the pump motor is in series with the contacts of the motor relay.

Power for the control circuit is taken from the main battery bus in the main distribution panel. The power feeder line for the fast feathering motor splices at a terminal in the engine terminal box with a power lead that is connected to the main bus in the main distribution panel and the main batteries in the wing.

When the button of the pilot's control switch is pushed in, its contacts close and are held closed by the relay coil. Closure of the control switch contacts completes the circuit through the motor relay coil whose own contacts in turn close, completing the motor circuit and starting the motors. When the propellers are fully feathered, pressure rapidly increases in the pressure switch until its contacts open and break the relay coil circuit of the pilot's control switch. Contacts of the switch open and cause the motor relay contacts to open and stop the motor.

Unfeathering is accomplished by the same sequence of operations as in fast feathering with one exception; the hydraulic pressure needed to unfeather the propellers is greater than that required for fast feathering. Therefore, since the pressure switch contacts open at a lower pressure, it is necessary to manually hold the button on the control switch "IN" until the necessary hydraulic pressure is obtained and the unfeathering operation completed.

(b) MAINTENANCE.

1. Inspect wires in junction boxes shown on wiring diagram. *(See figure 236.)*

a. If insulation is worn or broken, repair or replace wire.

b. If wire strands are broken, replace wire.

2. Inspect wire terminals in junction boxes shown on wiring diagram and if terminals are discolored or corroded, clean with No. 000 sandpaper.

3. Disconnect connector plugs at pressure cutout switch on engine propeller governor and on engine firewalls.

a. If insulation is cracked or damaged or pins do not make good contact, replace plug.

b. If pins are discolored or corroded, clean with crocus cloth.

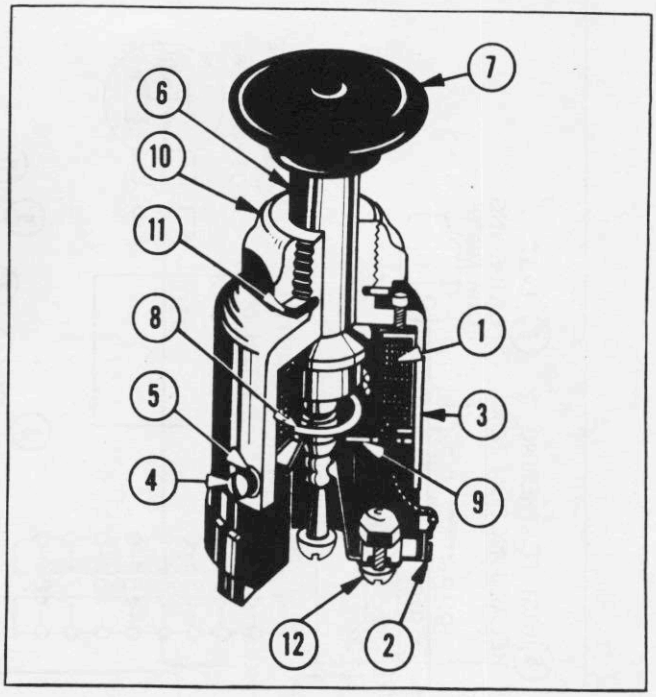
4. Inspect relays in fast feathering junction boxes on engine firewalls.

a. If terminals are discolored or corroded, clean with No. 000 sandpaper.

b. If contacts are discolored, corroded, or slightly pitted, clean with crocus cloth or No. 000 sandpaper.

c. If contacts are badly pitted or burned, replace contacts.

d. If relay coil does not function properly or relay does not otherwise operate properly, replace with new one.



No.	NAME
1	Holding Coil
2	Brush Holder
3	Shell
4	Brush Holder Screw
5	Lock Washer
6	Contact Pin Shaft
7	Control Knob
8	Compression Spring
9	Spring Seat
10	Retaining Nut
11	Lock Washer
12	Terminal Screw

Figure 237—Propeller Feathering Control Switch

5. For maintenance of fast feathering pump motor, refer to paragraph *v*, (3).

(c) OPERATIONAL CHECK.

1. Run engines at approximately 1500 rpm.

2. Push plunger controls of the fast feathering switches in the pilot's compartment "IN" as far as they will go. The plungers should remain in this position until the propeller blades have attained the full feathered position.

3. Push the plunger controls "IN" and hold them in. The propeller blades should unfeather after a short interval.

(2) PROPELLER FEATHERING CONTROL SWITCH.

(See figure 237.)

(a) DESCRIPTION.—The propeller feathering system is controlled by two General Electric type

2CC1B4 switches mounted in the fast feathering switch box, overhead in the pilot's compartment. The assembly consists of a switch and a holding coil. A knob (7) is attached to the contact pin shaft (6). This contact pin assembly is inserted in the shell (3) which contains the holding coil (1). A compression spring (8) retains the contact pin assembly and the knob in the normal out position. The brush holder assembly (2) which includes the brush and contact strips, is attached to the shell by two screws (4). The terminal board, and the recesses in the terminal board prevent the wire terminals from turning and thus prevent the terminals from becoming loose. A hinged Plexiglas guard over the switches protects them against accidental operation.

(b) REMOVAL.

1. Remove retaining nut, lock washer, and knob from outside of box.

2. Remove cover from forward face of box and pull switches as far out of box as wires will permit.

3. Remove wire terminals from switches.

4. Remove two screws and lock washers in the side and pull the plastic part from the metal part.

5. Remove the plunger.

(c) MAINTENANCE.

1. Clean the plunger with crocus cloth, if discolored or corroded.

2. If contact points are discolored or corroded, wrap a piece of crocus cloth around a pencil or small rod and work up and down through the hole in the plastic to clean the three spring contacts.

3. If retaining nut or knob is loose, tighten securely.

(d) TEST BEFORE INSTALLATION.

1. Test the electrical contacts by applying a load of approximately one ampere at 25 volts D.C. The intermittent contact tip rating is five amperes at 24 volts D.C. Do not exceed this rating.

2. Test the resistance of the holding coil. The coil resistance should be 35 ohms plus or minus 10 per cent.

3. Apply 24 volts D.C. to the holding coil and press the plunger down until it is held down by the coil. Reduce the voltage gradually. The holding coil should retain the plunger in the down position with the voltage reduced to 20 volts. The pressure required to close the switch should be not less 3¼ pounds. The pull required to open the switch against the holding coil should be slightly more than three pounds.

(e) INSTALLATION.

1. Connect the wire terminals to the back of the switch.

2. Install switch in box.

3. Install lock washer and retaining nut

4. Install plunger knob.

5. Replace cover of box.

(f) OPERATIONAL CHECK.—With the engine running at approximately 1500 rpm, push the plunger of the control switch "IN" as far as it will go. The plunger should remain "IN" automatically until the propeller blades have attained the full feathered position. To unfeather the propeller, push the control knob "IN" and hold it "IN" until the blades unfeather to the position which gives the desired engine speed.

CAUTION

Do not feather or unfeather both propellers at same time.

r. ANTI-ICING CIRCUITS.

(1) WING ANTI-ICING CIRCUIT.

(a) DESCRIPTION. *(See figure 238.)*—The electrical portion of the wing anti-icing system consists of two thermostatically controlled wing gate actuators; a double pole, double throw control switch; an indicator light; two five ampere fuses; and a single pole double throw switch. Current for the circuit, which is protected by the two five ampere fuses is derived from either of the main buses in the main distribution panel.

The actuators are in the forward section of each wing, outboard of and close to the engine nacelles. The gas filled thermostatic control bulb is in the air duct below the actuator and connected to it by a small metal tube. The control switch is located near the right end of the pilot's signal system box on the pilot's yoke. The indicator light is at the left of the control switch. The two five ampere fuses as well as the single pole double throw master control switch are located on the main distribution panel.

The control switch controls the actuators which are reversible. Two separate field coils are included in the motor, whose direction of rotation depends on which coil is energized. With the control switch in "AUTOMATIC AND MANUAL OPEN" position, either coil may be connected by means of a thermostatic control. With the control switch in "MANUAL CLOSE" position, only the coil that acts to close the door is connected. Adjustments are provided to regulate the opening and closing temperature range and the distance of travel of the shaft in each direction.

For a detailed description of operation and adjustments see Par. 25, *b*, (3), *(c)*, *4.*

(b) MAINTENANCE.

1. Check wires and wire terminals in junction boxes shown on wiring diagram. *(See figure 238.)*

a. If insulation is worn or cracked, repair or replace wire.

b. If wire strands are broken, replace wire.

c. If terminals are discolored or corroded, clean with No. 000 sandpaper.

2. Inspect switches and fuses shown on wiring diagram.

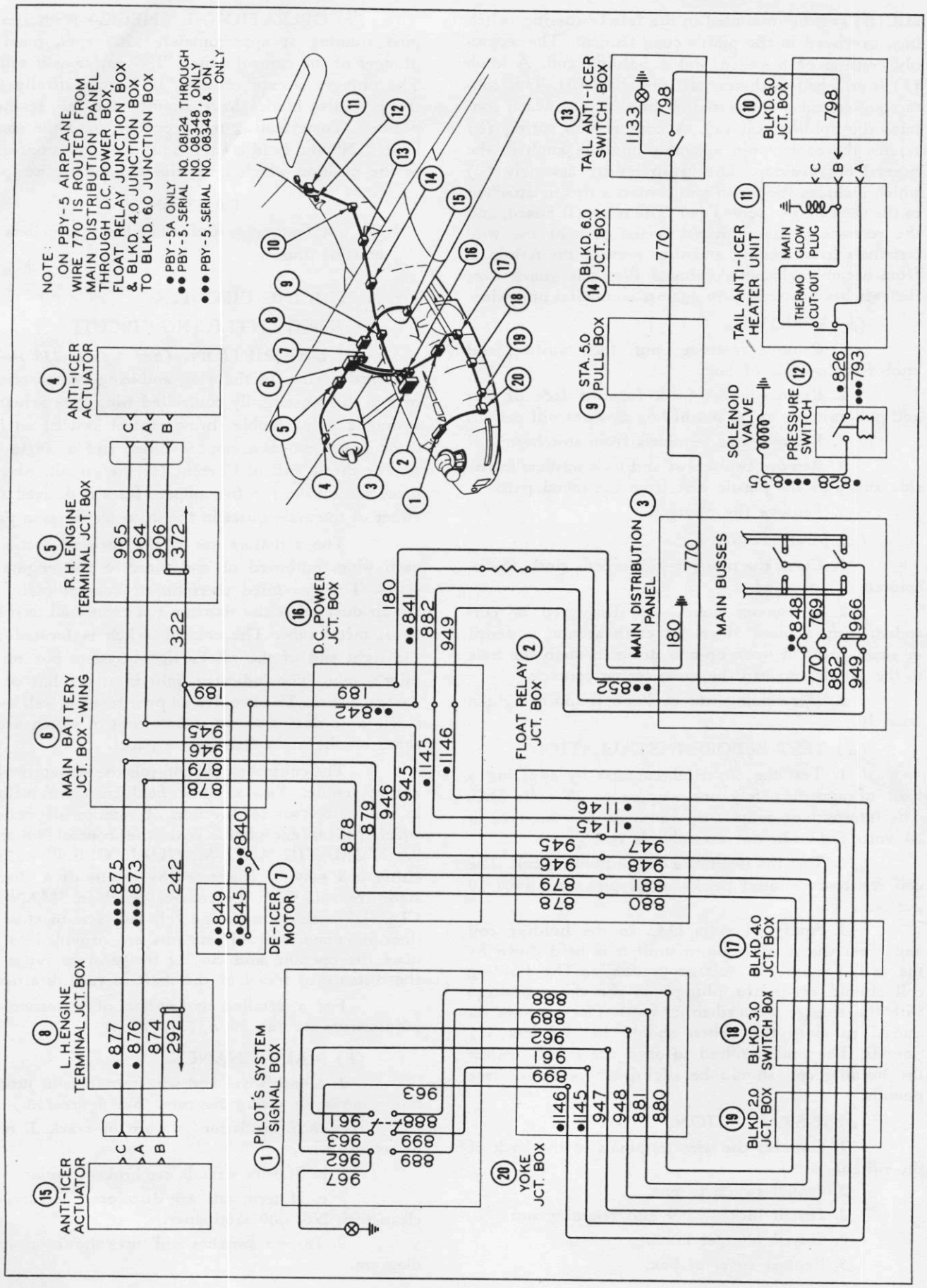


Figure 238—Wing and Tail Anti-Icing Circuit

a. If terminals are discolored or corroded, clean with No. 000 sandpaper.

b. If switches do not work properly, replace with new ones.

3. Disconnect connector plugs at actuator.

a. If insulation is cracked or damaged or pins do not make good contact, replace plug.

b. If pins are discolored or corroded, clean with crocus cloth.

4. Inspect indicator light on pilot's signal system box.

a. If bulb base is discolored or corroded, clean with No. 000 sandpaper.

b. If glass is discolored or loose, replace bulb.

c. If contacts of light base are discolored or corroded, clean with No. 000 sandpaper.

5. Inspect the wing gate actuator.

a. Inspect commutator and brushes by detaching two screws in the small cover on the opposite side of the lever arm and removing cover.

(1) Inspect brushes and brush holders.

(2) If brushes are worn, replace them.

(3) If brushes stick, clean the brushes and brush holder with unleaded gasoline and dry thoroughly.

(4) Inspect commutator; if dirty, clean with unleaded gasoline or sand armature with No. 000 sandpaper.

(5) Wipe clean with lintless cloth and dry thoroughly.

b. Inspect limit contacts.

(1) Remove split cover and split gaskets by detaching four screws and lock washers located under lever arm adjustment discs.

(2) Clean the contact points with No. 000 sandpaper. Check the contact assembly for tightness and the wire connections for breaks and poor insulation.

(3) Check the fibre block on the end of the middle contact for wear. If it is badly worn replace the middle contact or entire assembly.

(4) Check the operation of the points by loosening screws "L" and "R" and revolving the adjusting discs clockwise. First the middle and inside contact should close, then all three, and finally the middle and outside contacts. Whenever this is done, the lever arm will have to be re-adjusted for throw.

c. Inspect wiring.

(1) Detach two screws from sides of large cover and remove cover to inspect wiring.

(2) If solder connections are loose, resolder them.

(3) If wire is worn or broken, repair or replace wire.

(c) OPERATIONAL CHECK.

1. This check should be made before each flight, especially before a flight where icing conditions are expected.

2. With the engines running, throw "MAIN BATTERY" switch and the "ANTI-ICER" master control switch on main distribution panel to same bus ("A" or "B") and the control switch on the pilot's signal system box to "AUTOMATIC AND MANUAL OPEN" position. If this part of the system is operating properly, the wing temperature indicators in the engineer's compartment will rise in temperature.

3. With the switches in the same position, throw the control switch to "MANUAL CLOSE" position. If this part of the circuit is functioning correctly, a drop in temperature will be noted.

(2) TAIL ANTI-ICING CIRCUIT.

(a) DESCRIPTION. *(See figure 238.)*—Power for this circuit is taken from either of the main busses in the main distribution panel. The circuit is protected by a 30 ampere fuse located on the main distribution panel.

The circuit is controlled by the "ANTI-ICER" switch on the main distribution panel, and the "TAIL ANTI-ICER" switch on the forward face of bulkhead 7 above and to the port side of the hatch door. An indicator light above the "TAIL ANTI-ICER" switch indicates when the power is "ON."

The current to operate the heater goes through the "ANTI-ICER" switch and fuse on the main distribution panel to feed the "TAIL ANTI-ICER" control switch; the indicator light is lighted; and current is sent to the thermo switch which is mounted on the duct above and aft of the heater. The thermo switch contains an igniter thermo switch, an overheat thermo switch, and a relay.

In the anti-icer thermo switch box, the current divides. Part of the current flows through the coils of the relay and the igniter thermo switch which are in series. When the heater is cold, the thermo switch is closed. Flow of the current through the coil of the relay energizes the coil and thus closes the contacts of the relay. Closing the relay contacts sends another part of the current to the igniter in the heater which ignites the fuel. When the heater reaches a predetermined temperature, the thermo switch opens and thus de-energizes the relay coil and opens the contact points. This turns the igniter "OFF" and the heater operates without the igniter being "ON."

Another part of the current which goes through an overheat thermo switch and a pressure switch connected in series, feeds the fuel solenoid valve. The pressure switch is located on the air duct forward and below the heater. If either the pressure of the air entering the heater drops too low, or the heater becomes too hot, the circuit is broken and the fuel solenoid is de-energized, thus closing the fuel valve. If the temperature in the heater reaches a lower temperature or the pressure increases, the heater will automatically start and operate again.

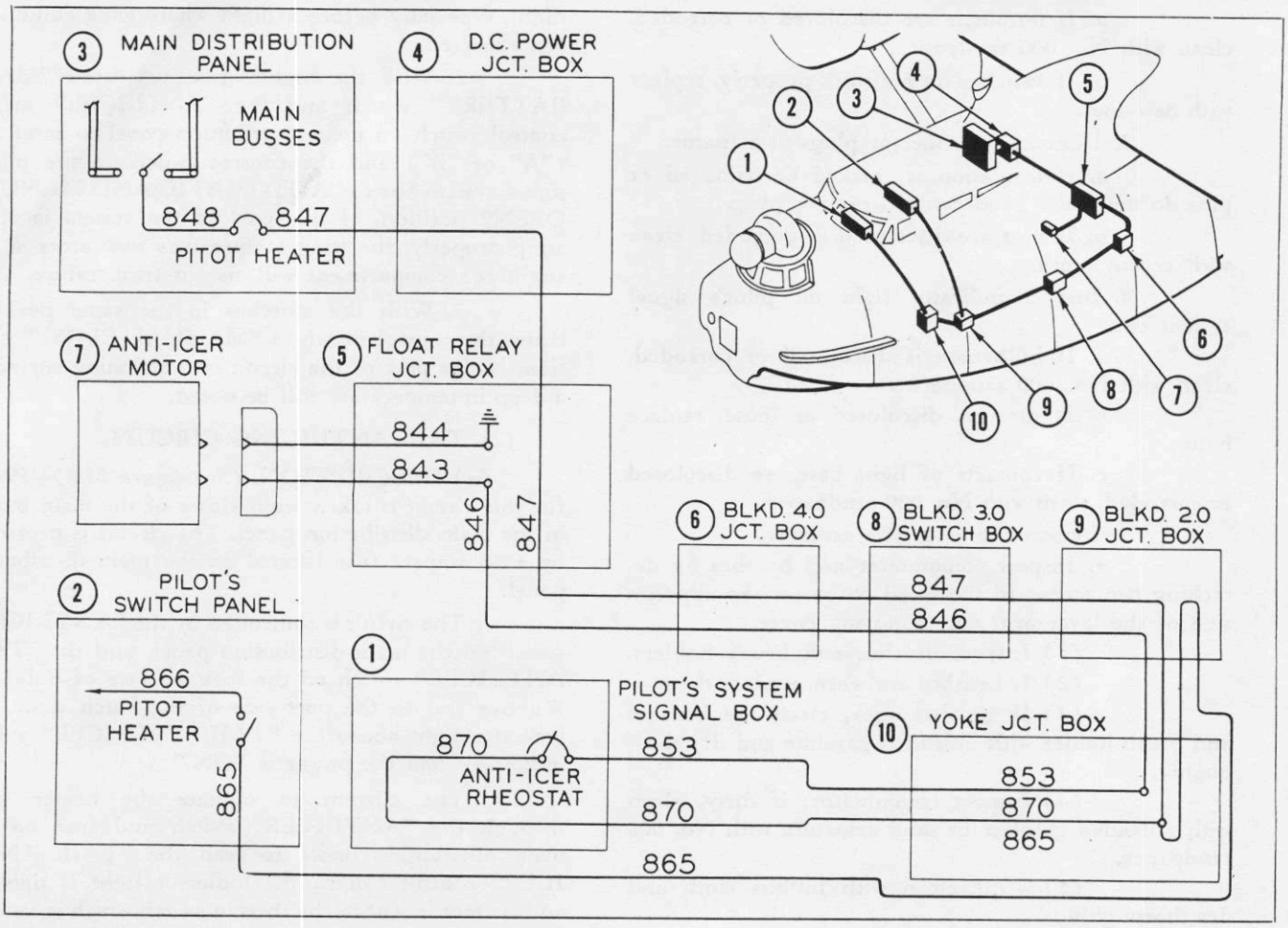


Figure 239—Propeller Anti-Icing Circuit

(b) MAINTENANCE.

1. Inspect wires and terminals in junction boxes shown in wiring diagram. *(See figure 238.)*

a. If insulation is worn or cracked, repair or replace.

b. If wire strands are broken, replace wire.

c. If terminals are discolored or corroded, clean with No. 000 sandpaper.

2. Inspect switches and fuse shown on wiring diagram.

a. If terminals are discolored or corroded, clean with No. 000 sandpaper.

b. If switches do not work properly, replace with new ones.

3. Disconnect connector plug at heater.

a. If insulation is cracked or damaged or pins do not make good contact, replace plug.

b. If pins are discolored or corroded, clean with crocus cloth.

4. Inspect indicator light on forward face of bulkhead 7.

a. If bulb base is discolored or corroded, clean with No. 000 sandpaper.

b. If glass is discolored or loose, replace bulb.

c. If contacts of light base are discolored or corroded, clean with No. 000 sandpaper.

5. Inspection of the thermo switch should be done at time of overhaul of heater or if trouble develops with themo switch. The heater must be removed and the section of duct above it must be removed in order that the thermo switch may be reached.

a. Detach two screws from top of cover and remove cover.

b. Inspect wires for worn or broken insulation; replace if any are found.

c. If wire strands are broken, replace wire.

d. If solder terminals are loose, resolder.

e. If relay contacts are discolored, corroded or slightly pitted, clean with No. 000 sandpaper.

f. If relay points are badly burned or relay does not otherwise work properly, replace with new one.

g. If thermo overheat switches do not operate properly, replace with new ones.

6. Inspect pressure switch.

a. Inspect wires and terminals on exterior of switch.

b. If wire insulation is worn or broken, repair or re-wire.

c. If wire or switch terminals are discolored or corroded, clean with No. 000 sandpaper.

d. Detach screws and lockwashers holding duct pressure switch cap assembly and then remove cap to inspect internal wiring of pressure switch and micro-switch.

e. If wires are worn or damaged, replace wires.

f. If micro-switch does not operate properly, replace micro-switch.

(c) OPERATIONAL CHECK.

1. If checking on ground, be sure canvas air scoop is installed over air duct inlet. See Par. 25, *c*, (4), *(a), 1,* for attaching air scoop.

2. With engines running at speeds as outlined in Par. 25, *c*, (4), *(c), 2,* throw "ANTI-ICER" switch on main distribution panel to "ON" position. Then upon throwing "TAIL ANTI-ICER" switch on bulkhead 7 to "ON" position, the indicator light beside the switch should light.

3. If the system is operating properly, a rise in temperature should be noted on the temperature indicator in the engineer's compartment.

(3) PROPELLER ANTI-ICING CIRCUIT.

(a) DESCRIPTION. *(See figure 239.)*—This circuit is controlled by an "OFF" position rheostat located on the pilot's switch panel.

The rheostat is graduated in gallons per hour and controls the speed of the propeller anti-icer motor which is located on the port aft side of bulkhead 4.

Current is taken from the hot side of the "PITOT HTR." switch on the main distribution panel and feeds through the "ANTI-ICER CONTROL" rheostat at the extreme right of the pilot's signal system box on the control yoke to the propeller anti-icer motor.

The circuit is protected by the same 30 ampere fuse on the main distribution panel that protects the pitot heater and control heater.

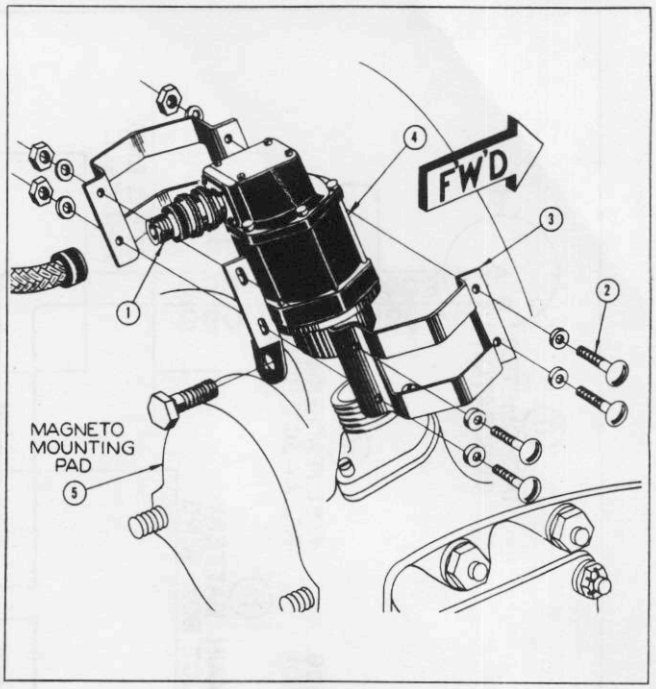
(b) MAINTENANCE.

1. Check wires and terminals shown on wiring diagram. *(See figure 239.)*

a. If wire insulation is worn or broken, repair or replace wire.

b. If wire terminals are discolored or corroded, clean with No. 000 sandpaper.

2. Inspect disconnect plug at propeller anti-icing motor.



No.	PART No.	NAME
1	AN3106-14S-1S	Disconnect Plug
2	AN526-1032-12	Screw
	AN365-1032	Nut
3	29P3152	Clamp
4	88-G-1375	Generator
5		Magneto

Item number 4 is a Federal Standard Stock Catalog part number.

Figure 240—Tachometer Generator Installation

a. If insulation is cracked or damaged or pins do not make good contact, replace plug.

b. If pins are discolored or corroded, clean with crocus cloth.

3. Inspect rheostat.

a. If open part of resistance coil is discolored or corroded, clean with crocus cloth.

b. If terminal solder connections are loose, resolder.

c. If enameled surface on resistance coil winding is cracked or broken, or, if the rheostat does not otherwise work properly, replace rheostat.

d. For maintenance of propeller anti-icer motor, see paragraph *v*, (3).

(c) OPERATIONAL CHECK.—Check the operation of the electrical circuit in the following manner:

1. Turn the shut-off valve, located in the line from the propeller anti-icer fluid tank to the propeller anti-icer motor to "OFF" position.

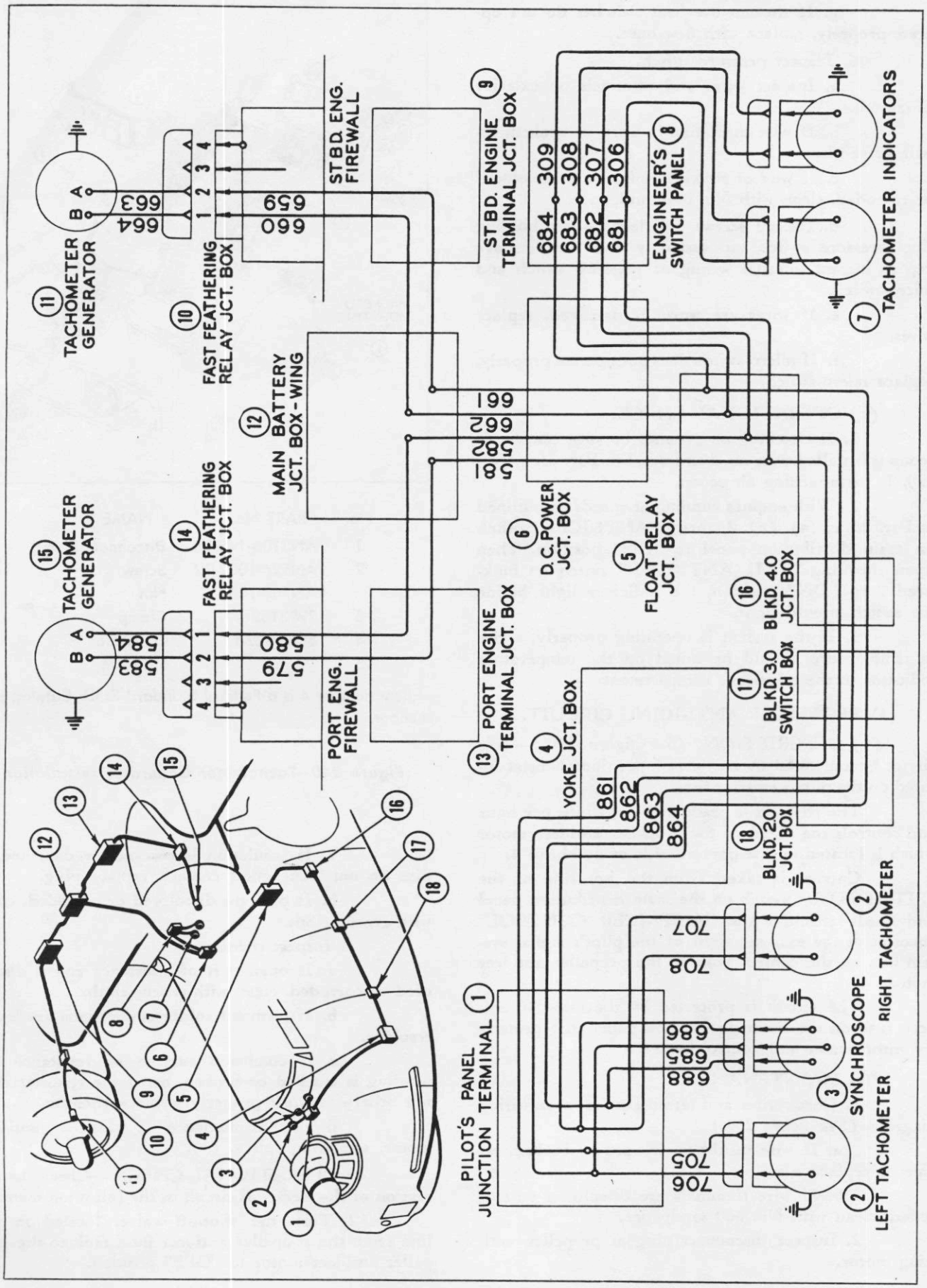


Figure 241—Tachometer Circuit

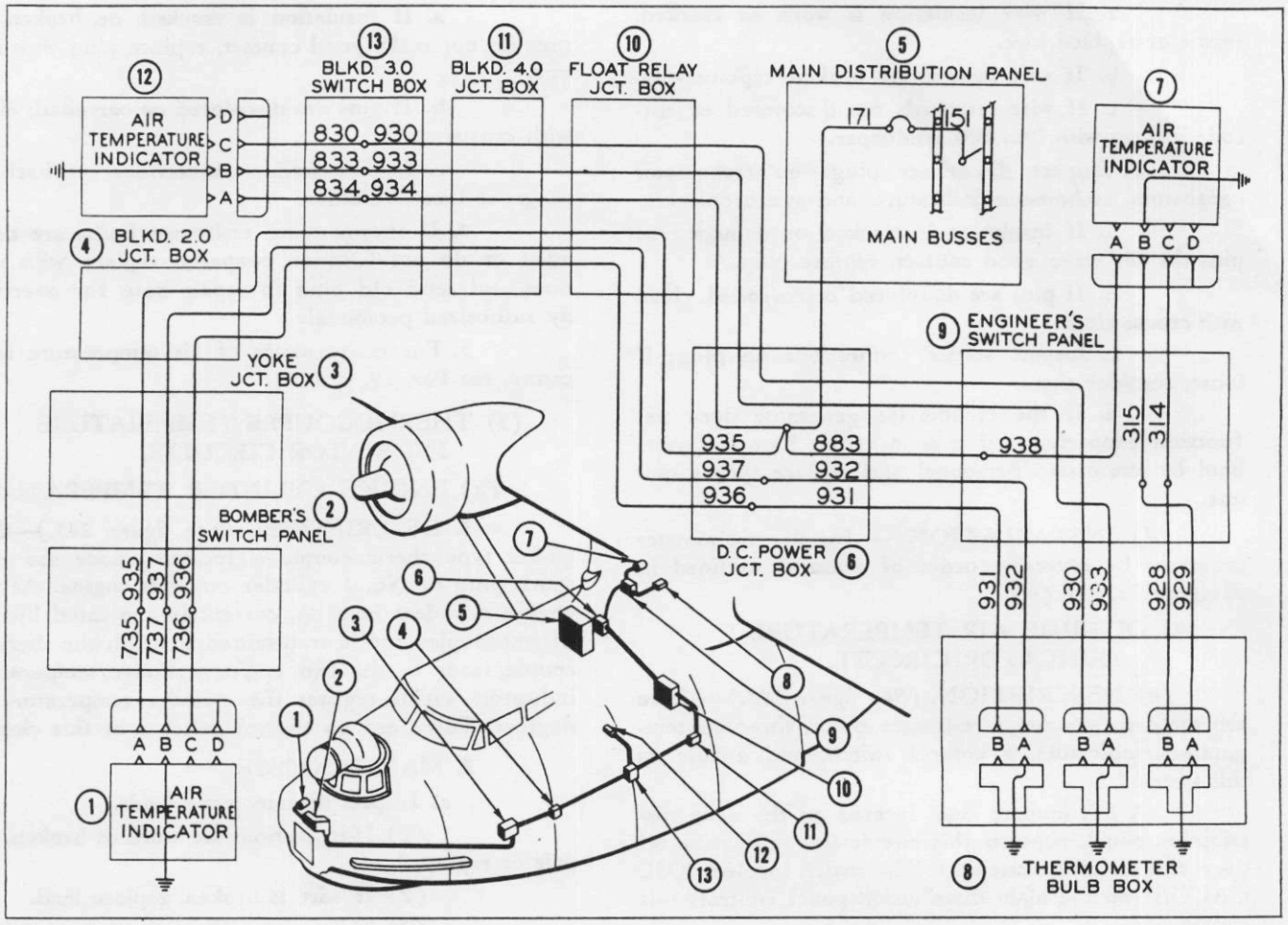


Figure 242—Outside Air Temperature Indicator Circuit

2. Throw the "MAIN BATTERY" switch and "PITOT HTR." switch on the main distribution panel to the same bus ("A" or "B").

3. Rotate "ANTI-ICER CONTROL" rheostat clockwise and then counterclockwise to "OFF" position.

4. If the system is operating properly; the propeller anti-icer motor will start; increase in speed; then decrease in speed; and finally stop.

s. ELECTRICAL INSTRUMENTS.

(1) TACHOMETER CIRCUIT.

(a) DESCRIPTION. *(See figure 241.)*—This system consists of two tachometer generators (F. S. S. C. NO. 88-G-1375), four tachometer indicators (F. S. S. C. NO. 88-I-2500), and one synchronizer (F. S. S. C. NO. 88-I-2200).

Note

On PBY-5A airplanes with serial numbers 46624 to 46639, dual type indicators (F. S. S. C. NO. 88-I-2380) and generators (F. S. S. C. NO. 88-G-1330) were installed instead of the above described equipment.

One tachometer generator is mounted to each engine just forward of the right magneto of each engine. The tachometer generator is connected to the engine and its speed of rotation is directly proportional to the speed of the engine. Current is sent from the generator to the indicators, this current being proportional to the speed of the generator or engine. This circuit is not connected with the electrical system and is inoperative when the engines are not running.

(b) REMOVAL AND DISASSEMBLY OF TACHOMETER GENERATOR.

(See figure 240.)

1. Uncouple the electrical disconnect plug (1).

2. Remove four screws (2) from clamp (3).

3. Remove clamp (3), and unscrew generator (4).

4. Disassembly and repair of the tachometer generator should be accomplished only by experienced personnel at authorized repair bases.

(c) MAINTENANCE.

1. Inspect all wires and terminals in junction boxes shown on wiring diagram. *(See figure 241.)*

a. If wire insulation is worn or cracked, repair or replace wire.

b. If wire strands are broken, replace wire.

c. If wire terminals are discolored or corroded, clean with No. 000 sandpaper.

2. Inspect disconnect plugs on tachometer generators, tachometer indicators, and synchronizer.

a. If insulation is cracked or damaged or pins do not make good contact, replace plug.

b. If pins are discolored or corroded, clean with crocus cloth.

c. Inspect solder connections on plug; if loose, resolder them.

d. If the tachometer generator does not function properly, send it to a repair base for overhaul by authorized personnel and replace with a new one.

(d) INSTALLATION. — Install tachometer generator by reversing order of removal outlined in paragraph *s*, (1), *(b)*.

(2) OUTSIDE AIR TEMPERATURE INDICATOR CIRCUIT.

(a) DESCRIPTION. *(See figure 242.)*—There are three thermometer resistance bulbs, three air temperature indicators, a control switch, and a fuse in this system.

A five ampere fuse, located on the main distribution panel, protects this circuit (as well as the oil gage and oil dilute circuits). The switch labeled "OIL GAUGE" on the main distribution panel controls this circuit.

As the temperature increases or decreases, the resistance in the thermometer bulb varies. This variation in resistance causes a variation in the current flowing to the indicator, thus causing a fluctuation of the indicator.

The thermometer resistance bulbs are located in a box on the starboard side of the engineer's compartment. The indicators are located on the bombardier's panel, navigator's instrument panel and the engineer's instrument panel.

(b) MAINTENANCE.

1. Inspect all wiring and terminals in junction boxes shown on wiring diagram. *(See figure 242.)*

a. If wire insulation is worn or broken, repair or replace wire.

b. If wire strands are broken, replace wire.

c. If terminals are discolored or corroded, clean with No. 000 sandpaper.

2. Inspect switch and fuse.

a. If terminals are discolored or corroded, clean with No. 000 sandpaper.

b. If switch does not work properly, replace with new one.

3. Inspect disconnect plugs at resistance bulbs and indicators.

a. If insulation is cracked or broken, or pins do not make good contact, replace plug with new one.

b. If pins are discolored or corroded, clean with crocus cloth.

c. Inspect solder connections on back of plugs; if loose, resolder.

4. If thermometer resistance bulbs are damaged or do not function properly, replace with new ones and send old ones to repair base for overhaul by authorized personnel.

5. For maintenance of air temperature indicators, see Par. 19, *c*, (17).

(3) THERMOCOUPLE TEMPERATURE INDICATOR CIRCUITS.

(a) ENGINE CYLINDER TEMPERATURE.

1. DESCRIPTION. *(See figure 243.)*—One gasket type thermocouple is located under the rear spark plug of No. 1 cylinder on each engine. As the engine cylinders heat up, current is generated by the thermocouples and is transmitted through the thermocouple leads to the two engine cylinder temperature indicators which register the cylinder temperature in degrees. There are no control switches in this circuit.

2. MAINTENANCE.

a. Inspect thermocouple leads.

(1) If insulations are worn or broken, repair or replace lead.

(2) If wire is broken, replace lead.

(3) Make sure all terminal connections are tight.

(4) If terminals are discolored or corroded, clean with crocus cloth.

Note

Thermocouple leads must be used as furnished; do not attempt to shorten or lengthen leads.

b. Inspect thermocouples on engines.

(1) If insulation on wires is worn or broken, replace thermocouple.

(2) If thermocouple is damaged, replace with new one.

(3) If thermocouple is discolored or corroded, clean with crocus cloth.

c. For maintenance of temperature indicator, see Par. 19, *c*, (16).

(b) HEAT ANTI-ICING.

1. DESCRIPTION. *(See figure 243.)*—One gasket type thermocouple is located outboard of each nacelle in the duct that runs from the heat exchanger. A third gasket type thermocouple is located in the duct which is aft and above the empennage heater in the fin. Leads run from these thermocouples to tempera-

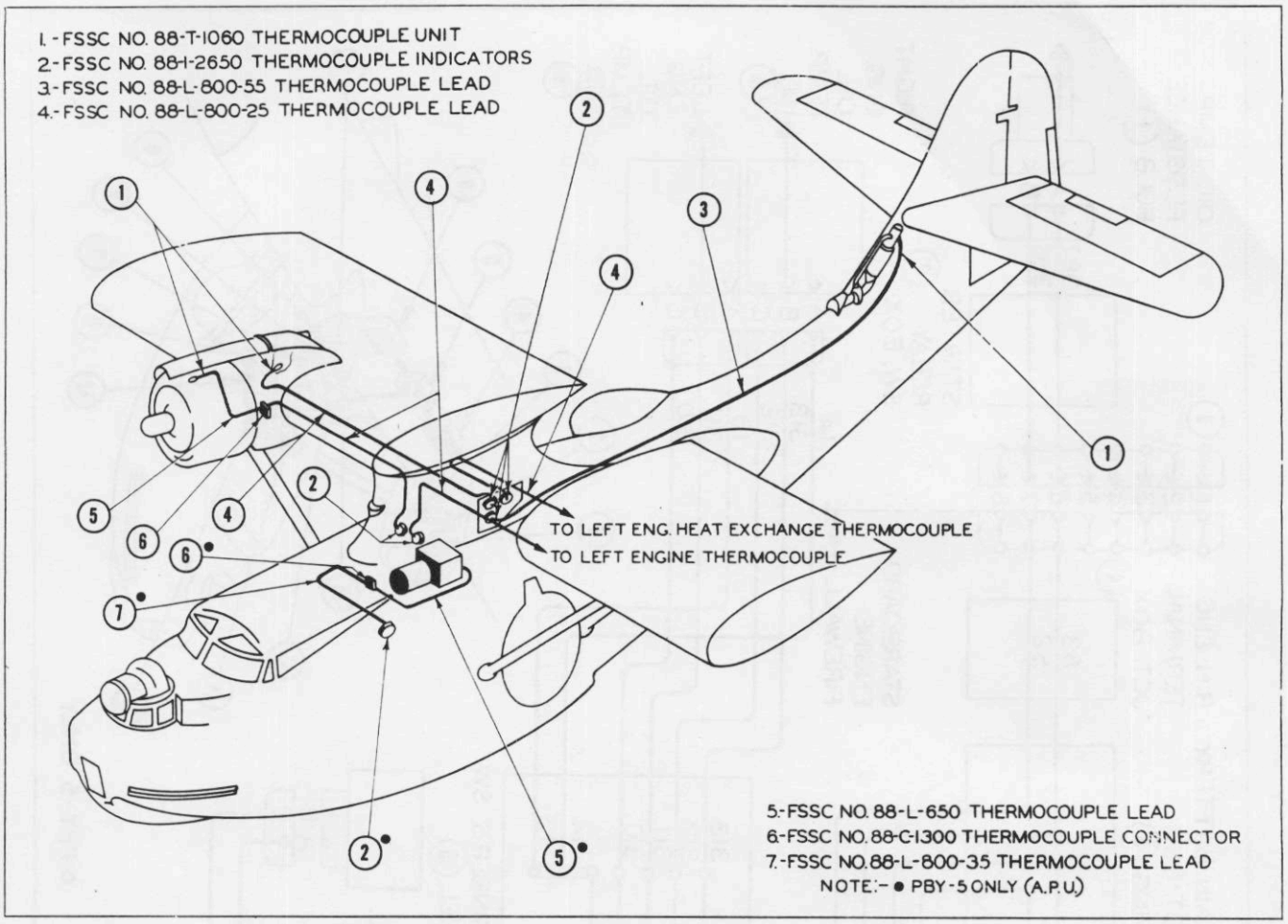


Figure 243—Thermocouple Circuits

ture indicators located on the port side of the engineer's seat.

These thermocouples function in the same manner as the engine cylinder temperature thermocouples.

2. MAINTENANCE.
(See paragraph *s*, (3), *(a)*, 2.)

(c) A.P.U. CYLINDER TEMPERATURE INDICATOR CIRCUIT (PBY-5 Only).

1. DESCRIPTION. *(See figure 243.)*—One gasket type thermocouple is located under the spark plug which is on the aft port of the outboard cylinder of the auxiliary power unit. Leads from this thermocouple run to the cylinder temperature indicator on the auxiliary power unit control panel just forward of the auxiliary power unit.

2. MAINTENANCE.
(See paragraph *s*, (3), *(a)*, 2.)

(4) ENGINE OIL TEMPERATURE INDICATOR CIRCUIT.

(a) DESCRIPTION. *(See figure 244.)*—This circuit consists of two temperature resistance bulbs, two indicators, a five ampere fuse and a control switch. One temperature resistance bulb is located in each engine. The temperature indicators (part of the engine gage units) are located on the engineer's instrument panel. The control switch, labeled "OIL GAUGE" and the five ampere fuse are both located on the main distribution panel. The circuit is protected by the five ampere fuse and controlled by the control switch on the main distribution panel. As temperature of the resistance bulb increases or decreases, the resistance of the element varies accordingly. This variation causes a corresponding change in the total current of the circuit and results in movement of the temperature indicator pointer.

(b) MAINTENANCE.

1. Inspect wiring and terminals in junction boxes shown on wiring diagram. *(See figure 244.)*

a. If wire insulation is worn or broken, repair or replace wire.

b. If wire strands are broken, replace wire.

c. If wire terminals are discolored or corroded, clean with No. 000 sandpaper.

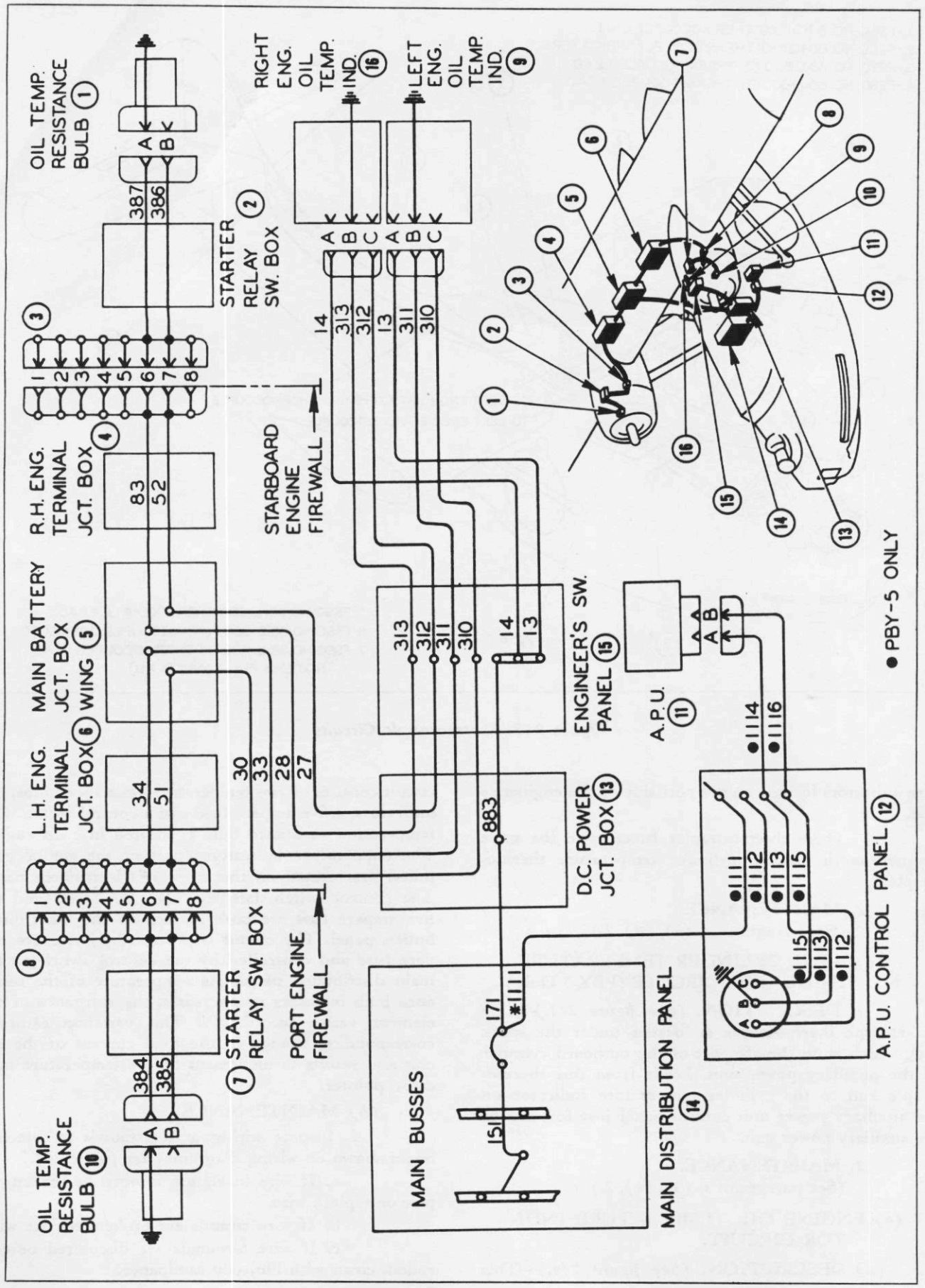


Figure 244—Engine Oil Temperature Indicator Circuit

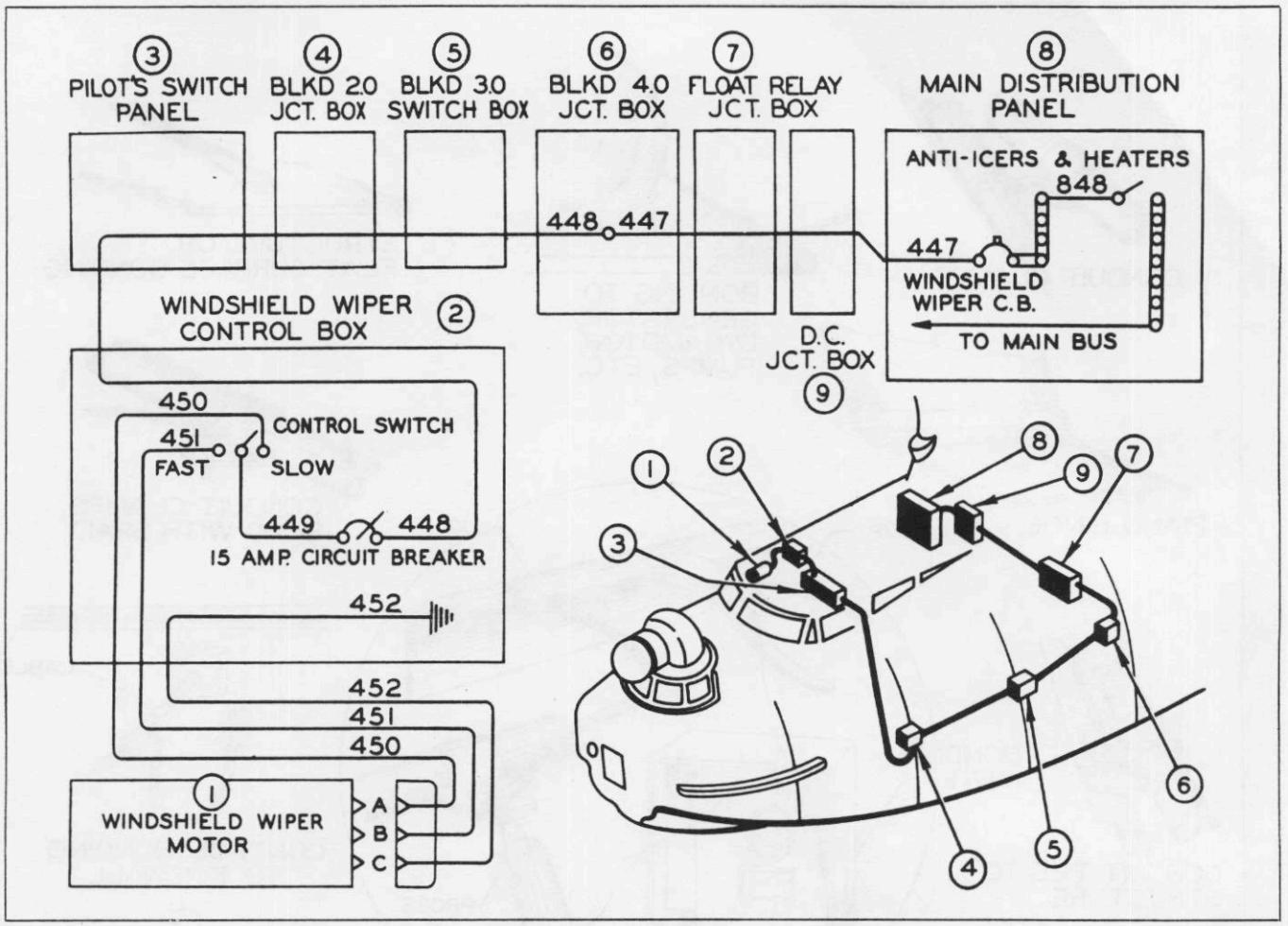


Figure 245—Windshield Wiper Circuit

2. Uncouple all disconnect plugs and inspect them.

a. If insulation is cracked or damaged, or pins do not make good contact, replace plug.

b. If pins are corroded or discolored, clean with crocus cloth.

c. If solder connections on back of plug are loose, resolder them.

3. For maintenance of switch and fuse, see paragraph *h*, (3).

4. For maintenance of oil temperature indicators, see Par. 19, *c*, (18).

5. If thermometer resistance bulbs are damaged or do not function properly, replace with new ones and send old ones to repair base for overhaul by authorized personnel.

(5) AUXILIARY POWER UNIT OIL TEMPERATURE INDICATOR CIRCUIT (PBY-5 Only).

(a) DESCRIPTION. *(See figure 244.)*—This circuit consists of a temperature resistance bulb located on the auxiliary power unit, an indicator located on the auxiliary power unit panel under the starboard food locker, and a five ampere fuse (which protects the circuit) and a control switch labeled "OIL GAUGE" located on the main distribution panel.

As the oil temperature in the auxiliary power unit increases or decreases, the resistance of the element in the resistance bulb varies accordingly. This variation causes a corresponding change in the total current of the circuit and results in movement of the temperature indicator pointer.

(b) MAINTENANCE.
(See paragraph *s*, (4), *(b)*.)

t. WINDSHIELD WIPER CIRCUIT.

(1) DESCRIPTION. *(See figure 245.)*—The circuit, which is controlled by a switch located on the windshield wiper control box installed overhead in the pilot's compartment just forward of bulkhead 2, is protected by a circuit breaker and a fuse. The circuit breaker, a 15 ampere toggle type, is located on the windshield wiper control box and the fuse, a 60 ampere type, is located on the main distribution panel. The windshield

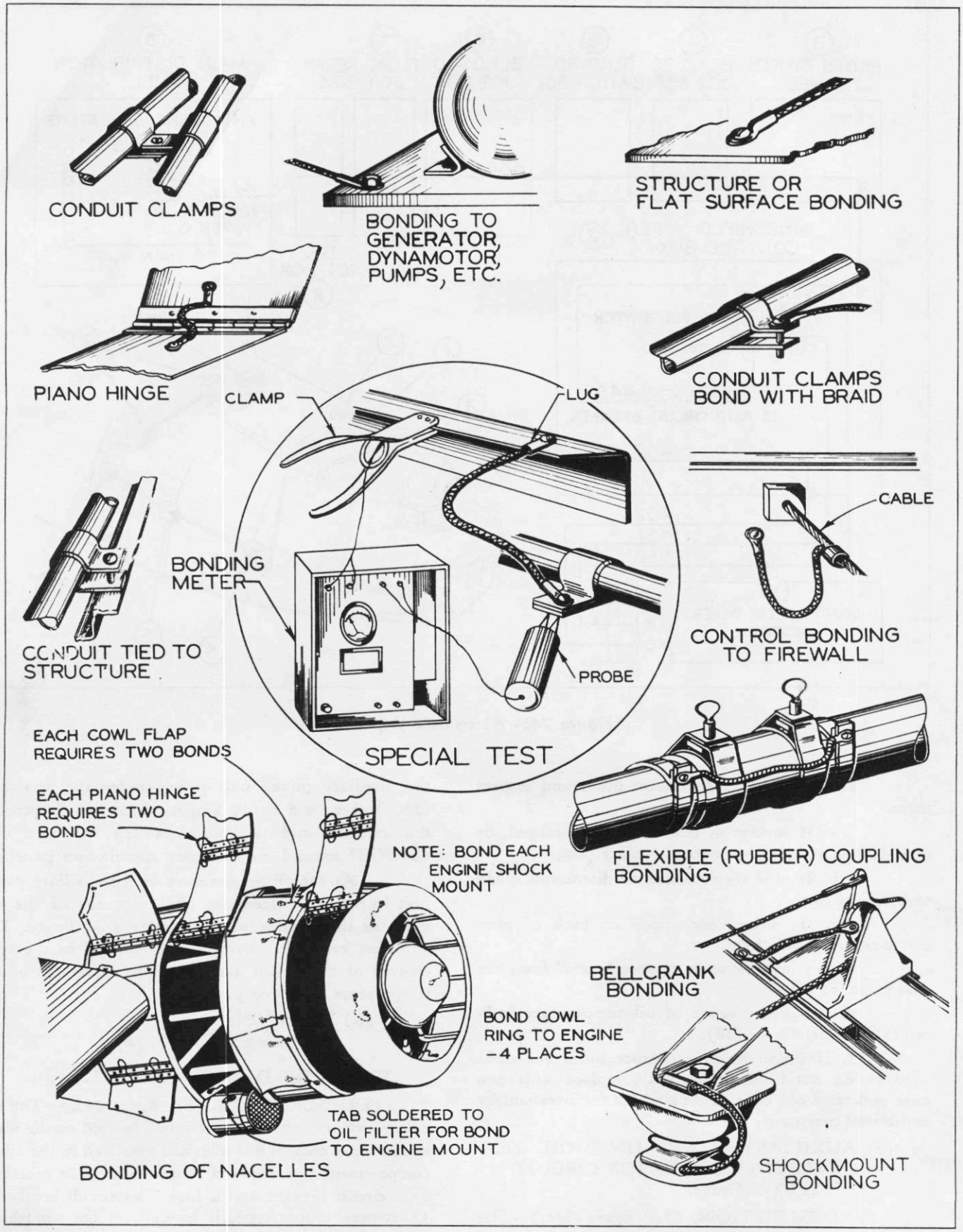


Figure 246—Typical Bonding

wiper motor is located overhead in the pilot's compartment just aft of the throttle quadrant.

The motor is a two speed motor. Current for the motor is taken from either bus in the main distribution panel through the "WINDSHIELD WIPER" master control switch and the 60 ampere fuse on the main distribution panel. The current then passes through a 15 ampere toggle type circuit breaker on the windshield wiper control box and is fed to the center terminal of the control switch. Current is then fed to the motor by throwing the control switch to either "FAST" or "SLOW" position.

(2) MAINTENANCE.

(a) Inspect wires and terminals in junction boxes shown on wiring diagram. *(See figure 245.)*

1. If insulation on wire is worn or broken, repair or replace.

2. If wire strands are broken, replace wire.

3. If wire terminals are discolored or corroded, clean with No. 000 sandpaper.

(b) Inspect switches and circuit breaker shown on wiring diagram.

1. If terminals are discolored or corroded, clean with No. 000 sandpaper.

2. If switches or circuit breaker do not otherwise operate properly, replace with new ones.

(c) Inspect disconnect plug at windshield wiper motor.

1. If insulation is cracked or damaged or if pins do not make good contact, replace plug.

2. If pins are discolored or corroded, clean with crocus cloth.

(d) For maintenance of windshield wiper motor see paragraph *v*, (3).

(3) OPERATIONAL CHECK.

(a) Throw "MAIN BATTERY" switch and "WINDSHIELD WIPER" switch on main distribution panel to the same bus ("A" or "B"). Throw circuit breaker switch on windshield wiper control box to "ON" position.

(b) If the circuit is operating properly, the motor will run slowly when the control switch is thrown to "SLOW" position and with a greater rate of speed when thrown to "FAST" position.

u. BONDING.

(1) DESCRIPTION. *(See figure 246.)*—Bonding consists of connecting metallic parts or equipment to the plane structure in such a way that there is a path for electric current between the parts or equipment and the plane structure. In general, all metallic surfaces, whether stationary or moving, should be so bonded wherever practicable. Joints made by soldering, welding, brazing, sweating, or swaging are considered as being thoroughly bonded. Semi-permanent metal to metal joints of machined parts, held together by lock threaded devices, riveted joints, tie rods, structural wires under heavy tension, primed fittings not subjected to wear, and clamp fittings normally permanent and immovable after installation are considered bonded if all insulating fittings are removed from the contact area before bonding. Parts not connected as above described, such as hinged units, pipes, etc., may be bonded by wire jumpers, bars or clamps tightly bolted, soldered, or brazed to the connected parts.

Parts as mentioned above are bonded in order that all parts of the airplane are of equal electrical potential to prevent leakage or sparks which cause some radio noises and which are injurious to efficient radio communication; to provide a transmitter and receiver ground (counterpoise) connection of maximum effectiveness by interconnecting as large a mass of metal as possible; and to lower the fire hazard due to possible arcing of unbonded joints when operating high power transmitters or when flying through thunderstorms. Bonds should be as short and as direct as practicable; connecting of parts directly to main airplane structure is preferred rather than bonding them through other bonded parts.

(2) MAINTENANCE.

(a) In the preparation of all bonding contacts, clean the contact areas thoroughly before assembly.

(b) Where the surfaces which are to be in contact are covered with non-conducting finishes such as paint or anodic film, the surfaces must be cleaned but no greater area cleaned than necessary. Where self-tapping screws are used, the surface treatment shall not be removed. The protective finishes shall never be removed from any vital structural part of the airplane for bonding purposes.

(c) When self-tapping screws are used, they should be dipped in a primer previous to application and never used in aluminum alloy where they would be subject to removal or replacement.

(d) Use aluminum alloy or cadmium plated steel screws and nuts wherever possible and in all cases where clamps or any part in contact with the screw or nut is made of aluminum or magnesium alloy.

(e) Oversize aluminum washers shall be used between any dissimilar metals unless both metals are among the following: phosphur bronze, copper, or stainless steel.

(f) Copper jumpers are used only where the bonded and bonding members are made of corrosion-resistant steel, cadmium plated steel, copper, brass, or bronze.

(g) Aluminum alloy jumpers are used in all cases where copper jumpers are not used.

(h) When the member to be bonded is of tubular or cylindrical cross section, the bonding jumper, when used, shall be fastened to the member to be bonded by means of a clamp. Cadmium steel clamps shall be used on steel, copper, bronze, or brass tubing or conduit. Aluminum alloy clamps shall be used on aluminum or magnesium alloy tubing or conduit.

(i) All contact areas on the bonding jumpers and structural members must be thoroughly cleaned with carbon tetrachloride or alcohol before assembly.

(j) After assembly and installation and just prior to refinishing the surfaces, the assembly must be thoroughly cleaned with carbon tetrachloride or alcohol.

(k) Refinish connection with its original finish or other suitable protective finish. Clamped or soldered connections shall receive one coat of zinc chromate, primer followed by the routine finish. (See Section VII.)

(l) Bonding jumpers should be replaced when they become worn or corroded in accordance with the previously mentioned procedures.

(3) SPECIAL TEST.

(a) Test all bonding by measuring the resistance with a milliammeter. The test is made by connecting one terminal or probe of the milliammeter to the part under test and the other terminal or probe to the nearest point of the structure.

(b) The resistance between the lug of bonding jumpers and the structural member to which the lug is attached must not exceed .001 ohms, except as noted below.

(c) The resistance between structure and the following members must not be over .0025 ohms:

1. Bomb racks, torpedo racks, etc.
2. Electrical conduit.
3. Electric motor mounts.
4. Radio racks.
5. Main distribution panel.
6. Hinges, and locking or latching mechanisms.
7. Gas and oil tanks.
8. Metallic fittings and couplings in fuel lines.
9. Oil radiator.
10. Central heater and tail heater.

(d) The resistance between airplane structure and the following members must not be over .01 ohms:

1. Control cables and rods to ailerons, elevators, rudders, and floats.
2. Hinged or sliding windows.
3. Cooking stove.

v. ELECTRIC MOTORS.

(1) DESCRIPTION.—All motors operate on 24-28 volts direct current. Amperage required varies with the size of the motor.

Main parts of the motor are the frame, field coils, armature, and brush assembly. Field coils are the coils wound around the field magnets, or pole pieces inside the frame. The armature is the rotating part of the motor. On one end of its windings (called armature windings), is connected the commutator. The armature consists of a cylindrical formation of copper bars separated from each other by insulations. The bars are called commutator segments. The brush assembly usually consists of four carbon brushes held in brush holders which in turn are fastened to the commutator end of the motor housing in such a way that the brushes are held by individual springs against the commutator segments.

The motor rotates due to interaction between the flux of the field magnets, energized by the field coils, and the current distributed to the armature windings through the brushes and commutator.

(2) DISASSEMBLY.—Disassembly methods vary with each motor; therefore, detailed instructions cannot be given here. Generally speaking, however, disassembly is as follows:

(a) Remove the commutator end of the motor housing from the frame by removing four nuts or bolts at that end.

(b) Remove the end bell from the housing, using care not to damage the brush assembly which is usually fastened to the end bell and to wires connecting the assembly to the field coils.

(c) Disconnect these wires, and, if necessary, tag wires to assure their correct re-connection.

(d) Remove the brushes by lifting their tension springs.

Note

Ordinarily it is not necessary to disassemble a motor to remove brushes or clean the commutator. Removal of a band around the motor or covers above the brush locations will give access to brushes and commutators of many motors. Small motors often have their brushes held in by insulated screws in the motor housing. Removal of these screws will allow pulling out of the brushes.

(e) Remove the armature assembly from the motor.

(3) MAINTENANCE.

(a) GENERAL CHECK.

1. Check motors for cracked or broken frames, especially at points where they are mounted to the airplane.

2. Check alignment of motors with their driven units.

CAUTION

Misalignment will cause high current consumption, heating, and bearing wear and also may seriously damage both motor and driven unit.

3. Inspect wiring connections for tightness and replace any loose connections at disconnect plugs with new parts.

4. Be sure motor is clean.

a. If dirty, clean motor with unleaded gasoline.

b. Blow out any accumulated dust or dirt, being careful not to blow dust or dirt into bearing or other moving parts.

(b) COMMUTATOR.

1. Be sure commutator is clean and free from oil or grease.

a. If it is dirty or oily, clean by washing with unleaded gasoline or Varnaline.

b. Wipe dry with a clean, lintless cloth.

c. Blow all dust and carbon particles out with clean, dry, compressed air.

2. If commutator is rough, use a piece of No. 000 sandpaper fitted into a wooden block that fits the contour of the commutator to smooth the commutator.

CAUTION

When smoothing with sandpaper, the commutator must be rotated slowly and the block moved along the surface so as not to put grooves in the commutator.

a. After smoothing the commutator, clean as described in paragraph *v*, (3), *(b)*, *1* above.

b. If the above methods do not clean or smooth the commutator, send motor to repair base for overhaul.

(c) BRUSHES.—Brushes wear faster at high altitudes than at low altitudes; and, therefore, the more high altitude flying that is done, the more often the brushes should be checked for wear.

1. Examine brushes.

a. If the brushes are worn to the extent that the brush holders are apt to touch the commutator before the next inspection, they should be replaced with new ones.

b. If new brushes are installed or old ones do not seat properly, hold a piece of No. 00 sandpaper around the commutator and the brushes with the sanded side toward the brushes, and then turn the commutator in the normal direction of rotation.

CAUTION

Do not use emery paper.

c. After seating the brushes, remove all dust or grit and wipe brushes and commutator clean.

d. Brushes should slide freely in the brush holders; if they do not, clean the brushes and holders. If brushes still stick, replace with new ones.

e. If brushes are oil soaked, replace with new ones.

2. Examine the brush springs to determine if the tension is correct.

a. If the tension is not correct, the springs can be bent to give the correct tension.

b. Springs permanently weakened should be replaced.

(d) LUBRICATION. — Motor bearings are packed with grease when assembled, and require no lubrication except at overhaul periods. This lubrication should be done at overhaul bases.

(e) ARMATURE AND FIELD WINDINGS. —These windings sometimes become broken, grounded, or shorted because of excessive loads or badly worn bearings. If such troubles develop, they will be evidenced in case of open windings, by non-operation of the motor, and in case of shorts or grounds, by excessive heating, diminished speed, arcing, or blowing of fuse in circuit.

If any of these troubles are encountered, replace motor and send old one to repair base for overhaul.

w. FIRING CIRCUIT.

(1) DESCRIPTION.

(a) CAMERA AND GUN SIGHTS CIRCUITS. *(See figure 247.)*—This part of the firing circuit provides power for the N4 Cameras and for the illuminated gun sights. By throwing a master control switch on the main distribution panel labeled "N4 CAMERA" to an energized bus, the gun sight receptacles are energized and the switches for the N4 Cameras are energized. Closing the N4 Camera switches energizes the N4 Camera receptacle.

The camera and gunsight circuits are protected by the 35 ampere fuse on the main distribution panel. The gun sight circuits are further protected by five-ampere push-button circuit breakers located in three places. One is located on the bombardier's switch panel, one on the port waist gunner's switch box, and one on the starboard waist gunner's switch box.

The control switches and receptacles for the N4 cameras are located in four places. One control switch and receptacle is located on the bombardier's switch panel, one on the port waist gunner's switch box, one on the starboard waist gunner's switch box, and one on the tail camera switch box.

Note

On PBY-5A airplanes with serial numbers 46580 and on, the N4 camera receptacle and switch were removed from the bombardier's switch panel.

There are three gun sight receptacles; one is located on the base of the nose turret to the left-hand side of the gun mount; and one near the top and on the inboard side of each of the gun mount posts for the waist gunners. The tail camera switch box is located to the port side of the tunnel gun door. The waist gun switch boxes are located on the longeron that runs just under the blisters and forward of the gun mount posts.

(b) CONTINUOUS FEED CIRCUIT. *(See figure 247.)*—This part of the firing circuit provides power for the continuous feed motors. The two con-

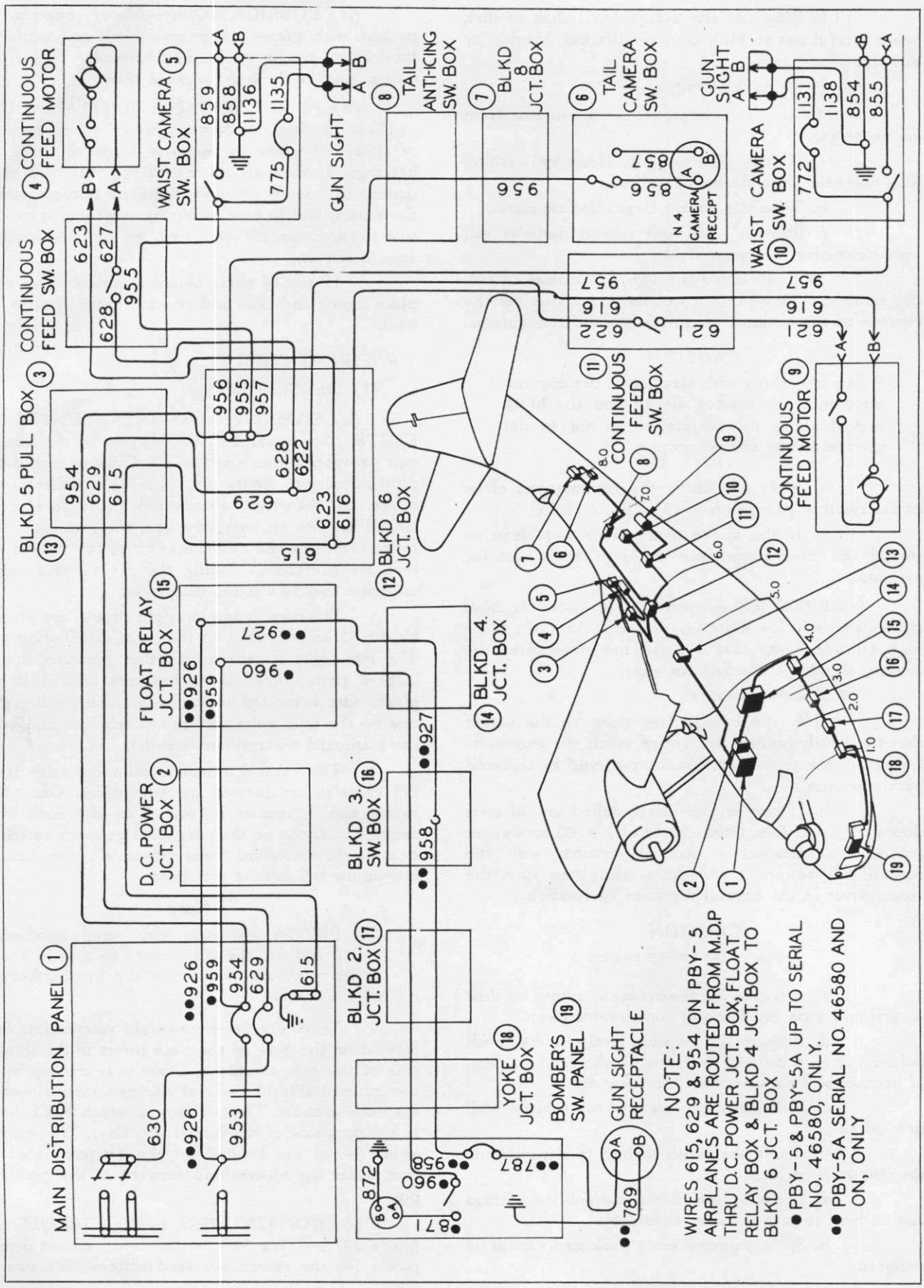


Figure 247—Firing Circuit

tinuous feed motors are controlled by switches located on the waist gunner's switch boxes.

The circuit, which obtains its current from the main battery lead in the main distribution panel, is protected by a 35 ampere fuse located on the main distribution panel. Mounted on the motor is a micro-switch which starts the motor when the tension on the ammunition belt is increased. A roller that rests on the ammunition belt is elevated when the tension in the belt increases while the arms that support the roller actuate the micro-switch.

The continuous feed motors are located on each side of the ammunition box above and inboard of the chine in the waist gunner's compartment.

(2) MAINTENANCE.

(a) Inspect wires and wire terminals in junction boxes shown on wiring diagram. *(See figure 247.)*

1. If wire insulation is worn or cracked, repair or replace wire.

2. If wire strands are broken, replace wire.

3. If wire terminals are discolored or corroded, clean with No. 000 sandpaper.

(b) Inspect busses and ground studs in junction boxes shown on wiring diagram. If busses or ground studs are discolored or corroded, clean with No. 000 sandpaper.

(c) Inspect switches, fuses and circuit breakers shown on wiring diagram.

1. If terminals are discolored or corroded, clean with No. 000 sandpaper.

2. If switches or circuit breakers do not function properly, replace with new ones.

(d) If micro-switch on continuous feed motor does not function properly, replace with new one.

(e) Inspect receptacles and disconnect plugs shown on wiring diagram.

1. If insulation is cracked or damaged, or pins do not make good contact, replace with new ones.

2. If pins are discolored or corroded, clean with crocus cloth.

3. If solder connections are loose, resolder them.

(f) For maintenance of continuous feed motor, see paragraph *v*, (3).

(3) OPERATIONAL CHECK.

(a) Throw "MAIN BATTERY" switch and "N-4 CAMERA" switch on main distribution panel to the same bus ("A" or "B").

(b) Throw the "ASSIST FEED" and "CAMERA" switches on the waist gunner's switch boxes to "ON" position.

(c) Throw the "CAMERA" switch on the tail camera switch box to "ON" position.

(d) Each receptacle may then be tested with a test lamp which consists of a lamp socket, 24 volt bulb, and two short wire leads. Insert the wire leads into the receptacle sockets. If the bulb lights up, the circuit is working properly. If desired, an AN 3106-16S-4P connector plug may be soldered to the two wire leads of the test lamp, in which case the plug may be coupled to the receptacle for testing.

(e) Lift the roller on the ammunition belt enough to free the micro-switch on the continuous feed motor. If the motor starts, this circuit is functioning properly.

x. SIGNAL SYSTEM LIGHT CIRCUIT.

(1) DESCRIPTION. *(See figure 248.)*—The signal system lights work as a visual signal system between the pilot and engineer. The system consists of two duplicate sets of indicating lights and switches. One set of lights is located in the pilot's signal panel on the pilot's yoke; the other set is located on the engineer's panel.

The lights and switches are so interconnected that either the pilot or engineer can turn any pair of lights "ON" or "OFF." Each switch on either panel controls its corresponding indicating light on both panels. Each pair of lights is in series and therefore if one fails, the other will not operate. The bulbs are 12-16 volt types and cannot be used in any other circuit in the airplane. Because the switches are of the three way type, the up or down position of the handles does not indicate whether they are on or off.

Nothing is wrong with the circuit if some handles are up and some down, and all their corresponding lights are on or off.

(2) MAINTENANCE.

(a) Check wiring in junction boxes shown on wiring diagram. *(See figure 248.)*

1. If wire insulation is worn or broken, repair or replace wire.

2. If wire strands are broken, replace wire.

(b) Inspect light bulbs and sockets.

1. If base of bulb is discolored or corroded, clean with No. 000 sandpaper.

2. If glass of bulb is darkened, discolored, or loose, replace bulb.

3. If contacts of socket are discolored or corroded, clean with No. 000 sandpaper.

4. To replace sockets: remove wire terminals from back of socket; detach six screws that clamp sockets in place and hold the shields; remove the bulb by pressing in and turning counterclockwise; remove old socket and replace with new one. Reassemble in reverse order of removal.

(c) Inspect the switches.

1. If solder connections are loose, resolder them.

2. If switches do not operate properly, replace with new ones.

3. If switches are replaced, the .064 dia. soft

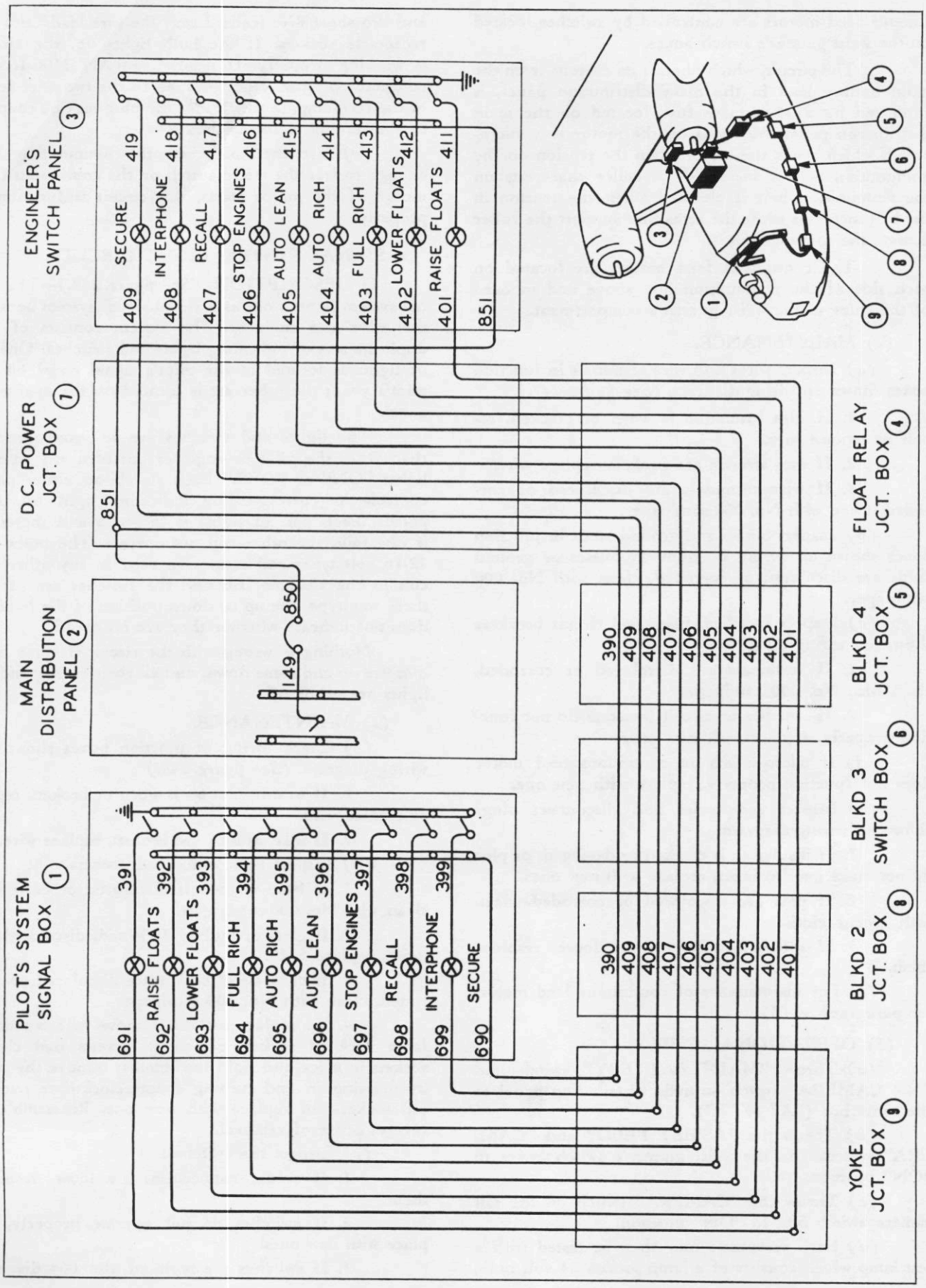


Figure 248—Signal System Light Circuit

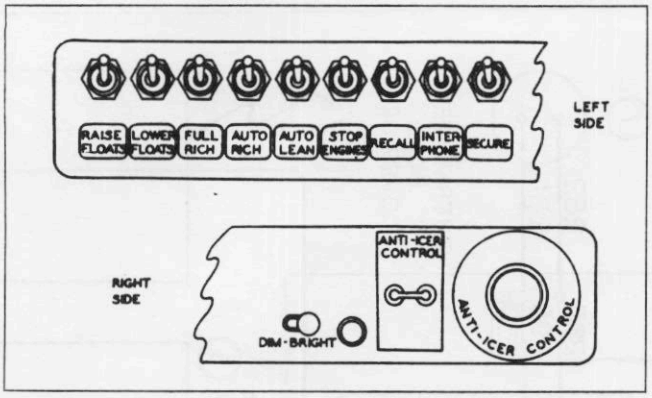


Figure 249—Pilot's Signal Panel

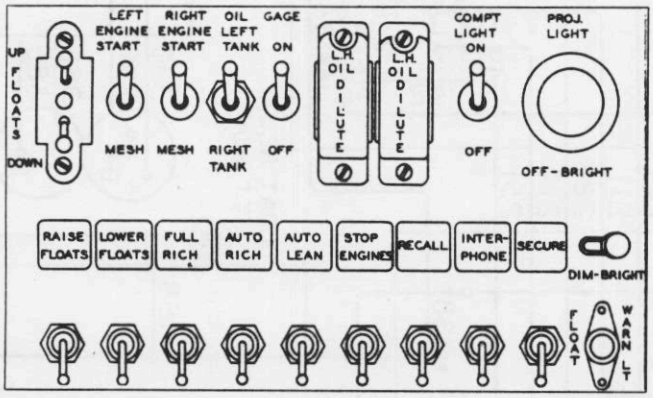


Figure 250—Engineer's Switch Panel

tinned copper wire (Specification ASTM B-33) that forms the busses on the back of the switches will have to be cut. Cut this bus wire as close to switch terminals as possible; unsolder wire that runs to center terminal of switch; remove nut that holds switch to panel; and then remove switch.

4. When installing a new switch, the wire that holds the center terminals of the switch must be re-soldered in place. If a short piece of .064 dia. soft tinned copper wire is not available to replace section cut-out when removing switch, a short piece of No. 20 or No. 18 wire (Specification AN-J-C-48) may be substituted. Be sure to resolder all connections well.

(d) Inspect five ampere fuse on main distribution panel.

1. If terminals are discolored or corroded, clean with No. 000 sandpaper.

2. If fuse does not operate properly, replace with new one.

(e) If window glass or dimmer glass is broken, replace with new one.

(3) OPERATIONAL CHECK.

(a) Throw "MAIN BATTERY" switch and "SIG. SYS. LIGHTS" switch on main distribution panel to same bus ("A" or "B").

(b) Throw all switches for the signal system on the pilot's signal panel (on the yoke) to a downward position. *(See figure 249.)*

(c) Throw all the switches for the signal system on the engineer's instrument panel to either up or down position. *(See figure 250.)*

(d) The lights on both signal panels should be either on or off depending upon the position of the switches on the engineer's panel.

(e) Throw the switches on the pilot's signal panel to an upward position. If the lights were off, they should now be on; or if they were on, they now should be off.

(f) Throw the switches on the engineer's signal panel to opposite position; if lights were off, they now should be on; and if they were on, they now should be off.

(g) With the lights on, loosen the knob located to the right side of the indicator windows, and then slide the knob back and forth. The lights should be dimmed when in "DIM" position, and brighter when in "BRIGHT" position.

y. MISCELLANEOUS CIRCUITS.

(1) OIL QUANTITY GAGE CIRCUIT.

(a) DESCRIPTION. *(See figure 251.)*—This circuit consists of two tank units, voltage compensator, two oil quantity indicator gages, a fuse, master switch, selector switch, control switch, and resistor.

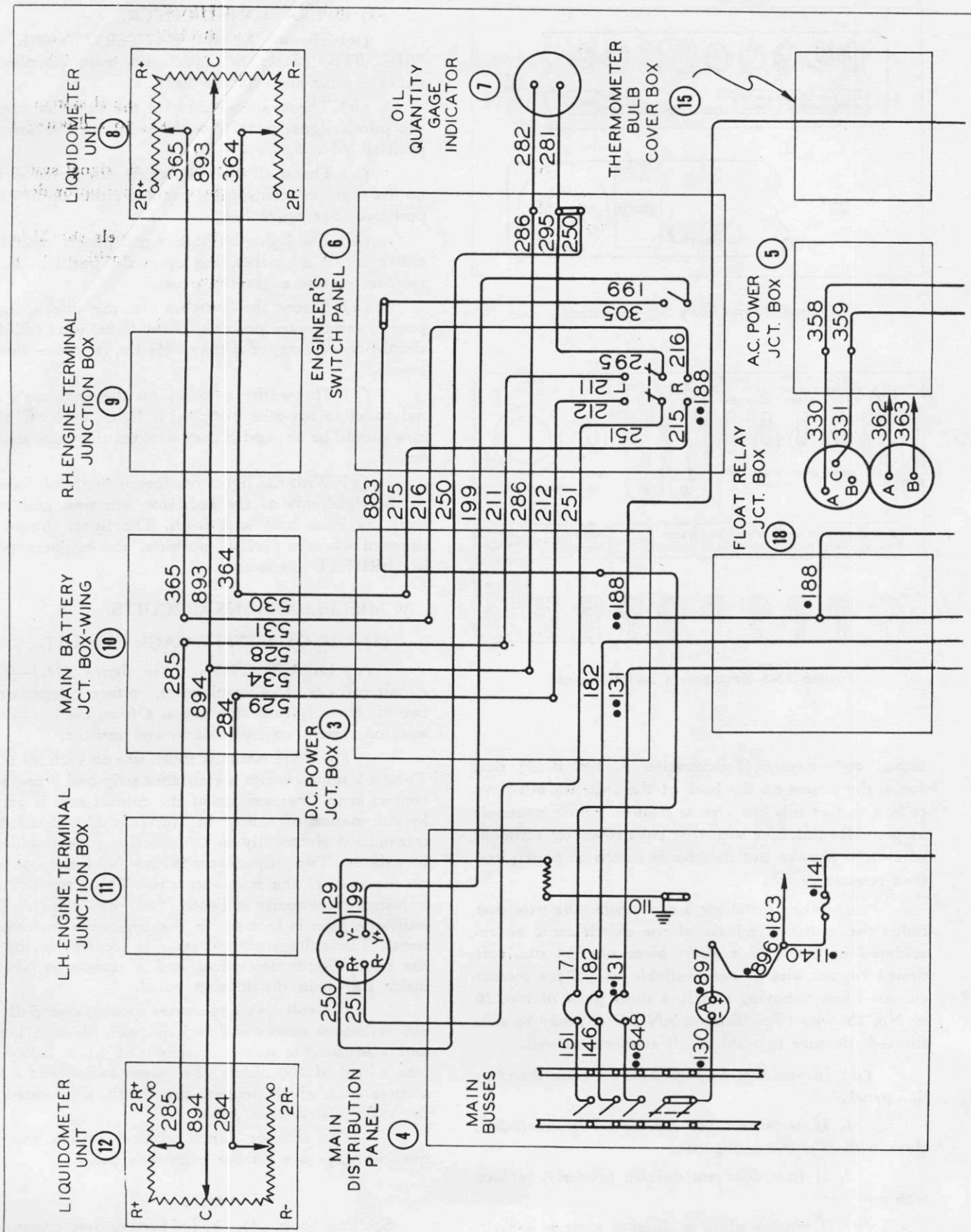
There are two tank units, one on each oil tank. The tank units contain a resistance strip and a movable contact arm. The position of the contact arm is varied by the motion of a float in the tank. This position is transmitted electrically to an indicator gage graduated in gallons. Two adjustment screws hold the contacts on the ends of the resistance strip. These contacts are adjusted to properly indicate "full" or "empty." The indicator gage is located on the engineer's instrument panel. The voltage compensator is located on top of the main distribution panel and a resistor is located inside the main distribution panel.

The voltage compensator consists essentially of two resistance spools and two tungsten filament lamps and is adjusted to supply an output of 4.1 $\pm$ 0.05 volts into a load of 100 ohms. The master switch and a five ampere fuse, which protects the circuit, are located on the main distribution panel.

The selector switch, control switch, and oil quantity gage are on the engineer's panel.

Note

See Par. 16, *b*, (4), *(a)* for further description of oil level gage mechanism.



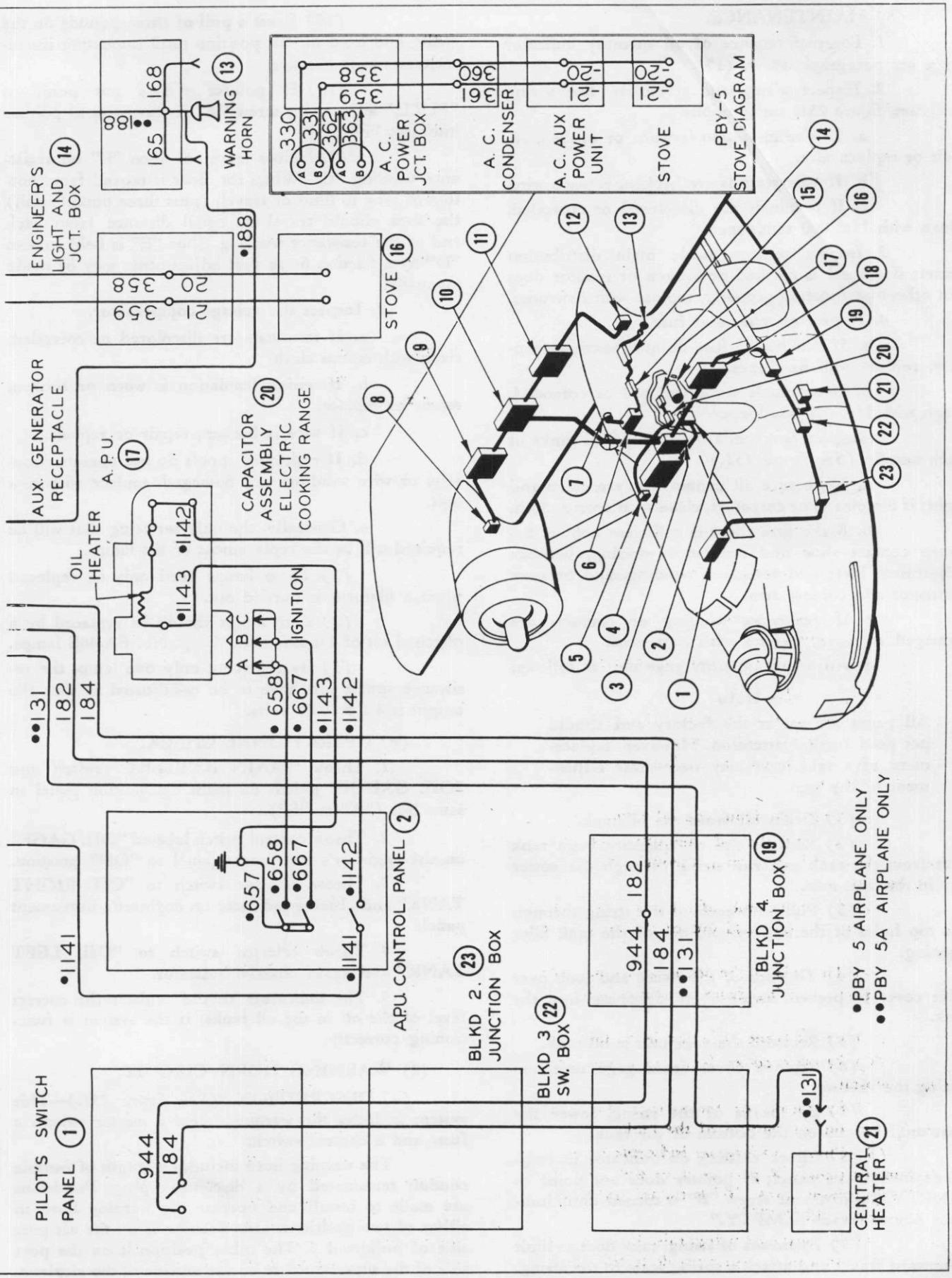


Figure 251—Miscellaneous Circuits

(b) MAINTENANCE.

1. For maintenance of oil quantity indicator gage see paragraph 19, *c,* (15).

2. Inspect wiring and terminals. See wiring diagram, figure 251, for locations.

a. If wire insulation is worn or broken, repair or replace wire.

b. If wire strands are broken, replace wire.

c. If terminals are discolored or corroded, clean with No. 000 sandpaper.

3. Inspect resistor inside main distribution panel; if enamel is cracked or broken or resistor does not otherwise function properly, replace with new ones.

4. Inspect switches and fuse.

a. If switches or fuse do not function properly, replace with new ones.

b. If terminals are discolored or corroded, clean with No. 000 sandpaper.

5. Inspect tank units on sides of oil tanks in each nacelle. *(See figure 153.)*

a. Make sure all connections are clean and tight; if discolored or corroded, clean with crocus cloth.

b. Make sure there is sufficient contact between contact shoe and resistance winding, between adjustment lever and resistance winding, and between contactor and contact arm.

c. If resistance winding or contacts are damaged or worn, replace with new ones.

d. Adjust oil quantity gage unit as follows:

Note

All gages are set at the factory and should not need further attention. However, replacement of a tank unit may necessitate adjustment of the unit.

(1) Drain oil from the oil tank.

(2) Remove the oil quantity gage tank unit from the tank and run string through the cotter key in the float arm.

(3) Pull both ends of the string through the top holes of the hopper and out of the tank filler opening.

(4) Tie ends of the string and loop over filler cover to prevent string from dropping into the tank.

(5) Reinstall the gage unit in oil tank.

(6) Remove cover from gage unit, exposing the rheostat.

(7) By means of the string, lower the float until it rests on the bottom of the tank.

(8) Check reading on indicator in engineer's instrument panel; if pointer does not point to "EMPTY," adjustment screw "B" is turned until indicator pointer reads "EMPTY."

(9) By means of string, raise float to limit of upward travel and attach a spring scale to the string.

(10) Exert a pull of three pounds on the string and hold in this position until indicating instrument has been checked.

(11) If pointer does not point to "FULL," adjustment screw "A" is turned until pointer indicates "FULL."

(12) Note travel of shoe "E" on resistance winding "E." When the float is moved from bottom of tank to limit of travel, (plus three pounds pull) the shoe should travel an equal distance from each end of the resistance winding. Shoe "E" is held to arm "D" by a friction fit so that adjustments may be made manually.

6. Inspect the voltage compensator.

a. If terminals are discolored or corroded, clean with crocus cloth.

b. If wiring insulation is worn or broken, repair or replace.

c. If wire is broken, repair or replace.

d. If resistance spools do not operate properly, or wire windings are damaged, replace with new unit.

e. Generally, the only servicing that will be required will be the replacement of the lamps.

(1) These lamps need only be replaced when a filament is burned out.

(2) Both lamps should be replaced by a matched set of Liquidometer Corp. No. EA-40B lamps.

(3) By replacing only one lamp, the resistance spools will have to be re-adjusted so that the output is 4.1 $\pm$ 0.05 volts.

(c) OPERATIONAL CHECK.

1. Throw "MAIN BATTERY" switch and "OIL GAUGE" switch on main distribution panel to same bus ("A" or "B").

2. Throw control switch labeled "OIL GAGE" on the engineer's instrument panel to "ON" position.

3. Throw selector switch to "OIL RIGHT TANK" and observe indicator on engineer's instrument panel.

4. Throw selector switch to "OIL LEFT TANK" and again observe indicator.

5. The indicators should register the correct level of the oil in the oil tanks, if the system is functioning correctly.

(2) WARNING HORN CIRCUIT.

(a) DESCRIPTION. *(See figure 251.)*—This system includes the warning horn, a master switch, a fuse, and a control switch.

The warning horn includes a length of flexible conduit terminated by a disconnect plug. Provisions are made to install and operate the warning horn in either of two positions. One position is on the aft port side of bulkhead 5. The other position is on the port side of the superstructure on the outside of the airplane.

The receptacle for connecting the warning horn conduit on the inboard position is located on the aft port side of bulkhead 5. The receptacle for connecting the warning horn conduit for the outboard position is located on the outside of airplane near the bracket that mounts the warning horn.

The control switch is located on the pilot's switch panel and is labeled "WARNING HORN."

The master control switch, labeled "PROJ. LIGHTS," and a 10 ampere fuse, which protects the circuit, are both located on the main distribution panel.

When the "MAIN BATTERY" switch and the "PROJ. LIGHTS" master switch on the main distribution panel are thrown to the same bus ("A" or "B"), the horn can be sounded in either inboard or outboard positions by means of the control switch on the pilot's switch panel.

(b) MAINTENANCE.

1. Inspect all wiring and terminals shown on wiring diagram. *(See figure 251.)*

a. If wire insulation is worn or broken, repair or replace wire.

b. If wire strands are broken, replace wire.

c. If terminals are discolored or corroded, clean with No. 000 sandpaper.

2. Inspect disconnect plugs and receptacles.

a. If insulation is damaged or cracked or pins do not make good contact, replace plug or receptacle.

b. If pins are discolored or corroded, clean with crocus cloth.

c. If solder joints are loose, resolder them.

3. Inspect switch and fuse.

a. If switch or fuse does not operate properly, replace with new one.

b. If switch or fuse terminals are discolored or corroded, clean with No. 000 sandpaper.

4. Inspect warning horn.

a. Remove screw in back of housing to which conduit is attached.

b. Inspect wire inside housing.

(1) If wire insulation is worn or broken, repair or replace wire.

(2) If wire is broken, replace with new wire.

(3) If solder connections are loose, resolder them.

(4) If horn does not otherwise work properly, replace with new horn and send defective horn to repair base for overhaul.

(c) OPERATIONAL CHECK.

1. Throw "MAIN BATTERY" switch and "PROJ. LIGHTS" master switch on main distribution panel to same bus ("A" or "B").

2. Connect warning horn to inboard position and plug in connection.

3. Throw "WARNING HORN" switch on pilot's switch panel to "ON" position.

4. If horn blows in this position, this part of the circuit functions properly.

5. Move warning horn to outboard position and make proper connections. This position can be reached through the port window in the engineer's compartment.

6. Again throw the "WARNING HORN" switch on the pilot's switch panel to "ON" position.

7. If the warning horn again blows in this position, this part of the circuit also functions properly.

(3) AUXILIARY POWER UNIT IGNITION CIRCUIT (PBY-5 Only).

(a) DESCRIPTION. *(See figure 251.)*—The circuit includes two ignition switches located on the auxiliary power unit control panel. One side of these switches is connected to a ground stud in the control panel, and the other side of the switches are connected to the magnetos. These switches are labeled "NO. 1 MAG." and "NO. 2 MAG." With these switches in "OFF" position, the magneto circuit is grounded, thus allowing no spark to reach the spark plugs.

These switches must be in "ON" position to start and run the auxiliary power unit.

(b) MAINTENANCE.

1. Inspect wires and terminals in auxiliary power unit control panel.

a. If wire insulation is worn or broken, repair or replace wire.

b. If wire strands are broken, replace wire.

c. If terminals are discolored or corroded, clean with No. 000 sandpaper.

2. Inspect switches on control panel.

a. If switches do not function properly, replace them.

b. If switch terminals are discolored or corroded, clean with No. 000 sandpaper.

3. Inspect disconnect plug on auxiliary power unit.

a. If insulation is cracked or damaged or pins do not make good contact, replace plug.

b. If pins are discolored or corroded, clean with crocus cloth.

(4) AUXILIARY POWER UNIT OIL HEATER CIRCUIT (PBY-5 Only).

(a) DESCRIPTION. *(See figure 251.)*—The circuit includes a 20 ampere fuse located on the main distribution panel, and a control switch and red warning light located on the auxiliary power unit panel located under the starboard food locker.

The current for operating the oil heater is drawn from the main battery bus in the main distribu-

tion panel, and passes through the protecting 20 ampere fuse to the control switch on the auxiliary power unit panel. From here the current divides to pass through the warning light and the oil heater in the auxiliary power unit.

(b) MAINTENANCE.

1. Inspect wires and terminals in junction boxes shown on wiring diagram. *(See figure 251.)*

a. If insulation on wire is broken or worn, replace wire.

b. If wire strands are broken, replace wire.

c. If wire terminals are discolored or corroded, clean with No. 000 sandpaper.

2. Inspect switch and fuse.

a. If terminals are discolored or corroded, clean with No. 000 sandpaper.

b. If switch or fuse does not operate properly, replace with new one.

3. Inspect light bulb and socket.

a. If base of bulb is discolored, clean with No. 000 sandpaper.

b. If glass of bulb is discolored, darkened, or loose, replace bulb.

c. If contacts of socket are discolored or corroded, clean with No. 000 sandpaper.

(5) COOKING STOVE CIRCUIT.

(a) DESCRIPTION. *(See figure 251.)*—The cooking stove derives its current from either the two main generator A.C. receptacles or the auxiliary power unit A.C. receptacle located on the A.C. power junction box just outboard of the main distribution panel. Two wires lead from the stove and its two regulator switches to a connector plug conveniently placed to insert in either of the three receptacles on the A.C. power junction box.

The stove is located just aft of bulkhead 4 on the starboard side. The stove is an A.C. type, equipped with two burners. Each burner or hot plate is controlled by switches on the inboard side of the base of the stove. These switches are labeled "HIGH," "OFF," "HOT," and "MED."

(b) MAINTENANCE.

1. Inspect wires and terminals shown on wiring diagram. *(See figure 251.)*

a. If wire insulation is worn or broken, repair or replace wire.

b. If wire strands are broken, replace wire.

c. If terminals are discolored or corroded, clean with No. 000 sandpaper.

2. Inspect stove.

a. If heating element does not function properly or switches do not operate properly, replace with new ones.

b. Be sure all connections and parts are clean and tight.

(c) OPERATIONAL CHECK.

1. Start the auxiliary power unit and then plug the stove wiring plug into the "AUXILIARY A.C. GENERATOR" receptacle on the A.C. power junction box just outboard of the main distribution panel.

2. Turn both switches on stove down to "LOW" position.

3. Hold hand a few inches above stove to feel heat.

4. Turn switches on stove to "MED." and "HIGH" positions and again feel heat from stove. In these positions, more heat should be given off than when in "LOW" position.

5. Turn switches to "OFF" position.

(6) CENTRAL HEATER CIRCUIT (PBY-5A Only).

(a) DESCRIPTION. *(See figure 251.)*—This circuit furnishes power for the central heater operation.

The current is controlled by a control switch and protected by a 15 ampere fuse both of which are located on the main distribution panel. (See Par. 26 for further discussion of central heater.)

(b) MAINTENANCE.

1. Inspect wiring and terminals shown on wiring diagram. *(See figure 251.)*

a. If wire insulation is worn or broken, repair or replace wire.

b. If wire strands are broken, replace wire.

c. If terminals are discolored or corroded, clean with No. 000 sandpaper.

2. Inspect disconnect plug at central heater control box.

a. If insulation is cracked or damaged, or pins do not make good contact, replace plug.

b. If pins are discolored or corroded, clean with crocus cloth.

c. Inspect solder connections; if loose, resolder them.

3. Inspect fuse and switch on main distribution panel.

a. If switch or fuse does not operate properly, replace with new one.

b. If terminals are discolored or corroded, clean with No. 000 sandpaper.

★ ★ ★

PARAGRAPH 23.

23. COMMUNICATIONS.

a. GENERAL.—The communications and navigational equipment of the PBY-5 and PBY-5A airplanes consists of the following:

(1) ATB AND ARB COMMAND RADIO EQUIPMENT.—This equipment is used for intra-squadron and short range communication.

(2) GO-9 and RU-19 LIAISON RADIO EQUIPMENT.—This equipment is used for intra-squadron and general long range communication.

(3) RL-24C INTERPHONE.—The interphone system provides for inter-communication between all crew members in the airplane.

(4) NAVIGATIONAL EQUIPMENT. — The navigational radio equipment consists of the radio apparatus used for the navigation and flying of the airplane. It is made up of the following units:

(a) DW-1 Radio Compass.

(b) AN/APN-1 Radio Altimeter.

Note

The radio altimeter is not installed in the PBY-5 airplane. It is installed in PBY-5A airplanes with serial numbers 48352 and on. (See introduction to this MANUAL.)

(c) Provision for the Marker Beacon radio.

(5) RADAR EQUIPMENT.—This equipment is of a confidential nature. It is designated as follows:

(a) ASB, installed on PBY-5A airplanes with serial numbers 48252 to 46600. It was removed on PBY-5A airplanes with serial numbers 46600 and on. (See introduction to this MANUAL.)

(b) ABK, installed on all PBY-5 and on PBY-5A airplanes up to serial number 48252.

(c) AN/APX-2, installed on PBY-5A airplanes with serial numbers 48252 and on.

(d) ABA, used as an alternate to AN/APX-2. Provisions only are installed.

WARNING

Operation of all radio equipment involves the use of high voltages which are dangerous to life. Operating personnel must at all times observe safety regulations. Do not change tubes or make adjustments inside the equipment with high voltage supply on. Always turn "OFF" the dynamotor or other associated power equipment and open main switch in power supply circuit. Under certain conditions, dangerous potentials may exist in circuit with the power control in the "OFF" position, due to charges retained by capacitors, etc. To avoid casualties, always discharge and ground circuits prior to touching them.

b. COMMAND RADIO EQUIPMENT.

(1) TRANSMITTING EQUIPMENT.

(a) DESCRIPTION. *(See figure 252.)*—The ATB transmitting equipment provides for intra-squadron communication and may be used generally for short range communication. It consists of the following units:

One transmitter with two tuning units (CRV-52233).
One spare tuning unit (CRV47191).
One dynamotor (CRV21724).
One pilot's control box (CRV23258).
One metering kit (CRV60025).
Inter-connecting cables.

