6-10736	15-8785

\* GOVERNMENT FURNISHED

7-541

Figure 381—Armament Diagram (Sheet 3 of 4)



## LEGEND

PART	MFGR.	MFGR'S NO.	B.A.C. INST. DWG
A - MACHINE GUNS, M-2(2) .50 CAL. * DWG. H39B5344	—	—	9-3610
B - AMMUNITION BOXES, (2) .50 CAL.	B.A.C.	15-7486	15-7524
C - FLEXIBLE AMMUNITION FEED, 65° (2)	—	—	15-7524
D - SERVO MOTOR ARMOR PLATE *	B.A.C.	6-11311	15-9293
E - STABILIZER (2) FOR .50 CAL. GUN	B.A.C.	6-9622	65-6806
F - GUN SIGHT, REAR GUN	B.A.C.	3-13519	15-7516
G - ARMOR PLATE, REAR GUNNERS	B.A.C.	3-13534	15-7360
H - ARMOR PLATE, REAR GUNNERS	B.A.C.	3-13546	65-7387
I - ARMOR PLATE, REAR GUNNERS	B.A.C.	3-13545	65-7387
J - ARMOR PLATE, REAR GUNNERS	B.A.C.	3-13544	65-7387
K - STRAP ASSY., ARMOR PLATE	B.A.C.	9-3640	65-7387
L - WINDOW, BULLET PROOF GLASS PITTSBURGH PLATE GLASS CO.	—	1-17551	15-7360
M - TAIL GUN BREACH HEATERS (2) (A.C. SPEC. 24864 TYPE J-I.L.H. & R.H.) *	—	—	9-3610
N - EJECTION CHUTE, SHELLS	B.A.C.	15-7776	15-7777
O - HOPPER, SHELLS	B.A.C.	15-7775	15-7777

\* - GOVERNMENT FURNISHED

★ - ON EARLY AIRPLANES

7-340

Figure 381—Armament Diagram (Sheet 4 of 4)



RADIO COMPARTMENT  
GUN AND ONE  
250 ROUND  
AMMUNITION BOX  
(300 ROUNDS WITH CHUTE)

TWIN TAIL GUN  
INSTALLATION AND  
TWO 565 ROUND  
AMMUNITION BOXES  
(WITH CHUTES)