The transmitter is on the starboard side of the radio compartment, forward of bulkhead 3; it is the aft one of the two units on a shelf above the GO-9 transmitter. On top of the transmitter is the metering kit. The spare tuning unit is on a bracket forward and above the ATB transmitter shelf. The dynamotor is on the floor on the starboard side, slightly forward of bulkhead 3. Its input power is derived from the D.C. power junction box to which it is connected by a flex cable. Other flex cables connect it to the transmitter and pilot's control box. The control box is on the forward face of bulkhead 2, above the starboard side of the hatch.

By means of the three tuning units the transmitter may be operated on frequencies from 2.3 to 9.05 megacycles.

(b) REMOVAL.

1. TRANSMITTER.

a. Turn off power at D.C. radio power box, forward of bulkhead 4 on starboard side.

b. Uncouple and withdraw the plug of cable to dynamotor, located on the front panel of transmitter.

c. Disconnect lines: to antenna lead-in, to pilot's ARB receiver, to antenna switching and clock panel, to ground.

d. Disengage two snap-slide fasteners at the lower corners of the front panel and pull transmitter unit inboard to remove.

2. PILOT'S CONTROL BOX.

a. Turn off power at D.C. radio power box, forward of bulkhead 4 on starboard side.

b. Uncouple and withdraw plug of cable to dynamotor.

c. Detach four mounting screws and remove.

3. DYNAMOTOR.—See paragraph *g*, (2), *(b)*.

(c) MAINTENANCE.

1. TUBES.—Tube failure may be indicated by loss of output. By substituting tubes of known good condition, faulty tubes can be isolated. Since several heaters in the circuit are connected in series, one burned out tube may remove the power supplied to the others.

2. RELAYS (With the exception of the keying and frequency selector relays, K103, K101).—If contacts are not smooth and clean, clean with carbon tetrachloride, polish with crocus cloth and burnish. Springs on relay should exert sufficient tension to insure a positive contact in the de-energized position of the relay.

3. KEYING RELAY (K-103.)—Special attention must be given this relay because of its frequency of operation and the rubbing action to which it is subjected at high speeds. If contacts are soiled or blackened, merely clean with carbon tetrachloride. These contacts must never be burnished. If removed, contacts must be replaced in their correct positions since the sequence of closure must be preserved for proper operation of the transmitter.

Contact pressures on the center bars are adjusted at the factory, but in case poor contacts develop, a slight downward pressure on the contacts will bend the spring enough to again assure good contact. Properly adjusted, spring contacts should show only a slight movement (approximately 0.005 inch) when coming in contact with the center bars.

The end contacts carry the heaviest current and consequently show the greatest wear. Their function is to open the starting winding on the relay coil at the end of each stroke. This spring contact is provided with a heavy silver contact disc.

Note

This relay should be so adjusted that the heavy contact opens before the opposite contact.

4. SELECTOR RELAY (K101).—The outside contacts of the selector switch make contact with the two terminal strips on the tuning units inserted in both channels. Spring tension of contacts should be checked to insure good electrical connection between the two units. If pressure is insufficient, a slight outward pull will restore tension of contacts. Contacts should be cleaned with carbon tetrachloride and burnished.

The sliding contacts should be cleaned and adjusted in the same manner as that described for keying relay (K103).

Lubrication of selector relay bearing every 30 days is recommended.

5. DYNAMOTOR.—See paragraph *g*, (2), *(c)*.

(d) INSTALLATION.—Reverse removal procedure as outlined in paragraph *b*, (1), *(b)*.

(e) OPERATIONAL CHECK.—Refer to the PILOT'S HANDBOOK (AN 01-5MA-1).

(2) RECEIVING EQUIPMENT.

(a) DESCRIPTION. *(See figure 252.)*—The ARB equipment consists of two receivers, one controlled by the pilot and the other by the radio operator. Pilot's receiver is used by the pilot for intra-squadron communication. The radio operator's equipment is used by the radio operator for liaison reception. The pilot's equipment consists of the following:

One ARB receiver (CRV-46151).
One control box (CRV-23254).
One remote tuning unit (CRV-23253).

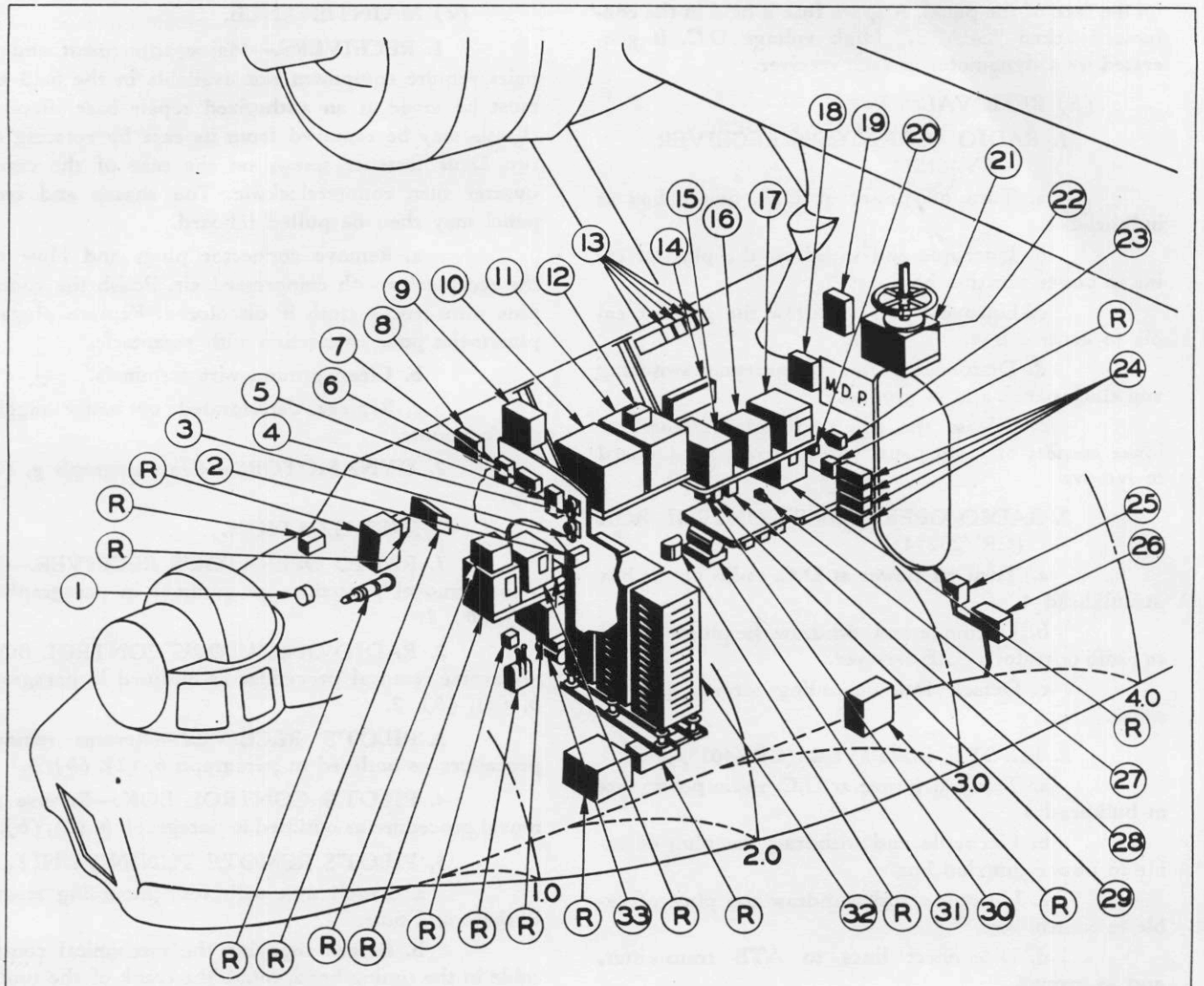
The radio operator's equipment is as follows:

One ARB receiver (CRV-46151).
One control box (CRV-23254).

The pilot's receiver is on the starboard side between bulkheads 2 and 3, on a shelf with and forward of the ATB transmitter. The shelf is above the GO-9 transmitter. His control box is on the forward face of bulkhead 2, above the port side of the hatch. The pilot's remote tuning unit is the lower of two similar units, outboard of the control box. The tuning unit is connected to the receiver by a flexible shaft.

The radio operator's receiver is the aft one of three units on the shelf above his table. His control box is the second unit from the forward end of the vertical section, between the shelf and radio table. His tuning dial is on the face of the receiver.

The receivers are six-tube superheterodynes with an operating range of 195 to 9050 kilocycles for the reception of voice, mcw, or continuous wave signals. The tubes operate on the 28 volt D.C. power system of the airplane. The pilot's receiver is connected to the power junction box on the starboard side wall outboard of the receiver. The radio operator's receiver is connected to the D.C. radio power box below and slightly outboard of the main distribution panel on the forward face of bulkhead 4. Each is protected by a 10 ampere, cartridge type, screw-in fuse, marked "FUSE"



R. RADAR EQUIPMENT
1. RADIO ALTIMETER INDICATOR
2. POWER JUNCTION BOX
3. REMOTE TUNING UNIT ARB
4. REMOTE TUNING UNIT (RU-19)
5. PILOT'S CONTROL BOX (ARB)
6. CONTROL BOX (RU-19)
7. CONTROL BOX (ATB)
8. PILOT'S SWITCH BOX (RU-19)
9. SPARE TUNING UNIT (ATB)
10. PILOT'S RECEIVER (ARB)
11. TRANSMITTER (ATB)
12. METERING UNIT (ATB)
13. SPARE TUNING UNITS (RU-19)
14. ANTENNA TRANSFER & CLOCK PANEL
15. RECEIVER (RU-19)
16. FREQUENCY METER (LM-10)
17. RADIO OPERATOR'S RECEIVER (ARB)
18. POWER BOX (AC)
19. OUTPUT METER (DW-1)
20. RADAR POWER RECEPTACLE
21. LOOP COUPLER UNIT
22. AZIMUTH SCALE & ROTATING MECHANISM
23. RADIO POWER BOX (DC)
24. SPARE TUNING UNITS (RU-19)
25. RADIO ALTIMETER POWER JCT. BOX
26. TRANSCEIVER (AN-APN-1)
27. RADIO OPERATOR'S KEY
28. RADIO OPERATOR'S CONT. BOX (ARB)
29. RADIO OPERATOR'S SWT. BOX (RU-19)
30. JUNCTION BOX (RU-19)
31. DYNAMOTOR (RU-19)
32. TRANSMITTER (GO-9)
33. DYNAMOTOR (ATB)

Figure 252—Radio Equipment

on the face of the panel. A spare fuse is held in the container marked "SPARE." High voltage D.C. is generated by a dynamotor in each receiver.

(b) REMOVAL.

1. RADIO OPERATOR'S RECEIVER (CRV46151).

a. Turn off power at D.C. power box at bulkhead 4.

b. Uncouple and withdraw the plug of cable to power junction box.

c. Uncouple and withdraw the plug of cable to control box.

d. Disconnect lines to antenna switching and clock panel, and to ground.

e. Release the two snap-slide fasteners at lower corners of front panel and pull receiver inboard to remove.

2. RADIO OPERATOR'S CONTROL BOX (CRV23254).

a. Turn off power at D.C. radio power box at bulkhead 4.

b. Uncouple and withdraw the plug of cable to radio operator's ARB receiver.

c. Detach four mounting screws, and remove.

3. PILOT'S RECEIVER (CRV46151).

a. Turn off power at D.C. radio power box at bulkhead 4.

b. Uncouple and withdraw the plug of cable to power junction box.

c. Uncouple and withdraw the plug of cable to control box.

d. Disconnect lines to ATB transmitter, and to ground.

e. Disconnect flexible mechanical cable to remote tuning head by unscrewing connector nut on face of panel.

f. Release the two snap-slide fasteners at lower corners of front panel, and pull receiver inboard to remove.

4. PILOT'S CONTROL BOX (CRV-23254).

a. Turn off power at D.C. radio power box at bulkhead 4.

b. Uncouple and withdraw the plug of cable to pilot's ARB receiver.

c. Detach four mounting screws, and remove.

5. PILOT'S REMOTE TUNING UNIT (CRV-23253).

a. Remove flexible mechanical cable to pilot's ARB receiver by unscrewing connector nut at bottom of panel.

b. Detach four mounting screws, washers, and nuts, and remove.

(c) MAINTENANCE.

1. RECEIVERS.—Major adjustment and repairs require equipment not available in the field and must be made at an authorized repair base. Receiver chassis may be removed from its case by rotating the two Dzus fastener screws on the rear of the case a quarter turn counterclockwie. The chassis and front panel may then be pulled inboard.

a. Remove connector plugs and blow out the receptacles with compressed air. Polish the contact pins with crocus cloth if discolored. Replace plugs if pins make poor connection with receptacle.

b. Clean ground wire terminals.

c. Replace deteriorated or badly sagging shock mounts.

2. DYNAMOTORS.—See paragraph *g*, (2), *(c)*.

(d) INSTALLATION.

1. RADIO OPERATOR'S RECEIVER.—Reverse removal procedure as outlined in paragraph *b*, (2), *(b)*, *1.*

2. RADIO OPERATOR'S CONTROL BOX.—Reverse removal procedure as outlined in paragraph *b*, (2), *(b)*, *2.*

3. PILOT'S RECEIVER.—Reverse removal procedure as outlined in paragraph *b*, (2), *(b)*, *3.*

4. PILOT'S CONTROL BOX.—Reverse removal procedure as outlined in paragraph *b*, (2), *(b)*, *4.*

5. PILOT'S REMOTE TUNING UNIT.

a. Install unit with four mounting screws, washers and nuts.

b. Before engaging the mechanical control cable in the tuning head, rotate the crank of the tuning head clockwise until the stop is reached.

c. Engage the cable at the tuning head and rotate the crank counterclockwise until the portion of the dial visible through the window is at the low-frequency end of its travel.

d. Disconnect flexible shaft from tuning head. Continue rotating the crank counterclockwise until the stop at the low frequency end of the dial is reached.

e. Re-engage the cable and fasten it to the tuning head by means of the connector nut.

(e) OPERATIONAL CHECK.—Refer to the PILOT'S HANDBOOK (AN 01-5MA-1).

c. LIAISON RADIO EQUIPMENT.

(1) TRANSMITTING EQUIPMENT.

(a) DESCRIPTION. *(See figure 252.)*—The GO-9 transmitter equipment is used by the radio operator for code operation only in conjunction with the RU-19 equipment for liaison communication. It consists of the following units:

One type CAY-52192 intermediate frequency transmitter.

One type CAY-52193 high frequency transmitter.

One type CAY-20103 rectifier unit.

One transmitter key.

The two transmitter units and the rectifier unit are joined together mechanically and electrically to form one assembly on the starboard side of the radio compartment slightly forward of bulkhead 3. The intermediate frequency unit is inboard, the rectifier in the middle, and the high frequency unit outboard in the assembly. The transmitter key is on the radio operator's table and connected by cable to the "KEY" jack in the rectifier unit. Each unit is individually mounted on Lord type shock mountings installed on the floor of the plane. Any unit may be removed separately for servicing and repairs.

The equipment, except the keying relay, operates from the 110 volt A.C. power supply to which it is connected by a flex cable between the rectifier unit and the power distribution box on the starboard side wall outboard of the set. The keying relay operates on 24-28 volts D.C., which is delivered to the relay through the same cable. The system is protected by two 10 ampere main fuses and one 10 ampere D.C. fuse inside the rectifier. Additional A.C. fusing ahead of the power distribution box is contained in the A.C. power panel on the forward face of bulkhead 4.

The intermediate frequency and high frequency transmitters are designed to operate on frequencies of 300-600 and 3000-18100 kilocycles respectively.

(b) REMOVAL.

1. TRANSMITTERS AND RECTIFIER UNIT.

a. Turn off the power by disconnecting "RADIO" plug at A.C. power box on the forward face of bulkhead 4.

b. Uncouple and withdraw the plug of cable to radio A.C.-D.C. junction box.

c. Withdraw all jack plugs from the front panel.

d. Disconnect the following lines: antenna leads, ground, lines to antenna switching and clock panel.

e. Turn locking knobs on front end of each mounting track counterclockwise, thus releasing the three units from mounts.

f. Pull intermediate frequency unit, rectifier unit, and high frequency unit aft, and slide out of Lord shock mount track assemblies.

2. TRANSMITTER KEY.

a. Remove "KEY" jack plug from rectifier unit.

b. Detach four screws from base of key and remove.

(c) MAINTENANCE.

1. Remove connector plug and blow out receptacle with compressed air. Polish contact pins with crocus cloth if discolored. Replace defective or weak tubes as required.

2. Check interlocks between units for tightness.

3. Lubricate every six months with a few drops of a penetrating oil (Specification AN-O-4) the following bearings: dial bearings, rotating coil bearings, variable capacitor bearings, switch bearings.

4. Maintenance involving the interior of the units should be attempted only at authorized repair bases.

(d) INSTALLATION.—Reverse removal procedure as outlined in paragraph *c,* (1), *(b).*

(e) OPERATIONAL CHECK.—Refer to the PILOT'S HANDBOOK (AN 01-5MA-1).

(2) RECEIVING EQUIPMENT.

(a) DESCRIPTION. *(See figure 252.)*—The RU-19 receiver equipment may be used by the pilot or radio operator for liaison reception. It is also used in conjunction with DW-1 loop to take unilateral or bilateral bearings. RU-19 equipment consists of the following units:

One type CW46048D receiver.

One type CW21441 dynamotor filter unit.

One type CW62017 junction box.

One type CW23012 remote tuning control.

Two type CW23087 receiver switch box.

One flexible remote tuning cable.

For use in the receiver there are nine interchangeable coil sets as follows:

One type CW47068, range D, 850-1330 KC.

One type CW47069, range E, 1330-2040 KC.

One type CW47072, range H, 4000-6000 KC.

One type CW47075, range K, 9050-13575 KC.

One type CW47105, range O, 195-290 KC.; range P, 290-435 KC.

One type CW47107, range Q, 540-830 KC.; range G, 3000-4525 KC.

One type CW47108, range Q, 540-830 KC.; range M, 5200-7700 KC.

One type CW47112, range L, 400-600 KC.; range N, 6000-9050 KC.

One type CW47204, range Q, 540-830 KC.; range F, 2040-3000 KC.

The receiver is the forward unit of the three units on the shelf above the radio operator's table. Forward, on the under side of the shelf, is the junction box. The radio operator's switch box is the forward

unit on the vertical section between the shelf and table. The pilot's switch box is on the forward face of bulkhead 2, above and starboard of the hatch. It is to the right of the ATB control box. The pilot's remote tuning unit is the upper of two similar units above the hatch on the port side of bulkhead 2. It is connected to the tuning dial of the receiver by a flexible mechanical cable. The dynamotor filter is the forward unit of the three units on the floor, next to the starboard side wall and outboard of the radio operator's table. Either the pilot's or radio operator's control switch may be connected to the set at the junction box, but not both at the same time.

The equipment operates from the 28 volt D.C. power supply to which it is connected by a cable between the D.C. radio power box, on the forward face of bulkhead 4, and the junction box. It is protected by a 20 ampere cartridge fuse on the face of the junction box. Two spare fuses are also mounted on the face of the box.

By use of the interchangeable coil sets, the receiver has an operating range of 195-13575 kilocycles. Only one coil set can be used in the receiver at a time. Either continuous wave (cw) or modulated continuous wave (mcw) signals can be received.

(b) REMOVAL.

1. RECEIVER.

a. Turn power off at D.C. radio power box at bulkhead 4.

b. Uncouple and withdraw the plug of cable to RU-19 junction box.

c. Remove mechanical flex cable to pilot's tuning head by unscrewing connector nut.

d. Disconnect the lines to DW-1 coupler unit, to antennae, and to ground.

e. Release the snap-slide fasteners at corners of panel and pull receiver inboard to remove.

2. JUNCTION BOX.

a. Turn power off at D.C. radio power box at bulkhead 4.

b. Uncouple and withdraw the plugs of cables to RU-19 receiver, to pilot's RU-19 switch box, to RU-19 dynamotor filter, to radio operator's RU-19 switch box, and to D.C. junction box.

c. Release the snap-slide fasteners at corners and slide junction box off mount.

3. DYNAMOTOR FILTER.—See paragraph *g*, (4), *(b)*.

4. SWITCH BOXES.

a. Turn power off at D.C. radio power box at bulkhead 4.

b. Uncouple and withdraw plug of cable to RU-19 junction box.

c. Detach four mounting screws, and remove.

5. REMOTE TUNING CONTROL.

a. Remove mechanical flex cable to RU-19 receiver by unscrewing connector nut.

b. Detach four mounting screws, and remove.

(c) MAINTENANCE.

1. Remove connector plugs and blow out receptacles with compressed air.

2. Polish contact pins with crocus cloth if discolored.

3. Test the tubes. Replace weak or defective tubes.

4. Replace deteriorated or badly sagging shock mounts.

5. If radio receiver is operating satisfactorily with dynamotor noise at a suitable low level, the dynamotor unit should be left alone. For maintenance of components of dynamotor see paragraph *g*, (2), *(c)*.

6. See that the proper coil set is in the receiver.

7. Do not operate RU-19 equipment outside the limit of 23 and 30 volts.

(d) INSTALLATION.

1. RECEIVER.—Reverse removal procedure as outlined in paragraph *c*, (2), *(b)*, *1.*

2. JUNCTION BOX.—Reverse removal procedure as outlined in paragraph *c*, (2), *(b)*, *2.*

3. DYNAMOTOR FILTER.—See paragraph *g*, (4), *(d)*.

4. SWITCH BOXES.—Reverse removal procedure as outlined in paragraph *c*, (2), *(b)*, *4.*

5. REMOTE TUNING CONTROL.

a. Install by attaching four mounting screws.

b. Before attaching mechanical flex cable from RU-19 receiver, rotate the dial on the tuning head until its reading coincides with the reading on the dial of the receiver. Then attach cable by fastening connector nut.

(e) OPERATIONAL CHECK.—Refer to the PILOT'S HANDBOOK (AN 01-5MA-1).

(3) FREQUENCY INDICATING EQUIPMENT.

(a) DESCRIPTION. *(See figure 252.)*—The Model LM-10 frequency meter is used to calibrate the frequencies of the following equipment:

ATB transmitter.
ARB receivers.
GO-19 transmitter.
RU-19 receiver.

The unit is crystal calibrated and adapted for adjusting adjacent radio transmitters and receivers to any desired frequency in the range from 125 to 20,000 kilocycles. The frequency meter is mounted on shock

mounts on the shelf above the radio operator's table, being the middle unit of the three on the shelf. A cable connects it to the interphone main junction box from which it receives both its 28 volt and high voltage current. A short antenna wire connects the "RF" terminal of the meter to the "LM" terminal of the antenna switching and clock panel. From this terminal it may be coupled to any of the sets to be calibrated.

(b) REMOVAL.

1. Turn off power at D.C. radio power box at bulkhead 4.

2. Uncouple and withdraw the power cable on lower right-hand side of meter.

3. Disconnect line to antenna switching and clock panel.

4. Pull the two locking tabs all the way out, thereby releasing meter from mounting. Lift meter upward and remove.

(c) MAINTENANCE.

1. Test the tubes and replace if weak or defective.

2. Replace deteriorated or badly sagging shock mounts.

3. Polish plug contact pins with crocus cloth and blow out receptacle with compressed air.

4. Do not lubricate any part of equipment.

5. If major repairs, replacements, or adjustments are necessary, return the meter to an authorized repair base.

(d) INSTALLATION.

1. With locking tabs all the way out, place meter on mounting studs. Push tabs all the way back.

2. Test each anchorage separately by pulling up.

3. Set the power, crystal, and modulation switches to the "OFF" position. Insert the plug of the power cable in the power input receptacle and tighten coupling.

(e) OPERATIONAL CHECK.—Refer to the PILOT'S HANDBOOK (AN 01-5MA-1).

d. INTERPHONE SYSTEM (RL-24C).

(1) DESCRIPTION. *(See figure 253.)*—The interphones are used as a system of communication between the members of the crew. By means of the control boxes and plug connections, the interphone system can be connected to the ARB receivers, RU-19 receiver, ATB transmitter, and DW-1 direction finder. The pilot, copilot, radio operator, and navigator can talk or listen through the interphones on some of the above equipment. Connections are such that none of them have access to all the equipment. None of the other crew members can talk or listen outside of the interphone system. The system consists of the following parts:

One pilot's control box.
One radio operator's control box and amplifier.
One pilot's station box.
One copilot's station box.
One radio operator's station box.
One navigator's station box.
One bombardier's station box.
One engineer's station box.
One radar operator's station box.
One starboard gunner's station box.
One port gunner's station box.
Two (starboard and port) gunner's extensions.
One tunnel gunner's station box.
One main junction box.
One interphone distribution box.
One dynamotor.
Nine headsets.
Nine microphones.
Connecting cables and wires.

The pilot's control box is located on top of the pilot's switch panel. The radio operator's control box and amplifier is mounted on a shelf of its own above the shelf of the radio operator's table, just aft of the antenna switching and clock panel unit. The main junction box is located just aft of bulkhead 3, on the ceiling approximately above the trailing antenna reel. The interphone distribution box is located aft of and below radio operator's table. The dynamotor is mounted on the floor below the forward edge of the radio operator's table. (For location of other units, see figure 253.)

(2) REMOVAL.

(a) PILOT'S CONTROL BOX.

1. Turn off power at D.C. radio power box at bulkhead 4.

2. Unscrew knurled connector nuts and withdraw plugs.

3. Detach four screws holding box to mounting base and remove.

(b) RADIO OPERATOR'S CONTROL BOX AND AMPLIFIER.

1. Turn off power at D.C. radio power box at bulkhead 4.

2. Unscrew knurled connector nuts and withdraw all plugs from ends of box.

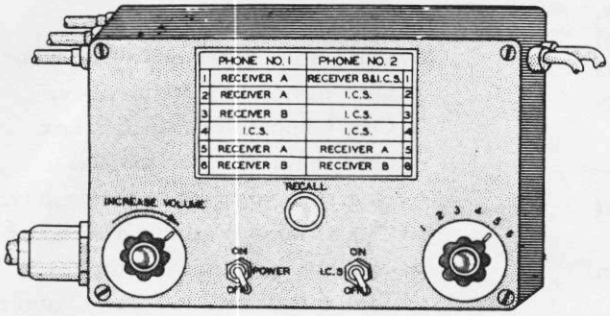
3. Pull all jack plugs.

4. Release the snap-slide fasteners at the corners of the mounting base and lift box off mounts.

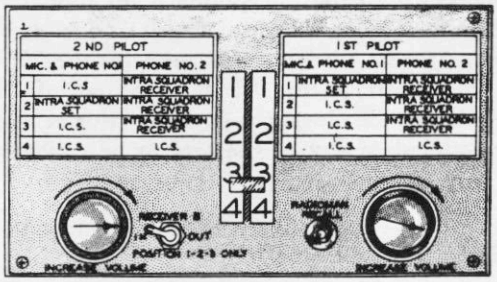
(c) STATION BOXES.

1. Turn off power at D.C. radio power box at bulkhead 4.

2. Unscrew knurled connector nuts and withdraw plugs. Remove jack plugs.



RADIOMAN'S INTERPHONE CONTROL BOX



PILOT'S INTERPHONE CONTROL BOX

(10) (12) (17) (1) (2) (13) (14) (22) (3)

STATION BOXES

1. WAIST GUNNER S' INTERPHONE BOXES
2. ENGINEER'S INTERPHONE BOX
3. NAVIGATOR'S INTERPHONE BOX
4. NAVIGATOR'S TABLE
5. CABLES TO RADIO EQUIPMENT
6. RADIO MAN'S INTERPHONE CONTROL BOX
7. POWER CABLE TO L.M.-10 FREQUENCY METER
8. POWER CABLE TO Z.A. EQUIPMENT
9. PILOT'S SWITCH PANEL
10. PILOT'S INTERPHONE BOX
11. PILOT'S INTERPHONE CONTROL BOX
12. COPILOT'S INTERPHONE BOX
13. BOMBER'S INTERPHONE BOX
14. RADAR OPERATOR'S INTERPHONE BOX
15. JUNCTION BOX
16. DYNAMOTOR
17. RADIOMAN'S INTERPHONE BOX
18. RADIO TABLE
19. JUNCTION BOX
20. D.C. POWER BOX
21. WAIST GUNNER S' JACK BOXES
22. TUNNEL GUNNER'S INTERPHONE BOX

Figure 253—Interphone Equipment

3. Detach four mounting screws on face of box. Remove box.

(d) MAIN JUNCTION BOX AND INTERPHONE DISTRIBUTION BOX.

1. Turn off power at D.C. radio power box at bulkhead 4.

2. Uncouple and withdraw connector plugs.

3. Detach four mounting screws on face of box. Remove box.

(e) DYNAMOTOR.—See paragraph *g*, (5), *(b)*.

(3) MAINTENANCE.

(a) PILOT'S CONTROL BOX.

1. Remove and check tube; replace if defective.

2. Replace volume control if noisy.

3. Remove connector plugs and blow out the receptacles with compressed air.

4. Polish contact pins with crocus cloth if discolored.

5. Replace plugs if pins make poor connection with receptacle.

(b) RADIO OPERATOR'S CONTROL BOX AND AMPLIFIER.

1. Remove the connector plugs and blow out receptacles with compressed air.

2. Polish contact pins with crocus cloth if discolored.

3. Replace plugs if pins make poor connection with receptacle. Tighten connector nuts.

4. Lubricate moving parts of gang switch S203 with a few drops of light oil (Specification AN-O-4).

5. Test switches for operation.

6. Renew signal light (I 101) and fuse (F 102) if necessary.

7. Check vacuum tubes; replace if defective.

8. Replace deteriorated or badly sagging shock mounts.

(c) STATION BOXES.

1. Replace volume control if noisy.

2. Remove connector plug and blow out receptacle with compressed air.

3. Polish contact pins with crocus cloth if discolored.

4. Replace plugs if pins make poor connection with receptacle.

(d) MAIN JUNCTION BOX.

1. Replace burned out fuses. Polish fuse contacts with crocus cloth.

2. Clean relay contacts with fine crocus cloth or a burnishing tool.

3. Remove the connector plugs and blow out receptacles with compressed air.

4. Polish the contact pins with crocus cloth if discolored.

5. Replace plugs if pins make poor connection with receptacles.

(e) INTERPHONE DISTRIBUTION BOX.

1. Resolder loose connections.

2. Replace wires with frayed insulation.

(f) DYNAMOTOR.—See paragraph *g*, (2), *(c)*.

(4) INSTALLATION.—Reverse removal procedure as outlined in paragraphs *d*, (2), *(a)* through *d*, (2), *(e)*.

(5) OPERATIONAL CHECK.—Refer to the PILOT'S HANDBOOK (AN 01-5MA-1).

e. NAVIGATIONAL EQUIPMENT.

(1) DW-1 LOOP DIRECTION FINDING EQUIPMENT.

(a) DESCRIPTION. *(See figure 252.)*—The DW-1 equipment is used by the navigator in conjunction with the radio operator's RU-19 receiver to take unilateral or bilateral bearings. By its use he can determine the bearing of the plane with reference to the station originating the received signal, or set and keep the course of the plane in the direction of the transmitting station. The equipment consists of the following units:

One type CRR50052 coupler unit.
One type CRR50062 mounting base.
One type CRR50053 loop.
One type CRR69027 azimuth scale and rotating mechanism.
One output meter.

The coupler unit is shock mounted on a bracket attached to the ceiling, on center line of airplane, just aft of beltframe 3.66.

Above the coupler unit are the azimuth scale and rotating mechanism. A shaft, connected at its lower end with the coupler unit, projects perpendicularly up through the top center line of the hull. Its upper end is connected to the loop antenna which is mounted on the leading edge of the wing center section. A hand wheel, clamped to the shaft just above the coupler unit, permits shaft and loop to be rotated. The transmission lines run through the interior of the shaft from loop to coupler unit. The output meter is installed on the starboard side of the coupler unit on a bracket attached to the coupler unit's mounting bracket.

The coupler unit is connected by a flex cable to the RU-19 junction box from which the system derives its D.C. power. Another cable connects, through the output meter, with the antenna terminal of the radio operator's RU-19 receiver. The lead-in of the sense antenna is connected to the "A" terminal of the coupler unit when fixed antenna reception is required.

(b) REMOVAL.

1. COUPLER UNIT.

a. Turn off power at D.C. radio power box at bulkhead 4.

b. Disconnect the ground braid, loop antenna leads, and sense antenna lead wire.

c. Uncouple and withdraw power cable plug, and cable plug to RU-19 receiver.

d. Remove loop antenna and upper rotating shaft from unit. (See paragraph *h*, (4), *(b)*.)

e. Release snap-slide fasteners and pull unit forward to remove from shock mount base.

2. OUTPUT METER.

a. Uncouple and withdraw cable plugs.

b. Detach screws from clamp on bracket.

c. Remove output meter from bracket.

(c) MAINTENANCE.

1. Check tightness of all fasteners and attaching screws.

2. Clean out connector plug receptacles with compressed air. Polish contact pins with crocus cloth if discolored. Replace plugs if pins make poor contact.

3. Test vacuum tubes; replace if weak or defective.

4. See that the loop tuning dial rotates freely, and test the action of its lock screw.

5. The clicker mechanisms of the selector and frequency band switches in the coupler unit should be lubricated with petrolatum or hard grease (Specification AN-P-51-1) when they become unduly stiff in action. No other parts of this equipment require lubrication.

Note

The azimuth scale bearing is packed with sufficient "ESSO PD403A" grease for the life of the equipment.

(d) INSTALLATION.—Reverse removal procedure as outlined in paragraph *e*, (1), *(b)*.

(e) OPERATIONAL CHECK.—Refer to the PILOT'S HANDBOOK (AN 01-5MA-1).

(2) RADIO ALTIMETER. — AN/ARN-1 or AN/APN-1.

Note

Radio altimeter equipment is installed in PBY-5A airplanes with serial numbers 48352 and on (See introduction to this MANUAL.) It is not installed in PBY-5 airplanes nor in PBY-5A's up to serial number 48352.

(a) DESCRIPTION. *(See figure 252.)*—The radio altimeter equipment provides direct indication of altitude relative to the terrain during flights at altitudes up to 4000 feet. The components of the system include a transmitter, receiver unit, transmitter antenna, receiver antenna, altitude indicator, altitude limit indicator lights, and an altitude limit switch.

The transmitter-receiver unit contains all the transmitting and receiving apparatus of the radio-altimeter equipment. All connections to the power supply, antennae control switches, and indicating instruments are made by means of electric cables which are plugged into the front panel of the unit. Operation of the unit is controlled by a master switch on the main distribution panel and the power switch on the indicator on the pilot's instrument panel.

The unit is protected from vibration by being mounted on a shock absorbing assembly which is located just above the hull bottom structure just aft of bulkhead 4 on the port side of the airplane.

The transmitter and receiver antennae used on this equipment are identical and interchangeable. Therefore, it makes no difference which antenna is used with the transmitter or receiver provided there is no interference with other radio equipment. The antennae are located on the lower surface of the wings between the wing strut about four feet outboard of the engine nacelles. They are described in paragraph *h*, (6).

The altitude indicator, which is located on the pilot's instrument panel on the copilot's side, is calibrated for two ranges: 0 to 400 feet, and 400 to 4000 feet on PBY-5A airplanes with serial numbers 46588 and on. On the earlier PBY-5A airplanes, the indicator was provided with only one range (0 to 400 ft.). The range selector switch is located at the upper right of the indicator dial rim. A power switch, controlling the battery input to the transmitter-receiver unit and altitude limit indicator, is located at the lower left of the indicator dial rim.

The altitude limit switch, which is located on the pilot's instrument panel forward of the copilot's seat, is graduated from 50 to 300 in increments of 25. Each unit represents one foot of altitude when the altimeter indicator is set for the narrow range, and 10 feet when the indicator is set for the broad range.

The altitude limit indicator lights are mounted on the pilot's instrument panel forward of the pilot's seat.

(b) REMOVAL.

1. TRANSMITTER-RECEIVER UNIT.

a. Turn "COMPASSES" switch (on main distribution panel) to "OFF."

b. Uncouple and withdraw the following plugs from the front panel of the transmitter-receiver unit:

(1) Transmitter antenna.

(2) Receiver antenna.

(3) Limit switch.

(4) Limit switch indicator.

(5) Indicator.

(6) Battery input.

c. Release the two snap fasteners on the front panel.

d. Pull the unit aft and remove from the rack.

2. LIMIT SWITCH.

a. Turn "COMPASSES" switch (on main distribution panel) to "OFF."

b. Uncouple and withdraw the electrical plug in the rear.

c. Remove the four mounting screws and remove the instrument from the back of the panel.

(c) MAINTENANCE.

1. TRANSMITTER-RECEIVER UNIT.

a. Clean out the connector plug receptacles with compressed air. Polish the contact pins of the plugs with crocus cloth. Replace plugs if pins make poor connection with the receptacle. Tighten coupling nuts.

b. Replace deteriorated or badly sagging shock mounts.

c. Remove the dust cover and inspect for mechanical damage, loose wires, bolts, etc. The dust cover is removed by unscrewing the two knurled thumbscrews on the front panel.

d. Check dynamotors for lubrication. Instructions for lubricating the dynamotor are on a nameplate attached to its frame.

e. Check fuses. Check for spare fuse. The fuses are located at the lower right-hand corner of the front panel of the transmitter-receiver unit. If necessary to make any substitution for the fuses (type 4 AG Littlefuse) which are supplied with the equipment and spare parts, use "slow-blowing" fuses of the same current capacity. If not available, substitute fuses of the next higher current rating for TEMPORARY EMERGENCY USE ONLY.

2. INDICATOR LIGHTS.—Unscrew the jewel lens from the red, white, and green altitude limit indicator lights. Withdraw the bulbs and test them on 24 volts. If they are burned out or blackened on the inside from long use, replace them.

3. LIMIT SWITCH.

a. Clean connector plug pins with crocus cloth and blow out the receptacle with compressed air.

b. Tighten mounting screws if necessary.

(d) INSTALLATION.

1. TRANSMITTER-RECEIVER UNIT.

a. Place the unit on the mounting rack and slide back in position.

b. Fasten the two slide locks.

c. Connect the following plugs at the front panel:

(1) Transmitter antenna.

(2) Receiver antenna.

(3) Limit switch.

(4) Limit switch indicator.

(5) Indicator.

(6) Battery input.

2. LIMIT SWITCH.

a. Place the instrument in the opening provided for it in the instrument panel. Tighten the four mounting screws.

b. Insert the electrical connector plug in the rear of the instrument and tighten the coupling ring.

(e) OPERATIONAL CHECK.—Refer to the PILOT'S HANDBOOK (AN 01-5MA-1). For further information see HANDBOOK OF OPERATING INSTRUCTIONS (AN-08-10-186).

f. RADAR EQUIPMENT.

(1) ABK RADAR.

Note

ABK equipment is installed on PBY-5 airplanes and on PBY-5A airplanes up to serial number 48252.

(a) COMPONENTS.—The component parts and their locations are as follows:

1. RECEIVER; located on the starboard side of tail gunner's compartment between station 7 and 7.25.

2. CONTROL UNIT; located on mounting base above radio operator's table.

3. PILOT'S CONTROL UNIT; located on pilot's control panel, copilot's side.

4. ANTENNA; located at top of vertical fin. (See paragraph *h*, (8).)

(b) DESCRIPTION, REMOVAL, MAINTENANCE, INSTALLATION AND OPERATION.—A detailed description of this radar equipment and instructions for its removal, maintenance, installation, and operation can be found in the HANDBOOK OF MAINTENANCE INSTRUCTIONS FOR MODEL ABK AIRCRAFT RADAR EQUIPMENT (BuAer publication).

(2) ASB RADAR.

Note

ASB equipment is installed only on PBY-5A airplanes with serial numbers 48252 through 46599. (See Introduction to this MANUAL.)

(a) COMPONENTS.—The component parts and their locations are as follows:

1. RECEIVER (CAY 4-6AAM); located on shock mounts on radar operator's table.

2. REMOTE CONTROL INDICATOR (CJP 55AAZ); located on shock mounts on radar operator's table aft of receiver.

3. AMPLIFIER (CPR 50 ABZ); located on shock mounts on top of receiver.

4. TRANSMITTER (CAY 52ARR); located on its base under radar operator's table.

5. ANTENNA SWITCHING UNIT (CJP 14 AAC); located on base between stations 2.5 and 3.

6. RECTIFIER POWER UNIT (CJP 20ABB); located on shock mounts on its base aft of radar operator's table between stations 2.5 and 3.

7. OPERATOR'S CONTROL BOX (CJP 23 ABM); located on bracket at station 2.5 on starboard side.

8. HYDRAULIC EXACTORS (ANACOSTIA 59316); mounted on a bracket on bulkhead 2 on the aft and starboard side.

9. PILOT'S CONTROL BOX (CPR-23-ACY); located on bracket above pilot's head at center line of the plane.

10. REMOTE CONTROL INDICATOR (CPR-55ACT); located on bracket supports above pilot's instrument panel in front of pilot or copilot.

11. ANTENNAE; located on both sides of hull near station 2.5. (See paragraph *h*, (9).)

(b) DESCRIPTION, REMOVAL, MAINTENANCE, INSTALLATION AND OPERATION.—A detailed description of this radar equipment and instructions for its removal, maintenance, installation, and operation can be found in the HANDBOOK OF MAINTENANCE INSTRUCTIONS FOR MODEL ASB AIRCRAFT RADAR EQUIPMENT (Co-Nav-Aer 08-5S-27).

(3) IFF EQUIPMENT (AN/APX-2).

Note

AN/APX-2 equipment is installed on PBY-5A airplanes with serial numbers 48252 and on. (This equipment is to be installed by service action.)

(a) COMPONENTS.—The component parts and their locations are as follows:

1. RECEIVER-TRANSMITTER UNIT (RT-24/APX-2); located in the radioman's compartment on the port side of the airplane on a rack under the navigator's table between stations 2.5 and 3.

2. RADAR OPERATOR'S CONTROL UNIT (C-56/APX-2); located on the aft face of bulkhead 2 on the starboard side of the doorway.

3. COPILOT'S CONTROL UNIT (C-57/APX-2); located on the starboard wall forward of station 1.66 under the window.

4. IMPACT SWITCH (SA-3/A); located near the trailing antenna fair-lead tube aft of station 3 on starboard side.

5. ANTENNAE (TYPE AS-32/APX-1); two whip antennae are used. They are located on the top of each side of the wing center section outboard of the nacelles. See paragraph *h*, (5).

(b) DESCRIPTION, REMOVAL, MAINTENANCE, INSTALLATION, AND OPERATION.—A detailed description of the radar equipment and instructions for its removal, maintenance, installation, and operation can be found in the HANDBOOK OF MAINTENANCE INSTRUCTIONS FOR MODEL AN/APX-2 AIRCRAFT IFF EQUIPMENT (CO AN-08-20-12).

g. DYNAMOTORS.

(1) GENERAL. *(See figure 252.)*—The following dynamotors are used to convert the 28 D.C. volt system into the high voltage required for the communication system:

One CRV21724 dynamotor for ATB transmitter.

Two ARB-D101 dynamotors for ARB receivers.

One CW21441 dynamotor filter for RU-19 receiver.

One RL-24C-0-801 dynamotor for the interphone system.

The CRV21724 dynamotor is located on the floor, starboard side, slightly forward of bulkhead 3. The two ARB-D101 dynamotors are contained within the two ARB receiver units. The CW21441 dynamotor is on the floor beneath the radio operator's table just aft of the forward edge of the table. The RL-24C dynamotor is located just forward of the CW21441 dynamotor beneath the radio operator's table.

(2) CRV21724 DYNAMOTOR.

(a) DESCRIPTION.—This unit is an assembly consisting of dynamotor and junction box. The box is fastened to the top of the dynamotor and contains most of the components of the voltage control and protective systems as well as the three receptacles for plugs. The unit requires a 28 volt D.C. input to give a maximum output of 150 volts D.C.

(b) REMOVAL.

1. Turn off power at D.C. radio power box at bulkhead 4.

2. Uncouple and withdraw the three right-hand plugs from the front of attached junction box.

3. Disengage four snap-slide fasteners at the base of unit and lift dynamotor off shock mounting.

4. Disassemble dynamotor as follows:

a. Remove from sub-base and junction box by detaching bolts and screws.

b. Remove end bells by detaching safety wire and five screws.

c. Remove brushes by unscrewing brush caps.

d. Further disassembly should only be attempted at an authorized repair base.

(c) MAINTENANCE.—The following information will hold good for all dynamotors dealt with in paragraph *g*.

1. The dynamotor draws considerable current from the power source when operating under full load, and therefore it is quite probable that the contacts of the relays will require cleaning more often than any other relays in the equipment.

2. The brushes are subject to wear and must be examined occasionally, especially if the dynamotor fails to start. If considerable wear is noted, brushes should be replaced. High and low voltage brushes are of different sizes; and brushes are marked "+" or "—" according to polarity. They must be replaced in their correct brush holders.

3. Commutators should be checked periodically to prevent grease, dirt, or copper dust from accumulating in the slots between the bars and possibly short circuiting segments of the armature. Blow compressed air on slots and clean with a cloth moistened with carbon tetrachloride.

4. If roughness develops on commutator, it may be smoothed by holding No. 000 sandpaper lightly against it with the motor running.

CAUTION

Never use emery paper as the metallic particles may gather in the slots between the bars and short the armature.

Always clean slots after sanding. A chocolate brown color on commutators is a sign of good contact, and should not be polished off.

5. Receptacles should be kept sealed or covered when unit is removed so that foreign matter does not collect in them.

6. Rubber shock mounts should be visually inspected and replaced if deteriorated.

7. Where fuses are employed, they must be inspected, and replaced if necessary.

8. If contact pins are badly discolored or corroded, polish with crocus cloth. Blow out dust and particles of foreign matter with dry, compressed air.

9. Dynamotors are pre-lubricated at the factory for 600 to 1000 hours of service. Inspection, however, every 100 to 120 hours is recommended for bearings. To lubricate, remove end covers from unit and insert sufficient grease (5-58 grease made by New York and New Jersey Lubricant Co. of New York City, or Andok C grease made by Standard Oil Co. of New Jersey, or equal) to cover ball retainers. After approximately 1000 hours or one year of service, disassemble, clean and lubricate bearings. DO NOT PACK HARD.

WARNING

Under normal conditions, the positive output circuits of these dynamotors is at a very high potential, and extreme care must be exercised in measuring voltages so that no personal injury will result.

(d) INSTALLATION.—Reassemble by reversing disassembly procedure. Then install on mount by reversing removal procedure as outlined in paragraph *g*, (2), *(b)*.

(e) OPERATIONAL CHECK.—After installation of dynamotor, operational check may be accomplished by operating the ATB equipment in accordance with instructions in the PILOT'S HANDBOOK (AN 01-5MA-1).

(3) ARB-D101 DYNAMOTORS.

(a) DESCRIPTION.—These dynamotors are contained within the chassis of the receiver units, bolted and electrically connected on the interior. Power receptacle is on the outside panel of receiver case. The dynamotor is designed to operate on an input of 28 volts D.C. and give a maximum output of 225 volts D.C.

(b) REMOVAL.

1. Remove receivers (CRV46151) as outlined in paragraph *b*, (2), *(b)*, *1*.

2. Remove receiver chassis from case by turning the two Dzus fasteners, located on the rear of case, one quarter turn counterclockwise. Pull front panel inboard.

3. Remove dynamotors from bottom of receiver chassis by detaching electrical connections and mounting screws.

4. Disassemble dynamotor as follows:

a. Remove end bells by cutting safety wire and detaching screws.

b. Unscrew the bearing end plates.

c. Remove brushes from their cartridges.

d. Detach nuts from the tie rods which hold the bearing end bells, and pull end bells away from the field coil assembly. Remove the armature.

(c) MAINTENANCE.—For maintenance of relays, brushes, commutators, receptacles, etc., and lubrication of unit, refer to paragraph *g*, (2), *(c)*.

(d) INSTALLATION.—Reassemble by reversing disassembly procedure. Then install in receiver unit and install receiver unit on shock mount bracket by reversing removal procedure as outlined in paragraph *g*, (3), *(b)*.

(e) OPERATIONAL CHECK.—After installation of dynamotors in receiver units, operational check may be accomplished by operating the ARB equipment in accordance with instructions in the PILOT'S HANDBOOK (AN 01-5MA-1).

(4) CW21441 DYNAMOTOR FILTER.

(a) DESCRIPTION.—This unit is mounted on a shock mount bracket beneath the radio operator's table just aft of the forward edge of the table. It is connected with the *RU-19 junction box* (CW62017) by a straight plug and power cable. The input current is 28 volts D.C. Its output yields a maximum of 275 volts D.C.

(b) REMOVAL.

1. Turn power off at D. C. radio power box at bulkhead 4.

2. Uncouple and withdraw plug of cable to RU-19 junction box.

3. Release the snap-slide fasteners at corners and pull dynamotor inboard to remove.

4. Disassemble as follows:

a. Remove end bells by cutting safety wire and detaching screws.

b. Remove brushes by unscrewing brush cap.

(c) MAINTENANCE. — For maintenance of brushes, commutators, receptacle, etc., and for lubrication of unit, refer to paragraph *g*, (2), *(c)*.

"Dynamotor noise" is sometimes due to a break in the shielding of one of the cables. If "audio noise" is loud, make certain brushes make good contact with commutator. If noise persists, disconnect the brushes and field coil and check each coil winding of armature with an ohmmeter. Variation in the resistance of coils indicates an open circuit, a short circuit, or a partial short circuit, in which case the armature must be replaced.

(d) INSTALLATION.—Reassemble by reversing disassembly procedure. Then install on shock mount bracket by reversing removal procedure as outlined in paragraph *g*, (4), *(b)*.

(e) OPERATIONAL CHECK.—After installation of dynamotor, operational check may be accomplished in accordance with instructions in the PILOT'S HANDBOOK (AN 01-5MA-1).

(5) RL-24C-0-801 DYNAMOTOR.

(a) DESCRIPTION.—This unit is a two pole totally enclosed machine equipped with grease lubricated ball bearings. The armature carries two windings, insulated from the core and from each other. Each winding is connected to a commutator. The ratio between input and output voltage is fixed. With an input of 28 volts, 3.1 amperes, the output is 350 volts and 170 milliamperes D.C. It is connected by a straight plug and power cable to the interphone amplifier and control box unit. The dynamotor is installed on a shock mount on the floor beneath the radio operator's table just forward of the CW21441 dynamotor.

(b) REMOVAL.

1. Turn power off at D.C. radio power box at bulkhead 4.

2. Uncouple and withdraw plug of cable to interphone amplifier and control box unit.

3. Loosen the four snap-slide fasteners at the corners and remove dynamotor.

4. Disassemble as follows:

a. Remove end bells by cutting safety wire and detaching two fillister head screws in each end.

b. Withdraw cotter pins and unscrew the brush screw plugs.

c. Unscrew grease plugs to bearings.

(c) MAINTENANCE.—For maintenance of brushes, commutators, receptacle, etc., and for lubrication of unit, refer to paragraph *g*, (2), *(c)*.

For replacement of field coils, armature, and filter components, refer to Instruction Book for Type RL-24-C Aircraft Interphone Equipment (BuAer. publication).

(d) INSTALLATION.—Reassemble by reversing disassembly procedure. Then install on shock mount bracket by reversing removal procedure as outlined in paragraph *g*, (5), *(b)*.

(e) OPERATIONAL CHECK.—After installation of dynamotor, operational check may be accomplished in accordance with instructions in the PILOT'S HANDBOOK (AN 01-5MA-1).

h. ANTENNAE. *(See figure 254.)*—The PBY-5A and PBY-5 airplanes are all equipped with the following antennae, except as noted:

Liaison antenna.

Command antenna.

Sense antenna.

Compass Loop antenna.

Radio Altimeter antennae (on PBY-5A airplanes only with serial numbers 48352 and on).

Trailing antenna.

ABK antenna (on PBY-5's and PBY-5A's with serial numbers up to 48252).

ASB antennae (on PBY-5A's with serial numbers 48252 through 46599).

IFF antennae (on PBY-5A's with serial numbers 48252 and on).

(1) LIAISON ANTENNA.

(a) DESCRIPTION. *(See figure 254.)*—The liaison antenna is rigged on the airplane in the form of a "V." It extends from a mast on the surface of the wing near the wing tip starboard side, aft through an insulator attached to the leading edge of the upper fin, then forward to a mast on the port side of the wing, the mast being similar to the one near the starboard wing tip. On the starboard side about opposite hull station 7.5, a wire goes down to the lead-in insulator which is located 3⅞ inches forward of station 3. As this wire passes between the wing and the wing strut, it is braced by a guy line which is fastened to the antenna wire by means of an insulator. The guy line is fastened to the side of the hull above the junction of hull and rear strut by a hook installed in the hull skin.

(b) REMOVAL.

1. Disconnect terminal (53) at lead-in insulator (54) by detaching brass nut (52) and washer.

2. Detach terminal (50) on guy line from hook (51) in hull above rear strut junction.

3. Remove safety wire and drilled head bolt (34) which hold shackle (35) on mast (36) at wing ends (starboard and port).

4. At upper fin detach safety cable (14) and link (12) from hook (11).

5. Handle antenna carefully to avoid forming kinks. Roll up for stowage.

(c) MAINTENANCE.

1. Clean the antenna and lead-in insulator before each flight with a cloth moistened with clean unleaded gasoline to remove all traces of oil or dirt. If insulators are cracked or chipped, replace them.

2. Keep terminal at lead-in tightened. If terminal is badly discolored or corroded, polish with crocus cloth.

3. A tension of 20 lbs. should be maintained on the antenna.

4. If antenna is frayed, worn, or shows corroded spots, replace it. In any case, replace antenna after 180 to 200 hours of service.

(d) INSTALLATION.

1. Before installation, thoroughly saturate antenna with Paralketone (Specification AN-C-52, type 2, grade B). Wipe off excess with dry cloth.

2. Reverse removal procedure as outlined in paragraph *h*, (1), *(b)* to install antenna.

(2) COMMAND ANTENNA.

(a) DESCRIPTION. *(See figure 254.)*—The command or "voice" antenna extends from a hook in the leading edge of the wing starboard side four and one-quarter inches inboard of station 14, down to a lead-in insulator on the starboard side of the hull, four and one-quarter inches forward of hull station 2.5.

(b) REMOVAL.
(See figure 254.)

1. Disconnect terminal (56) at lead-in insulator (58) by detaching brass nut (55) and lockwasher.

2. Detach link (12) and safety cable (15) from hook (11) on leading edge of wing.

3. Handle antenna carefully to avoid forming kinks. Roll up for stowage.

(c) MAINTENANCE.—See paragraph *h*, (1), *(c)*.

(d) INSTALLATION.

1. Before installation, thoroughly saturate antenna with Paralketone (Specification AN-C-52, type 2, grade B). Wipe off excess with dry cloth.

2. Reverse removal procedure as outlined in paragraph *h*, (2), *(b)* to install antenna.

(3) SENSE ANTENNA.

(a) DESCRIPTION.—The sense antenna extends from a hook in the leading edge of the upper vertical fin forward to a mast located on the wing center section leading edge slightly to starboard of the center line of the airplane and then down to a lead-in insulator on the deck, three inches aft of bulkhead 3 and 23¼ inches to starboard of the center line of the airplane.

(b) REMOVAL.
(See figure 254.)

1. Disconnect terminal (57) at lead-in insulator (59) by detaching brass nut and lockwasher.

2. Remove antenna (2) from mast (40) by detaching eyebolt (39) from shackle (38).

3. Remove link (13) and safety cable (16) from hook (11) in fin leading edge.

4. Handle antenna carefully to avoid forming kinks. Roll up for stowage.

(c) MAINTENANCE.—See paragraph *h*, (1), *(c)*.

(d) INSTALLATION.

1. Before installation, thoroughly saturate antenna with Paralketone (Specification AN-C-52, type 2, Grade B).

2. Reverse removal procedure as outlined in paragraph *h*, (3), *(b)* to install antenna.

(4) LOOP ANTENNA.

(a) DESCRIPTION. *(See figure 254.)*—The direction finding loop antenna is a ring shaped assembly. It is mounted on the wing leading edge at the center line of the airplane. The loop is connected mechanically by a shaft to the coupler unit inside the hull so that it can be rotated by means of a hand wheel clamped to the shaft above the coupler unit.

(b) REMOVAL.
(See figure 254.)

1. Open terminal access plate (64) on shaft just above hand wheel (65) and disconnect the two transmission lines inside shaft.

2. Detach six screws (63) which hold upper shaft to lower shaft of coupler unit (62).

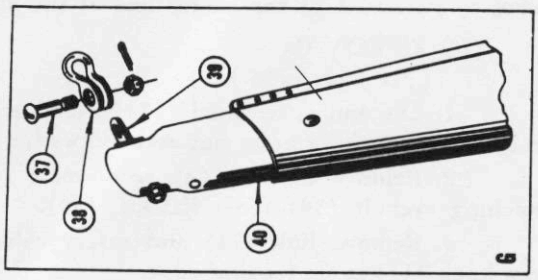
3. Atop leading edge center line, detach eight screws (60) from mounting collar (61) by which loop antenna (6) is held. Lift shaft and loop antenna up and out.

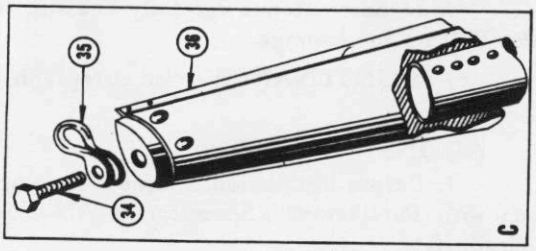
(c) MAINTENANCE.—Clean off all grease and dirt from loop antenna. If ring cover is cracked, replace antenna.

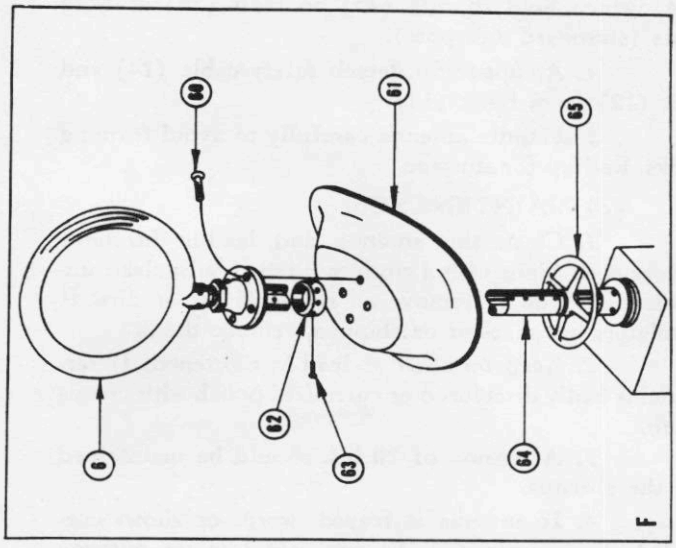
(d) INSTALLATION.—Reverse removal procedure as outlined in paragraph h, (4), (b).

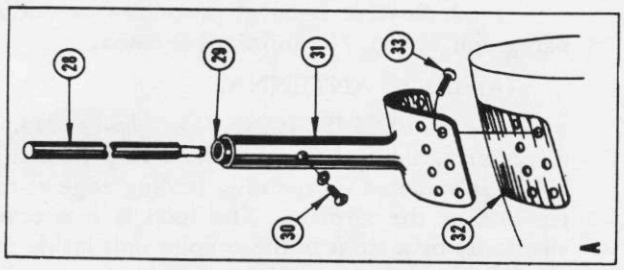
(5) IFF ANTENNAE.

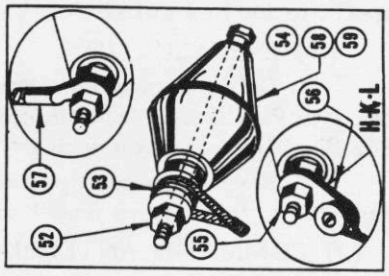
(a) DESCRIPTION. *(See figure 254.)*—The two IFF antennae, whip type, are mounted on top of the wing, starboard and port, three and one-quarter inches outboard of wing station 7.0 and 26 inches aft of the front spar. The antenna mounting base is fastened to a reinforcing plate which is set in the wing below the skin; the whip rod passes up above the skin through holes in the center of the plate and skin. The antenna assembly is held in place by eight screws which pass through outside of skin down through the skin

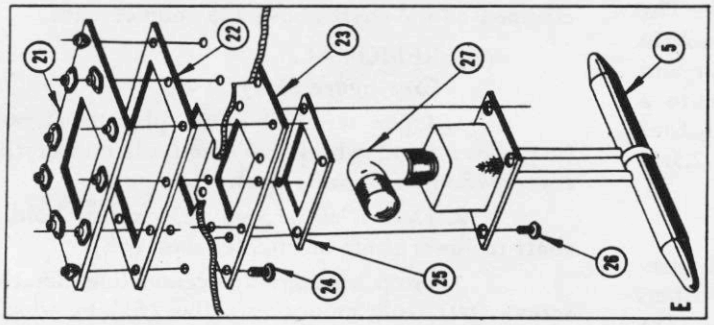


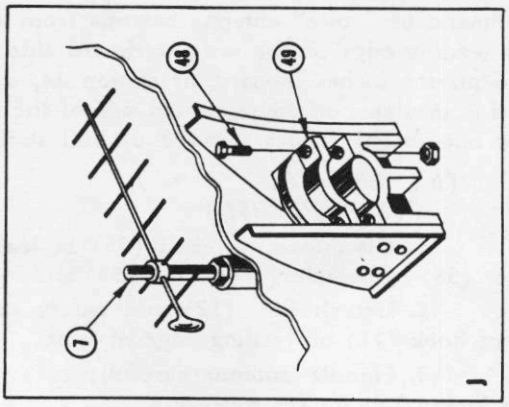


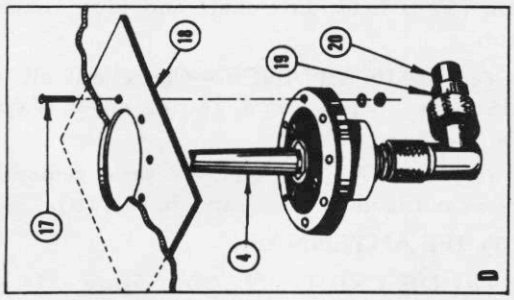


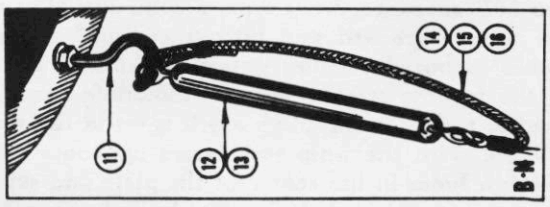


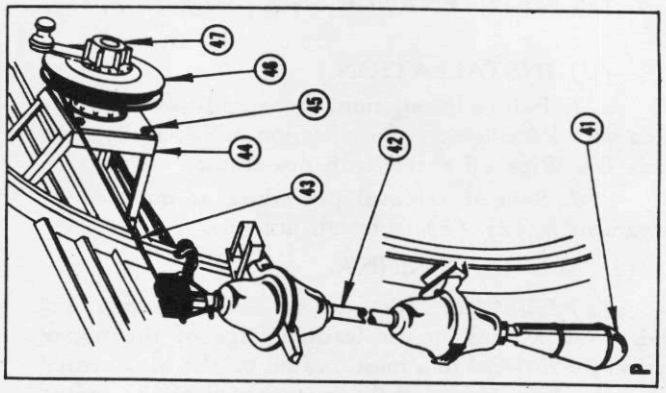












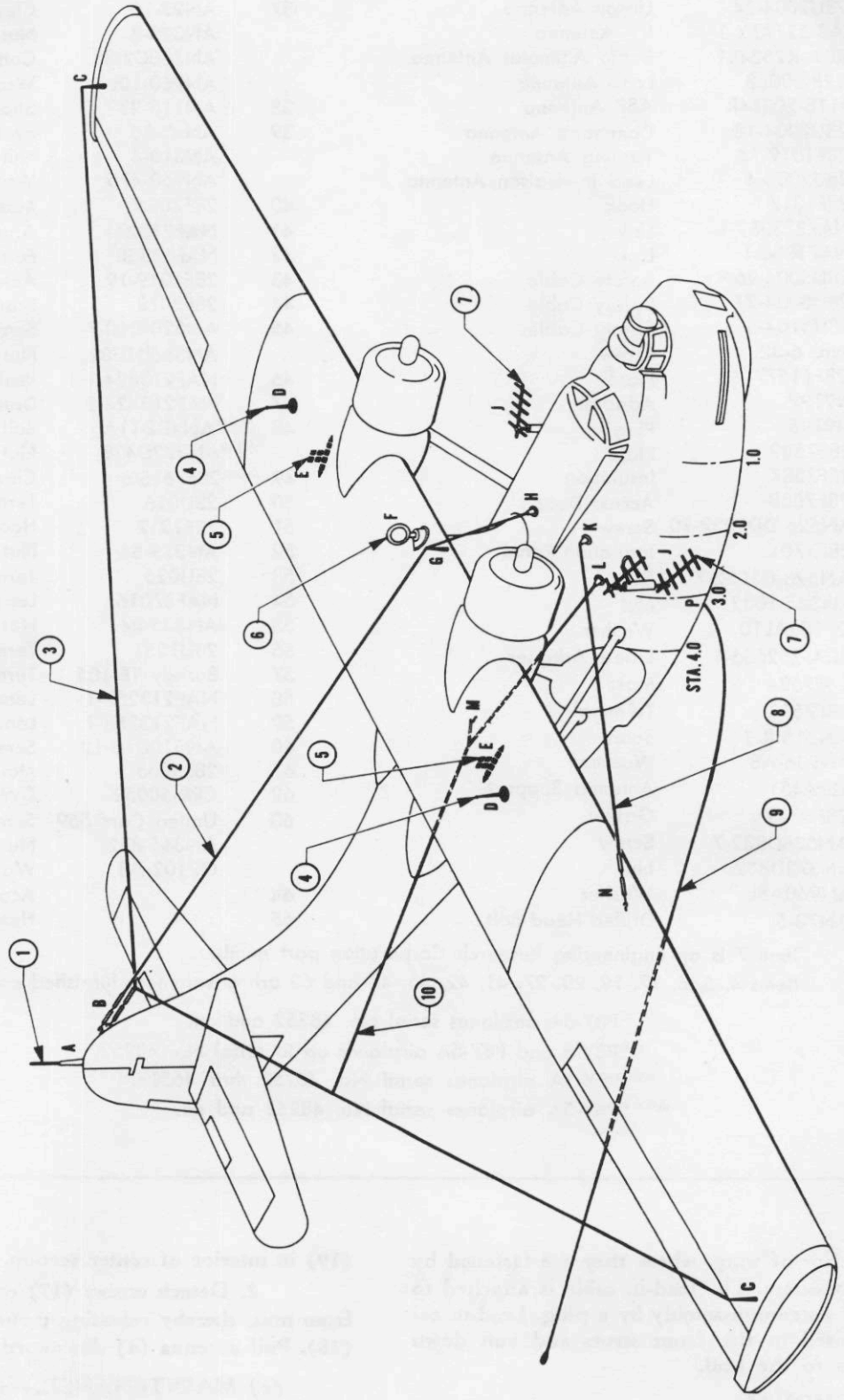


Figure 254—Antennae System

No.	PART No.	NAME
1	**28F7596	ABK Antenna
2	28U5104-21	Sense Antenna
3	28U2004-24	Liason Antenna
4	****AS-32/APX-1	IFF Antenna
5	*RCA-K252401	Radio Altimeter Antenna
6	CRR-50053	Loop Antenna
7	***5118-20014R	ASB Antenna
8	28U2004-18	Command Antenna
9	28F1019-15	Trailing Antenna
10	28U2004-4	Lead In—Liaison Antenna
11	28F1317	Hook
12	NAF213089-1	Link
13	NAF1086-1	Link
14	28U5004-26	Safety Cable
15	28U5004-27	Safety Cable
16	28U5104-6	Safety Cable
17	****No. 6-32	Screw
18	****28F11577	Plate
19	****49192	Adapter
20	****49195	Plug
21	*28F7589	Plate
22	*28F7587	Insulation
23	*28F7588	Access Door
24	*AN526-DD1032-10	Screw
25	*28F7701	Insulation Panel
26	*AN526-C1032-7	Screw
	*AN365-1032	Nut
	*Q7102AL10	Washer
27	*RCA-252666-1	Elbow Adapter
28	**28F7594	Mast
29	**28F7593	Terminal
30	**AN515-8-5	Screw
	AN936-A8	Washer
31	**28F6451	Antenna Support
32	**28F6825	Gasket
33	**AN526D832-7	Screw
	**AN372D832	Nut
	**AN960A8L	Washer
34	AN73-5	Drilled Head Bolt
35	AN115-8	Shackle
36	28F2135-30	Mast
37	AN23-10	Clevis Bolt
	AN320-3	Nut
	AN380C2-3	Cotter
	AN960-10L	Washer
38	AN115-21	Shackle
39	AN43-16	Eyebolt
	AN310-4	Nut
	AN960-416	Washer
40	28F7096	Mast
41	NAF213271	Antenna Weight
42	NAF67858	Fair-Lead
43	28F1019-19	Antenna Wire
44	28F3018	Bracket
45	AN520-D10-7	Screw
	AN365D1032	Nut
46	NAF213424-1	Reel Assembly
47	NAF213424-2	Drum
48	***AN4DD11A	Bolt
	***AN372D428	Nut
49	***28F7615-6	Clamp
50	28U026	Terminal
51	28F1317	Hook
52	AN335-B4	Nut
53	28U026	Terminal
54	NAF37016	Lead-In Insulator
55	AN335-B4	Nut
56	28U1051	Terminal
57	Burndy TE-105	Terminal
58	NAF213257-1	Lead-In Insulator
59	NAF213258-1	Lead-In Insulator
60	AN510D10-12	Screw
61	28F5065	Mounting Collar
62	CRR-50052	DW-1 Coupler Unit
63	United Carr 559	Screw
	AN365-832	Nut
	Q7102-A8	Washer
64		Access Plate
65		Hand Wheel

Item 7 is an Engineering Research Corporation part number.
Items 4, 5, 6, 17, 19, 20, 27, 41, 42, 46, 47 and 62 are government furnished parts.

*PBY-5A airplanes serial No. 48352 and on.
**PBY-5 and PBY-5A airplanes up to serial No. 48252.
***PBY-5A airplanes serial No. 48252 thru 46599.
****PBY-5A airplanes serial No. 48252 and on.

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and plate interior of wing, where they are fastened by nuts and lockwashers. The lead-in cable is attached to the bottom of antenna assembly by a plug. Lead-in cables are enclosed in the front struts and run down through struts to the hull.

(b) REMOVAL.

(See figure 254.)

1. By reaching through manhole in outer panel, detach connector plug (20) from antenna adapter (19) in interior of center section.

2. Detach screws (17) on top surface of wing from nuts, thereby releasing mounting base from plate (18). Pull antenna (4) downward and remove.

(c) MAINTENANCE.—See Confidential Instruction Manual (CO AN 08-20-12).

(d) INSTALLATION.

1. Place mounting base in position on the

plate at top interior of wing center section, pushing whip rod up through holes to the outside.

2. Attach screws from outside to nuts on interior and tighten evenly. Attach cable connector plug to antenna adapter.

(6) RADIO ALTIMETER ANTENNAE.

(a) DESCRIPTION. *(See figure 254.)*—The radio altimeter dipole antenna assembly consists of a cigar shaped horizontal member pendent on two vertical tubular arms spaced equally from the center of the horizontal member about three-eights inch apart. Between the arms, a ring insulator runs around the horizontal member. Through one tubular arm, the ground connection leads up; through the other, the transmission line is attached to an adapter plug fastened to the mounting base of the antenna assembly. This line runs through the front strut to the radio altimeter unit. There are two of these dipole antennae assemblies mounted on the lower surface of the wing center section 35 7/16 inches inboard of wing station 7.0, and 33½ inches aft of the front spar, one on the starboard side, and one on the port side. The antennae hang down from the lower surface of the wing.

(b) REMOVAL.

(See figure 254.)

1. Detach four screws (26) from insulation panel (25) of access door (23) and mounting base of antenna assembly (5). Remove insulation panel (25), and support antenna assembly with hand to avoid possibility of falling off of elbow adapter (27).

2. Detach ten screws (24) from access door. Remove access door (23) and insulation gasket (22).

3. Insert hand in access hole of plate (21) and disconnect plug at antenna mounting base end from elbow adapter (27) on transmission line. This will free antenna assembly (5) for removal.

(c) MAINTENANCE.

1. Clean antennae with a cloth moistened with clean unleaded gasoline. Be sure the insulator ring is clean.

CAUTION

If it is necessary to paint the antenna or adjacent structure of the airplane, avoid getting any paint on the insulator ring at the center of the horizontal member of the antenna assembly.

2. If contact pins of adapter plugs are discolored, or corroded, clean with clean unleaded gasoline and a stiff brush. Then polish the contacts with crocus cloth.

Note

Make sure that teeth at male end of fittings are engaged with notches at female ends before the coupling nuts are tightened firmly by hand. Check engagement and firmness by jiggling connections frequently while tightening.

(d) INSTALLATION.

1. Place gasket insulation for access door in position on plate.

2. Attach plug at antenna mounting base to elbow adapter on transmission line by inserting hand in access hole of plate and gasket.

3. Attach access door and gasket to plate by fastening ten screws. Cleaned area of access door must be down so as to be adjacent to alclad insulation cover.

4. Attach alclad insulation cover and antenna mounting base to access door by fastening four screws.

5. Cover edges around antenna mounting base with zinc chromate paste (Specification AAF 3596 condition B). Also, where antenna protrudes through access door, the edges should be covered with zinc chromate paste.

(7) TRAILING ANTENNA.

(a) DESCRIPTION. *(See figure 254.)*—The trailing antenna consists of a reel containing 500 feet of antenna wire, a tubular fair-lead containing an odometer, a weight attached to the lower end of the antenna wire and a plug assembly. The reel is mounted on a bracket on the starboard side wall just forward of bulkhead 3. Directly under it is a metal tube extending down and slightly aft through the bottom of the hull just inboard of the chine. When in use, the fair-lead is inserted in the tube so that its lower end projects through the bottom end of the tube. The pay-out end of the antenna line passes from the reel through the odometer at the top of the fair-lead and then through the fair-lead. The weight is hung on the end of the line at the bottom end of the fair-lead. The odometer measures the number of feet of antenna wire that is unreeled.

When not in use, or when landing or taking off, the fair-lead is removed from the tube and clamped to the forward side of bulkhead 3, where it is held by two brackets, the upper bracket being fastened flat onto the bulkhead, and the lower bracket fastened onto the forward bulkhead flange. It is not necessary to remove the wire or weight when removing and relocating the fair-lead. The fair-lead is replaced in the tube from which it was removed by a plug which clamps to the top of the tube in the same manner as does the fair-lead. At its lower end, a rod extends down through the tube. A round cover on the rod end fits against a shoulder on the lower end of the tube to close the opening in the hull.

The reel is equipped with a brake controlled by the knob on the hub of the drum. The reel is locked by turning this knob clockwise. The drum containing the antenna wire can be removed from the hub by releasing the snap lock located within the hub.

(b) REMOVAL.

(See figure 254.)

1. Disconnect the weight (41) from the antenna wire (43).

2. Withdraw antenna wire from fair-lead (42).

3. Turn brake control knob of the reel (46) clockwise and lock brake.

4. Release the snap lock on the reel drum (47).

5. Rotate the drum (47) clockwise slightly to release it from the studs, and remove the drum from the reel hub.

6. Detach the four screws (45) which fasten the reel base plate to bracket (44). Remove reel assembly (46).

(c) MAINTENANCE.

1. Disengage reel brake by turning lock control knob counterclockwise, and check freedom of reel rotation. If brake fails to disengage, clean the brake discs; if discs are defective, replace the entire set.

2. Turn the lock control knob slowly clockwise while rotating the reel and note whether brake applies smoothly and finally locks the reel. If roughness is felt as brake is applied, it indicates scored or damaged brake discs. Replace defective discs in entire sets.

Note

The reel brake is the multiple disc type. A small amount of backlash is unavoidable in this type of brake.

3. Unwind the antenna wire from reel to check the operation of the odometer. If odometer does not indicate accurately, replace it.

4. Replace antenna wire if kinks, or corroded, frayed, or damaged spots are found.

5. Tighten all loose screws on the reel, the reel bracket, the odometer and the fair-lead assembly.

6. Remove transmitter connection at each 240 hour inspection period. If terminal is discolored or corroded, polish with crocus cloth. Be sure connector is firmly tightened.

(d) INSTALLATION.

1. Install reel assembly on bracket by attaching four screws.

2. Fit drum on reel hub by rotating drum counterclockwise to engage it upon studs.

3. Engage the snap lock on the reel drum.

4. Turn brake control knob counterclockwise to release brake.

5. Insert antenna wire on odometer pulley and through fair-lead so that the wire extends beyond the bottom of the fair-lead.

6. Connect the weight onto the lower end of antenna wire.

7. Extend antenna fully to check whether wire travels smoothly over "V" pulley of odometer.

(8) ABK ANTENNA.

(a) DESCRIPTION. *(See figure 254.)*—The ABK antenna is a whip or mast type antenna. It is located at the top of the vertical fin on its center line 3⅛ in. forward of the rudder cut-out. The antenna is held in position by a support into which the mast fits and is fixed by two set screws. The antenna support and gasket are fastened to the skin of the fin by fourteen screws.

(b) REMOVAL.

(See figure 254.)

1. Remove antenna mast (28) from support (31) by detaching two screws (30).

2. Unsolder the transmission line from the terminal (29).

3. Reaching through access door just below antenna support in fin, pull transmission line down from antenna.

4. Detach fourteen screws (33) which hold antenna support (31) and gasket (32) to fin structure. Remove antenna support and gasket.

(c) MAINTENANCE.—See CONFIDENTIAL INSTRUCTION MANUAL (BuAer. publication).

(d) INSTALLATION.

1. Open access door just below antenna location.

2. Remove outer insulation from transmission line two inches from end, and shielding for a distance of 5/16" from end.

3. Thread line through ferrule and solder the conductor to terminal.

4. Slide ferrule up over insulator as far as it will go. Solder the ferrule to the shielding.

5. Install the mast on the support and secure with two set screws.

6. Install the antenna support and gasket on the fin by attaching twelve screws and nuts.

7. Close access door.

(9) ASB ANTENNAE.

(a) DESCRIPTION. *(See figure 254.)*—The ASB antennae are located on the hull starboard and port sides, centered 3⅝ inches forward of station 2.5. For further description, see CONFIDENTIAL INSTRUCTION MANUAL.

(b) REMOVAL.

(See figure 254.)

1. Disconnect transmission line on inside of hull by unscrewing knurled connector nut.

2. Detach four bolts (48) from clamp (49).

3. Remove clamp (49) and antenna (7).

(c) MAINTENANCE.—See CONFIDENTIAL INSTRUCTION MANUAL.

(d) INSTALLATION.—Reverse removal procedure as outlined in paragraph *h*, (9), *(b)*.

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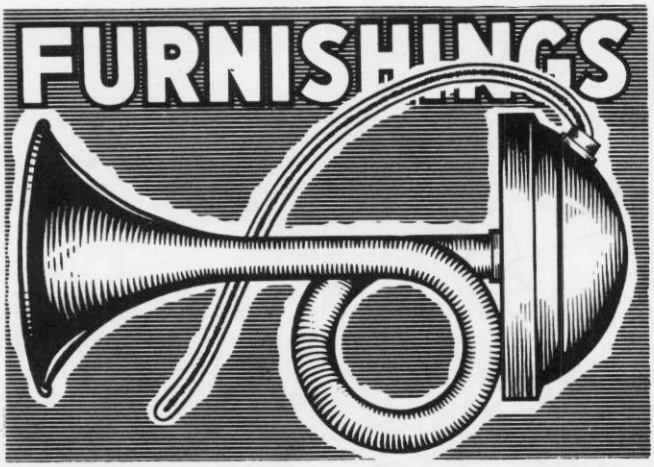
PARAGRAPH 24.



24. FURNISHINGS.

a. SEATS.

(1) PILOT'S AND COPILOT'S SEATS.
(See figure 255.)

(a) DESCRIPTION.—The pilot's and copilot's seats are installed side by side in the pilot's compartment, forward of bulkhead 2. They are made of aluminum alloy, being deeply upholstered and equipped with back rests.

An arm rest is provided for the outboard sides of each seat, leaving the inner sides free from any obstruction. These seats may be adjusted for tilt, and for fore-and-aft position by releasing spring-loaded locking pins which engage holes in the seat tracks.

A lever for the fore-and-aft adjustment is located on the outboard side of each seat. The seat is adjusted by pulling the lever back and pushing the seat to the desired position. The seat may be adjusted three inches forward and three inches aft of neutral position. Two stops installed in each channel of the seat-support limit the fore-and-aft motion of the seat rollers.

A lever for the tilt adjustment is located at the front of each seat. The seat is tilted by pushing the lever outboard and then adjusting the seat to the desired tilt. The seats may be tilted three degrees forward and seven and a quarter degrees aft, when in the normal and the forward positions. They may be tilted three degrees forward and three degrees aft when in the rear position.

(b) REMOVAL.
(See figure 255.)

1. On both inboard and outboard sides of seat, remove the four bolts (17) and (18), holding the forward part of the seat support (1) to the floor.

2. Remove the bolts (5), (6) and (15), attaching the bracket on the aft end of the seat support (1) to bulkhead 2.

3. On each side of seat, remove one bolt (16) attaching reinforcing bracket (13) to floor.

4. Lift seat and track assembly from airplane.

5. Remove the aft tie rod (2) by removing the nuts (14) on both ends.

6. Loosen the nuts (12) on the forward tie rod (11).

7. Remove the reinforcing bracket (13) by removing one bolt (9) from each end.

8. Remove trunnion and nut (4) attaching exerciser cord (3).

9. Separate the seat support channels (19) and (20) enough to allow the aft roller (8) to be removed from channels (19) and (20). Roll front roller (10) aft and then remove it from the channels (19) and (20). This operation detaches seat from its support.

(c) MAINTENANCE.—Lubricate the rollers, tilt mechanism, and fore-and-aft mechanism with a light oil (Specification AN-O-6).

(d) INSTALLATION.

1. Reverse the removal procedure outlined in foregoing paragraph *(b)*.

2. After the seat is assembled and installed in the airplane, adjust the nuts on end of the tie rods so that rollers will not bind and so that locking pins will engage properly in channel holes.

(2) NAVIGATOR'S SEAT.

(a) DESCRIPTION.—A swivel type chair is provided for the navigator. It is installed on the inboard side of the navigator's table and is attached to the aft leg of the table immediately forward of station 3.33. It is constructed of aluminum alloy and is equipped with a detachable upholstered seat cover. A small knob, located on the seat brace, locks the seat in desired position.

(b) REMOVAL.

1. Remove bolt which holds the seat post to the supporting arm.

2. Lift the seat assembly from seat brace.

3. Remove the seat brace from table support by removing the four clevis bolts.

(c) INSTALLATION.—Reverse the removal procedure outlined in foregoing paragraph *(b)*.

(3) RADIO OPERATOR'S SEAT.

(a) DESCRIPTION. — The radio operator's seat is a swivel type seat similar to the navigator's seat. It is installed on the starboard side of the airplane between stations 3.33 and 3.66 facing the radio operator's table. It is supported by four tubular legs joined

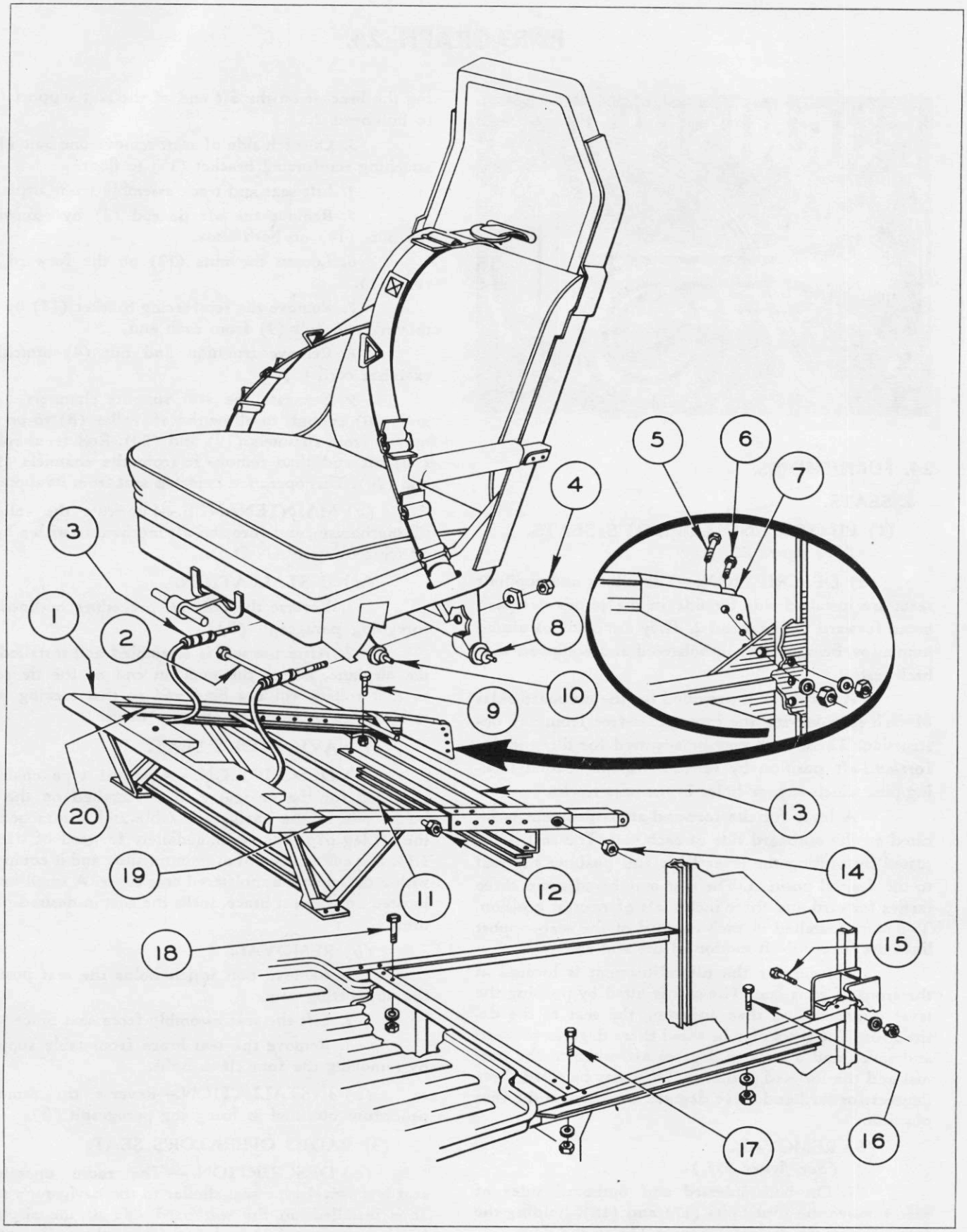


Figure 255—Pilot's and Copilot's Seat Assembly

No.	PART No.	NAME
1	28F5060-3L	Seat Support Assembly
2	28F6250	Tie Rod
3	28F1149-20	Exerciser Cord
4	28F1122	Trunnion
	AN315-4R	Nut
5	AN3-13A	Bolt
	AN372-1032	Nut
6	AN3-4A	Bolt
	AN372-1032	Nut
7	28F5060-6	Bracket
8	28F1084	Roller
9	AN4D-5A	Bolt
	AN365-D428	Nut
	AN960-AL416	Washer
10	28F1084	Roller
11	28F6250	Tie Rod
12	AN345-416	Nut
	AN365-428	Nut
	Q7102AL416	Washer
13	28F5353-8	Reinforcing Bracket
14	AN345-416	Nut
	AN365-428	Nut
	Q7102AL416	Washer
15	AN4-6A	Bolt
	AN372-428	Nut
16	AN4D-5A	Bolt
	AN365-D428	Nut
	AN960AL416	Washer
17	AN3-5A	Bolt
	AN372-1032	Nut
18	AN3-4A	Bolt
	AN372-1032	Nut
19	28F5060-8	Seat Support Channel
20	28F5060-9	Seat Support Channel

together at the collar for the seat post. The seat may be locked in position by a spring-loaded pin mechanism which is actuated by a handle. The handle is located under the seat on the forward side.

(b) REMOVAL.

1. Remove the clevis bolt attaching the seat post to the seat support.

2. Lift seat assembly from seat support.

3. Remove the seat support by removing the sixteen bolts holding it to the floor frames.

(c) INSTALLATION.—Reverse the removal procedure outlined in foregoing paragraph *(b)*.

(4) RADAR OPERATOR'S SEAT.

(a) DESCRIPTION. — The radar operator's seat is a swivel type seat, mounted on a post assembly. It has a removable back rest and an upholstered seat cushion. The seat is located at station 2.5 on the starboard side of the airplane; facing outboard is its normal position. It is latched in this position by means of a spring-loaded lever located on the seat post. The seat may be adjusted for height by removing the bolt which attaches the seat post to the support, and lowering or raising the seat as desired.

(b) REMOVAL.

1. Remove the bolt which attaches the seat post to the support.

2. Lift seat assembly from seat support.

3. Remove the seat from the post by removing the bolt at the upper extremity of the post.

(c) INSTALLATION.—Reverse the removal procedure outlined in foregoing paragraph *(b)*.

(5) ENGINEER'S SEAT.

(a) DESCRIPTION.—The engineer's seat is installed in the engineer's compartment. The seat, upholstered at the bottom and on the back, is suspended by eight braces from the sides of the superstructure.

(b) REMOVAL.

1. Remove the six bolts (four on PBY-5 airplanes) attaching the seat back to the bracket forward of bulkhead 5.

2. Remove the 24 screws which attach the eight braces to the brackets on the side walls of the superstructure.

(c) INSTALLATION.—Reverse the removal procedure outlined in the foregoing paragraph *(b)*.

(6) WAIST GUNNER'S SEATS.

(a) DESCRIPTION.—Two waist gunner's seats are attached to the aft face of bulkhead 6, one on the port, and the other on the starboard side. Each seat is equipped with a detachable upholstered cushion. When occupied, the seat is supported in a horizontal position, but when vacated, a spring mechanism located at the end of the seat brace causes it to snap back to a stowed position.

(b) REMOVAL.

1. Remove the bolt attaching the seat brace to the spring and brackets.

2. Unbolt the leg assembly from the seat.

3. Remove the hinge wire from the seat.

(c) INSTALLATION.—Reverse the removal procedure outlined in the foregoing paragraph *(b)*.

Note

When installing the spring, preload it one complete turn on each side in such a direction as to lift the seat for stowage.

b. TABLES.

(1) NAVIGATOR'S TABLE.

(a) DESCRIPTION.—The navigator's table is located on the port side of the airplane between bulk-

heads 2 and 4. The table top consists of spruce plywood reinforced by an aluminum alloy framework. Two brackets hold the table to the outboard side of the airplane, and three legs support the inboard edge of the table. The table contains two drawers; the navigator's drawer, and the watch drawer. A key is provided for locking the watch drawer. Two small Plexiglas windows are installed in the table top to allow viewing of the navigational watches without unlocking the watch drawer.

(b) REMOVAL.

1. Remove navigator's seat as described in paragraph *a*, (2), *(b)*.

2. Detach the two brackets located on the outboard edge of the tables by removing two screws on each bracket.

3. Remove the four screws holding the aft leg of the table to floor.

4. Remove the four clevis bolts attaching the two forward legs of the table to bulkhead 2 and station 2.5.

(c) INSTALLATION.—Install the table by reversing removal procedure described in foregoing paragraph *(b)*.

(2) RADIO OPERATOR'S TABLE.

(a) DESCRIPTION.—The radio operator's table is an aluminum alloy table containing one drawer, located on its forward side. A radio locker, located on its aft inboard end is an integral part of the table. The table is located on the starboard side of the airplane forward of bulkhead 4. A rack to hold radio equipment is located above this table.

(b) REMOVAL.

1. Make sure that radio power has been turned off.

2. Remove the transmitting key, located on top of the table, by detaching the four screws.

3. Remove the six screws attaching the three outboard braces to the side wall.

4. Disconnect the two table legs from the floor by removing two screws from each leg.

5. Remove the six screws attaching aft end of table to brackets on bulkhead 4.

(c) INSTALLATION.—Install the table by reversing removal procedure described in foregoing paragraph *(b)*.

(3) RADAR OPERATOR'S TABLE.—A spruce plywood rack for holding radar equipment is located on the starboard side of the airplane aft of bulkhead 2. The middle portion of the table may be adjusted for tilt by means of two wing nuts. This is used to vary the height of the radar visual indicator.

c. BUNKS.

(See figure 256.)

(1) DESCRIPTION.—On the PBY-5A airplanes, three bunks are installed in the living compartment between bulkheads 5 and 6, a lower on the port side, and an upper and lower on the starboard sides of the airplane. On the PBY-5 airplanes, two lower bunks are installed in the living compartment between bulkheads 5 and 6, one on the port and one on the starboard side of the airplane; a third lower bunk is also installed on the port side in the galley compartment between bulkheads 4 and 5. All bunks can be folded out of the way. Each bunk is constructed of stretched canvas laced to an aluminum alloy frame.

Note

A fourth bunk (upper on port side between bulkheads 5 and 6 on PBY-5A airplanes, and upper on starboard side between bulkheads 5 and 6 on PBY-5 airplanes) was deleted by service action.

(2) REMOVAL.—The following removal is typical for both PBY-5 and PBY-5A airplanes.

(a) Remove lower bunks as follows:

1. Detach the three bearing assemblies (8), (10) and (12) from frame (6) of lower bunk by removing the two bolts (1) from each bearing assembly.

2. Disconnect bunk leg assemblies (7), (9) and (11) from bunk frame fittings (16) by removing pins (15).

(b) Remove upper bunk as follows:

1. Detach the three bearing assemblies (3) from frame (2) of upper bunk by removing the two bolts (1) from each bearing assembly.

2. Disconnect the two strap assemblies (4), which are attached to the bunk frame (2), by removing the two screws (5) which attach each strap (4) to the beltframe.

(3) INSTALLATION.—To install bunks reverse the removal procedure outlined above.

d. LOCKERS.

(1) FOOD LOCKERS.

(a) DESCRIPTION.—On the PBY-5A airplanes, two food lockers are installed on the starboard side between bulkheads 4 and 5. On the PBY-5 airplanes, one food locker is installed on the port side between stations 4.25 and 4.5, above the bunk, and another is installed on the starboard side between stations 4.25 and 4.5. Each locker is partitioned by a shelf and has a hinged door on its inboard side.

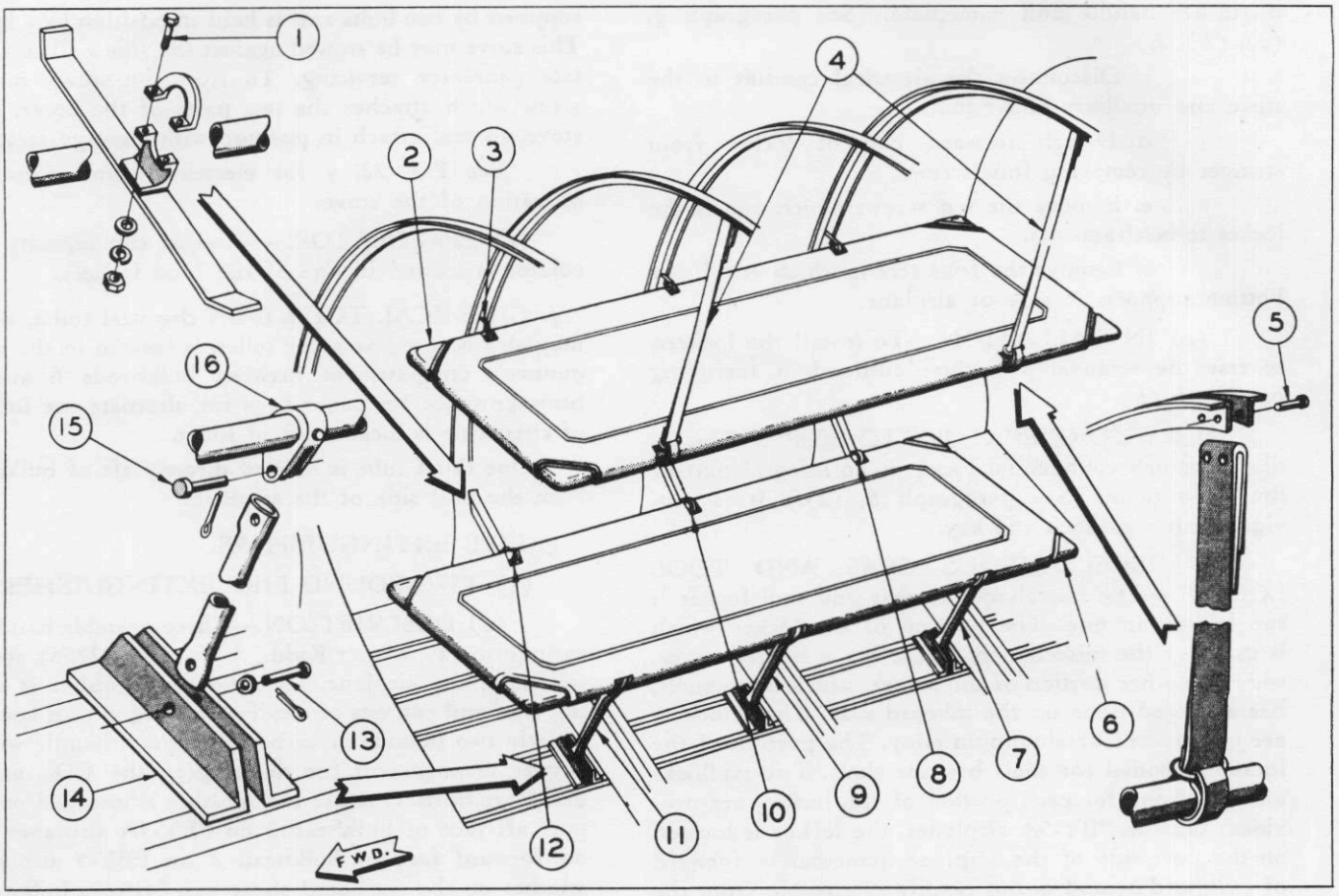
(b) REMOVAL.

1. Remove the forward locker on the PBY-5A airplanes as follows:

a. Unplug the electrical connections to the stove.

b. Remove the stove by removing the six screws attaching it to the locker.

c. Remove the four screws attaching locker



No.	PART No.	NAME
1	AN3-4A	Bolt
	AN315-3R	Nut
	AN935-10	Lock Washer
	AN960-10	Washer
2	28F203-10	Bunk Frame
3	28F3109-2	Bearing Assembly
4	28F2022-13	Strap Assembly
5	AN520D10-14	Screw
	AN365D1032	Nut
6	28F203-1	Bunk Frame
7	28F2022-8	Bunk Leg
8	28F3109-4	Bearing Assembly
9	28F2022-7	Bunk Leg
10	28F3109-6	Bearing Assembly
11	28F2022-6	Bunk Leg
12	28F3109-8	Bearing Assembly
13	AN394-37	Pin
	AN960-416	Washer
	AN380-2-2	Cotter Pin
14	28F021-7	Brackets
	28F021-12	
15	AN394-31	Pin
	AN380-2-2	Cotter
	Q7009-AL17-032	Washer
16	22F981	Frame Fitting

Figure 256—Upper and Lower Bunk Assemblies (PBY-5A Only)

to bulkhead 4, the two screws attaching it to beltframe 4.1 and the seven screws attaching it to beltframe 4.2.

2. To remove the aft locker on the PBY-5A airplanes, remove the six screws which attach the locker brackets to beltframe 4.2 and the six screws which attach the brackets to beltframe 4.1.

3. Remove port locker on PBY-5 airplanes as follows:

a. Detach angle at top of locker from stringers by removing the sixteen screws.

b. Remove the nine screws which attach aft end of locker to beltframe 4.50, and the four screws which attach forward end of locker to stringers.

c. Disconnect locker from the bottom supports by removing the four screws at the outboard end of the supports.

4. To remove starboard locker on the PBY-5 airplanes:

a. Remove the auxiliary power unit instrument panel. (See Par. 19, *b*, (5), *(b)*.)

b. Remove the auxiliary power unit fire ex-

tinguisher handle and nameplate. (See paragraph *g*, (3), *(b)*, *2.*)

c. Disconnect the electrical conduit to the stove and auxiliary power unit.

d. Detach forward end of locker from stringer by removing four screws.

e. Remove the ten screws which attach the locker to beltframe 4.5.

f. Remove the four screws which attach the bottom supports to side of airplane.

(c) INSTALLATION.—To install the lockers, reverse the removal procedure outlined in foregoing paragraph *(b)*.

(2) RADIO OPERATOR'S LOCKERS.—The radio operator's confidential locker is an integral part of the radio table. (See paragraph *b*, (2).) It is provided with a padlock and key.

(3) MISCELLANEOUS GEAR AND TOOL LOCKER.—The miscellaneous gear and tool locker is two lockers in one. The portion of the locker which is used for the miscellaneous gear has a hinged cover, while the other portion of the locker, which is for tools, has a hinged door on the inboard side. These lockers are constructed of aluminum alloy. The portion of the locker provided for tools has one shelf. Two padlocks and keys, one for each portion of the locker, are provided. On the PBY-5A airplanes, the locker is located on the port side of the airplane immediately forward of bulkhead 5, and is not readily removable from the airplane. On the PBY-5 airplanes, the locker is located on the starboard side immediately aft of bulkhead 4. It is attached to bulkhead 4 and beltframe 4.25 by means of nine screws.

(4) NAVIGATOR'S BOOKCASE.—The box for stowage of the navigator's books and papers is located on the port forward face of bulkhead 4. It is a small aluminum alloy box, opened at the forward end, and divided into four sections. A strap assembly is installed at the front of the box to keep the books and papers in position. The bookcase is attached to bulkhead 4 by ten screws.

(5) NAVIGATOR'S LOCKER.—A navigator's locker for the stowage of the navigator's binoculars and sextant is installed on PBY-5A airplanes up to serial numbers 46580 and on all PBY-5 airplanes. This locker is constructed of aluminum alloy and is located on the port side above the navigator's table. It contains three compartments and is provided with a padlock and key.

e. GALLEY EQUIPMENT.

(1) GALLEY STOVE.—An electric stove with two hot plates is installed in the galley compartment between stations 4 and 5. On the PBY-5A airplanes, the stove is installed on top of the forward food locker. The stove is attached to the locker by six screws.

On the PBY-5 airplanes, the stove is installed aft of the starboard food locker. It is attached to its supports by two bolts and is held in position by a brace. This stove may be stowed against the side wall to facilitate generator servicing. To stow the stove, remove screw which attaches the two parts of the brace, push stove up and attach in position with stowage straps.

See Par. 22, y for electrical connections and operation of the stove.

(2) PERCOLATOR.—An eight cup capacity percolator is stowed in one of the food lockers.

f. CHEMICAL TOILET.—A chemical toilet, which may also be used as a dry toilet, is located in the waist gunner's compartment between bulkheads 6 and 7. Stowage space for paper bags for alternate use instead of chemicals is located aft of toilet.

One relief tube is located directly aft of bulkhead 7 on the port side of the airplane.

g. FIRE EXTINGUISHERS.

(1) TWO-POUND FIRE EXTINGUISHERS.

(a) DESCRIPTION.—Three portable hand fire extinguishers (Walter Kidde & Co. No. 92756) are installed in the airplane. Each fire extinguisher is shatterproof and consists of a cylinder charged with approximately two pounds of carbon dioxide, a handle with a trigger arrangement for discharging the CO_2, and a discharge horn. One fire extinguisher is installed on the port aft face of bulkhead 2 on PBY-5A airplanes and on forward face of bulkhead 2 on PBY-5 airplanes, another on the starboard shear web between bulkheads 4 and 5 on PBY-5A airplanes and on forward face of bulkhead 5 on PBY-5 airplanes, and the third one on the aft face of bulkhead 6 below the door. They are supported by brackets and held in position by straps. To remove from brackets, release strap from around neck of extinguisher.

WARNING

The white discharge is dry ice. To avoid frost bite, do not permit continuous contact with skin.

(b) MAINTENANCE.—Determine weight of contents every six months. Replace extinguisher if weight is four ounces below total weight (including horn) stamped on valve body.

(2) FIVE-POUND FIRE EXTINGUISHER.—A five-pound capacity, portable fire extinguisher (Walter Kidde & Co. No. 92755) is installed on the port forward face of bulkhead 4. This fire extinguisher is similar to the two-pound fire extinguisher. For its maintenance refer to paragraph *g*, (1).

CAUTION

When using either the two or five pound extinguisher, hold it in an upright position, swing the horn outward, and use the trigger to control the spray. When fighting fire, direct the flow of CO_2 close to the bottom of the flame. Replace fire extinguisher immediately after use.

(3) AUXILIARY POWER UNIT FIRE EXTINGUISHER (PBY-5 ONLY).

(a) DESCRIPTION.—Fire extinguishing equipment is installed for the protection of the auxiliary power unit and its generator. This equipment consists of a 3.62 pound cylinder (Walter Kidde & Co. No. 23985) containing carbon dioxide under pressure, an automatic extinguishing valve (Walter Kidde & Co. No. 78225), a manual release lever (Walter Kidde & Co. No. 27387), and a discharge signal assembly (Walter Kidde & Co. No. 22315).

The cylinder is installed on a bracket at the starboard side of bulkhead 5.

The automatic valve is mounted on top of the CO_2 cylinder. It contains a release mechanism by means of which the gas may be automatically or manually released through a line connecting to various parts of the auxiliary power unit. This valve is actuated by means of detection units (Luxstats) located in four places in the auxiliary power unit. Each Luxstat has an inflammable celluloid tip and contains a small charge of fast burning powder. Any fire in the vicinity of the Luxstat ignites the tip which sets off the powder charge. Pressure generated by the burning powder is transmitted through the connecting tubing to the valve.

A safety valve is also connected to the automatic extinguishing valve. When the cylinder becomes overcharged it automatically discharges clear of the airplane through the discharge signal assembly. This assembly is located on the starboard side of the airplane, forward of bulkhead 5.

The manual release lever consists of a handle mounted on a bracket which is located on the bottom of the starboard food locker. It is connected by a wire cable to the tripping mechanism of the extinguishing valve. A pull on the handle trips the mechanism and releases the carbon dioxide.

(b) REMOVAL.

1. To remove the cylinder and valve:

a. Place the cutter in the automatic extinguishing valve on "SAFETY" to prevent accidental tripping while work is being done on the fire protection equipment. To set in the safe position, turn the reset wing nut counterclockwise as far as it will go.

b. Disconnect the Luxstat tubing line from the valve diaphragm chamber.

c. Disconnect the CO_2 tubing line from the outlet on the valve.

d. Disconnect the outboard discharge tubing at the valve end.

e. Disconnect the manual control cable at the valve end.

f. Remove the four screws attaching cylinder supports and remove the cylinder from the airplane.

g. Place the cylinder in a vise with soft metal-capped jaws and remove the automatic extinguishing valve from the cylinder disc body.

Note

Left-hand threads are used to attach the valve to the cylinder disc body.

WARNING

The above instructions should be strictly observed when work is being done on the CO_2 cylinder. Escape of gas with possible injury to personnel may otherwise result. Do not remove the disc body from the cylinder. Removal of the disc body would cause instantaneous discharge of the cylinder.

2. To remove the manual handle proceed as follows:

a. Disconnect the cable from the handle.

b. Remove the four screws which attach the handle bracket to the food locker.

(c) MAINTENANCE.

1. If a fire has occurred, the entire fire protection equipment must be checked as follows before the auxiliary power unit may be run again:

a. Remove cylinder from airplane and valve from cylinder. (See paragraph *g*, (3), *(b)*, *1.*)

b. Examine every part of the system for damage by fire or excessive heat. All unserviceable parts must be replaced.

c. Make sure that the Luxstat detection and CO_2 lines are clear and that all connections are tight.

2. Every six months the cylinder should be weighed. If the cylinder has decreased by four ounces or more from the "Full" weight stamped on the cylinder disc body, the cylinder must be removed and replaced.

(d) INSTALLATION.—To install cylinder, valve, and manual handle, reverse removal procedure outlined in foregoing paragraph *g*, (3), *(b)*.

h. STOWED EQUIPMENT.

(1) LADDER.—A portable ladder is provided for entrance to the airplane. This ladder can be installed on either port or starboard side at the waist gun blisters by hooking it into the eye bolts provided.

The ladder is detachable and is stowed on the starboard wall between the upper and lower bunks between bulkheads 5 and 6 on the PBY-5A airplanes. It is held in a horizontal position by two strap assemblies. On the PBY-5 airplanes, the ladder is stowed on its side on the port side, aft of bulkhead 6. It is held in position by two strap assemblies.

(2) WORK PLATFORMS.—Two folding type work platforms are stowed in the living compartment. Each platform is strapped in a horizontal position to either of the lower bunks. For description and use, refer to Par. 8, *g*.

(3) MAPHOLDER.—A mapholder for use by the pilot is located under the pilot's seat. It is bolted to the seat support.

(4) HOISTING SLING.—The hoisting sling is stowed on the forward face of bulkhead 5. See Section III, Par. 2, *a*, for its description and use.

(5) ANCHOR.—One 32 lb. Northill type non-magnetic steel anchor and 150 ft of quarter inch corrosion-resistant steel anchor cable is stowed in the anchor box which is located on the port side of the hull between beltframe 0.33 and bulkhead 1. The crank for the anchor reel is stowed on the starboard wall of the superstructure on the PBY-5A airplanes. It is stowed on the aft face of bulkhead 4 on the PBY-5 airplanes. For handling instructions, see Section III, Par. 2, *e*.

(6) KLAXON HORN.—The klaxon horn is stowed on the aft face of bulkhead 5, port side.

For description and use see Par. 22, *y*.

(7) ENGINE CRANK.—On the PBY-5A airplanes, the engine crank is stowed on the starboard shear web, forward of bulkhead 5. On the PBY-5 airplanes, it is stowed on the aft face of bulkhead 4. It is held in place by straps.

(8) SNUBBING POST.—A demountable snubbing post, when installed, is mounted on the bow of the hull adjacent to the bow turret. When not in use, the snubbing post is stowed in a bag located on the starboard wall aft of beltframe 0.66 on the PBY-5A airplanes and aft of station 1.33 on the PBY-5 airplanes.

(9) LANDING GEAR EQUIPMENT (PBY-5A ONLY).—The "DOWN LATCH" rod for the main landing gear is stowed on the port shear web between bulkheads 4 and 5. The lowering lever for the nose landing gear is stowed on the port aft face of bulkhead 2. For description and use, see Par. 4, *a*, (2), *(c)*, *1*.

(10) COVERS.

(a) PILOT'S ENCLOSURE COVER. — An olive drab, waterproof cotton duck cover is furnished for the pilot's enclosure and gun turret. When installed, this cover is tied to two places on each mooring platform with sash cords and is held in place over the bow and pilot's enclosures by means of eight snap fasteners attached to strap assemblies. No special stowage space is provided for this cover.

(b) WINDOW COVERS.—A cotton duck cover, which may be snapped to the window, is provided for each of the following windows: two rear windows in the pilot's compartment, the navigator's window, and the radio operator's window. No special stowage is provided for these covers.

An aluminum alloy cover is provided for the bombardier's window. A spider actuates rods which fit into blocks on the bomber's window and hold the cover in position. On the PBY-5A airplanes, the bombardier's window cover is stowed on the port forward face of bulkhead 2. Up to serial number 46596, two strap assemblies hold the cover in stowed position. On airplanes with serial numbers 46596 and on, three blocks, which engage three of the rods and hold the cover in stowage position, are installed on the bulkhead. On the PBY-5 airplanes, the cover is stowed on the hull floor between station 0.66 and bulkhead 1. It is held in position by two strap assemblies.

WARNING

The cover for the bombardier's window must be in place during landings and take-offs.

(c) MISCELLANEOUS COVERS. — Cotton duck covers are provided for the engines, the pitot tube head, the bombsight, the waist gun continuous feed mechanism (for PBY-5A airplanes with serial numbers 46609 and on, only), and the empennage step. An aluminum alloy cover is also provided for the revolving windshield slot on the bombardier's turret.

The engine covers are cinched in position with sash cords.

The waist gun continuous feed mechanism cover is laced in placed with lacing cord.

Four snap fasteners hold the step cover in place.

No attachment is needed for the pitot tube head cover and the bombsight cover.

The step cover is stowed with the sea anchor on the starboard forward face of bulkhead 6.

The revolving windshield slot cover is stowed in the bombardier's compartment.

No special stowage is provided for the other covers.

(11) CURTAINS.

(a) DRAFT CURTAIN.—A cotton duck curtain is provided for use between the bombardier's and the pilot's compartments. This curtain is snapped to bulkhead 1 with snap fasteners. The center part of the curtain has zippers on both sides and may be rolled up out of the way. Two strap assemblies installed at the top of the curtain hold it in the stowed position.

(b) BLIND FLYING CURTAIN.—Curtains for blind flying may be installed in the pilot's compartment. These olive drab duck curtains are fastened with snap fasteners to the top, side, and front of the port side of pilot's compartment and the inboard side of the copilot's seat. When not in use, the blind flying curtains are stowed in a stowage bag located on the port forward face of bulkhead 2.

(c) RADAR OPERATOR'S CURTAIN.—A curtain may be installed to separate the radar operator's compartment from the other sections of the navigator's compartment. This cotton duck curtain is snapped in position to the radar equipment supports. No special stowage is provided.

(12) TAIL ANTI-ICING SCOOP.—The scoop

assembly for the tail anti-icing heater is stowed with the sea anchor on the starboard forward face of bulkhead 6. For its description and use, see Par. 25, *c*, (4).

i. BILGE AND REFUELING PUMP.

(1) DESCRIPTION.—On the PBY-5A airplanes, a Romec portable refueling unit (RG4650) is provided. Two lengths (one 25 ft long and the other 10 ft long) of gasoline hose are furnished with the pump. The capacity of this refueling pump is 1500 U. S. (1249.5 Imp.) gallons per hour. This refueling pump and the hoses are stowed on the starboard side of the hull bottom between beltframe 5.75 and station 6, beneath the bunk. A bilge pump is attached to the auxiliary power unit. (See Par. 17). The hose for this bilge pump is attached to the pump and stowed in coils on the starboard aft face of bulkhead 5.

The Romec portable combination bilge and refueling unit (RG4635A), which is provided on the PBY-5 airplanes, consists of two pumps, one for fuel and the other for bilge water. Two lengths (one 25 ft long and the other 10 ft long) of gasoline hose and two lengths (one 10 ft long and the other 28 ft long) of water hose are furnished with the pump. The capacity of the bilge pump is 840 U. S. (699.7 Imp.) gallons per hour; that of the refueling pump is 1500 U. S. (1249.5 Imp.) gallons per hour. This combination bilge and refueling pump and the hoses are stowed on the starboard side of the hull bottom between beltframe 5.75 and station 6, beneath the lower bunk. The unit is held in place by straps.

(2) MAINTENANCE.

(a) Periodic inspection is required to check for fuel leakage at the coupling seal, gasket joints, and fittings. The pumps should not leak at any point.

(b) For best pump performance, keep inlet and outlet strainers clean.

(c) The motor is equipped with pre-lubricated bearings that need no further lubrication for the life of the motor.

(d) The oil level in the gear box should cover the bottom half of the small pinion gear. Check the oil level by removing the control handle plate and shift yoke assembly. Inspection of the gears may be made through the opened case, and the oil replenished if necessary. Oil (Specification AN-VV-O-446a, grade 1120) is recommended.

(e) After refueling, or pumping bilge water, disconnect the hoses and operate the pump for approximately one-half minute in order to dry it out. Then pour oil into the ports and revolve a few turns before replacing the caps for stowage.

CAUTION

Keeping these pumps well lubricated while stowed will help prevent corrosion, and, when next used, will help the self-priming ability by giving pumps a strong suction.

j. CUSHIONS.

(1) PILOT'S AND COPILOT'S SEAT CUSHIONS.—Cushions for the pilot's and copilot's seats and seat backs are made of bound hair with a cotton fabric covering. The covering is a corded green fabric slip cover with zipper openings. The seat cushion rests in the pilot's seat and is not fastened in place. The seat cushion back has straps which are fastened with snap fasteners to the seat assembly.

(2) NAVIGATOR'S SEAT CUSHION.—The cushion for the navigator's seat is a bound hair cushion covered with green fabric. The cushion has four small straps with snap fasteners to fasten on the navigator's seat.

(3) RADIO OPERATOR'S SEAT CUSHION.—The cushion for the radio operator's seat is a duplicate of the navigator's seat cushion described in foregoing paragraph (2).

(4) RADAR OPERATOR'S SEAT CUSHION.—The cushion for the radar operator's seat is a bound hair cushion, with a green fabric cover.

The cushion has four small straps with snap fasteners to fasten on the radar operator's seat.

(5) ENGINEER'S SEAT CUSHION.—A life preserver cushion is installed on the engineer's seat. It is a Kapok cushion with a tufted leather covering. It is snapped to the engineer's seat in four places with snap fasteners.

(6) WAIST GUNNER'S SEAT CUSHION.—A bound hair cushion covered with green fabric is provided for each waist gunner's seat. These cushions have three small straps with snap fasteners to attach them to the waist gunner's seats.

k. SAFETY BELTS.

(1) TYPE B-11 SAFETY BELT.—The pilot's, copilot's, navigator's, radio operator's, and engineer's seats are equipped with Army type B-11 lap type safety belt, part number 34-G 1646. These safety belts are bolted to a bracket on both sides of each seat, and are provided with quick-disconnect buckles which may be snapped off rapidly in an emergency.

(2) SHOULDER STRAPS.—The pilot's and copilot's seats are equipped with shoulder straps, besides the type B-11 lap type safety belts. The shoulder straps are attached to a spring-loaded wheel at the back of the seat. It is possible to lock the wheel in several positions to permit adjustment of the shoulder straps. Such an attachment provides the flexibility necessary to permit forward and backward adjustment of the pilot or copilot. The shoulder straps serve to hold the pilot in an erect position in case of injury and thus prevent him from possibly jamming the controls.

(3) GUNNER'S SAFETY BELTS.—At each gunner's position, there is provided a gunner's type safety belt (AN5708). The gunner type safety belt consists of a three inch cotton webbing belt which encircles

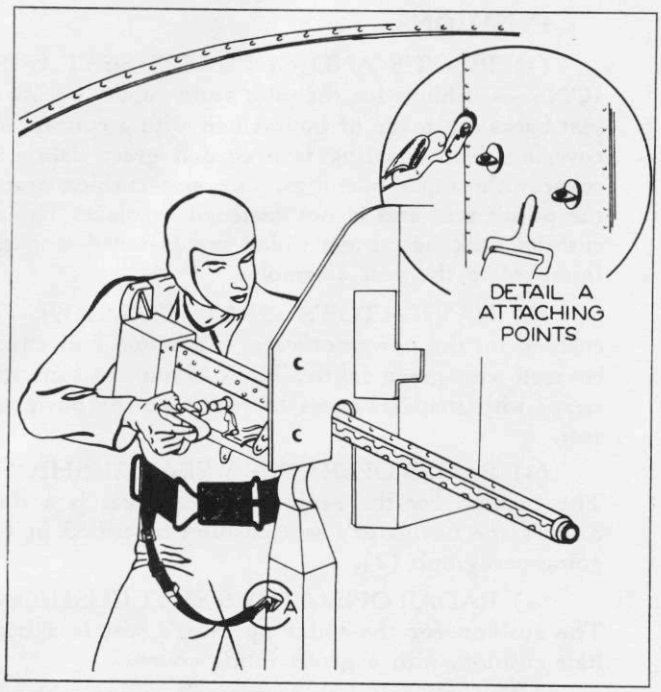


Figure 257—Gunner's Safety Belt

the gunner's waist, and two one and three-quarter inch webbings which are attached to the belt. A snap harness is attached to the end of each of these two webbings. The safety belt is provided with a quick-disconnect buckle.

Two eye bolts are installed on each side waist gun mount. These are used to attach the snap harness of the safety belt. *(See figure 257.)*

Two eye bolts are also installed on the revolving windshield in the bomber's compartment for attachment of the safety belt.

In the tunnel gunner's compartment, a safety belt cable is stowed overhead on beltframe 7.5. To install safety belt, unhook the ring end of the cable from its stowage hook and attach snap harness of safety belt to this ring.

The bombardier's safety belt may also be used when handling the anchor by attaching it to the two eye bolts which are installed on the outer skin of the hull above the anchor box.

l. MISCELLANEOUS.

(1) ENGINEER'S FOOTREST. — A folding footrest for use by the engineer when he is seated in the engineer's seat, is installed on bulkhead 4 over the bulkhead door. This aluminum alloy footrest can be folded up when not in use. Two bolts attach this footrest to the supporting brackets which are installed on bulkhead 4.

(2) ENGINEER'S HANDLES. — Two handles are installed in the engineer's compartment to facilitate entrance to the engineer's seat. One handle is bolted to each side of the superstructure above the engineer's seat.

(3) ENGINEER'S CRASH PADS.—Two crash pads are installed in the engineer's compartment, one above each window. The crash pad is a Kapok filled leather pad and is attached to the side of the superstructure by three screws.

(4) ENGINEER'S SEAT BUMPER PAD.—A Kapok filled leather pad is installed under the engineer's seat. This pad is for the protection of personnel passing under the engineer's seat. The pad is fastened to the engineer's seat with 38 brazier head screws.

(5) BOMBARDIER'S KNEE PAD.—A leather covered bound hair pad is installed in the bombardier's compartment to be used as a knee rest. This pad is installed on a bracket and can be folded against beltframe 0.33 when not in use.

To put pad in stowed position, remove pin at aft end of pad and snap strap assembly to beltframe.

(6) TUNNEL GUNNER'S KNEE PAD.—A pad for use by the tunnel gunner is installed in the tunnel gunner's compartment between stations 7.25 and 7.75. This is a bound hair pad with a tufted cotton bottom and a leather top. It is snapped in position on the floor with 13 snap fasteners.

(7) SUN SHADES.—A brown rubberized silk shade is installed under the pilot's enclosure, on both the port and starboard sides. These shades are provided with rollers on which to roll the shades when not in use. The sun shades are used to protect the pilot's eyes from excessive sun glare and reflection.

★ ★ ★

PARAGRAPH 25.

25. ANTI-ICING.

a. GENERAL.—Anti-icing systems provided in airplane protect against the formation of ice on the wing leading edges, the empennage leading edges, propeller blades, and the windshields. There are two kinds of systems: heated air, which prevents ice from forming on the wings and empennage; and anti-icing fluid, which prevents ice from forming on the propeller blades and windshields. There are two separate heated air systems, one serving the wings and one serving the empennage. There are also two separate anti-icing fluid systems, one serving the propeller blades, and one serving the windshields. The latter operates in conjunction with the windshield wipers.

On PBY-5 airplanes with serial numbers 08124 through 08348, wing and tail heated air anti-icing systems are not installed. Instead a boot de-icer system is furnished for wing and tail anti-icing. This de-icer system is described in paragraph *d*.

Note

PBY-5A airplanes with serial numbers 46610 through 46638 will not be provided with wing and tail heat anti-icing at the contractor's plant. However, provisions for a possible future installation of this anti-icing will be made.

b. WING ANTI-ICING.
(See figure 258.)

(1) GENERAL.—The anti-icing equipment for the wings consists essentially of a heat exchanger assembly connected to the outboard exhaust stacks of each engine. A suitable system of ducts distributes the heated air from this source to the wing leading edge. The section of the wing leading edge between the nacelles is not provided with anti-icing equipment, since ice accumulations in this area are rare. When anti-icing is required, air heated by passing over the heat exchanger, is directed through the wing ducts by a hinged wing gate in the side of each rear fairing. When this wing gate, actuated by a White—Rodgers electric motor, is closed, the heated air passes into the wing ducts. When anti-icing is not required, the wing gate is opened and the heated air is exhausted overboard. Whenever air temperature in the take-off duct exceeds 166°C (330°F), a thermostat regulating unit automatically actuates the wing gate motor, which opens the wing gate by mechanical lingage, thus permitting escape of the heated air to the slipstream. When the air duct temperature falls below 149°C (300°F), the motor again actuates the wing gate to close off escape of the heated air, thus permitting it to enter the ducts of the wing leading edge.

(2) HEAT EXCHANGERS.

(a) DESCRIPTION.—A 16-flute exhaust heat exchanger, Solar No. 11-355, with a capacity of 100,000 BTU per hour, is mounted on the oil tank and connected to the outboard exhaust stack of each engine. Hot exhaust gases, passing through the interior of the heat exchanger, heat its exterior fluted surface, which in turn heats the ram air circulating between this heated, fluted surface and an enveloping, close fitting shroud. The heated ram air is then conveyed through ducts to the wing leading edge outboard of the nacelles, or exhausted into the atmosphere through the closing or opening of the control wing gate at the inboard mouth of each duct. A series of four fairings are installed over and in connection with the heat exchanger assembly. The forward fairing encloses the exhaust manifold assembly, and its own forward end is open to form a scoop for the intake of ram air for heating by the heat exchanger. This is known as the forward ram air intake duct. A second or intermediate fairing continuous with but not integral with the first and immediately aft of it, encloses part of the heat exchanger. The third or rear fairing is aft of and continuous with but distinct from the intermediate fairing. It includes the door assembly and encloses the exit duct. The fourth or aft fairing encloses the aft part of the heat exchanger which protrudes in the form of a tail pipe exhaust.

(b) REMOVAL AND DISASSEMBLY.
(See figure 258.)

1. Remove intermediate fairing (12) from nacelle and rear fairing (13) by detaching screws (39).

2. Remove rear fairing from nacelle by detaching screws and washers (56) and from aft fairing by detaching screws (40).

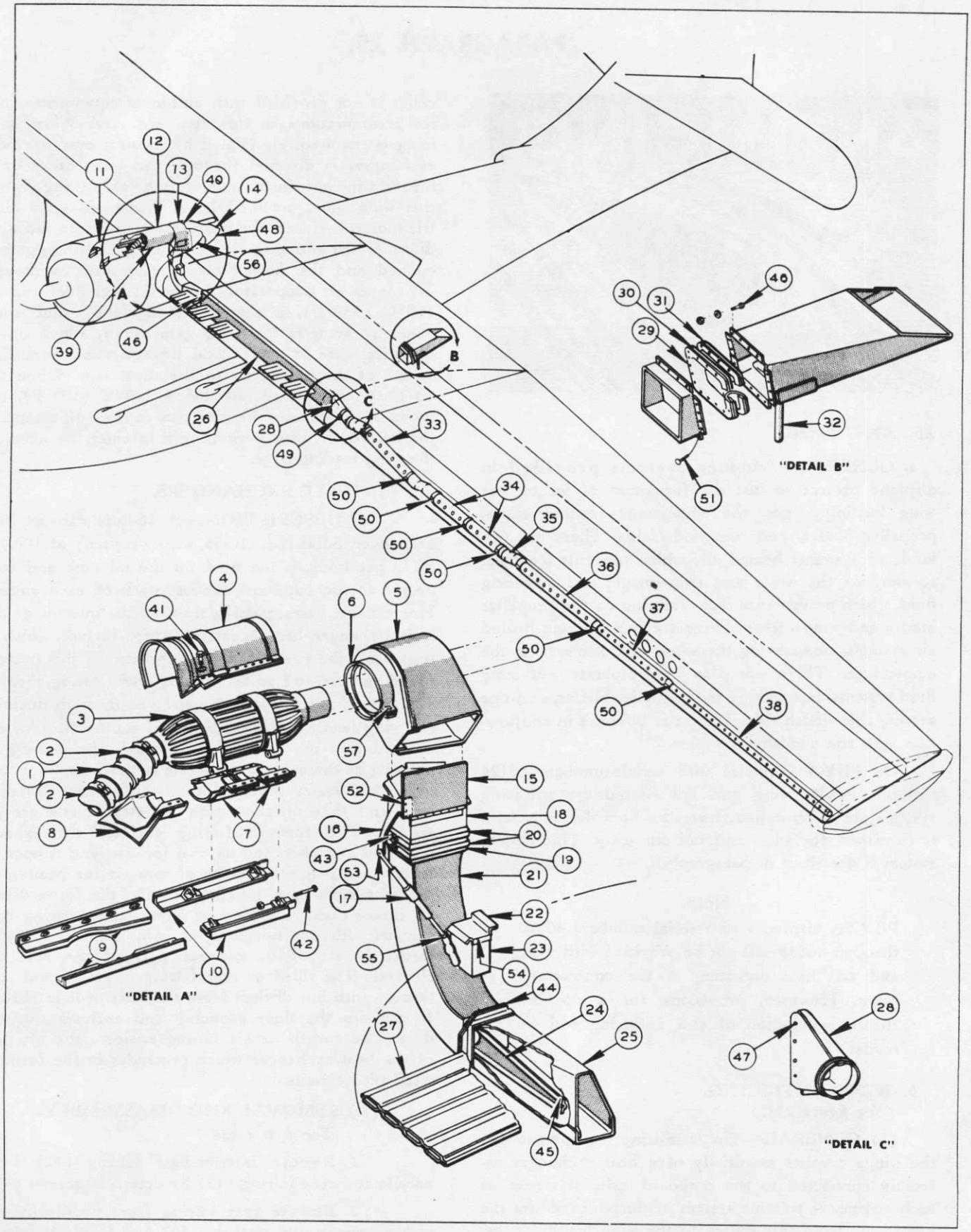


Figure 258—Wing Anti-Icing System

No.	PART No.	NAME	No.	PART No.	NAME
1	3-1169	Flexible Joint	41	AN3-4A	Bolt
2	3-1056-51	Clamp		AN960-10	Washer
3	11-355	Heat Exchanger	42	AN4-21	Bolt—Aft
4	28F6762	Shroud Ass'y.—Upper		AN310-4	Nut—Aft
5	28F7808-L&R	Exit Duct		AN5-20	Bolt—Forward
6	28F7808-6	Collar		AN310-5	Nut—Forward
7	28F6764	Shroud Ass'y.—Lower		AN380-C2-2	Cotter Pin
8	28F6770	Shroud—Scoop Ass'y.	43	AN530-10-8	Screw
9	28F7802	Support Angle Fairing		AN960AL10L	Washer
10	28F6778-L&R	Support Angle—Heat Exchanger	44	AN530-10-8	Screw
11	28F7838	Forward Fairing	45	AN530-10-8	Screw
12	28F6930-L&R	Intermediate Fairing	46	Q5106D10-8	Screw
13	28F6754-L&R	Rear Fairing	47	Q5106D10-6	Screw
14	28F7817-6L&6R	Aft Fairing	48	AN526-DD1032-8	Screw
15	28F6753-L&R	Door Ass'y.	49	AN526-DD1032-8	Screw
16	28F7837-L&R	Lever for Door		AN372-D1032	Nut
17	28F7811-8	Link	50	AN526DD1032-8	Screw
18	28F6922-17L&17R	Duct—Upper Nacelle		AN372D1032	Nut
19	28F6922-18	Flexible Joint	51	AN526DD1032-7	Screw
20	28F6922-24	Clamp		AN372D1032	Nut
21	28F6922-16L&R	Duct—Lower Nacelle		AN960AL10L	Washer
22	28F7836	Bracket—Actuator Unit	52	AN510C10-8	Screw
23	6202-330-3	Actuator Unit—Starboard	53	AN3-7	Bolt
	6202-330-4	Actuator Unit—Port		AN320-3	Nut
24	28F6739-6	Outlet to Extension Duct		AN960AL10L	Washer
25	28F6749-L&R	Transition Duct—Sta. 5 to 6		AN380-2-2	Pin
26	28F6733-10L&R	Center Panel Duct		Q810D6-10	Spacer
27	28F6741	Duct Extension	54	AN500A516-10	Screw
28	28F6750-L&R	Transition Duct		AN500A516-6	Screw
29	28F6799	Coupling—Exhaust Outlet		AN960AL516L	Washer
30	28F6797-7	Plate—Exhaust Outlet Coupling	55	AN3-5	Bolt
31	28F6797-6	Plate—Exhaust Outlet Coupling		AN320-3	Nut
32	28F7800-L&R	Drain—Exhaust Outlet		AN960AL10L	Washer
33	28F6744-10	Duct—Outer Panel		AN380-2-2	Pin
34	28F6736-10	Duct—Outer Panel		Q810-D6-10	Spacer
35	28F6736-9L&R	Duct—Outer Panel		AN526-1032-10	Screw
36	28F6736-8	Duct—Outer Panel		AN960-10	Washer
37	28F6736-7	Duct—Outer Panel		AN501-C10-10	Screw
38	28F6736-6	Duct—Outer Panel	56	AN526-1032-10	Screw
39	AN526C1032-6	Screw		AN960-10	Washer
40	AN526-DD1032-8	Screw	57	AN501-C10-10	Screw

Items number 1, 2 and 3 are Solar Aircraft Co. part numbers.

Item number 23 is a White and Rodgers Co. part number.

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3. Remove clamp (2) from flexible joint (1), thereby releasing forward end of heat exchanger (3).

4. Remove upper shroud (4) from lower (7) by detaching bolts (41).

5. Detach bolts (42) holding heat exchanger to supports (10).

6. Remove collar (6) holding exit duct to shroud by detaching screws (57).

7. Slide heat exchanger forward, up, and out to remove.

8. The heat exchanger is a welded unit and cannot be disassembled.

(c) MAINTENANCE.

1. Remove heat exchanger. Clean intake ducts, shroud, flutes of heat exchanger, and exhaust tail pipe, removing all dirt incrustation.

2. The heat exchanger unit cannot be repaired. If it is defective, it must be replaced.

(d) INSTALLATION.—Reverse the removal procedure outlined in paragraph *b*, (2), *(b)*.

(3) DUCTING SYSTEM.

(a) DESCRIPTION.

1. WING CENTER PANEL.—A duct of rec-

tangular shape takes off on the inside of each rear fairing and routes the heated air to the center panel wing duct, which extends through the wing leading edge from the nacelle outboard to the wing outer panel. At the junction of the take-off duct and the center panel duct, the center panel duct becomes trapezium in form and runs outboard between the leading edge structural braces immediately forward of the front spar. Funnel-shaped scoops, spaced along the forward inside wall of the center panel duct, arrest part of the heated air and direct it forward through feeder ducts against the inside surface of the leading edge, thus warming the skin of the leading edge. These feeder ducts, five in each wing, are 18 inches wide, 16 inches long, and ⅜ inches deep.

2. WING OUTER PANEL.—As it enters the outer panel, the trapezium-shaped duct of the center panel alters its form to become a circular, six-inch stove pipe type which reduces progressively to two and seven-eighths inches outboard, to terminate in a sealed end immediately inboard of the wing tip. This outer panel duct is installed immediately adjacent to the leading edge skin, which it heats by the emission of heated air through spaced louvers in the forward side of the circular duct.

3. HEATER AIR RELEASES.—Used heated air, freed from the ducts, is exhausted from the leading edge through four circular openings in the outer panel front spar at wing stations 17 to 19. This air circulates aft and inboard within the wing space to an eight inch square opening in the center panel rear spar, where it passes into an attached duct and through the duct to an opening in the upper skin of the trailing edge, and exhausts to the atmosphere. This outlet duct is provided with a pan and an aluminum alloy three quarter inch tubing drain to catch any liquid which may condense within the duct. The drain protrudes from the trailing edge under surface at wing station 9.

4. WING GATES.—The wing gates are located in that part of the rear fairing below and aft of the heat exchanger. They direct heated air either into the wing ducts or overboard to the slipstream. They are operated by White—Rodgers electric motors, No. 6202-3 for the port side, and No. 6202-4 for the starboard side. These motors are mounted adjacent to the stub firewall on the top skin within the leading edge. The motor control switch is on the pilot's yoke signal box and is manually operated. When the air duct temperature exceeds 166°C (330°F), the thermostat automatically closes the motor circuits to actuate the wing gates by a mechanical linkage, closing off the ducts and thus releasing the hot air to the slipstream. When the air duct temperature drops within safe limits, the action is reversed and the heated air is again routed into the duct system. Temperatures below 150°C (302°F) are safe for duct and wing structures.

A thermocouple in the take-off duct at its juncture with the center panel duct registers wing duct temperature on two gages installed on a panel attached to left side of engineer's seat supporting structure. At 5000 feet altitude, the indicated temperatures at 2200 rpm and 29½ in. Hg manifold pressure will vary between 100° and 166°C (212° and 330°F) depending on outside air temperatures.

5. OPERATION.—The correct precedure in proper sequence for operating the wing anti-icing system is as follows:

a. Throw the "ANTI-ICING" switch on the main distribution panel to the same bus position as that of the generators. Failure to select the proper bus will result in no current to the system.

b. Throw the pilot's "ANTI - ICING" switch to the upper or "AUTOMATIC-MANUAL" position. This switch is located on the switch box on the pilot's control yoke.

Temperatures of the heated air in each wing duct are indicated on gages on the port side, left of the flight engineer's position. Port and starboard duct temperatures are indicated on the center and forward gages respectively.

When the pilot's switch is thrown to the "AUTOMATIC-MANUAL" position, the actuator unit in each wing, working independently of the other, operates the wing gate so as to close the outside air vent of the heat exchanger and uncover the opening from the exchanger into the air duct. Control of each actuator is taken over by a thermostat located in the duct below the actuator and connected to it by a tube. Thermostats are set by the manufacturer at 166°C (330°F). When this temperature is reached they operate to reverse the action of the actuators, covering the openings from the heat exchangers to the air ducts, and opening the outside air vents of the heat exchangers, thereby exhausting the heated air into the slipstream. Cooling of the duct air causes the actuators to repeat the first operation.

c. To shut off heat from the wings, throw the pilot's "ANTI-ICING" switch to the "MANUAL-CLOSE" position. In this position, the wing gates are closed to the wing air ducts and open to the outside air vents. They remain closed regardless of wing temperature.

(b) REMOVAL AND DISASSEMBLY.
(See figure 258.)

1. WING CENTER PANEL DUCTING.

a. Open nacelle access door which is aft and outboard of firewall.

b. Remove clamps (20) from flexible joint (19) by detaching screws (43).

c. Remove leading edge. (See Par. 1, *b*, (4), *(b).*)

d. Detach twelve screws (44) fastening rectangular nacelle duct (21) to bulkhead wing center section.

e. Remove lower nacelle duct.

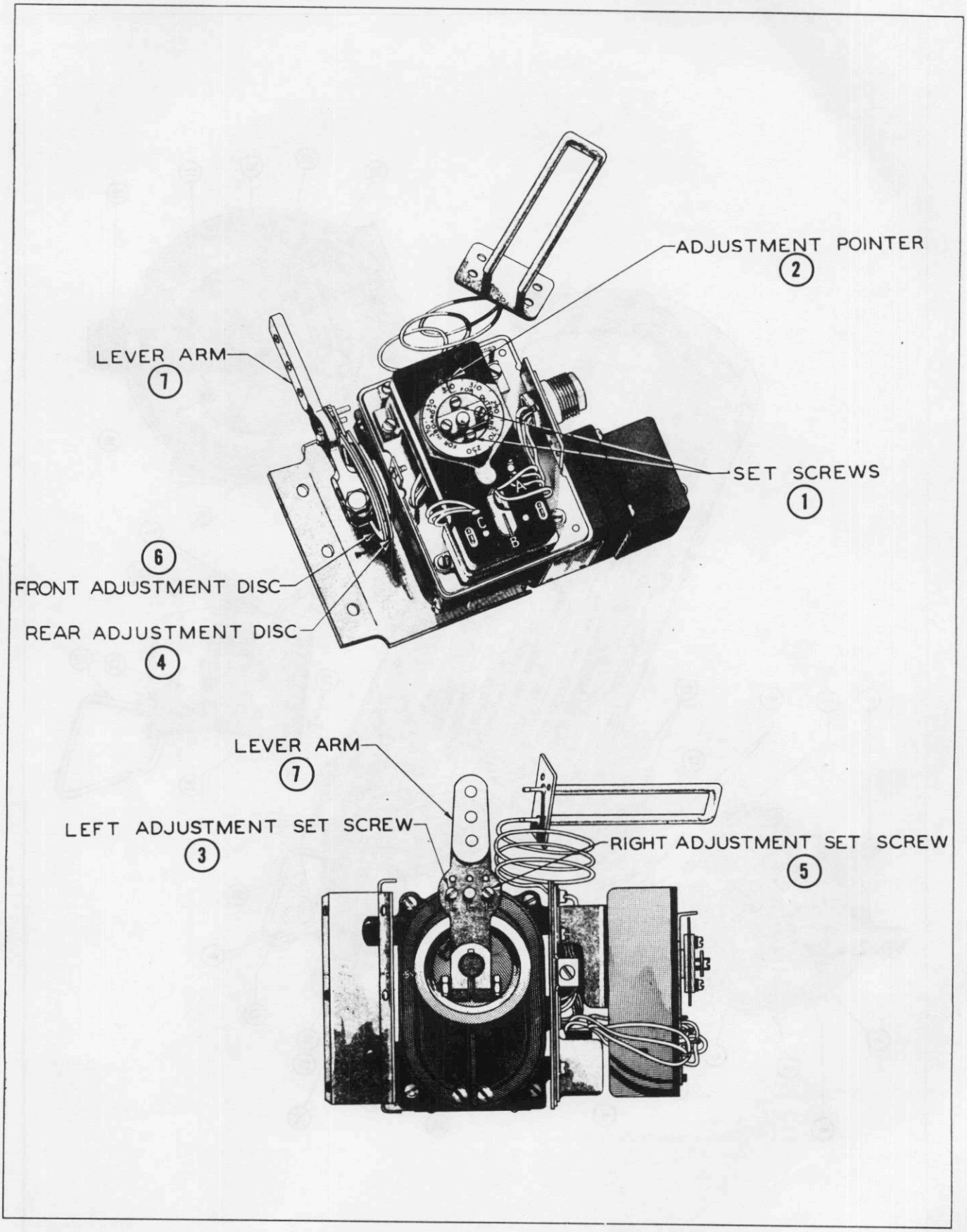


Figure 259—Wing Gate Actuating Mechanism

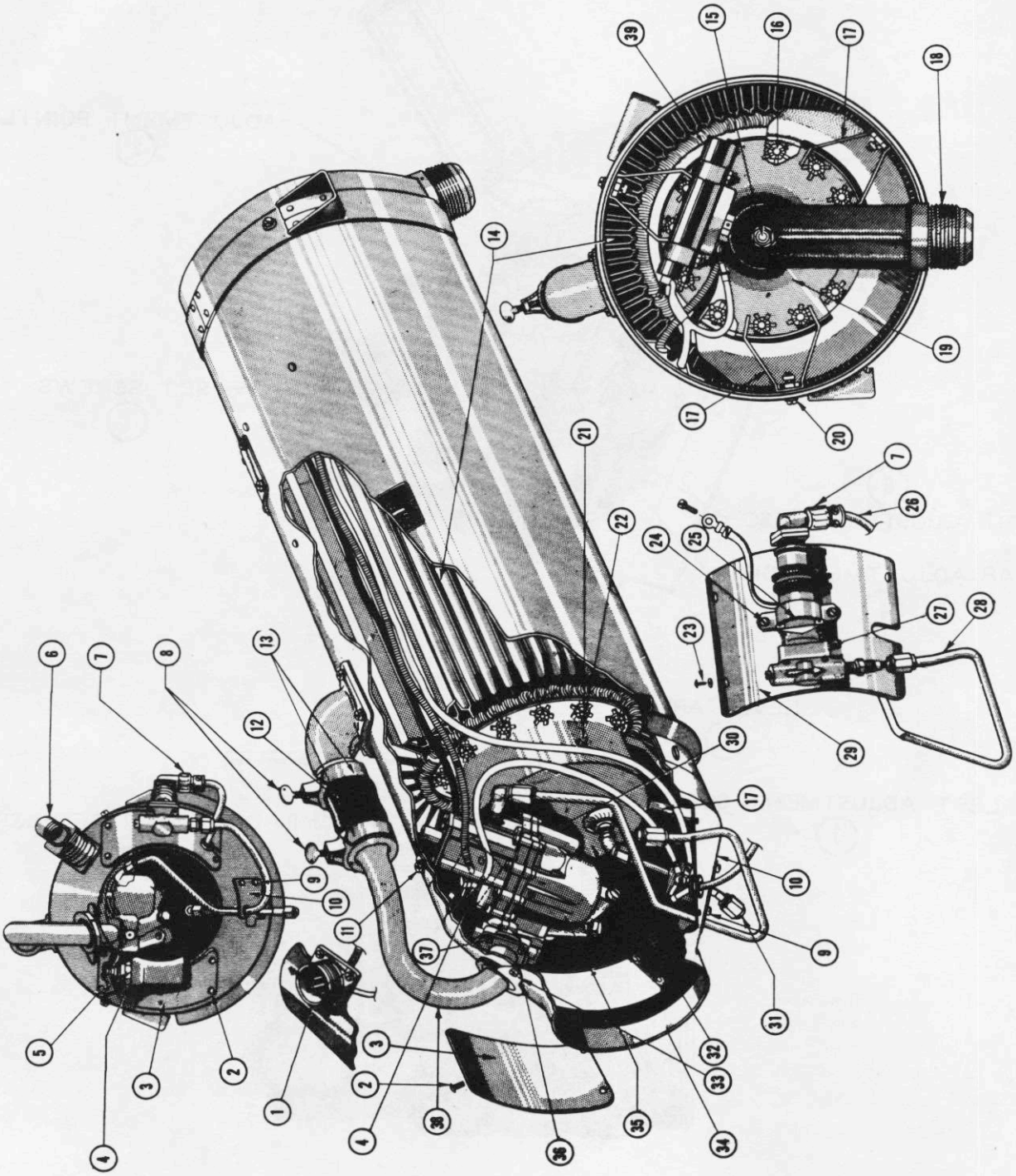


Figure 260—Tail Anti-Icing Heater

No.	PART No.	NAME
1	471335	Electrical Connection
2	471371	Screw
3	473553	Inspection Plate
4	472857	Igniter
5	472780	Gasket—Igniter
6	472790	90° Swivel Plug, Conn.
	472793	Coupling Nut, Conn.
	472795	Ferrule, Conn.
7	472866	Solenoid Valve Elec. Connector
8		Hose Clamp Screw
9	471371	Screw
10	473552	Fuel Line Plate
11	14447	Screw
	33815	Washer
	470792	Lock Nut
12	472787	Hose
13	470562	Clamping Bands
14	472855	Heat Exchanger
15	470999	Locking Nut
16	472637	Castle Nut
	472898	Lock Washer
17	472852	Bracket—Rear
	472851	Bracket—Front
18	472757	Exhaust Pipe
19		Exhaust Chamber Cap
20	76266	Screw
	79057	Washer
	471166	Lock Nut
21	472870	Combustion Chamber Cap
22	472637	Castle Nut
	472898	Lock Washer
23	471371	Screw
	33815	Washer
24	76232	Screw
25	472758	Valve Clamp—Inner
	472759	Valve Clamp—Outer
26		Solenoid Electrical Lead
27	471752	Solenoid Valve
28	G-472874	Fuel Line
29	473550	Valve—Mounting Plate
30	470419	Carburetor Attaching Bolts
31	G-472799	Drain Tube
32	472870	Combustion Chamber
33	471371	Screw
	33815	Washer
34	473551	Heater Case—Intake Duct
35	472789	Carburetor
36	472860	Gasket Retainer
37	471371	Screw
	33815	Washer
38	G-472868	By-pass Tube
39	472863	Overheat Switch

All items are Stewart-Warner Corporation part numbers.

f. Remove five duct extensions (27) from center panel duct (26) by detaching screws (45) from flanges.

g. Remove wing duct (26) from transition duct (25) by detaching screws (46).

h. Remove wing duct from transition duct (28) by removing screws (47).

i. Detach screws, one upper and one lower from supporting brackets at each station.

j. Remove center panel duct by sliding outboard.

2. WING OUTER PANEL DUCTING.

a. Remove leading edge (See Par. 1, *c*, (3), *(b)*.)

b. Remove transition duct (28) from outer panel duct by detaching screws (49) from coupling.

c. Remove short duct and adjustable elbow (which lie just outboard of the wing splice) by loosening screws at the couplings.

d. Remove duct (33) lying between stations 12 and 13 by loosening screws (50) at joint.

e. Remove adjustable elbow which lies between ducts (33) and (34) by loosening screws (50) at joint.

f. Remove duct (34) lying between station 13 and station 14 by detaching two screws (50) at juncture.

g. Remove duct (34) lying between station 14 and station 15 by detaching two screws (50) at juncture.

h. Remove joint assembly duct (35) lying between station 15 and station 16 by detaching six screws (50) at reducer juncture.

i. Remove duct (36) lying between station 16 and station 18 by detaching six screws (50) at reducer juncture.

j. Remove duct (37) lying between station 18 and station 20 by detaching six screws (50) at reducer juncture.

k. Remove duct (38) lying between station 20 and station 26.

3. HEATED AIR RELEASE.

a. Remove trailing edge, wing center panel. (See Par. 1, *b*, (5), *(b)*.)

b. Remove exit duct at rear spar by detaching screws (51) which fasten it to plate (30).

c. Remove plates (30) and (31) and coupling (29) by detaching screws (51).

d. Exit duct pan is riveted to angle supports and fastened to opening to trailing edge by rivets beneath the tape fabric.

4. WING GATES.

a. Remove lever (16) from door assembly (15) by detaching screws (52).

b. Remove lever from link (17) by detaching bolt (53).

c. Remove actuator unit (23) by detaching screws (54) from actuator bracket (22).

d. Remove link from actuator arm by removing bolt (55).

(c) MAINTENANCE.

1. WING CENTER PANEL.—See STRUCTURAL REPAIR MANUAL, AN 01-5MA-3.

2. WING OUTER PANEL.—See STRUCTURAL REPAIR MANUAL, AN 01-5MA-3.

3. HEATED AIR RELEASE.—See STRUCTURAL REPAIR MANUAL, AN 01-5MA-3.

4. WING GATES.

a. ACTUATOR TEMPERATURE ADJUSTMENT.
(See figure 259.)

(1) Remove the rectangular cover of actuator by detaching two screws on each side.

(2) Loosen the two setscrews (1) on the disc.

(3) Turn disc until desired temperature is opposite the notch in the pointer. Factory setting is 165°C (330°F).

(4) Tighten setscrews and replace cover.

b. WING GATE MOVEMENT. — The wing gates are adjusted at the factory for correct throw but should they operate incorrectly due to wear or slippage, they may be readjusted as follows:

Before adjustment, the unit should be disconnected from the electric circuit of the airplane at the Cannon plug and connected to an outside source of 24 volts D. C. power. A switching connection similar to that on the airplane should be used with the substitution of a single pole "ON-OFF-ON" switch for the double pole reversing switch to provide for stopping the motor at any desired point on its travel. Connect terminals "A" and "B" of the actuator plug to "ON" positions, and terminal "G" to the negative or ground side of the circuit.

If the adjustment must be made by use of the circuit of the airplane, station a man at the reversing switch in the pilot's compartment and one at the "ANTI-ICER" switch on the main distribution box to reverse or stop the action when called for by the adjuster.

If both "OPEN" and "CLOSED" adjustments are to be made, make the "CLOSED" adjustment first.

(1) OPEN ADJUSTMENT-STARBOARD ACTUATOR.

(a) Be sure the damper is in the closed position.

(b) Loosen screw "L" (3).

(c) Rotate the rear adjustment disc (4) to the right or left depending on the adjustment desired.

(d) Tighten screw "L" and test the adjustment by throwing the control switch to the "OPEN" position. If the throw is too great or too little, stop the action by throwing the switch to "OFF" and readjust. These operations *((a)* through *(d))* may have to be repeated several times before correct adjustment is obtained.

(2) CLOSED ADJUSTMENT-STARBOARD ACTUATOR.—This adjustment is more easily made by means of the turnbuckle on the link between the lever arm (7) and the lever of wing gate. To increase the throw, lengthen the rod; to decrease the throw, shorten the rod. If adjustment by this means is insufficient, proceed as for "OPEN" adjustment, but loosen screw "R" (5) instead of screw "L" (3), and rotate front disc (6) instead of rear disc (4). After completing either or both adjustments, open and close the gate a few times to test both operations and readjust if necessary.

(3) OPEN AND CLOSED ADJUSTMENTS—PORT ACTUATOR.—The adjustments are made in the same manner as those for the starboard unit except that the set screw (5) and the front disc (6) are used for "OPEN" adjustment, and the set screw (3) and rear disc (4) for "CLOSED" adjustment.

c. ELECTRICAL SYSTEM.—For maintenance of wing anti-icing electrical system, see Par. 22, r.

(d) ASSEMBLY AND INSTALLATION.—Reverse removal and disassembly procedure outlined in paragraph *b*, (3), *(b)*.

c. EMPENNAGE ANTI-ICING.
(See figure262.)

(1) GENERAL.—The hot air anti-icing system consists of an internal combustion heater (Stewart-Warner No. 901-A) installed in an inclined position at the base of the vertical fin leading edge. Ram air received from an air scoop which is located immediately forward of the base of the heater, is raised to the desired temperature by passing over and around the heater. The heated air is then directed out of the heater through a duct to a plenum chamber or manifold located at the junction of the vertical fin and horizontal stabilizer. Then the heated air is distributed by a suitable system of ducts to the leading edges of the fin and stabilizer. These leading edge ducts are perforated at regular intervals allowing the heated air to pass out of the ducts to spaces between the inner and outer skin of the leading edges. The heated air then exhausts to the slipstream through openings between the inner and outer skin.

A portion of the heated air is by-passed from the downstream duct of the heater and conducted

back to the air scoop. This heated air acts as a de-icer for the air scoop and the damper control installed in the duct. Any moisture resulting from de-icing or picked up by the scoop in take-off or flight, drains overboard through a tube. The volume of the air which enters the duct from the air scoop is regulated by a push-pull type control located on the forward side of bulkhead 7. This control is connected to a damper inside the air scoop and is manually operated to open or close damper the required degree.

A duct pressure switch (Stewart-Warner Model G-473338) is installed in the air intake duct just aft of the air scoop, which breaks the circuit when air pressure is insufficient for good heater operation. Breaking of the circuit causes the solenoid valve on the fuel line to close and thus stops the flow of fuel to the heater.

The fuel for the fuel-air mixture, necessary for the heater's operation, flows through a carburetor mounted within the heater's outer case. This carburetor, specially designed with an automatic compensator for altitude, is connected to the solenoid fuel shut-off valve mounted on the outer case of the heater. The valve in turn is connected to the fuel line running to a pressure regulator valve, then through a filter and fuel line to a shut-off valve between bulkheads 4 and 5, and on to a take-off fitting on the cross feed fuel line. Air for the fuel-air mixture is obtained by means of a by-pass tube, leading from the outer case of the heater to the throat of the carburetor. Electric current for the heater's operation is taken from the airplane's 24-volt system. This current is used for igniting the fuel-air mixture within the heater as well as for operating the solenoid control valve. Heater switch is on bulkhead 7.

Duct temperatures are controlled by an overheat installed in the heater unit. The overheat switch breaks the circuit whenever duct temperature reaches 150°C (302°F), or whatever temperature it may be set for, thus de-energizing the solenoid valve and shutting off supply of fuel to the heater. Similarly, the circuit closes whenever duct temperature drops within safe limits, and fuel is again supplied to the heater through the opening of the solenoid valve.

(2) HEATER UNIT.
(See figure 261.)

(a) DESCRIPTION.—An internal combustion heater (Stewart-Warner Model 901-A), rated at 100,000 BTU per hour, is installed in an inclined position at the base of the vertical fin leading edge above hull bulkhead 9. The heater consists essentially of a heat exchanger with internal flues and external fins and a combustion chamber, closely shrouded by the heater case. Its function is to heat ram air for circulation to fin and stabilizer leading edges, which it receives from the air scoop and duct immediately forward of the base of the heater. The ram air is heated by passing around the walls of the combustion chamber and heater fins, whence it proceeds through the aft duct to the plenum chamber. A by-pass tube is connected to the heated air compartment through the heater's case, which carries heated air forward to the throat of the carburetor. Carburetor, overheat switch, and electric igniter (glow plug type) are integral with heater unit.

The fuel air mixture upon leaving the carburetor enters the combustion chamber. Here it is ignited by the electric igniter and burns, releasing thermal energy through the combustion chamber walls to the air stream. The burning mixture then enters the flues of the heat exchanger where it is extinguished. The hot gases also release their heat to the air stream through the fins of the heat exchanger. Burnt out gases then pass through the exhaust chamber and exhaust fitting to the atmosphere. The exhaust fitting connects to a clam shell covered outlet in the skin of the airplane on the tail port side below the stabilizer. Fuel from the airplane's main fuel supply flows to the solenoid valve which is mounted on the port side of the inspection cover of heater. When the heater switch is turned to "ON", the solenoid lifts the valve sealing plate permitting fuel to flow to the carburetor. When the heater switch is turned to "OFF," the solenoid is de-energized and the valve spring forces the sealing plate down, closing the outlet port orifice.

Fuel flows from the solenoid valve to the carburetor where it is mixed with air before being delivered to the heater's combustion chamber. A fuel line drain just aft of where the fuel line enters the carburetor carries off and discharges outside the airplane at bulkhead 8, starboard side, any overflow from the heater combustion chamber. A by-pass tube connected to the air circulation compartment of the heater's case, carries heated air to the throat of the carburetor where it is mixed with fuel before going as a fuel-air mixture into the combustion chamber. To avoid too rich a mixture of fuel in proportion to air at high altitudes, a condition which would cause heater failure, a special altitude compensator is built into the carburetor so that the mixture is regulated automatically with the fall or rise of atmospheric pressure.

(b) REMOVAL AND DISASSEMBLY.

1. Remove heater unit as follows: *(See figure 261.)*

a. Remove heater access plate from base of fin.

b. Detach by-pass tube (12) to air intake duct by loosening clamps (5) which hold flexible hose (6).

c. Loosen bracket holding flexible duct to air intake end of heater by detaching screws.

d. Detach screws (8) holding outlet end of heater in duct.

e. Detach mounting bolts (7) and (10).

f. Remove connector lead (16) from heater.

g. Remove coupling from heater exhaust outlet.

h. Remove heater drain tube coupling from drain tube.

i. Remove fuel line connection to solenoid valve (15).

j. Slide heater forward, up and out of tail assembly.

2. Disassemble heater unit as follows: *(See figure 260.)*

a. Remove fuel line (28) from outlet of solenoid valve (27).

b. Detach screws (23) and washers holding solenoid valve mounting plate (29) to heater. Remove plate.

c. Remove fuel line from carburetor (35).

d. Remove drain tube (31) from combustion chamber (32).

e. Remove connector to solenoid valve and the leads from heater terminal.

f. Detach screws (24) holding solenoid valve support to plate.

g. Disassemble solenoid valve as follows:

(1) Remove electrical connector.

(2) Detach four screws holding electro-magnet control to valve. Remove the electro-magnet control.

(3) Remove ring cap of electro-magnet control.

(4) Lift valve body in one hand; place palm of other hand over copper sealing disc and turn valve upside down. Copper disc, valve disc, and spring will drop into palm of hand.

h. Remove clamping bands (13) from flexible hose (12) on by-pass tube (38) to carburetor.

i. Detach screws (33) holding gasket retainer (36) to heater case intake duct (34).

j. Detach screws (2) holding inspection plate (3) to heater. Remove plate.

k. Detach screws (9) and washers holding fuel line clamping plate (10) to heater case. Remove plate and lift carburetor fuel line and heater drain line (31) out of heater case.

l. Detach screws (11) and washers holding intake duct (34) on heater case.

m. Detach screws (37) and washers holding by-pass tube (38) to carburetor. Remove air by-pass tube.

n. Detach screws (30) and boot nuts holding carburetor to heater's combustion chamber intake tube. Remove carburetor.

o. Disassemble carburetor as follows:

(1) Detach nine screws and lock washers holding altitude compensator to carburetor float bowl. Remove from float bowl.

(2) Detach the pin holding float lever arm to carburetor cover (base of altitude compensator) and remove float.

(3) Remove inlet needle, seat, gasket and filter.

(4) Remove base plug.

CAUTION

Do not attempt to remove jet unless absolutely necessary. Care should be taken, in this case, to avoid stripping threads.

(5) Detach angle base plug screw.

p. Unsolder electrical connections to "AN" connector (1). Remove intake duct cap.

q. Remove igniter lead wire from igniter terminal (4). Remove overheat switch (39), and leads.

r. Detach screws (11) and nuts holding heat exchanger brackets (17) to intake end of heater.

s. Detach screws (20) and nuts holding heat exchanger brackets (17) to exhaust end of heater case.

t. Slide heat exchanger (14) out of heater case.

u. Remove igniter (4) and gasket (5) from heat exchanger.

v. Detach nuts (22) and lock washers holding combustion chamber cap (21) to heat exchanger.

CAUTION

Be sure and key combustion chamber cap brackets and heat exchanger.

w. Remove combustion chamber cap and brackets (17).

x. Detach exhaust chamber's locking nut (15) from positioning stud.

y. Detach castle nuts (16) and lock washers holding exhaust chamber cap (19) to heat exchanger.

CAUTION

Be sure and key exhaust chamber cap, brackets, and heat exchanger.

z. Remove exhaust chamber cap and brackets.

(c) MAINTENANCE.

1. Heater exhaust outlet should be examined at regular intervals for obstructions.

2. HEAT EXCHANGER. — Remove carbon or lead deposits from inner flues with wire brush or scraper. Be sure flues are not clogged. With wire brush, remove any dirt deposited on fins. Straighten and line-up fins.

3. COMBUSTION CHAMBER CAP.—Remove any carbon or lead deposits from inside of exhaust chamber cap and tube with wire brush or scraper.

4. EXHAUST CHAMBER CAP.—Remove any carbon or lead deposits from inside of exhaust chamber cap and tube with wire brush or scraper.

5. SOLENOID SHUT-OFF VALVE.—With one man in plane, at heater switch, and one observing heater—rapidly snap heater switch "ON" and "OFF." Solenoid valve should emit a clicking sound. If no clicking sound is heard, magnetic coil is defective and must be replaced.

6. CARBURETOR.—Leaning out of the fuel-air mixture at low altitudes indicates altitude compensator is defective and must be replaced. If float is damaged, it should be replaced.

(d) ASSEMBLY AND INSTALLATION.—Reverse assembly and removal procedure as outlined in paragraph *c*, (2), *(b)*.

(3) FUEL SYSTEM.

(a) DESCRIPTION.—Fuel for the heater is obtained from the engine's fuel pump by means of a take-off fitting placed in the cross feed fuel line. From here, a flexible line ⅜ in. inside diameter passes through bulkhead 4 to a manually operated shut-off valve (Parker 702-GG-4D) located in the hull structure just to the starboard of the engineer's seat. When this valve is open, fuel flows through a connector, through a filter (Adel 8989-1), then through a connection to a pressure regulating valve (Surface A52A26). From the outlet side of the pressure regulating valve, the fuel line runs aft on the starboard side generally following the overhead to the solenoid valve which is mounted on the port side of the inspection cover of heater. From there, when the solenoid valve is open, the fuel runs to the throat of the carburetor to be mixed with air and go as fuel-air mixture into the combustion chamber of the heater.

Note

On PBY-5A airplanes with serial numbers prior to 46580 and all PBY-5 airplanes (See the INTRODUCTION to this MANUAL for a list of serial numbers covered.) the fuel line passes through the deck, forward of bulkhead 4, to the filter (Adel 8989-1) and then through bulkhead 4 to the manually operated shut-off valve (Parker 702-FG-4D). From the shut-off valve, the fuel line proceeds to the filter (Surface A52A26) and thence aft to the empennage heater.

When the heater switch is turned to "ON," the solenoid valve opens and fuel flows to the carburetor. When the heater switch is turned to "OFF," the solenoid valve closes and fuel supply is shut off. Two other controls activate or de-activate the solenoid. The duct pressure switch breaks the circuit whenever the air pressure in the intake air duct becomes insufficient for good heater operation, causing the solenoid valve to close. The overheat switch breaks the circuit whenever the temperature in the heater outlet rises above the set degree. Thus again, the solenoid valve is closed and fuel shut off from the carburetor.

(b) REMOVAL AND DISASSEMBLY. *(See figure 262.)*

1. Remove fuel line connection (55) to solenoid valve.

2. Uncouple fuel line connection (57) forward of bulkhead 9.

3. Remove clips which attach fuel line to structure.

4. Remove aft section (55) of fuel line.

5. Uncouple fuel line connection (8) to pressure regulator (5) between bulkheads.

6. Remove clips (16) and (59) which hold fuel line to structure.

7. Remove center section of fuel line (60).

8. Uncouple fuel line connection (8) at shut-off valve (7).

9. Uncouple fuel line connection (63) to take-off fitting on cross feed fuel line forward of bulkhead 4.

10. Remove clips (61) and (64) which hold fuel line to structure.

11. Remove forward section of fuel line (62).

12. Remove elbow (10) from pressure regulator.

13. Remove nipple (11) between pressure regulator and filter (6).

14. Detach screws (2) holding pressure regulator to mounting plate (1). Remove pressure regulator.

15. Remove nipple (11) between filter (6) and manual shut-off valve (7).

16. Remove fitting (9) which connects shut-off valve to fuel line.

17. Detach screw (4) holding valve to support (3). Remove shut-off valve.

18. Disassemble pressure regulator as follows:

a. Detach cover cap.

b. Unscrew adjusting ferrule. Outlet spring will be freed.

c. Detach six elastic stop nuts and screws from regulator cover. Diaphragm assembly will now be free.

d. Detach valve seat which will free valve stem, valve assembly and valve spring.

19. Disassemble filter as follows:

a. Unscrew cap from threaded stem of element.

b. Remove cap from bowl by detaching nut.

c. Remove seal and element from bowl.

20. Disassemble shut-off valve as follows:

a. Detach screw and washer in handle. Remove handle from body.

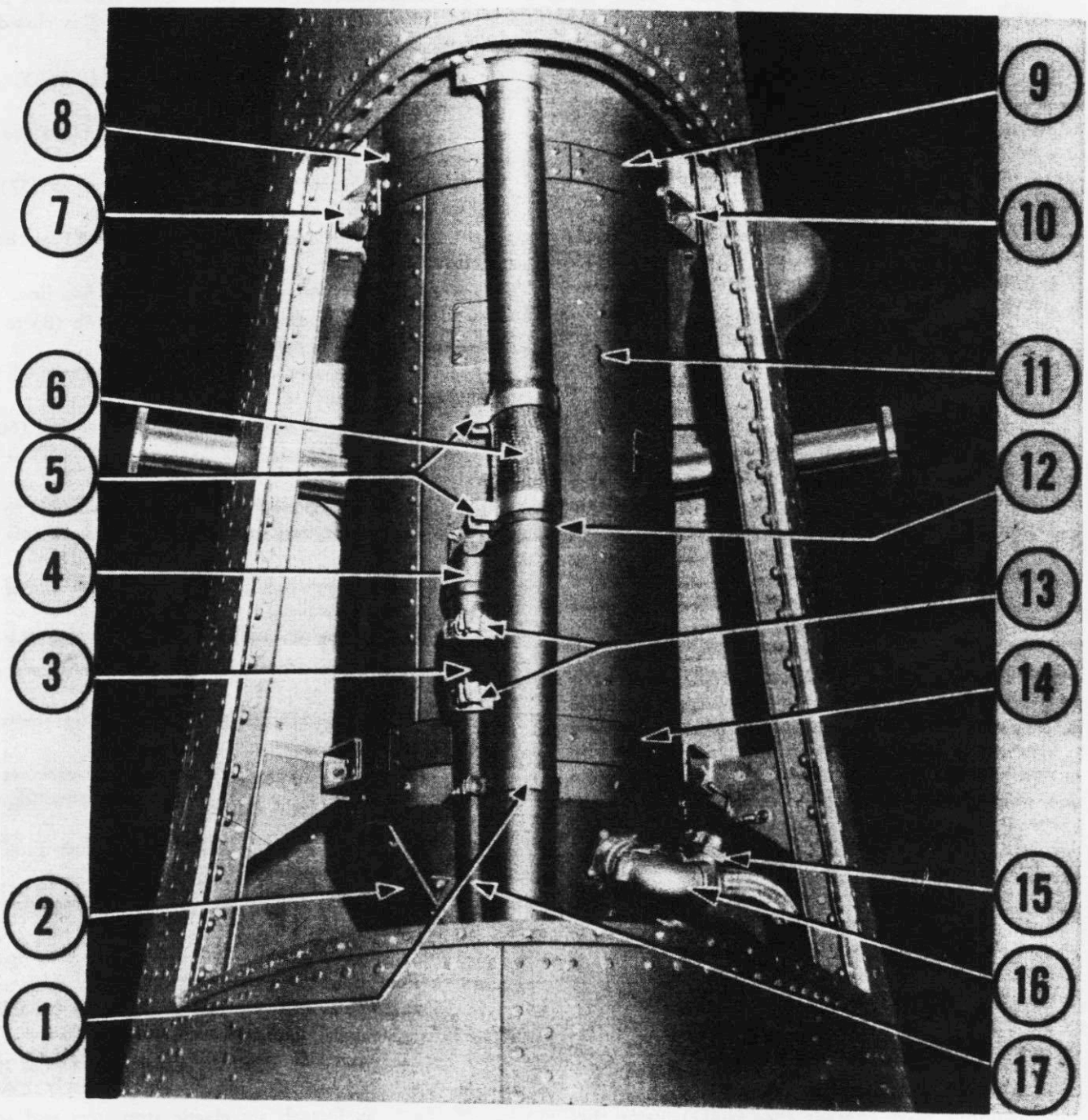


Figure 261—Tail Anti-Icing Heater Installation

b. Unscrew cap from body. Remove spring button, spring, and plug.

(c) MAINTENANCE.

1. If leakage occurs at connections, tighten clamps. If *it continues* replace defective parts.

2. If fuel line becomes cracked, unpliable, frayed, swollen, or worn, replace.

3. For clogging or obstruction in fuel line, disconnect at both ends. Blow compressed air through line and flush with clear gasoline to remove obstructing matter.

4. For lubrication of manual shut-off valve, use only VALVLUBE 3 ER. (Parker Appliance Co.)

(d) ASSEMBLY AND INSTALLATION.—Reverse disassembly and removal procedure as outlined in paragraph *c*, (3), *(b)*.

No.	PART No.	NAME	No.	PART No.	NAME
1	Q908A-24	Clip	11	*901-A	Heater
2	*473553	Inspection Plate	12	28F6731-23	By-pass Tube to Duct—Upper
3	*472787	Hose		28F6731-24	By-pass Tube to Duct—Lower
4	*472869	Elbow	13	*470562	Clamp
5	AN748-58	Clamp	14	*472752	Mounting Ring & Brackets
6	28F6731-25	Hose	15	*471752	Solenoid Valve
7	AN4DD-5A	Bolt	16	*472790	90° Swivel Plug, Connector
	AN372-D428	Nut		*472793	Coupling Nut
8	Q5106D10-8	Screw		*472795	Ferrule
9	*472752	Mounting Ring & Brackets	17	*472868	By-pass Tube to Carburetor
10	AN4DD-5A	Bolt			
	AN372-D428	Nut			

All items marked with an asterisk (*) are Stewart-Warner Corporation part numbers.

1. Use SEALUBE (Parker Appliance Co.) on all pipe threads.

2. Wrap all flexible fuel lines with friction tape at all clips and wherever necessary to prevent chafing.

(4) DUCTING SYSTEM.

(a) DESCRIPTION.

1. INTAKE SYSTEM.—Ram air enters the air scoop through air intake duct which is joined to the forward end of the heater unit by a flexible duct. The intake duct has a double skin construction for the circulation of heated air in inter-skin space so that intake and damper will be kept free of ice. The heated air is supplied by a by-pass tube connected with the intake duct's interior construction; it is picked up by the other end of the by-pass tube from the duct just aft of the heater and by-passed forward to the intake duct. Any moisture resulting from de-icing, or picked up by the scoop during take-off or flight, drains overboard through a tube connected with an opening in the intake duct and leading to a small clamshell fitting in the skin on the starboard side below the air scoop.

Installed in the intake duct is a manually operated damper, the push-pull control for which is mounted on the forward face of bulkhead 7. It regulates the amount of ram air which can enter the intake system. When the heater is operating, it must be open. It must always be closed when the airplane is taking off or landing so that salt water will not enter the heater.

Also installed within the intake duct, is the duct pressure switch, which breaks the circuit and closes the solenoid valve whenever duct air pressure is insufficient for good heater operation.

A rigid outlet duct is joined to the aft end of the heater unit. The rigid outlet duct in turn, is connected by a flexible duct to the plenum chamber. The function of the plenum chamber is to equalize the pressure of the heated air for distribution upward within the vertical fin's leading edge, and to port and starboard within the leading edge of the stabilizer. The plenum chamber is fitted with baffles, and is installed at the interior junction of fin and stabilizer.

When the heater is operated while the airplane is on the ground, ram air is supplied from the propeller wash. A detachable air scoop is fitted over the mouth of the intake duct, the smaller end being attached to the duct with "Lift-a-Dot" fasteners. The air gathering end, shaped and stiffened with a 30-inch aluminum hoop, is held in position by three straps, fitted with snap hooks, and attached to the surface of the airplane by eyebolts installed in the skin. A cap or canvas cover is installed over the air scoop of a grounded plane to keep the intake duct clear of ice and snow. The cap is attached to the mouth of the air scoop by "Lift-a-Dot" fasteners.

2. VERTICAL FIN SYSTEM.—From the plenum chamber, a duct of aluminum alloy goes up and aft. It is joined to an aluminum alloy circular duct which follows the fin through rib holes to the top. This duct, two and one-half inches in diameter, runs close to the leading edge, and allows heated air to pass out of it through one half inch louvers spaced two to three inches apart. Its upper end is perforated by a three quarter inch hole. Heated air circulating through the louvers passes between the inner and outer skin of the leading edge. The outer skin is formed by a plate extending back about eight inches from the center .ine of the leading edge. It is held at a distance of .064 inch from the inner skin by spacers. This inner skin has three eights inch perforations spaced two inches apart along its center line, thus allowing the heated air to circulate within interskin space. The air is then drawn out by negative pressure into the slipstream through spaces at the trailing edge of the outer skin.

3. STABILIZER SYSTEM.—The ducts to port and starboard from the plenum chamber outboard to the ends of the stabilizer are similar for both sides. A three and three quarters inch diameter circular duct takes off from the plenum. It is joined at station 6.0 by a duct two and thirteen sixteenth inches in diameter. This duct is joined at station 7.0 by a duct two and

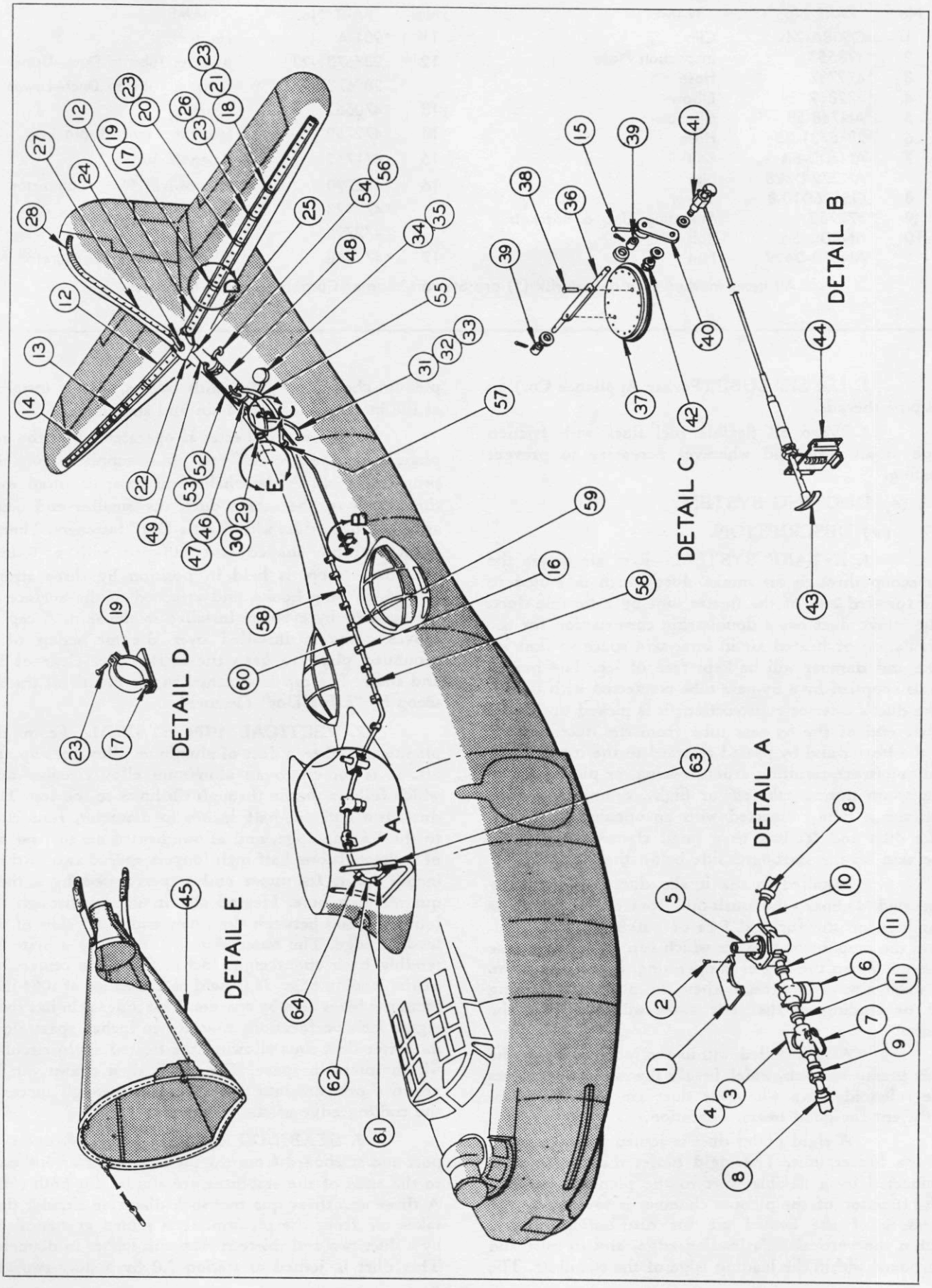


Figure 262—Tail Anti-Icing System

No.	PART No.	NAME
1	*28G10028	Mounting Plate—Press. Reg.
	**28G5544	Mounting Plate—Press. Reg.
	***28G5542	Mounting Plate—Press. Reg.
2	AN526-832-8	Screw
	AN365-832	Nut
	AN960-D8L	Washer
3	*28G10025	Angle Support—Shut-Off Valve
4	AN526-DD1032-8	Screw
	AN365-D1032	Nut
5	A52A26	Pressure Regulator
6	8989-1	Fuel Filter
7	*702-GG-4D	Manual Shut-Off Valve
	702-FG-4D	Manual Shut-Off Valve
8	AN748-26	Clamp
9	28G5186-6	Fitting
10	AN915-1D	Elbow
11	AN911-1D	Nipple
12	28F6826-17L&17R	Duct—Plenum to Sta. 4
13	28F6826-6L&6R	Duct—Sta. 4 to 8
14	28F6826-10	Duct—Sta. 8 to 12
15	AN392-33	Flat Head Pin
	AN380-2-2	Cotter Pin
	Q7102-AL4	Washer
16	Q908-A12	Clip
	AN526-DD1032-8	Screw
	AN365-D1032	Nut
17	AN526-DD1032-10	Screw
	AN526-DD1032-8	Screw
18	AN526-DD832-40	Screw
	AN372-D832	Nut
19	28F6826-41	Clamp
20	28F6826-37	Clamp
21	28F6826-15	Clamp
22	28F6873	Plenum Chamber
23	AN526-DD1032-9	Screw
	AN372-D1032	Nut
24	28F6755	Duct Elbow
25	28F7556	Coupling—Plenum Entrance
26	28F6826-34	Clamp
27	28F6729-6	Duct—Upper Fin
28	28F6729-7	Duct—Upper Fin
29	28F6875-2	Duct—Air Intake
30	AN526-DD1032-8	Screw
	AN372-D1032	Nut
31	28F6782-6	Drain Tube—Intake Duct
32	AN878-16-16	Hose
33	AN748-46	Clamp
34	G473338	Duct Pressure Switch
35	AN526-DD1032-10	Screw
	AN365-D1032	Nut
	Q7006-AL11	Washer
36	28F12808	Damper Rod
37	28F6877	Damper Disc
38	AN526-DD1032-8	Screw
39	28F6878	Damper Bearing
	AN380-C2-2	Cotter Pin
	AN960-A816	Washer
40	28F6884	Damper Arm
41	28F6785	Connector
42	AN960-A616	Washer
	AN310-D3	Nut
43	28F7590	Damper Control
44	28F6795	Lock—Damper Control
45	28F7849	Scoop
46	28F6740-6	Coupling
47	AN526DD1032-8	Screw
	AN372-D1032	Nut
48	901-A	Heater
49	28F6731-4	Heater Outlet Duct
52	28F6731-23	By-pass Tube—Upper
	28F6731-24	By-pass Tube—Lower
53	AN526-DD1032-10	Screw
	AN372-D1032	Nut
	AN960-A10	Washer
54	28F6769	Outlet—Heater Exhaust
55	*AN878-6-152	Fuel Line—Aft Section
	AN878-6-144	Fuel Line—Aft Section
56	28F6758	Exhaust Tube
57	*AN848-6D	Bulkhead Fitting
	28P5166-4D	Bulkhead Fitting
	AN924-6D	Nut—Bulkhead Fitting
	AN844-6D	45° Hose Fitting
	AN842-6D	90° Hose Fitting
	AN748-26	Hose Clamp
58	AN731-12-17	Grommet
59	Q908-A12	Clip
	AN526-DD1032-10	Screw
	AN365-D1032	Nut
60	*AN878-6-1380	Fuel Line—Center Section
	**AN878-6-1360	Fuel Line—Center Section
	***AN878-6-1872	Fuel Line—Center Section
61	Q908-A12	Clip
	AN526-DD1032-30	Screw
	Q810-D6-40	Spacer
	AN365-D1032	Nut
62	AN878-6-228	Fuel Line—Forward Section
63	AN840-6D	Coupling
	AN912-9D	Bushing
64	Q925-A12L	Clip
	AN526-632-9	Screw
	AN365-632	Nut
	AN960-D6L	Washer

Item 5 is a Surface Combustion Corp. part number.
Item 6 is an Adel Precision Products Corp. part number.
Item 7 is a Parker Appliance Co. part number.
Items 34 and 48 are Stewart-Warner Corp. part numbers.

*PBY-5A airplanes with serial numbers 46580 through 46638.
**PBY-5A airplanes with serial numbers 33960 through 34059, 48252 through 48451, and 46450 through 46579.
***PBY-5 airplanes.

seven sixteenths inches in diameter which in turn is joined to a duct at station 8.0 of two and one sixteenth inches in diameter. This last duct runs to the end of the leading edge of the stabilizer. The leading edge has a double skin construction formed by an outer plate extending back ten inches from the center line of the leading edge, on the top and bottom surfaces. The outer skin is spaced .091 from the inner skin. Louvers in the ducts, similar to those in the vertical fin, emit heated air to the inter-skin space through a series of holes in the top surface of the inner skin. The heated air circulates through the inter-skin space and is then drawn out into the slipstream through a series of three eights inch holes three inches apart in the trailing edge of the under surface of the outer skin.

(b) REMOVAL AND DISASSEMBLY.
(See figure 262.)

1. INTAKE SYSTEM.

a. Remove heater unit. (See paragraph *c*, (2), *(b)*.)

b. Remove flexible connection from intake duct by detaching screws (47).

c. Remove by-pass tube from intake duct by detaching screws on upper flange of duct.

d. Remove drain tube (31) from hose connector (32) at bottom of duct.

e. Detach electric leads from duct pressure switch (34). Remove duct pressure switch from duct by detaching screws (35).

f. Remove damper control connector (41) from damper arm (40) by detaching bolt and washers.

g. Remove screws (30) which hold intake duct to scoop structure.

h. Remove intake duct by lifting up and aft.

i. Remove by-pass tube from outlet duct (49) by detaching screws on upper flange of duct.

j. Slip flexible coupling from outlet duct.

k. Remove outlet duct by lifting forward and out.

l. Disassemble damper control as follows:

(1) Remove safety wire from connector (41).

(2) Remove connector from damper arm (40) by detaching nut and washer (42).

(3) Remove arm from rod by detaching pin (15).

(4) Remove bearings (39) from rod by detaching cotter pins.

(5) Remove damper disc (37) from rod by removing the two screws (38).

(6) Withdraw rod from duct.

m. Remove plenum chamber as follows:

(1) Remove the leading edge of the horizontal stabilizer. (Refer to Par. 2, *d*, (3), *(d)*.)

(2) Loosen clamp (19) on both the port and starboard sides by removing two screws.

(3) Slide duct (12) into plenum chamber until its outboard end is free and then pull outboard end forward until it clears end of duct (13).

(4) Pull duct (12) from plenum chamber.

(5) Detach the two screws which fasten the plenum chamber to the stabilizer structure and remove plenum chamber.

2. VERTICAL FIN SYSTEM.

a. Remove horizontal stabilizer from the airplane. (Refer to Par. 2, *d*, (2).)

b. Remove plenum chamber as described in paragraph *c*, (4), *(b)*, *1*, m above.

c. Remove the vertical fin ducts by pulling them downward through the bottom of the leading edge.

d. The three ducts which form the vertical fin system may be disassembled by removing the screw at their junctures.

3. STABILIZER SYSTEM.

a. Remove leading edge of stabilizer. (Refer to Par. 2, *d*, (3), *(d)*.)

b. Loosen clamp (19) by removing two screws.

c. Slide duct (12) into plenum chamber until its outboard end is free, and then pull outboard end forward until it clears end of duct (13).

d. Pull duct from plenum chamber.

e. Loosen clamps (20), (26) and (21) by removing two screws from each clamp.

f. Remove the remaining two ducts (13) and (14).

(c) MAINTENANCE.

1. For structural repairs, see STRUCTURAL REPAIR MANUAL (AN 01-5MA-3).

2. In operating heater with detachable air scoop while plane is grounded, the engines should be run at a speed of 1350 rpm. They should never be run at over 2000 rpm.

(d) ASSEMBLY AND INSTALLATION.—Reverse disassembly and removal procedure outlined in paragraph *c*, (4), *(b)*.

d. DE-ICER SYSTEM.

(1) GENERAL. *(See figure 263.)*—On PBY-5 airplanes with serial numbers 08124 through 08348, a Goodrich boot de-icer system is installed for wing leading edges and the tail stabilizer and fin leading edges. The system consists of wing and tail de-icer boots; a distributing valve and oil separator in the leading edge of the wing center section near the center line of the airplane; and one oil separator, a check valve, and a suction relief valve in each nacelle.

Air pressure for the system is provided from the

pressure side of the Pesco 3P-207-JA vacuum pump in each nacelle. The distributing valve control is located on the ceiling of the pilot's compartment between pilot and copilot. The pressure gage is located on the pilot's instrument panel. The switch for operating the distributing valve motor is mounted on the main distribution panel.

The suction relief valve allows air to be taken into the suction side of the pump in excess of that taken from the vacuum operated instruments. The oil separators at the engines remove most of the oil which enters the system through the vacuum pumps. The oil separator used in conjunction with the distributing valve further remove any residual oil. The check valves at the firewall prevent air from one pump being forced back through the other pump to the instruments. The oil drain is located in the de-icer exhaust line just aft of the firewall in the right hand nacelle.

(2) DISTRIBUTING VALVE.

(a) DESCRIPTION. *(See figure 263.)*—A five port distributing valve (Eclipse 572-2-A) integral with electric motor is installed in the leading edge between stations 1 and 2 on the port side. It receives air pressure from the vacuum pumps in each nacelle through check valves (Eclipse 557) and supplies pressure to five lines which actuate the de-icer boots. The order and timing of the firing of the boots are controlled by the distributing valve. Operation of the valve is managed by an Arens flexible control cable which is connected to a lever arm on the valve and runs down through the superstructure and forward to the pilot's compartment. Adjacent to the valve, between stations 2 and 3 the oil separator (Eclipse 558-1-A) is installed. From it, runs a line to the pressure gage on the instrument panel.

Turning the control shaft to the "ON" position, simultaneously closes the distributing valve motor circuit and opens the control valve. With the control valve opened, air pressure from the pump is directed through "DE-ICER" port of the control valve to the pressure type oil separator, where the air is cleaned of oil and dirt. The air from the oil separator then flows into the distributing valve through the "AIR-INLET" or "FROM SEP" port to the rotary valve housing. The motor rotates the rotary valve which distributes air to one "DE-ICER" port at a time, in the order that the ports are numbered. While one "DE-ICER" port is connected to air pressure, the other ports are connected through the "VENT LINE" ports to the pump suction. This action results in the periodic inflation and deflation of the "DE-ICER" boots. While the "DE-ICER" system is in operation, the pressure gage pointer will oscillate. The highest point to which the pointer swings indicates the pressure setting of the pressure relief valve in the oil separator. The pressure drops as each "DE-ICER" cell is connected to air pressure and rises again as each "DE-ICER" cell reaches full inflation. When the control shaft is turned to the "OFF" position, the motor circuit is opened and the control valve is closed simultaneously. With the valve closed, air pressure from the pump is directed overboard through the "OUTLET" port of the control valve instead of the "DE-ICER" system. All five "DE-ICER" ports are vented directly through the "VENT" port of the distributing valve to the pump suction when the control valve is shut "OFF."

(b) REMOVAL.

1. Remove distributing valve as follows:

a. Open access door on the upper surface of the leading edge just outboard of the center line of the airplane on the port side.

b. Disconnect electrical wires from the terminals and pull them out of the way.

c. Disconnect the Arens control from the lever arm on the distributing valve by removing clevis bolt.

d. Disconnect all lines from the distributing valve.

e. Remove the three screws which fasten the distributing valve to the mounting bracket.

f. Remove the distributing valve. When removing the valve it may be necessary to completely remove some of the de-icer lines from the leading edge. Be careful not to damage lines or adjacent structure.

2. Remove oil separator as follows:

a. Open access door on the upper surface of the leading edge for access to the oil separator.

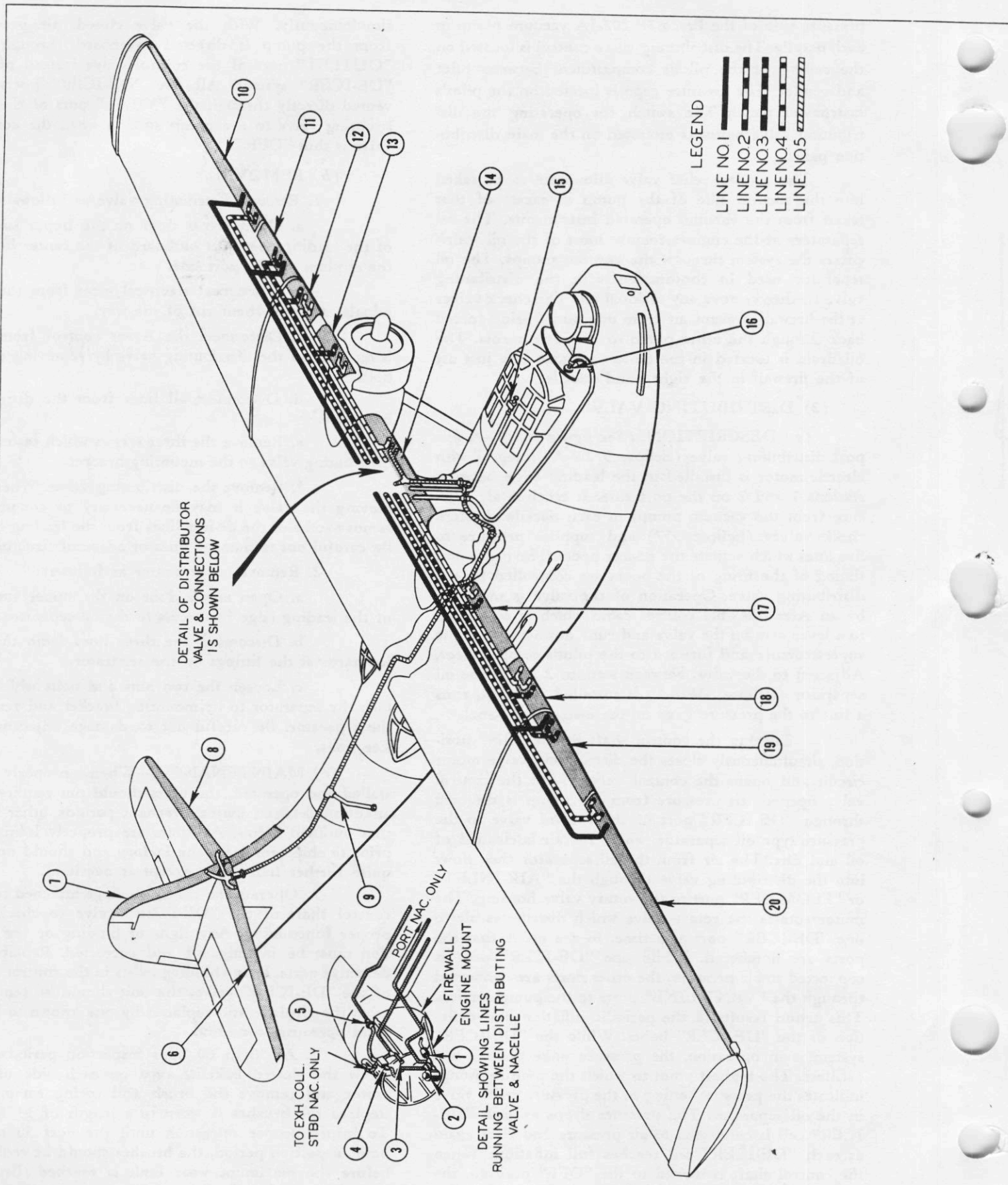
b. Disconnect the three lines from the oil separator at the fittings on the separator.

c. Loosen the two nuts and bolts which attach the separator to its mounting bracket and remove the separator. Be careful not to damage adjacent de-icer lines.

(c) MAINTENANCE.—When properly installed and operated, the units should not require any attention between major overhaul periods other than that outlined below. All units are properly lubricated prior to shipment from the factory and should not require further lubrication except at overhaul.

1. Operate the control linkage attached to the control shaft of the "DE-ICER" valve to check for proper functioning. Any signs of binding or lost motion must be investigated and corrected. Replace all defective parts. If any binding exists in the control shaft of the "DE-ICER" valve, the unit should be removed from the airplane and replaced by one known to be in good operating condition.

2. At 50 to 60 hour inspection periods, unscrew the slotted bakelite caps on each side of the motor and remove the brush and spring assemblies. Replace the brushes if worn to a length of 13/32 in. To insure proper operation until the next 50 to 60 hour inspection period, the brushes should be replaced before the maximum wear limit is reached. Brushes should have a free fit without excessive side play in the



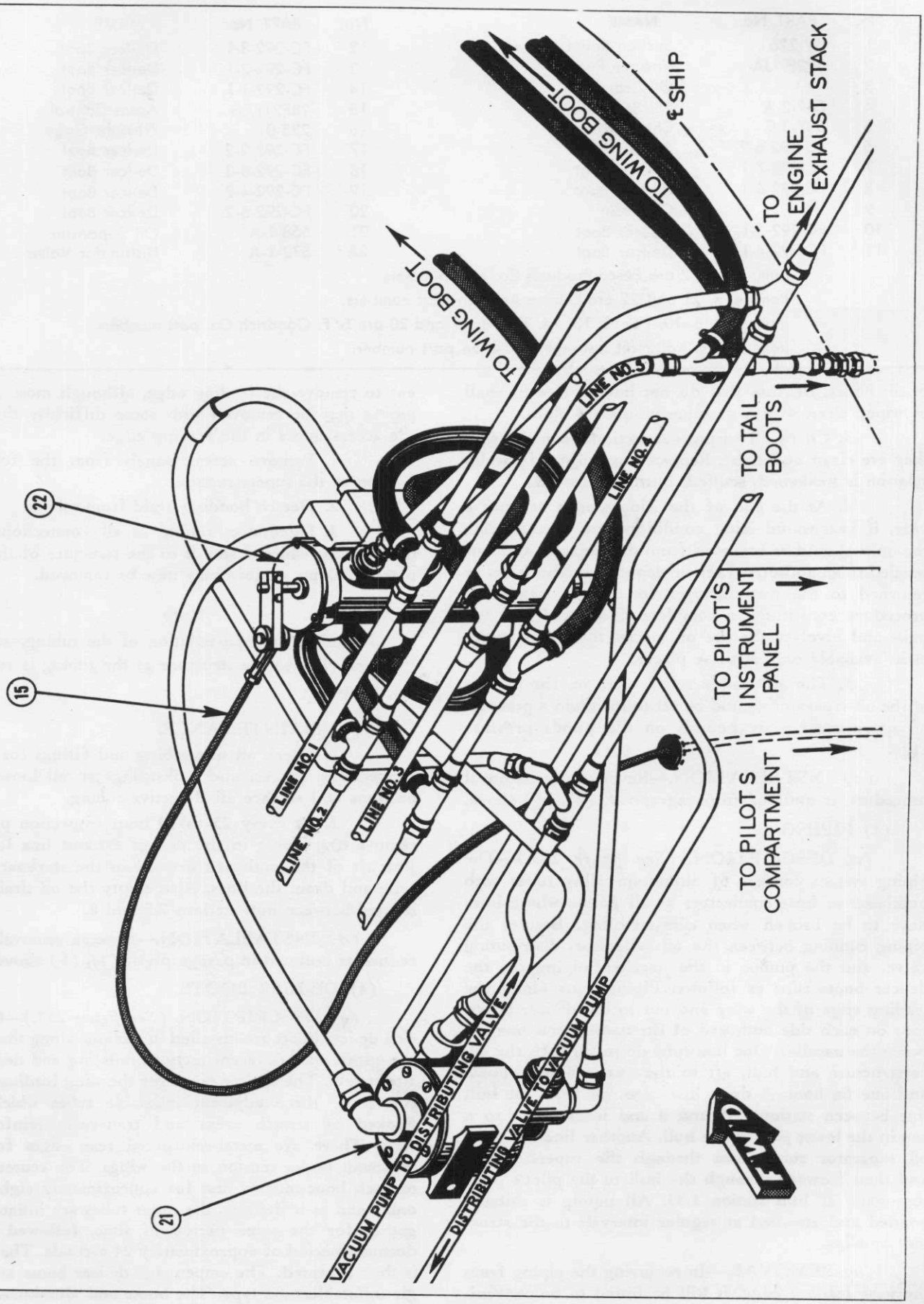


Figure 263—Wing and Tail De-Icing System (PBY-5 Only)

No.	PART No.	NAME	No.	PART No.	NAME
1	3V-216	Suction Relief Valve	12	FC-292-3-1	De-Icer Boot
2	3P207-JA	Vacuum Pump	13	FC-292-2-1	De-Icer Boot
3		Oil Drain	14	FC-292-1-1	De-Icer Boot
4	561-2-A	Oil Separator	15	28F2197-4	Arens Control
5	557-3-C	Check Valve	16	225-01	Pressure Gage
6	FC-292-6-2	De-Icer Boot	17	FC-292-2-2	De-Icer Boot
7	FC-292-7-1	De-Icer Boot	18	FC-292-3-2	De-Icer Boot
8	FC-292-6-1	De-Icer Boot	19	FC-292-4-2	De-Icer Boot
9		Oil Drain	20	FC-292-5-2	De-Icer Boot
10	FC-292-5-1	De-Icer Boot	21	558-1-A	Oil Separator
11	FC-292-4-1	De-Icer Boot	22	572-1-A	Distributor Valve

Items 1 and 2 are Pesco Products Co. part numbers.
Items 4, 5, 21 and 22 are Eclipse Aviation part numbers.
Items 6, 7, 8, 10, 11, 12, 13, 14, 17, 18, 19 and 20 are B. F. Goodrich Co. part numbers.
Item 16 is a Kollsman Instrument Division part number.

brush boxes. Brushes that do not have a free fit shall be wiped clean with a gasoline moistened cloth.

3. Check all wiring connections to make sure they are clean and tight. Replace any wiring if the insulation is weakened, scuffed, burnt, or frayed.

4. At the end of the icing season or once a year, if year-round icing conditions are encountered, the units should be removed from the airplane and forwarded to an authorized repair depot, overhaul base, or returned to the manufacturer for overhauling. This procedure constitutes a complete disassembly of the units and involves the use of special tools and equipment available only at these places.

5. The adjustable relief valve on the bottom of the oil separator should be set to maintain a pressure of approximately six pounds on the pilot's pressure gage.

(d) INSTALLATION.—Reverse the removal procedure as outlined in paragraph *d*, (2), *(b)* above.

(3) PIPING.

(a) DESCRIPTION. *(See figure 263.)*—The piping system consists of aluminum alloy tubes with bulkhead or hose connectors at all points where lines have to be broken when disassembling. Besides the piping running between the oil separator, distributing valve, and the pumps in the nacelles, piping for the de-icer boots runs as follows: Piping runs along the leading edge of the wing and out to the de-icer boots, four on each side outboard of the nacelle and one between the nacelles. One line runs down through the superstructure and hull, aft to the two stabilizer boots and one fin boot. A drain line takes off from the hull line between stations 7.5 and 8 and leads down to a can in the lower part of the hull. Another line from the oil separator runs down through the superstructure and then forward through the hull to the pilot's pressure gage at hull station 1.33. All piping is suitably bonded and attached at regular intervals to the structure by clips.

(b) REMOVAL.—In removing the piping from the wing leading edge, it will be found to be convenient to remove the leading edge, although most of the piping may be removed with some difficulty through the access doors in the leading edge.

1. Remove access panels from the forward portion of the superstructure.

2. Detach bonding braid from tubing.

3. Disconnect tubing at all connections and detach clips which fasten it to the structure of the airplane. Tubing sections may now be removed.

Note

To aid in the reinstallation of the tubing, attach clips to the structure as the tubing is removed.

(c) MAINTENANCE.

1. Check all line tubing and fittings for loose connections, breaks, and kinks. Tighten all loose connections and replace all defective tubing.

2. At every 25 to 30 hour inspection period, remove drain plug in the de-icer exhaust line located just aft of the outboard firewall in the starboard nacelle and drain the lines. Also empty the oil drain can located between hull stations 7.5 and 8.

(d) INSTALLATION.—Reverse removal procedure as outlined in paragraph *d*, (3), *(b)* above.

(4) DE-ICER BOOTS.

(a) DESCRIPTION. *(See figure 263.)*—Goodrich de-icer boots are installed in sections along the leading edges, with different sections inflating and deflating alternately. The de-icer boots for the wing leading edge consist of three adjacent inflatable tubes which are flanked by stretch areas and transverse reinforcing strip. There are metal-reinforced rear edges for attachment under tension to the wings. The center tube of each boot inflates first for approximately eight seconds, and as it deflates, the outer tubes are inflated together for the same period of time, followed by a dormant period of approximately 24 seconds. The cycle is then repeated. The empennage de-icer boots are single inflatable tube type. The boots and aluminum fair-

ing strips are held in place on the leading edges with screws which engage rivnuts.

(b) REMOVAL.

1. Remove screws which attach de-icer boot and fairing strip along one side of the leading edge to the leading edge.

2. Pull hoses which connect to the de-icer boot far enough out of the leading edge so that they may be disconnected from the boot. To make the disconnection, cut wire with which they are wrapped and pull them from the fittings on the boot.

3. Remove remaining screws which fasten the de-icer boot and fairing strip to the leading edge. De-icer boot is now free.

4. If de-icer boots are to be removed from the airplane for any length of time, push the de-icer tubes into the leading edge and plug the holes with Goodrich rubber buttons (33705). Cover rivnut holes with strips of predoped tape (Specification 27-T-14, Class A) applied with clear lacquer and painted to match adjacent surfaces.

(c) MAINTENANCE.—If it is necessary to make repairs on the rubber, they should be made with the materials supplied by Goodrich for de-icer repair, and in accordance with the instructions which appear in the de-icer repair kit and which appear below. In general, cold patch repairs are satisfactory for repairing all small cuts or breaks of less than three-quarters of an inch in the rubber. If the damage affects any of the fabric reinforcement of the de-icer, or if the damage is across the direction of stretch, the repair should be made with the rubberized fabric provided for this purpose. If the damage exceeds the above limit, or if there is any question as to the strength of the repair, the affected part should be removed for vulcanized repair. At no time should an airplane be sent out on a run with an unrepaired damage to the de-icer rubber parts.

If damage to de-icer is extensive, the part should be replaced. A temporary repair may be made, using care to assure a good cement bond and using the rubberized fabric.

1. Clean surface in vicinity of damage with soap and water and allow to dry.

2. Determine size of patch required and select template or buffing shield of corresponding size.

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

a. Rub with cloth soaked in Benzol to soften and remove Prenite-Graphite surface. Use care so that the cut or tear does not spread.

b. Roughen surface with wire buffer.

c. Smooth out with emery buffer so that surface has been removed, approximately .003 in.

d. Wash with Benzol (Navy Specification 51-B-3) and allow to dry.

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

4. Remove starched fabric backing from patch and apply light coat of No. 1 cement to surface so exposed.

a. Keep tacky surface of patch clean after removing fabric and cementing.

b. Allow to dry.

5. Apply patch to de-icer.

a. Stick center or one edge of patch lightly and work remainder down so as not to trap air between surfaces.

b. Roll patch down securely with metal roller on handle of wire buffer.

c. Make certain edges are down firmly—re-cement and allow to dry before re-sticking if necessary.

6. Allow to stand 10 to 15 minutes, then wipe patch and surrounding area lightly with Benzol.

7. Apply coat of Prenite-Graphite cement to restore conductive surface.

8. In the event that the damage cannot be repaired by the standard patches, repair material can be cut to size from the sheet rubber or rubberized fabric supplied. The sheet rubber can be used on cuts and tears in the direction of stretch, but for cuts and tears at right angles to stretch, the rubberized fabric should be used. In such repairs the procedure is the same except that the repair material should be cleaned thoroughly and given two coats of No. 1 cement.

9. Engine oil should be removed from the surface of the de-icers as soon as an airplane comes in from a run. This can be accomplished, preferably, by the use of a neutral soap and water solution. If necessary, however, the oil may be removed by wiping the de-icer surface lightly with a rag soaked in a suitable solvent. When solvent is used, the surface should be wiped dry immediately without allowing the solvent to penetrate into the rubber. Also exercise care to avoid scrubbing the surface of the de-icers as this will tend to remove the special graphite surfacing provided to afford electrical conductivity for the elimination of static.

(d) INSTALLATION.

1. Force a small amount of bituminous paint (Specification AN-P-31) into each rivnut by means of a grease gun.

2. It is necessary to make special screws of some 6-32 x 1¼ long machine screws by cutting heads off and making a screwdriver slot in them. Insert these screws at approximately three to four foot intervals in the rivnuts along the upper surface of the leading edge, leaving larger portion of screw above surface.

3. Position the de-icer boot and clip it on over these studs.

4. Install fairing strip over the studs.

5. Dip heads of the attaching screws (AN 505-6-8) in primer and install screws.

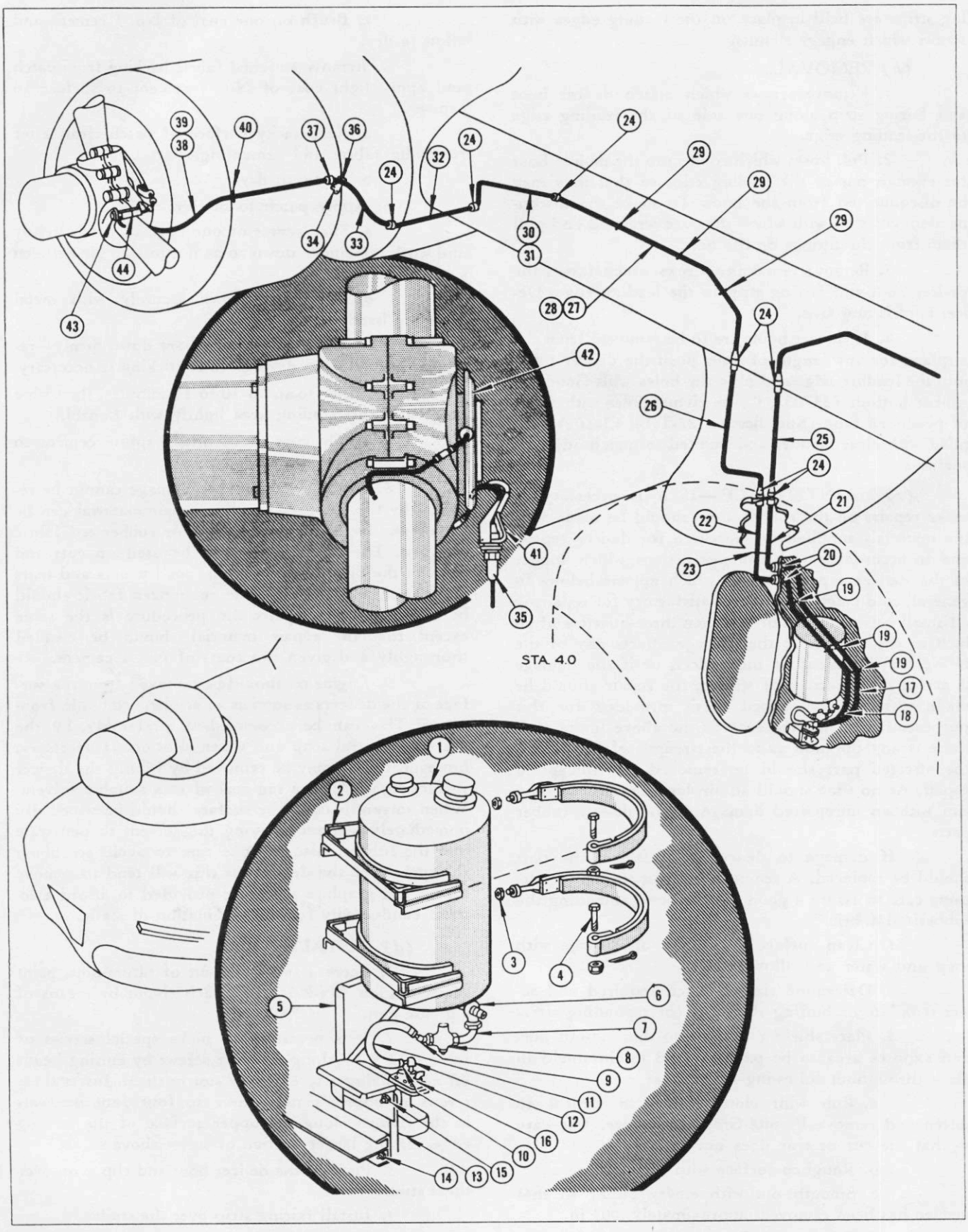


Figure 264—Propeller Anti-Icing System

No.	PART No.	NAME
1	28P5059-0	Fluid Tank
2	28P5063-0	Tank Bracket—Upper
	28P5063-2	Tank Bracket—Lower
3	AN365-D428	Nut
	AN960-D416	Washer
4	AN3-DD12	Bolt
	AN310-D3	Nut
	AN380-2-2	Cotter Pin
5		Tank Support
6	AC765-10	Shut Off Cock
7	*AN914-1D	90° Elbow Fitting
	*AN911-1D	Nipple Fitting
	**AN822-4D	90° Elbow Fitting
8	*B82304	Fluid Filter (Eclipse)
9	*AN844-4D	45° Elbow Fitting
10	*AN748-22	Hose Clamp
11	*AN878-4-38	Hose—Fluid Line
	**28P5061-9	Tube—Fluid Line
12	*AN842-4D	90° Elbow Fitting
	**AN822-4D	90° Elbow Fitting
13	*744-4	Fluid Pump (Eclipse)
	**265-DA	Fluid Pump (Pesco)
14	*AN4-DD7A	Bolt
	*AN372-D428	Nut
	**AN4-DD6A	Bolt
	**AN365-D428	Nut
15	*AN4-DD7A	Bolt
16	*AN822-4D	90° Elbow Fitting
	**28P5183	Fitting
17	*28P5539-6	Tubing Section—Port Line
	***28P5125-6	Tubing Section—Port Line
	****28P5060-6	Tubing Section—Port Line
18	*28P5539-7	Tubing Section—Stb'd. Line
	***28P5125-7	Tubing Section—Stb'd. Line
	****28P5060-7	Tubing Section—Stb'd. Line
19	Q908A-4	Clip
	AN526-DD1032-9	Screw
	AN365-D1032	Nut
	AN960-D10	Washer
20	*NAF213827-4D	Bulkhead Fitting
	AN924-4D	Nut—Bulkhead Fitting
	*AN822-4D	90° Elbow Fitting
	**AN832-4D	Bulkhead Fitting
21	*28P5539-15	Tubing Section—Port Line
	***28P5125-9	Tubing Section—Port Line
	****28P5060-8	Tubing Section—Port Line
22	*28P5539-14	Tubing Section—Stb'd. Line
	***28P5125-8	Tubing Section—Stb'd. Line
	****28P5060-9	Tubing Section—Stb'd. Line
23	*Q908A-4	Clip
	*Q5106-D10-12	Screw
	*AN372-D1032	Nut
24	AN832-4D	Bulkhead Fitting
	AN924-4D	Nut—Bulkhead Fitting
25	*28P5539-8	Tubing Section—Port Line
	**28P5060-10	Tubing Section—Port Line
26	*28P5539-9	Tubing Section—Stb'd. Line
	**28P5060-11	Tubing Section—Stb'd. Line
27	*28P5539-10	Tubing Section—Port Line
	**28P5060-12	Tubing Section—Port Line
28	*28P5539-11	Tubing Section—Stb'd. Line
	**28P5060-13	Tubing Section—Stb'd. Line
29	Q908A-4	Clip
	Q5106-D10-10	Screw
	AN372-D1032	Nut
30	*28P5539-12	Tubing Section—Port Line
	**28P5060-26L	Tubing Section—Port Line
31	*28P5539-13	Tubing Section—Stb'd. Line
	**28P5060-26R	Tubing Section—Stb'd. Line
32	32P079-9	Flexible Tube
33	28G3014-8	Flexible Tube
34	28P5108	Bracket—Port
	28P5107	Bracket—Starboard
35	*AN815-4D	Union
	**AC811-FT-4D	Nipple
36	AN3-DD5A	Bolt
	AN372-D1032	Nut
	Q908A-12	Clip
37	AN815-4D	Tubing Connection
38	*28P5539-16	Tubing Section—Port Line
	**28P5060-29	Tubing Section—Port Line
39	*28P5539-17	Tubing Section—Stb'd. Line
	**28P5060-30	Tubing Section—Stb'd. Line
40	28P3003	Special Clip
	Q908A-4	Clip
	Q5106-D10-9	Screw
	AN372-D1032	Nut
41	52745	Feeder Assembly
42	52904	Slinger Ring
43	53513	Barrel Bolt
	50095	Nut
44	52903	Nozzle Assembly

Items 41, 42, 43 and 44 are Hamilton Standard Propeller Corp. part numbers.