TWO SIDE GUNS  
AND TWO 600  
ROUND AMMUNITION  
BOXES

TOP TURRET  
WITH 400  
ROUNDS OF  
AMMUNITION  
PER GUN

BOTTOM TURRET  
WITH TWO 500  
ROUND AMMUNITION  
BOXES

CHIN TURRET SIGHT

CHIN TURRET CONTROLLER

CHIN TURRET AND TWO  
365 ROUND AMMUNITION BOXES

7-539

Figure 382—Gunnery Equipment

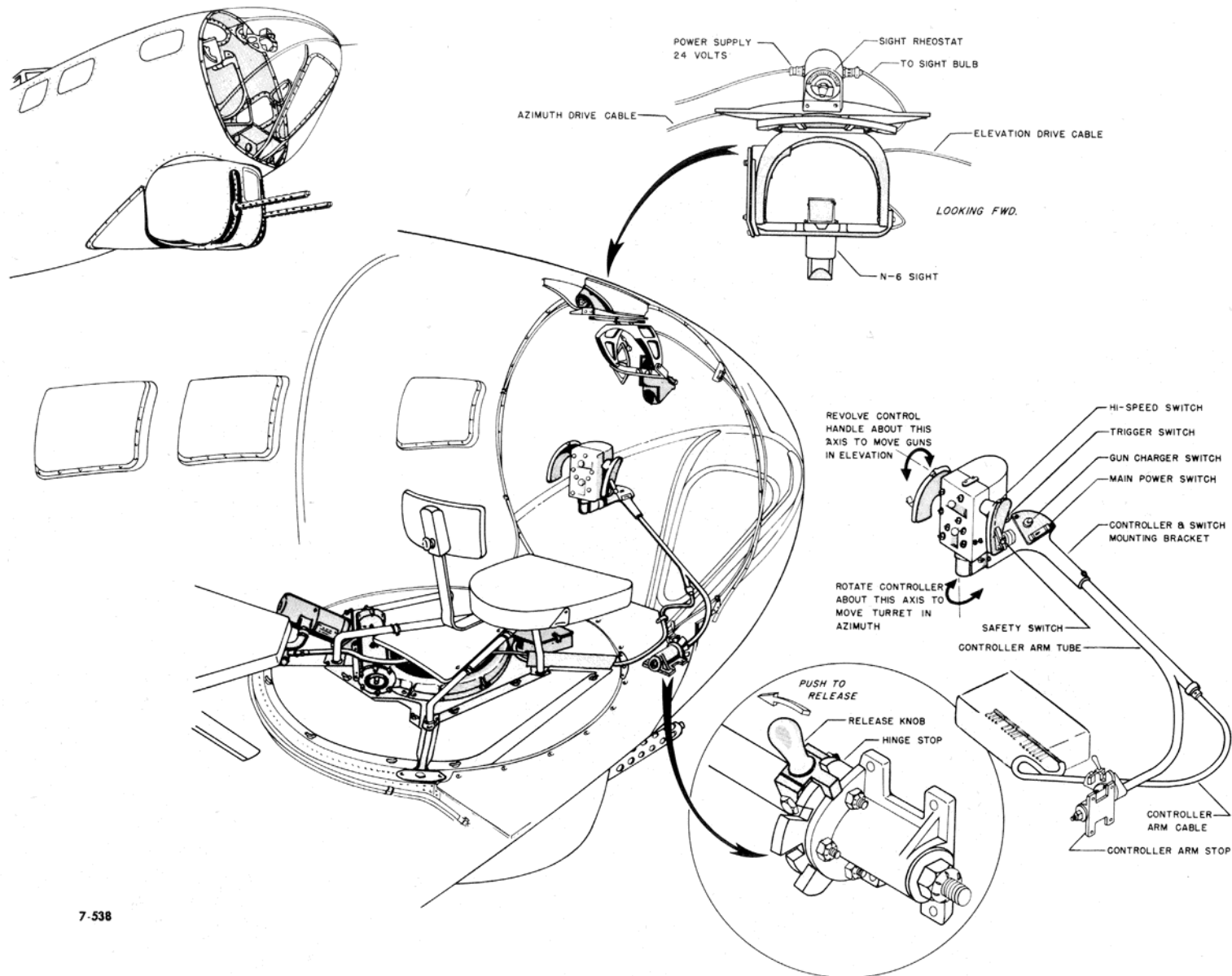


Figure 383—Chin Turret



.50-caliber flexible cheek gun on both sides of the nose section. See Armament Diagrams for guns that have electric breech heaters.

## (2) CHIN TURRET.

(a) GENERAL.—The A-16 chin turret is an electrically driven turret. It is in the bombardier's compartment, and it is operated by the bombardier. Two M-2 .50-caliber guns equipped with recoil absorbing mechanism, firing solenoids, and hydraulic gun chargers are mounted in the turret. (Later B-17G airplanes have manual gun chargers.) Three hundred and sixty-five rounds of ammunition can be stowed in the turret for each gun. The three units of the turret are the sight, the controller, and the main turret assembly.

1. SIGHT.—A type N-6 open sight is suspended at eye level from the top of the fuselage above the operator's position. The sight is synchronized with the movements of the guns in azimuth and elevation by tachometer shafts which are driven by the azimuth and elevation motors. The azimuth tachometer shaft moves the sight through a 1250-to-1 gear reduction and the elevation tachometer shaft moves the sight through a 1050-to-1 gear reduction. These reduction gears are in the same ratio as the respective azimuth and elevation turret-drive reduction gears. Thus the sight and the guns are always pointing in the same direction. A rheostat on the sight frame above the sight controls the intensity of the light of the two concentric circles which are projected on the sight glass.