*PBY-5A airplanes with serial numbers 46588 thru 46638.

**PBY-5A airplanes with serial numbers 33960 thru 34059, 48252 thru 48451, and 46450 thru 46587 and all PBY-5 airplanes.

***PBY-5A airplanes with serial numbers 33960 thru 34059, 48252 thru 48451, and 46450 thru 46587.

****PBY-5 airplanes only.

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6. Tighten the screws just enough to hold de-icer, using a blunt screw driver to prevent cutting the de-icer shoes in case the screw driver slips.

7. Hold back the de-icer shoe and dust under the surface of the boot and adjacent surface with talc or soapstone.

8. Connect the de-icer tubes to their respective air supply lines. Line with single outlet connects with the center fitting and line with double outlet connects to outside fittings.

9. Since the de-icer shoe is to be pulled tightly over the surface, it will be necessary to insert one of

the special screws in every second rivnut on the under surface. While one man pulls the rubber down over the leading edge with his open hand against the surface of the rubber, a second man can grasp the shoe and hook it into position over one stud after another and push it down against the skin to prevent bending the studs.

10. Install fairing strips over the studs and put screws in the intervening rivnuts.

11. Replace special screws by the regular screws and tighten all screws so that the front edge of the fairing strip imbeds itself in the rubber.

e. PROPELLER ANTI-ICING.

(1) GENERAL. *(See figure 264.)*—A system of anti-icing fluid circulation to the propeller blades is installed in the airplane for the purpose of removing or preventing ice formation on the blades. The anti-icing fluid (Specification AN-F-13) is contained in a reservoir tank on the port aft face of bulkhead 4, in the hull. The tank is connected to a fluid filter and a fluid pump is installed below it. The pump impels the anti-icing fluid through rigid aluminum alloy tubing which leads up through the superstructure to the wing. Here one line runs to the port, and one to the starboard nacelle. The lines pass between the engine's cylinders forward to the propeller hubs. Each propeller hub is equipped with a slinger ring into which the fluid is pumped. Tubes lead from the slinger ring to the propeller blade shanks. As the propellers spin, centrifugal force drives the fluid to the outside of the slinger rings, and so through the tubes out to the blades, bathing them with anti-icing fluid.

Note

PBY-5A airplanes with serial numbers prior to 46588 and all PBY-5 airplanes (See the INTRODUCTION to this MANUAL for a list of serial numbers covered) do not have a fluid filter between the tank and pump.

Operation of the system need not be continuous (only long enough to free propellers of ice). Running at one third speed, the pump will deliver two quarts of fluid per hour to each propeller.

The system is controlled and operated by a rheostat on the pilot's yoke signal box. Turning the rheostat to the right starts the pump; pump speed and fuel flows are increased or decreased by turning the rheostat to the right or the left respectively.

(2) PUMP SYSTEM.

(a) DESCRIPTION.—On PBY-5A airplanes with serial numbers 46588 through 46638, the pump system consists of the reservoir tank, the fluid filter, the fluid pump itself and connections between these. The whole system is mounted on the port aft face of bulkhead 4. The tank has a capacity of 3 U. S. (2.5 Imp.) gallons. Directly under it, a cock is installed. The lower end of the cock is connected to a fluid filter (Eclipse Aviation Co. B 82304) by an elbow. At the other end of the filter, an elbow and connector lead to a hose which in turn leads to the fluid pump by a connector and elbow. The fluid filter consists of a removable, disc type filter element assembled to a cap which is threaded into the filter housing. Its purpose is to remove foreign matter from the fluid before it enters the pump.

The fluid pump (Eclipse Aviation Co. 744-4) consists of three major assemblies: a two-pole, series wound electric motor for a 24 volt system, reduction gearing, and pump assembly. The motor drives the pump section through a 40:1 worm and wheel reduction. The speed of the motor, and thus the pressure which the pump exerts on the fluid are governed by control rheostats, manually operated and located on the pilot's switch panel.

On PBY-5A airplanes with serial numbers prior to 46588 and all PBY-5 airplanes (See the INTRODUCTION to this MANUAL for a list of serial numbers covered), the pump system is the same as that described above except that the fluid filter is not used. Fluid flows to the pump by means of a rigid tube connected to the pump and the shut off cock. The fluid pump (Pesco 265DA) consists of three major assemblies: a 24-volt direct current, continuous duty electric motor, reduction gearing, and pump assembly. The motor drives the pump section through a 10:1 worm and wheel reduction. The speed of the motor and thus the pressure which the pump exerts on the fluid are governed by control rheostats manually operated and located on the pilot's yoke signal box.

(b) REMOVAL AND DISASSEMBLY.
(See figure 264.)

1. After fluid tank (1) is drained, disconnect line (11) at the tank end.

2. Remove tank bracket by detaching nut (3) and bolt (4).

3. Remove tank from support (5).

4. Remove fluid filter (8) from cock (6).

5. Detach cock (6) from outlet port of tank (1).

6. Disconnect line (11) from pump (13).

7. Disconnect tubing (17) and (18) from the outlet ports of the pump.

8. Disconnect electrical leads from the pump motor terminals.

9. Remove pump (13) by detaching bolts (14) and (15) which hold it to its mounting bracket.

(c) MAINTENANCE.—Motor brushes must be replaced if worn to a length of eleven sixteenths of an inch. Unscrew the slotted brush cap screw to inspect brushes.

(d) ASSEMBLY AND INSTALLATION.—Reverse removal procedure outlined in paragraph *e*, (2), *(b)*.

(3) TUBING SYSTEM.

(a) DESCRIPTION.—Two quarter inch aluminum alloy tubes connecting to fittings at the two outlet ports of the fluid pump, lead up the face of bulkhead 4 and pass through to the forward face of the bulkhead continuing upward into the superstructure. Both lines go straight up into the wing before turning outboard. From the wing, each line leads to a nacelle, forward of the front spar. At the firewalls, flexible tubing takes over the lines, and they pass between the engine's cylinders. Close to the center line of the rear cylinders, the lines change again to rigid aluminum alloy tubing and continue forward to the nozzles which feed the propeller slinger rings.

(b) REMOVAL AND DISASSEMBLY.
(See figure 264.)

1. Remove tubes (17) and (18) from outlet ports of pump by uncoupling elbows (16).

2. Uncouple connections (20) where the lines go through bulkhead 4.

3. Remove clips (19) on aft face of bulkhead 4.

4. Remove tubing sections (17) and (18).

5. Uncouple tubing connections (20) and (24) between bulkhead and superstructure.

6. Remove clip (23) on forward face of bulkhead 4 by detaching screw.

7. Remove tubing sections (21) and (22).

8. Uncouple tubing connections (24) at leading edge.

9. Remove tubing sections (25) and (26).

10. Uncouple tubing connections (24) at wing station 4.5 leading edge, port and starboard.

11. Remove three clips (29) at wing stations 2.0, 3.0, and 4.0 port and starboard, by detaching screws.

12. Remove tubing sections (27) and (28).

13. Uncouple tubing connections (24) at firewall.

14. Remove tubing sections (30) and (31).

15. Uncouple flexible tubing connections (24) at the forward end of the engine mount rings, port and starboard sides.

16. Remove flexible tubing (32) both sides.

17. Uncouple tubing connections (37) at brackets (34) just aft of center line of the rear cylinders.

18. Remove clips (36) at brackets by detaching bolts.

19. Remove flexible tubing (33) both sides.

20. Uncouple tubing connections (35) at feeder assemblies (41).

21. Remove clip (40) at ignition manifolds.

22. Remove clips at magneto cooling tube brackets.

23. Remove tubing sections (38) and (39).

(c) MAINTENANCE.

1. If leakage occurs at connections, tighten connectors; if it continues, replace defective parts.

2. If flexible line becomes cracked, unpliable, frayed, swollen, or worn, replace it.

3. For clogging or obstruction in fluid lines, disconnect at both ends. Blow compressed air through line and flush with fluid to remove foreign matter.

(d) ASSEMBLY AND INSTALLATION.—Reverse removal and disassembly procedure outlined in paragraph *e*, (3), *(b)*.

(4) SLINGER RING SYSTEM.

(a) DESCRIPTION.—Attached to the end of the fluid line at each propeller, is a Hamilton Standard Feeder Nozzle Assembly of cast aluminum alloy. It is held in place by a bracket, which is fastened to the forward side of the gear case by the two lower stud nuts. The outlet of the nozzle fits into the propeller slinger ring at its lowest point so as to clear the ring by one thirty-second of an inch. The slinger ring is open and goes around the propeller shaft, being attached to the hub on the aft side by eight screws which pass through the barrel packing gland into the hub. There are three nipples integral with the slinger ring and equally spaced over which short hose couplings are fitted. The other end of each hose coupling fits over the nipple in the nozzle assembly bracket. Both connections are secured by safety wire. This bracket assembly consists of a nipple aft and a blade nozzle forward, integral with the bracket which is fitted over the hub boss and held in place by the barrel bolt adjacent to the blade shank. The end of the blade nozzle is clear of the blade shank by one sixteenth of an inch on the forward side of the blade.

Fluid impelled into the feeder nozzle is fed into the slinger ring. As the propeller spins, centrifugal force drives the fluid out through the slinger ring nipples and then through the hose connections, through nipples and blade nozzles of the bracket assembly onto the blades of the propeller which are thereby bathed with the anti-icing fluid.

(b) REMOVAL AND DISSEMBLY.
(See figure 264.)

1. Disconnect fluid line (38) and (39) at fitting (35) and plug the line to prevent escape of fluid.

2. Detach the two stud nuts which hold feeder assembly (41) in place on forward side of the gear case.

3. Remove feeder assembly.

4. Remove the propeller. (See Par. 13, *b*, (2).)

5. Remove the three barrel bolts (43) which hold the three nozzle assembly brackets (44) in place, by detaching cotter pins and nuts.

6. Disconnect the hose couplings to the nozzle bracket (44) nipples and to slinger ring (42) nipples by removing safety wire.

7. Remove the eight screws which hold the slinger ring (42) to the hub.

(c) MAINTENANCE.

1. Keep feed nozzle open to allow free flow of fluid.

2. The slinger ring must be kept free from deposits of dirt or grease.

3. If slinger ring is damaged slightly, it may be repaired. However, if the damage is of a nature to impede the flow of the anti-icing fluid, the slinger ring should be replaced.

4. The propeller assembly must be re-balanced if a new or reworked slinger ring is installed.

5. Replace any hose couplings that are damaged or show signs of deterioration. Be sure the new coupling is the same length as the old one. See that new coupling is slipped over both tubes the same distance, so that the joints are in the center of the coupling.

(d) ASSEMBLY AND INSTALLATION.—Reverse disassembly and removal procedure outlined in paragraph *e*, (4), *(b)*.

f. WINDSHIELD ANTI-ICING.

(1) GENERAL.—A system of anti-icing fluid circulation is installed in the airplane to supplement the windshield wipers in preventing or removing ice formation on the windshields. For this purpose, perforated spray tubes are located on the cowling outside the cockpit at the bottom of the pilot's and copilot's windshields. The anti-icing fluid (Specification AN-F-13) is contained in a tank which is connected to a manually operated hand pump located near the right side of the pilot's instrument panel. The tank is located forward of and below the pump. Six or eight strokes of the pump are sufficient for several minutes spraying operation. The pressure forces the fluid through tubes which lead from the pump ports to the perforated spray tubes on the cowling, and the fluid is deposited in a spray on the glass.

Note

To wash off salt spray after take-off, fresh water can be employed in this system. In this case, directly afterwards, the tank must be emptied of water and filled with anti-icing fluid.

(2) PUMP SYSTEM.

(a) DESCRIPTION.—A hand pump (Parker Appliance Co. DP4CA-2A), a fluid tank, and connections between them make up the pump system. The pump is installed on a panel to the right of pilot's instrument panel with the plunger handle aft of panel and the pump body forward of it. The panel is indexed: "OFF" "LEFT, ON" and "RIGHT, ON" and the pump handle includes a pointer. In the "OFF" position, the handle is locked against vibration. To operate the pump, the handle must be depressed as far as it will go, and then turned either to the "LEFT, ON" or "RIGHT, ON" position. The pump has a capacity of .500 ounces of fluid per stroke; six to eight strokes will suffice for several minutes operation. At its other end, the inlet port of the pump is connected by a fitting to a tube, which in turn connects through an elbow fitting to the tank. Center line of the tank is about ten inches forward of the control panel and the tank is held in place by a bracket. The tank has a capacity of .25 U. S. (.20 Imp.) gallons.

(b) REMOVAL.

(See figure 265.)

1. Remove tube (5) from elbow fitting (3) to tank (1).

2. Remove bracket (2) from tank by detaching screws (4).

3. Remove tank.

4. Remove tube from elbow fitting (6) inlet port of pump (8).

5. Remove tubes (7) from elbow connections of outlet ports of pump.

6. Remove three mounting screws attaching pump body to panel (9). Pull pump aft and lift out.

7. Remove panel (9) by detaching three screws.

(c) MAINTENANCE.

1. Packing for hand pump can be finger adjusted, serviced, or replaced without removing pump from mounting panel. Do not attempt to repack with string or ordinary packing. Use Parker formed packing. No other service is required.

2. If pump is defective, replace it.

3. If plunger is hard to push and pull, apply a few drops of Neatsfoot oil sparingly to piston rod.

(d) INSTALLATION.—Reverse removal procedure outlined in paragraph *e*, (2), *(b)* above.

(3) TUBING SYSTEM.

(a) DESCRIPTION.—Two quarter inch aluminum alloy tubes take off from the two outlet ports of the pump and run directly up behind the panel to a point on the hull just forward of the bottom of the copilot's windshield. From here, the two lines lead inboard parallel to the windshields to two elbow fittings directly on each side of the center line of the airplane. Attached to the two elbow fittings are two special fittings which go through the hull to the outside of the cowling. The special fittings are welded to spray tubes which run outboard, one starboard and one port, parallel and coterminous with copilot's and pilot's windshields respectively. These spray tubes are drilled at every inch and one quarter intervals with a No. 59 drill, and closed on the outboard ends with stainless steel screws to allow anti-icing fluid to spray upwards. Each tube is held in place on the skin by four clips.

(b) REMOVAL.

(See figure 265.)

1. Remove tubes (7) from outlet ports of pump by uncoupling elbow connections.

2. Remove tubes from elbow fittings (13) at center line of plane by uncoupling connections.

3. Detach three clips (10) which fasten tubes to inside of hull by unfastening screws (11) and nuts (12).

4. Remove tube sections (7) inside of hull.

5. Detach the two elbows from special spray tube fittings which go through hull to outside.

6. Remove eight clips (10), four on starboard and four on port side, which fasten spray tubes (14) to cowling below pilot's and copilot's windshields on the outside by detaching screws (15).

7. Remove the two spray tubes.

(c) MAINTENANCE.

1. If leakage occurs at connections of tubing, tighten connectors; if it continues, replace defective parts.

2. For clogging or obstruction in fluid lines, disconnect at both ends. Blow compressed air through line and flush with fluid to remove foreign matter.

3. Be certain that holes in spray tubes are always unclogged and open to permit good spraying operation.

(d) INSTALLATION.—Reverse removal procedure outlined in paragraph *f*, (3), *(b)* above.

g. WINDSHIELD WIPERS.

(1) GENERAL.—The pilot's and copilot's windshields are equipped with electrically operated windshield wipers which assist in preventing and removing ice formation on the windshield when employed in conjunction with anti-icing fluid spray, especially at the beginning of icing conditions. The windshield wipers (Marquette Metal Products Co. type) are driven by a converter which in turn is driven by an electric motor by means of a flexible drive shaft. The motor is mounted adjacent to the propeller controls above the pilot's right shoulder. A speed control box is located above the copilot's left shoulder. This control box contains a circuit breaker and a speed control for the motor so that the speed of the windshield wiper operation can be increased or decreased. The electric lines which run aft of the control box connect with the airplane's 24 volt system.

Note

Anti-icing is, of course, only one function of the windshield wipers. Their most common use is to keep windshields clean of rainwater, moisture, fogging, etc., and so increase visibility for pilot and copilot.

(2) MOTOR SYSTEM.

(a) DESCRIPTION.—The motor is mounted on a bracket attached to ceiling above pilot's right shoulder. Its drive shaft is directly connected with the flexible drive shaft that activates the converter. From its terminals, run lines in conduit to the speed control box. The motor operates on 24 volts D.C. current. It is series wound with a split field which provides reversibility and enables the motor to run at two speeds. Aft and a little to the starboard of the center line of the plane, the speed control box is mounted on a ceiling bracket. It contains the two-speed control switch and the circuit breaker switch. The circuit breaker switch is indexed on name plate "OFF" and "ON." The speed control switch is indexed "SLOW" and "FAST." At "FAST" position, the motor runs forward at 10,000 rpm, while the windshield wiper executes approximately 400 strokes per minute. At "SLOW" position, the motor runs backwards at 5,000 rpm, while the wiper executes approximately 200 strokes per minute.

(b) REMOVAL.

(See figure 265.)

1. Uncouple electrical conduit connection (17) at the motor and remove wire from terminal.

2. Cut safety wire (21) and detach fitting which holds the flexible drive (20) to the motor (16).

3. Detach the four bolts (19) which hold motor to bracket (18). Remove motor.

4. Disconnect electrical conduit connections (17) at speed control box (22), from line to motor and line to power source, and remove wires from terminals.

5. Detach screws (37) which hold box to bracket. Remove speed control box.

(c) MAINTENANCE.—For maintenance of motor and electrical system, see Par. 22, *t*.

(d) INSTALLATION.—Reverse removal procedure outlined in paragraph *g*, (2), *(b)*.

(3) WINDSHIELD WIPER SYSTEM.

(a) DESCRIPTION.—The flexible drive shaft connects forward to the converter which changes the rotary motion of the shaft to a push-pull motion. The converter is installed adjacent to the V brace of the forward beam at the top of pilot's compartment, two and a half inches to port of the center line of the plane. It is mounted on a spacer and fastened to a bracket on the overhead structure. Attached to it on both sides by fittings are push-pull flexible shafts enclosed in tubes which run outboard to the two window drive units. Here the push-pull motion of the flexible shafts is changed to a back-and-forth rotary motion of 85 degrees. The window drive units are located at the center of and just above pilot's and copilot's windshields. They are installed by means of three holes drilled through the skin so that the window drive shaft and the two screws which hold unit in place can pass through from inside to outside of skin. From the outside, screws run through holes in the mounting plate, gasket, skin, spacer, and

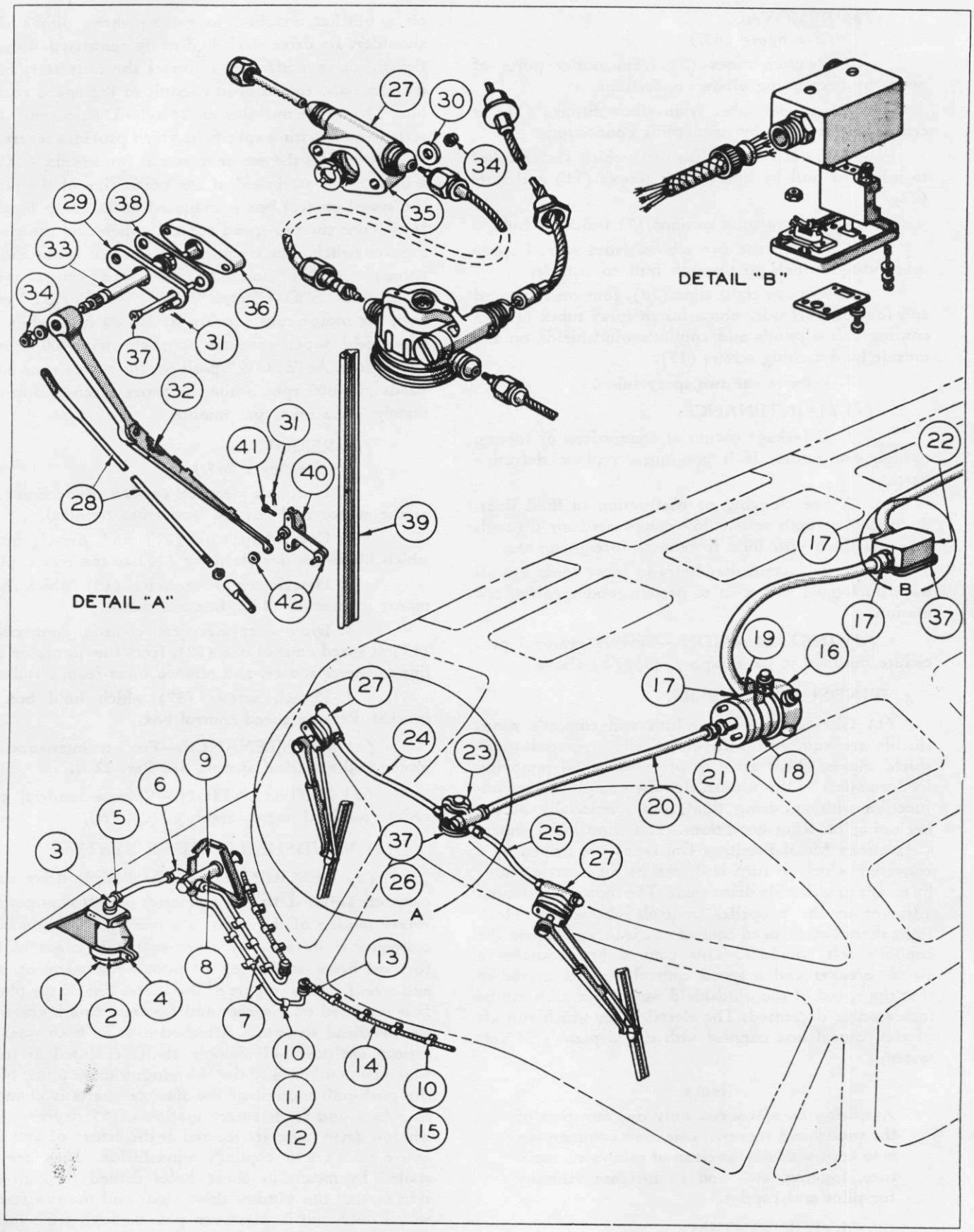

Figure 265—Windshield Wiper and Windshield Anti-Icing Spray

No.	PART No.	NAME
1	28B5264-7	Fluid Tank
2	28B5264	Tank Bracket
3	No. 10-2440-9 Type A	Elbow Fitting
4	AN526-DD-832-7	Screw
	AN365-D832	Nut
5	28B5262-6	Tubing Section
6	102-CB-4D	Valve
7	28B5262-7	Tubing Section—Port Spray
	28B5262-8	Tubing Section—Stb'd. Spray
8	DP4CA-2A	Manual Pump
9	28B5265	Panel
10	Q908-A4	Clip
11	AN526-DD832-12	Screw
12	AN365-D832	Nut
13	AN822-4D	Spray Tube Fitting
14	28B5263	Spray Tube
15	AN526-DD832-8	Screw
	AN365-D832	Nut
16	D12364	Electric Motor
17	AN3064	Conduit Connector
	AN3066	Lock Nut—Conduit Coupling
18	D14273	Motor Bracket
19	AN3DD6A	Bolt
	AN372D1032	Nut
20	B14248	Flexible Drive
21	AC995-C32-2	Safety Wire
22	28E5436	Speed Control Box
23	D12184	Converter
24	D14243	Control Cable—R. H.
25	B14239	Control Cable—L. H.
26	D14273-4	Spacer
27	B13832	Window Drive Unit
28	B13979	Tie Rod
29	A13931	Mounting Plate
30	AN960C10L	Washer
31	AN380C2-2	Cotter Pin
32	B13829	Wiper Arm
33	B13362	Shaft—Window Drive
34	AN365B1032	Nut
35	A12528	Housing—Window Drive
36	B14022	Spacer
37	AN510-10-40	Screw
38	A12788	Gasket
39	B14340	Wiper Blade
40	A13924	Blade Holder
41	A12238	Retainer Pin
42	AN960C6	Washer

Items 3, 6 and 8 are Parker Appliance Co. part numbers.

Items number 16, 18, 20, 23, 24, 25, 26, 27, 28, 29, 32, 33, 35, 36, 38, 39, 40, and 41 are Marquette Metal Products Co. part numbers.

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housing of unit, where they are fastened by washers and nuts.

Attached fast to the window drive shaft is the wiper arm assembly. This arm is hinged in the middle and includes a spring to impart pressure to the blade against the windshield. The tie-rod, adjustable for length, pivots on a pin integral with the window drive mounting plate on its outboard end. Attached to the other ends of arm and tie-rod, are the holder and blade assemblies. The blade fits into a groove in the holder where it is held by a retainer pin and cotter pin. On the other side of the holder directly out from the blade, the wiper arm pivots on a pin held on it by a cotter pin and washer; while the tie-rod pivots from a pin on the end of the small arm which comes out from the holder. It too, is held on the pin by a cotter pin and washer.

(b) REMOVAL.

(See figure 265.)

1. CONVERTER.

a. Cut the safety wire (21) and unscrew the fitting which holds flexible drive shaft (20) to the converter (23).

b. Unscrew the fittings which attach flexible shafts (24) and (25) to the converter.

c. Detach the screws (37) which hold the converter to spacer (26) and structure. Remove converter.

2. WINDOW DRIVE UNITS.

a. Unscrew the fitting which attaches flexible shaft (24) to the drive unit (27).

b. Remove tie-rod (28) from mounting plate pivot pin by detaching cotter pin (31) and washer (30).

c. Remove wiper arm (32) from shaft (33) by detaching nut (34).

d. Detach two nuts (34) and washers (30) from housing (35) of window drive unit. Pull unit aft to remove.

e. Remove spacer (36) by pulling it aft from screws (37).

f. Remove mounting plate (29) and gasket (38) on the outside of skin, by pulling the loose screws out forward.

3. BLADE AND HOLDER MECHANISM.

a. Remove blade (39) from holder (40) by detaching cotter pin (31) and retainer pin (41). Slide blade from groove.

b. Remove wiper arm from holder by detaching cotter pin and washer (42) from pivot pin on holder (40).

c. Remove tie-rod from holder by detaching cotter pin and washer (42) from pivot pin at the end of holder arm.

4. Converter, window drive units, and wiper arm should not be disassembled.

(c) MAINTENANCE.

1. Keep mounting screws, which hold the converter and the window drive units in place, tight at all times.

2. Check flexible drive shaft and push-pull shafts for excessive wear at the drive ends and lubricate with grease (Specification AN-G-3).

3. Converter and window drive units are suitably lubricated at the factory and should not need further lubrication during their life time.

4. Do not disassemble converter, window drive units, or wiper arm. If defective, replace them.

5. The wiper arm works on a splined shaft and needs no lubrication.

6. If the blades show sign of deterioration, replace them.

7. Adjust the pressure of the blades on the glass by turning the small screw of the wiper arm near the pivot point. Turn clockwise to increase the pressure and counterclockwise to decrease it. The pressure measured at the blade attachment should be approximately two and one half pounds.

CAUTION

Never operate the wiper on a dry windshield. Fine, circular scratches are left, which cause a dangerously dazzling effect when flying at night or against a low sun. Keep a supply of water on the glass while operating the wiper.

(d) INSTALLATION.—Reverse removal procedure outlined in paragraph *g*, (3), *(b)*.

Before connecting the flexible drive shaft to the converter, manually operate the converter to be sure that the blade sweep is properly located to avoid interference. The splines on the shaft permit adjustment in increments of 10 degrees. Since the blades will not perform their full sweep on dry glass, this operation should be performed with glass wet.

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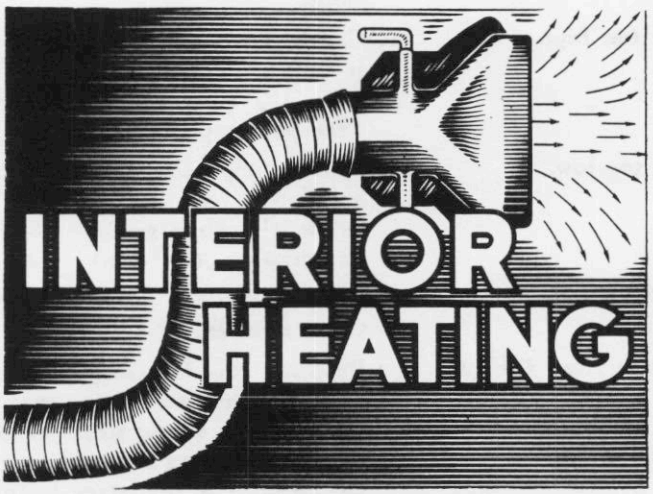
PARAGRAPH 26.



26. INTERIOR HEATING.

a. GENERAL.—The PBY-5A airplanes are equipped with a Skyheat Combustion Heater (Model SGE-1) which supplies heated air through a series of ducts for cabin heating, windshield defrosting, and engine warming.

Note

This heater was installed by the contractor in PBY-5A airplanes with serial numbers 46580 through 46638 and is to be installed by service action on all previous PBY-5A airplanes.

The heater, which operates from fuel supplied by the main fuel system, is designed to perform both when the airplane is in flight and when grounded. When grounded, the heater operates from power supplied either by the batteries or the auxiliary power unit. During flight, the heater receives power from the engine generators.

Heater operating instructions appear in the Pilot's Handbook and on the plate on the inboard face of the heater.

The PBY-5 airplanes are equipped with a Stewart-Warner central heating system which is described in paragraphs *e*, *f*, and *g*.

b. HEATING UNIT (PBY-5A ONLY).

(1) DESCRIPTION.—In flight, cold air is supplied to the heater through a series of ducts which extend from the air scoop on the side of the airplane to the heater. When the airplane is on the ground, cold air is supplied by a motor-driven fan, which is located on the forward end of the heater.

The cold air is forced into the heater, warmed, and transferred to various parts of the airplane.

When in flight, the rated heat output of the heater is 90,000 BTU per hour. With the airplane on the ground, the rated heat output is 57,500 BTU per hour.

(2) REMOVAL. *(See figure 266.)*—The heater may be removed from the airplane as follows:

(a) Shut off fuel supply at overhead valve.

(b) Remove navigator's seat and drawer.

(c) Detach bottom end of fuel supply line (71) from fuel pump (66) on aft end of heater.

(d) Disconnect electrical flex conduit (26) from bottom right-hand terminal at forward junction box (38).

(e) Disconnect the round insulated exhaust duct from the aft end of heater. (See paragraph *d*, (4), *(b)*.)

(f) Detach the aft compartment heating duct from the heater. (See paragraphs *d*, (3), *(a)*, *2*, d. and *d*, (3), *(a)*, *2*, e.)

(g) Detach the ram air duct from the heater. (See paragraph *d*, (2), *(b)*.)

(h) Remove the forward compartments rigid heating ducts. (See paragraph *d*, (3), *(b)*, *2*.)

(i) Detach the tube line (39) from the bottom of the diaphragm switch (17).

(j) Remove the four bolts and nuts (43) that secure the heater to the supports.

(k) Remove the navigator's table leg tubular diagonal brace. Remove table leg only if necessary.

(l) Remove heater.

(3) MAINTENANCE.

(a) TROUBLES AND REMEDIES.—In the event of improper operation, check applicable items in the Trouble Shooting Chart below:

TROUBLE	POSSIBLE CAUSE	REMEDY
1. All motors inoperative.	a. Loose power connection.	a. Tighten all connector plugs.
	b. Circuit fuse blown at main distribution panel.	b. Replace fuse.
2. Pump motors inoperative.	a. Ignitor burn out.	a. Replace ignitor.
	b. Resistor burn out.	b. Replace resistor.
	c. Connections loose.	c. Tighten all connections.

TROUBLE	POSSIBLE CAUSE	REMEDY
3. Smoke coming from exhaust.	a. Scoop not open (in flight).	a. Open scoop.
	b. Fan not running (on ground).	b. Check fan motor and connections.
	c. Pump voltage too high.	c. Check pump voltage to see if it is over 8½ volts during flight or over 4½ volts when grounded. (See paragraph *c*, (4), *(c)*.)
4. Heater operating but not enough heat.	a. Pump voltage too low.	a. Check pump voltage to see if it is below 8½ volts during flight or below 4½ when grounded. (See paragraph *c*, (4), *(c)*.)
	b. Valve partially closed.	b. Check and open all fuel valves.
	c. Strainer clogged.	c. Clean strainer.
5. Fire smokes in flight.	First check items *3*, a; *3*, b; *3*, c; and *6*, a. in this chart. If flight fire still smokes, combustion air pressure is too low.	Readjust the first stage bellows only of barometric compensator by loosening elastic stop nut and turning adjusting screw 1¼ turns clockwise. The first stage bellows adjusting screw is the one on top of the compensator unit nearest the heater jacket.
6. Pump motor voltage varies causing speed and fuel feed to vary.	Pump motor brushes and commutator dirty.	Clean commutator and brushes with gasoline moistened cloth. See Par. 22, *r*, (3) for general maintenance of electric motors.
7. Pilot light on combustion control box fails to light.	Ignitor may not be functioning properly.	Inspect ignitor and replace if burnt out. (See paragraph *c*, (2), *(b)*.)

(4) ADJUSTMENTS.—For adjustments, see adjustment instructions for the individual units under paragraph *c*.

(5) INSTALLATION. — Reverse the removal procedure outlined in paragraph *b*, (2).

c. MAIN UNITS OF HEATER (PBY-5A ONLY).

(1) VAPORIZER-MIXING HEAD ASSEMBLY.

(a) DESCRIPTION. — The vaporizer-mixing head consists of a capillary block enclosed in a stainless steel container. Fuel is fed into the container and by capillary action passes through the block to a series of holes where vapors are drawn through by primary combustion air to form a combustible mixture. This combustible mixture is ignited by a hot wire ignitor on the face of the vaporizer. Additional air to complete combustion is introduced into the fire through the mixing head.

The units are installed inside the aft end of the heat exchanger.

(b) REMOVAL.

(See figure 266.)

1. Disconnect the fuel line (72) from the constant level valve (80).

2. Disconnect the static line (88) from the rear exchanger plate fitting (78).

3. Remove the eight hexagon nuts (82) around the outer edge of the rear exchanger plate (77).

4. Withdraw the assembly about two inches and disconnect the ignitor lead wire (70) from the Fahnstock clip (84).

5. Unscrew the flexible conduit (68) from the plate fittings (81) and withdraw the wire.

6. Withdraw the complete assembly from the heater.

7. Remove the three screws (86) that join the mixing head (87) to the vaporizer (85).

(c) MAINTENANCE.—Keep all screws and nuts tightened firmly to prevent damage due to vibration.

(d) INSTALLATION.

(See figure 266.)

1. Join the vaporizer (85) and the mixing head (87) together by inserting the three screws (86).

2. Insert the assembly into the heater letting it protrude about three inches.

3. Before attaching the flexible conduit (68), insert the ignitor lead wire (70) through the elbow fitting (81).

4. Connect the wire to the Fahnstock clip (84). Screw the conduit (68) to the elbow fitting (81) on the exchanger plate (77).

5. Slide assembly into place and fasten with eight lock nuts (82).

6. Connect the static line (88) to the elbow fitting (78) on the right side of the exchanger plate.

7. Connect the fuel line (72) to the bottom of the constant level valve (80).

(2) IGNITOR.

(a) DESCRIPTION.—The ignitor is a small coil of silver nichrome wire stretched across the face of the vaporizer. The ignitor glows when the heater is turned on and ignites the gasoline vapor.

CAUTION

The ignitor is very brittle and subject to breakage if carelessly handled.

(b) REMOVAL.

(See figure 266.)

1. Remove the vaporizer mixing head as described under paragraph *c*, (1), *(b)*.

2. The ignitor (3) is now exposed upon the face of the vaporizer (85).

3. Remove the ground screw (4) at the left-hand end of the ignitor and the positive rod nut (5) at the right-hand end.

4. Loosen the ignitor holder bolt (2) at the center of the ignitor by removing the nut and ceramic knob (79).

5. Remove the three ceramic beads (1) from the ignitor.

(c) MAINTENANCE.—Replace ignitor when broken. Be sure that the ignitor holder at the center of vaporizer has a firm grip on the center bead and is drawn up tightly to the vaporizer face. The ends of the ignitor must be in contact with the face of the vaporizer.

(d) INSTALLATION.

1. Place the three ceramic beads (1) on the ignitor (3), the large bead in the center.

2. Fasten the ignitor and bead assembly to the face of the vaporizor (85) with the holder bolt (2). Center the large bead under the hook in the ignitor holder bolt (2).

3. Attach the left end of the ignitor to the vaporizer with the small ground screw (4).

4. Attach the right side of the ignitor under the positive rod nut (5).

5. Complete the installation by following the seven steps outlined in paragraph *c*, (1), *(d)*.

(3) FUEL PUMP.

(a) DESCRIPTION.—The fuel pump is the lowest unit on the aft end of the heater. Its speed is controlled by an adjustable resistor (See paragraph *c*, (4).) which permits a metered quantity of fuel to be delivered to the vaporizer.

(b) REMOVAL.

1. Disconnect the electrical flex conduit line (67) from the fuel pump (66).

2. Disconnect the three lines (65), (71), and (72) from the top of the fuel pump.

3. Remove the three nuts and bolts (69) attaching the pump to heater, and two insulating strips (60) and (61) separating the units.

4. Remove the pump.

(c) MAINTENANCE.—See paragraph 22, *r*, (3) for general maintenance on electric motors.

(d) ADJUSTMENTS.—The low fuel rate (0.7 gallons per hour) requires the pump to operate at 4½ volts and the high fuel rate (1.35 gallons per hour) require the pump to operate at 8½ volts. (See paragraph *c*, (4), *(c)*.)

(e) INSTALLATION. — To install the fuel pump, reverse the removal procedure outlined in paragraph *c*, (3), *(b)*.

(4) RESISTOR.

(See figure 266.)

(a) DESCRIPTION.—This unit permits a metered quantity of fuel to reach the vaporizer. As the adjusting lugs are moved the voltage to the fuel pump is altered, thereby increasing or decreasing pump's speed and output.

The resistor is fastened to the inside of the aft junction box cover (36) and is rated at 50 watts and 50 ohms.

(b) REMOVAL.

1. Remove the four corner screws (35) on the aft junction box cover (36).

2. Detach and label the wires (56), (57), and (58) from the resistor (55).

3. Detach the resistor from the cover by removing the two screws and nuts (34).

(c) ADJUSTMENTS.

1. With the battery-generator switch (54) in the "GEN" position and a terminal voltage of 28 from the auxiliary power unit, the voltmeter at the pump should read 4½ volts. If not, make the following adjustments:

a. Slide lug No. 1 (42) approximately 11/16 in. from the end of the resistor.

b. Slide lug No. 2 (41) approximately 1⅝ in. from the opposite end of the resistor.

c. Test the voltage by inserting a voltmeter in the circuit. Ground one of the voltmeter terminals on the heater, and touch the other terminal to the rigid connection (40) at the end of the resistor.

d. If the voltage is still slightly off, correct it to 4½ volts by adjusting lug No. 1.

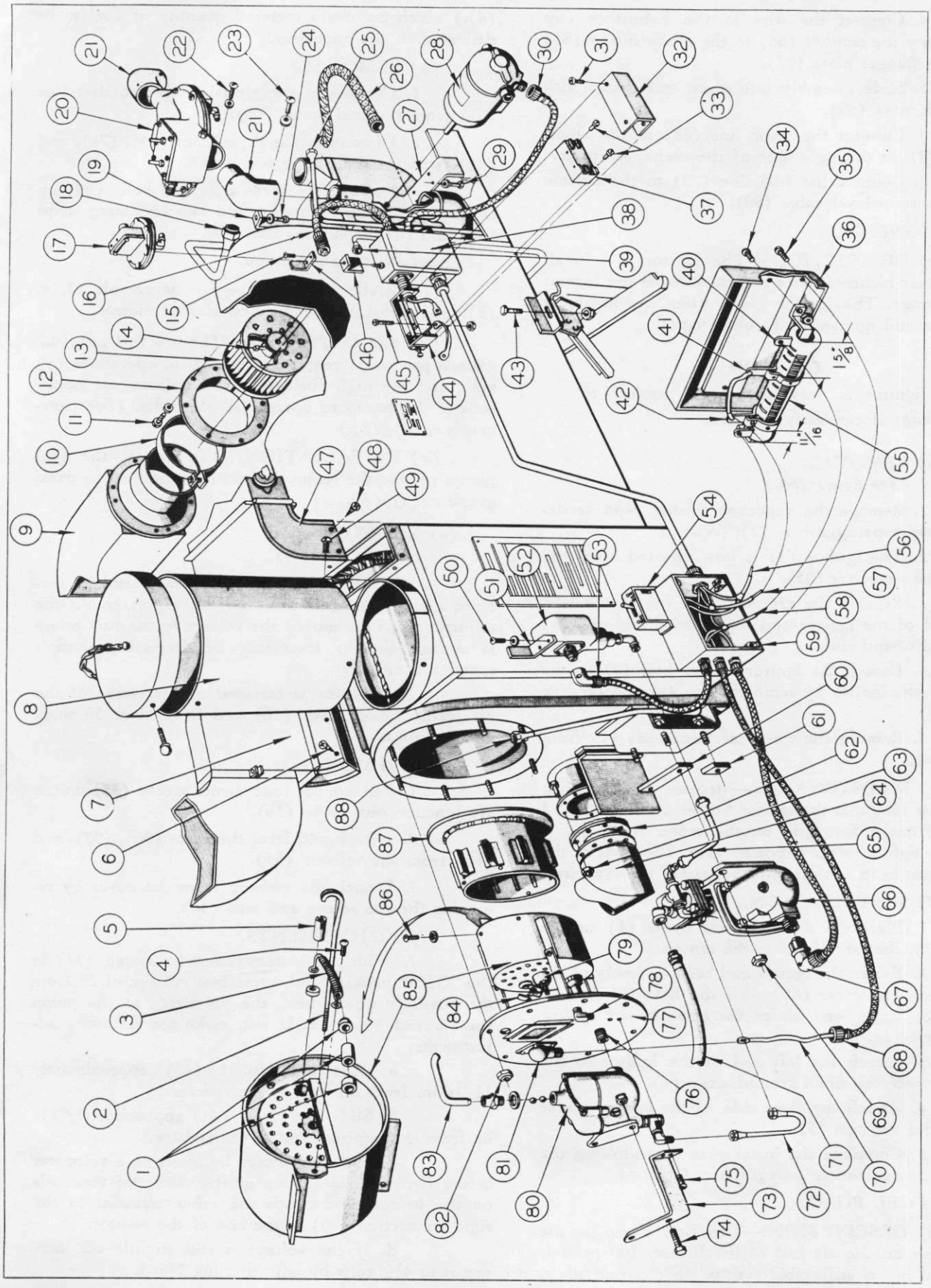


Figure 266—Central Heating Unit (PBY-5A Only)

No.	PART No.	NAME
1	*SH-1-63	Ceramic Beads
2	*SH-1-40	Ignitor Holder Bolt
3	*SH-1-62	Ignitor
4	AN515-8-4	Screw
5	*SH-1-38	Ceramic Rod Nut
	*SH-1-38	Ceramic Washer
6	AN504-8R6	Screw—Self Tapping
7	28F12206	"S" Duct Assembly
8	*SD-1-215	Engine Warming Connection Assem.
9	28F12208	90° Air Ram "ELL" Duct
	*SH-1-426	Flared Reduction Duct
10	*SH-1-426	Ring Clamp
11	AC501A5-4	Screw
	AN936-A6	Spring Washer
12	*SH-1-426	Fan Housing Cover
13	*SH-1-92	Fan Vane
14		Set Screw
15	AN515-8-8	Screw
16	NAF1150-4HB-36	Flex Conduit
	AN3064-6	Conduit Box Connector
	AN3066-6	Conduit Coupling Locknut
17	*SH-1-180	Diaphragm Switch
18	*SH-1-222	Equalizer Tube Assembly
19	*SH-1-229	Bracket
20	*SH-1-60	Barometic Compensator
21	*SH-1-68	90° Elbow
	*SH-1-369	Tube—Forward
	*SH-1-450	Tube—Aft
22	AN515-8-4	Screw
	AN935-8L	Spring Washer
23	AN515-8-4	Screw
	AN935-8L	Spring Washer
24	AN520-10-6	Screw
	AN935-10L	Spring Washer
25	*SH-1-208	Air Line Assembly
26	NAF1150-6A-384	Flex Conduit
27	*SH-1-230	Mounting Bracket
28	*SH-1-56	Fan Motor
29	AN74-A6	Bolt
	AN936-A416	Lock Washer
30	NAF1150-3A-28	Flex Conduit
	AN3106-10S-2S	Plug
	AN3064-3	Conduit Box Connector
	AN3066-3	Conduit Coupling Locknut
31	AC501A5-3	Screw
32	*SH-1-179	Switch Box Cover
33	AN520-5-4	Terminal Screw
34	AN515-8-8	Screw
	AN365-832	Nut
35	AN515-8-8	Screw
36	*SH-1-462	Junction Box Cover
37	*SH-1-179	Temperature Limit Switch
38	*SH-1-231	Forward Junction Box
39	28F7892-14	Air Line Assembly
40	*SH-1-604	Aft Resistor Terminal
41	*SH-1-604	Lug No. 2
42	*SH-1-604	Lug No. 1
43	AN4DD4A	Bolt—Inboard
	AN4DD11A	Bolt—Outboard Forward
	AN4DD12A	Bolt—Outboard Aft
	AN365-D428	Nut
43	28F7884-6	Spacer—Outboard Forward
	28F7884-7	Spacer—Outboard Aft
44	*SH-1-179	Support Bracket
45	AC501-5-18	Screw
	AN365D440	Nut
46	*SH-1-443	Bracket—Top
	*SH-1-219	Bracket—Bottom
47	*SD-1-181	Duct
48	AN504-8R6	Screw—Self Tapping
49	AN504-8R6	Screw—Self Tapping
50	AN515-8-6	Screw
	AN936-A8	Lock Washer
51	*SH-1-220	Bracket
52	*SH-1-181	Pressure Switch
53	NAF1150-3AB-29	Flex Conduit
	AN3064-6	Conduit Box Connector
	AN3066-6	Conduit Coupling Locknut
54	*Square "D" Type "C" Class 9300	Switch
55	*SH-1-604	Resistor
56	*	No. 20 Electric Wire
57	*	No. 20 Electric Wire
58	*	No. 20 Electric Wire
59	*SH-1-234	Aft Junction Box
60	*SH-1-203	Insulating Strip
61	*SH-1-203	Insulating Strip
62	*	Asbestos Gasket
63	AN3DD13	Bolt
	AN372-D1032	Nut
64	*SD-1-67	Exhaust—Lower Section
65	*SH-1-466	Air Line Assembly
	AN825-4D	Tee
	AN822-4D	Elbow—90°
66	*SH-1-93	Fuel Pump and Motor
	*SH-1-263	Shim
	*SH-1-264	Shim
67	NAF1150-3AB-37	Flex. Conduit
	AN3108-12-5S	Plug
	AN3064-6	Conduit Box Connector
	AN3066-6	Conduit Coupling Locknut
68	NAF1150-3AB-52	Flex. Conduit
	AN3064-6	Conduit Box Connector
	AN3066-6	Conduit Coupling Locknut
69	AN4-10	Bolt
	AN365-428	Nut
70		No. 14 Electric Wire
71	CVAC No.H0S6-50	Fuel Supply Line
72	*SH-1-461	Fuel Line Assembly
73	*	Bracket
74	AN74A6	Bolt
	AN365-420	Nut
75	AN515-8-5	Screw
76	*SH-1-320	Fuel Line Assembly
77	*SH-1-2	Rear Exchanger Plate Assem.
78	AN822-4D	Elbow
79	*SH-1-61	Ceramic Insulator Nut
	AN340-8	Nut
80	*SH-1-64	Constant Level Valve
81	AN3062-4	90° Elbow—Conduit

No.	PART No.	NAME	No.	PART No.	NAME
82	AN365-428	Nut	85	*SH-1-310	Vaporizer Assembly
83	*	Air Line	86	AN515-8-4	Screw
84	*FH-13-1	Fahnstock Clip		AN936-A8	Lock Washer
84	AN340-8	Nut	87	*SH-1-43	Mixing Head Assembly
	*SH-1-260	Porcelain Washer	88	*SH-1-208	Air Line Assembly

All items marked with an asterisk * are Anchor Post Fence Co. part numbers.

2. With the battery-generator switch (54) in the "BAT" position, the voltage at the pump should now read 8½ volts. If not, adjust lug No. 2 (41) until the correct voltage is obtained.

3. Repeat the above steps as a recheck.

4. Should the resistor heat excessively, check current by inserting an ammeter in the pump circuit. The reading should not be more than 0.9 amp. If more than 1.0 amp., replace the pump.

(d) INSTALLATION.
(See figure 266.)

1. Attach the resistor (55) to the junction box cover (36) with the two screws and nuts (34).

2. Attach the wires (56), (57), and (58) to the resistor as labeled, and solder.

3. Install the cover (36) on the junction box (59) with the four screws (35).

(5) FAN ASSEMBLY.

(a) DESCRIPTION.—The fan is used to supply air both for combustion and for heating. The fan employs a split housing which controls the correct proportioning of heating air and combustion air. The unit functions only when the airplane is grounded. When airborne all air is supplied by the air scoop assembly.

(b) REMOVAL.
(See figure 266.)

1. Remove navigator's table drawer to allow more room for working on heater.

2. Loosen ring clamp (10) at the fan intake, and pull the air duct (9) clear of the heater.

3. Detach the hat shaped housing cover (12) by removing the eight screws and lock washers (11).

4. Remove the vane assembly (13) from the motor (28) shaft by loosening the setscrew (14) on the hub of the vane and sliding the assembly outward.

5. Disconnect the flex conduit line (30) from the fan motor (28).

6. Remove the bottom four hex headed bolts (29) holding motor to the mounting bracket (27).

7. Slide motor away from heater.

(c) MAINTENANCE.—See Par. 22, *v*, (3) for general maintenance on electric motors.

(d) INSTALLATION.

1. Install fan motor (28) on mounting bracket (27), inserting the motor shaft through the opening into the vane housing.

2. Insert the four hex headed bolts (29) and tighten fan motor to the mounting.

3. Slide the vane assembly (13) into the housing opening and onto the motor (28) shaft.

4. Turn vane on shaft until set screw (14) is opposite the flat section of the shaft. Tighten set screw.

5. Spin the vane a few times to see if it rubs the housing; if it does, unloosen the set screw and slide the vane in or out on the shaft until the proper location is found.

6. Install the housing cover plate (12), using the eight screws and lock washers (11).

7. Slide the ram air duct (9) into the vane cover assembly and tighten clamp (10).

(6) BAROMETRIC COMPENSATOR.

(a) DESCRIPTION.—The barometric compensator is the upper-most unit above the fan.

This unit compensates both for air density and air speed to maintain a constant weight of air for combustion at the vaporizer. The compensator has an effective range from sea-level to an altitude of 40,000 feet.

One may observe, during flight, the movement of the linkage through the window in the linkage housing.

(b) REMOVAL.
(See figure 266.)

1. Disconnect the two lines (18) and (25) from the barometric compensator (20).

2. Remove screw and washer (24) attaching unit to support angle (19).

3. Remove the three screws (23) at the bottom of both elbows (21).

4. Remove the four screws (22) and detach the elbow assembly (21) from each side of the barometric compensator.

(c) MAINTENANCE.—The barometric compensator should be completely replaced when found defective. No repairs or adjustments should be made to this unit except at designated bases or bv the manufacturer.

(d) INSTALLATION.

1. Attach the two elbow assemblies (21) to

the tube openings on each side of the barometric compensator (20) with the four screws (22).

2. Attach the compensator unit to the angle bracket (19) with screw and washer (24).

3. Connect the two lines (18) and (25) to the compensator unit.

4. Insert and tighten the three screws (23) at the bottom of each of the two elbows (21).

(7) CONSTANT LEVEL VALVE.

(a) DESCRIPTION.—The constant level valve is located on the aft end of the heater above the fuel pump.

This unit is used to maintain the correct level of fuel in the vaporizer, and it also serves the additional purpose of stopping the flow of fuel to the vaporizer should the fire be out or not burning at its normal rate.

(b) REMOVAL.
(See figure 266.)

1. Disconnect the two lines (72) and (83) from the valve (80).

2. Disconnect the "L" shaped bracket (73) from the face of the exchanger plate (77) by removing the two screws and washers (75).

3. Separate the "L" shaped bracket and valve by removing the two bolts (74).

4. Turn the valve in a counterclockwise direction to remove from the exchanger plate fitting (76).

(c) INSTALLATION.—To install the constant level valve, reverse the removal procedure outlined in paragraph *c*, (7), *(b)*.

(8) PRESSURE SWITCH.

(a) DESCRIPTION.—The pressure switch is installed on the aft inboard side of the heater directly above the battery-generator switch. The pressure switch is set to stop the fuel pump if an excessive quantity of fuel is fed to the vaporizer.

(b) REMOVAL.

1. Disconnect the flex conduit line (53) from the switch (52).

2. Disconnect the line (65) from the bottom of the switch.

3. Detach switch from support angle (51) by removing the two screws and washers (50).

(c) MAINTENANCE.—The pressure switch should be completely replaced when found defective. No repairs should be made on this unit except at designated bases or by the manufacturer.

(d) INSTALLATION.—To install the pressure switch, reverse the removal procedure outlined in paragraph *c*, (8), *(b)*.

(9) DIAPHRAGM SWITCH.

(a) DESCRIPTION.—The diaphragm switch is above the forward junction box on the inboard face of the heater. This unit operates on static pressure from the ram air. This switch stops the fan motor and increases the fuel rate when the airplane is in flight and the air scoop is open. It also functions to re-start the fan motor and restore the low fuel rate when the airplane is landed and the air scoop is closed.

(b) REMOVAL.
(See figure 266.)

1. Disconnect the flex conduit line (16) from the diaphragm switch (17).

2. Disconnect the air line (39) from the bottom of the switch.

3. Detach the switch from the two angle brackets (46) by removing the three screws and washers (15).

(c) MAINTENANCE.—This unit should be replaced when found defective. Adjustments and repairs should be made only at designated bases or by the manufacturer.

(d) ADJUSTMENTS.—This unit is set at the factory and should not be changed.

(e) INSTALLATION.—To install the switch, reverse the removal procedure outlined in paragraph *c*, (9), *(b)*.

(10) HIGH TEMPERATURE LIMIT SWITCH.

(a) DESCRIPTION.—The high temperature limit switch is coupled with and located just aft of the forward junction box.

This unit will stop the heater if an abnormal temperature is reached within the heater casing, which could happen if all the heating air ducts were closed. The switch is factory set to stop the heater when a temperature of 74°C (165°F) is reached at the switch location.

(b) REMOVAL.
(See figure 266.)

1. Remove the switch box cover (32) by extracting the four screws (31).

2. Label the wires before removing from switch.

3. Melt the solder on the terminal screw heads with a hot iron. Extract the screws (33) from the switch (37).

4. Remove the two screws and nuts (45) that hold the switch in place. Do not remove the switch box from the heater.

(c) MAINTENANCE.—The switch should be completely replaced when found defective.

(d) ADJUSTMENTS.—The switch is factory adjusted to stop the heater when a temperature of 74°C (165°F) is reached at the switch location. The adjusting screw which, when turned clockwise, increases the temperature is factory set and locked by an elastic

stop nut. All adjustments should be made at designated bases or by the manufacturer.

(e) INSTALLATION.

1. Place switch (37) in box (44) on heater and insert the two screws and nuts (45), placing the ground wire under the aft nut.

2. Insert the terminal screws (33) and attach the wires as labeled.

3. Solder the wires to the screws (33).

4. Replace the switch box cover (32) and insert the four screws (31).

(11) COMBUSTION CONTROL UNIT.

(a) DESCRIPTION.—The combustion control unit is installed on the interior wall of the airplane above the navigator's table and approximately two inches forward of station 2.5.

This unit is used as a means of starting and stopping the heater, and it also automatically supervises the functioning of the fan, fuel pump, and ignition.

(b) REMOVAL.
(See figure 267.)

1. Detach the power cable (3) from the aft side of the control box (6).

2. Detach the control box cover by removing the three screws (5).

3. Detach the control box from the bracket (2) by removing the four screws and nuts (4).

4. Detach the control box bracket from the stringers by removing the four screws and nuts (1).

5. Detach the conduit (7) from the heater and airplane by removing the conduit installation clips (24). *(See figure 268.)*

(c) MAINTENANCE.—This unit should be completely replaced when found defective. Adjustment and repairs are to be made only at designated bases or by the manufacturer.

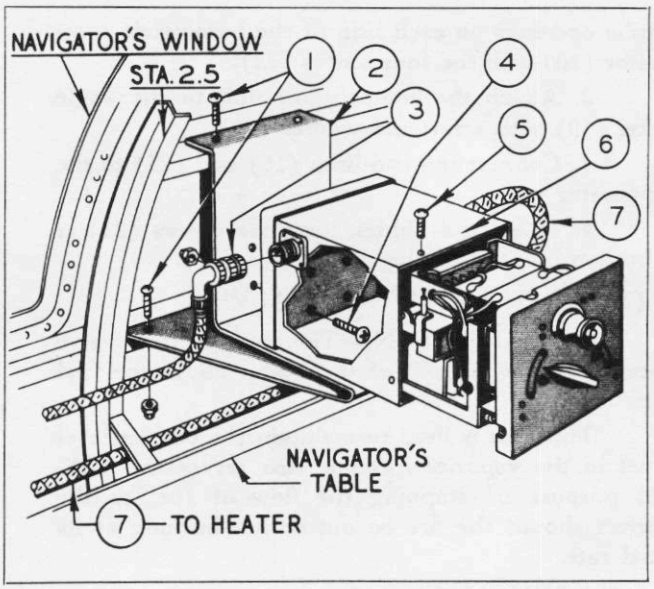
(d) INSTALLATION.—To install the combustion control unit, reverse the removal procedure outlined in paragraph *c*, (11), *(b)*.

d. DUCTING (PBY-5A ONLY).

(1) AIR SCOOP.

(a) DESCRIPTION.—The cool air supply which is heated by the heater and distributed through rigid ducts to various parts of the airplane is scooped into the ram air ducts through the action of an elbow duct with a small scoop shaped door which can be manually actuated to extend out the side of the airplane. The speed of the airplane and the degree to which the scoop is open governs the pressure of the air entering the ducts.

The air scoop is installed through the outer skin on the port side of the airplane just forward of bulkhead 4.



No.	PART No.	NAME
1	AN515-DD832-8	Screw
	AN372-D832	Nut
2	SD-1-20	Bracket
3	NAF1150-4A-73	Flex. Conduit
4	AN515-DD1032-10	Screw
	AN372-D1032	Nut
5	AC500-6-8	Screw
6		Combustion Control Unit
7	NAF1150-6A-384	Flex. Conduit
	AN3106-14S-6S	Plug

Items number 2 and 6 are Anchor Post Fence Co. part numbers.

Figure 267—Central Heater Combustion Control Unit (PBY-5A Only)

(b) REMOVAL.
(See figure 268.)

1. Remove the twenty-eight screws and nuts (14) where air scoop (4) joins the skin of the airplane.

2. Unclinch the seam at the joint where the air scoop duct (4) joins the ram air duct (3) by unfolding the metal lips.

3. Remove the air scoop and gasket (15).

(c) MAINTENANCE.

1. Keep all attaching and supporting screws tight to prevent damage due to vibration.

2. Refer to MANUAL OF STRUCTURAL REPAIR (AN 01-5MA-3) for information on the repair of ducting.

(d) INSTALLATION.

1. Assemble air scoop (4) and gasket (15) to

opening in side of hull with twenty-eight screws and nuts (14). Insert the screws from the outside.

2. Clinch the seam joint by folding over the metal lips where the air scoop (4) joins the rammed air duct (3).

(2) RAM AIR DUCTS.

(a) DESCRIPTION.—The cool ram air which enters through the air scoop is transmitted through a series of air ducts to the heater where the air is used for heating and combustion.

The ducts extend downward from the air scoop, on the outboard side of the heater, to the intake opening of the fan.

(b) REMOVAL.
(See figure 268.)

1. Remove duct bracket (32) at beltframe 3.33 by extracting the four screws and nuts (31) holding bracket to beltframe.

2. Detach bracket (32) from duct by removing the screw and nut (33) at the top corner of the bracket.

3. Loosen the screw (26) in the ring clamp (25) where the ducting joins with the heater, but do not detach the ring clamp from the heater.

4. Disconnect the air line (30) from the inboard side of the duct by removing the two screws (29).

5. Unclinch the seams by unfolding the metal lips where the ram air duct (3) joins the air scoop (4).

6. Slip the bottom end of the duct (27) off the heater fan housing.

7. Remove the duct from the airplane.

(c) MAINTENANCE.

1. Keep all attaching and supporting screws tight to prevent damage to ducts due to vibration.

2. Refer to MANUAL OF STRUCTURAL REPAIR (AN 01-5MA-3) for information on the repair of ducting.

(d) INSTALLATION.

1. Attach lower end of duct (27) to the heater fan housing, but do not tighten the ring clamp (25).

2. Attach upper end of duct to air scoop (4) by clinching the seams at the joint.

3. Attach the bracket (32) to the duct by inserting the screw and nut (33) in the corner of the top angle of the bracket.

4. Attach the bracket to beltframe 3.33 with the four screws and nuts (31).

5. Tighten the ring clamp (25) at the lower end of the ducting.

6. Connect the air line (30) to the inboard side of the duct with the two screws (29).

(3) WARM AIR DUCTS.

(a) AFT COMPARTMENT HEATING DUCT.

1. DESCRIPTION.—Warm air is supplied to the section of the airplane aft of bulkhead 4 by a duct which extends from the heater up to an opening in bulkhead 4.

2. REMOVAL.

a. Detach the upper duct section (9) from bulkhead 4 by removing the ten screws and locknuts (6).

b. Detach the upper section of the duct from the support bracket (8) by removing the three self-tapping screws (7).

c. Detach the vertical section of the duct (5) from the navigator's book stowage locker (1) by removing the two screws and nuts (2) from the brackets at the top and bottom.

d. Remove the 12 self-tapping screws (45) from the two splice clamps (48) at the upper end of the "S" shaped duct (44); remove the two screws and nuts (46) from the clamps; and detach the canvas splice (47).

e. Remove the four self-tapping screws (42) that hold the bottom section of the ducts to the heater.

f. Remove the duct from the airplane.

3. MAINTENANCE.

a. Keep all attaching and supporting screws tight to prevent damage to the ducting due to vibration.

b. Refer to MANUAL OF STRUCTURAL REPAIR (AN 01-5MA-3) for information on the repair of ducting.

4. INSTALLATION.—To install the aft compartments heating duct, reverse the removal procedure outlined in paragraph *d*, (3), *(a)*, 2.

(b) FORWARD COMPARTMENT HEATING DUCTS.

1. DESCRIPTION.—The section of the airplane forward of bulkhead 2 is supplied with heat for windshield defrosting and cabin heating through a series of rigid ducts which extend from the heater to bulkhead 2. At the bulkhead, the heated air is separated by a "Y" duct and transmitted through two lengths of flexible ducting, which carry the heat to the pilot's and bombardier's compartments.

2. REMOVAL.

a. Remove the engine preheater duct (8) from the heater by extracting the four screws (49). *(See figure 266.)*

b. Detach the aft section (35) of the forward compartment heating duct from the heater by removing the eight attaching screws (34). *(See figure 268.)*

c. Detach center section duct (21) sup-

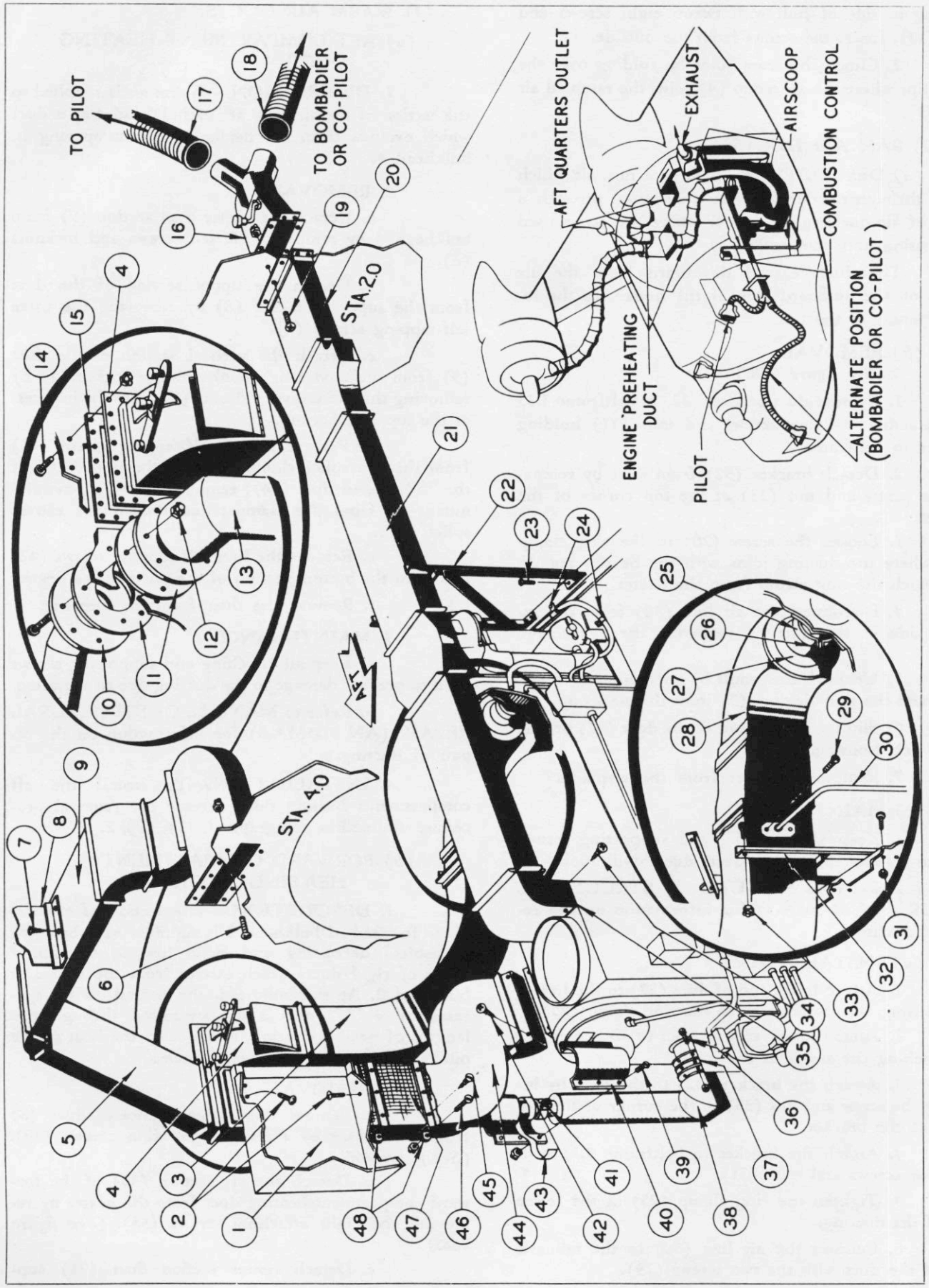


Figure 268—Central Heater Unit Ducting (PBY-5A Only)

No.	PART No.	NAME
1	28F4023	Navigator's Book Case
2	AN526-DD1032-8	Screw
	AN372-D1032	Nut
3	28F12205	Ram Air Sweep Duct
4	*SD-1-221	Air Scoop Assembly
5	28F12210	Vertical Duct Assembly
6	AN526-DD1032-8	Screw
	AN372-D1032	Nut
7	AN504-8R6	Self Tapping Screw
8	28F7892-7	Bracket
	28F7892-8	Angle
9	*SD-1-183	Top Aft Duct Assembly
10	28F12209	Exhaust Outlet
11	*IPBY-105	Asbestos Gasket
12	AN526-DD1032-14	Screws
	AN372-D1032	Nut
13	*SD-1-67	Exhaust—Upper Section
14	AN526-DD1032-12	Screws
	AN372-D1032	Nuts
15	28F7883	Gasket
16	28F7896	"Y" Duct
17	28F6833-14	Pilot's Heating & Defrosting Duct
18	28F6833-18	Bombardier's & Co-Pilot's Heating and Defrosting Duct
19	AN526-DD1032-8	Screw
	AN372-D1032	Nut
20	*SD-1-167	Straight Duct Section
21	*SD-1-182	Center Duct Section
22	*SD-1-220	Bracket Assembly
23	AN526-DD1032-10	Screw
	AN372-D1032	Nut
24	Q908A-9	Clip
	AN526-DD1032-9	Screw
	AN372-D1032	Nut
25	*SH-1-426	Ring Clamp
26	AN526-DD1032-8	Screw
	AN372-D1032	Nut
27	*SH-1-426	Flared Reduction Duct
28	28F12208	90° Air Ram Ell Duct
29	AN526-DD1032-8	Screw
	AN372-D1032	Nut
30	*SH-1-279	Air Line Assembly
31	AN526-DD1032-10	Screw
	AN372-D1032	Nut
32	*SD-1-219	Bracket
33	AN515-6-7	Screw
	AN365-632	Nut
34	AN504-8R6	Self Tapping Screw
35	*SD-1-181	Duct—Mushroomed Section
36	AN3DD13	Bolt
	AN372-D1032	Nut
37	*IPBY-105	Gasket
38	*SD-1-67	Exhaust—Lower Section
39	AN526-DD1032-8	Screw
	AN372-D1032	Nut
40	28F12207	Clamp
41	*SD-1-188	Exhaust Line Clamp
42	AN504-8R6	Self Tapping Screw
43	CVAC No. AS. 17-50	Asbestos Tape
44	28F12206	"S" Duct Assembly
45	AN504-8R6	Self Tapping Screw
46	AN515-6-7	Screw
	AN365-632	Nut
47		Canvas Section
48		Clamps

All items marked with an asterisk * are Anchor Post Fence Co. part numbers.

port bracket (22) from beltframe 3.0 by removing the four attaching screws and nuts (23).

d. Detach the forward end of the ducting (20) from bulkhead 2 by removing the ten screws and nuts (19). This operation also removes the "Y" duct (16) on the forward face of the bulkhead.

e. Remove the duct assembly from the airplane.

f. Separate the two lengths of flexible duct (17) and (18) from the "Y" duct by pulling the ducts from the expansion sleeves on the "Y" duct.

g. Remove the two flexible ducts from the airplane.

3. MAINTENANCE.

a. Keep all attaching and supporting screws tight to prevent damage to the ducting due to vibration.

b. Refer to MANUAL OF STRUCTURAL REPAIR (AN 01-5MA-3) for information on the repair of ducting.

4. INSTALLATION.—To install the forward compartment heating ducts and supports, reverse the removal procedure outlined in paragraph *d*, (3), *(b), 2.*

(4) HEAT EXCHANGER EXHAUST DUCT.

(a) DESCRIPTION.—The waste gases from the heater are emitted through an asbestos shrouded duct which extends upward from the aft end of the heater to the exhaust outlet immediately aft of the ram air scoop.

(b) REMOVAL.

1. Remove the eight screws and nuts (12) that secure the exhaust duct (13) to the skin of the airplane.

2. Remove the outside exhaust outlet (10) and gasket (11), and the inside gasket.

3. Detach the clamp assembly (40) from the exhaust duct by removing the six attaching screws and nuts (39).

4. Remove the asbestos tape (43), then loosen the splice clamp (41).

5. Detach the lower end of the duct and gasket (37) from the heater by removing the eight screws and nuts (36).

6. Divide the duct into two pieces by lowering the bottom half of the duct and separating it at the splice.

7. Remove the two sections from the airplane.

(c) MAINTENANCE.—Keep all attaching and supporting screws tight to prevent damage to the ducting due to vibration.

(d) INSTALLATION.

1. Place the lower section of the duct (38) into position.

2. Place the upper half of the duct (13) into position.

3. Place gasket (11) in between the upper flange and hull skin.

4. Outside the airplane, line up the gasket (11) and exhaust outlet (10) to the installation holes and insert the eight screws and nuts (12). Use new locknuts.

5. At the bottom end, insert the gasket (37) and eight screws and nuts (36). Use new locknuts.

6. Tighten the splice clamp (41) at the middle of the duct; wrap the bare duct section with asbestos tape (43); and replace the outside clamp assembly (40) with the six screws and nuts (39).

e. GENERAL.—The PBY-5 airplane (serial numbers 08124 and on) is equipped with a Stewart-Warner Heater Unit (Model 782-N) which supplies heated air to a series of ducts for cabin warming, for windshield and bomber's window defrosting, and for preflight engine warming. The unit is located between hull stations 2 and 2.5 on the port side of the airplane. The heater and its integral power plant operate with fuel supplied by the main fuel system. Electric power to ignite spark plugs is furnished by a magneto integral with the unit. The ignition switch is located on the flywheel housing. The heater operation is the same whether airplane is in flight or grounded.

f. HEATER UNIT (PBY-5 ONLY).

(1) DESCRIPTION.—The Stewart-Warner heater unit includes in one assembly the power plant, the heater, and the ventilating air blower assemblies. *(See figure 270.)*

(a) POWER PLANT.—The purpose of the power plant is to drive the fuel-air blower which impels fuel-air mixture from the carburetor to the engine and to the heater combustion chamber, and also to drive the ventilating air blower which supplies cold air to the heat exchanger, and heated air to the ducts. The power plant assembly includes the following:

1. The Lauson engine (1) which is a four cycle, one cylinder air-cooled unit, developing 1.4 horsepower and consuming approximately two pounds of gasoline per hour, and one quart of oil in 12 hours.

2. The Tillotson carburetor (12) which provides fuel-air mixture for both engine and heater combustion. A choker button is located between the ventilating blower housing, and the fuel-air blower (9).

3. The Wico magneto which produces high tension current to fire the spark plugs.

4. The fuel-air blower (9) which is coupled directly to the drive shaft of the engine. Two impellers, mounted on parallel shafts, rotate in opposite directions to impel air into the air opening and force the fuel-air mixture from carburetor to engine and to heater combustion chamber.

5. A manually operated throttle valve (7) which is located in the horizontal fuel-air tube at the top exterior of the fuel-air blower. This valve regulates the volume of fuel-air which enters the engine and, therefore, the engine speed, the speed of both blowers, and the output of heated air.

6. A by-pass tube (10) which extends from top to bottom of the exterior of the fuel blower body casting. A contained spring loaded, piston type automatic pressure valve opens where the pressure at the outlet side (top) of the fuel-air blower becomes greater than the pressure necessary for the most efficient operation of the heater, and allows the fuel-air mixture to flow through the by-pass tube to the inlet side (bottom) of the fuel-air blower, thereby reducing the fuel-air pressure to the desired range.

7. The fuel line which takes off from the port selector valve (14) on the main fuel line in the superstructure, comes down the forward face of bulkhead 4 and then moves forward to the inlet fitting on the heater unit. *(See figure 269.)*

8. Exhaust tubing which passes exhaust gases from the engine through a fitting and to a juncture with heater exhaust fitting at the output end of the heater. From here an exhaust line (8) carries the exhaust gases to the atmosphere through a fitting in the skin just aft of bulkhead 2.

(b) HEATER ASSEMBLY.—The heater assembly (2) consists essentially of a combustion chamber for igniting fuel-air mixture, a heater exchanger wherein air for distribution is heated, a butterfly valve thermostatically controlled for regulation of fuel-air mixture, flame arrestor, burner tube which acts as a baffle to the fuel-air flow, and heater exhaust. The heater has a rated output of 80,000 BTU per hour. *(See figure 270.)*

1. A thermostatically controlled butterfly valve, located in the vertical tube which conveys the fuel-air mixture from the fuel-air blower to heater, regulates the amount of fuel-air entering the heater according to set temperature. The thermostat is factory set for 94°C (201°F) ventilating air temperature. It can be set to maintain any temperature from 38°C (100°F) to 150°C (300°F) by turning control knob

gage to desired reading. When temperature at output end of the heater rises above the set temperature, the thermostatic coil contracts, causing the butterfly valve to close.

2. The flame arrestor is a fitting located in the intake elbow of the heater, designed to prevent back burning from combustion chamber to fuel-air inlet line.

3. The burner tube assembly is a directional tube with cone shaped baffle and eight vent holes at the outlet end. It decreases the velocity of the fuel-air flow and sets up a swirling motion of the fuel-air moving into the combustion chamber.

4. The combustion chamber is a hermetically sealed chamber between the burner tube and the heat exchanger where the fuel-air mixture is ignited by the spark plug.

5. The heat exchanger consists of a unit with interior flues and exterior fins. The burning fuel-air mixture is extinguished as it enters the flues, while the cold air which circulates around the fins and the exterior of the heat exchanger is heated. Burnt out gases pass through the interior of the heat exchanger to the exhaust fitting.

6. The exhaust fitting at the output end of the heater housing is connected with the Lauson engine exhaust line, permitting heater gases to exhaust to the atmosphere through the engine exhaust line.

(c) VENTILATING AIR BLOWER ASSEMBLY.—The ventilating air blower assembly (6) includes a blower fan enclosed in a housing. It is directly coupled with the Lauson engine drive. This blower forces cold air through the heater where it absorbs heat from the fins of the heat exchanger. The heated air is delivered to the output end of the heater, where a portion of it is directed over the thermostatic coil control before being delivered to the ducts.

(2) REMOVAL.

(See figures 269 and 270.)

(a) Remove entire heater unit assembly as follows:

1. Disconnect exhaust line (11) at exhaust fitting.

2. Disconnect fuel line (10) at engine fuel line inlet.

3. Remove sleeve to main duct (16) from output end of heater (5) by detaching clamp.

4. Detach the three bolts which hold heater unit through the three shock mounts to supporting structure. Remove heater unit.

(b) Remove Lauson engine as follows:

1. Remove fuel-air blower (9) as outlined in paragraph *f*, (2), *(e)*.

2. Detach safety wire and two castle nuts holding gasket and exhaust elbow to engine exhaust port.

3. Detach safety wire and two castle nuts holding gasket and fuel-air tube to engine intake port.

4. Detach safety wire and two nuts holding hood, conduit, and flange assembly (13) to engine head.

5. Remove heater spark plug connection from heater.

6. Detach safety wire and two Allen set screws on ventilating air fan wheel. Use a small block of wood and a hammer to tap wheel off shaft keyway.

CAUTION

Be sure to shoulder against steel coupling and tap from engine side of wheel.

7. Detach four stop nuts and bolts holding engine to base and side base bracket.

8. Detach two screws holding side bracket to base.

9. Remove engine.

(c) Remove carburetor (12) as follows:

1. Shut off fuel supply to inlet of carburetor and remove line at carburetor.

2. Detach safety wire and two screws holding gasket, air inlet flange, and adapter to carburetor.

3. Disconnect choke connecting rod.

4. Detach stop nuts on studs holding carburetor and gasket to intake elbow at base of blower.

5. Remove carburetor and fuel filter.

(d) Remove magneto as follows:

1. Remove flywheel cover by detaching four screws and detaching "ON" and "OFF" switch ground wire from terminal on side bearing plate.

2. Remove starting pulley by removing three screws.

3. Remove flywheel as follows:

a. Using a flywheel puller, turn three screws of puller into holes for starting pulley screws. Tighten center screw of flywheel puller against shaft until flywheel becomes loose.

b. Without using flywheel puller, remove flywheel nut and replace with castellated end of nut towards flywheel. Leaving a space between crankshaft nut and flywheel, strike the end of the crankshaft nut a sharp blow with a hammer. The flywheel will jar loose from taper on crankshaft.

4. Detach two bolts and washers holding magneto to bearing plate.

5. Detach ground wire, clip and heater spark plug cable at coil. Remove magneto.

(e) Remove fuel-air blower (9) as follows:

1. Shut off fuel supply at inlet of carburetor (12).

2. Detach two screws at top of blower holding by-pass tube (10) and gasket to three-way distributor tube assembly (8).

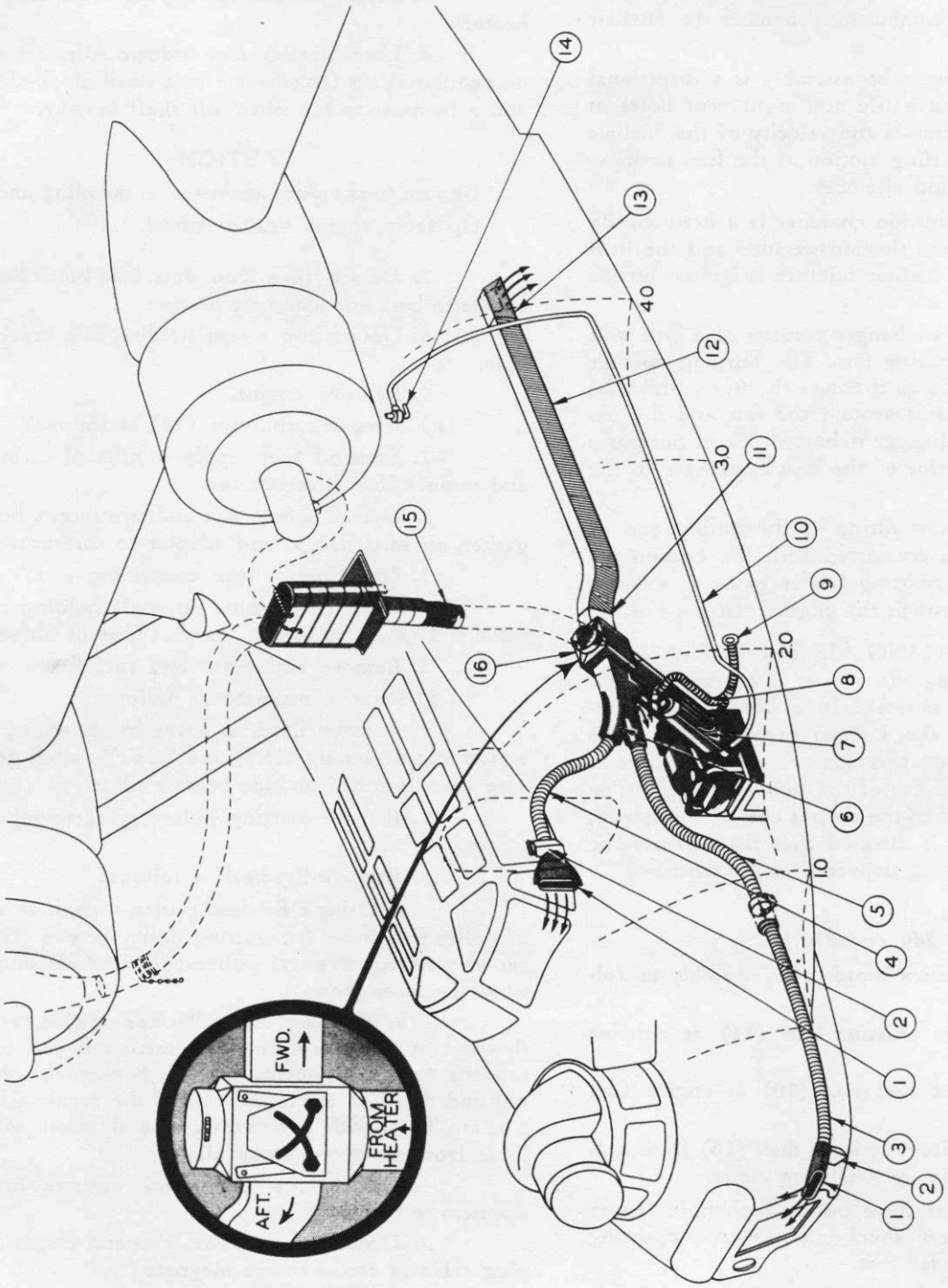


Figure 269—Central Heater System (PBY-5 Only)

No.	PART No.	NAME	No.	PART No.	NAME
1	28F6832-6	Fish-tail Diffusor Fitting	10	Q2202-6-222	Fuel Line
2	28F6842	Bracket	11	28F6849	Sleeve Coupling, Aft
3	28F6833-6	Exten. Tube—Bomber's Compt.	12	28F6837-9	Aft Duct
4	28F6843-15	Flex. Tube to Pilot's Windshield	13	28F6847	Deflector Duct
5	28F6834	Flex. Tube to Bomber's Compt.	14	No. 703-3-6D	Selector Valve, Port
6	28F6841	Conn. & Deflector Duct	15	Stewart-Warner (G. F. E.)	Engine Preheater Tube
7	471239	Rod, Thermostatic Control	16	28F6815	Main "Y" Duct
8	471934	Engine & Heater Exhaust Line			
9	28F2026-20	Collar Clamp, Exhaust Line			

3. Detach two screws at bottom of blower holding by-pass tube and gasket (10) to intake fitting of blower.

4. Remove by-pass tube.

5. Detach two screws at top of blower holding motor fuel-air lead tube and gasket to three-way tube assembly (8).

6. Remove clamp holding heater flexible tube fuel-air lead to three-way tube assembly.

7. Detach two nuts holding three-way tube and gasket to studs on outlet side of blower.

8. Detach nut and bolt holding choke rod bracket to top of blower housing.

9. Disconnect fuel line to carburetor and choke connecting rod.

10. Detach two screws at bottom of blower holding gasket, air intake flange and adapter to carburetor.

11. Remove carburetor as outlined in paragraph *f*, (2), *(c)*.

12. Detach four nuts and bolts holding blower feet to frame.

13. Detach nut on blower holding brace rod between blower and motor.

14. Grip sides of blower and pull away from shaft coupling. It is a free fitting coupling and blower shaft should come out easily. Remove blower.

(f) Remove fuel line as follows:

1. Break fuel line at port selector valve (14) on the main fuel line by unscrewing connector.

2. Break line at superstructure by unscrewing connector.

3. Break fuel line at inlet to carburetor by unscrewing connector.

4. Remove clips, and remove line by pulling through grommets.

(g) Remove exhaust line (8) as follows:

1. Remove collar clamp (9) at skin opening by detaching clevis bolt and nut.

2. Detach exhaust line at heater exhaust fitting.

3. Remove clips and then remove exhaust line.

(h) Remove heater (2) as follows:

1. Disconnect heater spark plug cable.

2. Remove spark plug and spark plug shield.

3. Detach four nuts and studs holding intake tube to valve housing and intake elbow of heater.

4. Detach four castle nuts and studs holding inlet elbow and gasket to ventilating air blower housing on outside, and heater inlet and gasket to the housing on inside.

5. Remove flame arrestor from intake elbow.

6. Detach four screws holding thermostatic control to output end of housing.

7. Remove thermostatic control and rod (7) from fuel-air flow valve sleeve.

8. Detach two screws holding fuel-air flow valve to housing. Remove valve.

9. Detach two screws holding motor exhaust "Y" to elbow of heater exhaust.

10. Remove elbow from heater exhaust.

11. Detach six screws holding heater housing to ventilating air blower housing.

12. Detach two screws holding heater housing to supporting frame. Remove heater.

(i) Remove ventilating air blower (6) as follows:

1. Remove Lauson engine (1) as outlined in paragraph *f*, (2), *(b)*.

2. Remove fuel-air blower (9) as outlined in paragraph *f*, (2), *(e)*.

3. Disconnect heater unit (2) from fan housing as outlined in paragraph *f*, (2), *(h)*.

4. Detach six cap screws (three inside—three outside) holding housing to frame. Remove housing.

(3) MAINTENANCE.

(a) LAUSON ENGINE.

1. IGNITION TROUBLES.

a. Check for spark by disconnecting spark plug from cable. If spark jumps gap, spark plug is defective. If no spark, check ignition cable and magneto.

b. Check spark plug for broken or cracked ceramic, cleanliness, and proper clearance (.020 inch)

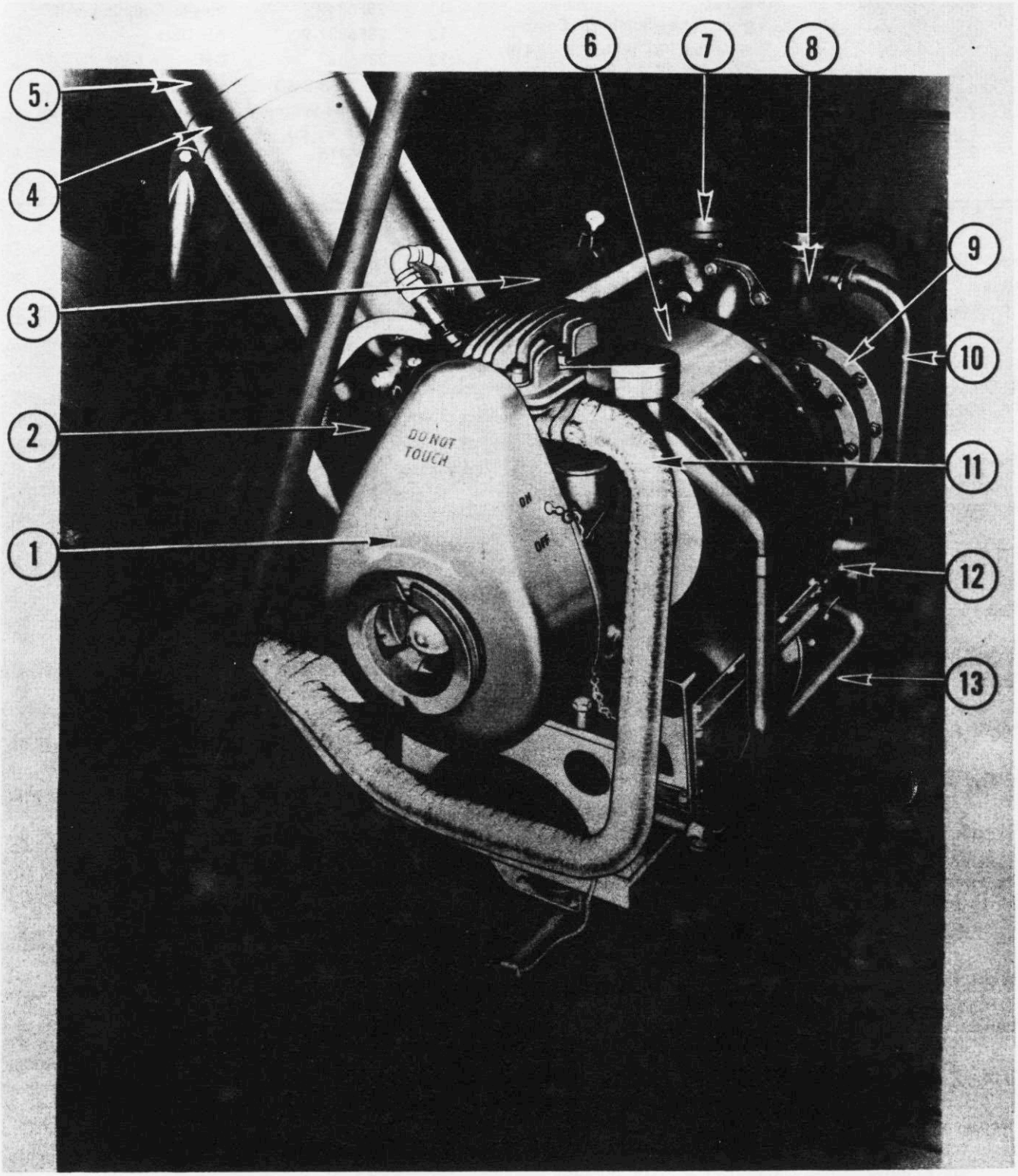


Figure 270—Central Heater Unit (PBY-5 Only)

No.	PART No.	NAME	No.	PART No.	NAME
1	471282	Lauson Engine	8	471154	Distribut'n Tube & Valve Assem.
2	471931	Heater Assembly		470040	Gasket
3	470563	Motor Fuel—Air Hose	9	471126	Fuel-Air Blower
4	470733	Strap & Clamp Assem.	10	471158	By-pass Tube & Flange Assem.
5		Output End of Heater		470312	Gasket
6	470263	Wheel, Blower & Hub Assem.	11	471934	Exhaust Tube & Flange
7		Throttle Valve	12	471731	Carburetor
			13	471261	Hood, Conduit & Flange

between points. Replace plug if necessary with Champion C-10-S spark plug or its equivalent.

c. If spark plug is moist or sticky, too rich a mixture is being delivered by the carburetor.

d. If ignition cable is broken or insulation worn, or cable is oil or water soaked, replace.

2. COMPRESSION.—Remove spark plug and place a compression gage in opening. Turn flywheel. If compression is below 100 pounds pressure, valves or piston rings leak. Squirt oil on top of piston through spark plug hole. If compression is good, piston rings are faulty. If compression is still low, valves need grinding. Check cylinder head gasket and spark plug gasket, and see that both are tight.

3. LUBRICATION.

a. Before starting engine fill crankcase with high grade oil such as Specification AN-VV-0-446.

b. Always fill the crankcase at the oil filler plug to the full point after each eight hours of operation.

c. Drain oil after 30 hours running and refill with new oil. Do not flush with kerosene. Draining oil when engine is warm will remove all sediment and dirt.

CAUTION

If heater unit is to be idle for a period in excess of 30 days, the fuel system should be drained of all gasoline to prevent gum formation (oxidation) in carburetor fuel lines, etc.

(b) CARBURETOR.

1. ADJUSTMENT OF FUEL NOZZLE.

a. The adjustment rotates the opening in the nozzle so that it faces upstream or downstream in the flow of air through the carburetor.

b. Use a screwdriver to set the adjustment. When the fuel jet opening is facing air inlet or upstream, the mixture is lean. Facing the fuel jet downstream enriches the mixture. A 1/16 inch indicator spot on the adjustment near the screwdriver slot is in the same relative position as the opening in the fuel jet.

c. The normal setting is about 20° upstream from a crosswise base line (base line at right angles to flow of air through carburetor).

d. To set the carburetor, start the engine, open throttle about one-half turn. Turn fuel jet gradually upstream until engine just starts to slow down. This is the correct fuel-air setting.

e. The upstream angle of the fuel jet automatically compensates for changes in density due to altitude and maintains the correct mixture ratio at all throttle openings.

2. TO PREVENT GASOLINE LEAKAGE.—To prevent gasoline leakage past the upper packing, the nozzle must be held quite tight in the casting. Check tension as follows:

a. Loosen lower packing nut one turn, then when adjusting with screwdriver appreciable resistance should be encountered.

b. If loose, replace upper packing having a thickness of .120 inch to .135 inch.

3. ADJUSTMENT OF FLOAT LEVEL.—To set correctly, remove float cover assembly, and turn upside down so that float lever rests on inlet needle. Bend lever, if necessary, to give a distance of 1 13/16 inches from flange of cover (without gasket) to bottom edge of float.

4. TO CLEAN CARBURETOR.—Keep carburetor free of grit and water as follows:

a. Clean bowl after removing the cover.

b. Clean screen by removing the inlet to connection.

5. FUEL FILTER.—The fuel filter should be removed and cleaned as often as it accumulates considerable amounts of dirt and foreign matter.

(c) MAGNETO.—Contact points are adjusted as follows:

1. Remove flywheel housing, pulley and flywheel.

2. When the magneto breaker arm rests on the highest part of the breaker cam, the correct gap should be .020 of an inch.

3. To adjust gap between points, loosen contact breaker plate adjusting screw and move contact breaker plate to obtain correct gap.

4. Contact points should be clean and should touch squarely. If pitted, a small file should be used to make them meet squarely. Points should be adjusted

after cleaning. After adjusting, tighten contact breaker plate adjusting screw.

(d) FUEL-AIR BLOWER.

1. Check bearings for lubrication every 25 hours running time. If necessary, use grease (Specification AN-G-3). To replace the grease fittings, use a No. 1650 Alemite Hydraulic Fitting, ⅛ inch P.T.

2. The gear end of the mechanism must be supplied with oil, such as Specification AN-VV-O-446, before starting, not while blower is in operation. Do not over-lubricate. Take out oil plug when pouring in the oil, and when oil reaches proper level it will drain out through side drain hole.

CAUTION

Do not attempt to disassemble fuel-air blower in the field. It operates on very fine tolerances and must not be subjected to any rough treatment.

(e) HEATER.

1. SPARK PLUG.

a. Examine spark plug cable from magneto for poor connections or worn insulation.

b. Test cable at plug for spark on heater frame.

CAUTION

Be sure any spilled gasoline has been thoroughly wiped off of heater frame.

c. Remove and clean plug. Check and reset clearance between points to .062 of an inch.

d. If ceramic is broken, replace plug with Champion No. C-10-S shielded plug or equivalent.

2. FUEL-AIR SUPPLY.

a. Inspect fuel inlet line to heater for punctures or loose connections.

b. Check exhaust elbow for obstructions.

c. Check fuel-air flow valve. Remove rod and thermostatic control and test manually if valve is frozen shut.

d. Check thermostatic control.

(4) INSTALLATION AND ASSEMBLY.

(a) Install entire heater unit assembly by reversing removal procedure outlined in paragraph *f*, (2), *(a)*.

(b) Install Lauson engine by reversing removal procedure outlined in paragraph *f*, (2), *(b)*.

(c) Install carburetor by reversing removal procedure outlined in paragraph *f*, (2), *(c)*.

(d) Install magneto as follows:

1. Place magneto on crankshaft.

2. Replace cam spacer and cam.

3. Fasten magneto plate with two bolts.

4. Insert heater spark plug cable through bearing plate hole near oil level rod. Crimp and solder end of cable to eyelet on coil.

5. Insert engine spark plug cable through bearing plate hole near oil filler tube. Crimp and solder end of cable to other eyelet on coil.

6. Place small insulating washer in ground terminal hole and larger insulating washers on each side of hole.

7. Insert terminal screw and attach ground wire from magneto on outer side of engine.

8. Fasten lug securely with terminal nut.

9. Replace flywheel, pulley and cover by reversing removal procedure outlined in paragraph *f*, (2), *(d)*.

(e) Replace fuel-air blower by reversing removal procedure outlined in paragraph *f*, (2), *(e)*.

(f) Replace fuel line by reversing removal procedure outlined in paragraph *f*, (2), *(f)*.

(g) Replace exhaust line by reversing removal procedure outlined in paragraph *f*, (2), *(g)*.

(h) Replace heater by reversing removal procedure outlined in paragraph *f*, (2), *(h)*.

Note

In replacing rod, slotted end goes through thermostatic control housing onto center of bimetal coil, with gage turned to lowest reading. Other end of rod fits into holder on fuel-air flow valve.

(i) Replace ventilating air blower by reversing removal procedure as outlined in paragraph *f*, (2), *(i)*.

g. DUCTING SYSTEM.

(1) DESCRIPTION. *(See figure 269.)*—From the output end of the heater unit, heated air driven by the ventilating blower enters the main "Y" duct through a sleeve connection. This duct located directly above the heater unit divides into a duct forward and one aft, while a short extension continues upward.

The forward duct leads through bulkhead 2 where it delivers heat directly behind the pilot, and in turn branches into two flexible tubes. One flexible tube passes under the flight deck floor beneath the pilot's seat to terminate in a cap at the forward end of the floor, facing into the bombardier's compartment. The threaded screw cap at the end of the flexible tube is removable to permit the addition of a length of similar flexible tubing having a collar for attachment at one end and a fish-tail fitting at the other. This tube is stowed, when not in use, on the forward face of bulkhead 2, starboard side. It provides heated air for the bombardier's compartment. The fish-tail end is held in a bracket at the bottom of the bombardier's window for defrosting. The other flexible tube which branches off from the forward duct leads to the pilot's side of

the windshield, and it too terminates in a fish-tail fitting which is supported by a bracket so that the heated air is diffused against the glass for defrosting. There is a finger operated shutter in the fitting which regulates the flow of heated air from the tube. The air can be entirely shut off from the windshield and utilized for heating the cockpit.

The duct which leads aft from the "Y" duct is attached to it by a flexible coupling, and runs aft and through bulkhead 4, terminating just aft of bulkhead 4 in a deflector which throws the heated air downward to warm engineer's compartment and crew's living quarters.

In the short upward extension of the main "Y" duct, there is an access door which permits the attachment of engine warming flexible extension tubes. They carry heated air to the nacelles through a hatch. These two flexible tubes are fitted into a container. When in use they are pulled out and connected to the nacelles while the bottom of the container is attached to the upward extension of the "Y" duct by a sleeve. When not in use the tubes in the container are stowed forward of bulkhead 5, starboard side. Fabric form fitting covers for the nacelles are provided in cold weather. They are attached by "Lift-a-Dot" fasteners and buckle straps, and fitted snugly by zipper closures. There is a flap-covered opening with "Lift-a-Dot" fasteners for attachment of the engine warming extension tubes.

The main stack of the "Y" duct contains manually adjustable shutters or dampers whereby the heated air can be shut off either forward or aft, or allowed to go both ways. Also the shutters can shut off or pass the heated air to the upward extension for engine warming.

(2) REMOVAL.

(See figure 269.)

(a) Remove deflector (13) aft of bulkhead 4 by detaching screws and nuts which hold it to duct, and screws and nuts which hold both deflector and duct to bulkhead.

(b) Remove aft duct (12) between bulkhead 4 and heater by detaching clamps from coupling (11) and screws holding duct to bulkhead and beltframes.

(c) Detach clamp at bulkhead 2, thereby loosening forward arm of "Y" duct (16) from forward connections.

(d) Remove lower end of "Y" duct stack from output end of heater unit by detaching bolts from connecting sleeve. Remove sleeve and "Y" duct.

(e) Remove "Y" connection and deflector duct (6) forward of bulkhead 2 by detaching screws which fasten it to bulkhead.

(f) Pull the two flexible tubes (4) and (5) out of "Y" connector duct's expansion sleeves.

(g) Remove flexible tube (4) to windshield by detaching clips, and detach fish-tail fitting (1) at windshield bracket by unscrewing wing nuts.

(h) Remove flexible tube (5) to bombardier's compartment (as far as station 1.33) by detaching clips.

(i) Remove extension tube (3) to bombardier's window by unscrewing coupling at station 1.33 and detaching fish-tail fitting (1) from window bracket by unscrewing wing nuts.

(3) MAINTENANCE.—For maintenance and repair of ducts see STRUCTURAL REPAIR MANUAL (AN 01-5MA-3).

(4) INSTALLATION.—Reverse removal procedure outlined in paragraph *g*, (2).

Note

Neoprene covered asbestos CVAC Fab 13-50 is used for gaskets at all duct junctions.

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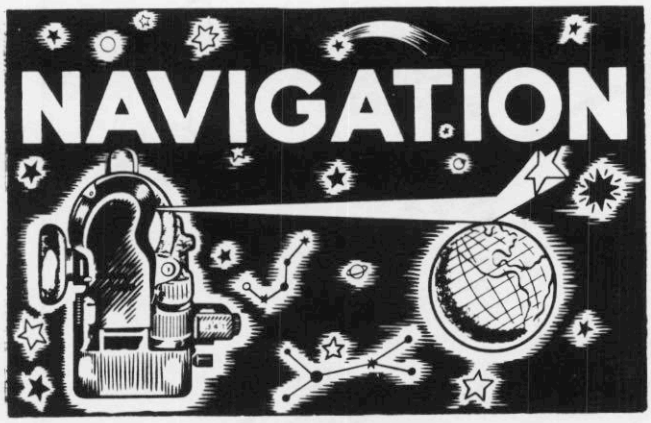
INTERIOR HEATING

SECTION V
USEFUL LOAD



1. NAVIGATION EQUIPMENT.

a. GENERAL.—The navigation equipment included in the useful load of the airplane consists of a pelorus drift sight and mounting bases, an Astro Compass, an Astrograph, a sextant, a protractor, two navigational watches, two pair of binoculars, and miscellaneous items such as plotting boards, charts, etc.

b. MARK 2C PELORUS DRIFT SIGHT.

(1) DESCRIPTION.—The pelorus drift sight is used to measure the relative angle between the center line of the airplane and an object which has been passed over or dropped from the airplane.

The Mark 2C pelorus drift sight (F.S.S.C. No. 88-H-175) consists of an optical head and a post. The optical head is a sighting piece which contains a pair of illuminated crosslines that are visible when sighting through the instrument.

The crosslines are illuminated by both external and internal light. A flashlight lamp and 1.5 volt dry cell are located in the optical head to provide internal light. The internal illuminator assembly can be moved to one side by means of an "ON-OFF" switch to permit the use of external or daylight vision.

Three filters are provided with the pelorus drift sight. They are attached to the optical head and can be inserted in the line of sight singly or in any combination. The filter farthest from the eye in normal sighting position consists of two polarizers in a single frame, one rotatable with respect to the other through an angle of approximately 90 degrees. The fixed polarizer is aligned for minimum transmission of light reflected from a horizontal surface. A handle for rotating the rotatable polarizer permits maximum light transmission when it is at one limit of its path of motion and minimum light transmission when it is at the other limit. The next filter is of glass, being light yellow in color. The filter nearest the eye is of deep yellow glass. Its transmission is such that, when used in combination with the polarizers crossed in the first filter, the total transmission is approximately one tenth of one per cent. These filters enable the navigator to see speed lines, float lights, and other markers when the air is hazy.

The optical head, which is attached to a post, can be rotated about the screw pivot so that the line of sight can be changed continuously from 50 degrees above the horizontal plane to 80 degrees below the horizontal plane. It can be secured in position by means of a thumb screw.

Three bases for mounting the pelorus are provided on PBY-5A airplanes with serial numbers 46580 and on; four bases are provided on all PBY-5 airplanes and on PBY-5A airplanes up to serial number 46580. Brackets for the installation of two Mark 2B bases (F.S.S.C. No. 88-B-150) are installed on the port and starboard sides of the pilot's enclosure on the forward frames of the sliding window. *(See figure 271.)* On all PBY-5 airplanes and on PBY-5A airplanes up to serial number 46580, a Mark 2B base is also installed on the revolving windshield of the bow turret in the bombardier's compartment. The Mark 2B base is a non-recording type base with an adjustable azimuth scale. When not in use, the Mark 2B bases are stowed in fabric pouches, one on each side of the forward face of bulkhead 2.