## 2. CONTROLLER.

a. The handle-bar-type controller is fastened to a movable arm which is mounted on a locking hinge fastened to the floor at the right of the turret. The controller can be locked in the stowed position on the right side of the airplane or in the combat position in front of the operator. The direction and speed of the guns are controlled by the movement of the control handles. Moving the control handles in azimuth and elevation moves potentiometers which supply current to excite the fields of the azimuth and elevation amplidyne generators. The amount of exciting current is proportional to the movement of the control handles from the neutral position, and establishes a generator output which controls the speed of the ½-horsepower drive motors. The azimuth drive motor is connected to the guns through a 1250-to-1 gear train. The elevation drive motor is connected to the guns through a 1050-to-1 gear train.

b. This amplidyne system of control automatically furnishes a constant speed for any setting of the control handles regardless of the change of torque. Thus the drive motors move the guns in azimuth and elevation at an RPM proportional to the movement of the control handles. The speed of the guns can be varied in azimuth and elevation from ¼ to 12 degrees per second in slow speed and from ¼ to 33 degrees per second in fast speed.

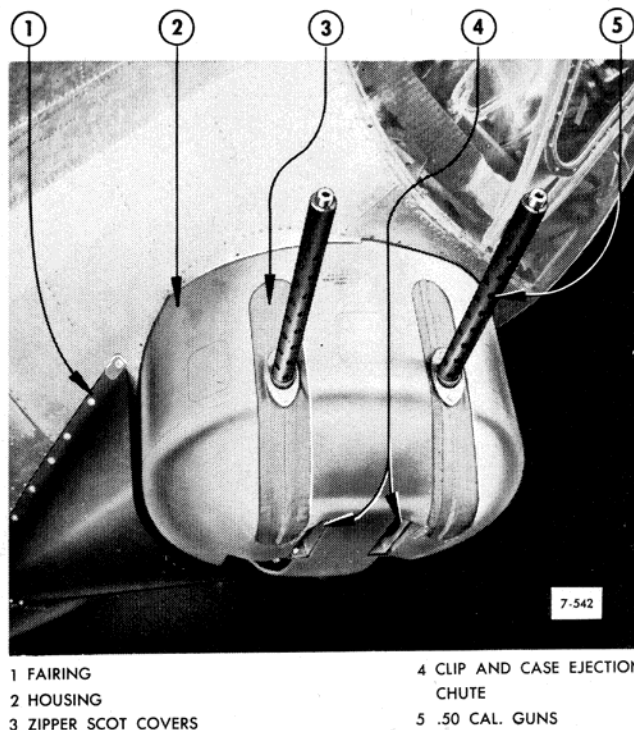


Figure 384—Chin Turret (Traversed)

c. CONTROLS.—The control switches on the controller are the main power switch, gun charger switch, safety switches, high speed switches, and spring trigger switch.