An adapter mount for a Mark 2C base (F.S.S.C. No. 88-B-110) can be installed on the tunnel gun mounting post located on center line of airplane aft of station 7.0. *(See figure 272.)* The Mark 2C base is a recording type base with an adjustable azimuth scale. This base can record on a chart the motion of a stylus actuated by the rotation of the index arm from 22 degrees right to 22 degrees left. The paper chart moves at the rate of approximately two inches a minute. Installed on the base is a handle to wind the recording mechanism. The mechanism can operate itself for about two and a half minutes without having to be rewound. When the Mark 2C base is not in use, it is stowed with its adapter mount on the starboard wall aft of station 7.75. It is held in this stowage position by means of a strap and a safety chain.

When the drift sight head and post is not in use it is stowed on the inboard side wall of the navi-

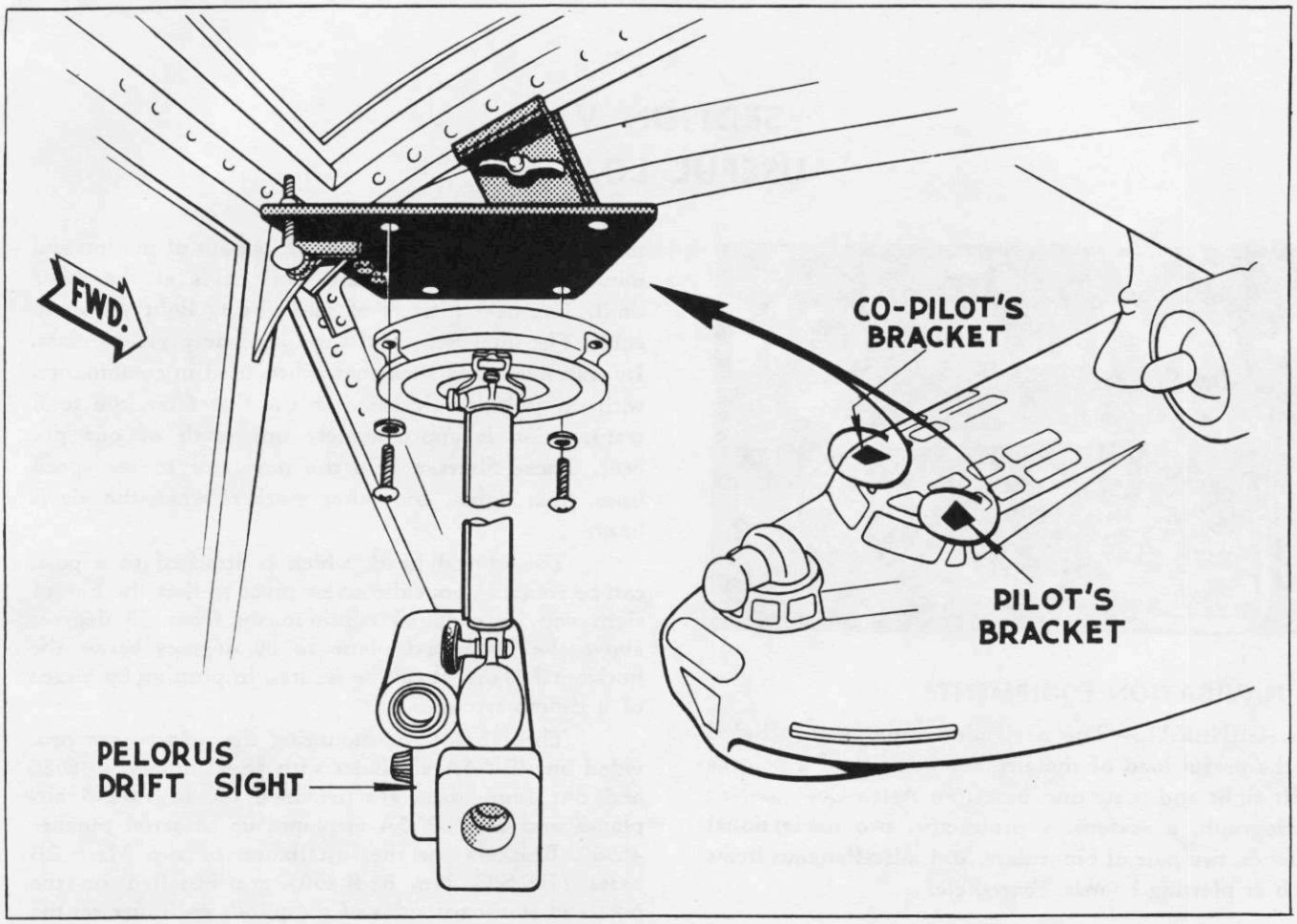


Figure 271—Pelorus Drift Sight Installation (Pilot's Compartment)

gator's bookcase. This bookcase is located on the port forward face of bulkhead 4.

(2) INSTALLATION.

(a) To install the Mark 2B or Mark 2C base on bracket or mount, place the base on the mount in its proper position and attach by means of four bolts.

Note

The zero axis of graduations on the base must be parallel to the center line of the ship.

(b) To install adapter mount for Mark 2C base in the tunnel gun compartment, place the mount in its proper position on the tunnel gun base and secure with two screws.

(c) To install drift sight on its base, place in position and secure by means of the hand screw which is located on the base.

(3) MAINTENANCE.

(a) All exposed lenses should be kept clean with lens tissue or a soft clean cloth.

(b) The lamp and dry cell should be inspected regularly for necessary replacement. To remove lamp and dry cell, pull the light box arm to the forward position; in this position the lamp and dry cell can be easily removed.

c. MARK 7 DRIFT SIGHT.—The Mark 7 drift sight which was installed at the aft end of the navigator's table is to be deleted by service action on all PBY-5 and PBY-5A airplanes.

d. MARK 2 ASTRO COMPASS.

(1) DESCRIPTION.—The Mark 2 Astro Compass (F.S.S.C. No. 88-C-770) is a sighting device designed to provide the navigator accurately and rapidly with the true heading of the aircraft and the true bearing of a distant object. It is also used for star identification and for compass swinging in the air.

The lower part of the instrument consists of an azimuth circle which is free to rotate against a lubber line. It is mounted on a fitting designed for insertion in the 0.5 type standard (F.S.S.C. No. 88-S-1310) and levelled by means of cross levels and adjusting screws.

Two vertical standards carry a horizontal axis lying above the parallel to the 90°-270° line on the azimuth circle. A latitude scale, marked in tens of de-

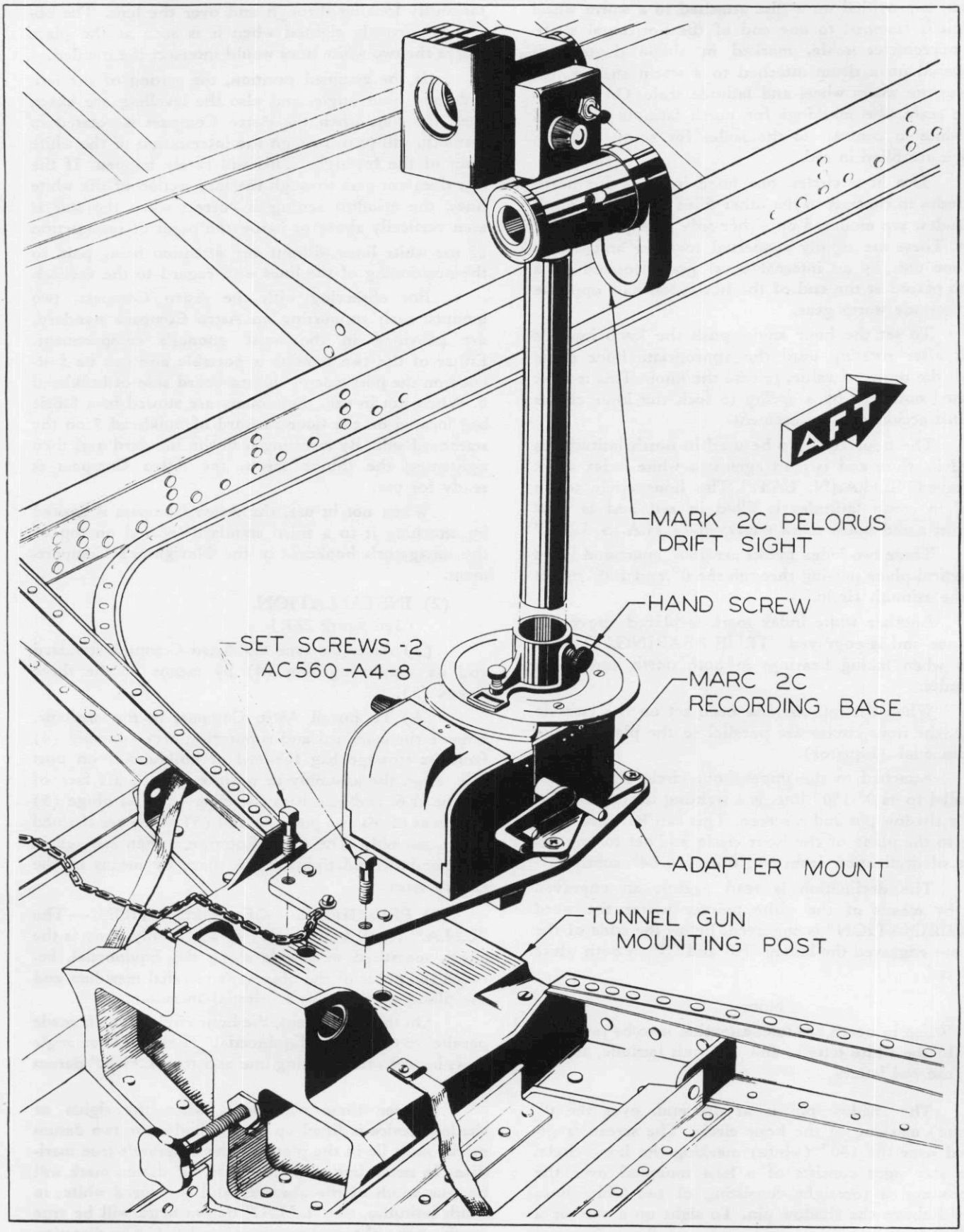


Figure 272—Pelorus Drift Sight (Tunnel Gun Compartment)

grees, is provided on a disc attached to a worm wheel which is fastened to one end of the horizontal shaft. A micrometer scale, marked in single degrees, is mounted on a drum attached to a worm shaft which drives the worm wheel and latitude scale. On the latitude scale, the markings for north latitude are filled in white in contrast to the scales for south latitudes which are filled in red.

Two hour circles, one filled in white for north latitudes in contrast to the other filled in red for south latitudes, are mounted on either side of the horizontal axis. These are rigidly connected together and driven as one unit by an internal bevel gear actuated by a knob placed at the end of the horizontal axis opposite the latitude worm gear.

To set the hour angle, push the knob inwards and, after rotating until the appropriate hour circle reads the required value, release the knob. This is then pushed outwards by a spring to lock the hour circles against accidental displacement.

The hour circle to be used in north latitudes is filled in white and is read against a white index mark engraved "L.H.A.↓N. LAT." The hour circle to be used in south latitudes is filled in red and is read against a red index mark engraved "L.H.A.↓S. LAT."

These two index marks are 180° apart and lie in a vertical plane passing through the 0° and 180° marks of the azimuth circle.

Another white index mark is placed above the red one and is engraved "TRUE BEARING." This is used when taking bearings in both north and south latitudes.

When the latitude has been set on the latitude scale, the hour circles are parallel to the plane of the Equinoctial (Equator).

Attached to the upper hour circle and aligned parallel to its 0°-180° line, is a sighting device containing a shadow pin and a screen. This can be tilted relative to the plane of the hour circle and set to any degree of declination from 64° north to 64° south.

The declination is read against an engraved arc by means of the white pointer where the word "DECLINATION" is engraved. Below the ends of the arc are engraved the letters "N" and "S" in both white and red.

Note

When in north latitude, attention is to be paid to the white letters, and in south latitude, to the red letters.

The shadow pin is at the end, over the 0° (white) marking of the hour circle. The screen is situated over the 180° (white) marking the hour circle. The star sight consists of a lens mounted over the screen and a foresight consisting of two white lines placed above the shadow pin. To sight on a star or a terrestial object, it is necessary to see the object and the white lines clearly at the same time while simultaneously looking through and over the lens. The object is correctly sighted when it is seen at the place where the two white lines would intersect if extended.

If the assumed position, the setting of the lati tude and hour angle, and also the levelling are exact, then the star, when the Astro Compass is rotated in azimuth, will pass through the intersection of the white lines of the foresight. This will rarely happen. If the star does not pass through the intersection of the white lines, the azimuth setting is correct when the star is seen vertically above or below the point of intersection of the white lines without any attention being paid to the positioning of the lines with regard to the vertical.

For observing with the Astro Compass, two mounts, each supporting an Astro Compass standard, are provided in the waist gunner's compartment. Either of the two mounts is portable and can be fastened on the port side or the starboard side of bulkhead 6. When not in use, the mounts are stowed in a fabric bag located on the floor forward of bulkhead 7 on the starboard side. By inserting it in the standard and then tightening the thumb screw, the Astro Compass is ready for use.

When not in use, the Astro Compass is stowed by attaching it to a third standard located on top of the navigator's bookcase in the Navigator's Compartment.

(2) INSTALLATION.
(See figure 273.)

(a) Assemble type 0.5 Astro Compass standard and its supporting arm (4) by means of the three screws (3).

(b) To install Astro Compass in the airplane, remove the standard and supporting arm assembly (4) from its stowage bag forward of bulkhead 7 on port side, align the assembly in position on the aft face of bulkhead 6, and attach to the clips (2) and hinge (5) by means of the two pins (1) and (6) which are chained to the assembly. The Astro Compass is then inserted in the standard and tightened in place by means of the thumb screw.

(3) PRINCIPLES OF OPERATION. — The "L.H.A." (local hour angle) of a heavenly body is the angle, measured westwards along the Equinoctial, between the plane of the observer's celestial meridian and the plane of the body's celestial meridian.

On the instrument, the hour circle plane is made parallel to that of the Equinoctial. The local hour angle is set between the sighting line and the "L.H.A." datum mark.

Under these conditions, when the sights or shadow device is lined up on the body, the two datum marks must lie in the plane of the observer's true meridian. In north latitudes, the "L.H.A." datum mark will be true south of the observer and is colored white; in south latitudes, the "L.H.A." datum mark will be true north of the observer and is colored red. The direction of increasing hour angle in north latitudes is clockwise

and the direction of increasing hour angle in south latitudes is counterclockwise.

The datum marks are fixed in the same vertical plane as the 0°-180° line of the azimuth circle. The white "L.H.A." datum mark lies vertically above the 180° graduation, while the red datum mark lies vertically above the 0° graduation. Therefore, the azimuth circle is automatically brought into correct orientation with the true meridian.

The azimuth circle can now be used as a compass card, the true heading of the aircraft being read against the lubber line. A reversal of the above procedure provides an easy means of star identification, the original values of local hour angle and declination being read direct from the proper scales.

When the instrument is used for taking bearings, the hour circle is set parallel to the azimuth circle and, by using the other datum mark engraved "TRUE BEARING," becomes a bearing plate.

If the azimuth circle is set with the true course opposite the lubber line, then its 0°-180° line must lie in the true meridian.

As the increasing direction of azimuth is clockwise in both north and south latitudes, only one datum mark for bearings is required. This mark is placed over the 0° end of the 0° 180° diameter of the azimuth circle.

(4) MAINTENANCE AND ADJUSTMENT.

(a) ALIGNMENT OF STANDARDS.—It is essential to ensure that the standards in which the Astro Compass is to be used are lined up correctly with the fore-and-aft line of the aircraft. Two simple methods of doing this are given below:

1. METHOD I.

a. Place Astro Compass in the standard, and then level.

b. Find heading of aircraft by means of Astro Compass.

c. Find the true heading of aircraft by a landing compass or other external means.

d. Compare the two headings. If there is a discrepancy, rotate the standard until Astro Compass heading agrees with the correct true heading.

e. Repeat for each standard.

2. METHOD II.—If the sun is not visible, find the heading by Astro Compass as follows:

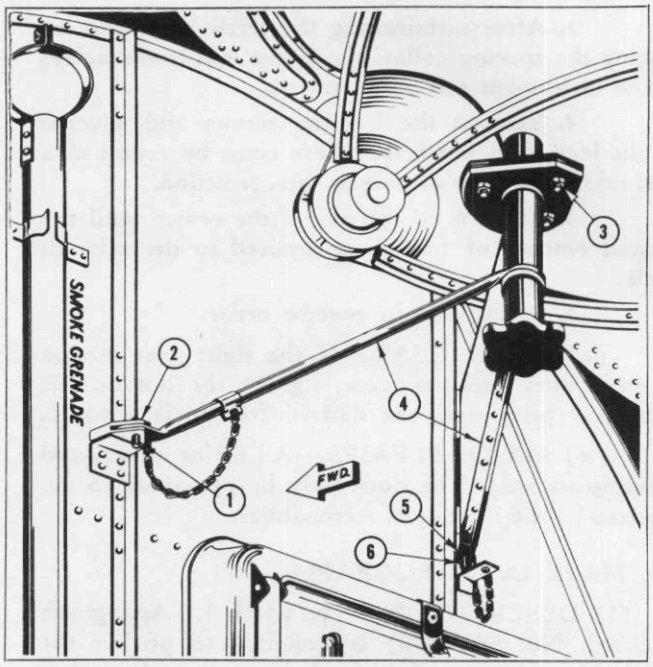
a. Place Astro Compass in the standard, and then level.

b. Set latitude to 90°.

c. Set up landing compass at a distance and observe true bearing of the Astro Compass.

d. Set reciprocal of this true bearing against bearing datum on Astro Compass.

e. Rotate instrument until sights are lined up on landing compass.



No	PART No.	NAME
1	28F5730-2	Pin
2	28F7285	Clip Fitting
3	AN526DD1032-12	Screw
	AN365D1032	Nut
4	28F5719-2	Supporting Arm Assembly
5	28F5724	Hinge
6	28F5730	Pin

Figure 273—Astro Compass Installation

f. Note heading as given by Astro Compass.

g. Compare this heading with correct heading as found by external means.

h. Adjust as in Method I above.

i. Repeat for other standards.

Note

It is important to level the instrument as accurately as possible. An error of 1° in level may cause an error of 1° or more in observation.

(b) LEVELING SCREWS.—If, in course of time, the leveling screws become too loose and the azimuth circle motion and the motion of the sight gear in declination become too free, repair instrument as follows:

1. Push down the azimuth plate above the spring leg as far as it will go, and then fix a clamp at the bottom of the spring leg to hold it in that position.

2. Screw down one of the two leveling screws as far as it will go (this gives access to one of the four screw pivots of the gimbal ring used for leveling).

3. After withdrawing the screw pivot and removing the spacing collar, the upper and lower halves of the instrument can be separated.

4. Remove the leveling screws and squeeze up the legs from which they have come by means of a vise, taking care not to overdo the correction.

5. Tighten up the nut in the center until the desired amount of friction is restored to the azimuth circle.

6. Reassemble in reverse order.

(c) SIGHT GEAR.—If the sight gear motion in declination becomes loose, tighten the nut on the sight gear pivot until the desired friction is restored.

(d) MAJOR REPAIRS.—All major repairs and adjustments should be done only by personnel so authorized by the Bureau of Aeronautics.

e. MARK 1A ASTROGRAPH.

(1) DESCRIPTION.—The Mark 1A Astrograph (F.S.S.C. No. 88-A-650) is designed to project the equal altitude curves of selected stars on standard plotting charts. The Astrograph is comprised of two components: a ring fixed rigidly over the aircraft table; and a detachable projector which is supplied in a transit case complete with height gage, spare bulb, and a number of tins of film. The star curves are printed on the films, which cover the various latitude ranges. The projector is attached to the ring by spring clips and adjusted by three screws. A special bulb projects the curves as shadows on the chart.

The central knob moves the lamphouse to adjust the N.-S. position of the curves. Two wheels wind the film to any desired E.-W. position.

The Astrograph mounting ring is installed on a bracket located over the navigator's table forward of station 3.33.

(2) INSTALLATION.—Hold the Astrograph and ring in position on its bracket and attach by means of 16 bolts.

(3) OPERATION.

(a) TO FIT THE ASTROGRAPH:

CAUTION

For use on 12 and 24 volt supplies, the series lamp resistance is tapped at two points. It is essential to use the correct tapping. The tappings are marked and may be inspected on removal of the resistance cover at the back of the instrument. If a change-over is necessary, it must be made *very* carefully to avoid any shift of the tapping rings.

1. Remove the aircraft supply socket from the dummy plug on the mounting ring.

2. Attach the projector to the mounting ring so that the leveling screws register on the hole, slot, and plane.

3. Plug into and check the aircraft voltage supply.

4. Set up the height gage (22.3 inch long).

5. Using the height gage directly under each leveling screw in turn, adjust until the height gage will just pass between the surfaces of the lower metal plate and the chart table.

Note

To gain access to the leveling screws, it is necessary to release the right hand hook and lower the projector body before each adjustment.

6. Tighten the locknuts securely and recheck with the height gage.

(b) TO FIT OR CHANGE A FILM.

1. Wind all the film upon the right-hand spool.

2. Undo the four corner screws and remove the projector base which carries the spool brackets.

3. Pull out the right-hand adjusting knob and remove the full spool.

4. Insert the new spool with the free end of the film below the spool and pointing to the left.

5. Pass the end of the film between the roller and the friction pad and insert it in the gap between the glass plates.

6. Push the film towards the empty spools, depressing with a rule the friction pad below the left-hand roller to assist the passage of the film.

7. Insert the end in the slit in the empty spool and wind it on until the star chart is reached.

8. Refit the base to the projector body.

CAUTION

Changing a film is not an easy operation during flight and should not be attempted unless absolutely essential; it is better to carry a reserve astrograph.

(c) PROCEDURE BEFORE FLIGHT.

1. Look up in Astrograph tables and mark in ink on the plotting charts the longitude setting to be used during the flight, and then write adjacent thereto the time additions and the date. Check these computations carefully, as they cannot be checked during flight.

2. Write in ink on the plotting charts, preferably on opposite sides of the marked longitude settings, the corresponding conversion table of the G.M.T. (Greenwich Mean Time) hours to A.M.T. (Apparent Mean Time) hours for the expected periods of use of the Astrograph and then check.

3. Place approximately in position on the table the plotting chart to be first used, trimming the chart, if necessary.

4. Switch on and adjust Astrograph to bring time scale to central latitude line of chart.

5. Smooth and pin chart so that the central latitude line coincides exactly with time scale.

6. Convert probable G.M.T. of first observation to A.M.T. and wind film approximately to this value of A.M.T. so as to be ready for use.

7. See that there is a serviceable spare bulb, and then switch off.

(d) PROCEDURE DURING FLIGHT TO OBTAIN FIX.

1. Before observing, convert the probable G.M.T. of observation to A.M.T., switch off table lamp, switch on and set Astrograph.

2. Note the names and approximate altitude of the stars, whose altitude curves cover the D.R. (dead reckoning) position.

Note

If a change of stars occurs at about the D.R. position, it is preferable to wait a few minutes before observing.

Carefully note the position of both stars before observing the first, to avoid unnecessary intervening delay, and use the approximate altitudes to preset the sextant.

3. Observe the star altitudes and times of observation.

4. Apply corrections for blister refraction if observations are taken through the waist gun blisters.

5. Set Astrograph for A.M.T. of first observation (pressing chart lightly onto table to avoid errors due to buckling of chart), and, if necessary, readjust latitude line nearest D.R. position.

6. Near the D.R. position, draw the line for the observed altitude of first star. This is the first position line.

7. Reset Astrograph for time of second observation and obtain position line for second star in like manner.

8. Switch off Astrograph and turn on table lamp.

9. Transfer first position line to obtain fix.

10. If desired to obtain latitude as a check: observe Polaris; set Astrograph; apply dome refraction, if necessary; and then apply Polaris correction.

(4) MAINTENANCE.

(a) The lamp wired for 12 volts will burn out on 24 volts; make certain that the tapping is correct.

(b) Do no finger the glasses or bulb, as smear marks seriously interfere with definition; remove any smear marks with a clean handkerchief.

(c) To prevent breakage of glasses, always stow the Astrograph in its transit box.

(d) When a bulb has burned out, replace as follows:

1. Carefully pull out the plug at the right-hand side of the lamphouse and discard it.

2. Withdraw the spare plug and bulb carefully from the back of the instrument.

3. Clean the bulb with a clean handkerchief and insert it in the instrument and push well home.

(e) All repairs are to be made by specially trained personnel authorized by the Bureau of Aeronautics.

f. MARK 5 SEXTANT.

(1) DESCRIPTION. *(See figure 274.)*—The Mark 5 sextant (F.S.S.C. No. 88-S-350) is used to measure the angular altitude of a celestial body by reference both to a natural horizon and to a bubble horizon. The art of navigating by observation of heavenly bodies is largely dependent upon the skill with which the aircraft sextant is used.

The main scale of the Mark 5 sextant is attached to a worm sector, which is operated by a knob. This scale carries a graduation line for each five degrees. On the periphery of the knob is a micrometer scale. It is marked off into five principal divisions, each representing one degree. These major graduations are further subdivided into 30 parts, one for each two minutes of arc.

The optical system consists of a series of lenses and prisms arranged to give an erect image of the celestial body. An astigmatizer may be inserted in the optical system to elongate the celestial image, forming a horizontal line of light which can be adjusted to bisect the bubble. The horizon prism, which may be inserted in the optical system when the natural horizon is used as a reference point, transmits the celestial image and also picks up the image of the horizon.

An averaging device, incorporated in the sextant, contains a clockwork mechanism which automatically records 1/60 of the altitude (drum reading) every two seconds for a two-minute period, and gives the average of the 60 readings on a counter window. By thus averaging out the effect of bubble acceleration, greater accuracy in taking sights and computing positions is assured.

A polarizing filter, which is made to fit the eyepiece of the sextant, is furnished with the sextant. It may be inserted on the eye side of the eye lens without removing the eyepiece from the sextant.

On PBY-5A airplanes up to serial number 46580, and on all PBY-5 airplanes, the sextant and case are stowed in the navigator's locker. On the PBY-5A airplanes with serial numbers 46580 and on, no special provisions are made for stowing the sextant and case.

(2) OPERATION.—A bubble is formed by turning the bubble control nut. The bubble thus formed represents an artificial horizon. Next, a celestial body is sighted, and, by turning the knob which contains the micrometer scale, its image is brought alongside the

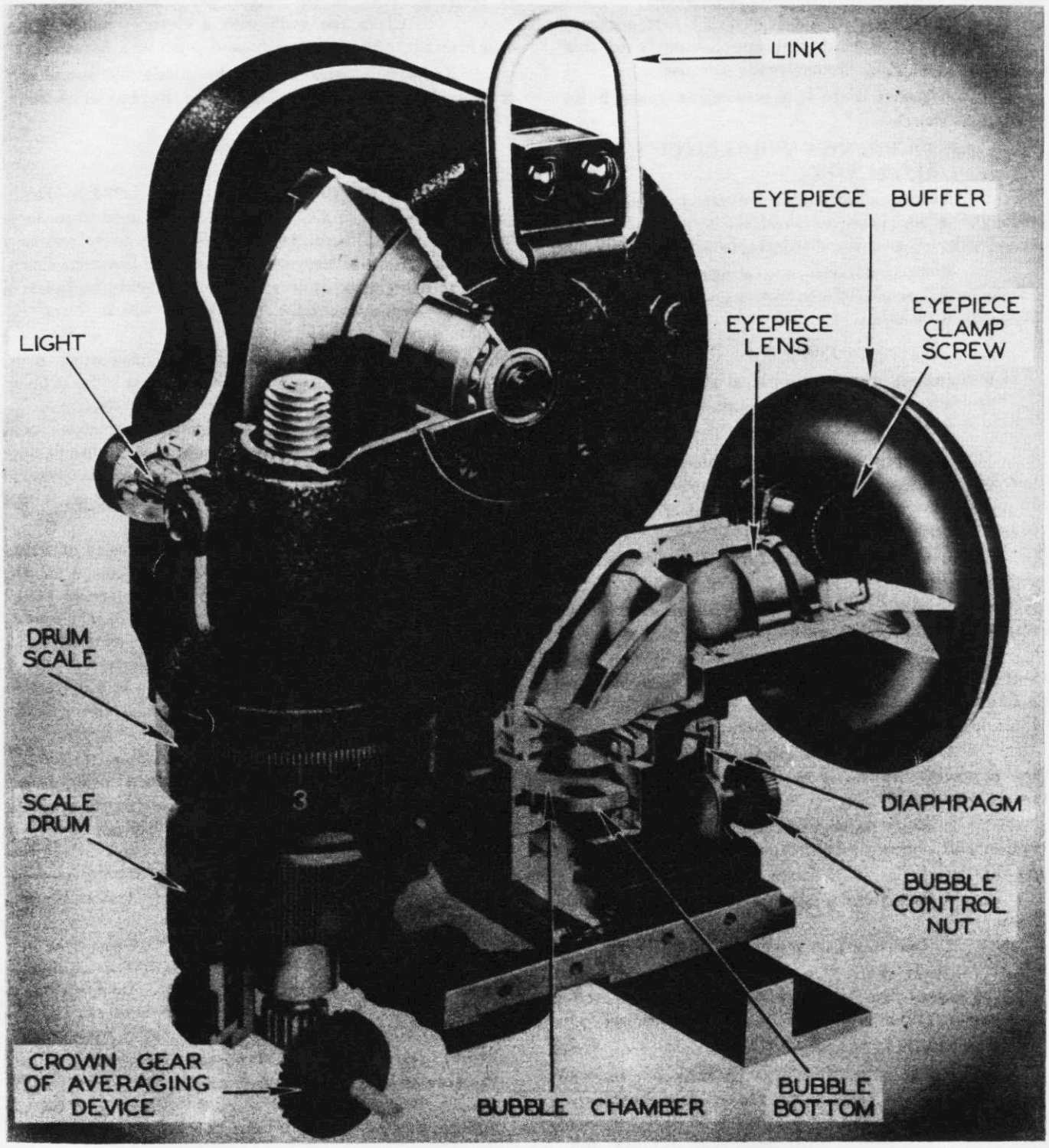


Figure 274—Mark 5 Sextant

bubble so that the center of the body and the center of the bubble are aligned horizontally. When the two images are thus arranged, the astigmatizer may be inserted into the optical system by pushing the knob marked "ASTIGMATIZER." The astigmatizer elongates the image of the celestial body. The resulting symmetrical arrangement of the images facilitates estimating the center of the bubble, and makes for precision accuracy in the use of the sextant. When the two images are thus brought into relation, the combined reading of the two scales is the angular altitude of the heavenly body.

With this angle and the average time of the observations, the navigator can accurately compute the position of the aircraft.

(3) MAINTENANCE.—Preceding flights, the sextant should be checked to see that the bubble can be formed; that the light will operate; that the filters and astigmatizer operate; and that the cylinder, by means of which the index prism is rotated, operates smoothly without sticking.

If the sextant fails to operate properly, it should be returned to a repair base where all repairs are to be made by specially trained personnel authorized by the Bureau of Aeronautics.

g. MARK 3B PROTRACTOR.

(1) DESCRIPTION.—The Mark 3B protractor (F.S.S.C. No. 88-P-945), also known as a drafting machine, is used in plotting courses and also for scaling distances of large maps, charts, and plotting sheets on the navigator's table.

(2) INSTALLATION.—The protractor is swiveled from an anchor that is fastened to the outboard edge of the navigator's table by means of wood screws.

Since the machine is held in the anchor by an adjustable pivot screw, the machine may be easily removed from the anchor if desired. After the drafting machine has been attached to the chart table, the protractor head should be moved to various positions. If the table is warped, the drafting machine will not be in proper contact with the table in some positions. This can be remedied by inserting a thickness or two of cardboard between the table and the anchor.

When not in use, the protractor is stowed in a wooden case strapped to the under side of the navigator's table drawer on PBY-5A airplanes with serial numbers 46580 and on. On all PBY-5 airplanes and on PBY-5A airplanes up to serial number 46580, this case is strapped to the hull bottom beneath the navigator's table.

h. NAVIGATIONAL WATCHES.

(1) DESCRIPTION.—The two watches used by the navigator are a master navigation watch and a navigational stop watch. The master navigation watch (F.S.S.C. No. 88-W-510) is used as the standard for accurate time. This watch has a 24-hour dial and a sweep-second hand. It is stem wound and stem set in the usual manner. The master navigation watch is carried in the airplane in the horizontal dial up position in the navigational watch box, which contains a window for observing the time indicated by the watch.

The standard navigational stop-watch (F.S.S.C. No. 88-W-590) is stem set like an ordinary watch. The minute, hour, and small second hands run continuously and are uninfluenced by the "stop-watch" mechanism consisting of the sweep-second hand the small minute totalizer hand. These last two hands are started, stopped, and returned to zero by successive depressions of the plunger which extends through the center of the crown.

Both watches are stowed in the watch drawer located at the aft end of the navigator's table.

(2) PREPARATION FOR USE.—The master navigation watch must be set with care. When the stem is pulled out preparatory to setting the hands, the sweep-second hand and the watch itself are stopped. If it is desired to set the watch by a radio time signal, for example, the stem is pulled out just as the sweep-second hand reaches "60." The minute and hour hands are then set by turning the crown in either direction to indicate the desired hour and minute. At the instant the time signal is heard, the stem is pushed in to start the watch at the correct second.

(3) MAINTENANCE.—Since the master navigation watch is to be used as the standard, it should be given the best of care. The following instructions are important in the use and care of the watch and should be observed:

(a) Wind the watch at the same time every day. Wind it slowly and be careful not to come up too hard against the end of the mainspring when it becomes fully wound.

(b) Check the watch against a "time tick" daily (at the same time of day, if possible).

(c) Keep a record of the daily rate (the gain or loss of time each day in seconds per day) of the watch.

(d) With the watch in the watch box, keep a slip of paper which gives the average daily rate of the watch over the last few days. Be sure to indicate on this slip of paper whether watch is gaining or losing. Also, in the watch box, place a record of the error of the watch in seconds, fast or slow, at the last time at which the watch was checked. Be sure that the day and hour at which the check was made are indicated.

(e) Protect the watch as well as possible from such things as sudden or extreme changes in temperature, strong magnetic fields, and vibration.

(f) In case of failure of the watch, return to repair base where repairs should be made only by personnel so authorized by the Bureau of Aeronautics.

i. BINOCULARS.

(1) DESCRIPTION.—Two pairs of binoculars, a Mark 21 and a Mark 23, are furnished for navigation. The Mark 21 (F.S.S.C. No. 88-B-320) is a 7x50 binocular and is for either day or night use. The Mark 23 (F.S.S.C. No. 88-B-345) is a 10x50 binocular, having a narrow angle of vision. It is used for observations where a higher magnification is desired at the expense of a reduced field of view.

Note

In giving the size of a binocular, such as 7x50, the first number (7) indicates the magnifying power of the binocular, and the second number (50) indicates the diameter of the objective lens in millimeters.

Both pairs of binoculars are furnished with polarizing filters, which may be mounted in front of the eyepieces. The filters should be used in bright sunlight to eliminate glare or annoying reflections. They have "axis" lines engraved on their metal holders and for the best results should be inserted into the ocular rings with their engraved lines in vertical positions.

The leather carrying cases which are furnished for each pair of binoculars remain on the binoculars while in use. Flaps, opening at both ends of each carrying case, permit the use and adjustment of the binocular without the binocular being removed from the case.

On PBY-5A airplanes up to serial number 46580, and on all PBY-5 airplanes, the binoculars are stowed in the navigator's locker. On PBY-5A airplanes with serial numbers 46580 and on, there are no special provisions for stowage of the two pairs of binoculars in the airplane.

(2) MAINTENANCE.—In handling binoculars, care should be exercised to NEVER PLACE THE FINGERS ON ANY GLASS SURFACE. Perspiration (always on the fingers) may cause corrosion of optical glass. The outside surfaces of the lenses may become dusty, soiled, or finger-marked through exposure or careless handling.

Lens surfaces may be cleaned with the least possible damage by means of the following cleaning method:

(a) Blow on the lens surface to remove large dust and grit particles. This is often all that will be necessary. If any lens surface becomes finger marked, it should be cleaned at the earliest opportunity to avoid permanent damage.

(b) Remove finger marks or remaining dust by breathing upon the lens, and then, using a circular motion, wipe the moist surface lightly with either a soft, clean, cotton cloth, or a well-washed, soft handkerchief which is to be kept for this special purpose. When available, regular lens tissue is best for cleaning. In every case, dusting as described above should precede wiping.

CAUTION

The use of a coarse cloth and a needless amount of rubbing may result in scratching the lens surface and impairing the optical qualities of the instrument. Liquids are not to be used in cleaning any of the binocular parts, as they may injure the dustproof seals.

(c) In case of damage to the binoculars, return them to repair base where repairs should be done only by personnel so authorized by the Bureau of Aeronautics.

j. MISCELLANEOUS EQUIPMENT.—Two plotting boards and bases, miscellaneous charts, navigation books, and miscellaneous loose navigation equipment are also stowed in the airplane for use in navigation.

The two Mark 5A plotting boards (F.S.S.C. No. 88-B-790) and bases (F.S.S.C. No. 88-B-180) are employed to solve problems encountered in dead reckoning navigation. They are made of a durable transparent plastic with a matte finish suitable for erasing and for marking with a pencil. One plotting board and its base is stowed in the drawer of the navigator's table; the other one is stowed under the pilot's seat.

Navigational books and papers are stowed in the navigator's bookcase which is located on the port side forward face of bulkhead 4.

The navigator's case (F.S.S.C. No. 88-C-649), navigational charts, computer (F.S.S.C. No. 88-C-1120) and miscellaneous loose equipment which includes dividers, pencils, erasers, and a 15 inch ruler (F.S.S.C. No. 18-R-705) are also stowed in the drawer of the navigator's table.

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PARAGRAPH 2.

2. OXYGEN SYSTEM.

a. DESCRIPTION.—The oxygen equipment carried in the PBY-5A airplane consists of three individual diluter-demand units, which have their own integral supply systems, oxygen regulators (9), and flow indicators (7). *(See figure 275).* Mountings for these units are provided at the pilot's, copilot's, and engineer's stations. This apparatus is designed to supply the user with either a properly proportioned mixture of air and oxygen or 100 per cent oxygen dependent upon the setting of the adjustable air valve lever. The wearer breathes the oxygen by inhaling through a mask (1) from the oxygen cylinder (11) and in turn, exhales to the outer atmosphere by means of a nonreturn exhaust valve located in the mask. Major units of the diluter-demand system consist of an oxygen cylinder (11), diluter-demand oxygen regulator (9), oxygen flow indicator (7), and an oxygen mask (1).

The oxygen equipment carried in the PBY-5 airplane *(See figure 276.)* consists of two portable individual supply type rebreathers which have their own integral supply system, pressure gages, and reducer valves. Mountings for these rebreathers are provided at the pilot's, copilot's and engineer's stations. Three spare oxygen bottles and eight spare canisters are stowed in the miscellaneous gear locker which is located on the starboard side aft of bulkhead 4. This apparatus is designed to supply the user with respirable air that contains the high percentages of oxygen required for high altitude service. The apparatus operates independently of the external atmosphere. That is, the wearer breathes oxygen in a closed circuit by inhaling from a flexible breathing bag and in turn exhaling through a chemical purifier back into the breathing bag, from which the unused oxygen is available for rebreathing. The chemical purifier removes the exhaled air. As the oxygen supply from the breathing bag is used up, an equivalent amount will be replenished in the breathing bag by automatic admission of oxygen from the high pressure oxygen cylinder and from liberation of oxygen due to the reaction of the exhaled air with the chemical purifier. Major units of the rebreather system are an oxygen cylinder (10), pressure gage (5), reducing valve (16), admission valve (6), breathing bag (8) canister (25), and mask (4).

(1) OXYGEN CYLINDER.—The shatterproof oxygen cylinder supplied with each unit has a volume of approximately 295 cubic inches on diluter-demand systems, and 96 cu in. on rebreather systems. It is fitted with a diaphragm type valve which requires only a slight turn of the handwheel to open it for the flow of oxygen. The handwheel is rubber covered to provide a softer and firmer grip to the user and facilitates operation of the valve. A safety plug employing a fusible alloy and fragile disc is incorporated on the valve to prevent explosion of the cylinder in case of fire.

(2) DILUTER-DEMAND OXYGEN REGULATOR (PBY-5A ONLY).—The diluter-demand regulator (AN-6004-1) is designed to meet the demands of the inhalation phase of the breathing cycle and deliver either a properly proportioned mixture of air and oxygen or 100 per cent oxygen depending upon the setting of the adjustable air valve lever. With the air valve set to the "ON" or normal oxygen position, air is drawn into the breathing system and is automatically mixed with oxygen from the supply cylinder to give the total needed oxygen required up to approximately 30,000 feet, beyond which 100 per cent cylinder oxygen is delivered. With the air valve set to the "OFF" or 100 per cent oxygen position, 100 per cent oxygen is delivered at all altitudes. With the air valve of the diluter-demand regulator set to the "ON" position, a relatively small inhalation suction (one inch of water suction) is sufficient to deliver a flow of 150 liters of oxygen per minute. This characteristic assures the user an adequate oxygen flow and ease of breathing.

An emergency by-pass handle (6) is located on top of the regulator (9), and when turned "ON," causes the oxygen to by-pass the mechanism in the regulator and flow directly to the outlet. *(See figure 275.)*

Screens are provided in the oxygen inlet and the air port to prevent foreign particles from entering the regulator.

A pressure gage (5) is installed on top of the regulator and is connected with the high-pressure oxygen line. The range of this gage is from zero to 2000 lb/sq in.

The regulator (9) is bolted to the oxygen cylinder bracket (12) and is connected to the mask by means of a kink-proof *flexible rubber* breathing tube (13) and a quick-disconnect coupling (15).

(3) OXYGEN FLOW INDICATOR (PBY-5A ONLY).—The oxygen flow indicator (7) is designed

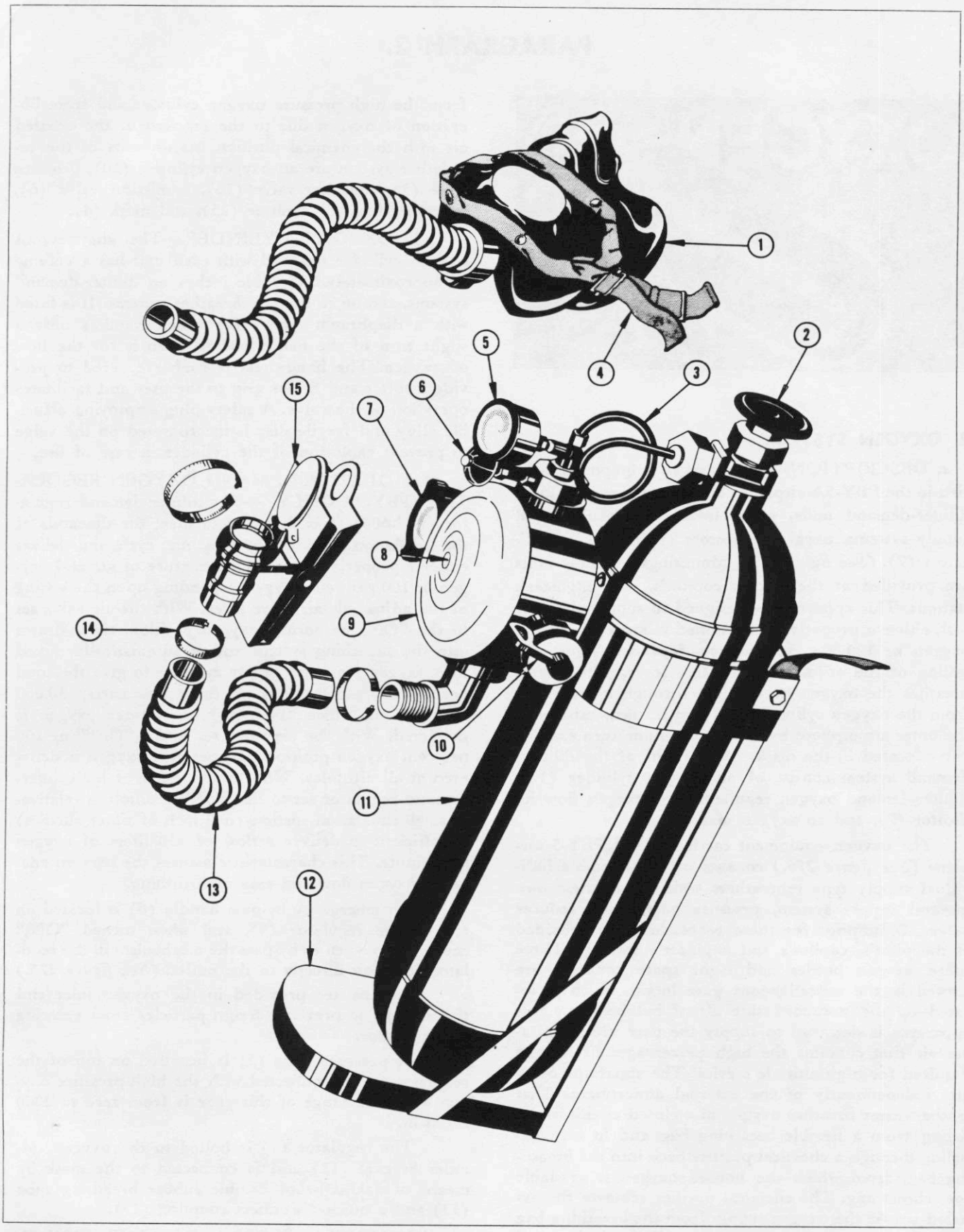

Figure 275—Portable Diluter-Demand Oxygen Equipment (PBY-5A Only)

No.	PART No.	NAME	No.	PART No.	NAME
1	R83-M-178990	Mask (Type A-14)—Small	8	PB50852-1	Diaphragm Knob
	R83-M-178995	Mask (Type A-14)—Medium	9	R83-R-301200	Oxygen Regulator
	R83-M-179300	Mask (Type A-14)—Large	10	PB50872-1	Air Valve Lever
2	R51-C-12045	Cylinder Valve	11	NAF1135-22	Oxygen Cylinder
3	986-SK	High-pressure Line Assembly	12	9153	Bracket
4		Helmet Straps	13	AN6003-3 (or -4)	Breathing Tube
5	PB52034-1	Pressure Gage	14	R33-C-70-1060	Hose Clamp
6	PB52835-1	Emergency Handle	15	AN6002	Quick Disconnect Coupling
7	R83-1-620100	Flow Indicator		AN6002A	

Items number 3 and 12 are Bu/Aer drawing numbers.
Items number 5, 6, 8 and 10 are Eclipse-Pioneer Instrument Co. part numbers.
Items number 1, 2, 7, 9 and 14 are Aviation Supply Office part numbers.

to give visual indication (blinking) of the positive flow of oxygen through the diluter-demand regulator (9). *(See figure 275.)* The flow indicator is attached directly to the diluter-demand regulator by means of a threaded boss on the regulator case. This flow indicator is omitted on some units.

(4) OXYGEN MASK.—On PBY-5A airplanes *(See figure 275.)*, the oxygen mask (1) consists of a molded gray rubber facepiece which fits snugly over the nose and mouth of the wearer, and a kink-proof flexible rubber tube which is connected by the quick-disconnect coupling (15) to the breathing tube. The mask incorporates a nonreturn exhaust valve for the exhalation phase of the breathing cycle. The mask also contains a pocket which holds a microphone for use in the interphone system.

On PBY-5 airplanes *(See figure 276)*, the oxygen mask consists of a molded gray rubber facepiece which fits snugly over the nose and mouth of the wearer, a combination nitrogen vent and shut-off (facepiece) valve (2), and a rubber breathing tube (1) which connects the mask (4) to the canister assembly (25). The mask (4) is attached to the vent and shut-off valve (2) by means of a quick opening clamp which prevents ready interchange of mask (4). The facepiece valve (2) is employed in the cleaning out process of any air or nitrogen that may be in the breathing circuit. When the knob clamp (3) of the facepiece valve (2) is released, the round knob on the valve moves outward to its open position and the mask (4) then becomes a part of the breathing circuit. When the round knob is pushed inward as far as it will go, the valve (2) is in its closed position and no air will flow from the breathing appartus circuit to the mask or from the mask into apparatus. The knob clamp (3) is provided on the facepiece valve (2) to hold the round knob in the closed position. The breathing tube has a small length of chain and a spring clip (17) assembled to it. This clip is attached to the wearer's clothing or parachute harness, when the apparatus is worn, to support the weight of the lower section of the breathing tube.

The mask has three helmet webbing straps for attaching the mask to a standard flying helmet. The straps are snapped to the left side of the helmet and attached to the right side of the helmet by means of a quick-release tab with a loop buckle. These straps are designed to permit ready adjustment to fit the individual wearer.

(5) PRESSURE GAGE.—On PBY-5 airplanes *(See figure 276)* a light weight pressure gage (5) is mounted in the top of the apparatus case and indicates at all times the pressure of the oxygen contained in the supply cylinder (10) when the cylinder valve (12) is open. Graduations of the gage dial are in lb/sq in. with a full scale reading of 2500 pounds. The figures and graduations are luminous so that they can be read regardless of the surrounding light conditions. The gage is provided with a spring-mounted safety back which is released in the event of failure of the gage under high pressure and thus guards against shattering of the dial glass.

On the PBY-5A airplanes the pressure gage is an integral part of the oxygen regulator. (See paragraph *a*, (2).)

(6) REDUCING VALVE (PBY-5 ONLY).—*(See figure 276.)*—The reducing valve (16) is of the single stage expanding bellows type in which the pressure of oxygen supplied from the cylinder is reduced to a maximum of seven lb/sq in. above the surrounding atmospheric pressure. A pressure release safety valve is provided integral with the reducing valve assembly to prevent the development of excessive pressure in the bellows in event of failure of the valve mechanism.

(7) ADMISSION VALVE (PBY-5 ONLY). *(See figure 276.)*—Flow of oxygen from the reducing valve (16) into the breathing bag (8) of the apparatus is automatically controlled by a lung-governed admission valve (6). The complete admission valve assembly consists of a lever (11), adjusting screw (13), valve plunger (14) and admission valve (6).

In operation, the wearer's inhalation deflates the bag to the point where the adjusting screw (13) presses upon the admission valve plunger (14). This pressure

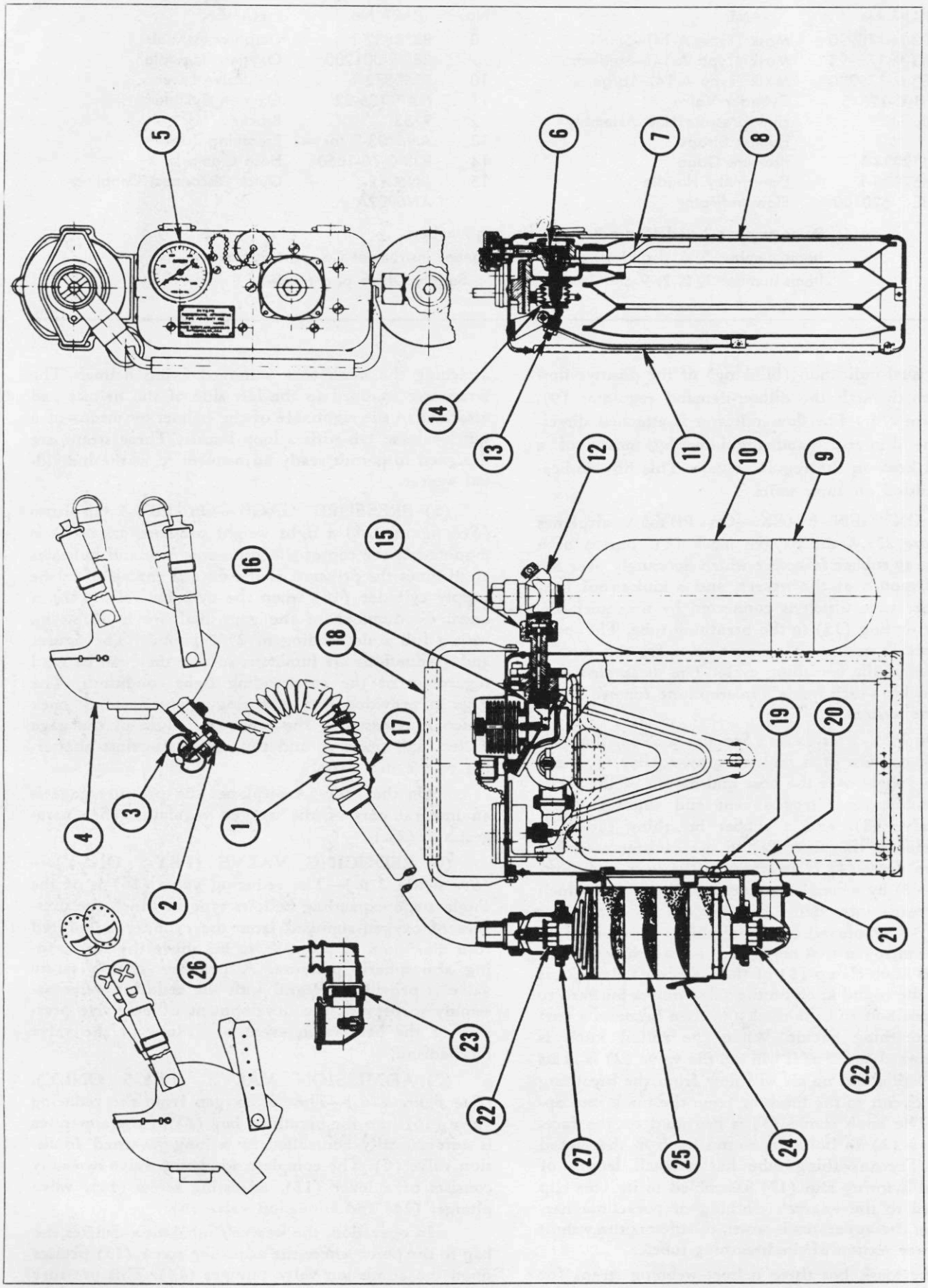

Figure 276—Portable Rebreather Oxygen Equipment (PBY-5 Only)

No.	PART No.	NAME	No.	PART No.	NAME
1	17581	Breathing Tube	15		Coupling Nut
2	16599	Facepiece Valve	16	16603	Reducing Valve
3	15072	Knob Clamp	17	40421	Chain
4	40844	Mask	18	16586	Carrying Handle
5	16571	Pressure Gage	19	53034	Wing Nut
6	16603	Admission Valve	20	16588	Connecting Tube
7	16573	Oxygen Tube	21	3532	Coupling Nut
8	16572	Breathing Bag	22	15029	Sealing Valves
9	17765	Cylinder Clamp		15558	Sealing Valves
10	17876	Cylinder	23	15048	Inhalation Check Valve
11	16562	Admission Valve Lever	24	16583	Clamp Lever
12	17125	Cylinder Valve	25	40395	Canister
13	16652	Admission Valve Adjust. Screw	26	16608	Inhalation Tube
14		Admission Valve Plunger	27	40394	Canister Holder

All numbers are Mine Safety Appliances Co. part numbers.

on the plunger opens the valve and allows a sufficient amount of oxygen to enter and inflate the breathing bag (8) until the adjusting screw (13) is no longer in contact with the valve plunger (14). Accordingly, only enough oxygen is supplied to take care of the wearer's requirements and keep the bag inflated. The adjusting screw may be adjusted to permit regulation of the amount of inflation of the breathing bag to suit the particular needs of the wearer.

(8) BREATHING BAG (PBY-5 ONLY). *(See figure 276.)*—The breathing bag (8) is a stockinette-reinforced rubber storage reservoir for the oxygen supply. Its bellows design permits free respiratory action with a minimum resistance. The wearer exhales and inhales oxygen to and from the breathing bag. The bag is kept inflated by the automatic action of the admission valve (6).

(9) CANISTER (PBY-5 ONLY). *(See figure 276.)*—The canister (25) contains a chemical that fulfills the two-fold purpose of evolving oxygen upon contact with moisture in the exhaled breath of the wearer, and absorbing the exhaled carbon dioxide. This canister is easily replaceable. During storage, it is kept tightly sealed with rubber lined metal tear-off caps to prevent deterioration of the chemical. The canister has an opening on each end, each of which is provided with a soft, molded rubber gasket to make a gas tight connection between the canister (25) and the sealing valve (22) mounted in the canister holder assembly. Both ends of the canister are identical and interchangeable, so that no detailed positioning is necessary when inserting the canister in place.

(10) CANISTER HOLDER (PBY-5 ONLY). *(See figure 276.)*—The canister holder (27) attached to the side of the appartus case is provided with a quick acting toggle clamp (24) which securely holds the canister in place and permits ready replacement of spent canisters. Automatic sealing valves (22) are provided in the upper and lower chambers of the canister holder (27). When a spent canister is removed from the holder, these valves, which are spring actuated, close and prevent entrance of the outside atmosphere to the breathing circuit. Leakage of oxygen from the apparatus is also held to a negligible amount. During the interval the apparatus functions as a demand type in which oxygen is obtained directly from the breathing bag (8) and the oxygen cylinder (10). In exhaling, the wearer's exhaled air is forced out around the edges of the mask (4). When a new canister is inserted and the holder clamp is closed, the valves (22) are opened by the canister necks. The new canister automatically becomes part of the breathing circuit, and the apparatus is restored to the closed circuit rebreathing type. By means of this design, canisters may be interchanged without interruption in the use of the apparatus.

(11) APPARATUS CASE (PBY-5 ONLY). *(See figure 276.)*—The apparatus case encloses and protects the breathing bag (8), admission valve mechanism (6) and reducing valve (16), and provides a mounting for the canister holder (27) and oxygen cylinder (10). A carrying handle (18) having a rubber grip is hinged to the top of the apparatus case and permits carrying by hand. When the apparatus is in use, the handle may be turned out of the way. Two types of body harnesses are furnished with each apparatus. One type consists of an adjustable shoulder strap and the other an adjustable waist strap. Each harness is made of one and three quarter inch black webbing and has a suitable snap fastener assembled to each end.

b. ASSEMBLY AND INSTALLATION.

(1) To assemble PBY-5A oxygen equipment: *(See figure 275.)*

(a) Install cylinder (11) in bracket (12) and tighten wing nut.

(b) Attach diluter-demand oxygen regulator (9) to cylinder bracket (12) by means of the three screws.

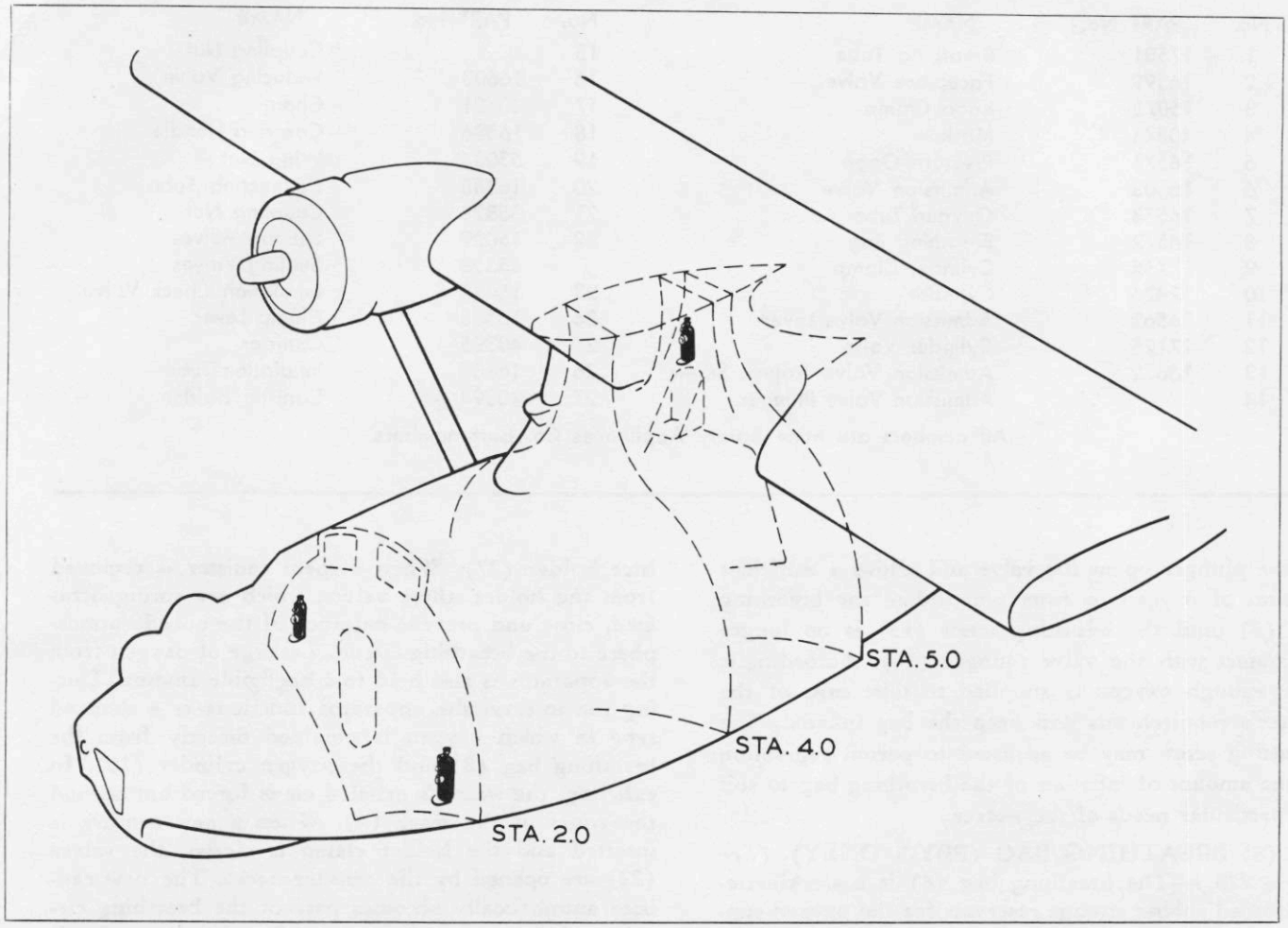

Figure 277—Portable Oxygen Equipment—Stowage Location

(c) Attach high-pressure line assembly (3) to cylinder (11) and regulator (9) by tightening the nuts on each end of the line.

(d) Remove plug from regulator (9) and screw the flow indicator (7) into the regulator.

(e) Connect breathing tube (13) to regulator (9) by means of hose clamp (14).

(f) Attach mask (1) to breathing tube (13) by means of quick-disconnect coupling (15).

(2) To assemble PBY-5 oxygen equipment. *(See figure 276.)*

(a) Install cylinder (10) to the apparatus case by means of coupling nuts (15) at top of cylinder, and cylinder clamp (9) at bottom of case.

(b) Attach canister holder (27) to apparatus case by slipping holder in position on the case and attaching with wing nuts (19) and coupling nuts (21). Open cover of apparatus case to install wing nut (19) on retaining screw.

(c) Attach the mask and breathing tube assembly to apparatus by means of fluted coupling nut which is located on the end of breathing tube (1).

(3) The oxygen unit is installed in the airplane merely by strapping it in place at the pilot's, copilot's and engineer's stations. *(See figure 277.)*

c. PREPARATION FOR USE.—The following items should be checked while the plane is on the ground prior to flight in which oxygen is to be used, or is likely to be used, to assure proper functioning of the oxygen system:

(1) On PBY-5A airplanes, check the diluter-demand equipment as follows: *(See figure 275.)*

(a) Close emergency valve (6).

(b) Open cylinder valve (2), allowing at least ten seconds for pressure in line to equalize. Pressure gage (5) should read 1800 $\pm$ 50 lb/sq in. if the cylinder (11) is fully charged.

(c) Close cylinder valve (2). After a few minutes, observe pressure gage (5) and simultaneously open cylinder valve. If gage pointer jumps, leakage is indicated.

(d) If leakage is indicated, test further. Open cylinder valve (2), carefully noting pressure gage (5) reading, then close cylinder valve. If gage pointer

drops more than 100 lb/sq in. in five minutes, there is excessive leakage and such an oxygen unit must be repaired prior to use.

(e) Check mask (1) fit by placing thumb over end of mask tube and inhale lightly. If there is no leakage, mask will adhere tightly to face due to suction created. If mask leaks, tighten mask suspension straps (4) and adjust nose wire.

WARNING

Do not use mask that leaks.

(f) Couple mask securely to breathing tube (13) by means of quick-disconnect coupling (15).

Note

Mating parts of coupling must be fully engaged and not "cocked."

(g) Open cylinder valve (2). Depress diaphragm knob (8) through hole in center of regulator case and feel flow of oxygen into the mask; then release diaphragm knob. Breathe several times, observing oxygen flow indicator (7) for "blink," verifying the positive flow of oxygen.

Note

Since the amount of added oxygen is very small at sea level, the oxygen flow indicator (7) may not operate while plane is on the ground. In this case, turn air-valve to "OFF" or to "100 PER CENT OXYGEN," and test again. If oxygen flow indicator (7) operation is now satisfactory, reset air valve (10) to "ON" or "NORMAL OXYGEN," in which setting adequate oxygen flow and "blinker" operation will be assured at oxygen use altitudes.

(h) Check emergency valve (6) by turning counterclockwise slowly until oxygen flows vigorously into mask (1), then close emergency valve (6).

(2) On PBY-5 airplanes check the rebreather equipment as follows: *(See figure 276.)*

(a) Depress facepiece valve (2) and put knob clamp (3) in place.

(b) Open oxygen cylinder valve (12). Equalize pressure. Close oxygen cylinder valve (12).

Note

High pressure gage should read 1800 ± 50 lb/sq in. for fully charged cylinder.

(c) Observe high pressure gage (5) carefully and OPEN oxygen cylinder valve (12). A jump of high pressure gage needle indicates leakage in system.

(d) By finger pressure through rebreather cover, depress admission valve (6) to fill breathing bag (8) completely in five seconds. If breathing bag (8) does not fill in five seconds or deflates under external pressure, DO NOT USE.

(e) Check canisters (25) for proper number and condition.

Note

Should apparatus fail in any of the above tests, have inspection made by specially trained personnel. Keep oil, dirt and foreign matter away from rebreather.

d. OPERATING INSTRUCTIONS.

(1) Oxygen shall be used:

(a) On all flights when above 10,000 ft.

(b) On night flights when above 5,000 ft. except by personnel whose keenness of night vision is not essential.

(c) On flights of more than four hours between 8,000 and 10,000 ft, oxygen shall be used a minimum of fifteen minutes out of every hour.

(2) To use oxygen unit on PBY-5A airplanes: *(See figure 275.)*

(a) Open oxygen cylinder valve (2). Pressure gage (5) should read 1800 ± 50 lb/sq in. if cylinder (11) is fully charged.

(b) Set regulator air valve (10) to "ON" or "NORMAL OXYGEN."

Note

Regulator air valve is set to "OFF" or "100 PER CENT OXYGEN" when presence of excessive carbon monoxide is suspected.

(c) Put on oxygen mask (1). Check fit as outlined in foregoing paragraph *c*, (1), *(e)*.

(d) Couple mask securely to breathing tube (13) by means of quick-disconnect coupling (15).

CAUTION

Be sure that quick-disconnect coupling is fully engaged.

(e) Depress diaphragm knob (8) through hole in center of regulator case, and feel flow of oxygen into mask; then release diaphragm knob (8). Breathe several times, observing oxygen flow indicator (if installed) for "blink" which verifies the positive flow of oxygen.

(f) Do not use oxygen supply below 300 lb/sq in., except in an emergency.

(g) Upon completion of oxygen usage, close cylinder valve (2).

WARNING

Use emergency valve only if regulator becomes inoperative or anoxia is suspected.

(3) To use oxygen unit on PBY-5 airplanes: *(See figure 276.)*

(a) Insert canister (25) in canister holder (27) after removing tear-off caps from ends of canister.

(b) Retest for tightness. (Refer to paragraph *c*, (2).)

(c) Put on mask (4). Release knob clamp (3).

(d) Check mask fit by squeezing corrugated

breathing tube (1) and inhaling lightly. Tight fitting mask should collapse on face. If mask leaks, adjust nose wire on mask and tighten adjustable headstraps. DO NOT USE MASK THAT LEAKS.

(e) Flush apparatus as follows:

1. Inhale deeply with facepiece knob released and sprung outward.

2. Depress facepiece valve (2) knob and exhale fully.

3. Repeat steps 1 and 2 until a total of three successive inhalations have been exhaled.

4. With facepiece knob sprung outward, breathe normally in and out of rebreather.

5. Repeat above flushing procedure after five, fifteen and thirty minutes operation and every thirty minutes thereafter.

Note

Extreme care must be taken to prevent entrance of outside air into the breathing system.

(f) Replace canister (25) after two hours continuous usage or when excessive resistance to exhalation occurs.

Immediately after changing canisters, flush apparatus as outlined in paragraphs *(e)*, 1 through *(e)*, 3 above, and every thirty minutes thereafter.

(g) Check mask fit frequently.

(h) Upon completion of oxygen flight:

1. Close oxygen cylinder valve (12).

2. Remove and properly dispose of all opened and used canisters.

3. Stow mask assembly with facepiece valve knob released and sprung outward.

e. REMOVAL.

(1) OXYGEN UNIT FROM MOUNTING.—To remove unit, merely remove the quick-disconnect straps that hold it in place. *(See figure 277.)*

(2) Disassemble diluter-demand units as follows: *(See figure 275.)*

(a) OXYGEN MASK.—To remove oxygen mask (1) from unit, disconnect at quick-disconnect coupling (15).

(b) OXYGEN FLOW INDICATOR.—To remove the oxygen flow indicator (7), unscrew indicator (7) from oxygen regulator (9). Plug the outlet.

(c) DILUTER-DEMAND OXYGEN REGULATOR.—To remove regulator (9):

1. Remove breathing tube (13) by detaching hose clamp (14).

2. Remove oxygen high-pressure line assembly (3) by loosening nut. Plug the outlet.

3. Unscrew the regulator from mounting panel, which is on cylinder bracket.

(d) OXYGEN CYLINDER.—To remove oxygen cylinder:

1. Loosen nut at cylinder valve (2) and remove high-pressure line assembly (3).

2. Remove wing nut and lift cylinder (11) from the bracket (12).

(3) Disassemble rebreather units as follows: *(See figure 276.)*

(a) CYLINDER.—To remove cylinder (10), loosen the coupling nut (15) and lift cylinder from cylinder clamp (9).

CAUTION

When the cylinder is removed, a male plug should be assembled to the coupling nut to prevent entrance of outside air and foreign matter into apparatus, or escape of oxygen from apparatus.

(b) CANISTER HOLDER.

1. Disconnect the coupling nut (21) at the bottom of the holder.

2. Disengage wing nut (19).

Note

The cover of the apparatus case must be removed in order to remove wing nut from the retaining screw.

3. With the coupling nut disconnected and wing nut removed, a slight upward thrust of the holder will detach holder from apparatus case.

f. MAINTENANCE.

(1) When not in regular service, the unit should be inspected periodically and tested for tightness as described under foregoing paragraph *c.*

(2) For general sanitary purposes, after each period of use, the mask should be cleaned as follows:

(a) Remove mask microphone if installed. In removing the microphone, care should be taken to avoid excessive bending of the nose wire embedded in the mask with consequent danger of breaking the wire.

(b) Wash mask thoroughly inside and out with abundant lather made from any good neutral soap.

CAUTION

Do not use toxic or inflammable solvents, such as gasoline or alcohol, for washing the mask.

A soft brush may be used to advantage in cleaning the mask.

(c) Rinse thoroughly in clean, cold water.

(d) Allow mask to drain and dry completely in a well ventilated place.

CAUTION

Do not hang mask in sunlight.

(e) Reinstall mask microphone.

(f) Inspect exhalation valve and seat on diluter-demand units to insure that no particles of extraneous matter have lodged under valve to hold it open.

WARNING

Oil and grease must not be brought into contact with the unit or used to lubricate any of the parts, owing to the danger of combustion.

(3) The usable pressure of the high-pressure cylinder is from 1800 to 300 lb/sq in. When the pressure has dropped to 300 lb/sq in., replace the cylinder. Do not return cylinder for recharging with less than 15 lb/sq in. of residual charge remaining in cylinder. Cylinders exhausted below this pressure must be completely reconditioned.

(4) All repairs should be made by personnel especially trained and qualified for repair of this apparatus.

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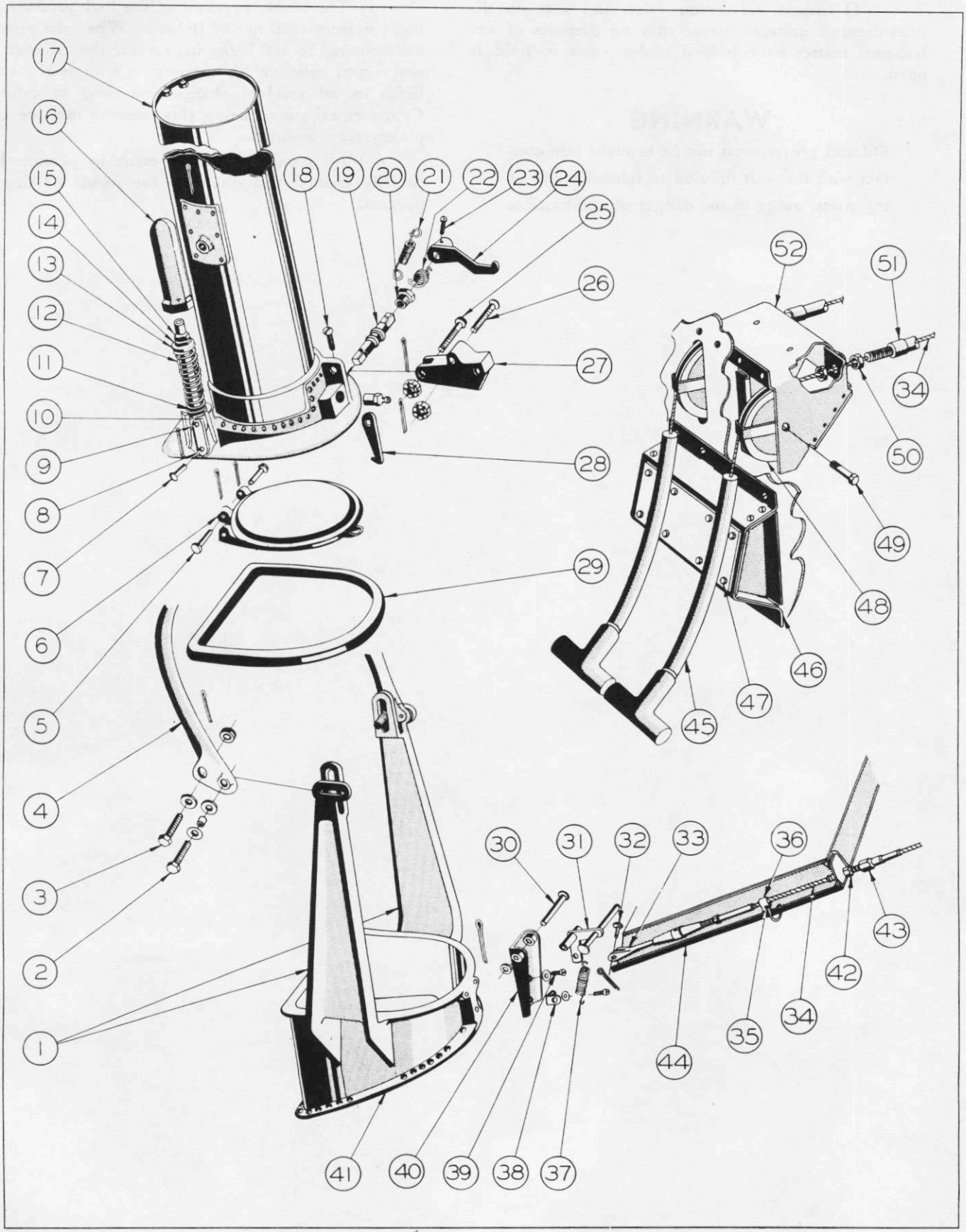
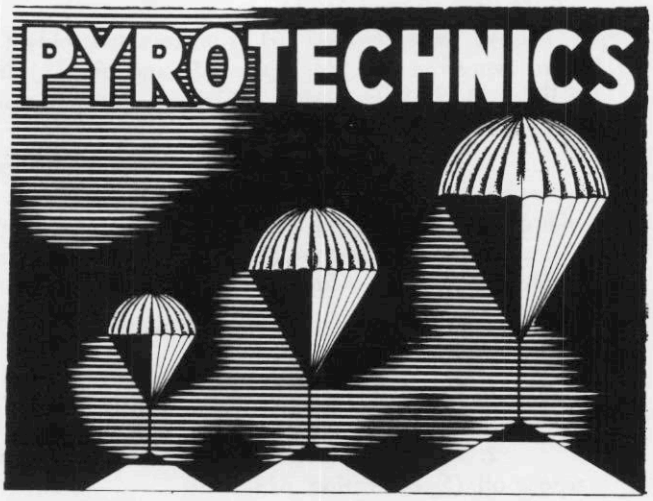


Figure 278—Parachute Flare Adapter

PARAGRAPH 3.



3. PYROTECHNICS.

a. PARACHUTE FLARES.

(1) FLARE ADAPTERS.

(See figure 278.)

(a) DESCRIPTION. — Two parachute flare adapters are located immediately aft of station 7.25, one on each side of the hull. These are used to carry Mark 5-3 parachute flares. Each flare adapter consists of an aluminum alloy tube assembly with a door located at the bottom. This tube assembly is mounted on a base which incorporates a toggle handle for use in swinging the tube to a horizontal position. The base is riveted to the floor of the airplane. The door mechanism is actuated by manually controlled cable assemblies. The control handles for both flare adapters are located on the forward face of bulkhead 2 above

No.	PART No.	NAME
1		Base Leg
2	AN3-5A	Bolt
	AN380-2-4	Cotter Pin
	Q610-6-9	Spacer
3	AN3-7A	Bolt
	AN380-2-4	Cotter Pin
	Q610-6-14	Spacer
4	28F1099	Handle
5	AN393-39	Hinge Pin
	AN380-2-2	Cotter Pin
6	28F1095	Door
7	AN393-15	Pin
	AN380-2-2	Cotter Pin
8	28F1124	Link
9	AN394-11	Pin
	AN380-2-2	Cotter Pin
10	28F1123	Eyebolt
11	28A1006-17	Neoprene Washer
12	28F1147	Spring
13	28F1349	Washer
14	AN316-D5R	Nut
15	AN365-D524	Nut
16	28F1348	Housing
17	28F1096	Tube Assembly
18	AN520-10-5	Screw
19	28F1143	Shaft
20	28F1145	Packing Nut
21	Q113	Spring
22	28F1152	Torque Spring
23	NAF210517-208	Screw
24	28F1344	Arm Assembly
25	AN23-14	Clevis Bolt
	AN320-3	Nut
	AN380-2-2	Cotter Pin
26	AN23-19	Clevis Bolt
	AN320-3	Nut
	AN380-2-2	Cotter Pin
27	28F4008	Safety Lock
28	28F1146	Door Catch
29	28F1194	Gasket
30	AN394-57	Pin
	AN380-2-2	Cotter Pin
	AN960-416	Washer
31	28F1120	Lever Assembly
32	AN393-11	Pin
	AN380-2-2	Cotter Pin
33	AN160-8S	Fitting
34	28A1006-4	Cable Assembly
35	AN526-832-6	Screw
	AN365-832	Nut
36	22F1653	Clip
37	28F1156	Spring
38	28F1157	Clip
39	AN502-10-8	Screw
40	28F1119	Channel
41	28F1098	Base
42	AN316-4R	Nut
43	AN8005	Stop
44	28F1172	Bracket
45	120457	Flare Release Handle
46	28F078	Bracket
47	AN3-4A	Bolt
	AN365-1032	Nut
	AN960-10	Washer
48	AN210-2A	Pulley
49	AN3-7	Bolt
	AN310-3	Nut
	AN380-2-2	Cotter Pin
50	AN316-4R	Nut
51	AN8005	Stop
52	28F079	Bracket

Item 45 is a Bureau of Ordnance part number.

the door. The cables run aft from the handle to the adapter through a flexible cable sheath that is held in position by clips.

(b) REMOVAL AND DISASSEMBLY.
(See figure 278.)

1. To remove tube assembly (17) and handle (4) from base (41), remove bolts (2) and (3) located in base legs (1) and tube (17) respectively.

2. Remove cable assembly (34) as follows:

a. Detach cable assembly (34) from flare adapter by removing pin (32) from the fitting (33) and lever (31).

b. Remove screw (35) attaching bonding braid to clip (36). Lift clip (36) from cable assembly (34).

c. Unscrew the two nuts (42) from the stop (43) and pull cable assembly (34) from bracket (44).

d. On forward face of bulkhead 2, remove handles (45) from bracket (46) by removing the six attaching bolts (47).

e. On flare release handle (45) drill out the solder at the end of handle and the solder which is about an inch from the end of handle.

f. Pull cable from handle, exerting a little force if necessary to free cable at solder.

g. Remove pulley (48) by removing bolt (49).

h. Unscrew the two nuts (50) from the stop (51) and pull cable through bracket (52).

i. Remove cable assembly from airplane after removing the 23 clips on PBY-5A airplanes and 20 clips on PBY-5 airplanes along with attaching screws that secure the cable sheath between bulkhead 2 and the tunnel gun compartment.

3. Disassemble the locking mechanism as follows:

a. Remove the safety lock (27) by removing bolt (26) which holds spring (21) in position, and bolt (25) which attaches lock (27) to the tube assembly (17).

b. Unscrew the screw (23) and cut the lockwire holding the arm assembly (24) on the shaft (19).

c. Unhook the torque spring (22) from the arm assembly (24).

d. Remove the screw (18) holding the torque spring (22) to the tube assembly (17).

e. Slide the arm assembly (24), torque spring (22), and tension spring (21) off the shaft (19).

f. Loosen packing nut (20) and remove shaft (19).

g. Lift the door catch (28) from the can assembly.

h. Unhook spring (37) from the lever assembly (31) and the clip (38), which is attached to the channel (40).

i. Remove lever assembly (31) from channel (40) by cutting lockwire and removing pin (30).

j. Unscrew the three screws (39) holding channel (40) to base (41).

4. Remove door (6) from tube assembly (17) by removing the two hinge pins (5) and pin (7) from the link (8). Pull the gasket (29) from the tube assembly (17).

5. Disassemble the door spring mechanism by unscrewing and removing housing (16) and then removing the two nuts (14) and (15), washer (13), spring (12), and neoprene washer (11). Detach link (8) from eyebolt (10) by removing pin (9) and cotter.

(c) MAINTENANCE.—Lubricate after 100 to 120 hours of operation as follows:

1. Press grease (Specification AN-G-10) into the Zerk fitting on each release rack.

2. Lubricate all moving parts with a general purpose oil (Specification AN-O-6).

3. For maintenance of control cables, see Section IV, Par. 18, *b*, (3).

(d) ASSEMBLY AND INSTALLATION.
(See figure 278.)

1. Assemble the door spring mechanism by reversing disassembly procedure described in paragraph *a.*, (1), *(b)*, *5.*

2. Assemble door (6) to the tube assembly (17) by aligning the door (6) with tube assembly (17) and inserting the hinge pins (5). Attach hinge pin (7) to link (8). Insert gasket (29) in channel of tube assembly (17).

3. Assemble and then attach locking mechanism to tube assembly by reversing disassembly procedure described in paragraph *a.*, (1), *(b)*, *3.*

4. Install cable assembly (34) by reversing disassembly procedure described in paragraph *a*, (1), *(b)*, *2*, observing the following:

a. Tin end of cable before soldering to handle. Fray out end of cable and solder to end of handle. Do not file flush.

b. Adjust turnbuckle so that release lever (31) is fully returned allowing safety latch (27) to seat properly after release has been operated.

5. Assemble the tube assembly (17) to the base (41) by placing in position and attaching the bolt (2) which joins legs (1) of base and handle (4), and the bolt (3) which joins the tube assembly (17) to the base legs (1) and handle (4).

(2) FLARES.

(a) DESCRIPTION.—The Mark 5-3 parachute flares are used for the purpose of illuminating a large area sufficiently to permit reconnoitering, bombing, or the landing of aircraft.

Mounted in one end of the flare is a variable delay fuse which can be set to the desired delay. The delay is shown on the bevel of the fuse setting ring and

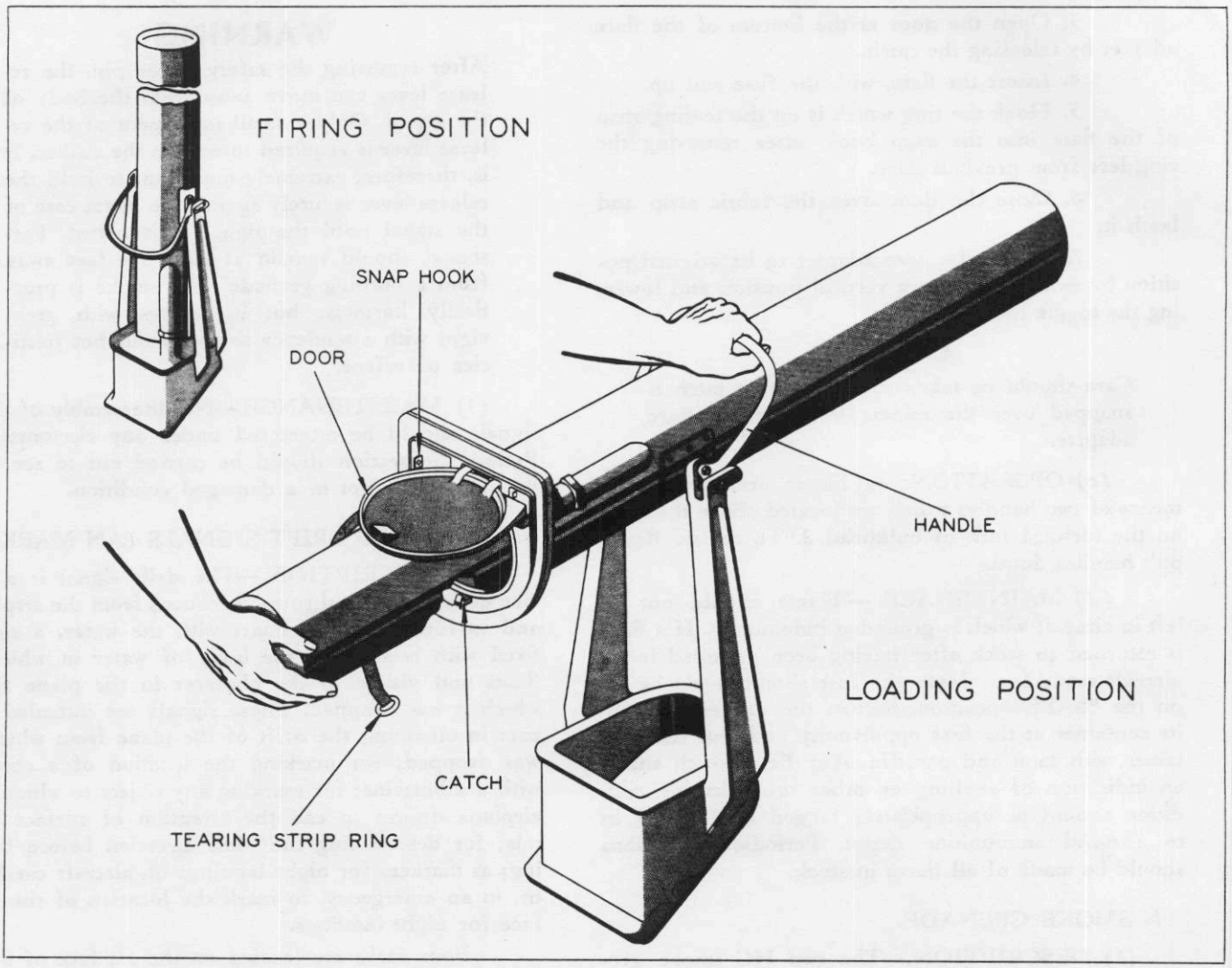


Figure 279—Operation of Parachute Flare Adapter

indicates the vertical distance the flare will drop before igniting. This distance, or delay, can be varied from a minimum of 300 feet to a maximum of 12,000 feet.

Ordinarily, two parachute flares are carried with the airplane. These flares are always carried in the two adapters except when the airplane is on the water, in which case the flares are stowed in two racks near the adapters. The two racks are located between station 7.5 and station 7.75, one on the port side and the other on the starboard side.

TECHNICAL DATA

Burning time	3 minutes
Rate of fall after ignition (approximately)	450 feet per minute
Terminal velocity before ignition (approximately)	225 feet per second
Drop at which terminal velocity is reached (approximately)	1000 feet
Light produced (intensity)	750,000 candle power
Color of Light	Yellow
Weight (as dropped)	18 pounds
Length of flare case	27 inches
Diameter of flare case	4.75 inches
Pull required to break snap cord	38 pounds

(b) PREPARATION FOR USE. *(See figure 279.)*—To load the adapter with a new flare, proceed as follows:

1. Remove the metal end-cover and set the fuse pointer opposite the drop at which the flare is desired to function. The support bands are not used in this installation. Tighten the thumbscrew so that the point penetrates the chipboard case. Replace the metal end-cover.

2. Raise the toggle locking handle, and then, swing the flare adapter tube into a horizontal position.

3. Open the door at the bottom of the flare adapter by releasing the catch.

4. Insert the flare, with the fuse end up.

5. Hook the ring which is on the tearing strip of the flare into the snap hook, after removing the ring left from previous flare.

6. Close the door over the fabric strip and latch it.

7. Return the flare adapter to its original position by swinging it into a vertical position and lowering the toggle locking handle.

CAUTION

Care should be taken that the safety latch is snapped over the release lever on the flare adapter.

(c) OPERATION. — Flares are released by means of two handles which are located above the door on the forward face of bulkhead 2. To release flares, pull handles down.

(d) MAINTENACE. — Flares should not be left in aircraft which is grounded indefinitely. If a flare is returned to stock after having been mounted in an aircraft ready for release, the fuse should again be set on the "SAFE" position. Return the unused flare to its container at the first opportunity and seal the container with tape and paraffin. Any flare which shows an indication of swelling or other unserviceable condition should be appropriately tagged and turned in to a naval ammunition depot. Periodic inspections should be made of all flares in stock.

b. SMOKE GRENADE.

(1) DESCRIPTION.—The two HC smoke grenades (AN-M8) are used primarily to attract attention to personnel who have made a forced landing. The hand grenade furnishes a dense white cloud nontoxic smoke for a period of about three minutes after ignition. A pouch for stowage of these grenades is located on the starboard aft face of bulkhead 6. A handle for use with the grenades is stowed on the face of the bulkhead just to the right of the pouch.

TECHNICAL DATA

Weight of Signal	1.68 pounds
Length of Signal	5.70 inches
Diameter of Signal	2.57 inches
Delay time	3.0 seconds
Burning time	3.5 minutes
Color of smoke	Gray-White

(2) OPERATION.—Clamp smoke grenade to the end of the handle. To operate firing mechanism, grasp the signal in one hand, being sure that the release lever is held against the body of the signal. With the other hand, pull the safety ring which is attached to the safety cotter pin. After removal of the safety cotter pin, extend the grenade on the end of the handle.

WARNING

After removing the safety cotter pin, the release lever can move away from the body of the signal. Only a small movement of the release lever is required to release the striker. It is, therefore, extremely important to hold the release lever securely against the metal case of the signal until the signal is launched. Personnel should remain at least five feet away from a burning grenade. The smoke is practically harmless but it evolves with great vigor with a tendency to throw out hot particles of refuse.

(3) MAINTENANCE.—No disassembly of these signals should be attempted under any circumstance. Periodic inspection should be carried out to see that the signals are not in a damaged condition.

c. AIRCRAFT DRIFT SIGNALS (AN MARK 4).

(1) DESCRIPTION.—The drift signal is a device designed to be thrown overboard from the airplane and to furnish, after impact with the water, a signal fixed with relation to the body of water in which it floats and visible to the observer in the plane from which it was dropped. These signals are intended for use: in obtaining the drift of the plane from which it was dropped; for marking the location of a contact with a submarine; for marking any object to which the airplane desires to call the attention of surface vessels; for determining the wind direction before landing; as markers for night landings on aircraft carriers; or, in an emergency, to mark the location of the surface for night landings.

Four racks are located on the aft face of bulkhead 7 for stowage of 18 aircraft drift signals (AN Mark 4).

TECHNICAL DATA

Body diameter	3 inches
Overall diameter across fins (diagonal)	4.2 inches
Length	13 inches
Weight	2 pounds
Burning time	3 to 3.5 minutes
Time from impact to ignition	8 to 12 seconds

(2) OPERATION.—To launch drift signals, throw them over the side of the airplane, preferably in a horizontal position with the nose end forward.

When launched from the airplane, the drift signal falls nose downward. On impact with the surface, the water breaks the paraffined-paper sealing disk, and drives the firing pin back against the primer. Flame from the primer ignites the time fuse which runs the length of the hole in the center of the pyrotechnic pellets. The time fuse burns about eight to twelve sec-

onds in the AN Mark 4 signal. This gives the drift signal enough time to return to the surface and right itself.

A bright flame 12 to 15 inches high and a white smoke are produced. The flame can be seen at night a distance of six or seven miles in clear weather. Because the smoke is white, daylight observation is difficult under certain conditions. The AN Mark 4 signal burns for about three minutes.

(3) MAINTENANCE.—No maintenance except proper stowage and periodic inspection is necessary.

d. SIGNAL PISTOL.

(1) DESCRIPTION. — The signal pistol (AN-M8) is used as a method of emergency identification of aircraft. Signals that are fired from the signal pistol project two separate, freely falling stars of the same or different colors. They can be seen at any time during the day or night, but should not be fired when it is possible to use the radio or electric signal lights.

On PBY-5A airplanes with serial numbers 48252 and on, the signal pistol is located on the starboard side wall of the hull, aft of station 1.33. *(See figure 280.)* A mounting adapter holds the pistol in position for firing through the starboard wall of the hull. Twenty-four rounds of signal ammunition are provided. This ammunition is stowed in a fabric stowage bag located on the forward face of bulkhead 2, starboard side.

On all PBY-5 airplanes and on PBY-5A air-

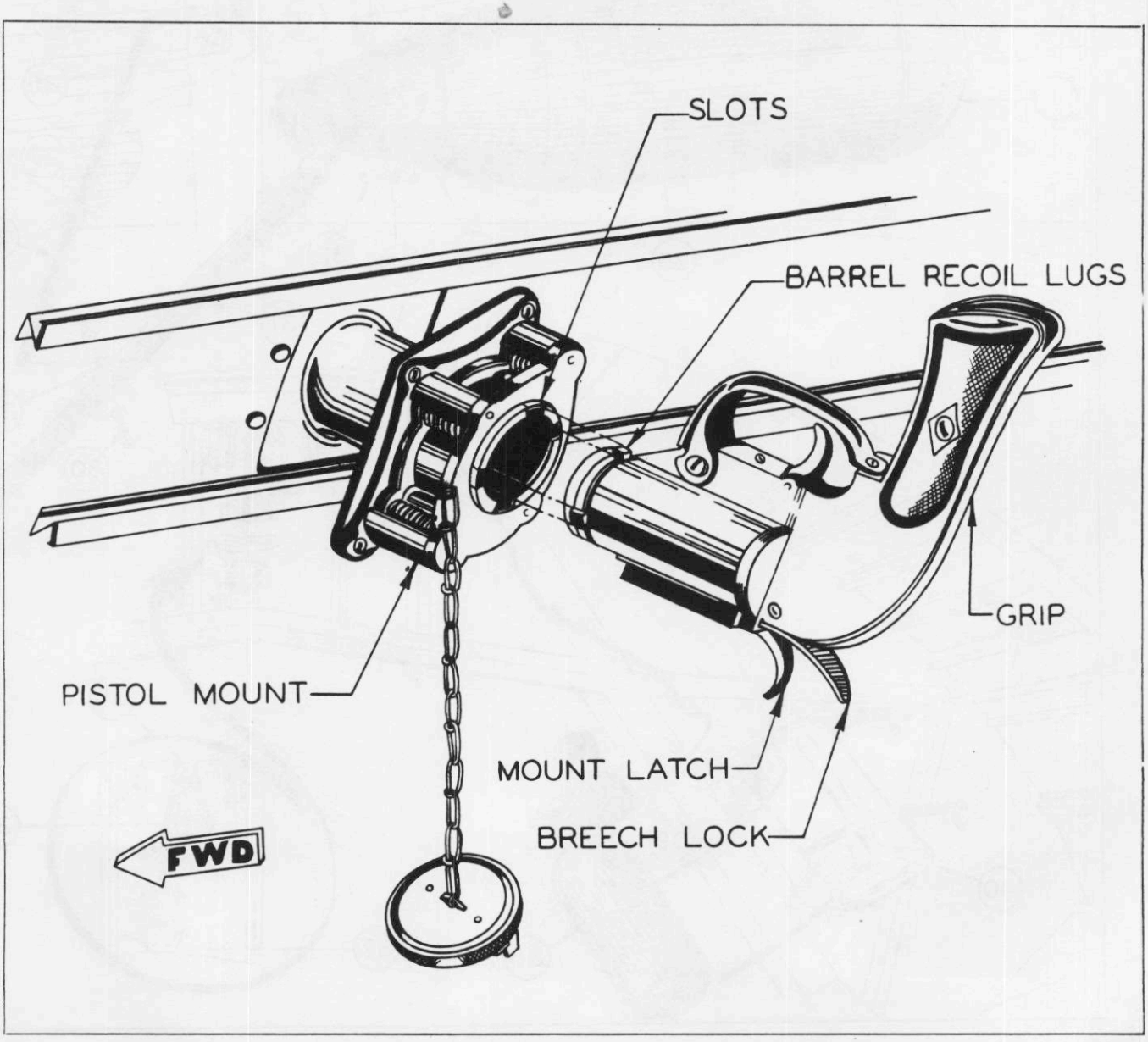


Figure 280—Signal Pistol (PBY-5A Only)

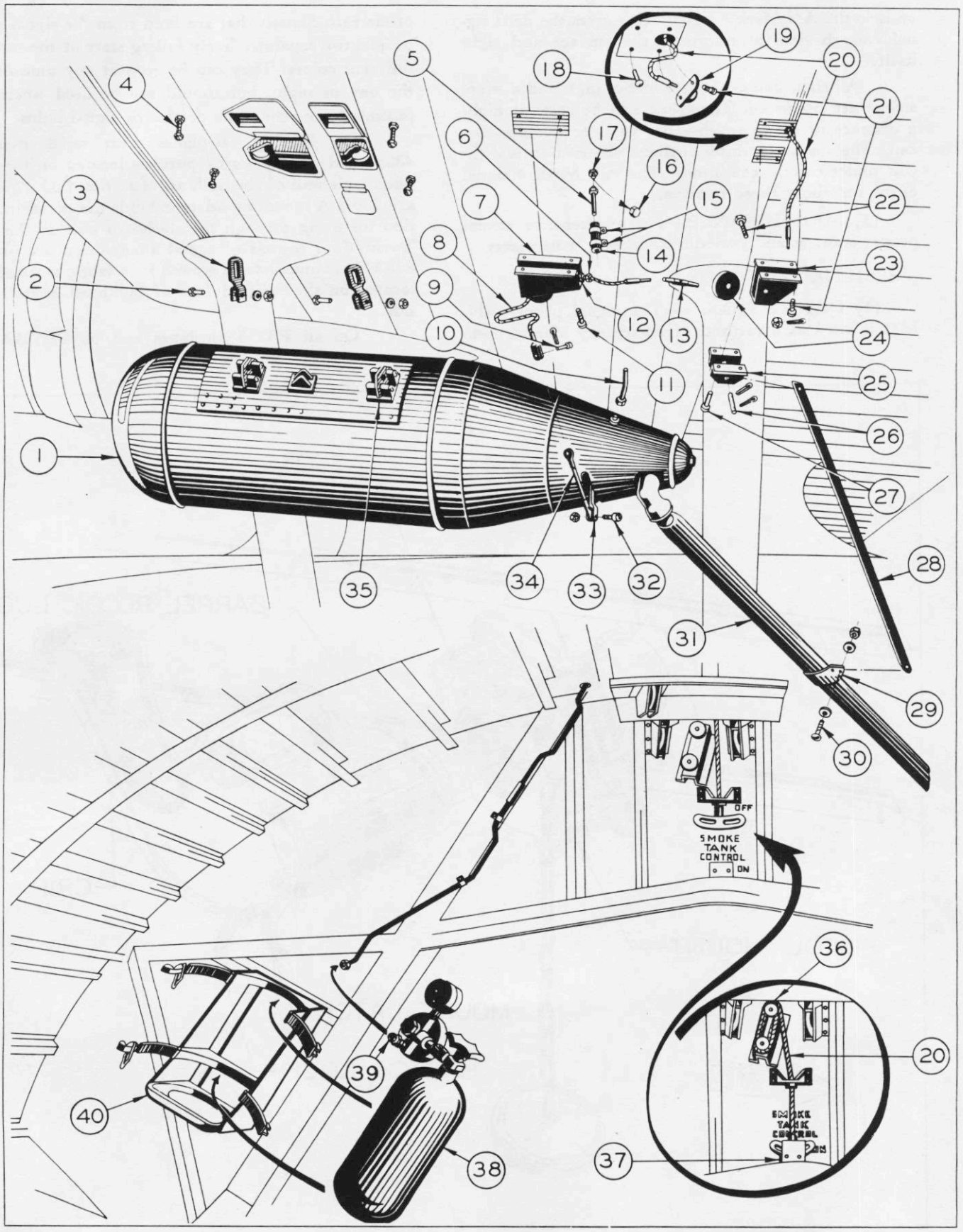


Figure 281—Smoke Tank System

No.	PART No.	NAME
1	Mark 5-3	Smoke Tank
2	AN4-11A	Bolt
	AN365-428	Nut
	Q810-8-11	Spacer
3	28A1110	Lug
4	28A2001	Chock Adjusting Screw
5	Parker 6-HLT-D	Fitting
6	AN316-4R	Nut
7	28A1028	Pulley Bracket
8	28A2008-8	Cable Assembly
9	AN393-9	Pin
	AN380C2-2	Cotter
10	28A2044	CO_2 Tube
11	AN520-10-10	Screw
12	AN8005	Stop
13	AN155-8S	Turnbuckle
14	28A1109	Hose
15	NAF27842-1	Clamp
16	Parker 6-PT-D	Cap
17	Parker 6-3221-A-D	Fitting
18	AN520-10-10	Screw
19	28A1079	Cable Stowage Nut
20	28A2008-6	Cable Assembly
21	AN520-10-10	Screw
22	AN3-7	Bolt
	AN320-3	Nut
	AN380C2-2	Cotter
23	28A1027	Rear Pulley Bracket
24	AN210-2A	Pulley
25	28A1106	Smoke Tube Strut Bracket
26	28A1112	Pin
	AN380C2-2	Cotter
27	AN520-10-10	Screw
28	28A1029-2	Smoke Tube Strut
29		Smoke Tube Clamp
30	AN520-10-12	Screw
	AN365-1032	Nut
	Q7007A13-091	Washer
31		Smoke Tube
32	AN3-6	Bolt
	AN320-3	Nut
33		Smoke Tank Gate Valve Handle
34	28A1108	Link
35		Smoke Tank Fittings
36	28A1104	Bracket Assembly
37	28A1078	Clip
38		CO_2 Bottle
39	Parker No. 6	Coupling Nut
40	28A1016	Bracket Assembly

planes with serial numbers through 34059, the signal pistol is located forward of bulkhead 7 on the port side. A mounting adapter holds the pistol in position for firing through the top of the hull. The stowage bag for the twenty-four rounds of signal ammunition is located on the forward face of bulkhead 7 on the starboard side.

(2) INSTALLATION.—To attach the pistol to the mount, hold the pistol by the grip with the right hand. Position the recoil lugs of the barrel with slots in the recoil sleeve of the mount. Push pistol fully forward and turn pistol clockwise one-quarter turn at which time the lug of the mount latch will snap into position in the slot of the recoil sleeve of the mount.

(3) OPERATION.—To load the pistol, place the thumb of the right hand on the knurled portion of the breech lock and force open. By swinging handle to one side, breech will then be open. Glance into the barrel chamber to detect any obstructions. Put the cartridge in the barrel chamber. Swing the handle down until it is positioned, and locked by the breech lock.

The pistol is fired by a continuous squeeze on the trigger.

WARNING

If signal fails to fire, pull trigger twice; if signal still fails to fire, count 30 slowly before unloading. Then unload and inspect firing pin. If it functions properly, reload with a new signal.

(4) REMOVAL.—To remove pistol from mount, hold the pistol by the grip with the right hand. Push pistol fully forward and turn pistol counterclockwise one-quarter turn. Pistol can then be removed from mount.

(5) MAINTENANCE. — The pistol should be thoroughly cleaned after use to insure against an accumulation of foreign matter and corrosive action of the propelling charge gases. It should, also, be cleaned as often during nonuse as may be necessary to insure proper functioning. Wipe all parts of the pistol and mount with a slightly oiled rag, using oil (Specification AN-O-6). Do not leave oil on exposed parts of pistol, as it will collect dirt. Clean all exposed parts with a dry rag after lubricating.

e. SMOKE TANK.

(1) DESCRIPTION. *(See figure 281.)*—When required, a smoke screen tank (Mk 5-3) is installed on the lower surface of the port wing. It is supported by the inboard internal bomb rack (Mk 51-7). The discharge tube from the aft end of the smoke tank extends aft and downward. It is supported near its lower end by a brace which connects to a bracket on the lower surface of the wing.

The smoke tank control handle is located over the door on the aft face of bulkhead 5. The "ON" and "OFF" positions of the handle are marked on the bulkhead. The control cable extends from the handle to the smoke tank gate valve handle. A bracket with two spools is provided for cable stowage when the

smoke tank is not carried on the airplane. This bracket is located above the control handle.

A bottle charged with carbon dioxide is located on the aft face of bulkhead 5 on the port side of the opening. The bottle is held in its bracket by two metal straps with toggle clamps, so that it can be readily removed for replacement. A pressure gage, graduated in 5 pound increments from zero to 300 pounds is attached to the bottle. A seat type valve at the top of the bottle controls the release of carbon dioxide. A tube leads from the bottle up through the superstructure and into the wing, and connects to a fitting on the smoke tank.