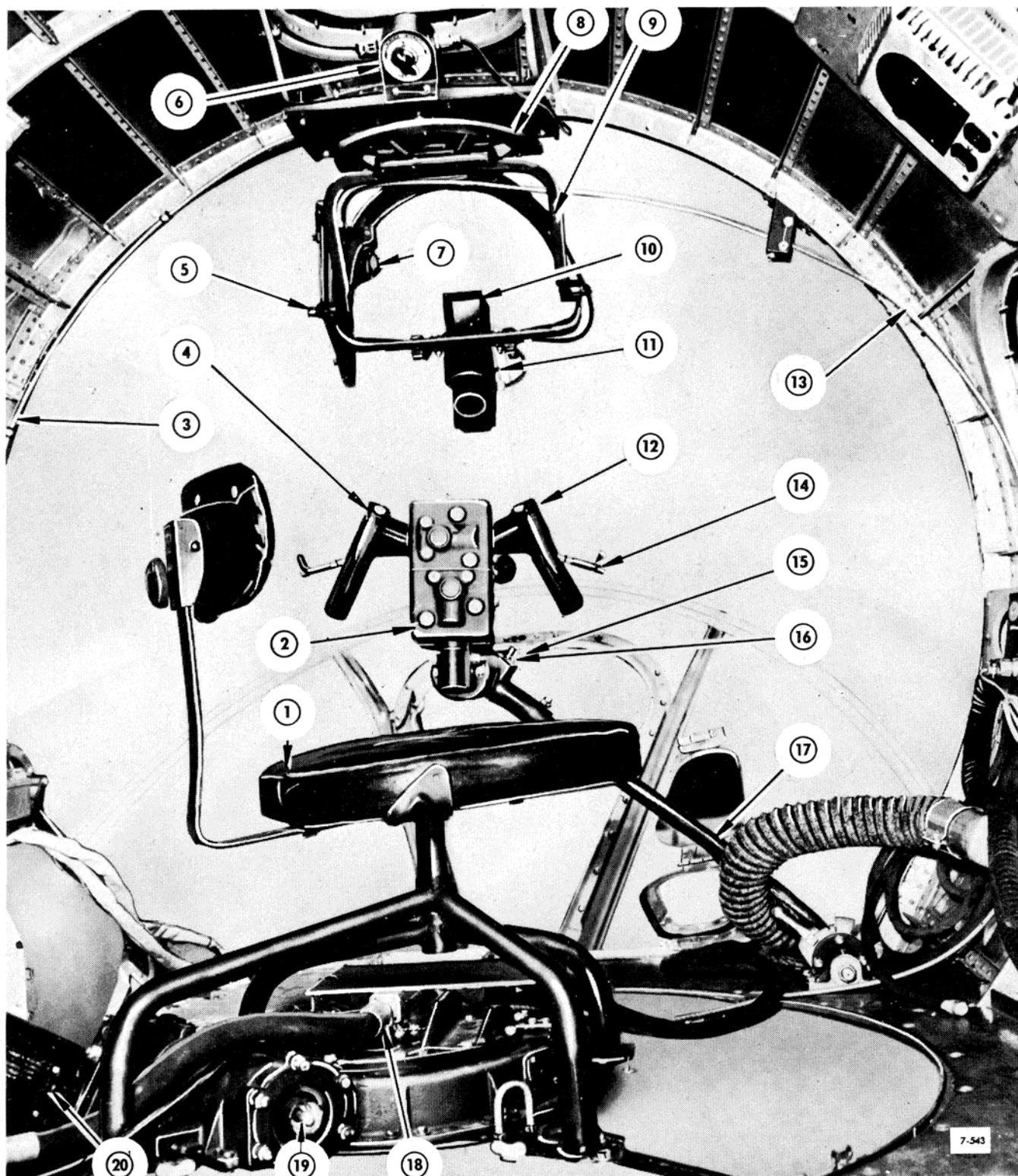
(1) MAIN POWER SWITCH.—The main power switch is in the front of the controller on the controller arm. The standard toggle switch actuates the power solenoid which supplies the current to the turret.

(2) GUN CHARGER SWITCH.—The gun charger switch is beside the main power switch in front of the controller on the controller arm. It energizes the Bendix Electric solenoid control valve on the hydraulic charger valve. Fluid from the airplane's hydraulic system is released to the gun chargers which move the gun bolts to the rear. When the charger button is released, the solenoid control valve closes the pressure line and opens the return line to the gun chargers. Then the gun bolts move forward to charge the guns or to remove a faulty cartridge. Later B-17G turrets have manual gun chargers.

(3) SAFETY SWITCHES.—The safety switches are on the outside of each handle. At least one safety switch must be closed by gripping the control handle before the turret can be operated. When both safety switches are released, the dynamic brakes are applied to stop the movement of the guns in azimuth and elevation.

(4) HIGH SPEED SWITCHES.—The high speed switches are the small buttons on the top of each control handle. When a high speed switch is depressed, the speed of the guns in azimuth and elevation is increased.





1. SEAT
2. CONTROLLER
3. AZIMUTH DRIVE CABLE
4. CONTROL GRIP
5. SIGHT DRIVE ELEVATION

6. RHEOSTAT
7. ELEVATION PINION
8. AZIMUTH SIGHT DRIVE
9. SUPPORTING YOKE
10. N-6 SIGHT

11. RESERVE FILAMENT SWITCH
12. TRIGGER SWITCH (FORWARD SIDE OF GRIP)
13. ELEVATION DRIVE CABLES
14. SAFETY (DEADMAN) SWITCH

15. CHARGER SWITCH
16. POWER SWITCH
17. CONTROLLER ARM
18. HYDRAULIC SWIVEL GLAND
19. SHIFTER SHAFT
20. AZIMUTH DRIVE MOTOR

Figure 385—Seat Control and Sight Unit—Chin Turret