(2) INSTALLATION. *(See figure 281.)*—Only the brackets, handles, tubing, and cables which are located inside the airplane are installed permanently. However, when the smoke tank is to be used, the following additional installations have to be made:

(a) BRACKETS.—The following brackets are to be installed on the lower surface of the left wing center section:

1. The rear pulley bracket (23) is installed on the rear spar, nine and one-eighth inches outboard from wing station 9.0. Remove the two screws (18) which plug the screw holes and the two screws (21) which attach the cable stowage nut (19). By inserting the four screws (18) and (21) through these four holes and the nut plates above them, attach the rear pulley bracket (23) to the wing.

2. Another pulley bracket (7) is installed forward of the first bracket (23). Remove the four screws (11) that plug the screw holes and attach pulley bracket (7) with these same four screws (11).

3. The strut bracket (25) is installed on the rear spar just inboard of the pulley bracket (23). Use the four screws (27) which plug the screw holes to install the bracket (25).

(b) SMOKE TANK.—To install smoke tank (1) on lower surface of wing, attach the two lugs (3) to fittings on the smoke tank with nuts and bolts (2). Hoist tank to the wing and hang from the Mark 51-7 bomb rack. Adjust the four chock adjusting screws (4) that are installed for the 1000 pound bombs.

(c) SMOKE TANK TUBE STRUT.—Attach fitting end of strut (28) to smoke tube clamp (29) by means of screw (30) and attach other end to bracket (25) by inserting fiber shear pin (26) through holes in bracket (25) and strut (28), and securing with two cotter pins.

Adjust smoke tube (31) to 40° down from center line of smoke tank (1) by sliding clamp (29) along tube (31), then tightening clamp (29).

(d) CO_2 BOTTLE.—Mount CO_2 bottle (36) on bracket assembly (38) by means of the two metal straps. This bracket assembly is located on the aft starboard face of bulkhead 5.

(e) CO_2 TUBING.

1. Connect tube to CO_2 bottle (36) outlet by means of coupling nut (37).

2. Connect tube (10) to smoke tank (1) by means of coupling nut.

3. Remove cap (16) from tubing on lower side of wing.

4. Connect tube (10) to fitting (5) on lower side of wing by means of hose (14) and two clamps (15).

(f) CABLE.

1. Remove pulley (24) from rear bracket assembly (23) by removing bolt (22).

2. Remove the aft terminal of the cable assembly (20) from the cable stowage nut (19).

3. Unwind cable assembly (20) from spool on bracket assembly (40) which is on bulkhead 5 and feed cable assembly through pulley bracket assembly (23).

4. Replace pulley (24) and bolt (22).

5. Attach large end of link (34) to smoke tank gate valve handle (33) by means of bolt (32).

6. Attach the other end of link (34) to fork end of cable assembly (8) with pin and cotter (9).

7. Thread sleeve end of cable assembly (8) through pulley in front pulley bracket (7).

8. Attach this cable assembly (8) to cable assembly (20) which came from inside of airplane; attach these with turnbuckle barrel (13).

9. Tighten stop (12) which is located on cable assembly (8) to slot in front pulley bracket (7) by means of the two nuts (6) installed on stop (12).

10. Adjust turnbuckle (13) to hold smoke tank gate valve fully open.

11. With gate valve closed, adjust stop (12) to clear terminal on cable assembly (8) by one-sixteenth inch minimum.

(3) OPERATION.—Open the regulator valve on the CO_2 bottle by turning the adjusting screw which is located on the valve stem. Pull the smoke tank control handle down to the "ON" position. This causes the carbon dioxide to combine with the chemical agent in the smoke tank. This generates a white smoke which is discharged through the smoke tank tube. The control handle is held in the "ON" position by a clip.

(4) MAINTENANCE.

(a) SMOKE TANK.—No repair of smoke tank should be attempted except by specially trained personnel.

(b) CO_2 BOTTLE.—Check pressure gage to see that CO_2 bottle is charged. If the pressure is low, replace with a fully charged bottle.

(c) CONTROL CABLES.—For maintenance of control cables see Section IV, Par. 18, *b.*, (3).

(5) REMOVAL.—When the smoke tank is not in use it is removed from the airplane as follows:

(a) Disconnect the aft end of cable assembly (20) from turnbuckle barrel (13).

(b) Disconnect fork end of the other cable assembly (8) from link (34) which is attached to smoke tank gate valve handle (33).

(c) Remove front pulley bracket (7) and replace screws (11) to plug holes.

(d) Remove rear pulley bracket (23) and replace screws (18) in two forward holes.

(e) Slide off cable assembly (20) by removing pulley (24).

(f) Remove strut bracket (25) and replace screws (27) to plug holes.

(g) Disconnect CO_2 tube (10) from wing fitting by removing the two clamps (15).

(h) The smoke tank can now be released from the bomb rack and lowered from the wing.

(i) Attach the aft terminal of the cable assembly (20) to the cable stowage nut (19).

(j) Withdraw cable (20) into wing and attach nut to rear spar flange, using same attachment holes and screws (21) as were used for rear bracket assembly (23).

(k) Cover protruding end of CO_2 tube wing fitting with cap (16).

(l) At bulkhead 5, loop cable around spools on bracket (40) and stow handle under clip (39).

(m) Disconnect tube from CO_2 bottle (36).

(n) Remove bottle from bracket assembly (38) by unfastening toggle clamps.

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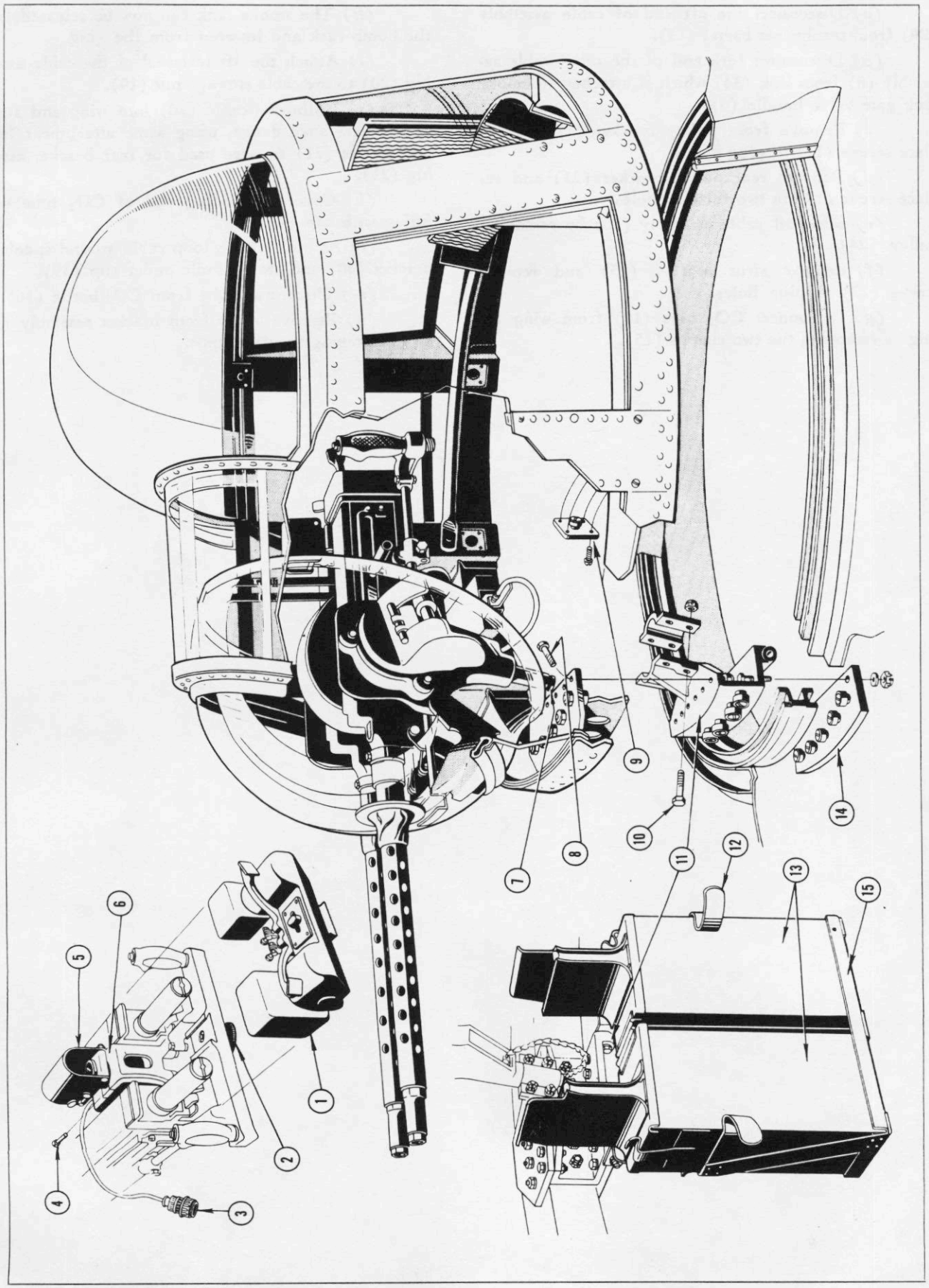


Figure 282—Bow Gun Turret (PBY-5A—Serial Numbers 46580 Through 46638)

PARAGRAPH 4.

4. ARMAMENT.

a. GUNNERY EQUIPMENT.

(1) GENERAL.—PBY-5A airplanes with serial numbers 46580 through 46638 are equipped with two 50-caliber machine guns and three 30-caliber machine guns. Two of the three 30-caliber machine guns are mounted in the bow turret, and the third in the tunnel gun position. In addition, for PBY-5A airplanes with serial numbers 46624 through 46638, provisions are made in the tunnel gun compartment to mount two ball and socket mounts for 30-caliber machine guns, one on each side of the center line of the airplane.

PBY-5A airplanes prior to serial number 46580 and all PBY-5 airplanes (See the INTRODUCTION to this MANUAL for a complete list of serial numbers covered) are equipped with only one 30-caliber machine gun in the bow turret. All other gunnery equipment in these earlier model airplanes is the same as for the later models.

(2) BOW GUNS.

(a) PBY-5A airplanes with serial numbers 46580 through 46638.

1. DESCRIPTION. *(See figure 282.)*—Two 30-caliber machine guns are located in the bow turret and are mounted on a MK 14 adapter. The gun barrels protrude thru a Plexiglas ball bolted to the gun mount. Ammunition is fed to the guns from two cans located just below the guns. A stowage is provided for additional ammunition to the right of the gunner. A Mark 9 illuminated gun sight is bolted to a bracket on the Mark 14 adapter.

The turret is maneuvered manually by the use of a bail mounted in the rear of the turret. With this bail the gunner is able to move the turret 170° in azimuth, 85° on each side of the center line. The MK 14 adapter is a hand held mount with the conventional spade grips. With these grips the gunner is able to depress the guns 23° and elevate them 63°. An additional 27° on each side of center line can also be obtained in azimuth by hand movement of the mount.

The guns are fired manually by the conventional thumb triggers that are located between the spade grips. The guns are charged with a manual gun charger located on the outboard side of each gun.

The guns may be partially dismantled and the barrels removed for servicing without removing the guns from the gun mount.

The guns may be removed individually from the gun mount without removing the mount. The guns, gun mount, and Plexiglas ball can be removed as one unit from the airplane.

2. REMOVAL.

a. BOW GUNS AND MOUNT.

(1) Disconnect the electrical wire (3) that plugs the gun sight (5) into the electrical power supply of the airplane.

No.	PART No.	NAME
1		Gun Cover Plate
2		Thumb Screw—Cover Plate
3		Electrical Conduit—Gun Sight
4		Screw—Gun Sight Mounting
5	Mark 9	Illuminated Gun Sight
6		Gun Sight Bracket
7	Mark 14	Gun Adapter and Post
8	AN4-DD10	Bolt
	AN310-D4	Nut
	AN960-D416	Washer
9	PB16437	Vertical Rollers
10	AN4-DD12	Lower Bolt
	AN4-DD7	Upper Bolt
	AN310-D4	Nut
	AN960-D416	Washer
11	PB16439	Adapter Bearing Assembly
12		Spring Clip
13	PB16126	Ammunition Cans
14	PB16441	Lower Bearing Plate
15		Support—Ammunition Cans

Items 9, 11, 13 and 14 are Ryan Aeronautical Co. part numbers.
All items listed above are government furnished.

(2) Remove the four bolts (10) that clamp the gun adapter post (7) into place.

(3) Lift the assembled unit from the turret; carry it through the airplane and remove through the side waist blisters. The gun mount can also be removed through the escape hatch in the bow turret.

b. GUN SIGHT.—The gun sight (5) may be detached by removing two screws (4) from the gun sight bracket (6) and lifting the sight off the bracket.

c. AMMUNITION CANS. — Release the spring clips (12) that hold the two ammunition cans (13) in place and lift the cans off the supporting bracket (15).

d. GUNS.

(1) GUN REMOVAL FROM GUN MOUNT.

(a) Loosen the thumb screw (2) located on center line between the grips. The cover plate (1) can then be slid off the mount.

(b) Remove forward and rear gun mounting bolts.

(c) Guns are now free of the mount.

(2) DISASSEMBLY FOR CLEANING AND SERVICING.

(a) Loosen the thumb screw (2) located on center line between the grips. The rear cover plate (1) can then be slid off the mount.

(b) Disassemble the guns as necessary for cleaning. Be careful not to disturb the attachment of the gun sight to the mount since it will then be necessary to rebore-sight the guns.

e. REMOVING TURRET FROM AIRPLANE.

(1) Disconnect the electrical wiring that runs to the illuminated gun sight plug.

(2) Remove the lower horizontal cluster of rollers (14) that are located just below the turret structure that supports the mount.

(3) Remove 12 bolts (8) which tie the adapter mount (11) to the upper and lower roller plates (14), then remove adapter mount (11) from the turret by removing the eight screws which attach it to the turret.

(4) Remove all the vertical rollers (9) that are located around the turret.

(5) Lift the turret from the airplane. The turret would be much lighter and easier to handle if first the guns and mount are removed as outlined in paragraph *a*, (2), *(a)*, *2*, a.

3. INSTALLATION.—To install the bow turret, reverse the procedure as outlined in paragraph *a*, (2), *(a)*, *2*, e.

4. BORE-SIGHTING.—Since the guns cannot be adjusted with respect to the adapters, the illuminated sight must be bore-sighted to the guns by means of a template *(See figure 283 for template construction)*. This template should be placed 50 ft. from the muzzle of the guns so that the line of sight and gun fire will converge at 300 yds. Before tightening the sight clamp bolts, roughly align the sight hood to approximate parallelism with the gun axis by moving the whole sight in the sight clamp so the final bore-sighting can be accomplished within the limits of the fine adjustments on the sight.

(b) PBY-5A AIRPLANES WITH SERIAL NUMBERS PRIOR TO 46580 AND ALL PBY-5 AIRPLANES.

Note

For a complete list of serial numbers covered, see the INTRODUCTION to this MANUAL.

1. DESCRIPTION.—One 30-caliber machine gun is located in the bow turret and is mounted on a Mark 9 gun mount adapter. The gun accessories include a MK 7 ammunition magazine, MK 3 Mod. 1 ejected case container, MK 5 ejected link container, MK 8 rear ring sight, and a MK 5 forward bead sight.

The MK 9 adapter yoke post seats in the socket of a stirrup. The stirrup is bolted to the bow gun mount carriage. The stirrup is locked in the firing position by a lever on the right-hand side. The carriage, together with the revolving circular windshield, moves on a track which is permanently fastened to the structure of the hull. The gun, with the adapter and stirrup, is moved in azimuth with the carriage and the circular windshield. An azimuth adjustment, consisting of two horizontal screws in the upper portion of the stirrup, permits an adjustment of the angle of train (or azimuth) of the gun and adapter relative to the stirrup, carriage and windshield. The heads of the two horizontal adjusting screws fit against and position the forward face of the adapter. The amount of adjustment is five degrees on either side of the center line of the stirrup. The gun has a vertical movement of 130° (from 40° below horizontal to vertical). The ring sight and the post sight are normally adjusted so that their center line is 4 1/16 inches above the center line of the bore of the gun.

The carriage, riveted to the windshield, moves on the circular track, supported by 17 rollers. Four large rollers move about a horizontal axis, and 13 rollers move about a vertical axis. The revolving windshield moves on seven vertical and eight horizontal rollers. To make the windshield and mount readily removable, all horizontal rollers and the lower vertical roller bracket on the carriage can be removed.

The turret is held in position by two friction blocks, spring-loaded to press against the track. To rotate the turret, these blocks may be released by pulling back on the small lever just forward of the

right-hand gun grip. A Bowdenite cable connects this lever to the blocks which are housed on the turret above the gunner's right knee.

The emergency release consists of a ring link at the housing, with connections to the spring-loaded blocks. A pull on this ring releases the blocks. The turret may be kept in this released (unlocked) position by slipping the ring over a pin just inboard of the ring.

2. GUN STOWAGE.—To stow the bow gun the following procedure is outlined:

a. Elevate the gun to a vertical position.

b. Rotate the windshield to the right until it hits the stop.

c. Unlock the stirrup, retract the gun, and swing it inboard.

d. Place the muzzle in the socket aft of the firing step and lock the spade grip to the bracket on bulkhead 1.

e. Lock the turret with the friction lock (left of gun mount).

f. Slide the slot cover in place.

g. Clip the manhole cover harness snaps into the eyebolts on the windshield on the straight side of the manhole.

h. Swing the cover up and lock with toggle locks along the rim.

i. To place the gun in firing position, reverse the procedure above.

3. REMOVAL.

a. BOW GUN AND MOUNT.

(1) Remove the turret lock release lever assembly from the right-hand side of the gun by loosening the three screws which attach it to the gun and stow it on the aft face of the right-hand panel in the turret.

(2) Remove the gun mount adapter latch that holds the adapter yoke post to the stirrup.

(3) Lift the assembled unit from the supporting structure and remove through the top of the turret or the side waist blisters.

b. GUN SIGHT. — The ring and bead sights can be detached by removing the two attaching screws and nuts.

c. AMMUNITION MAGAZINE. — The MK 7 ammunition magazine that is held in the MK 9 adapter can be removed by pulling upward on the magazine.

d. EJECTED LINK CHUTE.—The MK 5 ejected link chute can be removed from the gun by removing the pin that attaches the chute to the gun. This pin is located between the gun and the ejected link chute.

e. GUN.

(1) GUN REMOVAL FROM GUN MOUNT.

(a) Remove ejected link chute as described in paragraph *a*, (2), *(b)*, *3*, d above.

(b) Remove the two bolts that fasten the gun to the MK 9 adapter.

(c) The gun is now free of the mount.

(2) DISASSEMBLY FOR CLEANING AND SERVICING.

(a) Remove ejected link chute as described in paragraph *a*, (2), *(b)*, *3*, d above.

(b) Disassemble the guns as necessary for cleaning. Take care not to disturb the attachment of the sight to the gun barrel since it would be necessary to rebore-sight the gun.

f. REMOVING TURRET FROM AIRPLANE.

(1) Remove the gun and gun mount from the turret as described in paragraph *a*, (2), *(b)*, *3*, a above.

(2) Remove the bail assembly from the turret in the following manner:

(a) Disconnect shock cord from the bail by removing the attaching nut, bolt and washer.

(b) Detach bail mounting brackets, one on each side of the turret, by removing the six screws in each bracket.

(c) The bail is now free of the turret and may be removed.

(3) Remove cam lock assembly from the

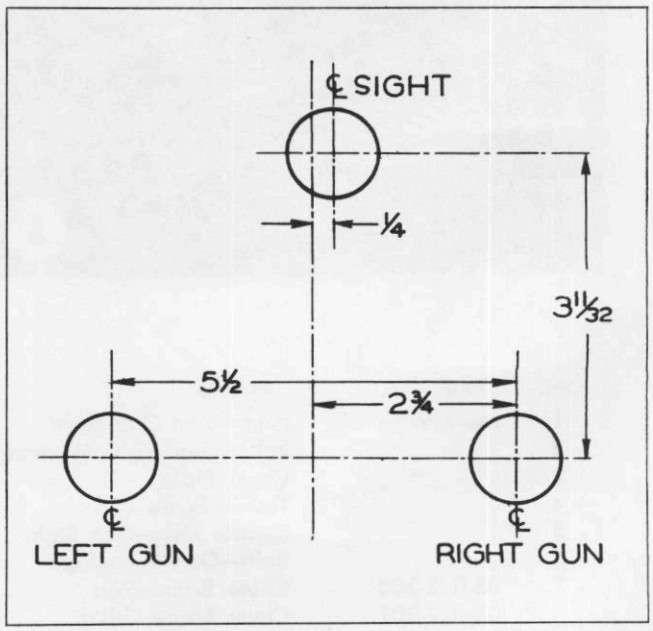
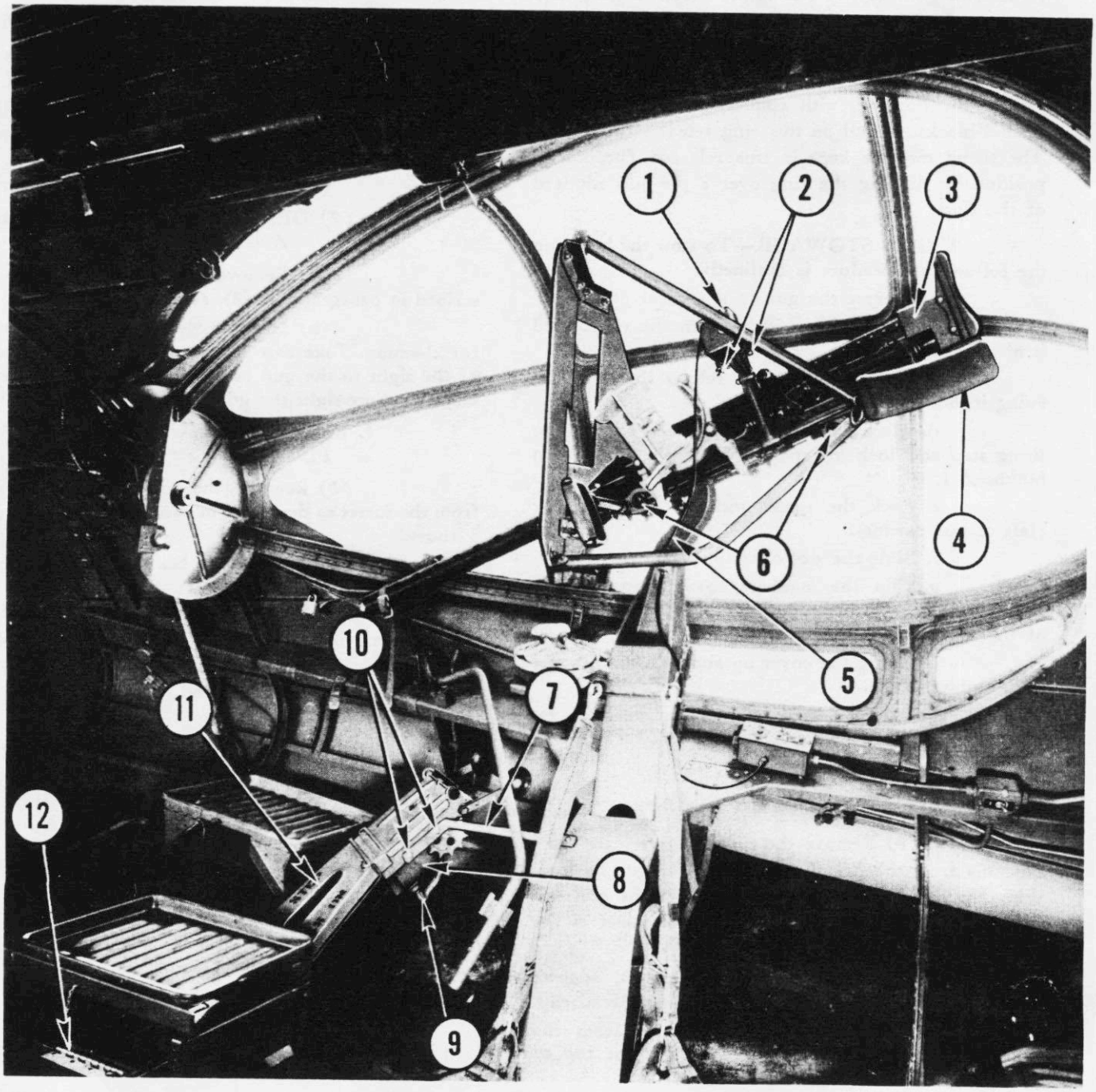


Figure 283—Bore-Sighting Diagram for Bow Turret



No.	PART No.	NAME	No.	PART No.	NAME
1	Mark 9	Illuminated Gun Sight	8	03-047-080	Assist Motor Install.—Port
2		Bolts—Gun Sight Mounting		03-047-384	Assist Motor Install.—Stb'd.
3		Cover Plate	9		Electrical Conduit
4		Thumb Screw	10	AN3-4A	Bolt
5		Electric Plug—Gun Sight		AN372-1032	Nut
6		Bolts—Gun Mounting	11	03-042-400	Ammunition Chute—Port
7	03-042-705	Chute Brace—Port		03-042-401	Ammunition Chute—Stb'd.
	03-042-701	Chute Brace—Stb'd.	12		Hinge Pin

Items 7, 8 and 11 are Bell Aircraft Corp. part numbers.

Figure 284—Side Waist Gun

left-hand side of the turret by loosening the four screws that fasten it to the turret.

(4) Remove lower vertical roller support from the gun carriage by loosening the five nuts, bolts and washers that fasten it to the carriage.

(5) Release stirrup and allow it to hang from the carriage.

(6) Remove the four horizontal rollers from the gun carriage by loosening the four screws that fasten each roller assembly to the carriage.

(7) Remove the eight horizontal roller assemblies, one from the base of each of the uprights in the turret, by loosening the four screws that attach each roller assembly to the turret.

(8) The turret may now be lifted from the airplane.

4. INSTALLATION.—To install the bow turret, reverse the removal procedure as outlined in paragraph *a*, (2), *(b)*, *3*, f above.

5. BORE-SIGHTING. — No information is available to bore-sight the bow gun.

(3) SIDE WAIST GUNS.

(a) DESCRIPTION. *(See figure 284.)*—One 50-caliber machine gun is mounted in each of the side waist blisters on a MK 10-2 (L.H.) and a MK 10-3 (R.H.) adapter. Ammunition is fed to the guns from a continuous feed. A Mark 9 illuminated gun sight is bolted to a bracket on each adapter. Switches for controlling the ammunition booster motors and gun sight are located just forward of the gun post on the beam running beneath the blister.

The guns are manually moved and charged.

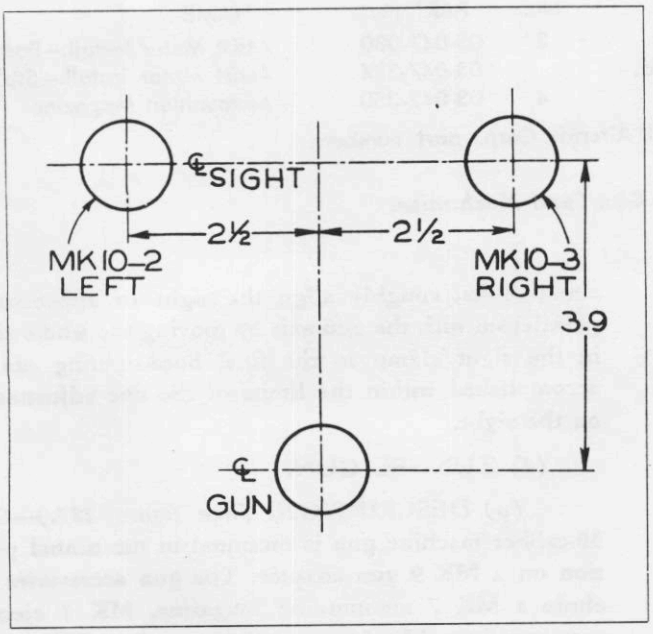


Figure 285—Bore-Sighting Diagram for Waist Guns

The gun may be partially dismantled and the barrels removed for servicing without removing the guns from the airplane.

The gun may be removed from the gun mount without removing the adapter. The gun, gun mount, and armor plate can be removed as one unit from the airplane.

Armor plate is provided the gunner, and the removal and installation of the armor is explained in paragraph *d*, (3).

(b) REMOVAL.

1. SIDE WAIST GUNS AND MOUNT.

a. Disconnect the electrical wire (5) that plugs the gun sight (1) into the electrical power supply of the airplane.

b. Remove the gun mount adapter latch that holds the yoke post to the gun post.

c. Lift the assembled unit from the gun post and remove through the side waist blister opening.

2. GUN SIGHT.—The Mark 9 gun sight can be removed by removing the two attaching bolts (2).

3. AMMUNITION BOX.

a. Remove bolts that hold the ammunition box (4) to the airplane. *(See figure 286.)*

b. Remove hinge pins (12) that fasten the box to the ammunition chutes (11). *(See figure 284.)*

c. The ammunition box can now be removed.

4. AMMUNITION CHUTE.
(See figure 284.)

a. Remove electrical conduit (9) that plugs into the micro-switch beside the ammunition booster motor (8).

b. Remove the bolts (10) that hold the chute to the supporting steel tubes (7).

c. Detach the lower bracket from the waist gunner's floor by removing the two nuts, bolts and washers.

d. The ammunition chute can now be removed.

5. GUNS.

a. GUN REMOVAL FROM MOUNT.
(See figure 284.)

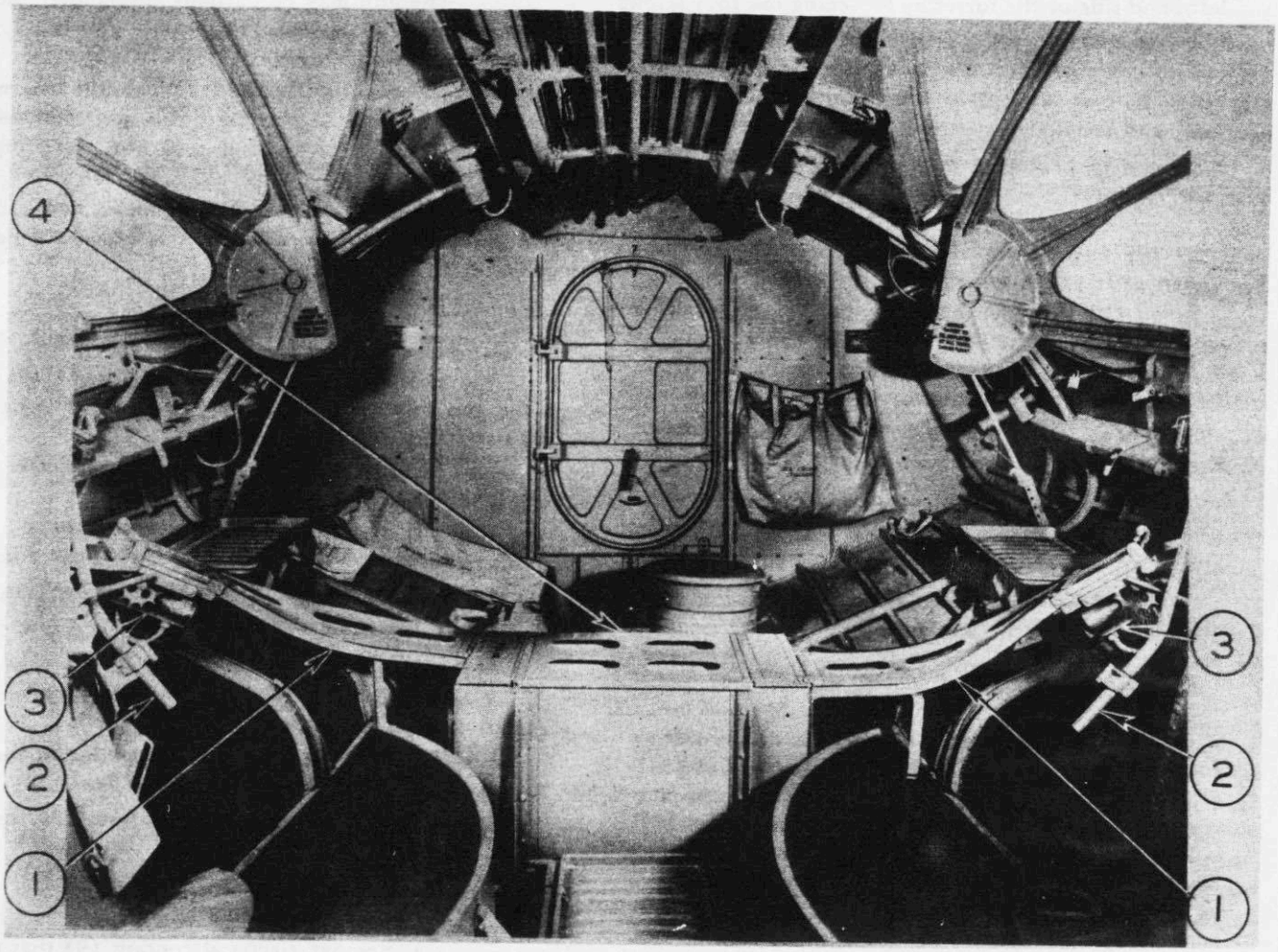
(1) Loosen the thumb screw (4) that is located beneath the rear cover plate (3) on center line of the mount, then slide the rear cover plate off the mount.

(2) Remove forward and rear gun mounting bolts (6) that hold the gun to the adapter.

(3) The gun is now free of the mount.

b. DISASSEMBLY FOR CLEANING AND SERVICING.

(1) Loosen the thumb screw (4) that is located beneath the rear cover plate (3) on center line



No.	PART No.	NAME	No.	PART No.	NAME
1	03-042-400	Ammunition Feed Chute—Port	3	03-047-080	Assist Motor Install.—Port
	03-042-401	Ammunition Feed Chute—Stb'd.		03-047-384	Assist Motor Install.—Stb'd.
2	28A5592	Firing Guard	4	03-042-350	Ammunition Magazine

Items 1, 3 and 4 are Bell Aircraft Corp. part numbers.

Figure 286—Waist Gun Feed Mechanism

of the mount. The rear cover plate can then be slid off the mount.

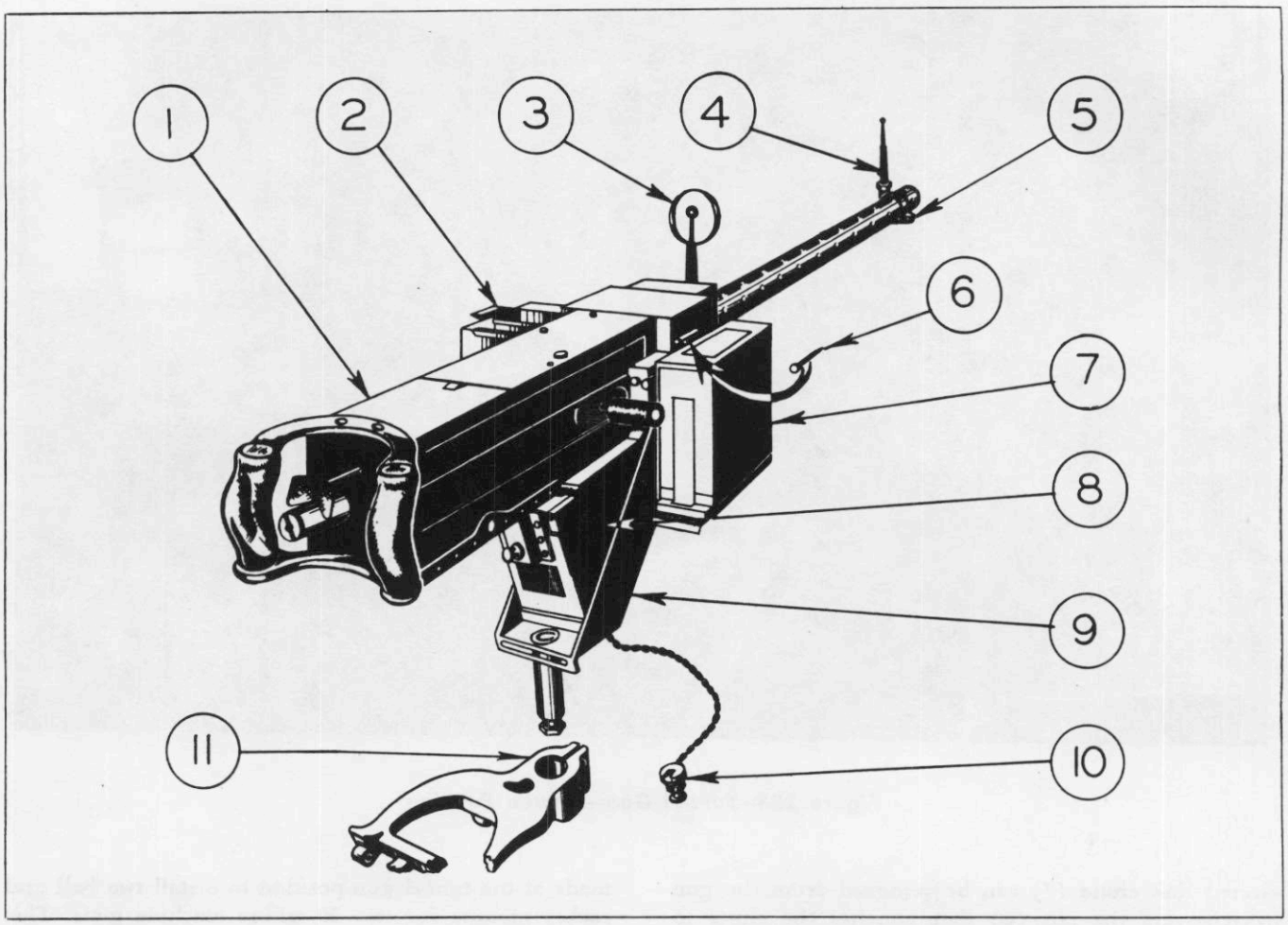
(2) Disassemble the guns as necessary for cleaning. Take care not to disturb the sight attachments.

(c) INSTALLATION. — To install the side waist gun mount, reverse the procedure as outlined in paragraph a, (3), (b).

(d) BORE-SIGHTING.—The illuminated gun sight must be bore-sighted to the gun by means of a template. *(See figure 285 for template construction.)* This template should be placed 50 ft. from the muzzle of the gun so that the line of sight and the gun fire will converge at 400 yds. Before tightening the sight clamp bolts, roughly align the sight to approximate parallelism with the gun axis by moving the whole sight in the sight clamp so the final bore-sighting can be accomplished within the limits of the fine adjustments on the sight.

(4) TUNNEL GUN.

(a) DESCRIPTION. *(See figure 287.)*—One 30-caliber machine gun is mounted in the tunnel position on a MK 9 gun adapter. The gun accessories include a MK 7 ammunition magazine, MK 3 ejected case container, MK 5 ejected link container, MK 8 rear ring sight, and a MK 5 forward bead sight. Four MK 7



No.	PART No.	NAME	No.	PART No.	NAME
1	BAM-30, M2	Flexible Machine Gun	7	Mark 5	Ejected Link Chute
2	Mark 7	Ammunition Magazine	8	Mark 3, Mod. 1	Ejected Case Container
3	Mark 8	Sight—Open Rear Ring	9	Mark 9	Adapter—Gun Mount
4	Mark 5	Sight—Forward Bead	10		Latch—Gun Mount Adapter
5		Screw—Sight Bracket	11	28F1104	Stirrup—Tunnel Gun
6		Pin—Container Attaching			

All items except number 11 are government furnished.

Figure 287—Tunnel Gun—Ready Position

ammunition magazines are stowed to the left of the gunner.

The gun is manually moved and charged. The gun may be partially dismantled and the barrel removed for servicing without removing the gun from the airplane.

The gun, gun mount, ammunition magazine, ejected link container and ejected case container can be removed as one unit from the airplane.

(b) REMOVAL.

1. TUNNEL GUN.

a. Remove the gun mount adapter latch (10) that holds the adapter (9) yoke post to the stirrup (11).

b. Lift the assembled unit from the supporting structure and remove through the tunnel gun opening or the side waist blisters.

2. GUN SIGHT.—The ring (3) and bead (4) sights can be detached by removing the two attaching screws and nuts (5).

3. AMMUNITION MAGAZINE.—The MK 7 ammunition magazine (2) that is held in the MK 9 adapter (9) can be removed by pulling upward on the magazine.

4. EJECTED LINK CHUTE.—The MK 5

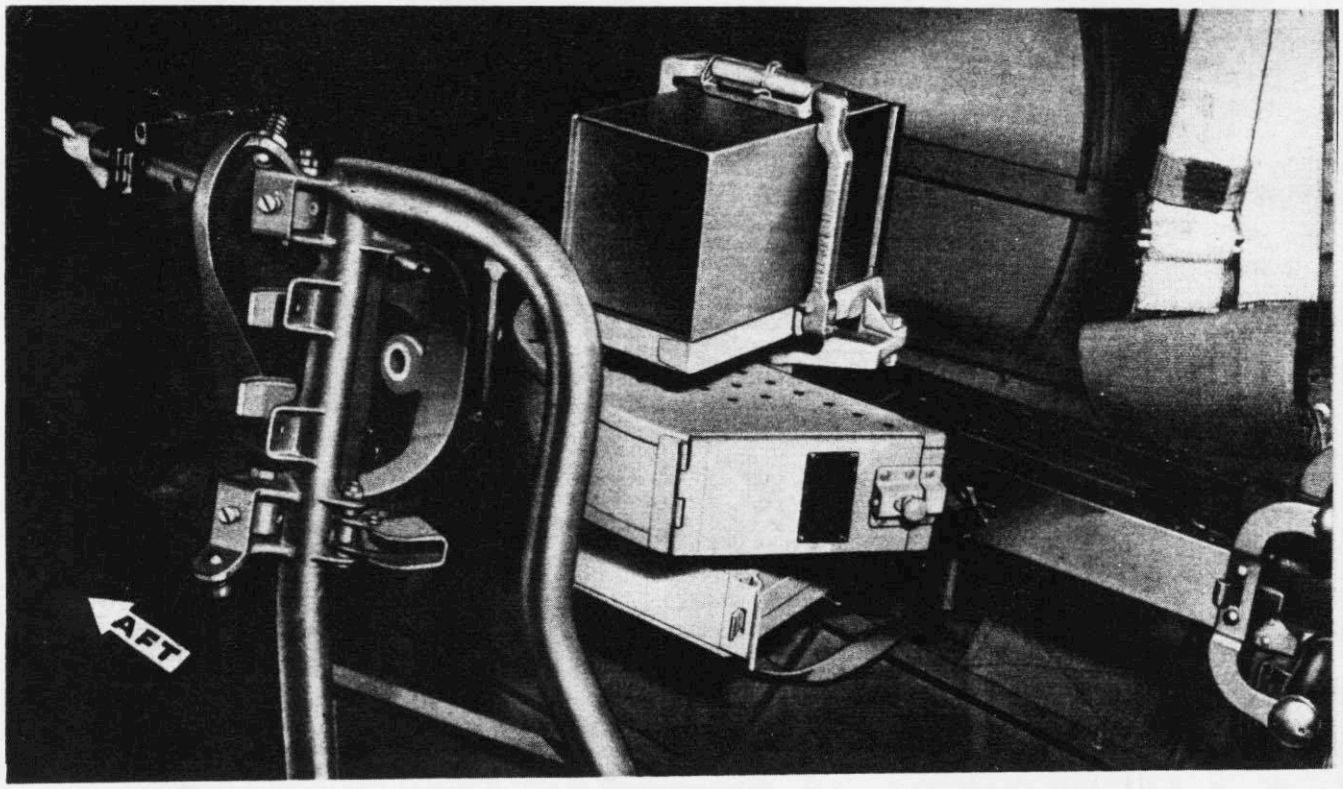


Figure 288—Tunnel Gun—Stowed Position

ejected link chute (7) can be removed from the gun by removing the pin (6) that attaches the chute to the gun. This pin is located between the gun (1), and the ejected link chute.

5. GUN.

a. GUN REMOVAL FROM MOUNT.

(1) Remove ejected link chute as described in paragraph *a*, (4), *(b)*, *4*.

(2) Remove the two bolts that fasten the gun to the MK 9 adapter.

(3) The gun is now free of the mount.

b. DISASSEMBLY FOR CLEANING AND SERVICING.

(1) Remove ejected link chute as described in paragraph *a*, (4), *(b)*, *4*.

(2) Disassemble the guns as necessary for cleaning. Take care not to disturb the attachment of the sight to the gun barrel since it would be necessary to rebore-sight the gun.

(c) INSTALLATION.—To install the tunnel gun, reverse the removal procedure as outlined in paragraph *a*, (4), *(b)*.

(d) BORE-SIGHTING.—No information is available to bore-sight the tunnel gun.

(5) TUNNEL GUN BLISTERS.—Provisions are made at the tunnel gun position to install two ball and socket mounts for two 30-caliber machine guns. This equipment is customer furnished and installed.

Note

On all PBY-5 airplanes and on PBY-5A airplanes prior to serial number 46624, the two ball and socket mounts are to be installed by service action.

To install this equipment, it is necessary to remove the Plexiglas windows located in the tunnel gun position and install the customer furnished blister which includes the ball and socket mount. *(See figure 289.)*

b. BOMB EQUIPMENT.

(1) GENERAL. — The airplane is designed to carry several alternate bomb loads suspended from each wing. The bomb carrying equipment includes all the accessories necessary to accommodate the various bomb loads, and the electrical and manual bomb release systems.

The bomb loads that may be carried are:

(a) Twelve 100 pound G.P., fragmentation, practice, or chemical bombs, suspended six under each wing.

(b) Eight 325 pound depth bombs, suspended four under each wing.

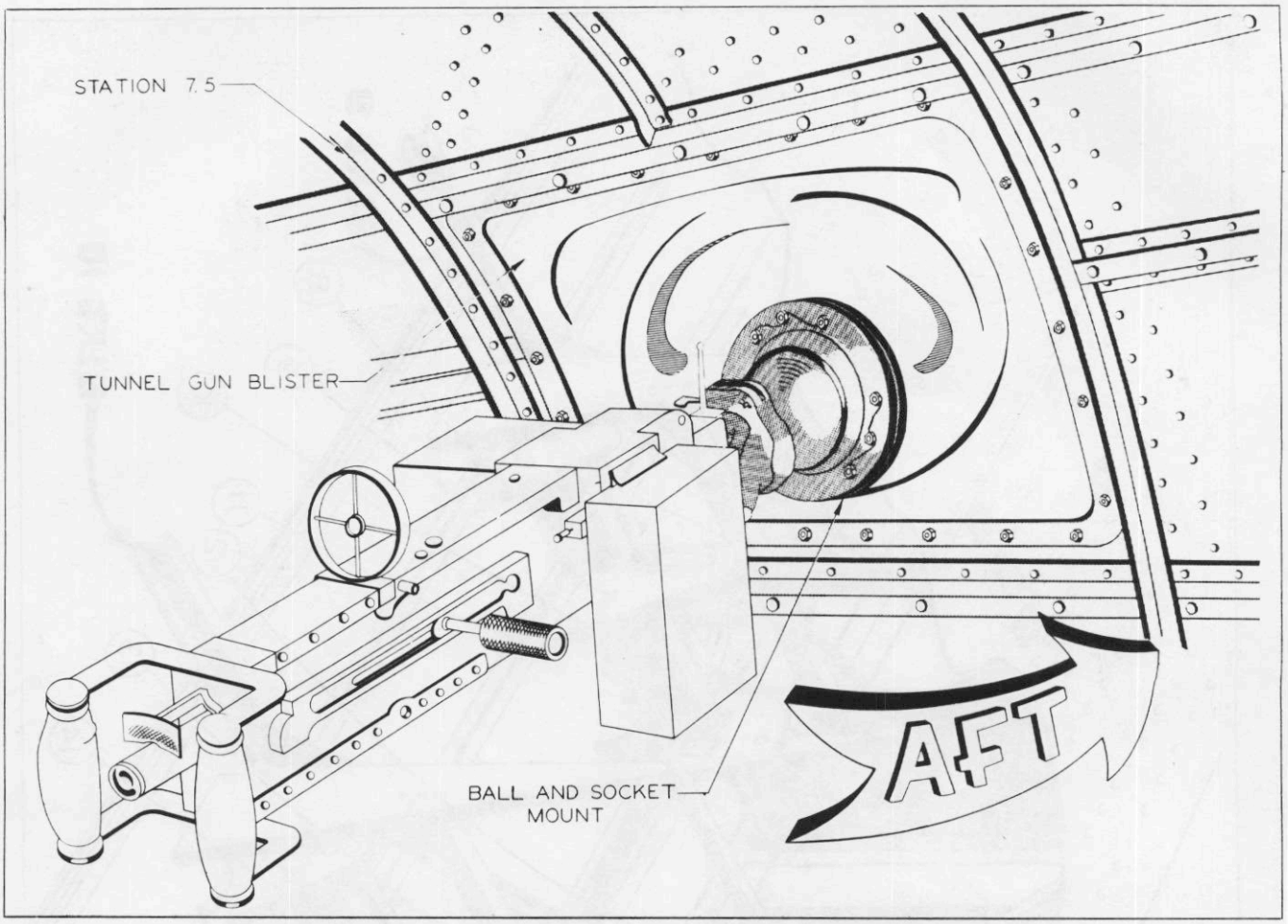


Figure 289—Tunnel Gun Blister Position

(c) Four 500 pound G.P. or S.A.P. bombs, suspended two under each wing.

(d) Four 1000 pound G.P., A.P. or S.A.P. bombs, suspended two under each wing.

(2) BOMB CARRYING EQUIPMENT.

(a) GENERAL.—Bombs are carried by racks located within the lower surface of the wing, racks attached beneath the lower surface of the wing, or by addition of certain accessories to the torpedo carrying equipment. (See paragraph *c*, (2), *(a)*.) The quantity and character of the bomb load to be carried determines which rack, or combination of racks, is to be used.

(b) BOMB RACKS INSIDE WING.

1. DESCRIPTION. — The principal bomb carrying unit is the group of racks located within the wing. Two Mark 51-7 bomb racks are mounted inside the lower surface of each wing, slightly outboard of the wing strut attachments. These racks are designed to accommodate all sizes of bombs up to and including the 1000 pound type.

2. REMOVAL. (See figure 290.)—Access to the racks may be gained by entry through the manholes opening in the top surface of each wing outer panel. The racks may be reached by crawling through the inside of the wing toward the center of the airplane.

a. Pull the connector plug (4) of the electrical harness from its receptacle.

b. Disconnect the manual release cable (7) from the rack (1) by removing the bolt (14) at the attachment point just above the rack.

c. Remove the hoist cable guide tube (6) by unscrewing the nuts on the attaching U-bolts (13).

d. Remove forward stringer splice yoke (10) by removing attaching bolts (11).

e. Remove aft stringer splice yoke (8) by removing attaching bolts (9).

f. Remove six bolts (2) and spacers which secure rack in place.

g. Lift out Mark 51-7 rack.

h. Replace stringer splice yokes (8) and (10).

WARNING

Do not fly airplane without stringer splice yokes installed.

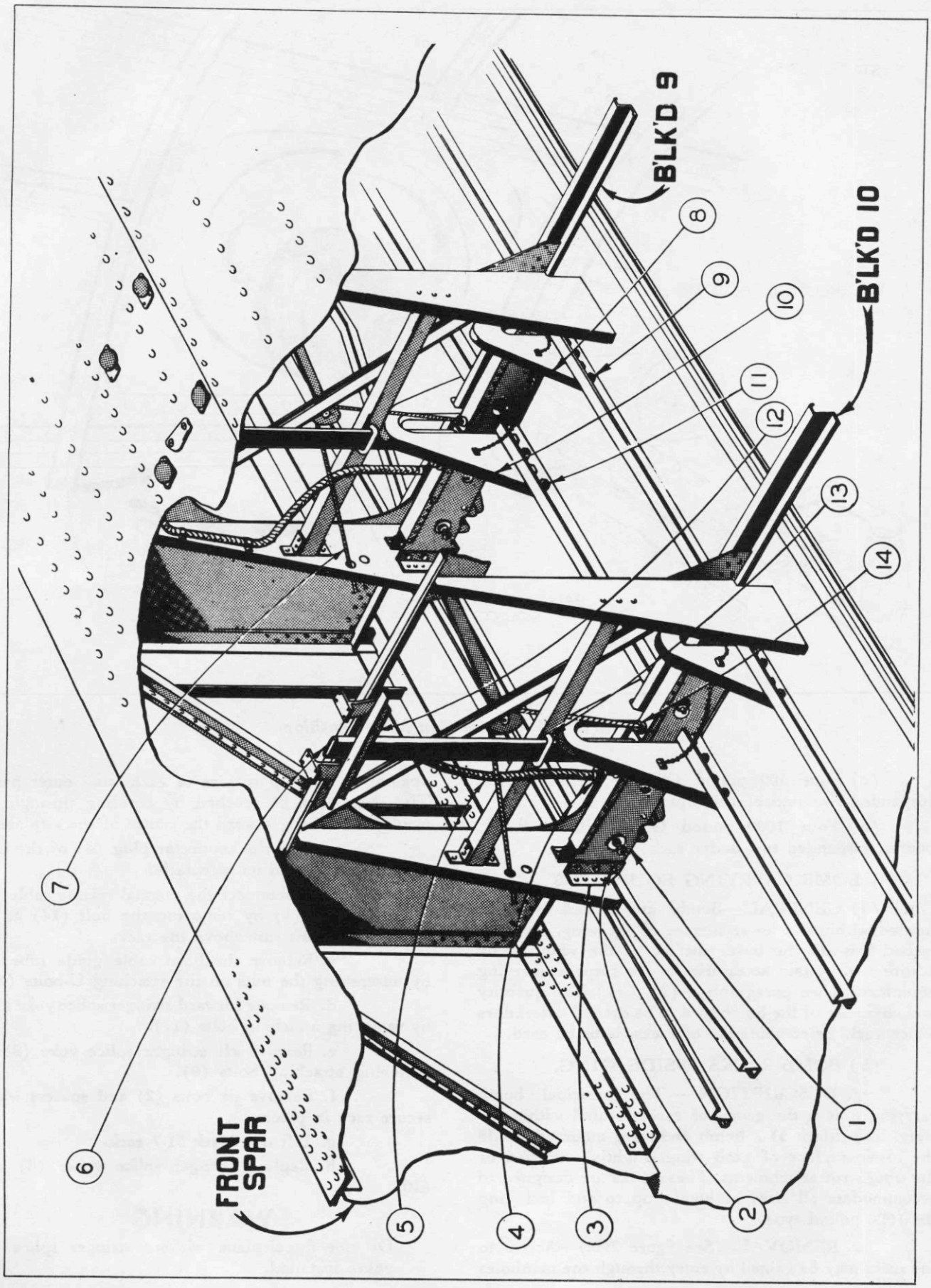


Figure 290—Internal Wing Bomb Racks

No.	PART No.	NAME
1	Mark 51, Mod. 7	Internal Bomb Rack
2	AN6-20A	Bolt
	AN365-624	Nut
	Q820-D12-29	Spacer
3		Angle—Bomb Rack Support
4		Electrical Connector Plug
5		Electrical Harness
6	28A5157	Guide Tube—Hoist Cable
7		Bomb Release Cable
8	28W2005-113	Stringer Splice Yoke—Port
	28W2005-114	Stringer Splice Yoke—Stb'd.
9	AN4-5A	Bolt—Outboard Side
	AN4-6A	Bolt—Inboard Side
	AN365-428	Nut
	Q7102-AL416	Washer
10	28W5025 L&R	Stringer Splice Yoke
11	AN4-5A	Bolt—Outboard Side
	AN4-6A	Bolt—Inboard Side
	AN365-428	Nut
	Q7102-AL416	Washer
12	AN372-D1032	Nut
13	28F2052	"U" Clamp
14	AN23-13	Bolt
	Q7102-AL10	Washer
	AN320-3	Nut
	AN380-2-2	Cotter Pin

3. MAINTENANCE.

a. Replace any Mark 51-7 bomb rack (1) that fails to operate satisfactorily or one that has become excessively worn or damaged.

b. Replace any of the rack attachment bolts (2) or stringer splice yoke bolts (9) and (11) that have worn threads or are damaged.

c. Use crocus cloth to clean any of the electrical connector plugs (4) that have become discolored or corroded.

d. Replace any electrical harness (5) that is chafed or damaged.

e. Repair any dents, cracks, or other damage to the bomb rack mounting structure or stringer splice yokes according to Structural Repair Manual (AN 01-5MA-3.)

4. INSTALLATION.

(See figure 290.)

a. Remove forward and rear stringer splice yokes (8) and (10) as described in paragraphs *b*, (2), *(b)*, *2*, d and *b*, (2), *(b)*, *2*, e.

b. Slide Mark 51-7 bomb rack (1) into place between the bomb rack support angles (3). The rack should be placed so that the electrical plug connection is at the forward end of the rack.

c. Place a spacer between the side plates of the rack at each attaching bolt hole and insert bolts (2).

d. Secure bolts with nuts.

e. Replace stringer splice yokes (8) and (10).

f. Connect manual release cable (7) to rack (1) with bolt (14), which is secured with washer, shear nut, and cotter.

g. Install bomb hoist cable guide tube (6) with U-bolts (13), and nuts (12).

h. Insert electrical connector plug (4) into receptacle on rack and screw tight to secure.

i. Check proper installation of rack by trial operation of electrical and manual release systems.

(c) BOMB PROVISIONS ON TORPEDO RACKS.

1. DESCRIPTION.—When it is desired to carry a load arrangement of eight 325 pound depth bombs, special fittings are added to the torpedo racks to convert them into bomb carrying equipment. It is then possible to supplement the normal quota of four bombs carried by the bomb racks installed inside the wing. For description of the torpedo rack installation, refer to paragraph *c*, (2).

2. REMOVAL.

a. PBY-5A AIRPLANES WITH SERIAL NUMBERS 46598 THROUGH 46638.—Inasmuch as the bomb carrying adaption of the torpedo rack consists only of alteration of the rack itself, procedure for general removal of the racks from the airplane will be identical with that of the torpedo racks, described in paragraph *c*, (2), *(b)*, *1*. Description following will be devoted solely to reconversion of the rack from bomb carrying arrangement to that of torpedo carrying. *(See figure 296.)*

(1) Remove front chock *(36)* by unscrewing four bolts (3).

(2) Invert chock (36) and replace on rack by replacing the four bolts (3). This is the position for carrying torpedoes.

(3) Remove rear chock (35) by unscrewing four bolts (3).

(4) Invert chock (35) and replace with four bolts (3), giving torpedo carrying position.

b. PBY-5A AIRPLANES WITH SERIAL NUMBERS PRIOR TO 46598 AND ALL PBY-5 AIRPLANES.

Note

For a complete list of serial numbers covered, see the INTRODUCTION to this MANUAL.

Inasmuch as the bomb carrying adaption of the torpedo rack consists only of alteration of

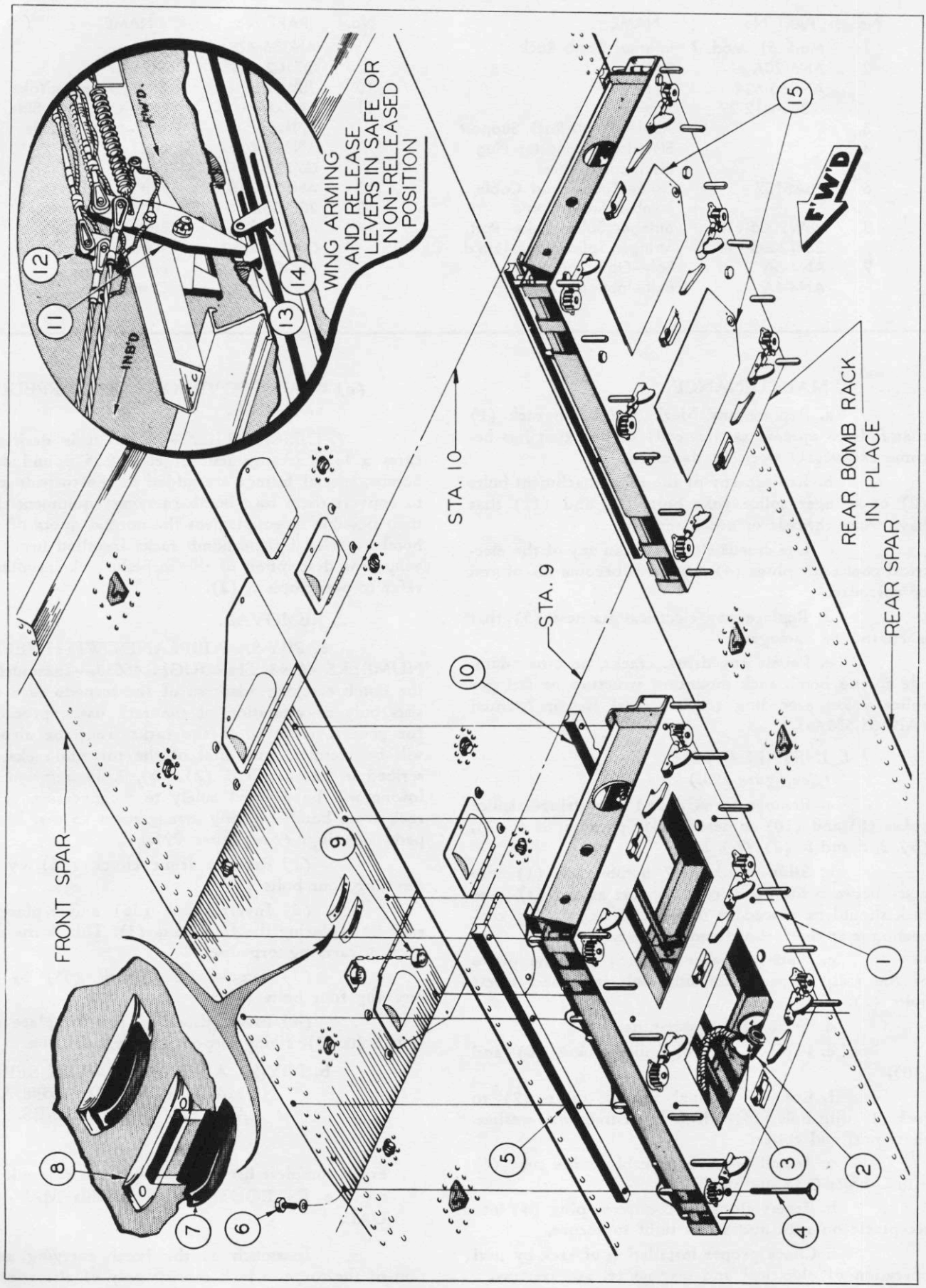


Figure 291—External Wing Bomb Rack

No.	PART No.	NAME	No.	PART No.	NAME
1		Mark 42 Bomb Rack	8	28F1043	Control Lever Guard
2	28E11573	Conduit Assy.	9	2209-6	Protective Cap
3		Knurled Nut	10	28A1033	Rear Rail
4	AN75-45	Attaching Bolt	11	28F1218	Release Lever—Wing
5	28A1032	Forward Rail	12	28F1218	Arming Lever—Wing
6	AN5-4	Plug Bolt	13		Arming Lever—Rack
	Q7102-AL516	Insulating Washer	14		Release Lever—Rack
7	28W4004	Neoprene Plug	15		Bomb Rack Access Doors

Item number 9 is a Cannon Electric Co. part number.

the rack itself, procedure for general removal of the racks from the airplane will be identical with that of the torpedo racks, described in paragraph *c*, (2), *(b)*, *2*. Description following will be devoted solely to reconversion of the rack from bomb carrying arrangement to that of torpedo carrying. *(See figure 297.)*

(1) Remove the front and rear lateral bomb rack chocks (21) by unscrewing the two bolts (20) in each end of the chocks.

(2) Attach the four torpedo rack bumper blocks (5) and (16) to the rack. The two long blocks attach to the forward end of the rack and the two short ones to the aft end.

3. MAINTENANCE.

a. Replace chock bolts which have worn threads or are otherwise damaged.

b. Replace outer chock castings which are found to be cracked or broken.

c. Other maintenance instructions are the same as for the torpedo rack. (See paragraph *c*, (2), *(c)*.)

4. INSTALLATION.

a. PBY-5A AIRPLANES WITH SERIAL NUMBERS 46598 THROUGH 46638.—Inasmuch as this bomb rack is merely an adaption of the torpedo rack, procedure for installation will in general be the same as that of the torpedo installation. (See paragraph *c*, (2), *(d)*, *1*. The starting lanyard and torpedo stop are not needed, so disregard steps (15) and (16).) The description following will discuss only the changes necessary to convert the torpedo installation into a bomb carrying unit.

(1) Remove front chock (36) *(See figure 296)* by unscrewing the four bolts (3).

(2) Invert chock (36) and replace on rack by replacing the four bolts (3). This will provide an arrangement shown in figure 296 as "Bomb Condition."

(3) Remove rear chock (35) by unscrewing four bolts (3).

(4) Invert chock (35) and replace on rack with four bolts (3) giving bomb carrying condition.

b. PBY-5A AIRPLANES WITH SERIAL NUMBERS PRIOR TO 46598 AND ALL PBY-5 AIRPLANES.

Note

For a complete list of serial numbers covered, see the INTRODUCTION to this MANUAL.

Inasmuch as this bomb rack is merely an adaption of the torpedo rack, procedure for installation will in general be the same as that of the torpedo installation. (See paragraph *c*, (2), *(d)*, *2*. The starting lanyard and torpedo stop are not needed, so disregard steps (17) and (18).) The description following will discuss only the changes necessary to convert the torpedo installation into a bomb carrying unit. *(See figure 297.)*

(1) Remove the four torpedo rack bumper blocks (5) and (16) by loosening the four screws in each of the blocks.

(2) Attach the front and rear lateral bomb rack chocks (21) to the rack by means of two bolts (20) through each end of the chocks.

(d) MARK 42 BOMB RACKS.

1. DESCRIPTION.—For twelve 100 pound bomb condition, the Mark 42 racks are used. Four of these racks are installed externally beneath the wing, two in tandem on each side of the airplane center line outboard of the wing struts and directly beneath the area used by the internal racks.

2. REMOVAL.

(See figure 291.)

a. If field work platforms are not available, install portable bomb loading platforms on the lower side of the wing as described in paragraph *c*, (4), *(c)*, *3*. Place the platform in the sockets located at the splice of the wing center section and the outer panel, and the other in the set of sockets opposite the landing light location in the wing leading edge.

b. Remove electrical plug (2) of each rack from receptacle in lower surface of the wing.

c. Replace receptacle caps (19) which are attached to the receptacle by guard chains.

d. Remove lockwire securing the row of four bolts (4) at the front and rear of each rack.

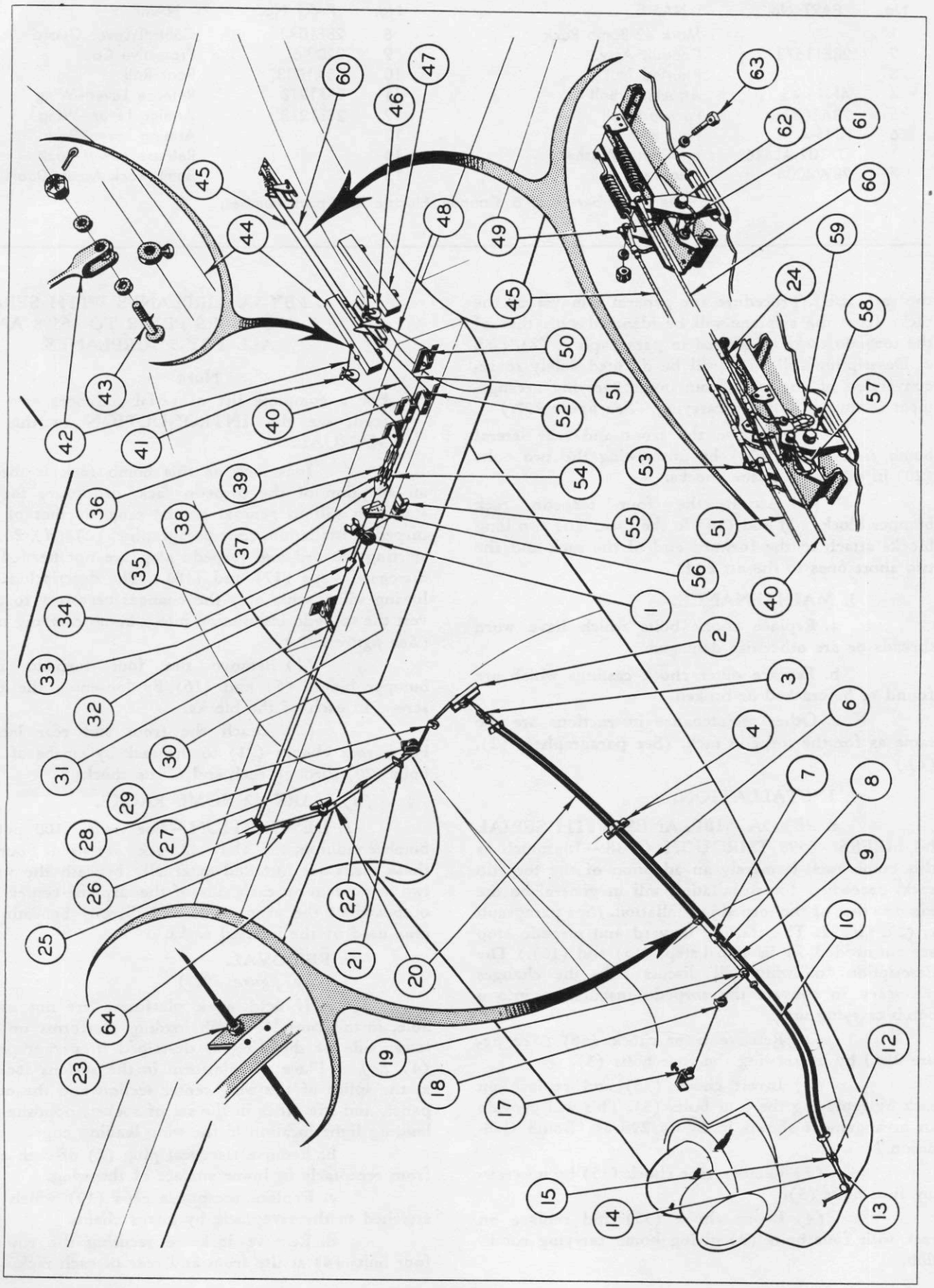


Figure 292—Bomb Arming and Release Cable System

No.	PART No.	NAME
1	Q4002-2-1	Pulley Bracket
	AN210-2A	Pulley
2	28F139-L&R	Pulley Bracket
	AN210-2A	Pulleys
3	Q3112-2	Nut—Stop Pedal
	Q3802-4	Plug—Stop Pedal
4	28F6344	Casing Clip
	AN526-DD832-8	Screw
	AN372-D832	Nut
6	28F1299-4	Bomb Arming Cable—Port
	28F1299-25	Bomb Arming Cable—Stb'd.
7	28C5120	Plate
8	AN155-8S	Turnbuckle
9	*Q6303-ONL-64 3/4	Cable—Port
	**Q6303-ONL-67 3/8	Cable—Port
	Q6303-ONL-68 3/4	Cable—Stb'd.
10	28F6345-6	Bomb Release Cable—Port
	28F6345-14	Bomb Release Cable—Stb'd.
12	AN155-8S	Turnbuckle
13	Q6303-BNR-25	Arming Cable
14	Q6303-BNR-24½	Release Cable
15	AN155-8S	Turnbuckle
17	*28F6130-5	Pulley Bracket—Port
	**28F6130-70L	Pulley Bracket—Port
	28F6130-70R	Pulley Bracket—Stb'd.
	AN210-2A	Pulley
18	28F1427-L&R	Pulley Bracket
	AN210-2A	Pulley
19	28F1430-3	Pulley Bracket—Port
	28F1429	Pulley Bracket—Stb'd.
	AN210-2A	Pulley
20	28F6345-7	Bomb Release Cable—Port
	28F6345-15	Bomb Release Cable—Stb'd.
21	28F1541-L&R	Fairlead
22	AN155-8S	Turnbuckle
23	AN316-4R	Bowdenite Casing Nut
24	Q506-A2-8	Bonding Braid
25	AN155-8S	Turnbuckle
26	AN210-2A	Pulleys
27	28F4017-L&R	Pulley Bracket
	AN210-2A	Pulleys
28	28A5152-15	Bomb Release Cables—Port
	28A5152-16	Bomb Release Cables—Stb'd.
29	AN210-1A	Pulleys
30	Q6303-CNL-48 1/8	Torpedo Release Cable—Port
	Q6303-CNL-48 11/16	Torpedo Release Cable—Stb'd.
31	28F6341	Lever
32	28A5152-22	Bomb Release Cable
33	28C5120	Plate
34	28A5152-24	Cable
35	28C5122	Plate
36	Q4002-1-1	Pulley Bracket
	AN210-2A	Pulley
37	AN155-8S	Turnbuckle
38	AN155-8S	Turnbuckle
39	28F6921-L&R	Pulley Bracket
	AN210-2A	Pulley
40	28A5152-11	Bomb Release Cable Ass'y.
41	Q4002-2-1	Pulley Bracket
	AN210-2A	Pulley
42	28A5152-7	Bomb Release Cable Ass'y.
43	AN23-13	Bolt
	AN310-3	Nut
	AN960-A10L	Washers
	AN380-2-3	Cotter Pin
44	Mark 51 M7	Bomb Rack
45	28F1299-8	MK 42 Rack Arming Cable
	AN155-8S	Turnbuckle
	AN160-8S	Fork Fitting
46	Q4002-2-1	Pulley Bracket
	AN210-2A	Pulley
47	Mark 51 M7	Bomb Rack
48	28A5152-8	Bomb Release Cable Ass'y.
49	28F1218	Lever
50	Q4002-1-1	Pulley Bracket
	AN210-2A	Pulley
51	28A5152-19	Bomb Arming Cable Ass'y.—Port
	28A5152-20	Bomb Arm. Cable Ass'y.—Stb'd.
52	Q4002-1-1	Pulley Bracket
	AN210-2A	Pulley
53	28F1218	Lever
54	AN155-8S	Turnbuckle
55	AN210-2A	Pulley
56	28A5167-L&R	Fairlead
57	Q506-A2-3	Bonding Braid
58	28F1218	Lever
59	Q506-A2-3	Bonding Braid
60	28F1299-8	MK 42 Bomb Rack Release Cable
	AN155-8S	Turnbuckle
	AN160-8S	Fork Fitting
61	Q506-A2-3	Bonding Braid
62	28F1218	Lever
63	AN23-10	Bolt
	AN320-3	Nut
	AN380-B2-2	Cotter Pin
64	28F1238-2	Pulley Bracket—Port
	28F1238-3	Pulley Bracket—Stb'd.
	AN210-1A	Pulleys

*PBY-5A only.
**PBY-5 only.

e. Remove all except one of the middle bolts at the front of the rack.

f. Remove all except one of the middle bolts at the rear of the rack.

g. Support rack (1) with hand or shoulder while removing remaining two bolts (4).

Note

It is recommended that removal of the rack be accomplished by two persons working as a pair with the rack *between them.*

h. Lower rack and spacer rails (5) and (10) to loading platform.

i. Insert neoprene plug (7) in slot in control lever guards (8). There are two of these slots per rack.

j. Plug attachment bolt holes in wing (eight per rack) with bolts (6) and .010 aluminum washers for insulation.

k. Repeat process for remaining Mark 42 racks.

l. Lower racks (1) and rails (5) and (10) from platform to ground.

m. Remove platforms and erect on opposite wing. (See paragraph *c*, (4), *(c)*, *3.*)

n. Remove remaining Mark 42 racks, repeating process just described.

3. MAINTENANCE.

a. The Mark 42 rack and component parts are made of corrosion resistant steel, but occasionally replacement parts are made of other steel which is subject to corrosion. The racks should be inspected for corrosion in such parts, and the parts should be replaced if they show deterioration or tendency to bind or jam in operation.

b. The access doors (15) in the lower face of the rack should be removed by unlocking the Dzus fasteners, to permit inspection of the operating mechanism of the rack.

c. Check solenoid movements by hand operation to assure free movement. The three solenoids are inside the rack along the forward edge and may be reached through the access doors.

d. Straighten the lower fairing of the rack if it interferes with the solenoid release linkage.

e. Examine the electrical cables for chafing or other damage. Replace cables that are damaged. Use crocus cloth to clean any of the electrical connections that have become discolored or corroded.

f. Replace any Mark 42 rack that fails to operate satisfactorily or one that has become excessively worn or damaged.

g. Replace any of the rack attachment bolts (4) that have worn threads or are otherwise damaged.

h. Nut plates in the wing which secure the rack attachment bolts may suffer stripped threads. Nut plates located between the spars should be replaced when damage is discovered. The nut plates located on the forward flange of the front spar should be inspected and replaced where necessary when the wing leading edge is removed at overhaul.

4. INSTALLATION.

(See figure 291.)

a. If field work platforms are not available, install portable bomb loading platforms on the lower side of the wing as described in paragraph *c*, (4), *(c)*, *3.* Place one of the platforms in the set of sockets located at the splice of the wing center section and the outer panel, and the other in the set of sockets opposite the landing light location in the wing leading edge.

b. Remove access doors (15) from lower face of Mark 42 rack by unlocking Dzus fasteners.

c. Place Mark 42 rack (1) on one of the loading platforms so that the "forward" marking and arrow which is stamped in the lower face of the rack points toward the wing leading edge.

d. Place the rear spacer rail (10) across the rear top edge of the rack so that the semicircular notches in the rail fit on the upper shafts of the bomb chocks. The grooved surface of the rail should face upward to clear wing rivet heads when the rack is installed on the wing.

e. Place the forward spacer rail (5) across the top forward end of the rack so that the four holes in the rail match four similar holes in the rack. The grooved surface of this rail should also face upward.

f. The rack is mounted to the lower surface of the wing by eight bolts (4) which are spaced as indicated by the holes in the spacer rails (5) and (10). Inspection of the lower surface of the wing will reveal matching holes for installation of the rack. For the front rack, one row is located along the front spar position and another approximately 18 in. aft. For the rear rack, one row of holes is located along the rear spar position and the other row approximately 18 in. forward. The holes are usually plugged with bolts to exclude moisture or dirt.

g. Remove plug bolts (6) and insulating washers from lower surface of wing.

h. Remove neoprene slot plugs (7) from slots in control lever guards on the lower surface of the wing. These plugs should be saved for replacement when the Mark 42 racks are removed.

i. Raise the rack into place against the lower surface of the wing, aligning the mounting holes of the rack with the mating holes in the wing.

Note

It is recommended that installation of the rack be accomplished by two persons working as a pair with the rack between them.

j. Check arming and release arms (13) and (14) of Mark 42 rack as they enter the slot in the lower surface of the wing. The arming and release levers (12) and (11) in the wing are spring loaded so that their lower tips should be just forward of the rack arming and release arms in the "safe" and "non-released" positions.

k. Secure rack to wing by installation of eight bolts (4).

l. Secure bolts with lockwire through their drilled heads.

m. Unscrew the protective cap (9) on the electrical receptacle in the lower surface of the wing. This may be accomplished by reaching through the access opening in the lower face of the Mark 42 rack.

n. Insert electrical plug (2) of Mark 42 rack in the receptacle to establish electrical connection

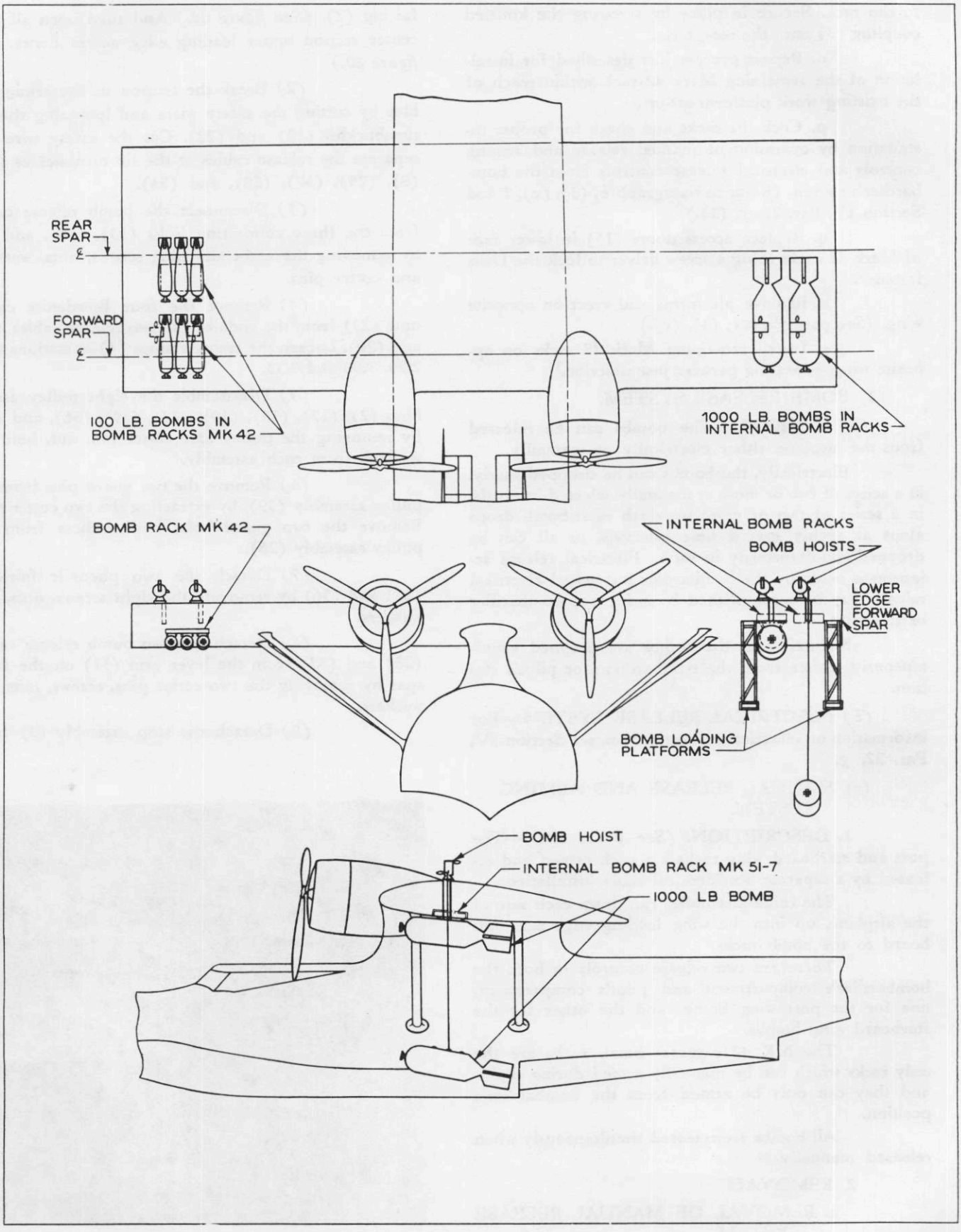


Figure 293—Bomb Loading Diagram

to the rack. Secure in place by screwing the knurled coupling (3) onto the receptacle.

o. Repeat process just described for installation of the remaining Mark 42 rack within reach of the existing work platform set-up.

p. Cock the racks and check for proper installation by operation of manual release and arming controls and electrical release controls from the bombardier's station. (Refer to paragraph *b*, (3), *(c)*, *1* and Section IV, Par. 22, *g*, (1).)

q. Replace access doors (15) in lower face of Mark 42 racks using a screw driver to lock the Dzus fastener.

r. Remove platforms and erect on opposite wing. (See paragraph *c*, (4), *(c)*.)

s. Install remaining Mark 42 racks on opposite wing, repeating process just described.

(3) BOMB RELEASE SYSTEM.

(a) GENERAL.—The bombs can be released from the airplane either electrically or manually.

Electrically, the bombs can be dropped singly, in a series of two or more at manually selected intervals, in a series of two or more in which each bomb drops alone at evenly spaced time intervals, or all can be dropped simultaneously in salvo. Electrical release selection is made by the bombardier but actual electrical release may be accomplished by either the bombardier or the pilot.

Manually, all the bombs are dropped simultaneously, either from the bombardier's or pilot's station.

(b) ELECTRICAL RELEASE SYSTEM.—For information on electrical release system, see Section IV, Par. 22, *g*.

(c) MANUAL RELEASE AND ARMING SYSTEM.

1. DESCRIPTION. *(See figure 292.)*—The port and starboard wing racks are each armed and released by a separate but identical cable installation.

The cable assemblies run down each side of the airplane, up into the wing leading edge and outboard to the bomb racks.

There are two release controls in both the bombardier's compartment and pilot's compartment, one for the port wing bombs and the other for the starboard wing bombs.

The MK 42 external bomb racks are the only racks which can be manually armed during flight, and they can only be armed from the bombardier's position.

All bombs are released simultaneously when released manually.

2. REMOVAL.

a. REMOVAL OF MANUAL RELEASE SYSTEM.

(1) Remove the forward superstructure fairing (2). *(See figure 64.)* And then open all wing center section upper leading edge access doors. *(See figure 20.)*

(2) Break the tension in the arming cables by cutting the safety wires and loosening the two turnbuckles (12) and (22). Cut the safety wire and separate the release cables at the six turnbuckles (15), (8), (25), (37), (38), and (54).

(3) Disconnect the bomb release cables from the three connecting links (33), (35), and (7) by removing the eight attaching screws, nuts, washers, and cotter pins.

(4) Remove the four Bowdenite casing nuts (23) from the ends of the two release cables (10) and (20). Loosen the casing clamps (4) at stations 0.66, 2.50, 3.00 and 3.33.

(5) Disassemble the eight pulley assemblies (2), (17), (18), (19), (27), (29), (36), and (50) by removing the pulley axle cotter pin, nut, bolt and washers from each assembly.

(6) Remove the two guard pins from the pulley assembly (39), by extracting the two cotter pins. Remove the two guard bolts and washers from the pulley assembly (26).

(7) Detach the two phenolic fairleads (21) and (56) by removing the eight screws, nuts, and washers.

(8) Detach the two bomb release cables (28) and (32) from the lever arm (31) on the front spar by removing the two cotter pins, screws, nuts and washers.

(9) Detach the stop assembly (3) from

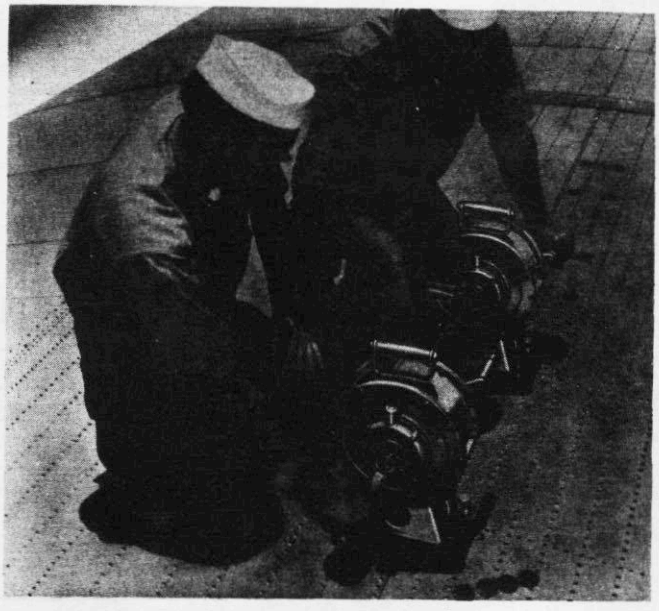


Figure 294—Mark 6 Hoist—Installed

the bomb release cable (20) by removing the nut on the end of the stop.

(10) Crawl through the manhole located in the outer panel between wing stations 13 and 14 and disassemble the two pulley assemblies (41) and (46) by removing the axle cotter pins, nuts, bolts, and washers, then detach the ends of the two MK 51 bomb release cables (42) and (48) from the bomb racks (44) and (47) by removing the cotter pin, two washers, and bolt (43) from each rack release fitting.

(11) Detach the four bonding braids (24), (57), (59), and (61) from the MK 42 bomb release cables (60) and (40) by removing the three screws, nuts, washers, and clips.

(12) Detach the bomb release cables (60) and (40) from the two bomb release levers (58) by removing the two nuts, screws and washers (63).

(13) Remove all bomb release cables and casings from the airplane.

(14) Repeat the above procedure for removal of the manual bomb release system from the opposite side of the airplane.

b. REMOVAL OF MANUAL ARMING SYSTEM.

(1) Remove the forward superstructure fairing (2). *(See figure 64.)* Open all wing center section upper leading edge access doors. *(See figure 20.)*

(2) Break the tension in the bomb release cables by cutting the safety wires and loosening the six turnbuckles (15), (8), (25), (37), (38), and (54). Cut the safety wire and separate the arming cables at the two turnbuckles (12) and (22).

(3) Disassemble the four pulley assemblies (2), (27), (29), and (52) by removing the axle cotter pin, nut, bolt and washers from each assembly.

(4) Remove the Bowdenite casing nut (23) from the two ends of the arming cable casing (6). Loosen the cable casing clamps (4) at station 0.66, 2.50, 3.00, and 3.33.

(5) Remove the two guard bolts and washers from the pulley assembly (26) on the front spar at the center line of the airplane.

(6) Detach the two phenolic fairleads (21) and (56) by removing the eight screws, nuts, and washers.

(7) Crawl through the manhole located in the outer panel between wing stations 13 and 14 and detach the three bonding braids (57), (59), and (61) from the two MK 42 bomb arming cables (51) and (45) by removing the three nuts, screws, washers and clips.

(8) Detach the two bomb arming cables (51) and (45) from the two bomb arming levers (49) and (53) by removing the two screws, nuts, and washers (63).

(9) Remove all bomb arming cables and casing from the airplane.

(10) Repeat the above procedure for removal of the manual bomb arming system from the opposite side of the airplane.

3. MAINTENANCE.

a. MAINTENANCE OF RELEASE AND ARMING CABLES.

(1) If the cables are coated with dust or dirt, they should be wiped with a clean cloth and then coated with corrosion-preventive compound (Specification AN-C-52, type 1).

(2) The presence of broken wires may be detected by rubbing a cloth over the cable. If five or more wires are broken, the cable should be replaced immediately.

b. MAINTENANCE OF PULLEYS.—If a pulley, when turned by hand shows signs of being contaminated with grit, it should be replaced.

4. INSTALLATION.

a. INSTALLATION OF MANUAL RELEASE SYSTEM.—To install the bomb manual release system, reverse the removal procedure as outlined in paragraph *b*, (3), *(c)*, *2*, a.

b. INSTALLATION OF MANUAL ARMING SYSTEM.—To install the MK 42 bomb arming system, reverse the removal procedure as outlined in paragraph *b*, (3), *(c)*, *2*, b.

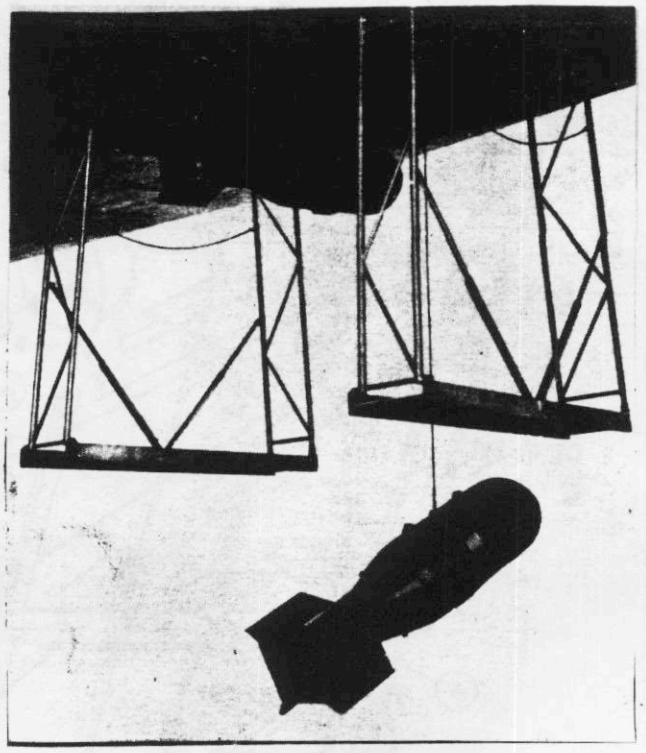


Figure 295—Bomb Hoisting

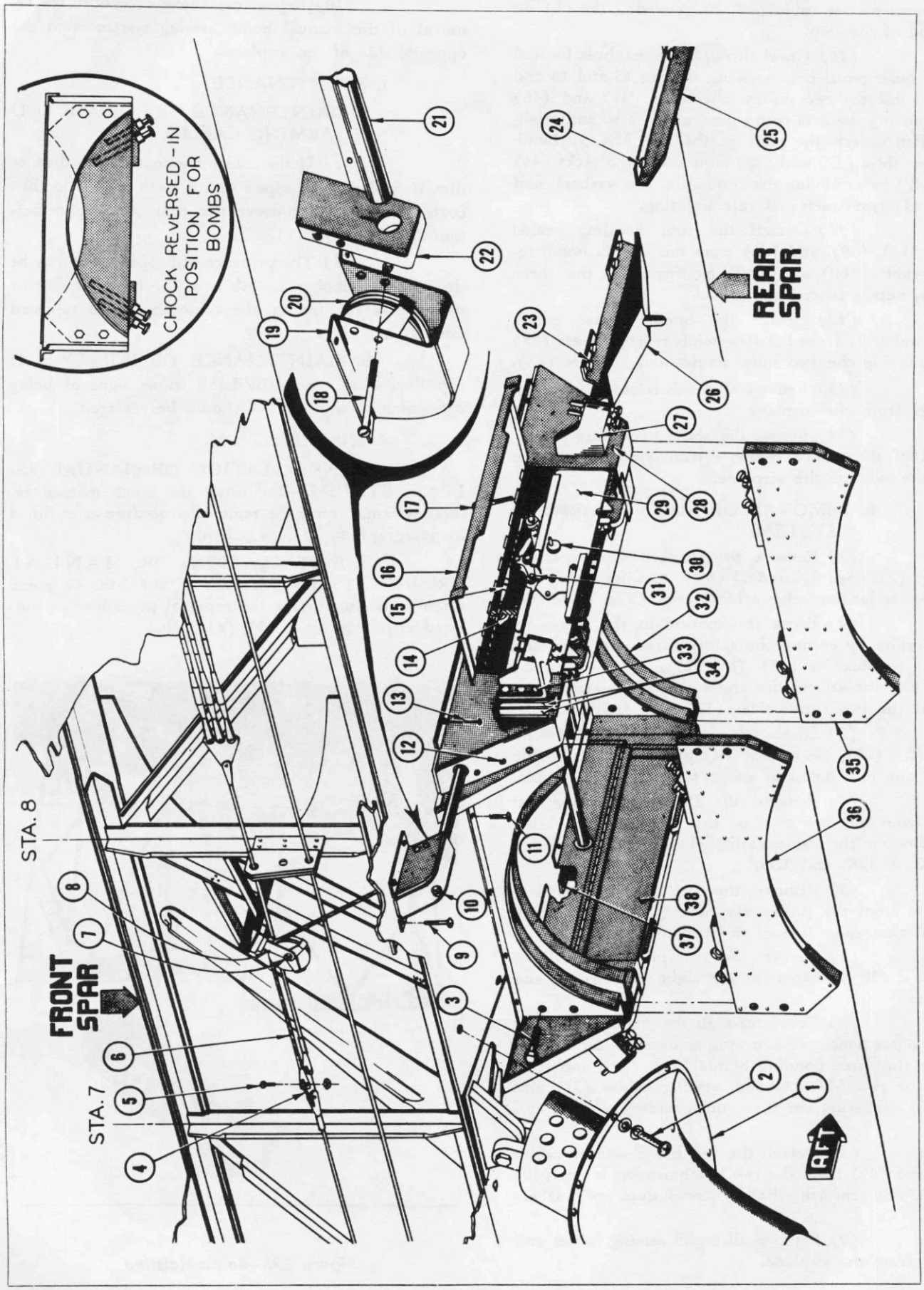


Figure 296—Torpedo Rack (PBY-5A—Serial Numbers 46598 through 46638)

No.	PART No.	NAME
1	28W5075-L&R	Fairing—Front Strut
2		Fairing Attaching Screws
3	AN6-15A	Bolt
4	28C5120	Plate
5	AN23-8	Clevis Bolt
	AN320-3	Nut
6	Q6303-CNL-48 1/8	Cable—Port
	Q6303-CNL-48 11/16	Cable—Starboard
7	AN3-10	Bolt
	AN310-3	Nut
	AN960-AL10	Washer
8	Q4002-2-1	Pulley Bracket
9	AN526-DD1032-10	Screw
10	AN310-6	Nut
	AN380-3-3	Cotter Pin
11	AN74-5	Bolt
12	AN526-DD1032-8	Screw
13	AN526-DD1032-14	Screw
14		Electrical Conduit
15	AN155-8S	Turnbuckle
16	28A5234-L&R	Door—Splash Fairing
17	28A5626	Lock Screw
18	AN526-DD1032-36	Screw
	AN372-D1032	Nut
19	28A5625-L&R	Pulley Bracket
20	AN210-2A	Pulley
21	28A5236	Cable Guard
22	28A5244-L&R	Micarta Block
23	AN74-5	Bolt
	Q7102-AL416	Washer
24	AN73-6	Bolt
	Q7102-AL10	Washer
25	28F5340	Lanyard Angle
26	28F3045-50	Torpedo Stop
27	28A5538-L&R	Sway Chock
28	28A5243-L&R	Splash Fairing—Outb'd.
	28A5243-2L&2R	Splash Fairing—Inb'd.
29	Mark 51, Mod. 7	Bomb Rack
30		Rack Cocking Knob
31	AN23-12	Clevis Bolt
	AN960-AL10L	Washer
	AN310-3	Nut
	AN380-2-2	Cotter Pin
32	28A5132-3L&3R	Torpedo Rack Assembly
33	AN76-31	Bolt
34	29A020-3	Spacer—Inner
	29A020-5	Spacer—Outer
35	28A5229-2	Rear Chock
36	28A5229-0	Forward Chock
37	AN74-5	Bolt
	AN74-6	Bolt
	Q7102-AL416	Washer
38	28A5233-L&R	Door—Splash Fairing

(4) BOMB HOISTING AND EQUIPMENT.

(a) GENERAL.—The loading of all bomb racks is handled in practically the same manner. A seven man crew, one MK 6 portable bomb hoist, and two bomb and torpedo loading platforms are all that is needed to complete the loading of bombs on any of the bomb racks.

(b) BOMB HOISTING PROCEDURE. *(See figure 295.)*

1. Check to see that all bomb electrical release switches are off.

2. Install the torpedo and bomb loading platforms to the lower surface of wing as outlined in paragraph *c*, (4), *(c)*, *3.*

3. If the MK 51 internal racks are to be used, open the small hinged access doors below the racks. If the MK 42 external bomb racks are to be used, install the racks as outlined under paragraph *b*, (2), *(d)*, *4.* If the converted torpedo racks are to be used, follow the installation procedure as outlined in paragraph *c*, (2), *(d)*.

4. Remove the two rubber plugs from the bomb hoist installation position on the upper surface of the wing.

5. Swing the bomb hoist cable slot cover to one side.

6. Attach the bomb hoist to the wing installation holes with the four mounting bolts and feed the end of the hoist cable down through the slotted hole in the wing, through the center of the bomb rack and down to the bomb on the ground. *(See figure 294.)*

7. Attach the end of the hoisting cable to the clevis fitting on the bomb.

8. If necessary to balance the bomb while hoisting, tie a rope to each end of the bomb so that two crewmen can keep the bomb level from the ground.

9. Cock the MK 42 bomb rack by pulling downward on the three levers.

10. With one man to give instructions stationed in front of the airplane where all crew members can see him, raise the bomb to the bomb rack. See paragraph *c*, (4), *(d)*, for information regarding operation of MK 6 bomb hoist.

11. If using the MK 51 internal bomb racks or the torpedo racks, cock the racks after the bomb reaches position. When sure bomb is properly installed, detach the hoisting sling cable from the bomb.

12. Repeat the above steps, moving the hoist and platforms as necessary until the bombs are all loaded.

13. Remove the torpedo and bomb loading platforms as outlined under the removal procedure in paragraph *c*, (4), *(c)*, *2.*

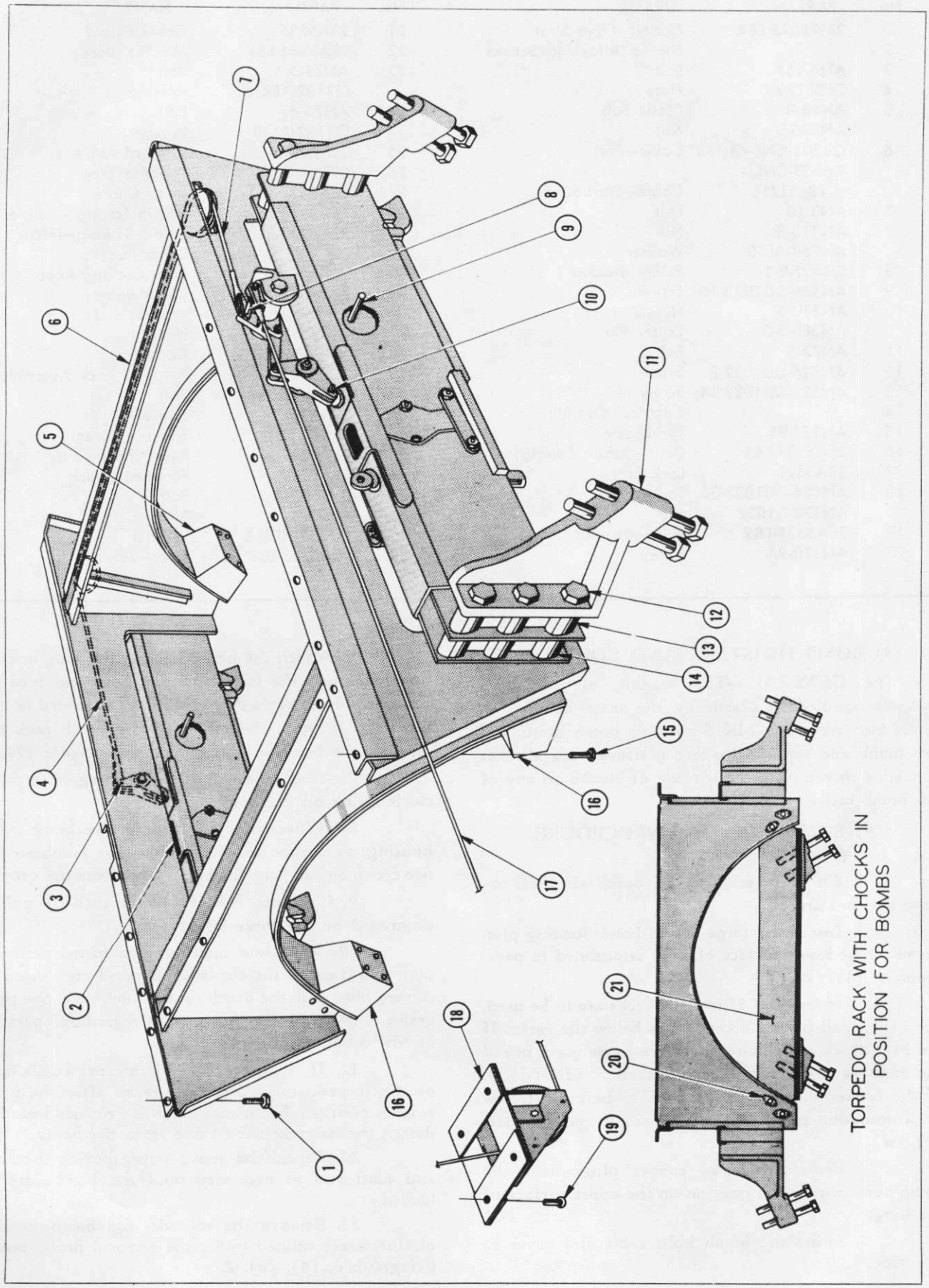


Figure 297—Torpedo Rack (PBY-5 & PBY-5A Prior to Serial Number 46598)

No.	PART No.	NAME
1	AN74-6	Bolt
	Q7102-A416	Washer
2	Mark 51, Mod. 7	Bomb Rack
3	AN23-12	Clevis Bolt
	AN960-AL10L	Washer
	AN310-3	Nut
	AN380-2-2	Cotter Pin
4	Q6303-BNL-25 ¼	Cable
	AN155-8S	Turnbuckle
5	28A3037-7L&7R	Torpedo Bumper Block
6	28A5132-2L&2R	Torpedo Rack Assembly
7	Q6303-CNR-19 3/8	Cable
8	AN23-22	Clevis Bolt
	AN310-3	Nut
	AN380-2-2	Cotter Pin
9		Cocking Knob
10	AN23-12	Clevis Bolt
	AN960-AL10L	Washer
	AN310-3	Nut
	AN380-2-2	Cotter Pin
11	28A5538-L&R	Sway Chock
12	AN76-31	Bolt
13	29A020-5	Spacer
14	29A020-3	Spacer
15	AN74-5	Bolt
	Q7102-A416	Washer
16	28A3037-6L&6R	Torpedo Bumper Block
17	Q6303-CNL-48 1/8	Cable—Port Rack
	Q6303-CNL-48 11/16	Cable—Starboard Rack
	AN155-8S	Turnbuckle
	AN161-8RS	Turnbuckle Fork
18	28A5149-L&R	Pulley Bracket
	AN210-2A	Pulley
19	AN526-DD1032-10	Screw
20	AN4-14A	Bolt
	AN960-AL416	Washer
21	28A5132-20	Bomb Adapter—Torpedo Rack

c. TORPEDO EQUIPMENT.

(1) GENERAL.—The airplane can carry two Mark 13-1 or 13-2 torpedoes as an alternate to the bomb loads. The torpedoes are suspended by cable slings from torpedo racks fastened to the bottom of the wing.

The torpedoes can be released manually by the bombardier, pilot, and copilot; but electrically they are controlled only by the pilot and copilot.

The airplane is equipped with the necessary equipment to provide for the carrying of torpedoes.

(2) TORPEDO RACK INSTALLATION.

(a) DESCRIPTION. — The equipment necessary for the conversion is composed of the following: two external torpedo racks, four torpedo slings, two torpedo stops, and two torpedo starting lanyard angles.

On PBY-5A airplanes with serial numbers 46598 through 46638 the torpedo racks are composed chiefly of two Mark 51 Mod. 7 bomb racks and two reversible chocks which when reversed make the rack adaptable to carrying bombs. The rack and manual release cable are protected by a splash fairing.

On PBY-5A airplanes with serial numbers prior to 46598 and on all PBY-5 airplanes (See the INTRODUCTION to this MANUAL for a complete list of serial numbers covered), the torpedo racks are composed chiefly of two Mark 51 Mod. 7 bomb racks and four torpedo rack bumper blocks attached to the interconnecting structure between the two Mark 51 Mod. 7 bomb racks. When using this rack as an external bomb rack it is necessary to replace the four torpedo rack bumper blocks with two lateral bomb rack chocks and four external bomb rack chocks.

(b) REMOVAL AND DISASSEMBLY.

1. PBY-5A AIRPLANES WITH SERIAL NUMBERS 46598 THROUGH 46638. *(See figure 296.)*

a. Install the torpedo and bomb loading platforms as outlined in paragraph *c*, (4), *(c)*, 3.

b. Open the two access doors (7), and (8) on the upper surface of the center section leading edge by removing nine screws. *(See figure 20.)*

c. Working through the access opening, disconnect the forward torpedo release cable (6) from the three-way connecting link (4) by removing the screw and nut (5); then detach the pulley from the bracket (8) by removing the cotter pin, nut, and pulley axle bolt (7).

d. Separate the release cable from the pulley and reassemble the pulley and bracket.

e. Detach the pulley and cable splash fairing from the lower surface of the wing as follows:

(1) Remove the cotter pin and nut (10) from the bottom of the pulley bracket (19).

(2) Remove the four screws (9) that attach the bracket (19) to the wing.

(3) Remove the two screws and nuts (18) that hold the micarta block (22) in the end of the bracket.

(4) Pull the bracket (19) loose and remove from the airplane.

(5) Detach the cable (6) from the pulley (20) by removing the pulley axle bolt, nut, and cotter pin.

(6) Pull the release cable (6) down through the hole in the wing.

(7) Slide the micarta block (22) and cable guard (21) from the cable.

f. Wind the release cable (6) in a small loop and stow on the torpedo rack (32).

g. Disconnect the two electrical cables (14) from the wing fittings. Screw the caps over the wing fittings.

h. On the torpedo rack, open the splash fairing doors (16) by loosening the screws (17), and remove the 21 rack installation bolts (37) that run through the upper flange of the rack and into the wing.

i. Detach the rack from the wing by removing the 25 remaining installation bolts (11) and (13). Rack must be supported by a crew member while the last few bolts are being extracted. Lower rack to ground. Plug the holes with screws.

j. Detach the torpedo stop (26) from the wing by removing the eight attaching screws (23). Then plug the holes by replacing the screws.

k. Detach the torpedo lanyard angle (25) from the wing by removing the two screws (24), then plug the holes by replacing the screws.

l. Replace the forward wing strut fairing (1) with the 12 installation screws (2).

m. Close the access doors (7) and (8) on top of the leading edge and lock with the nine screws. *(See figure 20.)*

n. DISASSEMBLY OF TORPEDO RACK.

(1) Detach the splash fairings (28) from the torpedo rack by removing the 16 attaching screws (12) from the ends and bottom of the rack.

(2) Detach the two reversible chocks (35) and (36) from the rack by removing the four bolts *(3)* at each end of the rack.

(3) Remove the cotter pin and nuts from the release bell crank pivot bolt (31).

(4) Detach the four sway chocks (27), eight spacers (34), and two Mark 51, Model 7 bomb racks (29) from the torpedo rack by removing the lockwire and bolts (33) from each side of the torpedo rack.

2. PBY-5A AIRPLANES WITH SERIAL NUMBERS PRIOR TO 46598 AND ALL PBY-5 AIRPLANES.

(See figure 297.)

Note

For a complete list of serial numbers covered, see the INTRODUCTION to this MANUAL.

a. Install the torpedo and bomb loading platforms as outlined in paragraph *c*, (4), *(c)*, *3*.

b. Open the two access doors (7) and (8) on the upper surface of the center section leading edge by removing nine screws. *(See figure 20.)*

c. Working through the access opening, disconnect the forward torpedo release cable (30) from the three-way connecting link (33) by removing the screw and nut; then detach the pulley from the bracket (1) by removing the cotter pin, nut and pulley axle bolt. *(See figure 292.)*

d. Separate the release cable from the pulley and reassemble the pulley and bracket.

e. Remove cable guard bolts from pulley bracket (18) and pull cable from the leading edge of the wing. *(See figure 297.)*

f. Disconnect cable (17) from the torpedo rack by removing bolt (8).

g. Remove pulley bracket (18) by loosening the four screws (19) that fasten it to the wing.

h. Disconnect the two electrical cables from the wing fittings. Screw the caps over the wing fittings.

i. Detach the rack from the wing by removing the 35 installation bolts (1) and (15). Rack must be supported by a crew member while the last few bolts are being extracted. Lower rack to ground. Plug the holes with screws.

j. Detach the torpedo stop (26) from the wing by removing the eight attaching bolts (23). Then plug the holes by replacing the bolts. *(See figure 296.)*

k. Detach the torpedo lanyard angle (25) from the wing by removing the two bolts (24), then plug the holes by replacing the bolts.

l. Replace the forward wing strut fairing.

m. Close the access doors (7) and (8) on top of the leading edge and lock with nine screws. *(See figure 20.)*

n. DISASSEMBLY OF TORPEDO RACK.

(See figure 297.)

(1) Remove the torpedo rack bumper blocks (5) and (16) by loosening the four screws that attach them to the rack.

(2) Disconnect cables (4) and (7) by loosening turnbuckle on the aft end of the torpedo rack. Cable (7) may now be removed.

(3) Detach cable (4) at the bell crank by removing clevis bolt (3) and then withdraw cable from the rack.

(4) Remove bolt (10) from the bell cranks on both sides of the torpedo rack. This disconnects bell crank from the bomb rack release.

(5) Detach the four sway chocks (11), eight spacers (13) and (14), and two Mark 51 Mod. 7 bomb racks (2) from the torpedo rack by removing the lockwire and bolts (12) from each side of the torpedo rack.

(c) MAINTENANCE.

1. Replace any defective Mark 51, Model 7 bomb racks.

2. Replace all thread worn bolts and nuts.

3. Clean all oil and dirt from electrical connector plugs with unleaded gasoline and a wire brush.

4. Repair any cracks, dents, or other damage to the torpedo racks according to the instruction outlined in the Manual for Structural Repair. (AN 01-5MA-3.)

(d) INSTALLATION AND ASSEMBLY.

1. PBY-5A AIRPLANES WITH SERIAL NUMBERS 46598 THROUGH 46638. *(See figure 296.)*

a. Assemble the torpedo rack as follows:

(1) Attach the two Mark 51, Model 7 bomb racks (29), eight spacers (34), and four sway chocks (27) with the 12 bolts (33) to the torpedo rack (32). Lock each of the four groups of bolts with lockwire.

(2) Replace the nut and cotter pin to the release bell crank pivot bolt (31).

(3) Attach the two reversible chocks (35) and (36) to the torpedo rack with the eight bolts (3), the contour side of the chocks being exposed.

(4) Attach the splash fairings (28) to the torpedo rack with the 16 attaching screws.

b. Install the torpedo rack as follows:

(1) Install the torpedo and bomb loading platforms as outlined in paragraph *c*, (4), *(c)*, 3.

(2) Detach the forward wing strut fairing (1) from the airplane by removing the 12 screws (2).

(3) Remove the screws (11) and (13) from the wing where the rack is to be attached. Bolts (37) will be used for the installation of the torpedo rack.

(4) Hoist the torpedo rack assembly to the wing and insert the 13 attaching bolts and washers (11), and 12 attaching bolts and washers (13).

(5) Open the splash fairing doors (16) on each side of the torpedo rack by loosening the screw (17), and through the door enclosures insert the the remaining 21 attaching bolts and washers (37). Run lockwire through all bolts.

(6) Detach the torpedo release cable hole cover plate from the bottom of the wing, by removing the four attaching screws.

(7) Attach the pulley (20), bracket (19) and release cable splash fairing (21) as follows:

(a) Slide the release cable splash guard (21) onto the cable. The end of the guard with the two holes goes forward.

(b) Slide the micarta block onto the release cable and over the end of the cable guard.

(c) Insert the release cable around the pulley (20) and into the hole in the wing, then assemble the pulley to the pulley support by inserting the bolt, nut, and cotter pin.

(d) Attach the pulley bracket (19) to the wing with the four screws (9).

(e) Attach the nut and cotter pin (10) to the pulley support bolt.

(f) Lock the micarta block (22) to the bracket (19) and cable guard (21) by inserting the two bolts and nuts (18).

(8) Open the two access doors (7) and (8) on the upper surface of the center section leading edge, by removing the nine screws. *(See figure 20.)*

(9) Working through the access door openings, remove the torpedo release cable pulley (8) from the bracket assembly by removing the cotter pin, nut, and axle bolt (7).

(10) Working through the access door openings, draw the release cable (6) up through the hole and pulley bracket (8).

(11) Reinstall the pulley (8) with the axle bolt, nut, and cotter pin (7).

(12) Attach the end of the torpedo release cable (6) to the forward hole in the three-way connecting link (4), with the bolt, nut, and cotter pin (5). Close the two access doors and insert the nine screws.

(13) Test the release cable down near the rack for tension. The cable should have a small amount of slack. Make adjustments at the turnbuckle (15). After adjustments have been made, lock the turnbuckle with safety wire.

(14) Test the manual operation of the tropedo rack by first pushing up on the cocking knobs (30) on each side of the rack, then release the rack by pulling the emergency bomb release handle under the center of the pilot's instrument panel.

(15) Install the torpedo stop (26) on the bottom of the wing, directly aft of the torpedo rack, with the eight installation screws (23).

(16) Install the starting lanyard angle (25) on the bottom of the wing directly aft of the torpedo stop (26) with two installation screws (24).

(17) Check to see that all bomb release switches inside the airplane are off, then attach the two electrical cables (14) to the sockets in the bottom of the wing, where the racks are installed.

(18) The torpedo racks are now ready for use. (See paragraph *c*, (4), *(b)* for torpedo hoisting instructions.)

2. PBY-5A AIRPLANES WITH SERIAL NUMBERS PRIOR TO 46598 AND ALL PBY-5 AIRPLANES. *(See figure 297.)*

Note

For a complete list of serial numbers covered, see the INTRODUCTION to this MANUAL.

a. Assemble the torpedo rack as follows:

(1) Attach the two Mark 51 Mod. 7 bomb racks (2), eight spacers (13) and (14) and four sway chocks (11) with the 12 bolts (12) to the torpedo rack (6). Lock each of the four groups of bolts with lockwire.

(2) Attach bell cranks to the Mark 51 Mod. 7 bomb rack releases by means of bolts (10).

(3) Attach cable (4) to bell crank on the inboard side of the rack with clevis bolt (3) and then thread cable around pulley.

(4) Thread cable (7) around pulley on the aft outboard end of the torpedo rack and then connect it to cable (4) with a turnbuckle barrel.

(5) Attach the torpedo rack bumper blocks (5) and (16) to the rack with four screws.

b. Install the torpedo rack as follows:

(1) Install the torpedo and bomb loading platforms as outlined in paragraph *c*, (4), *(c)*, *3*.

(2) Detach the forward wing strut fairing from the airplane by removing the attaching screws.

(3) Remove all bolts and screws from the lower surface of the wing where the torpedo rack is to be installed.

(4) Hoist the torpedo rack assembly to the wing and insert the attaching bolts and washers. Of the 35 bolts used to attach the rack to the wing, 31 of them are AN74-5 bolts and the other four are AN74-6 bolts. The four longer bolts are used on the inboard side of the rack nearest the strut attachment fitting. Lockwire all bolts after they have been tightened.

(5) Remove the torpedo release cable hole cover plate from the bottom of the wing by unscrewing the four attaching screws.

(6) Open access doors (7) and (8) on the top of the leading edge of the wing. *(See figure 20.)*

(7) Attach pulley bracket (18) to the lower surface of the wing leading edge with the four screws (19). *(See figure 297.)*

(8) Connect cables (7) and (17) to the bell crank on the torpedo rack by means of clevis bolt (8).

(9) Place cable (17) around pulley on pulley bracket (18) and pull the free end of the cable up into the wing leading edge.

(10) Insert cable guard bolts into pulley bracket (18).

(11) Working through the access door openings, remove the torpedo release cable pulley (1) from the bracket assembly by removing the cotter pin, nut and axle bolt. *(See figure 292.)*

(12) Draw the release cable (30) up through the pulley bracket (1).

(13) Reinstall pulley (1) with the axle bolt, nut and cotter pin.

(14) Attach the end of the torpedo release cable (30) to the forward hole in the three-way connecting link (33) with the bolt, nut and cotter pin. Close the two access doors and secure them with nine screws.

(15) Test the release cable down near the rack for tension. The cable should have a small amount of slack. Make adjustments at the turnbuckle. After adjustments have been made, lock the turnbuckles with safety wire.

(16) Test the manual operation of the torpedo rack by first pushing up on the cocking knobs (9) on each side of the rack, then release the rack by pulling the emergency release handle under the center of the pilot's instrument panel. *(See figure 297.)*

(17) Install the torpedo stop (26) on the bottom of the wing, directly aft of the torpedo rack, with the eight installation bolts (23). *(See figure 296.)*

(18) Install the starting lanyard angle (25) on the bottom of the wing, directly aft of the torpedo stop (26), with two installation bolts (24).

(19) Check to see that all bomb release switches inside the airplane are off, then attach the two electrical cables to the sockets in the bottom of the wing, where the racks are installed.

(20) The torpedo racks are now ready for use. (See paragraph *c*, (4), *(b)* for torpedo hoisting instructions.)

(3) TORPEDO RELEASE CONTROLS.

(a) GENERAL. — The torpedoes can be released either manually or electrically. The bombardier can release the torpedoes manually only, while the pilot and copilot can release the torpedoes either manually or electrically.

(b) ELECTRICAL TORPEDO RELEASE SYSTEM.—The pilot and copilot are furnished an electrical release control for the torpedoes. The torpedoes may be dropped individually or both together. Refer to Section IV, Par. 22, *g* for further information concerning the electrical torpedo circuit.

(c) MANUAL TORPEDO RELEASE SYSTEM.

1. DESCRIPTION. *(See figure 292.)*—The torpedoes and bombs are manually controlled by the same release mechanism.

The cable release mechanism for bombs installed on the port wing bomb racks extends from the emergency release handle in the bombardier's compartment, along the port side of the airplane, joins with the pilot's emergency release cable and continues on to bulkhead 4, up through the deck and superstructure into the wing leading edge, and outboard along the front spar to the rack installation. An identical installation runs along the starboard side of the airplane, and joins with the copilot's emergency release controls, for release of bombs installed under the starboard wing.

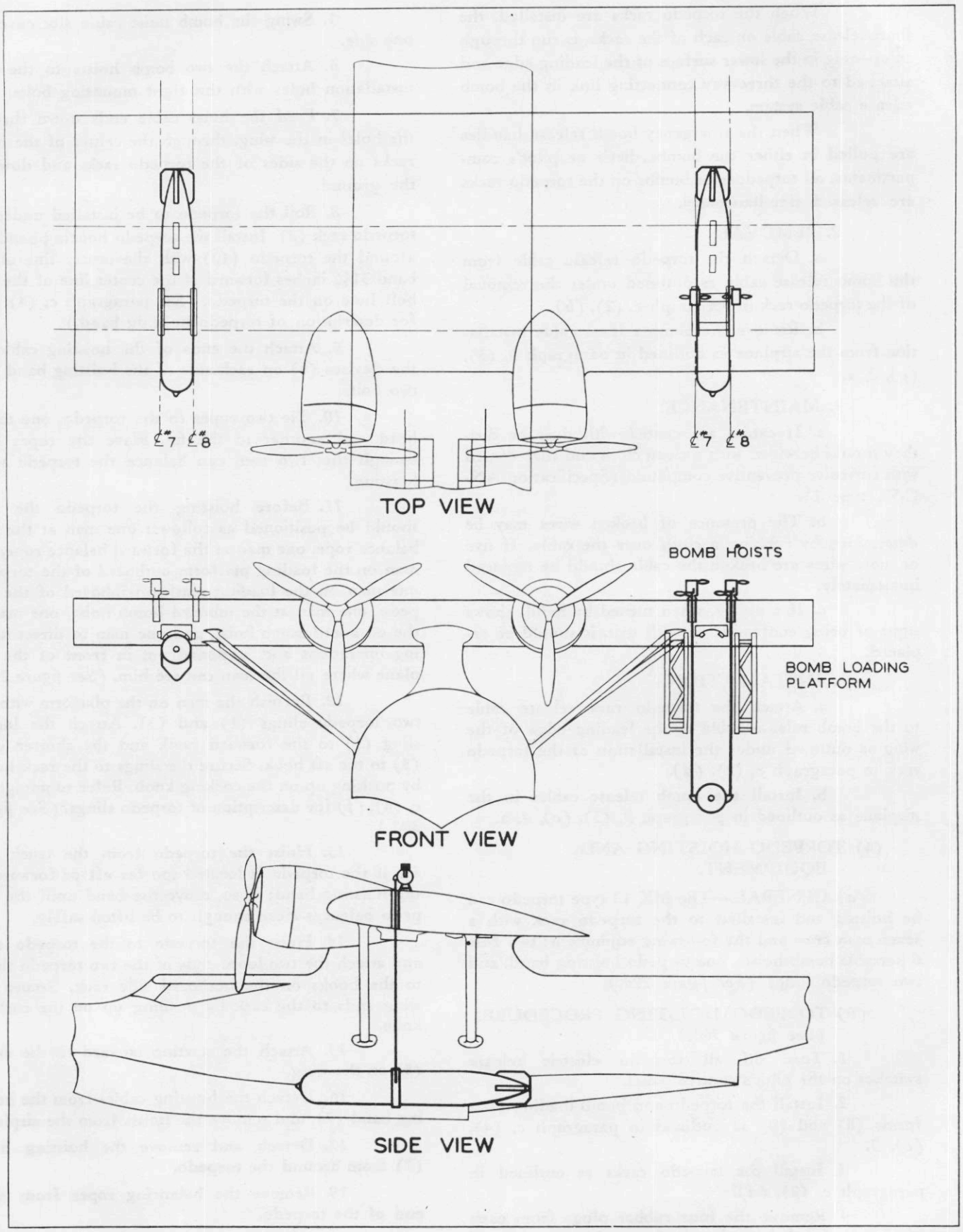


Figure 298—Torpedo Loading Diagram

When the torpedo racks are installed, the short release cable on each of the racks, is run through an opening in the lower surface of the leading edge and attached to the three-way connecting link in the bomb release cable system.

When the emergency bomb release handles are pulled in either the bombardier's or pilot's compartments, all torpedoes or bombs on the torpedo racks are released simultaneously.

2. REMOVAL.

a. Detach the torpedo release cable from the bomb release cable as outlined under the removal of the torpedo rack in paragraph *c*, (2), *(b)*.

b. Remove the bomb release cable installation from the airplane as outlined in paragraph *b*, (3), *(c)*, *2*, a.

3. MAINTENANCE.

a. If cables are coated with dust or dirt, they should be wiped with a clean cloth and then coated with corrosive-preventive compound (Specification AN-C-52, type 1).

b. The presence of broken wires may be determined by rubbing a cloth over the cable. If five or more wires are broken the cable should be replaced immediately.

c. If a pulley, when turned by hand, shows signs of being contaminated with grit, it should be replaced.

4. INSTALLATION.

a. Attach the torpedo rack release cable to the bomb release cable in the leading edge of the wing as outlined under the installation of the torpedo rack in paragraph *c*, (2), *(d)*.

b. Install the bomb release cables in the airplane as outlined in paragraph *b*, (3), *(c)*, *4*, a.

(4) TORPEDO HOISTING AND EQUIPMENT.

(a) GENERAL.—The MK 13 type torpedo can be hoisted and installed to the torpedo rack with a seven man crew and the following equipment: two MK 6 portable bomb hoists, one torpedo hoisting band, and two torpedo slings. *(See figure 299.)*

(b) TORPEDO HOISTING PROCEDURE. *(See figure 300.)*

1. Turn off all torpedo electric release switches on the pilot's control panel.

2. Install the torpedo and bomb loading platforms (8) and (9) as outlined in paragraph *c*, (4), *(c)*, *3*.

3. Install the torpedo racks as outlined in paragraph *c*, (2), *(d)*.

4. Remove the four rubber plugs from each of the two bomb hoist installation positions on top of the wing.

5. Swing the bomb hoist cable slot covers to one side.

6. Attach the two bomb hoists to the wing installation holes with the eight mounting bolts.

7. Feed the hoist cable ends down through the holes in the wing, through the center of the bomb racks on the sides of the torpedo rack, and down to the ground.

8. Roll the torpedo to be installed under the torpedo rack (2). Install the torpedo hoisting band (7) around the torpedo (10) with the center line of the band 31¾ inches forward of the center line of the stop bolt hole on the torpedo. (See paragraph *c*, (4), *(e)*, for description of torpedo hoisting band.)

9. Attach the ends of the hoisting cables to the clevises (6) on each side of the hoisting band with two bolts.

10. Tie two ropes to the torpedo, one to the head and another to the fin. Have the ropes long enough that two men can balance the torpedo while hoisting.

11. Before hoisting the torpedo the men should be positioned as follows: one man at the rear balance rope, one man at the forward balance rope, one man on the loading platform outboard of the torpedo, one man on the loading platform inboard of the torpedo, one man at the inboard bomb hoist, one man at the outboard bomb hoist, and one man to direct hoisting operations and stationed out in front of the airplane where all the men can see him. *(See figure 299.)*

12. Furnish the men on the platform with the two torpedo slings (1) and (3). Attach the longer sling (1) to the forward hook and the shorter sling (3) to the aft hook. Secure the slings to the rack hooks by pushing up on the cocking knob. Refer to paragraph *c*, (4), *(f)* for description of torpedo slings. *(See figure 300.)*

13. Hoist the torpedo from the truck and see if the torpedo is located too far aft or forward in the hoisting band; if so, move the band until the torpedo balances close enough to be lifted safely.

14. Hoist the torpedo to the torpedo rack and attach the two loose ends of the two torpedo slings to the hooks on the outboard side rack. Secure the sling ends to the rack by pushing up on the cocking knob.

15. Attach the starting lanyard to the angle (5) on the wing.

16. Detach the hoisting cables from the hoisting band (7), and remove the hoists from the airplane.

17. Detach and remove the hoisting band (7) from around the torpedo.

18. Remove the balancing ropes from each end of the torpedo.

19. Remove the torpedo loading platforms as outlined in paragraph *c*, (4), *(c)*, *2*.

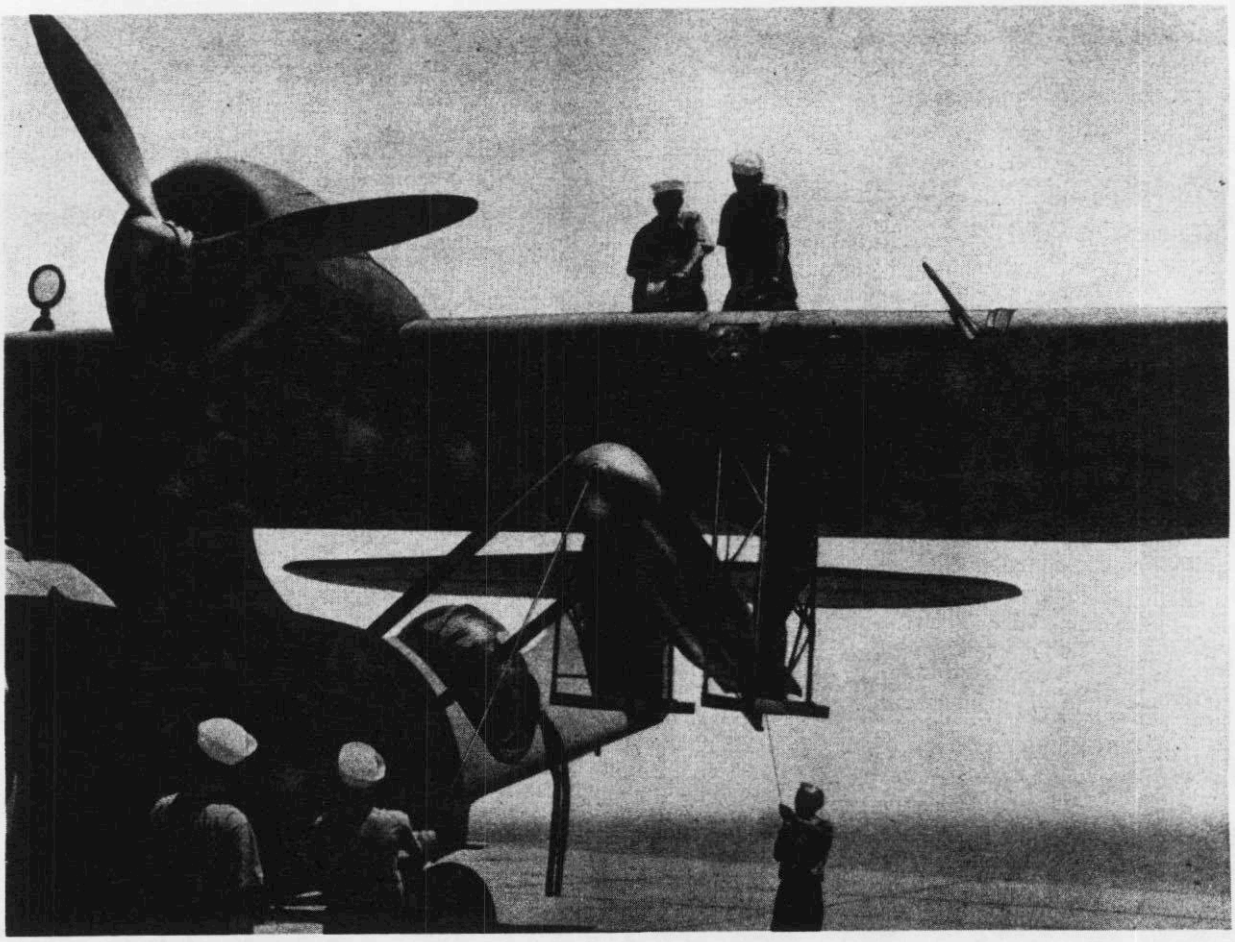


Figure 299—Hoisting Torpedo

(c) BOMB AND TORPEDO LOADING PLATFORM.

1. DESCRIPTION.—The bomb and torpedo loading platforms are designed for attachment to alternate sets of fittings which are built in the lower surface of the wing. The fittings are so arranged that the platforms can be installed on both or either side of any bomb or torpedo rack installation.

Bomb and torpedo loading crew members are thereby able to work from the platforms while installing the bombs, torpedoes, or their attaching racks to the bottom of the wing.

The platforms are constructed of a corrugated alclad walkway, supported by chrome-moly steel, seam welded hangers and braces.

2. REMOVAL.—Remove the bomb and torpedo loading platform from the airplane as follows: *(See figure 300.)*

a. Have two crew members on ladders, one at each end of the platform.

b. Slide the lock pin down, at the top of each of the four support hangers.

c. Hold up on the forward end of the platform with one hand, and with the other bend the forward diagonal brace at the knee joint until the platform is detached from the wing.

d. At the aft end, lift up on the platform and push forward, and then let the platform down to the ground.

e. Bend the aft brace knee joint and fold the brace down to the platform.

f. Fold the forward brace down over the aft brace.

3. INSTALLATION.—Install the bomb and torpedo loading platform on the airplane as follows:

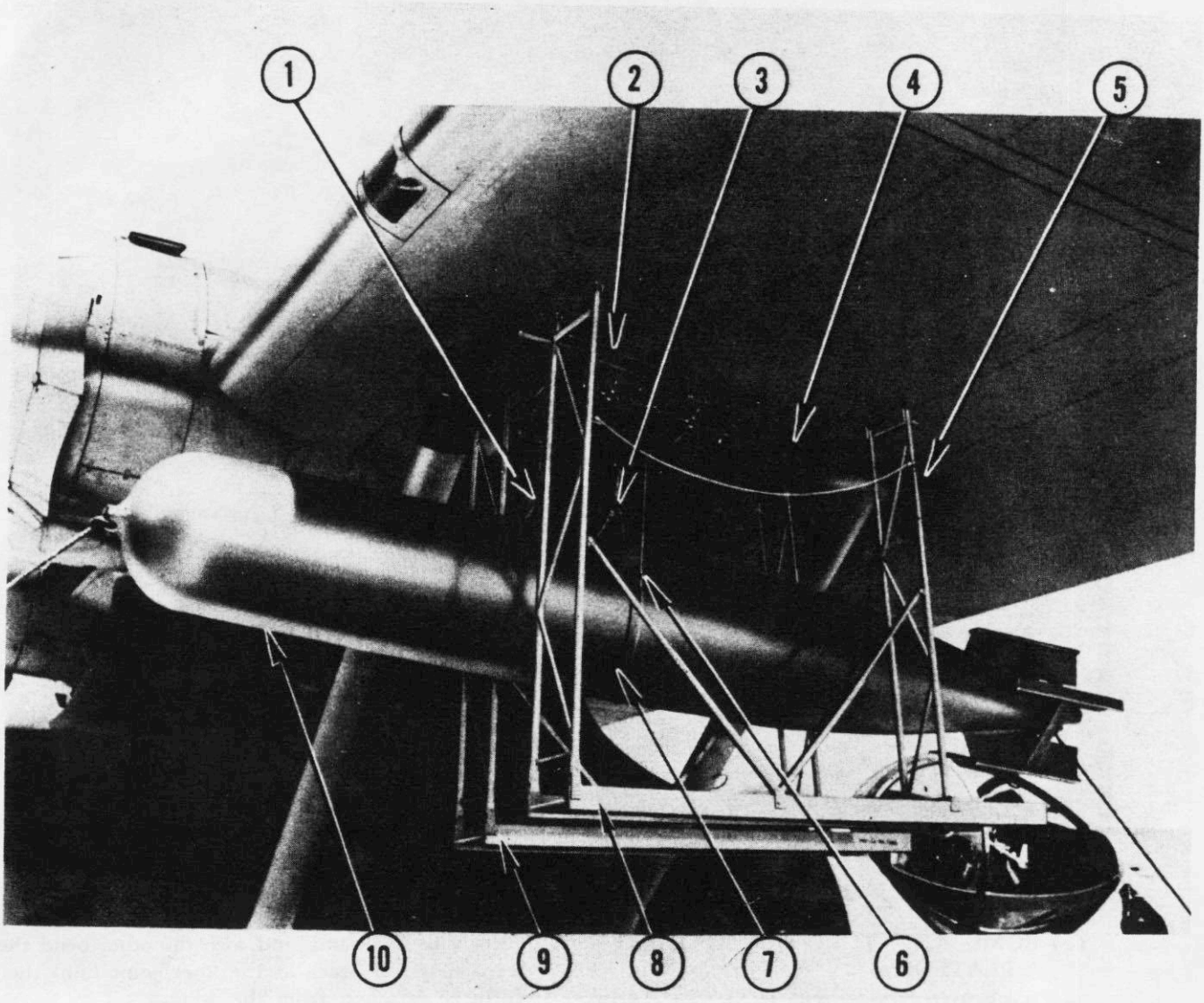
a. Have two men with ladders, one each to be used under the forward and aft wing platform fittings.

b. Open the forward hanger, but not all the way.

c. Open the aft hanger all the way, straightening the diagonal brace.

d. Raise the platform and insert the aft hanger into the wing fittings. Push aft until the lock pin can be pushed up into the fitting.

e. Straighten out the forward diagonal



No.	PART No.	NAME	No.	PART No.	NAME
1	29A017-86	Torpedo Sling	6		Cable Attaching Clevis
2	28A5132-3L&3R	Torpedo Rack Assembly	7	28A3008	Hoisting Band
3	29A017-82	Torpedo Sling	8	28A1063-3	Loading Platform
4	28F3045-50	Torpedo Stop	9	28A1063-4	Loading Platform
5	29F5340	Lanyard Angle	10	Mark 13	Torpedo

Figure 300—Hoisting Torpedo with Loading Platform in Position

brace and at the same time insert the hanger into the wing fitting.

f. Lock the hanger into the fitting by pushing up on the lock pin.

g. The platform is now ready for use.

(d) BOMB HOIST (MARK 6). *(See figure 294.)*—The hoist is mounted on top of the wing above the bomb rack and the cable is run through the wing and rack.

The unit consists of a cylindrical cast aluminum alloy frame that houses a gear train and brake mechanism. The base is drilled for four mounting bolts.

Attached to one side of the hoist is a ratchet crank which turns the shaft and bearing. Another crank, not directly attached to the shaft, operates the brake side of the hoist.

The load is raised by turning the ratchet crank in a counterclockwise direction or by turning the brake crank in a clockwise direction. The load is lowered by turning the brake crank in a counterclockwise direction. This releases friction in the brake sufficiently

to allow the suspended load to be lowered by its own weight, but only while the crank is turned.

(e) TORPEDO HOISTING BAND. *(See figure 300.)*—The torpedo hoisting band is a single circular steel strap used to hoist torpedoes of the Mark 13 type into position on the airplane. The band may be opened for installation by loosening the take-up nut.

The band is placed around the torpedo with hoisting brackets on each side. After the band is located and the take-up nut is tightened, the torpedo is hoisted into position by two bomb hoists.

(f) TORPEDO SLINGS. *(See figure 300.)*—Two slings are used for installing the torpedo on the torpedo rack. The slings are made of 5/16" diameter 7 x 19 extra flexible steel cable, and equipped with turnbuckles and eye fittings at each end. The forward sling is longer by approximately three inches because of one extra link. The aft sling is equipped with a link at one end only.

(5) MARK 28-2 TORPEDO DIRECTOR.

(a) DESCRIPTION.—The MK 28-2 torpedo director is mounted on a track in the pilot's compartment, where it can be used by either the pilot or the copilot.

Note

Provisions for mounting the torpedo director are made on all PBY-5 airplanes and on all PBY-5A airplanes prior to serial number 46586.

Because of the dimensional limitations of the pilot's enclosure, extreme target angles off the port side may be more readily sighted by the copilot, while extreme target angles off the starboard side may be more readily sighted by the pilot.

The mount for the torpedo director consists of a carriage supported by ball bearing rollers. The track for the carriage is mounted above the instrument panel.

(b) REMOVAL.

1. Pull down on the knobbed head of the spring-loaded pin which holds the torpedo director to the carriage. This releases the torpedo director from the carriage so that by pulling aft on the torpedo director it may be slid from the carriage.

2. Remove the four screws which hold the forward track to its mounting brackets.

3. Remove the carriage, with the forward track affixed to it, from the rear track by withdrawing the carriage rollers through the slots cut in the rear track flanges.

4. Remove front track from carriage by removing bolt at the forward end of carriage.

(c) INSTALLATION.—To install the torpedo director and its carriage, reverse the removal procedure as outlined in paragraph *c*, (5), *(b)* above.

d. ARMOR.

(1) GENERAL. *(See figure 301.)*—Armor plate is installed in eight places in the airplane. One major armor plate installation is located on the pilot's seat back and an identical installation is supplied for the copilot's protection. Both waist gunners are supplied with a portable armor plate installation mounted directly on the waist guns. The tunnel gunners positions is protected by two large sheets of armor plating. The fuel sump is provided protection from gunfire through three points: the superstructure armor installation, upper bulkhead 5 assembly, and the installation on the rear wing spar.

All installations are composed of homogeneous steel armor plate ranging in thickness from 3/16 in. to ⅜ in. except the waist gun assembly which is composed of ⅜ in. face-hardened steel armor plate.

(2) BOW GUN SKIRT ARMOR PLATE.

(a) DESCRIPTION. — PBY-5 airplanes are equipped with two pieces of bow gun skirt armor plate used to protect the bow gunner from gun fire in the direction he is aiming. The armor plate is mounted to brackets on the gun carriage and circular windshield just below the gun. The armor plate is secured to the brackets with wing nuts and the two pieces are hinged so that they may be removed, folded and stowed in the airplane.

(b) REMOVAL.

1. Remove the four wing nuts that fasten the armor plate to the support brackets.

2. Pull armor plate from the mounting studs protruding from the brackets.

3. To disassemble the two pieces of armor plate, remove the two hinge bolts, nuts and spacers.

(c) INSTALLATION.—To install the bow gun skirt armor plating, reverse the removal procedure outlined in paragraph *d*, (2), *(b)* above.

(3) PILOT'S AND COPILOT'S ARMOR PLATE.

(a) DESCRIPTION.—The pilot and copilot are protected from gunfire from the rear, by a large sheet of ⅜ inch homogeneous steel armor plate. The armor plates form the back structure of the pilot's and copilot's seat.

There are approximately 70 lb of armor plate and attaching parts to each seat.

(b) REMOVAL.—The armor plate is an integral part of the seat back structure and is not readily removable.

(4) WAIST GUNNER'S ARMOR PLATE.

(a) DESCRIPTION. *(See figure 302.)*—The waist gunner is protected by a "V" shaped armor plate installation which is assembled on the gun directly over the mount. The protection consists of two pieces of ⅜ inch face-hardened steel armor plate.

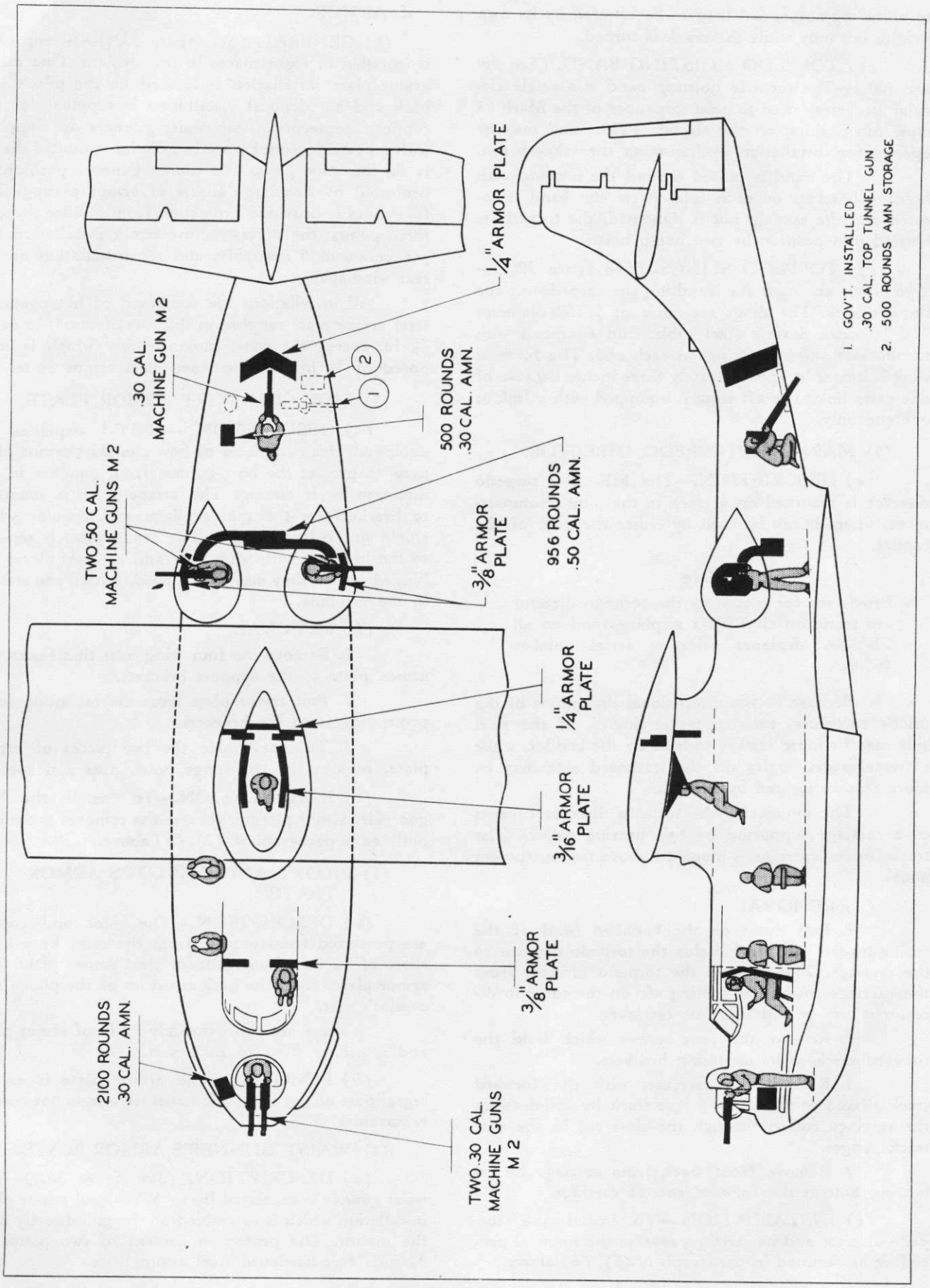


Figure 301—Defensive Armament Diagram

Upper body and head protection is furnished the gunner only from the approximate direction in which the gun is aimed. The armor plate installation for each gun weighs approximately 49.0 lb. The complete installation is jettisonable during flight.

(b) REMOVAL.—Four men can remove the armor plate from the two guns in four minutes time. Tools used are two 9/16 ratchet socket wrenches, two 7/16 in. speed wrenches, two ⅜ in. ratchet socket wrenches, two ⅜ in. open end wrenches, one hammer, one chisel, two slot head screw drivers, and two pliers.

1. Detach bracket (18) from side of gun by removing the two bolts and nuts (19).

2. Detach the lower-center armor plate bracket (11) from the handle shaft by removing the two bolts and nuts (12) from the two clips (13). Pry the clips open and remove from the shaft.

3. Detach the chest pad (16) from the butt end of the gun by removing the nut (17) from the attaching bolt.

4. Loosen the bolt and nut (15) where the gun mount tube (14) attaches to the gun. Pull the tube outward.

5. Remove the armor plate assembly from the airplane.

(c) INSTALLATION.—To install the waist gunner's armor plate reverse the removal procedure outlined in paragraph *d*, (4), *(b)* above.

(5) TUNNEL GUN ARMOR PLATE.

(a) DESCRIPTION. *(See figure 302.)*—The tunnel gunner is protected by two large plates of ⅜ inch homogeneous steel. The armor plates are installed in an inclined and "V" position, just aft of the tunnel gun hatch.

This armor plate installation protects the tunnel gunner from rear gun fire only.

The armor plate and supporting braces weigh approximately 111.0 lb. The complete installation is jettisonable during flight.

(b) REMOVAL.—Two men can completely remove this armor installation in five minutes. Tools needed are: two ⅜ in. ratchet socket wrenches, two ⅜ inch speed wrenches, two ⅜ in. open end wrenches, two Phillips head screw drivers, two slotted head screw drivers, one hammer, two pliers, and one chisel.

1. Clamp the armor plates to the vertical braces (8) with "C" clamps before starting the removal operations. This will allow complete removal of all installation screws and bolts without danger of the plates slipping or falling and damaging the airplane.

2. Detach the attaching clips (4) from each of the four outboard corners of the armor plate, by removing the four bolts, nuts, and washers (1).

3. Detach the armor plate support clip (3) and micarta spacers from the top of the center brace by removing the six bolts, nuts, and washers.

4. Loosen the six bolts, nuts, and washers (9) at the bottom of the center brace.

5. Remove the armor plate from the airplane.

(c) INSTALLATION.—To install the tunnel gunner's armor plating, reverse the removal procedure outlined in paragraph d, (5), *(b)* above.

(6) FUEL SUMP ARMOR PLATE.

(a) GENERAL.—The fuel sump is protected by a series of armor plating, which shields the unit from rear and side gun fire.

The major installation is in the superstructure between the skin and fuel sump. The other two smaller installations, which protect the sump from the rear, are located immediately behind the sump on bulkhead 5 and on the rear wing spar.

(b) SUPERSTRUCTURE ARMOR PLATE.

1. DESCRIPTION. *(See figure 302.)*—The sump is portected from side and lower rear gun fire by a series of small sheets 3/16 in homogeneous steel armor plating. The plates are padded with thin sheets of neoprene rubber and held in place by small bolted angles and clips. The total installation including attaching parts weighs approximately 60 lb. It may be completely removed from the airplane only if the wing is removed.

2. REMOVAL.—Four men can readily remove the armor plate installation with the following tools: two ⅜ in. ratchet socket wrenches, two ⅜ in. open end wrenches, two slotted head screw drivers, two Phillips head screw drivers, one hammer, and one chisel.

a. Detach and hoist wing. (See Section IV, Par. 1, *b*, (2), *(a)*.)

b. Remove the eight upper armor plate angle clips (62) and (70) by extracting the eighteen screws, nuts and washers (64).

c. Slide the seven pieces of side armor from their positions and remove from the airplane.

d. Detach the nut plate strip (57) and rubber strips by removing the eight bolts (75). Three bottom washer plates (76) will come off when the bolts are extracted.

e. Detach the six angle clips (58) and rubber strips by removing the seven bolts (60) and one screw and nut (67).

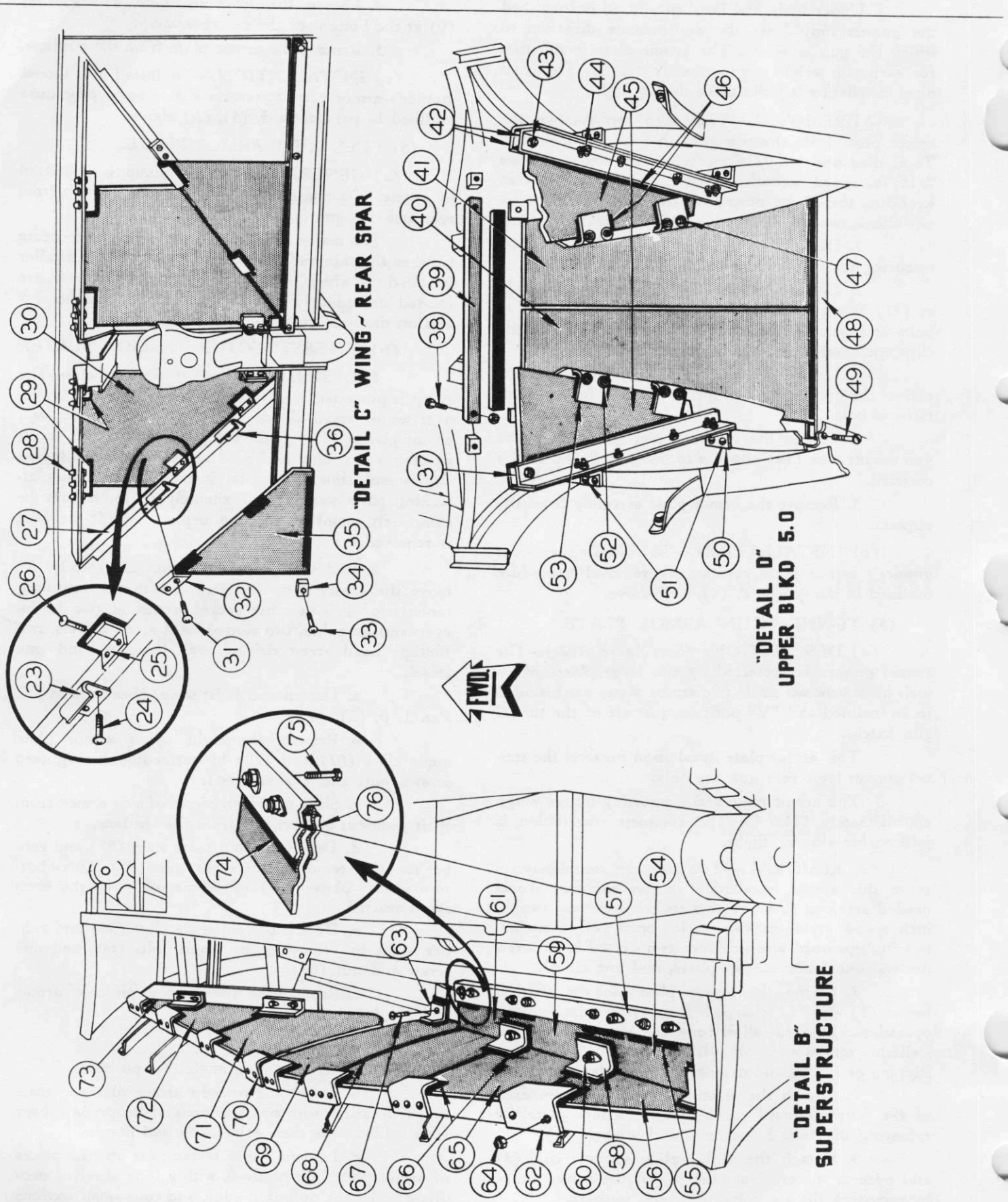
f. Remove the three bottom pieces of armor and the long angle.

3. INSTALLATION.

a. Lay the long angle into position.

b. Insert the upright armor plates in their proper location, with small sections of neoprene rubber (66) folded over their joints, top and bottom.

c. Lay the three rectangular shaped pieces of armor plate into position, with a long sheet of neoprene under the outboard edge, and four small sections



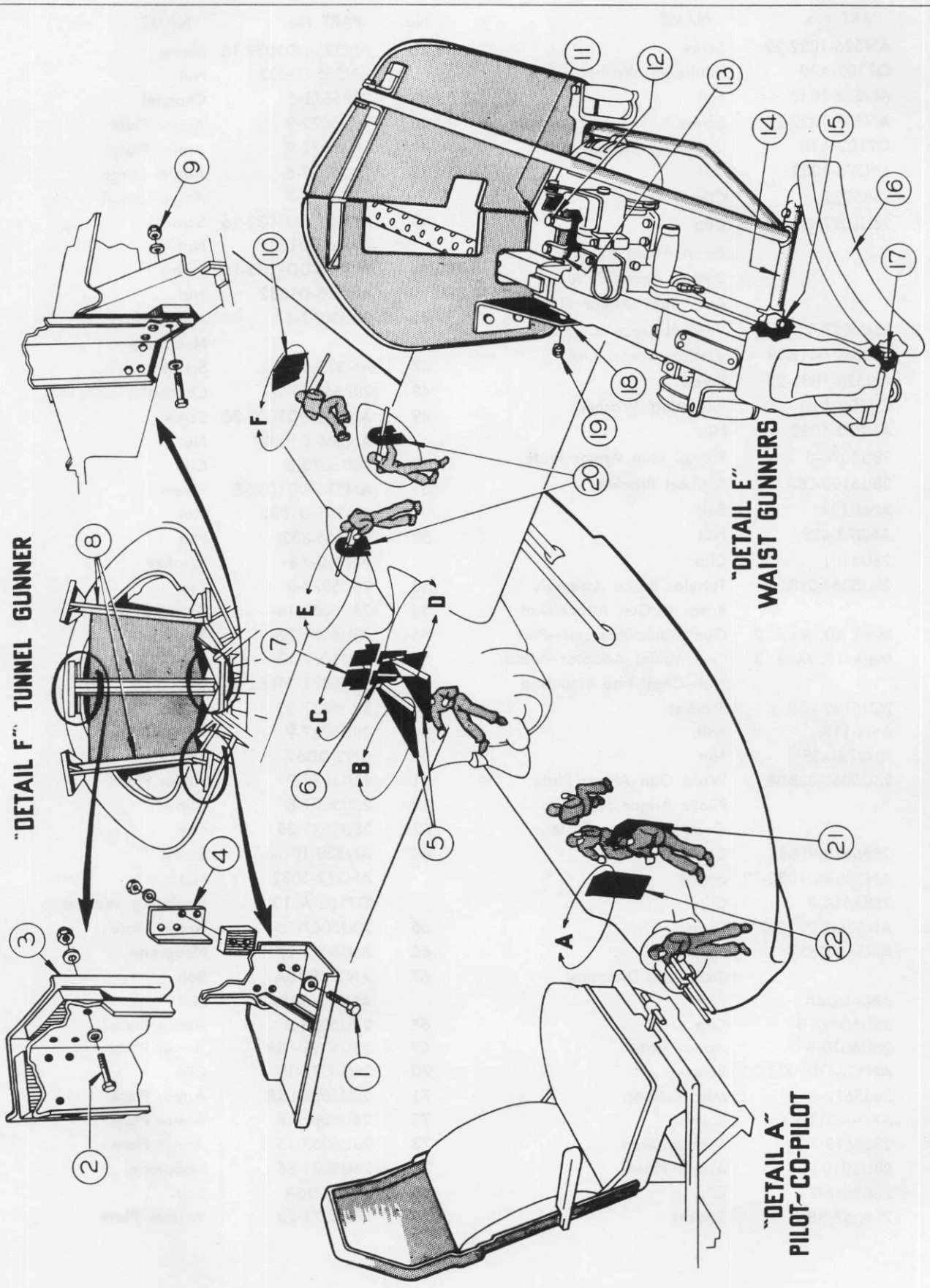


Figure 302—Armor Plate Installation

No.	PART No.	NAME
1	AN526-1032-22	Screw
	Q7102-A10	Insulating Washer
	AN372-1032	Nut
2	AN526-1032-22	Screw
	Q7102-A10	Insulating Washer
	AN372-1032	Nut
3	28B5023	Clip
4	28U5077-8L&8R	Clip
5		Sump Armor Plate
6		Blkd. 5 Armor Plate
7		Rear Spar Armor Plate
8	28U5077-11	Vertical Brace—Center
	28U5077-9L&9R	Vertical Brace—Outer
9	AN526-1032-22	Screw
	Q7102-A10	Insulating Washer
	AN372-1032	Nut
10	28U5076-6	Tunnel Gun Armor Plate
11	28U5100-L&R	Support Bracket
12	AN4-13A	Bolt
	AN372-428	Nut
13	28U5101	Clip
14	28U5064-2L&2R	Tubular Brace Assembly
15		Brace to Gun Attachment
16	Mark 10, Mod. 2	Gun Mount Adapter—Port
	Mark 10, Mod. 3	Gun Mount Adapter—Stb'd.
17		Nut—Chest Pad Mounting
18	28U5102-L&R	Bracket
19	AN4-11A	Bolt
	AN372-428	Nut
20	28U5058-3L&3R	Waist Gun Armor Plate
21		Pilot's Armor Plate
22		Copilot's Armor Plate
23	28B5618-9L&9R	Clip
24	AN526-DD1032-12	Screw
25	28B5618-8	Clip
26	AN526-DD832-8	Screw
	AN365-D832	Nut
27		Rear Spar Diagonal
28	AN3-DD4A	Bolt
29	28U5069-10	Clip
30	28U5070-8	Armor Plate
31	AN526-DD1032-20	Screw
32	28B5619-6	Micarta Stop
33	AN3-DD11A	Bolt
34	28B5619-7	Micarta Stop
35	28U5070-9	Armor Plate
36	28B5618-7	Clip
37	28B5670-8	Spacer
38	AN526-DD1032-16	Screw
	AN365-D1032	Nut
39	28B5671-6	Channel
40	28U5072-9	Armor Plate
41	28U5072-9	Armor Plate
42	28U5073-6	Angle—Large
	28U5073-7	Angle—Small
43	AN526-DD1032-16	Screw
	AN365-D1032	Nut
44	AN526-DD1032-10	Screw
	AN365-D1032	Nut
45	28U5072-8	Armor Plate
46		Neoprene
47	AN515-8-16	Screw
48	28B5671-7	Channel
49	AN526-DD1032-20	Screw
	AN365-D1032	Nut
50	28U5073-8	Clip
51	AN526-DD1032-8	Screw
	AN365-D1032	Nut
52	AN365-832	Nut
	AN960-A8	Washer
53	28U5073-9	Clip
54	28U5067-14	Armor Plate
55	28U5071-36	Neoprene
56	28U5067-17	Armor Plate
57	28U5071-21L&21R	Nut Plate Strip
58	28U5071-23	Clip
59	28U5067-9	Armor Plate
60	AN3-DD6A	Bolt
61	28U5067-9	Armor Plate
62	28U5071-8	Clip
63	28U5071-35	Clip
64	AN520-10-10	Screw
	AN372-1032	Nut
	Q7102-AL10	Insulating Washer
65	28U5067-18	Armor Plate
66	28U5071-27	Neoprene
67	AN3-DD10A	Bolt
	AN372-D1032	Nut
68	28U5093-6	Armor Plate
69	28U5091-L&R	Armor Plate
70	28U5071-10	Clip
71	28U5092-L&R	Armor Plate
72	28U5067-16	Armor Plate
73	28U5067-15	Armor Plate
74	28U5071-36	Neoprene
75	AN3-DD6A	Bolt
76	28U5071-22	Washer Plate

of neoprene (55) around each joint on the inboard edge.

d. Fasten the nut plate strip (57) into position with the eight bolts (75). Insert a double thickness of neoprene (74) under the inboard edge of the strip. The three washer plates (76) will act as washers on the under side of the armor.

e. Attach the five angle clips (58) with the eight bolts (60). Insert three sections of neoprene (66) under the three aft clips between the bottom flange of the clip and the armor plates.

f. Attach the small angle clip (63) at the bottom near the sump outlet with the bolt and nut (67).

g. Attach the tip angle clips (62) and (70) with the eighteen screws and nuts (64).

(c) BULKHEAD 5 ARMOR PLATE.

1. DESCRIPTION. *(See figure 302.)*—The fuel sump is protected from rear gun fire by a group of four plates of ¼ in. homogeneous steel armor plate. The armor plates are attached with small angles and channels to the top aft side of bulkhead 5.

The total installation weighs approximately 19 lbs. and can readily be removed through the opening in the aft section of the superstructure.

2. REMOVAL.—This installation can be removed from the airplane by two men in six minutes. Tools needed are: two ⅜ in. ratchet socket wrenches, two ⅜ in. open end wrenches, two Phillips head screw drivers, two slotted head screw drivers, one hammer, and one chisel.

a. Remove the upper aft superstructure fairing (9). *(See figure 64.)*

b. Detach the four angle clips (53) by removing the eight nuts and washers (52).

c. Remove the two outboard assemblies by removing the eight screws and nuts (51).

d. Remove the sixteen screws and nuts (43) and (44) attaching the two angles (42) together and then remove the armor plates (45) and neoprene strips (46).

e. Remove the channel strip (39) from the top of the two large pieces of armor plate, by extracting the two screws and nuts (38).

f. Lift up on the left-hand plate (40) and push forward. Then pull the right-hand plate (41) inboard and aft, until out.

g. Remove the left-hand plate (40).

h. Remove the bottom channel strip (48) by extracting the two screws and nuts (49) from the ends.

3. INSTALLATION.

a. Install the bottom channel strip (48) between the two bulkhead flange angles, with the two screws and nuts (49). Insert eight screws (47) through the holes in the bulkhead angles for installation of the two small plates.

b. Insert a strip of neoprene in the channel (48).

c. Slide the right-hand plate (41) up into position.

d. Install the left-hand plate (40) by pushing the right-hand plate (41) up and forward until the left-hand plate is in position.

e. Lay a piece of neoprene over the top edge of the two plates and install the top channel strip (39) with the two screws and nuts (38).

f. Insert the small section of armor plate (45), a strip of neoprene, and two spacers (37), between the two angles (42) and insert the screws and nuts (43).

g. Tie the two angles together by installing the two screws and nuts (44).

h. Attach the two angle clips (50) to the angle assembly (42) with the four screws and nuts (44).

i. Attach the assembly to the airplane with the four screws and nuts (51).

j. Attach the two angle clips (53) and the two neoprene strips (46) with four nuts and washers (52) on the screws (47).

(d) REAR SPAR ARMOR PLATE.

1. DESCRIPTION. *(See figure 302.)*—The fuel sump is protected from upper rear gun fire by a group of four ¼ in. homogeneous steel armor plates which are installed on the aft side of the rear wing spar directly over the center line of the airplane.

The plates are supported by the diagonal stiffeners of the rear spar and a series of removable clips.

The armor plates and the attaching parts weigh approximately 37 lb.

2. REMOVAL.—The rear spar armor can be removed from the airplane by two men in 15 minutes. Tools needed are: two ⅜ in. ratchet socket wrenches, two ⅜ in. open end wrenches, two Phillips-head screw drivers, two slotted head screw drivers, and one pair of pliers.

a. Gain access to the armor plate installation through the two fabric access openings (33), located on top of the trailing edges at the center line of the airplane. *(See figure 20.)*

b. Remove the micarta stop block (34) at the bottom of the lower armor plate (35) by removing the screw, nut and washer (33). *(See figure 302.)*

c. Remove the micarta stop block (32) at the top of the lower armor plate by removing the two screws, nuts, and washers (31).

d. Remove the lower armor plate from the

airplane by prying it outward until loose, and then lifting it out through the access opening.

e. Detach the two lower armor plates supports (23) and (36) from the diagonal stiffener (27) by removing the four screws and nuts (24).

f. Detach the two upper armor plate (30) clip plates (25) from the diagonal stiffener by removing the four screws and nuts (26).

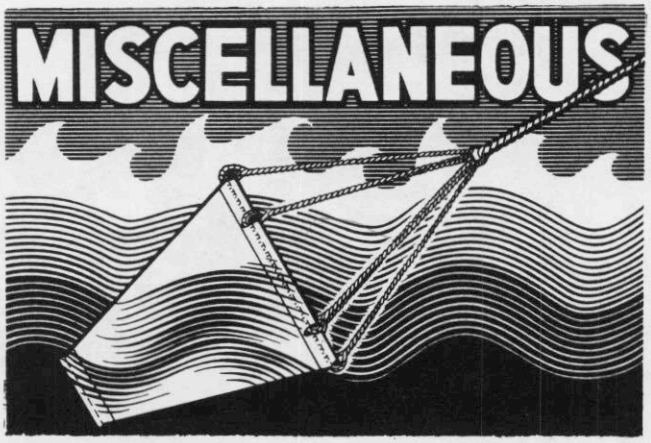
g. Detach the two upper armor plate support clips (29) by removing the six bolts and nuts (28).

h. Pull the armor plate (30) loose, and remove, first clearing the torque tube by lowering the plate under the tube and aft through the access opening.

3. INSTALLATION.—To install the wing rear spar armor plate, reverse the removal procedure outlined in paragraph *d*, (6), *(d), 2* above. Armor plates must be padded with short channels of rubber, at all points of contact with metal.

★ ★ ★

PARAGRAPH 5.



5. MISCELLANEOUS EQUIPMENT.

a. LIFE RAFT.
(See figure 304.)

(1) DESCRIPTION.—The Mark VII, Type "D" life raft is a seven man life raft, constructed of rubberized fabric. In normal operation, it is inflated by a cylinder containing a charge of approximately 4.7 pounds of CO_2. In an emergency, it can be inflated by means of a hand pump furnished with the raft.

It is enclosed by a carrying case which is secured by snap fasteners. This carrying case will remain in an opened condition after the inflated raft is free of the case, the case thereby acting as a sea anchor for the raft case. A ten foot bridle consisting of four lines of one-quarter inch cotton rope secures the case to the raft.

The equipment furnished in the life raft consists of the following:

Three collapsible oars (Navy Specification M-162)
A hand pump (Navy Specification M-197)
Two sails (Navy Specification AN-S-34)
A fishing kit (Navy Specification AN-K-2)
One waterproof compass and match holder (Navy Specification AN-C-101)
A smoke grenade holding clamp
A jack knife (Boy Scout type)
A tweny-five foot length of cord
A whistle
A chromium-plated reflector for signalling
Navigation charts
A fish spear
One life raft repair kit
Six bullet hole leak plugs

These articles are stowed in watertight pockets in the raft.

An emergency equipment container is attached to the life raft by a ten foot rope. The container holds the following emergency equipment:

First Aid Kit (Specification 57-K-0366b Bureau of Medicine and Surgery)
Emergency Rations (7) (Navy Specification M-539)
Emergency Drinking Water (14) (Army-Navy Specification AN-W-5)
Smoke Grenades (2) (Bureau of Ordnance Type M-8)
Sea Marker (Navy Specification M-528)
Mosquito Headnets (7) (Navy Specification M-565)
Pyrotechnic Projectors
Six Red Very's cartridges

On all PBY-5 airplanes and on PBY-5A airplanes up to serial number 46609, the life raft is stowed on the floor on the port side forward of bulkhead 7. On PBY-5A airplanes with serial numbers 46609 and on, the life raft is stowed in a vertical position on a fabric platform on the forward port side of bulkhead 7. *(See figure 303.)*

The life raft is held in position by strap assemblies.

(2) OPERATION.—Just before dropping the raft from the plane, pull the ripcord handle which is attached to the CO_2 bottle. When the handle is pulled, the carbon dioxide is released into the raft flotation tube. As the raft inflates, the snap fasteners on the carrying case are forced apart and the inflated raft emerges from the carrying case.

Note

In the event the ripcord does not function, the inflation of the life raft can also be accomplished by manual operation of the CO_2 cylinder.

(3) MAINTENANCE. — An inspection of the life raft assembly every 200 to 240 hours should be made by placing the life raft (in the carrying case) on some reasonable clean level surface and then pulling the handle. The raft should inflate in less than 30 seconds. When the raft is fully inflated, check for leaks with a soap solution. Check the pressure in the raft. It should be ½ to 1½ pounds per square inch at 21°C (70° F). By means of the topping off valves, deflate one compartment of the raft at a time. The raft should not change its shape.

If the raft is found to be satisfactory, clean it off thoroughly, dry it well, and dust it off with powdered talc. Recharge the CO_2 cylinder or replace with a fully charged one. Refold the raft in accordance with the chart in the pocket of the life raft carrying case; stow in airplane.

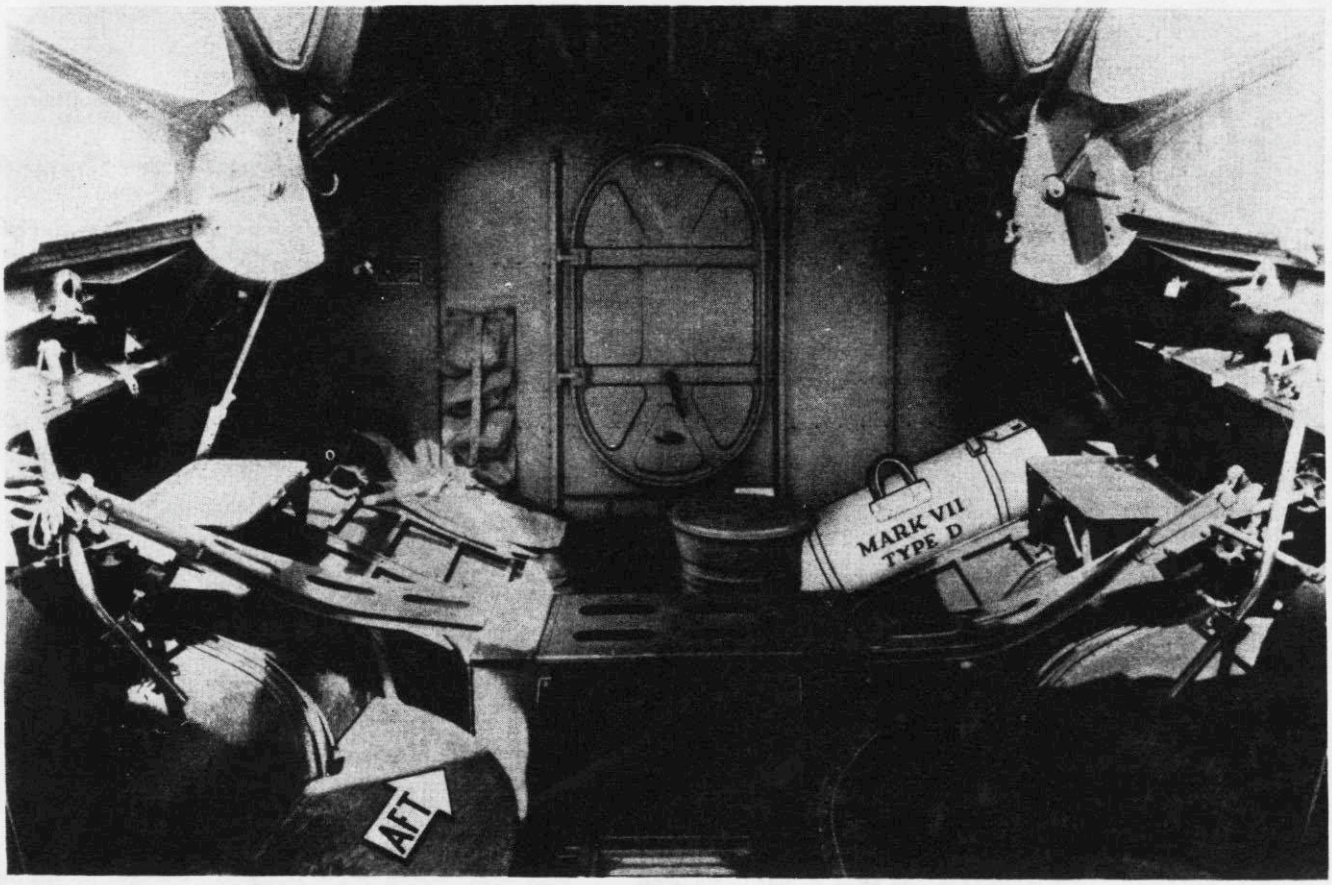


Figure 303—Life Raft Stowage (PBY-5A Serial Numbers 46609 and On)

A repair kit is furnished for emergency repairs to the life raft. This repair kit contains patching material, tire patches, rubber cement, a roughing tool, a pair of pliers, and a pair of scissors.

b. MARK 7 TOWING REEL.
(See figure 305.)

(1) DESCRIPTION.—The Mark 7 target towing reel is a hand operated reel used in aircraft gunnery practice to hold the tow cable, to control it as it is run out, and to rewind the cable into the airplane after the target has been released. The reel has a capacity of 4500 feet of 3/32 inch diameter cable or 2500 feet of one-eighth inch diameter cable.

Provision is made in the airplane for the installation of the tow target reel in the tunnel gun compartment. The reel is mounted on the "Vee" brace where the tunnel gun stirrup is normally mounted, between bulkheads 7 and 8. The reel is supported at four points, with the tow reel projecting through the tunnel entrance and below the keel.

The target towing reel consists of a cable drum assembly mounted between two side plates which are held rigidly in place by four spacer shafts. On one side of the reel is a brake assembly; on the other side, a gear train and crank assembly. This reel does not have a level winding mechanism but is provided with a hand-held cable guide to facilitate even laying of the cable upon the drum.

In the stowed position, the reel and frame is folded forward and secured to the floor by straps.

(2) INSTALLATION.
(See figure 305.)

(a) Remove the gun stirrup from the "Vee" brace (12).

(b) Attach the reel base (13) with the same bolts and nuts (11) as were used for the stirrup.

(c) Secure the "Vee" brace (12) to the stirrup base (10) with the bolt (7).

(d) Attach the reel (16) to the reel base (13) by means of the four bolts and nuts (23).

(e) Assemble the sheave (5), upper struts (3) and center struts (8) to the lower struts (4) by means of the bolt and nut (6).

(f) Attach the center struts (8) to the eyebolts (9).

(g) Assemble the socket (1) and plug (2) to the lower strut (4).

(h) Attach the rear struts (24) to the reel base (13).

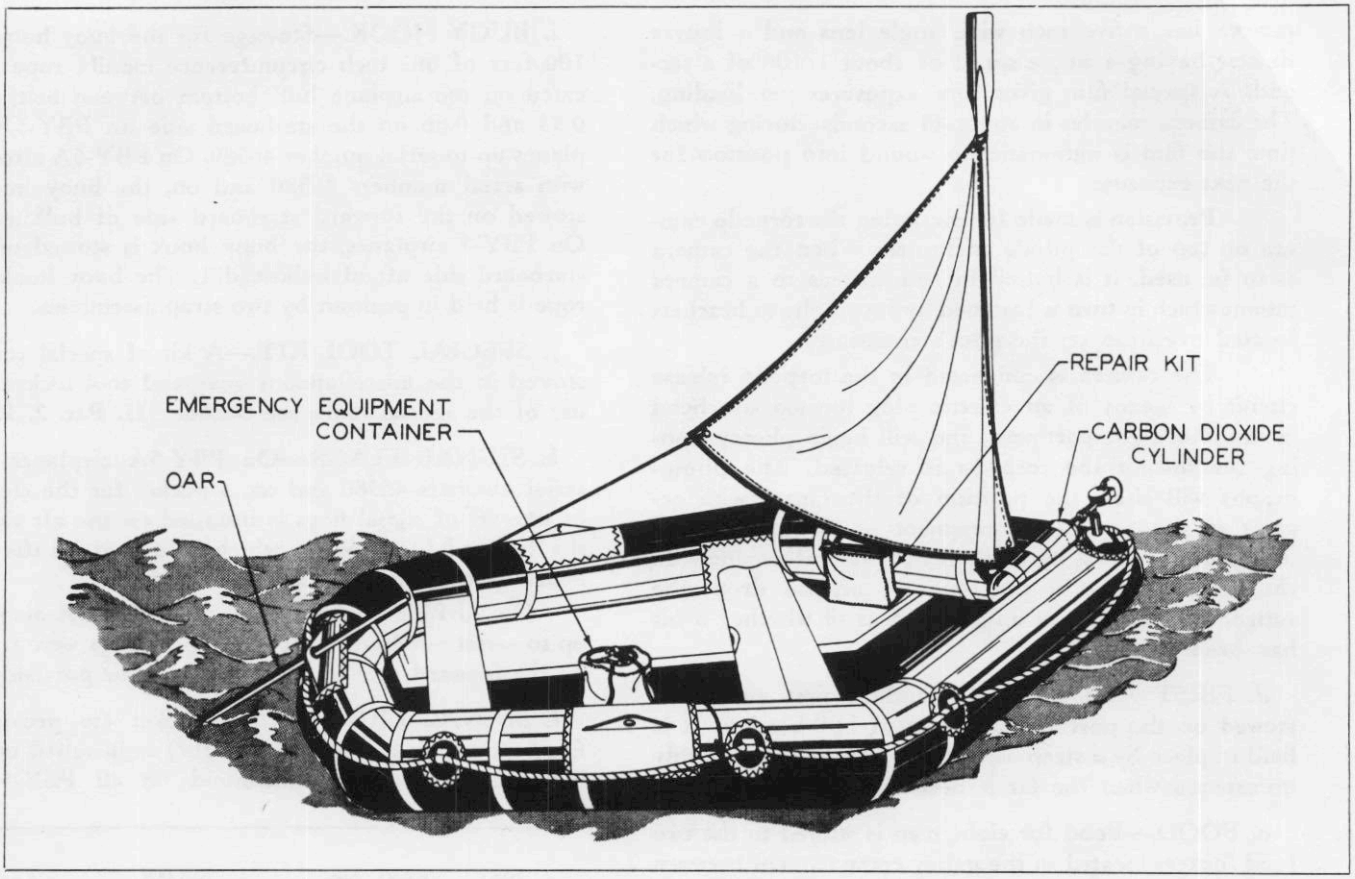


Figure 304—Life Raft Inflated

(i) Secure the reel base (13) to the floor, then to the struts with the stowage straps (15) provided.

(3) PREPARATION FOR USE.

(See figure 305).

(a) Loosen the stowage straps (15) and swing the sheave (5) down into position.

(b) Raise the base (13) and reel (16).

(c) Attach the lower strut (4) to base (13) with nuts (19).

(d) Attach rear struts (24) to clips (20) with two nuts (21).

(e) Tighten the installation with the pin (14) located under the stirrup base (10).

(f) Adjust and attach upper struts (3) and eyebolts (17) to reel (16) with nuts (18).

(4) OPERATION.—Before the target is launched from the airplane, unwind from the reel a length of cable sufficiently long to insure that the target will clear the tail of the airplane. The gear housing cover should be down, preventing the ratchet gear pawl from engaging. Be sure that the hand crank has been removed from the reel.

Note

The crank should be mounted on the cable drum shaft only when it is desired to wind the cable onto the drum.

Partially set the brake to control the speed of running out the cable before launching the target. After the target has been launched, control the speed at which the cable is run out by operating the brake.

After the desired length of tow cable has been run out, gradually set the brake and engage the ratchet gear pawl locking the drum securely.

When reeling in, use the cable guide to guide the cable onto the drum in even, equally spaced turns. The ratchet gear pawl should be kept on the ratchet gear throughout the rewinding; this will prevent the reel from running out cable in case the crank becomes disengaged.

(5) MAINTENANCE.—Before each towing mission, all bolts and nuts should be checked to insure tightness. Check the brake to be sure that it will operate properly. The brake band may be adjusted by turning the adjusting screw.

The gear box should be kept packed with grease (Specification AN-G-10).

(6) REMOVAL.—To remove the towing reel, reverse the installation procedure outlined in paragraph *b.*, (2).

c. TORPEDO CAMERA. (Type F-46.)—The type F-46 torpedo camera is used to determine the result of actual combat or practice aerial torpedo attacks. The

camera has a five inch wide angle lens and a louvre shutter having a single speed of about 1/100 of a second. A special film gives four exposures per loading. The camera recycles in about 45 seconds, during which time the film is automatically wound into position for the next exposure.

Provision is made for mounting the torpedo camera on top of the pilot's enclosure. When the camera is to be used, it is bolted in four places to a camera mount which in turn is fastened by four bolts to brackets located overhead on the pilot's enclosure.

The camera is connected in the torpedo release circuit by means of an electric plug located overhead in the pilot's compartment, and will begin photographing the instant the torpedo is released. The photographs will show the position of the target with respect to the airplane. Assessment of the negative by means of the assessing equipment gives information on the flight attitude at the time of torpedo drop, the range, lead and target angles, and as to whether a hit has been scored.

d. FIRST AID KIT.—A standard first aid kit is stowed on the port forward face of bulkhead 6. It is held in place by a strap assembly, which may be readily unfastened when the kit is needed.

e. FOOD.—Food for eight men is stowed in the two food lockers located in the galley compartment between bulkheads 4 and 5. Ten pounds of food is provided for each man for normal consumption and ten pounds for each man for emergency consumption.

f. WATER. — Four removable, corrosion-resistant steel containers for water are provided in the airplane. In the PBY-5A airplanes, two containers (one above the other) are located on the aft face of bulkhead 2, port side. They are supported by brackets fastened to bulkhead 2 and held in position by straps. The other two are located on the starboard shear web aft of bulkhead 4. A spring loaded pin located at the top inboard end of each tank holds it in position. A faucet is provided on each tank for a water outlet. On PBY-5A airplanes, two containers are located overhead between bulkheads 4 and 5, one on each side of the engineer's seat. These are held in position by brackets and metal straps. Two other containers, one above the other, are installed on brackets on the forward port face of bulkhead 6 and held in position by strap assemblies. For information regarding capacities and replenishing of water tanks see Section III, Par. 2, *h.*, (8).

g. CANVAS BUCKET.—A three gallon capacity canvas bucket is stowed in the miscellaneous gear and tool locker which is located in the galley compartment between bulkheads 4 and 5. This bucket is used for bailing purposes.

h. MANILA ROPE.—Two lengths of one and a half inch circumference manila rope, each 150 feet long, are stowed in the miscellaneous gear and tool locker. This rope is used for miscellaneous purposes.

i. BUOY HOOK.—Stowage for the buoy hook and 100 feet of one inch circumference manila rope is located on the airplane hull bottom between beltframes 0.33 and 0.66 on the starboard side on PBY-5A airplanes up to serial number 46580. On PBY-5A airplanes with serial numbers 46580 and on, the buoy hook is stowed on the forward starboard side of bulkhead 1. On PBY-5 airplanes, the buoy hook is stowed on the starboard side aft of bulkhead 1. The buoy hook and rope is held in position by two strap assemblies.

j. SPECIAL TOOL KIT.—A kit of special tools is stowed in the miscellaneous gear and tool locker. For use of the special tools, see Section III, Par. 2, *k.*

k. SIGNAL FLAGS.—On PBY-5A airplanes with serial numbers 46580 and on, a pocket for the stowage of one set of signal flags is installed on the aft side of the forward food locker, which is located on the starboard side between bulkheads 4 and 5.

On all PBY-5 airplanes and on PBY-5A airplanes up to serial numbers 46580, the signal flags were stowed on the forward face of bulkhead 4 on the port side.

l. SIGNAL LIGHT.—One bracket (to provide a fixed mounting for the signal light) is installed on the bow turret revolving windshield on all PBY-5 air-

No.	PART No.	NAME
1	28F1168	Socket
2	28A2039	Plug
3	28A5082	Upper Strut
4	28A2036	Lower Strut
5	28A2032	Sheave
6	AN8-17	Bolt
	AN310-8	Nut
	AN380-C3-3	Cotter
7	AN4-5A	Bolt
	AN365-428	Nut
8	28A2037	Center Strut
9	28F2265	Eyebolt
10	28F1067	Stirrup Base
11	AN5-15	Bolt
	AN310-5	Nut
	AN380B2-2	Cotter
	Q614-10-28	Spacer
12	28F5217	"Vee" Brace
13	28A5081	Reel Base
14	28F1171	Pin
15	Q5708K1-50	Strap Assembly
	Q5748K1-55	Strap Assembly
16	NAF67879	MK 7 Tow Target Reel
17	28A2034	Eyebolt
18	28A5084	Nut
19	28A2033	Nut
20	28A5079	Clip
21	28A2033	Nut
22	AN4-5A	Bolt
	AN365-428	Nut
23	AN6-20A	Bolt
	AN365-624	Nut
24	28A5083	Rear Strut

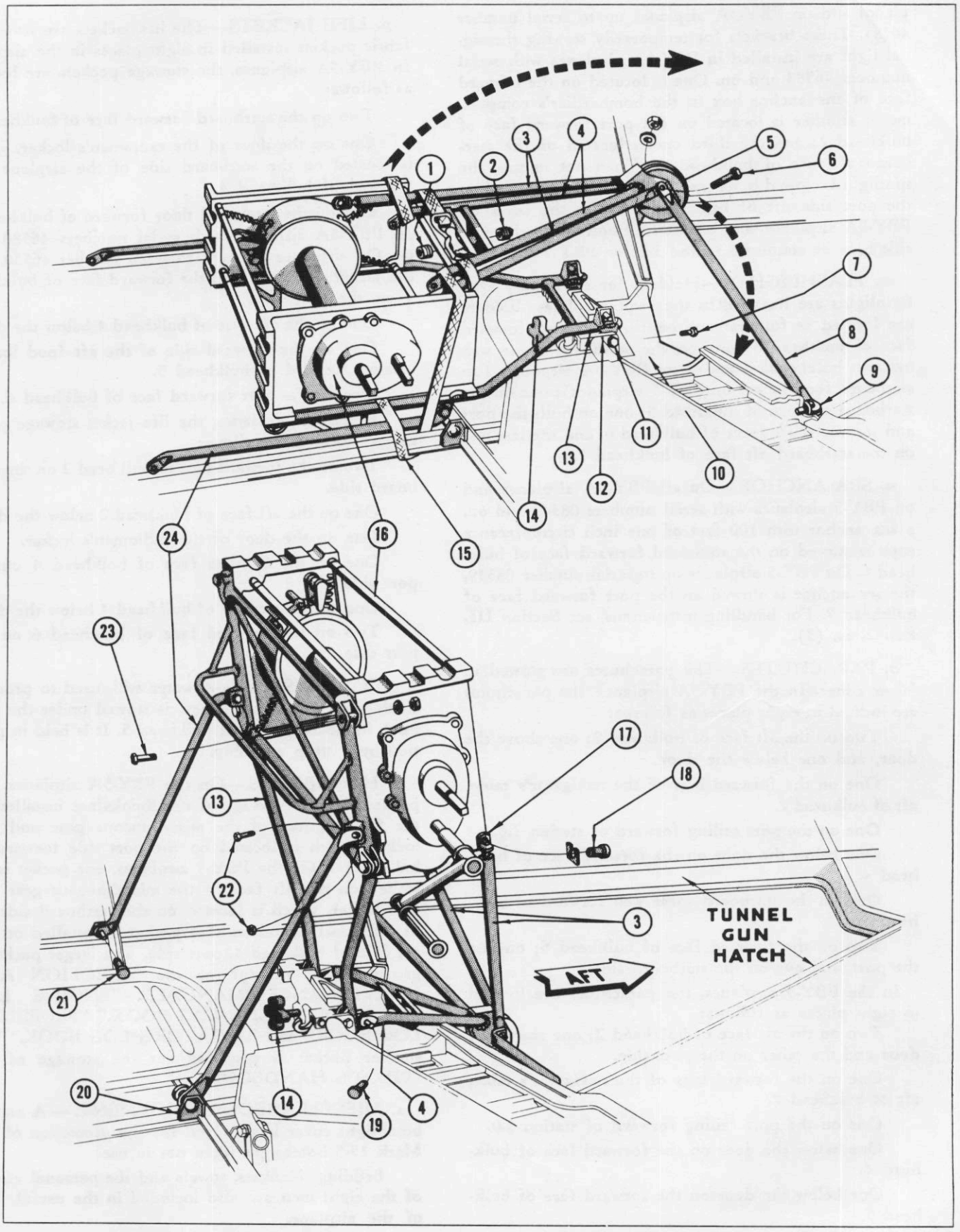


Figure 305—Tow Target Reel

planes and on PBY-5A airplanes up to serial number 46583. Three brackets for temporarily stowing the signal light are installed in PBY-5A airplanes with serial numbers 46583 and on. One is located on the inboard face of the anchor box in the bombardier's compartment; another is located on the port forward face of bulkhead 2; and the third one is located on the starboard aft face of bulkhead 6. When not in use, the spotlight is stowed in its case, which in turn is stowed on the port side aft of bulkhead 5 under the bunk on PBY-5A airplanes, and on the hull bottom on the port side between stations 3.33 and 3.66 on PBY-5 airplanes.

m. FLASHLIGHTS.—Holders for six battery type flashlights are installed in the airplane. These holders are located as follows: one on the starboard forward face of bulkhead 1; one on the starboard shear web between bulkheads 4 and 5 on PBY-5A airplanes (on starboard food locker on PBY-5 airplanes); one on the starboard aft face of bulkhead 5; one on both the port and starboard aft faces of bulkhead 6, and the last one on the starboard aft face of bulkhead 7.

n. SEA ANCHOR.—On all PBY-5A airplanes and on PBY-5 airplanes with serial numbers 08349 and on, a sea anchor with 100 feet of one inch circumference rope is stowed on the starboard forward face of bulkhead 6. On PBY-5 airplanes up to serial number 08349, the sea anchor is stowed on the port forward face of bulkhead 7. For handling instructions, see Section III, Par. 2, *e.*, (3).

o. PARACHUTES.—The parachutes are stowed in fabric slings. In the PBY-5A airplanes, the parachutes are located in eight places as follows:

Two on the aft face of bulkhead 2; one above the door, and one below the door.

One on the forward legs of the navigator's table, aft of bulkhead 2.

One on the port ceiling forward of station 3.0.

One below the door on the forward face of bulkhead 4.

One on the starboard shear web forward of bulkhead 5.

Two on the forward face of bulkhead 6; one on the port, and one on the starboard side.

In the PBY-5 airplanes, the parachutes are located in eight places as follows:

Two on the aft face of bulkhead 2; one above the door and the other on the port side.

One on the forward legs of the navigator's table, aft of bulkhead 2.

One on the port ceiling forward of station 3.0.

One below the door on the forward face of bulkhead 4.

One below the door on the forward face of bulkhead 5.

Two on the forward face of bulkhead 6; one on the port, and the other on the starboard side.

p. LIFE JACKETS.—The life jackets are stowed in fabric pockets installed in eight places in the airplane. In PBY-5A airplanes, the stowage pockets are located as follows:

Two on the starboard forward face of bulkhead 2.

One on the door of the radioman's locker, which is located on the starboard side of the airplane just forward of bulkhead 4.

One on the starboard floor forward of bulkhead 4 on PBY-5A airplanes with serial numbers 46580 and on. On airplanes previous to serial number 46580, this life jacket was stowed on the forward face of bulkhead 4 on the port side.

One on the aft face of bulkhead 4 below the door.

One on the forward side of the aft food locker, located forward of bulkhead 5.

Two on the port forward face of bulkhead 6.

In PBY-5 airplanes, the life jacket stowage pockets are located as follows:

Two on the forward face of bulkhead 2 on the starboard side.

One on the aft face of bulkhead 2 below the door.

One on the door of the radioman's locker.

One on the forward face of bulkhead 4 on the port side.

One on the aft face of bulkhead 4 below the door.

Two on the forward face of bulkhead 6 on the port side.

q. WATER STILL.—A water still, used to produce fresh water in an emergency, is stowed under the port bunk immediately aft of bulkhead 5. It is held in position by a strap assembly.

r. HANDBOOKS.—On the PBY-5A airplanes, two pockets for the stowage of handbooks are installed on the forward face of the miscellaneous gear and tool locker, which is located on the port side forward of bulkhead 5. On the PBY-5 airplanes, one pocket is installed on the aft face of the miscellaneous gear and tool locker, which is located on the starboard side aft of bulkhead 4, and another pocket is installed on the aft face of bulkhead 4, port side. The larger pocket is provided for stowage of the "ERECTION AND MAINTENANCE MANUAL," "ENGINE LOG BOOK," "AIRPLANE LOG BOOK," "PROPELLER LOG BOOK" and "AVIATOR'S LOG BOOK." The smaller pocket is provided for the stowage of the "PILOT'S HANDBOOK."

s. MISCELLANEOUS EQUIPMENT. — A canvas bombsight cover is provided for the protection of the Mark 15-5 bombsight when not in use.

Bedding, blankets, towels and the personal effects of the eight men are also included in the useful load of the airplane.

No special provisions have been made for the stowage of this miscellaneous equipment.

SECTION VI
MATERIALS OF CONSTRUCTION

A LIST OF MATERIALS USED IN THE CONSTRUCTION OF THE PBY-5 AND PBY-5A IS LISTED IN THE FOLLOWING TABLES:

TABLE A
ALUMINUM ALLOYS

MATERIAL	SPECIFICATION	HEAT TREAT SPECIFICATION	TENSILE STRENGTH P. S. I.	REMARKS
Bar and Rod				
2S-½H	QQ-A-411 ½H H (Cold worked)	Not heat-treatable	½H 16,000 H 22,000	Good forming. Excellent corrosion resistance. Weldable. Non-structural applications.
17S-T	QQ-A-351 Cond. T (Heat-treated)	AN-QQ-H-186	55,000	Not weldable. Used for structural fittings. 24S-T may be used as an alternate material.
24S-T	QQ-A-354 Cond. T (Heat-treated)	AN-QQ-H-186	62,000	Not to be welded. Used for structural fittings, etc.
53S-O 53S-T	QQ-A-331 Cond. A (Annealed) T (Heat-treated)	AN-QQ-H-186	A 19,000 (max.) T 32,000 (min.)	Weldable. Good corrosion resistance. Heat-treat SO to ST after welding or forming. Semi-structural uses.
Sheet				
2S-O 2S-½H	QQ-A-561 Cond. A (Annealed) ½H (Cold worked)	Not heat-treatable	A 15,500 (max.) ½H 16,000 (min.)	Weldable. Good forming and drawing. Excellent corrosion resistance. Used for name plates, electrical junction boxes, etc.
3S-½H	QQ-A-359 Cond. ½H (Cold worked)	Not heat-treatable	½H 19,500	Similar to 2S, but harder.
24S-O	AN-A-12 Cond. A (Annealed)	AN-QQ-G-186	35,000 (max.)	Heat-treat SO to ST after forming. Not to be welded. Structural applications.
24S-T	AN-A-12 Cond. T (Heat-treated)		64,000*	*Flat Sheet. For coiled sheet, T.S. = 62,000 psi.
Alclad 24S-O Alclad 24S-T	AN-A-13 Cond. A (Annealed) T (Heat-treated)	AN-QQ-H-186	A 34,000 (max.) T 59,000*	Heat-treat SO to ST after forming. Not to be welded. Avoid use in conjunction with unclad materials. General structural applications. *Flat sheets. For coiled sheet, T.S. = 56,000 psi.
52S-O 52S-½H	47-A-11 Cond. A (Annealed) ½H (By cold work)	Not heat-treatable	A 31,000 (max.) ½H 34,000 (min.)	Similar to 2S, but stronger. Weldable. Good corrosion resistance. Used for tanks and fairings. Supporting sheet for fuel cells. Alternate for 2S.

TABLE A (Continued)

MATERIAL	SPECIFICATION	HEAT TREAT SPECIFICATION	TENSILE STRENGTH P. S. I.	REMARKS
Extrusions				
14S-O 14S-T	AN-A-8 Cond. A (Annealed) T (Heat-treated)	AN-QQ-H-186	A 35,000 (max.) T 60,000 (min.)	Heat-treat SO to ST after forming. Structural applications. 24S-T may be used as an alternate material for 14S-T.
24S-O 24S-T	QQ-A-354 Cond. A (Annealed) T (Heat-treated)	AN-QQ-H-186	A 35,000 (max.) T 57,000 (min.)	Heat-treat SO to ST after forming. Structural applications.
53S-O 53S-T	QQ-A-331 Cond. A (Annealed) T (Heat-treated)	AN-QQ-H-186	A 19,000 T 32,000 (min.)	Weldable. Good forming properties. Good corrosion resistance. Heat-treat SO to ST after forming. Semi-structural applications where extensive forming is required.
Wire				
17S (1)	AN-QQ-W-298 Comp. 17S	AN-QQ-H-186	30,000*	Rivet Wire. *Shear strength after aging four days at room temperature after heat-treatment.
24S-T	QQ-A-354 Cond. T. (Heat-treated)	AN-QQ-H-186	62,000	Limited formability. For applications requiring a strong aluminum alloy wire. Hinge pins, etc.
Tubing				
2S-½H	WW-T-783 Cond. ½H	Not heat-treatable	½H 16,000	Weldable. Good corrosion resistance. Easily formed. Used for all rigid electrical conduit.
17S-O 17S-T	WW-T-786 Cond. A (Annealed) T (Heat-treated)	AN-QQ-H-186	A 35,000 (max.) T 55,000 (min.)	Easily formed in SO condition. Heat-treat to ST after forming. Not to be welded. Used structurally.
24S-O 24S-T	WW-T-785 Cond. A (Annealed) T (Heat-treated)	AN-QQ-H-186	A 35,000 (max.) T 64,000 (min.)	Similar to 17S-T but stronger. Use of 24S preferred to 17S.
52S-O	WW-T-787 Cond. A	Not heat-treatable	31,000 (max.)	Weldable. Good corrosion resistance. Easily formed. Non-structural uses such as fuel, oil, de-icer fluid lines. Alternate for 2S.
Castings				
Nos. 13 and 85	AN-QQ-A-366	Not heat-treatable	No. 13 33,000 No. 85 32,000	Welding not recommended. Small non-structural parts.

(1) If 17S-T rivets are not available, or if facilities are not available for heat-treatment, use A17S-T rivets, increasing the number of rivets originally specified by 10 per cent.

TABLE A (Continued)

MATERIAL	SPECIFICATION	HEAT TREAT SPECIFICATION	TENSILE STRENGTH P. S. I.	REMARKS
No. 43	AN-QQ-A-405	Not heat-treatable	17,000	Weldable. Sand casting. For non-structural fittings.
195T4	AN-QQ-A-390 Cl. I	AN-QQ-H-186	29,000	Welding not recommended. Good ductility. Used for handles, brackets, etc.
195T6	AN-QQ-A-390 Cl. II	AN-QQ-H-186	32,000	Obtained by heat-treating 195T4. Welding not recommended. Used for handles, brackets, etc.
S195T6	AN-A-5 Cl. II	AN-QQ-H-186	32,000	Alternate for 195T4 castings. Welding not recommended.
220T4	AN-QQ-A-392	Not heat-treatable	42,000	Welding not recommended. High resistance to impact.
356T6	AN-QQ-A-394	AN-QQ-H-186	30,000	Welding not recommended. Good corrosion resistance. For structural and miscellaneous parts.
Magnesium, ASTM 4	AN-QQ-M-56 Comp. A Cond. HTA	AN-H-25	34,000	Limited in welding. Non-structural parts.
Forgings				
14S-T	QQ-A-367 Cl. 5	AN-QQ-H-186	65,000	Not weldable. For structural fittings.
A51S-T	QQ-A-367 Cl. 3	AN-QQ-H-186	44,000	Not weldable. General use.

TABLE B
STEEL ALLOYS

MATERIAL	SPECIFICATION	HEAT TREAT SPECIFICATION	TENSILE STRENGTH AS RECEIVED P. S. I.	MAX. HEAT-TREATED TENSILE STRENGTH P. S. I.	REMARKS
Bar and Rod					
SAE 1020 SAE 1025	AN-QQ-S-646	Not heat-treatable	55,000		Weldable. Low strength. General use.
SAE 1095	AN-S-5 Cond. C (Spherodized)	AN-QQ-H-201	95,000	Over 200,000	High carbon steel. Not weldable. For parts requiring high wear resistance.
SAE 2330	AN-QQ-S-689 Cond. C (Annealed)	AN-QQ-H-201	90,000	150,000	Weldable. Used for bolts, terminals, clevises, pins, etc.

TABLE B (Continued)

MATERIAL	SPECIFICATION	HEAT TREAT SPECIFICATION	TENSILE STRENGTH AS RECEIVED P. S. I.	MAX. HEAT-TREATED TENSILE STRENGTH P. S. I.	REMARKS
SAE 4130	AN-QQ-S-684 Cond. C (Annealed) Cond. D (Normalized)	AN-QQ-H-201	C 65-85,000 D 90-125,000	175,000*	Weldable. Heat-treat after welding. Used for high strength structural fittings. *In sections up to 1¼ in.
SAE 4140	AN-QQ-S-752 Cond. C (Annealed)	AN-QQ-H-201	70-90,000	200,000*	Alternate for SAE 4130. Not recommended for welding. *In sections up to 2 in.
SAE 4340	AN-QQ-S-756 Cond. C (Annealed)	AN-QQ-H-201	85-110,000	200,000*	Alternate for SAE 4130. Weldable if preheated to 370-480°C (700-900°F). *In sections between 1¼ in and 2 in.
SAE 6150	AN-QQ-S-687 Cond. C (Annealed)	AN-QQ-201		200,000	Chrome vanadium steel. Used for heavy springs. Form in annealed condition and heat-treat to spring temper. Used for landing and beaching gear springs.
NE 8630	AN-S-14 Cond. C (Annealed) Cond. F (Hardened and tempered)	AN-QQ-H-201	C 65-85,000 F 125-150,000	175,000	Alternate for SAE 4130. For sections ¾ in. and smaller. Weldable.
NE 8635 8735	AN-S-15 Cond. C (Annealed) Cond. D (Normalized)	AN-QQ-H-201	C 65-85,000 D 90-125,000	175,000*	Alternate for SAE 4130. Preheating to 150-260°C (300-500°F) advisable before welding. *In sections up to 1¼ in.
NE 8640 8739	AN-S-16 Cond. C (Annealed)	AN-QQ-H-201	70-90,000	200,000*	Alternate for SAE 4140. Not recommended for welding. *In sections up to 2 in.
Bar and Rod (Corrosion-Resistant)					
AISI 303 18-8 Type	AN-QQ-S-771 Comp. FM Cond. A (Annealed) Comp. FM Cond. B (Cold rolled)	Not heat-treatable	A 75-100,000 B 125,000		Free machining. Not recommended for welding. For use at temperatures below 370°C (700°F).
AISI 431	AN-QQ-S-770 Cond. A (Annealed)	AN-QQ-H-201	75-85,000	115,000* 175,000*	Weldable. For bolts, terminals, etc. *Heat-treatable to 115,000 and 175,000 psi only.

TABLE B (Continued)

MATERIAL	SPECIFICATION	HEAT TREAT SPECIFICATION	TENSILE STRENGTH AS RECEIVED P. S. I.	MAX. HEAT-TREATED TENSILE STRENGTH P. S. I.	REMARKS
Sheet					
SAE 1020 1025	AN-S-11 (Cold rolled)	Not heat-treatable	55,000		Weldable. Non-structural steel.
SAE 1095	AN-QQ-S-666 (Cold rolled)	AN-QQ-H-201	106,000	250,000	Not weldable. For making flat springs. Form in annealed condition.
SAE 4130	AN-QQ-S-685 Cond. A (Annealed) Cond. N (Normalized)	AN-QQ-H-201	A 65-85,000 N 90-125,000	200,000	Weldable. Structural applications.
NE 8630	AN-S-12 Cond. A (Annealed) Cond. N (Normalized)	AN-QQ-H-201	A 65-85,000 N 90-125,000	200,000	Alternate for SAE 4130. Weldable.
Sheet (Corrosion-Resistant)					
AISI 321	AN-QQ-S-757 Cond. A (Annealed)	Not heat-treatable	100,000		Weldable. For use where temperatures above 370°C (700°F) are encountered. Used for exhaust collectors and similar applications.
AISI 304	AN-QQ-S-772 Comp. G Cond. A (Annealed) Cond. B (Cold worked) Cond. C (Cold worked)	Not heat-treatable	A 75-110,000 B 125,000 C 150,000		Not weldable. For use at temperatures below 370°C (700°F). Cond. B same as Cond. A but decreased formability. Cond. C—formability further reduced.
Wire					
Music Wire	AN-QQ-W-441		225,000* to 350,000		High strength spring steel. For use in small springs for aircraft. *Strength depends on wire diameters.
Steel (Zinc Coated)	AN-QQ-W-435	Not to be heat-treated	45-75,000		Lockwire on nuts and turnbuckles. Hinge pins.
Steel (Corrosion Resistant)	AN-QQ-W-423 Cond. A (Annealed)		85-115,000		Lockwire, hinge pins.
Type 316	Cond. B (Spring tempered)		180-250,000*		Springs. *Strength depends on wire diameters.

TABLE B (Continued)

MATERIAL	SPECIFICATION	HEAT TREAT SPECIFICATION	TENSILE STRENGTH AS RECEIVED P. S. I.	MAX. HEAT-TREATED TENSILE STRENGTH P. S. I.	REMARKS
Tubing					
SAE 1025 Seamless	AN-WW-T-846	Not heat-treatable	55,000		Weldable. General purpose. Low strength tubing.
Welded	AN-T-4	Not heat-treatable	55,000		
SAE 4130 Seamless Welded	AN-WW-T-850 Type I Cond. N (Normalized) AN-T-3 Type I Cond. N (Normalized)	AN-QQ-H-201	95,000	200,000	Weldable. Used for high strength structure.
NE 8630 Seamless Welded	AN-T-15 Type I Cond. N (Normalized) AN-T-33 Type I Cond. N (Normalized)	AN-QQ-H-201	95,000	200,000	Alternate for SAE 4130 tubing. Weldable.
NE 8635 Seamless	AN-T-22 Type I Cond. N (Normalized)	AN-QQ-H-24	100,000	200,000	Alternate for SAE 4130 tubing.
Tubing (Corrosion-Resistant)					
AISI 304 (18-8 Type)	AN-WW-T-855 Cond. A (Annealed)	Not heat-treatable	75-100,000		Non-weldable. For use at temperatures below 370°C (700°F).
	Cond. B ¼ hard		120,000		Same as Cond. A, but formability is decreased.
AISI 321 and 347	AN-WW-T-858 (Annealed)	Not heat-treatable	100,000		Weldable. For use where the temperature may exceed 370°C (700°F). Exhaust manifolds, etc.
Iron Castings					
Malleable Iron	Comm.		50,000		May be bronze welded. Used for housing assembly in carburetor air control.
Grey Iron	Comm.		18-24,000		Preheat to dull red color before welding. Used for cap in landing gear nose strut.
Steel Castings					
SAE 4130	49S-1 Class F	AN-QQ-H-201	90,000 (min.)	165,000	Weldable. Weld prior to heat-treating. Structural applications.

TABLE B (Continued)

MATERIAL	SPECIFICATION	HEAT TREAT SPECIFICATION	TENSILE STRENGTH AS RECEIVED P. S. I.	MAX. HEAT-TREATED TENSILE STRENGTH P. S. I.	REMARKS
Steel Castings (Corrosion-Resistant)					
AISI 303	46-S-27 Grade 7	Not heat-treatable	70,000 (min.)		Welding not recommended. Non-seizing. Free machining.
AISI 304	46-S-27 Grade 1	Not heat-treatable	70,000 (min.)		Weldable. Used where subject to severe corrosion.
Steel Forgings					
SAE 4130	AN-QQ-S-684 Cond. C-2 (Annealed)	AN-QQ-H-201	70-90,000	175,000*	Weldable. Weld prior to heat-treatment. For high strength structural fittings. *In sections less than 1¼ in.
SAE 4140	AN-QQ-S-752 Cond. C-2 (Annealed)	AN-QQ-H-201	75-100,000	200,000	Alternate for SAE 4130, but welding not recommended.
NE 8630	AN-S-14 Cond. C-2 (Annealed)	AN-QQ-H-201	70-90,000	175,000	Alternate for SAE 4130. For sections ¾ in. and under. Weldable.
NE 8635 NE 8735	AN-S-15 Cond. C-2 (Annealed)	AN-QQ-H-201	70-90,000	175,000*	Alternate for SAE 4130. Weldable. *In sections less than 1¼ in.
NE 8640 NE 8740	AN-S-16 Cond. C-2 (Annealed)	AN-QQ-H-201	70-90,000	200,000	Alternate for SAE 4140. Not readily welded.
Steel Forgings (Corrosion-Resistant)					
AISI 303 (18-8 Type)	AN-QQ-S-771 Comp. FM Cond. B (Cold Worked)	Not heat-treatable	125,000*		Welding not recommended. Free machining. *In sections up to ¾ in.
AISI 410	QQ-S-763 Class 3, Type A	AN-QQ-H-201	60-80,000	100,000* 175,000*	Weldable. Heat-treat for stress relief after welding. *Heat-treatable to 100,000 and 175,000 psi only.
AISI 431	AN-QQ-S-770 Cond. A (Annealed)	AN-QQ-H-201	105-120,000	115,000* 175,000*	Alternate for 18-8 steel. Weldable. Preheat before welding. Heat-treat after welding. *Heat-treatable to 115,000 and 175,000 psi only.

TABLE C
COPPER AND COPPER ALLOYS

MATERIAL	SPECIFICATION	TENSILE STRENGTH P. S. I.	REMARKS
Bar and Rod			
Copper	QQ-C-501 Cond. S (Annealed) H (Hard by cold work)	S—37,000 (max.) H—45,000* (min.)	Electrical applications. *Bars ⅜ in. and less.
Commercial Brass	QQ-B-611a Cond. S ½ H (Half hard by cold work)	S—48,000* (min.) ½H—55,000* (min.)	Use—Hose couplings, valves, etc. Free machining. General purpose. S* / ½H* / Section 48,000 / 55,000 / ½″ to 1″ 44,000 / 50,000 / 1″ to 2″ 40,000 / 45,000 / Over 2″
Brass	AN-QQ-B-646	67,000*	For turnbuckle barrels and similar aircraft parts. *In sections 1 in. and less.
Aluminum Bronze	QQ-B-666 Grade B	80,000*	Greater resistance to corrosion than manganese bronze. Used for bushings, bearings, shafts, etc. *In sections, ½ in. and less.
Manganese Bronze	QQ-B-721 Cl. A Cond. ½H (Half hard)	72,000*	For parts requiring high strength and freedom from corrosion. Used for bushings, rods, shafts, etc. *In sections 1 in. and less.
Phospher Bronze	QQ-B-746 Gr. A, Cond. H (Hard)	72,000	Excellent wear resistance. Alternate for manganese bronze. Used for bushings, sleeves, etc.
Sheet Stock			
Copper	QQ-C-501 H (Cold worked)	35,000 (min.)	General electrical applications.
Commercial Brass	QQ-B-611 Comp. C ½H (Half hard)	53,500 (min.)	Malleable. Suitable for bending and forming. Used for electrical lugs and binding clips.
Phospher Bronze	QQ-B-746 Gr. A ½H (Half hard) H (Hard)	½H 55,000 (min.) H 72,000 (min.)	Small flat springs.
Wire			
Phospher Bronze	QQ-W-401	105-150,000	Corrosion-resistant. Used for springs, etc.
Brass	QQ-W-321 Gr. C Spring temper	116-120,000	Corrosion-resistant. Used for springs.
Tubing			
Copper, Seamless	WW-T-799 Type N (Soft annealed)		Miscellaneous applications.

TABLE C (Continued)

MATERIAL	SPECIFICATION	TENSILE STRENGTH P. S. I.	REMARKS
Copper, High Pressure	44-T-12c		Miscellaneous applications.
Red Brass	44-T-156 Grade 1		Excellent resistance to salt water corrosion. Miscellaneous applications.
Castings			
Naval Brass	QQ-B-621 Comp. A	30,000 (min.)	Corrosion-resistant casting where strength is unimportant. Small fittings and miscellaneous parts.
Phospher Bronze	QQ-B-691 Type II Comp. 6X	30,000 (min.)	Easily machined. Used for bushings, bearings, etc.
Manganese Aluminum Bronze	QQ-B-726 Class C	110,000 (min.)	"Super Manganese Bronze," "Lumen No. 20," "Ampculoy No. 66." Tough, strong, resistant to erosion. Machined into bushings, bearings, and parts requiring high strength.

TABLE D
MISCELLANEOUS METALLIC MATERIALS

MATERIAL	SPECIFICATION	REMARKS
Lead Strip	Comm.	Counter Weights.
Monel "K" Rod	QQ-N-286 Cond. HT	Tensile strength, 145,000 psi. Heat and corrosion-resistant. Weldable. Use: Shaft for control wheel.
Screen		
Aluminum Alloy, No. 30 mesh	42-C-12 Type G	Weldable. Used for bag containing potassium dichromate corrosion inhibitor.
Brass, No. 10 mesh	42-C-12 Type B	Corrosion-resistant. Oil strainer.
Stainless Steel, No. 10 mesh	42-C-12 Type F	Corrosion-resistant. General use.
Cables		
Steel, (Carbon, Non-flex)	AN-C-76	Non-flexible. Used only in straight sections.
Steel, (Tinned Carbon)	AN-RR-C-43	Preferred for control cables. Flexible.
Steel, (Corrosion-Resistant)	AN-RR-C-48	Preformed. Flexible. Non-magnetic. Used for cables passing near a compass in cases where a magnetic steel cable would cause compass errors. Used for anchor cables and cables exposed to salt water.
Casing (Flexible Control Cable)	49-C-10	Commercial "Bowdenite" casing. (Cloth covered coiled wire sheathing used on bomb release and flare release cables.)
Conduit, (Flexible Shielded)	AN-WW-C-561	Flexible conduit for electric wiring.

TABLE E
FIBROUS MATERIALS

MATERIAL	SPECIFICATION	REMARKS
Insulation		
Asbestos Cloth		U. S. Rubber No. D-53 or equivalent. Neoprene coated without wire insert. Temperature limit 180°C (350°F). Heat de-icer flexible couplings, insulation, etc.
Asbestos Tape		Johns-Manville No. 1091 or equivalent. Temperature limit 180°C (350°F). Insulation over tubing ducts, etc.
Fabrics		
Duck (White Cotton)	24-C-8	Eight ounce single fill canvas. Used for bunk covers.
Duck, Cotton	24-D-4 Type I 24-D-4 Type II	Waterproof. Standard width 36 in. For outside engine and enclosure covers. Waterproof. For curtains, pockets, mapholders, etc.
Duck (Olive drab)	ccc-D-771 Type III	Mildew resistant and water repellant. Used for blind flying curtains.
Upholstery (Green Canda Cloth)		Commercial—Collins and Aikman, or equivalent. General upholstery, pilot's seats, arm rests, etc.
Cloth, Airplane (Mercerized Cotton)	AN-C-121	Covering for control surfaces and wing trailing edge.
Tape (Grade A Surface)	24-T-14	Reinforcement on ribs, seams, rivets, etc.
Bound Hair	AN-H-5a	Seat cushion padding.
Felt, Wool	AN-F-14, F-13.	Used for cushion padding.
Kapok	27-K1	Used in conjunction with felt as a cushion padding. Life preserver filling.
Leather, Artificial	E-KK-L-136 Type 3, Cl. B	General upholstering, pockets, life preserver covering, covering for seat cushions.
Gasket Material		Vellumoid or equivalent. Aromatic fuel resistant. Temperature limit 120°C (250°F). General purpose gasket material.
Tape (Zinc Chromate)		Seam sealer for water tightness in hull. Insulation between dissimilar metals.
Sitka Spruce	Comm.	Used for navigator's table, fuel cell support, etc.
Plywood	Comm.	Fuel cell support.

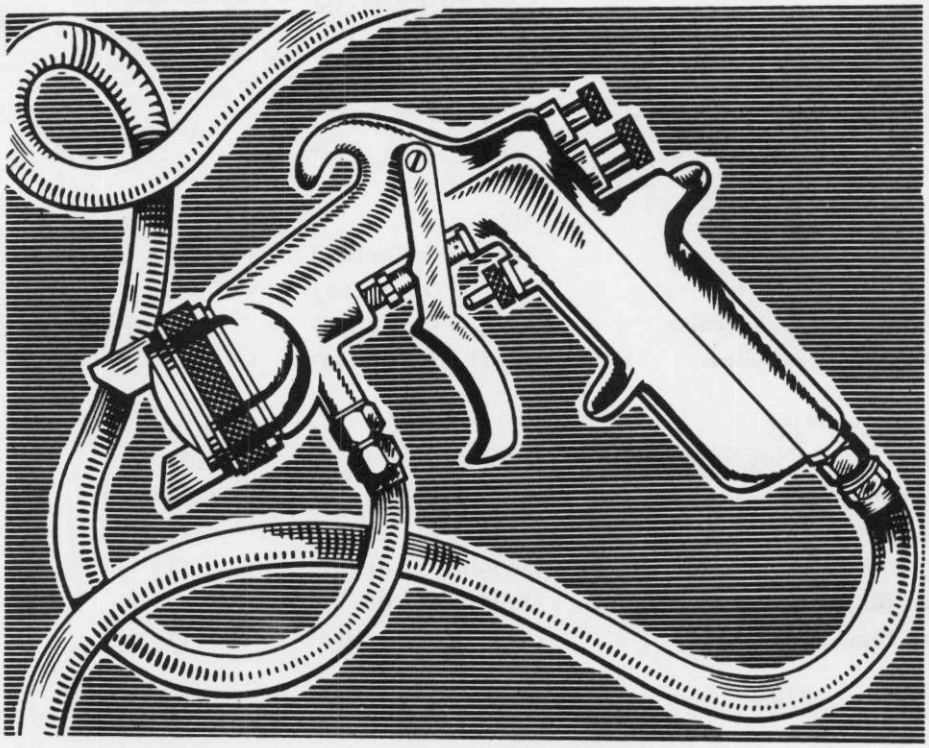
TABLE F
PLASTIC MATERIALS

MATERIAL	SPECIFICATION	COMMERCIAL DESIGNATION	REMARKS
Cellulose Acetate Sheet	P-41	"Plasticel" "Lumarith"	Thermoplastic. Transparent. Easily formed. Used for windows, etc., where optical properties are not critical.
Methyl Methacrylate	33 M1 Cl. A-1	"Plexiglas" "Lucite"	Thermoplastic. Transparent. Good electrical insulating properties. For windows, blister enclosure, etc. Not to be used for windshields and windows requiring undistorted vision.
Tubing			
		Plastic CR 39*	Transparent tubing. Aromatic fuel resistant. Fuel sight gage tube. *Manufactured by Columbia Chemical Division, Pittsburg Plate Glass Company.
Vinyl Resin Tubing	Commercial	Transflex	Translucent. Flexible. Good electrical insulating properties. Used for electrical insulation, sleeving, harness, etc. Do not use where temperature exceeds 70°C (160°F).
	Commercial	Superflex	Flexible. Black color. Used for drain tubes, wire harness, etc. Do not use where temperature exceeds 70°C (160°F).
	Commercial	Hyflex	Flexible. Black color. Used for relief tubes.
Phenolic Material (Laminated)			
Sheet, Rod and Tubing, Fabric Base	17P5-FBG	"Micarta" "Bakelite" "Formica"	Thermosetting. Moisture resistant. Tensile strength—8-12,000 psi. Compressive strength—30-44,000 psi. Do not use where temperature may exceed 120°C (250°F). Used for electrical panels, fair-leads, pulleys, small gears, etc.
Paper Base	17P5-PBG	"Micarta" "Bakelite" "Formica"	Thermosetting. Easily machined. General electrical applications such as panels, terminal blocks, etc.
Phenolic Material (Moulded)	17P4	"Micarta" "Bakelite"	Thermosetting. May be moulded into intricate shapes. Used for small electrical and mechanical parts.

TABLE G
RUBBER MATERIALS

MATERIAL	SPECIFICATION	REMARKS
Sheet	Du Pont Fairprene M 5580	This is the only synthetic rubber sheet acceptable for use as gaskets in riveted joints for sealing the fuel tank.
Sheet	Neoprene	General use for packing, sealing, etc.
Moulded Parts		Gaskets, sealing rings, etc. Fuel systems to use Hycar type only.
Extrusions		Weather sealing, door seals, etc.
Sponge Rubber		Window and door sealing, pads, cushions, etc.
Cord (Elastic Shock Absorber)	49C1 (NAVAER)	Obtainable in ⅜, ½ and ⅝ in. diameter. Exerciser cord for pilots' seats, waist gun enclosure, etc.
Cord (Elastic Exerciser)	AN-ZZ-C-561	Obtainable in 3/16 and 5/16 in. diameter. Used for stowages and seat adjustment.
Hose (Self-sealing Fuel)	M-562 (NAVAER)	Aromatic resistant. For synthetic rubber fuel lines ⅝ in. and larger.
Hose (Synthetic Aromatic Resistant)	AN-H-26	For oil and gas lines ⅜ in. and smaller. Not self-sealing.
Hose (Low Pressure)	AN-H-26	"Weatherhead No. 3752" aromatic fuel resistant. Used for oil and fuel pressure lines, instrument lines, air hoses, etc.
Flexible Hose (Bellows Type)		U. S. Rubber Co. "Stockinette" cover, Hycar lined. Aromatic resistant. For air vent, self-sealing fuel cells.

SECTION VII



FINISH SPECIFICATION

1. MATERIALS.

PROBABLE PROCUREMENT SOURCES.

(1) E. I. du Pont de Nemours & Company, Arlington, New Jersey

(2) Andrew S. Brown Company, Los Angeles, California

(3) Pittsburg Plate Glass Company, Milwaukee, Wisconsin

(4) Minnesota Mining and Manufacturing Co., St. Paul, Minnesota

(5) Sherwin Williams Company, Cleveland, Ohio

(6) Nuodex Products Company, Inc., Elizabeth, New Jersey

(7) Akron Paint and Varnish Company, Akron, Ohio

(8) Aluminum Company of America, Pittsburgh, Pennsylvania

(9) Standard Oil Company of Louisiana, New Orleans, Louisiana

(10) General Electric Company, Schenectady, New York

MATERIAL	PROCUREMENT SPECIFICATION	PROBABLE PROCUREMENT SOURCE	ESTIMATED QUANTITY PER AIRPLANE
Brush Wash	Commercial	(3)	50 gal
Compound, Beeswax and Grease	C-88 (Navy)		
Compound, Rust Preventive (Paralketone Type)	AN-C-52, Type I	(9)	5 gal
Compound, Thread Anti-Sieze	AN-C-53	(3)	
Compound, Zinc Chromate		(3)	20 lb

MATERIAL	PROCUREMENT SPECIFICATION	PROBABLE PROCUREMENT SOURCE	ESTIMATED QUANTITY PER AIRPLANE
Dope, Cellulose Acetate Butyrate, Clear	AN-D-1	(2)	70 gal
Dope, Cellulose Acetate Butyrate, Pigmented	AN-D-3		
Insignia White	AN-D-3 (color 601)	(2)	8 gal
Intermediate Blue	AN-D-3 (color 608)	(2)	8 gal
Sea Blue, Non-Specular	AN-D-3 (color 607)	(2)	2 qt
Sea Blue, Semi-Gloss	AN-D-3 (color 606)	(2)	10 gal
Enamel, Camouflage			
Black, Dull, Non-Specular	Du Pont 71-006	(1)	14 gal
Insignia Blue	Du Pont 71-038	(1)	2 qt
Insignia White	Du Pont 71-001	(1)	8 gal
Intermediate Blue	Du Pont 71-101	(1)	3 gal
Sea Blue, Non-Specular	Du Pont 71-102	(1)	5 gal
Sea Blue, Semi-Gloss	Du Pont 81-23390	(1)	5 gal
Enamel, Gloss, White	AN-E-3	(1)	1 gal
Glyptol	G.E. 1201	(10)	1 qt
Lacquer, Cellulose Nitrate	AN-TT-L-51		
Clear	55-AN	(2)	5 gal
Gloss Black	51-AN	(2)	3 gal
Insignia Blue	49-AN	(2)	1 gal
Insignia Red	47-AN	(2)	1 gal
Instrument Black	52-AN	(2)	10 gal
Interior Green	55-AN	(2)	1 gal
Light Yellow	44-AN	(2)	1 gal
White	50-AN	(2)	1 gal
Linseed Oil, Raw	RM-11c (Navy)	(3)	
Paint, Rubber, Intermediate Blue	M-529 (Navy)	(7)	2 qt
Paint, White Rubber	M-529 (Navy)	(7)	2 qt
Paint Remover	Commercial	(3)	
Paste, Aluminum	AN-TT-A-461	(8)	8 lb
Primer, Aluminized Green	(See Par. 3, *d*, (2))	(3)	75 gal
Primer, Zinc Chromate	AN-TT-P-656	(3)	75 gal
Shellac	Commercial	(3)	1 qt
Tape, Tubing Identification		(4)	

MATERIAL	PROCUREMENT SPECIFICATION	PROBABLE PROCUREMENT SOURCE	ESTIMATED QUANTITY PER AIRPLANE
Tape, Zinc Chromate		(3, 5)	1500 sq ft
Thinner, Camouflage Enamel	T 8903	(1)	10 gal
Thinner, Cellulose Acetate Butyrate Dope	AN-T-27	(2)	25 gal
Thinner, Cellulose Acetate Butyrate Dope, Blush Retarding	AN-T-28	(2)	8 gal
Thinner, Enamel	TT-T-291 (Federal)	(1)	2 qt
Thinner, Glyptol	G.E. 1500	(10)	1 qt
Thinner, Lacquer	AN-TT-256	(3)	5 gal
Thinner, Rubber Paint	TT-T-291 (Federal)	(3)	1 gal
Thinner, Zoluol Primer	AN-T-86	(3)	375 gal
Varnish	AN-TT-V-118	(3)	1 gal
Walkway Material	MMM EC 244 (Federal)	(4)	1 qt
Wood Sealer, Waterproof	AN-S-17	(2)	4 gal
Zinc Napthenate (12% Zinc) Solvent Free		(6)	10 lb

2. APPLICATION OF SURFACE TREATMENTS OTHER THAN PAINTING.

a. TO ANODIZE ALUMINUM AND ALUMINUM ALLOYS.—Unless specifically exempted, all aluminum and aluminum alloys shall be anodized. All such parts shall be anodized at 40 volts for 30 minutes or as long as is necessary to produce anodic films in accordance with specification AN-QQ-A-696a. Navy Aeronautical Specification PT-19 may be followed for guidance.

b. TO ANODIZE ASSEMBLIES.—In general, the anodic treatment shall be applied to parts prior to assembly except that welded assemblies shall be anodized after assembly. Disassembly for the purpose of individual treatment of the component parts is not required when all of the following conditions are met:

(1) The assembly is so situated in the structure that contact with salt water, or the possibility of salt water or spray entering or remaining due to lack of free draining, is remote.

(2) No dissimilar metals form a part of the assembly. (See Par. 5, *c.*)

(3) The assembly is an integral unit in the structure not subject to breakdown or disassembly in maintenance and overhaul.

(4) Waterproof or insulating fabric or compounds subject to deterioration in the acid bath are not a part of the assembly.

(5) The final paint coating forms a continuous unbroken film over the edges of the assembled parts.

CAUTION

These instructions shall not be interpreted to permit the omission of the anodic film on faying surfaces which moisture may enter and be retained by capillary action. Experience shows that these surfaces in the structures appear to be most liable to corrosion and it is at these points that the maximum protection is necessary. Where advantage is taken of the foregoing waiver permitting the anodization of complete assemblies, the priming coat shall be applied to the assembly immediately after anodizing.

The maximum protection by anodic film shall be obtained by performing as much work, such as coating, drilling, forming, etc., as is practicable prior to anodizing and assembling parts. The drilling of rivet or bolt holes is permissible in anodized parts without subsequent reanodization in cases where extensive work is required in the manufacture of the assembly, and where the parts are insulated against moisture by application of the paint coating and remain as an integral structural unit not subject to disassembly in maintenance and overhaul. Where anodized material is cut or scratched through the film, the raw surface shall be treated with chromic acid. This treatment shall not be required for the edges of punched holes.

c. TO ANODIZE MAGNESIUM ALLOYS.—Where specified, magnesium alloy parts and surfaces may be given anodic treatment in accordance with specification AN-M-12. Where the use of magnesium alloy is approved, parts or surfaces shall receive the chemical dip treatments in accordance with specification AN-M-12.

d. ELECTROPLATING.

(1) GENERAL.—All steel parts except as noted below shall be cadmium or zinc plated. All welding shall be done prior to plating. Brass, bronze, copper, and lead parts shall be cadmium plated. Exceptions to these are as follows:

(a) Parts manufactured of corrosion resistant steel. (Castings and forgings of this material which are not fully machined shall be given a coat of camouflage enamel. A coat of green primer shall be applied over this camouflage where appearance dictates.) (Refer to paragraph *d*, (8).)

(b) Parts which are welded to unplated structures.

(c) Welded structures, such as hollow parts which cannot be thoroughly cleaned to insure removal of plating solution.

(d) Cable, chain and parts manufactured from wire. (For springs, see paragraph *d*, (7).)

(e) Steel bearings and pressed-fit bushings. (These parts shall receive a black ordnance treatment, Penetrate Process-Heatbath Corp., or equivalent.) This treatment need not be removed from the interior of the bushings.

(f) Inside of nonstructural tubular members.

(g) Working and bearing surfaces of bearings and bushings. (Press-fit bushings of brass, bronze, and copper shall be inserted with wet primer and have a coating of primer applied to the ends.)

(h) Parts of mechanisms enclosed for lubrication.

(i) Copper bus bar used in the electrical system.

(j) Teeth and bore of gears.

(k) Parts receiving aluminum or zinc metal spray treatment and parts on which plating materials other than zinc or cadmium are specified.

(l) Parts on which plating is not required by standard Army-Navy Drawings.

(2) CADMIUM PLATING.—Cadmium plating shall be in accordance with specification AN-QQ-P-421.

(3) ZINC PLATING.—Zinc plating shall be in accordance with specification AN-P-32.

(4) CHROMIUM PLATING.—When specified, chromium plating shall be in accordance with specification AN-P-39.

(5) NICKEL PLATING.—Where specified, nickel plating shall be in accordance with specification AN-P-34.

(6) METAL SPRAYING.—Where specified, metal spraying shall be applied to carefully and thoroughly sand blasted surfaces in accordance with specification AN-M-8, using either aluminum or zinc for the coating material. Zinc metal spray may be used instead of cadmium or zinc electroplate where increased weight of coating is not a factor and where close tolerances are not involved.

(7) SPRINGS.—Springs shall be electroplated. Wire .18 inch diameter or smaller, and flat springs .18 inch or less in thickness shall be baked for three hours at 375° plus-minus 25° F. immediately after plating, to eliminate embrittlement. Steel springs shall be painted with two coats of primer, except closely coiled springs, in which case paralketone shall be used instead of zinc chromate primer. Small springs shall not be cleaned by sand blasting. The term "springs" is to include all parts subjected to repeated flexure, and having a hardness greater than Rockwell C-40.

(8) CORROSION RESISTANT STEEL.—Parts made of this material shall be sandblasted, polished or passivated as required. Sandblasting should only be accomplished when it is necessary to remove casting slag, welding flux, or other foreign materials. Polishing is not required where the part is to receive a subsequent coating. Close fits should be polished and not painted. A paint coating shall be subsequently applied

only where appearance dictates. (Refer to paragraph *d*, (1), *(a)*.) Passivation is required only in those cases where the part has been welded, drop-hammered, heat-treated or has surfaces that are not fully machined. An exception to this requirement is the exhaust system.

3. APPLICATION OF FINISHING MATERIALS.

a. CONDITION OF SURFACES. — All surfaces shall be thoroughly clean and dry at the time of application of any paint coating. They shall have been conditioned in an atmosphere of sufficiently low humidity to insure that the surfaces are free from any evidence of moisture.

b. CLEANING OF SURFACES.

(1) PRIOR TO PRIMING.—When material proceeds directly from a process of surface treatment other than painting, and when there is no contamination of such surface by handling or other means, cleaning is not necessary prior to priming. When there is a delay or a handling of parts between these processes, the material shall be cleaned and dried to insure against contamination resulting from such delay or handling.

(2) PRIMED SURFACES.—After fabrication of sub-assemblies and assemblies of previously primed material, the surfaces thereof shall be cleaned prior to application of finish coats. The cleaning agent shall remove a minimum amount of the primer coat.

c. AIR AND WEATHER CONDITIONS.—Paint coatings shall be applied in warm air-conditioned rooms of low humidity. Conditions shall be such that drying takes place as rapidly as possible without blushing. Blushing is evidenced by a whitish appearance of the doped surface and results from application under conditions at high humidity and strong drafts. If such conditions are unavoidable, dope thinned with blush retarding thinner should be used.

d. PREPARATION OF COATING MATERIALS. —Materials shall be prepared for application under clean conditions with clean equipment. Mixing shall be controlled by either weight or volume to insure uniformity of all materials prepared for use. It is important that only selected and trained personnel be allowed to prepare all finishing materials for production use.

(1) Green primer shall be used generally as the second coat of all finish schedules in order to detect "holidays," or unpainted spots, and to indicate the fact that a second coat of primer has been applied. This primer is green in color and may be easily distinguished from zinc chromate primer which possesses a light yellow-green color.

(2) The green primer specified above shall consist of primer (Specification AN-TT-P-656b-1.) shaded to produce a product matching the color of Army-Navy Interior Green, Color No. 611. Primer shall be shaded by mixing according to the following formula:

Zinc Chromate primer (Specification AN-TT-656b-1.), 5 gallons.

Black Enamel (Specification AN-E-7 or du Pont 71-006.), 5½ pints.

Aluminum Paste (Specification AN-TT-A-461a, Grade A.), 8½ oz avoir.

e. FILM THICKNESS. — Zinc chromate primer shall be applied in such thickness that a distinctly greenish color is produced. When application is such as to yield a full yellow color, it is indicative of too heavy a coating and should be avoided.

4. DETAIL REQUIREMENTS FOR FINISHING SYSTEMS.

Note

The number of primer and finish coats specified herein shall be considered the minimum required.

a. SHOP PRIMER COAT.—After surface treatment other than painting, all metal surfaces except those under paragraph *b.*, (5) shall receive a shop primer coat. This shall be applied as soon as practicable. After shop fabrication is completed, this coat shall be thoroughly cleaned as specified in Par. 3, *b.*, (2) and may then serve as a first coat of the following schedules.

b. DETAIL PROTECTIVE SCHEDULES.

(1) CLASS "AA" OR FOUR-COAT PROTECTION.

(a) Magnesium parts. (See Par. 8, *a.*)

(b) Strut ends. (See Par. 8, *h.*)

(c) Interior surfaces of the rudder.

(d) Interior surfaces of the wing leading edges. (See Par. 8, *k*, (2).)

(e) Interior surfaces of the empennage leading edges. (See Par. 8, *k.*, (3).)

(2) CLASS "A" OR THREE-COAT PROTECTION.

(a) Interior of hull below flooring and inaccessible parts of hull above flooring.

(b) Brass and bronze parts generally. (See Par. 2, *d.*, (1).)

(c) Interior of floats and float panels.

(d) Interior of tail surfaces. (The rudder interior shall receive an additional coat, as outlined in paragraph *b.*, (1), *(c)*.)

(e) Interior of wings, ailerons, and trailing edge members.

(f) Exterior of oil tanks (no finish on interiors).

(g) All accessible structural surfaces inside hull above flooring.

(h) For tubing, see Par. 8, *f.*, (1).

(i) For electrical bonding connections, see Par. 5, *f.*, (4).

(j) Exterior surfaces of empennage leading edges. (See Par. 8, *k.*, (3).)

(3) CLASS "B" OR TWO-COAT PROTECTION.

(a) All exterior metal surfaces, except when individual parts require additional finish. The second coat (the first coat being primer) shall be camouflage enamel. (See Par. 10, *b*.)

(b) Interior of cowling.

(c) Interior and exterior of wing struts. The second coat on the exterior may be camouflage enamel.

(d) All readily accessible nonstructural parts. (Where the use of alclad is provided, and dissimilar metals are not involved, one coat may be omitted from these parts.)

(e) For tubing, see Par. 8, *f*.

(f) Faying surfaces, generally.

(4) CLASS "C" OR ONE-COAT PROTECTION.

(a) Interior of integral and nonintegral fuel tanks.

(b) For tubing, see Par. 8, *f*.

(5) CLASS "D" OR SURFACE TREATMENT ONLY.

(a) For tubing, see Par. 8, *f*.

(b) Interior of oil tanks.

c. RIVET HEADS.—In the area below one foot above the waterline, rivet heads shall receive a coat of primer, green or yellow, prior to application of the final finish. All other rivet heads shall receive a minimum of one coat of primer.

5. CORROSION PREVENTION.

a. FREE DRAINAGE.—A special inspection shall be made of the airplane, primarily from the standpoint of its attitude at rest, but also considering its attitude in flight, to determine that every possible pocket, large or small, is provided with a means of complete drainage. This inspection shall be made at such times during process of construction and repeated as necessary to insure that its purpose is being effectively accomplished. Where necessary, holes shall be drilled of sufficient size that they may be adequately painted without endangering subsequent stoppage. Where drain holes cannot be provided for minor pockets, the affected area shall be filled with zinc chromate paste, such as to insure the elimination of moisture concentration by this method.

b. FAYING SURFACES AND SEAMS.

(1) FAYING SURFACES.—Faying surfaces (metal surfaces in mutual contact with other metal surfaces) shall be painted with a minimum of two coats of zinc chromate primer on each surface. Where alclad is used and dissimilar metals are not involved, one coat may be omitted from each alclad contacting surface. Where dissimilar metals are involved, additional coats as specified in paragraph *c*., shall be applied.

(2) SEAMS.—Seams shall receive careful workmanship to insure fair mating of faying surfaces providing a minimum of non-meeting area. Care should be exercised not to use so much paint as to cause shrinkage with resultant loose rivets or joints.

(a) SEAMS IN FLOATS AND HULLS.—Such seams shall be sealed and filleted in such manner as definitely to preclude all possibility of moisture entering any part of the seam. Zinc chromate tape shall be used between all seams in the hull and floats which are to be made watertight. Where pockets, crevices, or large non-meeting areas occur, and there is danger of entrapping moisture, these areas shall be filled with zinc chromate paste and leveled off to provide a smooth fillet.

(b) SEAMS IN GASOLINE TANKS.—These seams shall be sealed with a gasket material which is insoluble in high octane fuels and aromatic fuels containing as much as 40 per cent aromatics. The material shall be non-hygroscopic; shall not shrink appreciably or swell excessively under the influence of such fuel shall be permanently flexible and not subject to cold flow at all operating temperatures. The gasket material shall be neoprene-type synthetic rubber, equivalent to Fairprene 5580, manufactured by E. I. du Pont de Nemours Co.

c. DISSIMILAR METALS, INSULATION OF.—In cases of dissimilar metal contacts, precaution shall be taken for their insulation. For the purposes of this discussion, the more commonly used aluminum alloys may be divided into two groups as follows:

GROUP A

2S	53S	355
3S	61S	356
52S	43	Alclad

GROUP B

14S	24S
17S	195

Contacts between a member of any one group with another member of the same group may be considered as similar. Contacts between a member of Group "A" and a member of Group "B" must be considered as dissimilar. These dissimilar metal contacts shall receive two additional coats of primer over and above those mentioned for the individual parts—either one coat on each surface or two coats on only one surface. Steel and copper shall be either cadmium or zinc plated, subject to the restrictions of Par. 2, *d*., and the faying surfaces shall each receive an additional coat of zinc chromate primer. Where the assembly will permit, it shall first be filled with zinc chromate compound, in such a manner as to be squeezed out at all boundaries and the excess removed to leave a complete fillet all around the boun-

dary. Where the assembly does not permit the insertion of a sealing compound, two additional coats of primer shall be applied and a complete fillet shall be applied after assembly. Mechanically tight joints within the airplane shall receive three coats of primer on each surface. Coats after the first one may be green primer. Mechanically tight joints on the outside of the airplane shall be insulated with a non-hygroscopic insulating material such as zinc chromate tape in addition to the primer and plastic compound.

d. HEAT TREATMENT OF ALUMINUM ALLOY.—The requirements of Specification AN-QQ-H-186a shall be strictly followed to obtain the maximum corrosion resistance of aluminum alloy parts.

e. HEAT TREATMENT OF STEEL.—The heat treatment of steel parts shall be in accordance with Specification AN-QQ-H-201.

f. ELECTRICAL CONNECTIONS AND BONDING.

(1) GENERAL.—Bonding shall be in accordance with Specification AN-B-10.

(2) DISSIMILAR METAL CONNECTIONS.—Where dissimilar metal connections are required by bonding, such connections shall not be made to any structural part of the airplane. The design of structures should provide for integral tabs to which bonding connections may be made. Aluminum braid may be used as a bonding material and thereby reduce to a minimum the number of dissimilar metal connections required by bonding.

(3) PROTECTION OF ELECTRICAL CONDUIT.

(a) FLEXIBLE CONDUIT.—No finish need be applied.

(b) SOLID CONDUIT.—This type of conduit shall not be anodized. It shall receive one exterior coat of zinc chromate primer before assembly and one coat of green primer after assembly. When installing conduit, remove all finish coatings at attaching points and touch up after connection is made.

(c) CONDUIT FITTINGS AND JUNCTION BOXES.—These shall not be anodized. They shall receive two exterior coats of prime. Interiors shall not be painted. Junction boxes may be installed with only one prime on the exterior, receiving the additional coat in final finish.

(4) PROTECTION OF BONDING CONNECTIONS.—Before contact is made, all anodic film and organic finish shall be removed from areas where intimate electrical contact is desired. After contact has been made, three organic coats shall be applied with the final coat matching the adjacent surfaces. Electrical points in exterior locations, such as control surface hinge bonds, shall receive a coating of paralketone in addition to the above.

Anodic treatment may be omitted from clips and fair-leads which are used both as a support and as a bonding. These clips shall receive two coats of primer. The grooved areas shall be protected from paint.

(5) ELECTRICAL SWITCHES, DISTRIBUTION PANELS, AND HOUSING FOR CONNECTOR RECEPTACLES.—These shall not be anodized.

6. GENERAL PRECAUTIONS.

a. METAL PARTICLES.—Precautions shall be taken in the fabrication and assembly of materials, particularly the wing tip floats and other relatively inaccessible sections, and inspection made to insure that metal particles, particularly of dissimilar character, do not remain lodged behind frames or stringers by becoming partially imbedded in organic coatings. A strong suction vacuum cleaner should be employed for frequent cleaning in such areas.

b. STEEL WOOL.—Use of steel wool on aluminum and magnesium alloy surfaces is prohibited.

c. LEATHER.—Due to the hygroscopic character of leather, it shall not be used anywhere on naval aircraft except for removable upholstery.

d. WELDING AND SOLDERING.—Welded aluminum alloy parts shall be cleaned in accordance with the current issue of specification PT-5 as soon as practicable after welding, and in such a manner as to insure complete removal of the welding flux. Welding, soldering, or filing shall not be permitted on an assembly after it has been painted, without prior approval of the inspector.

e. WORKING SURFACES.—Special care shall be exercised to ascertain that paint is not applied to working surfaces or to adjustable screw threads, oil holes, etc. The finish shall consist only of the specified lubricant. Paint shall not be applied to fittings in such a manner as to cause malfunctioning of bearings.

f. RUBBER OR SYNTHETICS.

(1) Rubber shall not be painted, greased, or oiled except as specificed herein. Any overspray on these surfaces as a result of painting adjacent surfaces shall be subject to specific approval by the Government. A direct spray shall not be permitted. Whenever a rubber part must be painted to match adjacent camouflage scheines, rubber paint in accordance with Specification M-529a shall be used.

(2) Main landing gear tires shall be painted to match adjacent surfaces when the gear is retracted.

(3) Self-sealing fuel hose shall be identified by markings applied by the vendor. No additional identification shall be applied to the hose.

g. DRILLING AND FORMING.—Precautions shall be taken during drilling and forming operations on shop primed material to avoid scratching, marring, or destroying the shop protection coating.

7. FABRIC SURFACES.

Fabric covered surfaces shall be doped in accordance with Navy Aeronautical Specification SR-70d-2, except as specified below.

a. DOPE PROOFING.—Not required.

b. FIRE PROOFING.—The finish of fabric surfaces as specified in Bureau of Aeronautics Specification SR-70d-2, shall meet this requirement.

c. FINISH.—Fabric shall be coated as follows: two brush coats of clear acetate butyrate dope and two brush or spray coats of the same material followed by two spray coats of pigmented acetate dope on both the upper and lower surfaces in accordance with the color scheme of Par. 10, *b*. The aforementioned coats of clear dope shall be considered the minimum except that tautness rather than weight shall be the criterion for acceptance. Upon approval of the Inspector, additional coats shall be applied to produce a uniformly taut, smooth, and rigid surface. The fabric shall be mildew-proofed by the addition of four and one half ounces by weight of Zinc Napthenate (12 per cent zinc), solvent free, to each gallon of the thinned dope used for application as the first clear brush coat. Mildew-proofed material shall be added to the first clear brush coat only.

d. WEBBING STRAPS.—The ends of webbing straps shall be dipped in clear dope to prevent ravelling, unless a metal tip or other mechanical device is used.

e. COVERS.—Fabric covers for enclosures, engines, etc., shall be camouflaged so as to harmonize with the general camouflage scheme when they are installed.

8. MISCELLANEOUS ITEMS AND REQUIREMENTS.

a. MAGNESIUM—ADDITIONAL PRECAUTIONS.—Four coats of primer over and above the surface treatment described in Par. 2, *c*, shall be applied to all surfaces of magnesium alloys. The first coat shall be applied as soon after surface treatment as is practicable.

b. ACID PROOFING.—Surfaces within at least 12 inches of storage batteries or parts further removed which are subject to acid spillage or spray, except flexible conduit, shall be given one coat of clear lacquer in accordance with Specification AN-TT-L-51-2 over and above the finish schedule for the detail parts.

c. STANDARD PARTS.—Standard parts such as bolts, nuts, screws, etc., shall be painted with zinc chromate primer prior to assembly wherever dissimilar metals are involved. Bolts subject to frequent removal shall be coated with rust preventive compound instead of primer. The heads of steel bolts and steel nuts bearing on aluminum alloy parts shall be insulated from these parts by alclad washers. After assembly, parts shall be thoroughly coated with primer in such manner as to provide an organic fillet around all boundaries. Threads of adjustable parts such as turnbuckles, control rods, etc., shall not be painted, but shall be lubricated and protected both before and after assembly with anti-seize compound conforming to specification AN-C-53-1, or an equivalent material, or protected after assembly with rust preventive compound.

d. CONTROL CABLES.—Control cables shall be protected by immersion in paralketone or equivalent prior to installation and then lightly coated with the same material after installation.

e. TANKS.

(1) FUEL TANKS.—(See Par. 4, *b*, (4), *(a)*.)

(2) OIL TANKS.—(See Par. 4, *b*, (2), *(f)*.)—The interior shall not be painted. Tanks placed in storage shall be filled with light oil and drained.

f. TUBING.

(1) STRUCTURAL TUBING.—All open structural tubing shall receive two coats of primer on the interior and three coats of primer on the exterior. Where camouflage is required as the final coat, two coats of primer may be omitted on the exterior. Steel tubing shall be sandblasted prior to the application of any finish coats. Steel fittings in conjunction with aluminum alloy tubing shall not be employed if avoidable. End fittings used with open tubing shall be so designed or drained that pockets are not formed where moisture can collect.

(2) SEALED STEEL STRUCTURE.—The interior surfaces of all closed or sealed steel parts, and those parts which are plated and which contain crevices or pockets where the plating solution might be held, shall be protected by a coating of rust preventive compound (Alternate, raw linseed oil). The liquid shall be applied by forcing it into the hollow members under pressure, or by immersing the part in a bath of the liquid. The liquid shall be at a temperature of not less than 71°C (160°F) during application and shall be allowed to remain on the surface for at least two minutes. In the case of large structure, interconnecting holes may be drilled between various members so that the liquid will circulate. This shall be accomplished in such a manner as not to adversely affect the strength of the structure. The presence of the liquid in each member may be checked by noting the increase in temperature. Parts which are immersed shall be manipulated so as to insure the absence of air pockets and shall remain in the bath until all bubbling has ceased. The members shall be thoroughly drained after treatment and wiped free from oil on all exterior surfaces. All accessible holes drilled in the members shall be closed with cadmium plated self-tapping screws. Solder shall not be used to close the holes.

Finally, sealed steel structures shall be sand blasted, plated or metal sprayed without delay, and then immediately protected with one coat of primer. An additional finish coat of primer, enamel, or lacquer shall be applied to match the proper color scheme.

(3) NONSTRUCTURAL TUBING.

(a) INSTRUMENT LINES. (2S, 3S, 52S, or 53S Aluminum Alloy).

1. Do not anodize.

2. Apply no finish to interiors.

3. Apply one green prime and the markings to exterior.

(b) ANTI-ICER LINES (2S, 3S, 52S, or 53S Aluminum Alloy).

1. Anodize.

2. Apply one green prime and markings to exterior.

(c) FUEL, OIL AND HYDRAULIC LINES (2S, 3S, 52S, or 53S Aluminum Alloy).

1. Do not anodize.

2. Apply no finish to interiors.

3. Apply one green prime and the markings to exterior.

(d) HEATER LINES (2S, 3S, 52S, or 53S Aluminum Alloy).

1. Anodize.

2. Apply one green prime and the markings to exterior.

(e) VENT LINES (2S, 3S, 52S, or 53S Aluminum Alloy).

1. Anodize.

2. Apply one prime, one green prime and the markings to exterior.

(f) Exterior markings shall be in accordance with AND10375. All lines called out above shall receive the anodic treatment if made of 17S or 24S aluminum alloy material. In paragraph *f.*, (3), *(b)* thru *f.*, (3), *(e)*, if lines are 17S or 24S, an additional coat of primer shall be applied. In this instance, only the second coat shall be green prime.

g. POTASSIUM CHROMATE.—Potassium chromate shall be supplied in suitable containers, and employed in the sumps of integral fuel tanks and in the low point of each individual compartment of the floats and hull. Provisions shall be made so that inspection and replenishment of this material may be readily accomplished.

h. STRUT ENDS.—All fastenings, strut ends, and other similar parts exposed to the action of salt water or spray shall receive class "AA" protection by being treated with a coating of beeswax, paralketone, or equivalent rust preventive compound. All open end struts shall be dipped subsequent to painting to a depth of at least 18 inches, drained, and wiped prior to installation.

i. INTERIOR WOOD SURFACES.

(1) TABLE TOPS.—Apply two coats of waterproof wood sealer; one coat of filler across the grain; lightly sand the surface; and then apply either two coats of lacquer or one coat of enamel. The material may be clear or colored as appearance dictates. If clear material is used, a coat of green primer may be applied prior to the final coat in order to harmonize with adjacent surfaces. Wood-to-metal contacts shall be insulated with one coat of varnish.

(2) WOOD SURFACES OTHER THAN TABLE TOPS.—Apply two spray coats of waterproof wood sealer; lightly sand; and finally, apply either two spray coats of waterproof clear lacquer or one coat of enamel. On those surfaces where appearance dictates, a coat of green prime may be applied prior to the initial coat of lacquer. Wood-to-metal contacts shall be insulated with one coat of varnish.

(3) PLYWOOD SURFACES. — See the paragraph above.

j. ARMOR PLATE.—Apply two coats of primer. The second coat shall be green primer. In preparing armor plate for finishing, light sanding or shot-blasting may be employed, but no acid pickling process shall be used. The plates shall not be heated or subjected to temperatures above 100°C (212°F).

k. HEAT ANTI-ICING PARTS.

(1) WING LEADING EDGE AND EMPENNAGE DUCTS.—The ducts shall receive the anodic treatment and one coat of primer followed by one coat of green primer on both interior and exterior surfaces.

(2) WING LEADING EDGES.—The interior surface of the wing leading edge skin shall receive one coat of dull black camouflage enamel as the final interior coat in addition to the finish specified in Par. 4, *b*, (2), *(e)*.

(3) EMPENNAGE LEADING EDGES. — The exterior surface of the true leading edges shall be given a coat of gloss white enamel in place of the third primer coat specified herein. The false leading edges shall be anodized and given a coat of primer, one coat of green primer, and the final coat of camouflage enamel. The interior surfaces of the skin shall be given an additional spray coat of dull black camouflage enamel.

l. PLASTICS.—No finish shall be applied.

9. HULL AND FLOATS.

a. HULL WATERLINE.—Suitable black markings, one inch in width, shall be painted inside the hull in each compartment at the normal load waterline of the airplane. Where possible, these markings shall be so located as to be visible with all furnishings and equipment installed. No waterline shall be painted on the exterior of the hull.

b. FLOAT BUMPERS.—The forward face of each float, the float strut fittings, and the float tow rings shall be given Class "AA" protection by the addition of a coat of paralketone.

10. COLOR SYSTEM.

a. DRAWINGS.—The exterior of the airplane shall be finished in accordance with Consolidated Drawings 28Z5070 and 28W5550.

b. EXTERIOR SURFACES.—All exterior metal surfaces shall be finished in accordance with specification SR-2e except that Dupont Line 71 camouflage enamel shall be used in lieu of camouflage lacquer per specification M-485 and except as further specified herein. The final finish on the fabric surfaces shall be in accordance with specifications SR-2e. (See Par. 7, *c* for fabric finish.)

The final finish on landing gear parts shall consist of one coat of gloss black lacquer followed by one coat of camouflage enamel in accordance with the general camouflage scheme.

c. INTERIOR COLOR SCHEME.

Hull Interior, Generally	Green Primer
Instrument Panels	Dull Black
Landing Light Compartment	Black
Seat Covers	Grey Brown
Curtains	Dark Green
Marking and Stenciling	Black

11. INSIGNIA AND MARKING.

Insignia and markings shall conform to CVAC Drawings 28Z5070 and 28W5550 which shall be in accordance with specification Sr-2e as modified by specification AN-I-9.

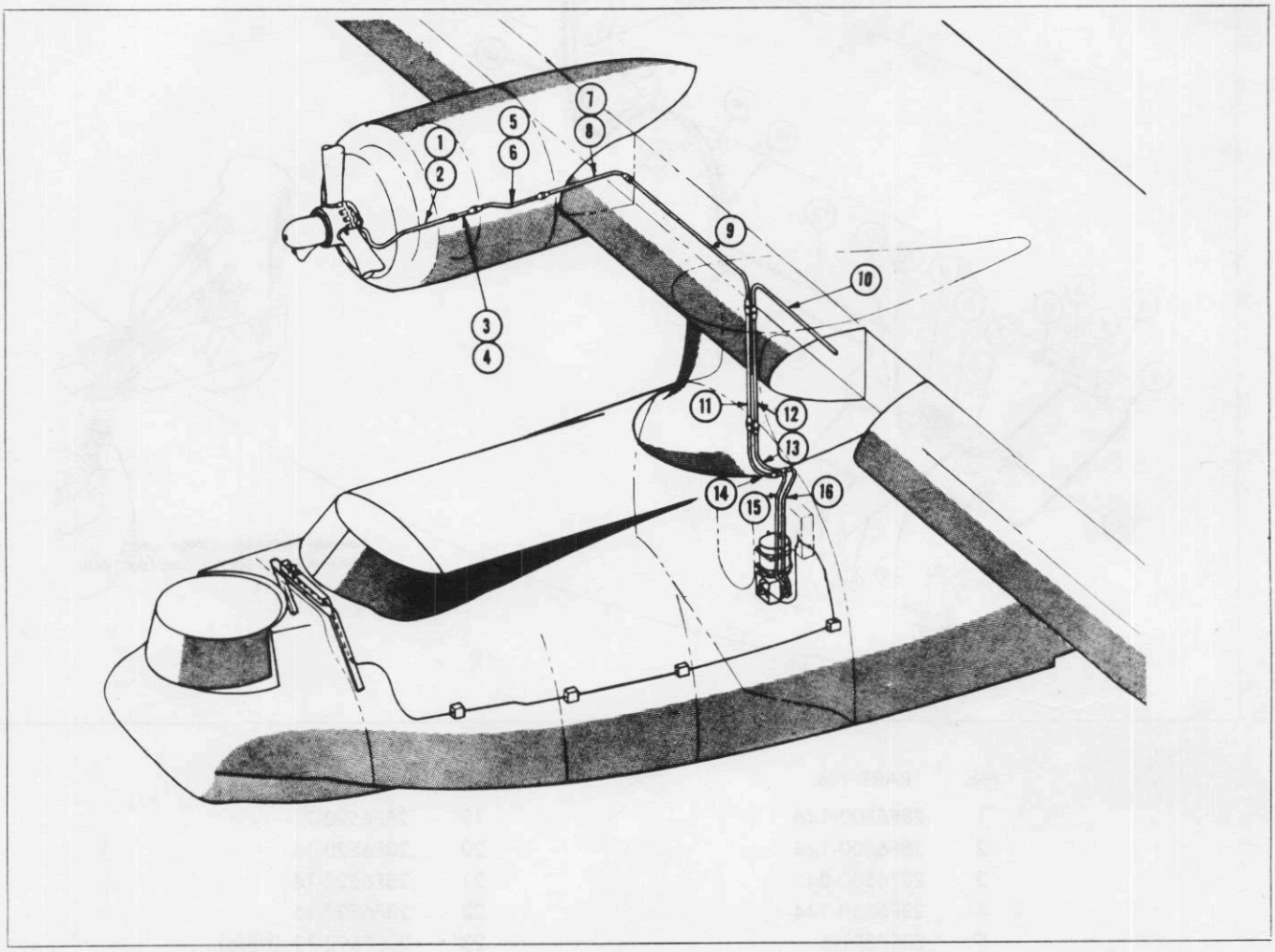
12. APPLICABLE PROCESS SPECIFICATIONS.

Anodic Films, Corrosion Protective for Aluminum Alloys	AN-QQ-A-696a
Anodic Oxidation Treatment for Aluminum Alloys	PT-19 (Navy)
Application of Protective Coatings to Fabric Surfaces in Aircraft	SR-70d-2 (Navy)
Bonding, Electrical, (for Aircraft)	AN-B-10
Heat Treatment of Aluminum Alloys	AN-QQ-H-186a
Heat Treatment of Steels	AN-QQ-H-201-2
Insignia and Markings for Aircraft	SR-2e (Navy) and AN-I-9b.
Magnesium Alloys, Process for Corrosion Protection of	AN-M-12
Metal Spraying	AN-M-8
Plating, Cadmium	AN-QQ-P-421
Plating, Chromium	AN-P-39
Plating, Nickel	AN-P-34
Plating, Zinc	AN-P-32
Process for Finishing of Corrosion and Heat Resisting Alloys of Naval Aircraft	SR-39e (Navy)
Sandblasting Metal Parts	PS-5-1 (Navy)

SECTION VIII

TUBING CHARTS

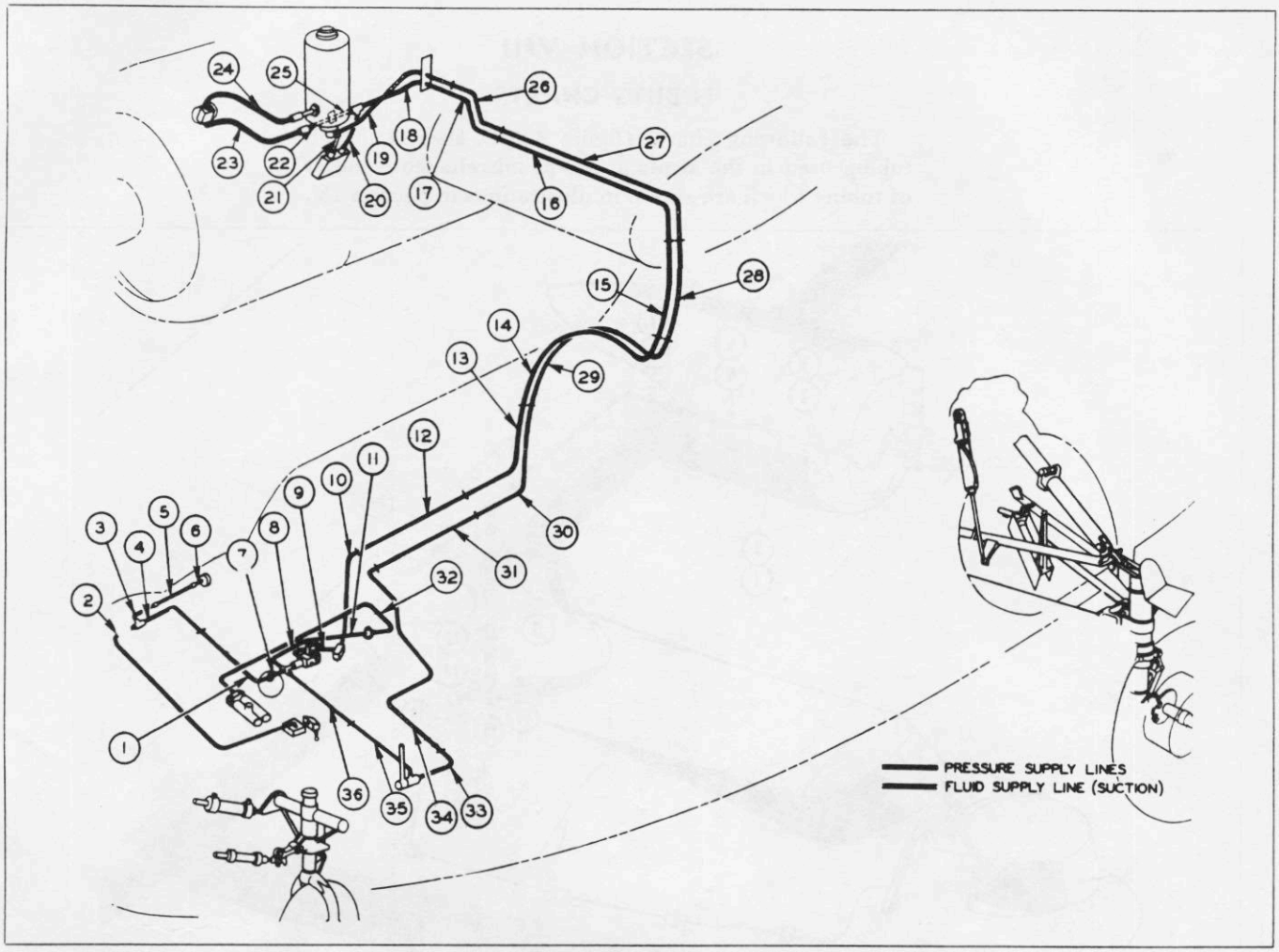
The following charts (figure 306-12 sheets) list all tubing used in the airplane except miscellaneous pieces of tubing which are shown in illustrations in Section IV.



No.	PART No.	No.	PART No.	No.	PART No.
1	*28P5060-30	8	*28P5060-26R	13	***28P5060-8
	**28P5539-17		**28P5539-13		****28P5125-9
2	*28P5060-29	9	*28P5060-13		**28P5539-15
	**28P5539-16		**28P5539-11	14	***28P5060-9
3	28G3014-8 (Hose)	10	*28P5060-12		****28P5125-8
	28G3014-8 (Hose)		**28P5539-10		**28P5539-14
5	32P079-9	11	*28P5060-11	15	***28P5060-7
6	32P079-9		**28P5539-9		****28P5125-7
7	*28P5060-26L	12	*28P5060-10		**28P5539-7
	**28P5539-12		**28P5539-8	16	***28P5060-6
					****28P5125-6
					**28P5539-6

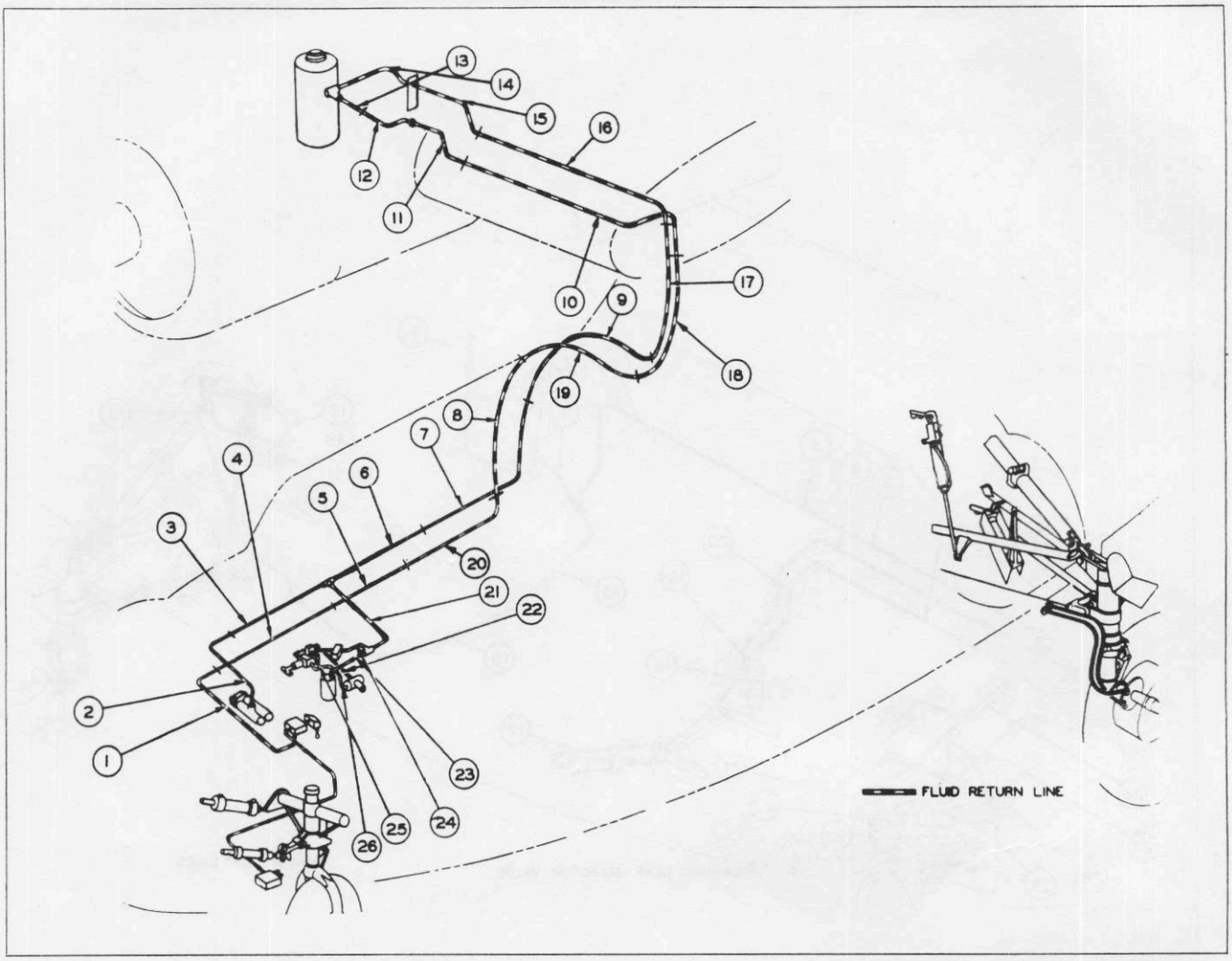
*PBY-5 airplanes and PBY-5A airplanes up to serial No. 46588.
**PBY-5A airplanes serial No. 46588 and on.
***PBY-5 airplanes only.
****PBY-5A airplanes up to serial No. 46588.

Figure 306—(Sheet 1 of 12 sheets)—Propeller Anti-Icing System



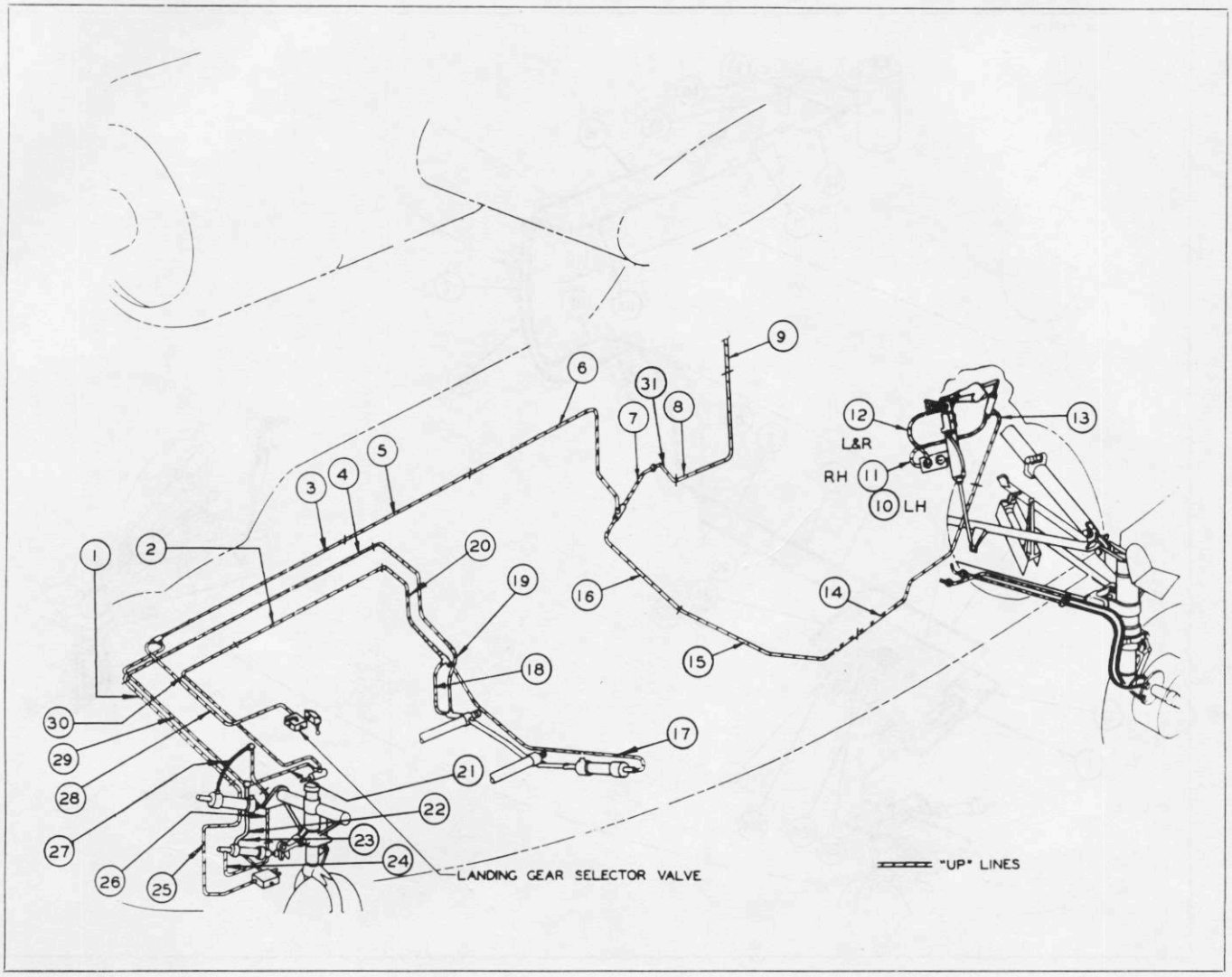
No.	PART No.	No.	PART No.
1	28F6500-146	19	28F6520-7
2	28F6500-145	20	28F6520-14
3	28F6500-84	21	28F6520-16
4	28F6500-144	22	28F6520-15
5	28F7591-6	23	28F7592-12 (Hose)
6	28F6500-139	24	28F7592-13 (Hose)
7	28F6500-149	25	28F6520-13
8	28F6519-13	26	28F6520-10
9	28F6519-14	27	28F6500-57
10	28F6500-24	28	28F6500-54
11	28F6519-16	29	28F6500-43
12	28F6500-33	30	28F6500-41
13	28F6500-39	31	28F6500-35
14	28F6500-42	32	28F6500-23
15	28F6500-53	33	28F6500-140
16	28F6500-58	34	28F6500-26
17	28F6520-11	35	28F6500-28
18	28F6520-8	36	28F6500-83

Figure 306 (Sheet 2 of 12 sheets)—Main Hydraulic System—Pressure and Supply Lines (PBY-5A Only)



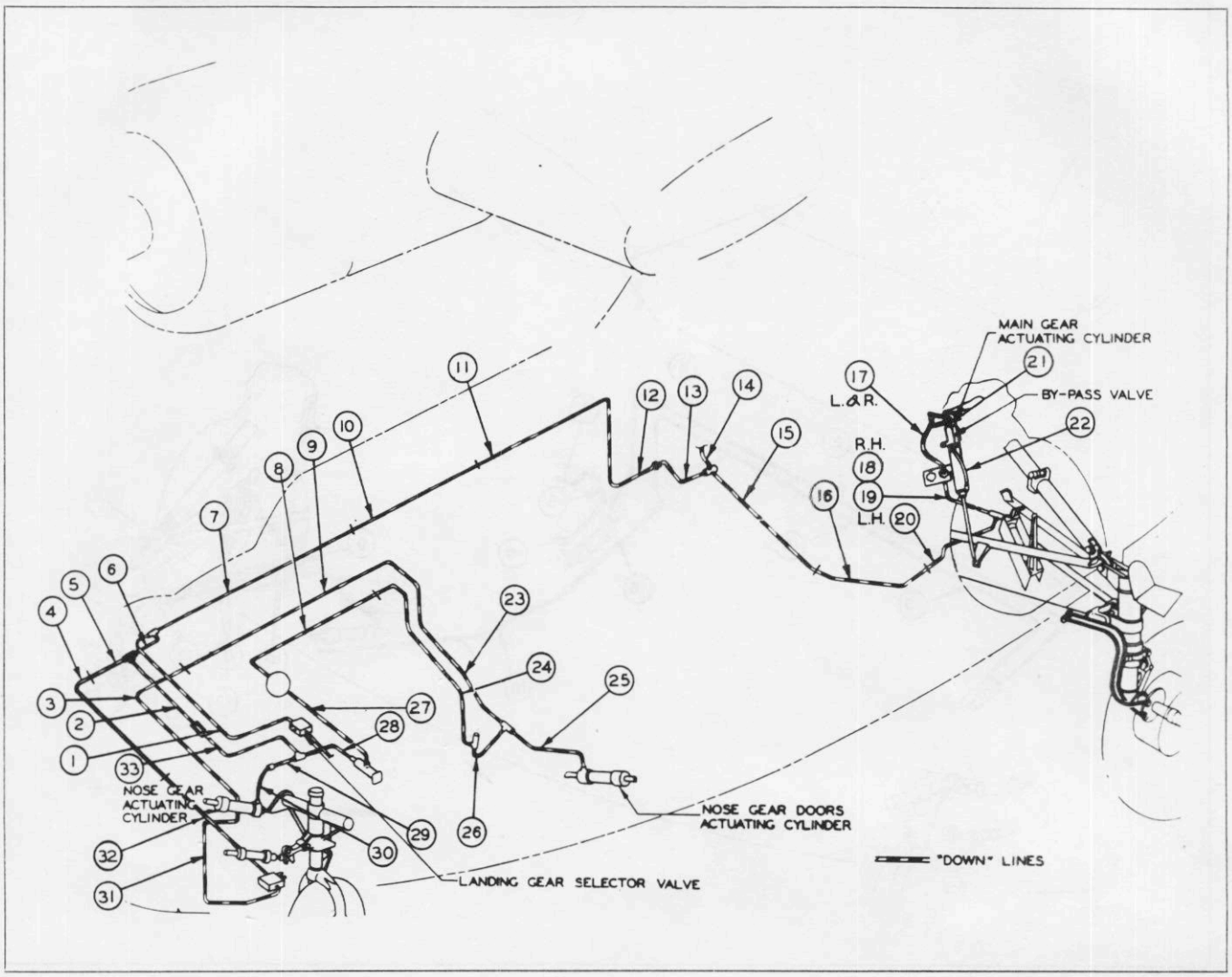
No.	PART No.	No.	PART No.
1	28F6500-124	14	28F6520-18
2	28F6500-129	15	28F6520-9
3	28F6500-18	16	28F6500-56
4	28F6707-14	17	28F6500-55
5	28F6707-13	18	28F6707-9
6	28F6500-34	19	28F6707-10
7	28F6500-40	20	28F6707-12
8	28F6707-11	21	28F6500-95
9	28F6500-44	22	28F6519-9
10	28F6707-8	23	28F6519-11
11	28F6707-7	24	28F6519-10
12	28F6707-6	25	28F6519-8
13	28F6707-15	26	AC39B3480-8-16 (Hose)

Figure 306 (Sheet 3 of 12 sheets)—Main Hydraulic System—Return Lines (PBY-5A Only)



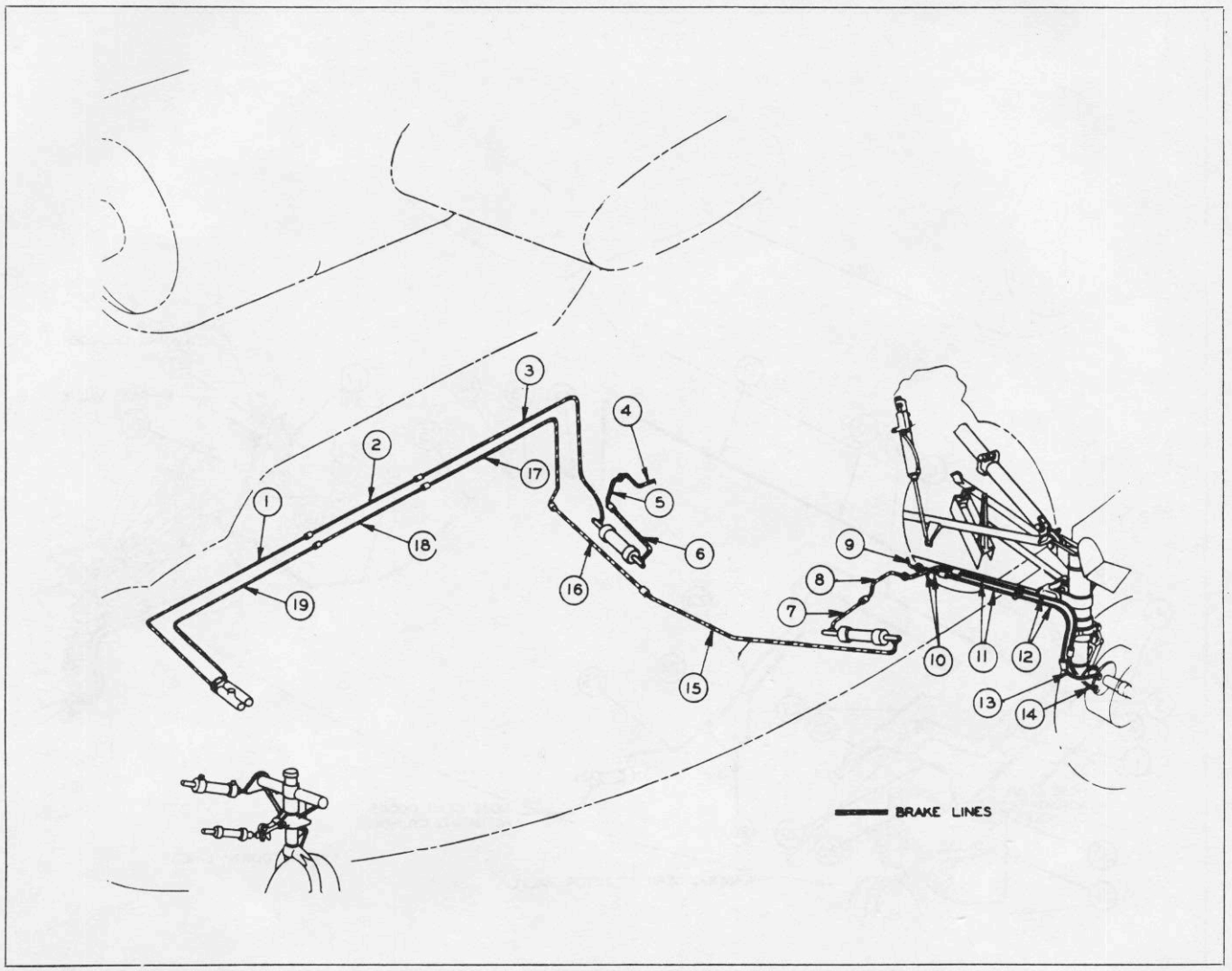
No.	PART No.	No.	PART No.
1	28F6500-86	17	28F6500-77
2	28F6500-15	18	28F6500-96
3	28F6500-7	19	28F6500-85
4	28F6500-92	20	28F6500-80
5	28F6500-31	21	28F6500-14
6	28F6500-114	22	28F6500-131
7	28F6500-115	23	28F6500-13
8	28F6500-64	24	28F6500-136
9	28F6500-130	25	28F6500-133
10	28F6500-71	26	28F6500-135
11	28F6500-63	27	28F7592-7 (Hose)
12	28F7592-8 (Hose)	28	28F6500-151
13	28F6500-72	29	28F6500-11
14	28F6500-103	30	28F6500-110
15	28F6500-112	31	28F6500-106
16	28F6500-116		

Figure 306 (Sheet 4 of 12 sheets)—Landing Gear Hydraulic System—Up Lines (PBY-5A Only)



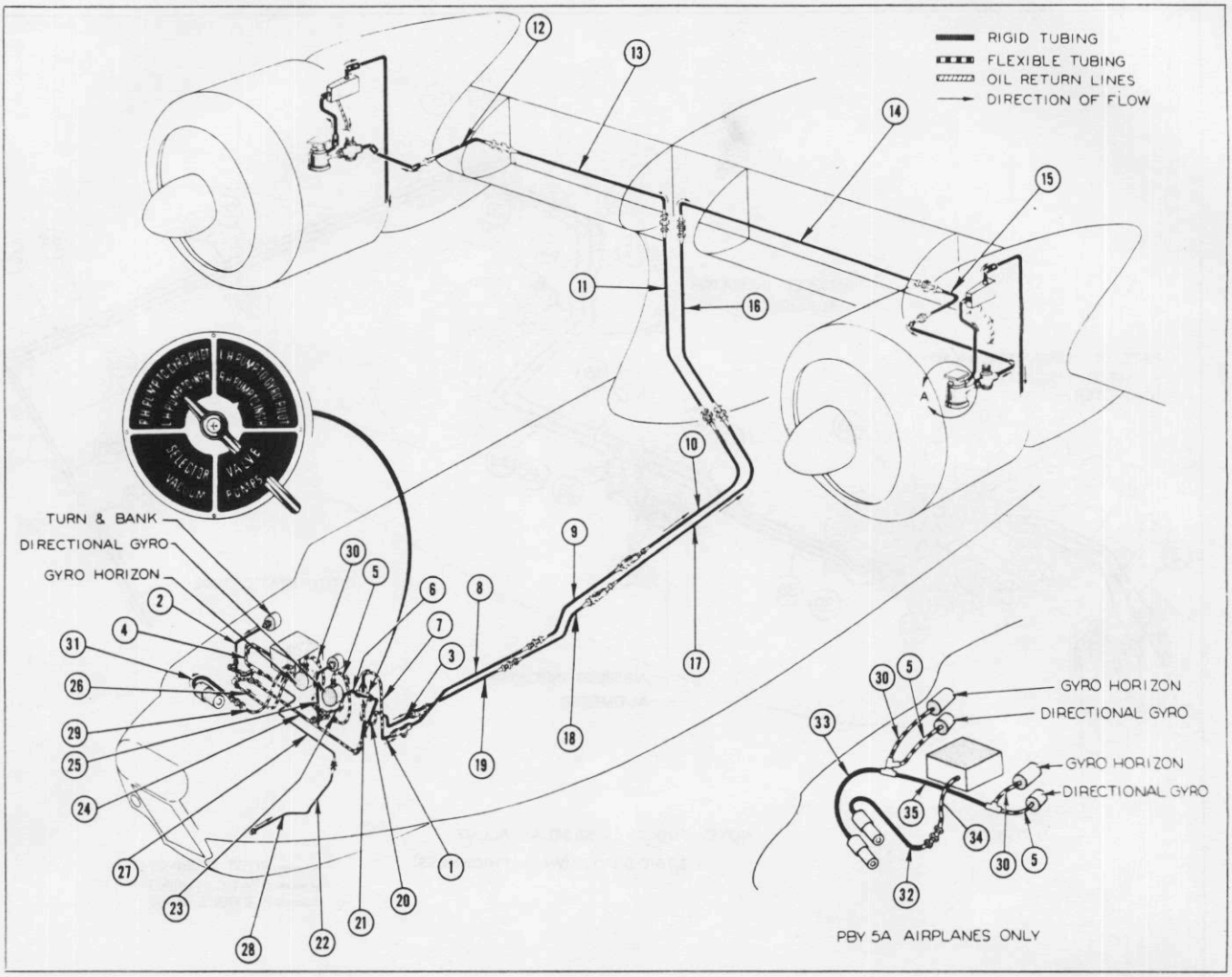
No.	PART No.	No.	PART No.
1	28F6500-128	18	28F6500-65
2	28F6500-99	19	28F6500-73
3	28F6500-87	20	28F6500-104
4	28F6500-88	21	28F6531-7
5	28F6500-89	22	28F6531-6
6	28F6500-100	23	28F6500-81
7	28F6500-6	24	28F6500-79
8	28F6500-16	25	28F6500-76
9	28F6500-93	26	28F6500-74
10	28F6500-29	27	28F6500-109
11	28F6500-27	28	28F6500-97
12	28F6500-52	29	28F6500-17
13	28F6500-107	30	28F7592-6 (Hose)
14	28F6500-150	31	28F6500-134
15	28F6500-59	32	28F6500-132
16	28F6500-66	33	28F6500-98
17	28F7592-6 (Hose)		

Figure 306 (Sheet 5 of 12 sheets)—Landing Gear Hydraulic System—Down Lines (PBY-5A Only)



No.	PART No.	No.	PART No.
1	28F6500-20	11	28F6545-6
2	28F6500-30	12	28F7592-11 (Hose)
3	28F6500-36	13	28F7592-8 (Hose)
4	28F6500-105	14	28F7592-10 (Hose)
5	28F6500-61	15	28F6500-111
6	28F6500-47	16	28F6500-102
7	28F6500-113	17	28F6500-38
8	28F6500-70	18	28F6500-32
9	28F6545-9	19	28F6500-21
10	28F7592-9 (Hose)		

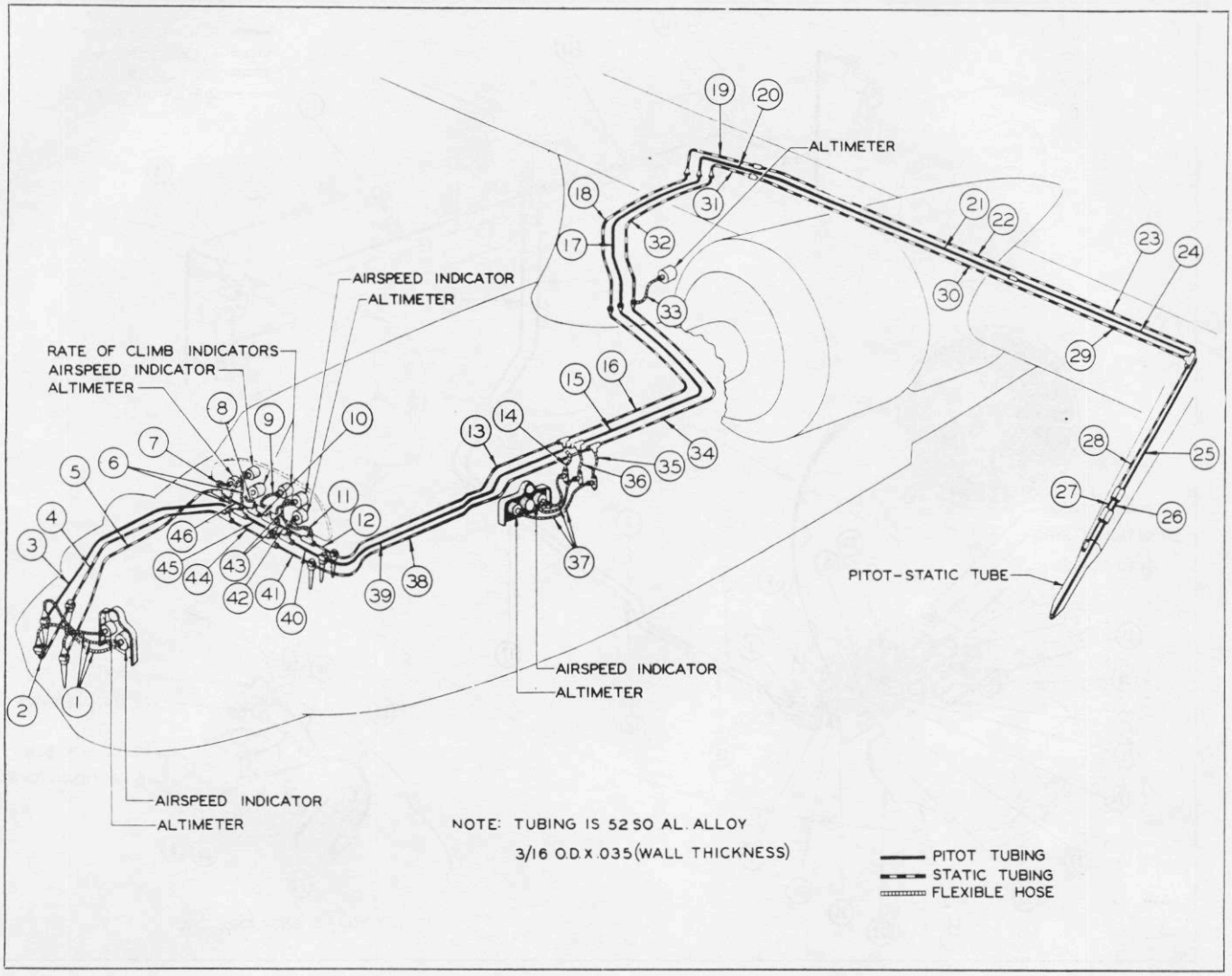
Figure 306 (Sheet 6 of 12 sheets)—Brake Hydraulic System Lines (PBY-5A Only)



No.	PART No.	No.	PART No.
1	28F6282-30	19	28F5337-7
2	28F3100-13 (Hose)	20	28F6282-16
3	28F6282-21	21	28F3099-11
4	CVAC-HOS-17 (Hose)	22	*28F6282-31
5	AN856-6 (Hose)		**28F6282-28
6	28F6282-15	23	28F6282-14 (Hose)
7	28F3099-12	24	28F3098-4
8	28F5337-6	25	28F3100-13 (Hose)
9	28F5337-10	26	CVAC-HOS-14 (Hose)
10	28F5337-8	27	28F6282-27
11	28F5337-12	28	28F6282-29
12	28F5337-16	29	**CVAC-HOS-22-50 (Hose)
13	28F5337-14	30	AN856-6 (Hose)
14	28F5337-15	31	**28F5363-21 (Hose)
15	28F5337-17	32	*28F12002-6
16	28F5337-13	33	*28F12002-7
17	28F5337-9	34	*AN856-10 (Hose)
18	28F5337-11	35	*28F12002-8

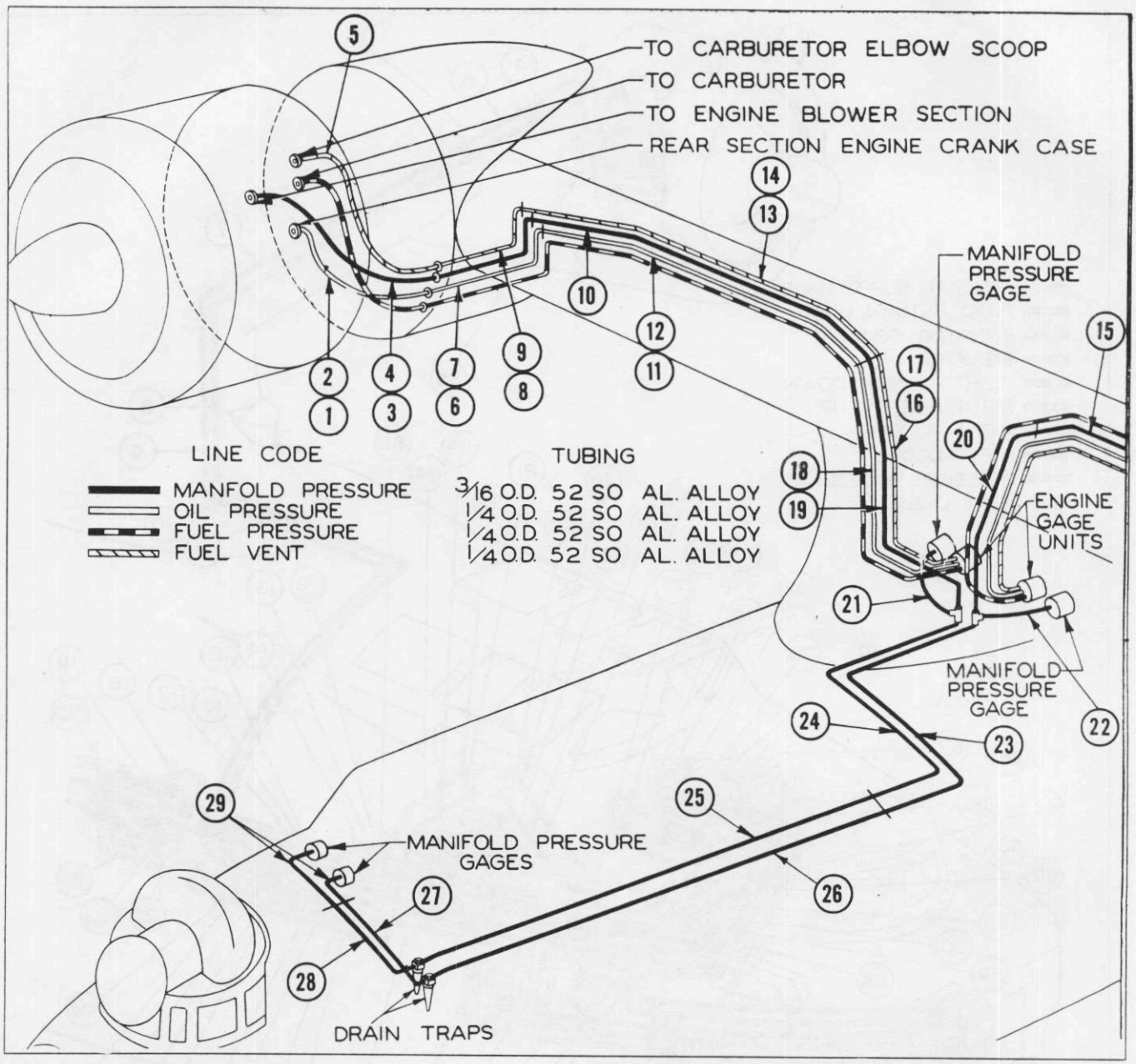
*PBY-5A airplanes only.
**PBY-5 airplanes only.

Figure 306 (Sheet 7 of 12 sheets)—Vacuum System Lines



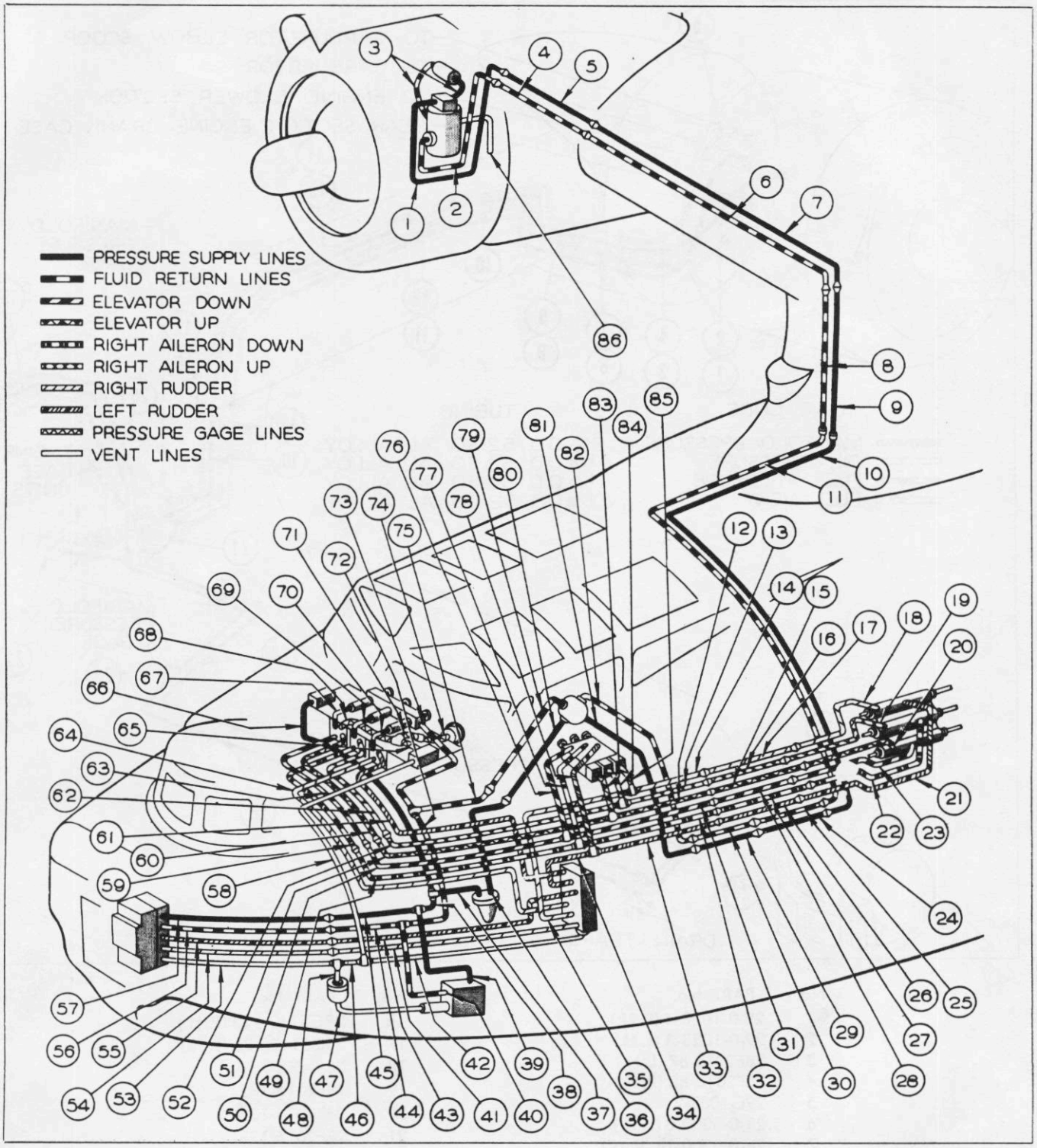
No.	PART No.	No.	PART No.
1	CVAC-HOS-32 (Hose)	24	28F2016-186
2	28F2016-171	25	28F2021-13
3	28F2016-122	26	28F2021-7
4	28F2016-120	27	28F2021-7
5	28F2016-121	28	28F2021-11
6	28F3100-5	29	28F2016-188
7	28F3100-3 (Hose)	30	28F2016-198
8	28F3100-5 (Hose)	31	28F2016-37
9	28F3100-5 (Hose)	32	28F2016-133
10	28F6282-10	33	28F2123
11	28F3100-3 (Hose)	34	28F2016-35
12	28F6282-12	35	28F2016-190
13	28F2016-24	36	28F2016-191
14	28F2016-189	37	28F2111-6
15	28F2016-45	38	28F2016-34
16	28F2016-25	39	28F2016-44
17	28F2016-132	40	28F6282-11
18	28F2016-134	41	28F6282-13
19	28F2016-47	42	28F6282-8
20	28F2016-27	43	28F3100-5 (Hose)
21	28F2016-197	44	28F6282-7
22	28F2016-199	45	28F6282-9
23	28F2016-187	46	28F6282-6

Figure 306 (Sheet 8 of 12 sheets)—Pitot-Static Instrument Lines



No.	PART No.	No.	PART No.
1	29-0-1028-4 (R. H.)	16	28G5142-123 (R. H.)
2	29-0-1028-3 (L. H.)	17	28G5142-126 (L. H.)
3	28F2016-87 (L. H.)	18	28-0-5000-15
4	28F2016-88 (R. H.)	19	28F2016-135
5	29G1087-7	20	28F2016-136
6	28-0-5000-8 (L. H.)	21	28F2016-128
7	28-0-5000-14 (R. H.)	22	28F2016-127
8	28G5142-131 (L. H.)	23	28F2016-73
9	28G5142-130 (R. H.)	24	28F2016-72
10	28F2016-85	25	28F2016-70
11	28-0-5000-9 (L. H.)	26	28F2016-71
12	28-0-5000-13 (R. H.)	27	28F6282-23
13	28G5142-125 (L. H.)	28	28F6282-22
14	28G5142-122 (R. H.)	29	28F3100-18 (Hose)
15	28F2016-83		

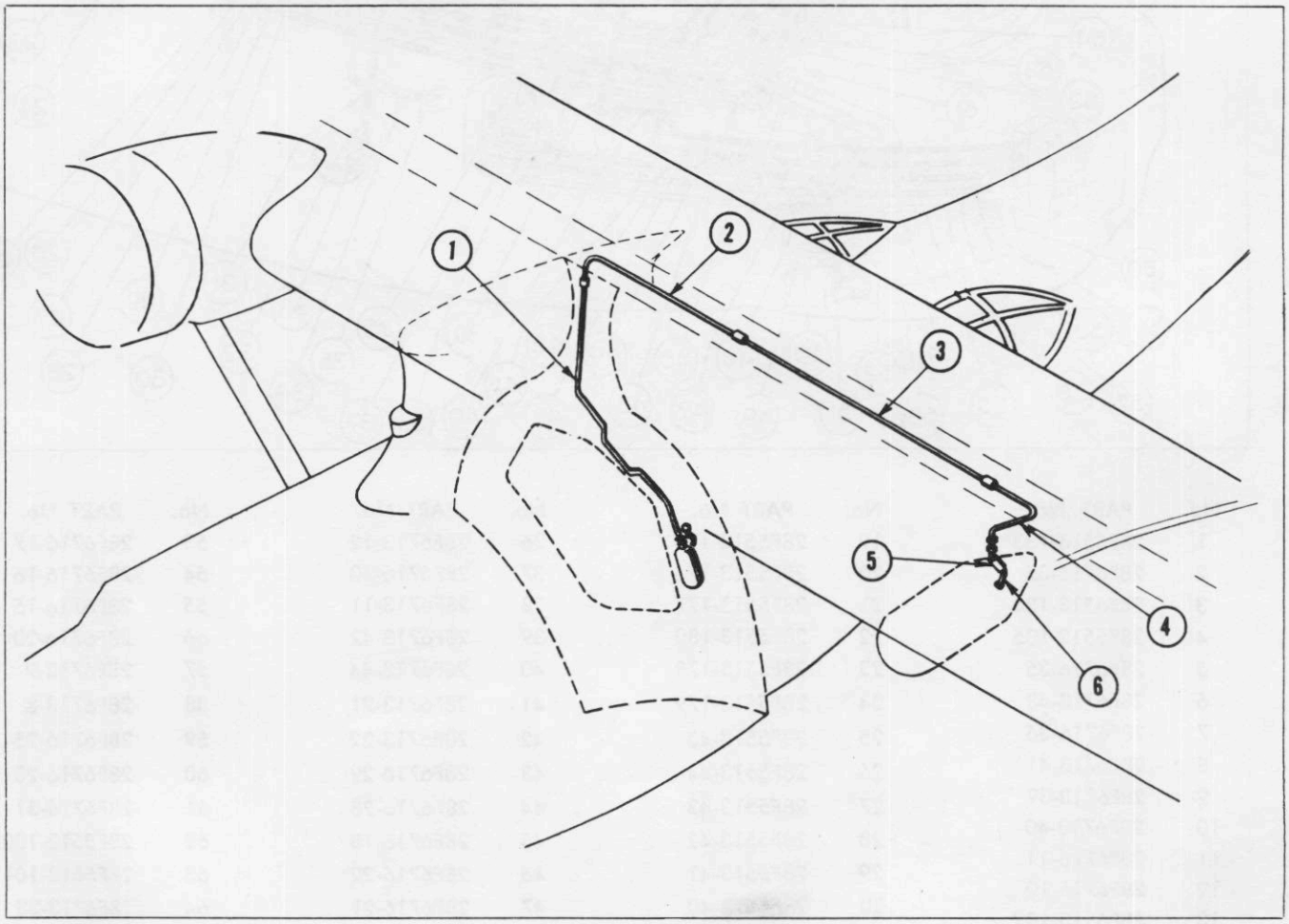
Figure 306 (Sheet 9 of 12 sheets)—Engine Instrument Lines



No.	PART No.	No.	PART No.	No.	PART No.	No.	PART No.
1	28F5513-159	6	28F5513-78	11	28F5513-149	16	28F5513-41
2	28F5513-158	7	28F5513-79	12	28F5513-141	17	28F5513-40
3	CVAC-HOS-15 (Hose)	8	28F5513-76	13	28F5513-140	18	28F5513-175
4	28F5513-162	9	28F5513-77	14	28F5513-139	19	28F5513-176
5	28F5513-163	10	28F5513-148	15	28F5513-42	20	28F5513-177

Figure 306 (Sheet 10 of 12 sheets)—Automatic Pilot Hydraulic System Lines (PBY-5 Only)

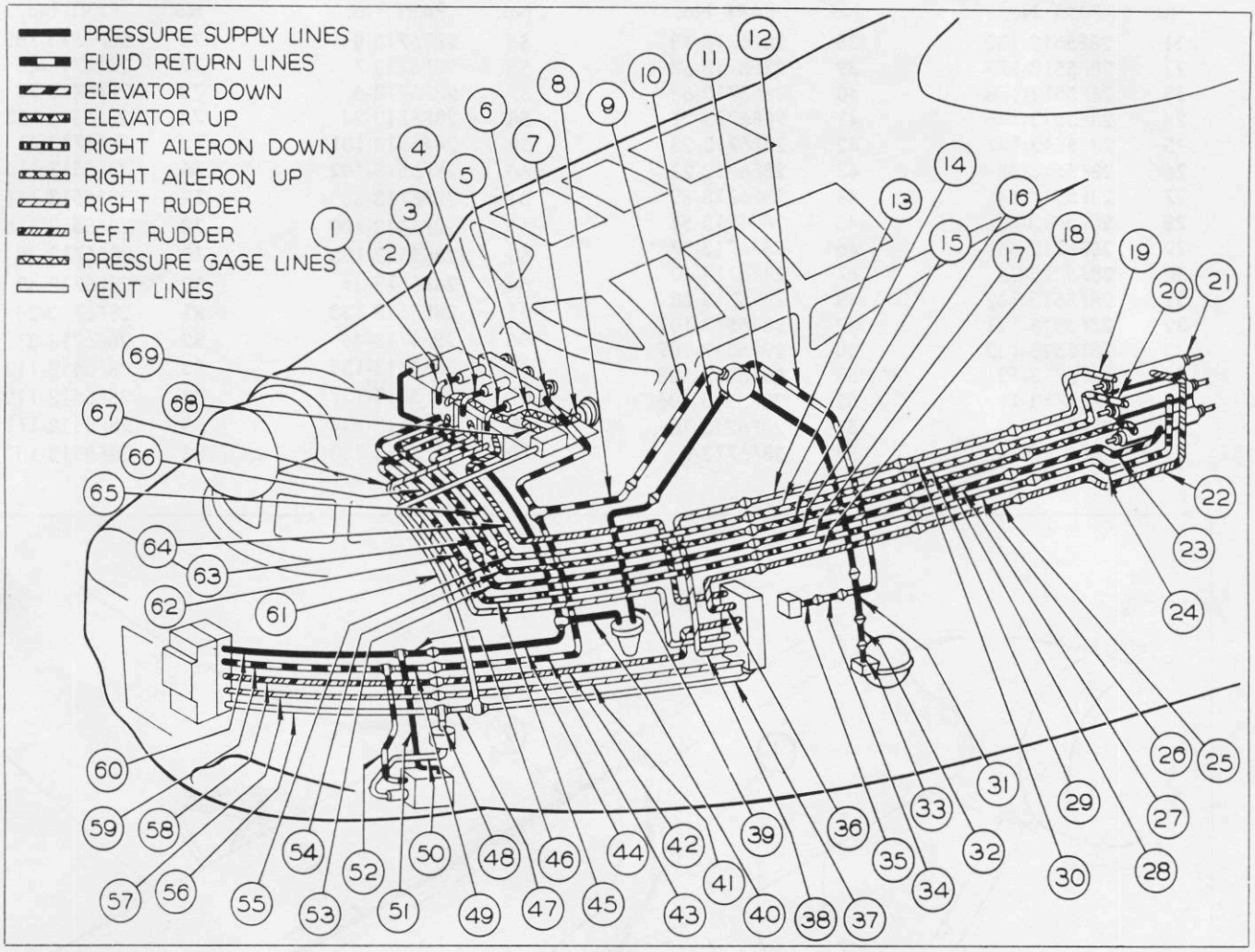
No.	PART No.	No.	PART No.	No.	PART No.	No.	PART No.
21	28F5513-180	38	28F6713-48	55	28F6713-8	71	28F5513-152
22	28F5513-179	39	28F6713-63	56	28F6713-7	72	28F6713-45
23	28F5513-178	40	28F6713-68	57	28F6713-6	73	28F6713-43
24	28F5513-146	41	28F6713-21	58	28F6713-24	74	28F5513-153
25	28F5513-147	42	28F6713-23	59	28F5513-101	75	28F6713-41
26	28F5513-45	43	28F6713-22	60	28F5513-102	76	28F5513-114
27	28F5513-44	44	28F6713-49	61	28F6713-33	77	28F5513-115
28	28F5513-43	45	28F6713-51	62	28F5513-100	78	28F5513-116
29	28F6713-36	46	28F6713-27	63	28F5513-103	79	28F6713-39
30	28F6713-35	47	28F6713-60	64	28F6713-34	80	28F6713-40
31	28F5513-142	48	28F6713-28	65	28F5513-138	81	28F6713-38
32	28F5513-121	49	28F5513-107	66	28F6713-46	82	28F6713-37
33	28F5513-122	50	28F5513-109	67	28F5513-135	83	28F5513-113
34	28F6713-12	51	28F5513-108	68	28F5513-137	84	28F5513-112
35	28F6713-11	52	28F5513-106	69	28F5513-134	85	28F5513-111
36	28F6713-42	53	28F6713-10	70	28F5513-133	86	28F5513-157
37	28F6713-44	54	28F6713-9				



No.	PART No.
1	*28A2008-17
	**28A2008-11
2	28A2008-10
3	28A2008-12
4	28A2008-14
5	28A1109 (Hose)
6	28A2044

*PBY-5A only.
**PBY-5 only.

Figure 306 (Sheet 11 of 12 sheets)—Smoke Tank Lines



No.	PART No.	No.	PART No.	No.	PART No.	No.	PART No.
1	28F5513-133	19	28F5513-175	36	28F6713-12	53	28F6716-17
2	28F6716-37	20	28F5513-176	37	28F6716-30	54	28F6716-16
3	28F5513-134	21	28F5513-177	38	28F6713-11	55	28F6716-15
4	28F5513-135	22	28F5513-180	39	28F6713-42	56	28F6716-20
5	28F6716-35	23	28F5513-178	40	28F6713-44	57	28F6713-9
6	28F6713-43	24	28F5513-179	41	28F6713-21	58	28F6713-8
7	28F6716-36	25	28F5513-45	42	28F6713-22	59	28F6716-25
8	28F6713-41	26	28F5513-44	43	28F6716-29	60	28F6716-23
9	28F6713-39	27	28F5513-43	44	28F6716-28	61	28F6716-31
10	28F6713-40	28	28F5513-42	45	28F6716-18	62	28F5513-102
11	28F6716-11	29	28F5513-41	46	28F6716-22	63	28F5513-101
12	28F6716-10	30	28F5513-40	47	28F6716-21	64	28F6713-33
13	28F5513-139	31	28F6716-12	48	28F6716-6	65	28F5513-103
14	28F5513-140	32	28F6716-13	49	28F6716-24	66	28F5513-100
15	28F5513-141	33	28F6716-32	50	28F6716-40	67	28F6713-34
16	28F5513-142	34	28F6716-34	51	28F6716-26	68	28F6716-38
17	28F5513-121	35	28F6716-33	52	28F6716-27	69	28F6713-46
18	28F5513-122						

Figure 306 (Sheet 12 of 12 sheets)—Automatic Pilot Hydraulic System Lines (PBY-5A Only)

SECTION IX
CHARTS AND TABLES

TABLE A

CHANGE IN CABLE TENSION DUE TO TEMPERATURE CHANGE

Temperature change degrees, C° (F°)		Change in Cable Tension (lb)			
		Cable Diameter			
		3/16	1/8	3/32	1/16
0°	(0°)	0	0	0	0
11	(20)	20	10	5	3
22	(40)	40	20	10	5
33	(60)	60	30	15	8
44	(80)	80	40	20	10
56	(100)	100	50	25	13

All control cables (Specification AN-RR-C-43) should be rigged so that the following tensions are obtained in flight for the average flight temperatures expected:

3/16 in. dia. ..... 90 lb.
1/8 in. dia. ..... 35 lb.
3/32 in. dia. ..... 25 lb.
1/16 in. dia. ..... 15 lb.

If the temperature of the airplane structure at the time the cables are rigged is not the same as that expected in flight, the ground rigging tension can be adjusted by using Table A above.

The table indicates the change in cable rigging tension to be expected for a change in temperature. If the temperature drops, the cable tension will decrease. When the temperature of the airplane increases, the cable tension increases.

Example: The elevator control cables are 3/16 inches in diameter. If they are being rigged in a hangar where the temperature is 60°F, and the airplane is to be flown on operations where the outside temperature will average —20°F, the temperature difference to be allowed for is —80°. From Table A, the decrease in cable tension will be 80 lb. Therefore it is desirable to adjust the tension of the cables to 80 lb. more than normal, or 90 + 80 equals 170 lb. Similarly the other cables can be adjusted by using the information shown for their diameters in Table A.

The values stated in Table A are average and considerable variation from them will be encountered in service. It should be noted that the tension corrections are listed for changes in temperature of the airplane structure. If the airplane is exposed to strong sunlight, the structure will be much warmer than the surrounding air, and allowance should be made for this condition when estimating the temperature of the airplane structure.

TABLE B

ALLOWABLE TORQUES ON BOLTS

Mat'l	STEEL								Al. ALLOY**			
Nut	AN 365				AN 364				AN 365		AN 364	
Cond.	Dry		Lubricated		Dry		Lubricated		Lubricated *			
Bolt Size	In-Lbs.	Ft-Lbs.	In-Lbs.	Ft-Lbs.	In-Lbs.	Ft-Lbs.	In-Lbs.	Ft-Lbs.	In-Lbs.	Ft-Lbs.	In-Lbs.	Ft-Lbs.
1/8					7-9	½-1	5-6	½				
5/32					11-14	1	8-10	½-1				
3/16	35-50	3-4	25-35	2-3	29-37	2-3	20-26	1½-2	10-14	1	10-15	1-1¼
¼	55-90	5-7	38-63	3-5	55-70	5-6	39-49	3-4	20-35	2-3	20-30	1½-2½
5/16	90-150	8-12	63-105	5-8	95-120	8-10	67-84	5-7	50-75	4-6	40-55	3-5
⅜	200-350	17-29	140-245	12-20	145-185	12-15	102-130	8-11	80-110	7-9	65-85	5-7
7/16	350-600	30-50	245-420	21-35	210-270	18-23	147-189	12-16	100-140	9-11	85-110	7-9
½	500-850	42-70	350-595	29-49	335-430	28-36	234-301	20-25	150-200	12-16	125-155	10-13
⅝	850-1300	71-108	595-910	50-76	670-860	56-72	469-602	39-50	300-460	25-38	235-300	20-25
¾	1200-1750	100-146	840-1225	70-102							490-630	41-53

*Lubricant—anti-seize paste (Zinc dust and petroleum jelly).

**Aluminum alloy nuts are used with aluminum alloy bolts.

Torque limits on bolts of steel or aluminum alloy, having either a tension or shear nut, and being either dry or lubricated are listed in Table B above.

Excessive tightening of a nut not only produces a stretching or distortion of the threaded portion, but also pre-stresses the bolt which may eventually lead to its failure. To eliminate the possibility of such damage, it is necessary that the twisting movement of torque be accurately controlled and held below the above failure limits yet above the minimum limits necessary to secure the fastening of parts.

In applying the specified torque loads, effort should be made to stop inside the prescribed lower limit, thus leaving sufficient reserve to enable further tightening to secure alignment of cotter holes without exceeding the specified upper limit. A nut should never be backed off to secure cotter alignment.

TABLE C

AMERICAN AND BRITISH EQUIVALENT GOVERNMENT SPECIFICATIONS FOR EXPENDABLE AND NON-RECOVERABLE MATERIAL

American Specification Number	Title	British Substitute	
		Specification	RAF Stores Ref. Number
AN-F-28	Aircraft Fuel—Grade 100/130	DTD 2475	.34A/75
AN-F-26	Aircraft Fuel—Grade 91/96	DED 2474	.34A/113
AN-F-25	Aircraft Fuel—Grade 87	DTD 230	.34A/59
AN-F-23	Aircraft Fuel—Grade 73	RDE/F/73	.34A/135
AN-VV-O-446	Oil, Lubricating Aircraft Engine		
	Grade 1120	DTD 472/C/O	.34A/144
	Grade 1080	DTD 472/A/O	.34A/152
	Grade 1065	RDE/O/59 (Prev.)	.34A/123
AN-G-3a	Grease; Low Temperature	DTD 577	.34A/174
AN-G-4	Grease; Aluminum Soap		
	Grade AA		.34A/65
	Grade B		.34A/54, 72
AN-G-5	Grease; High Temperature Water Resistant	DTD 588	
AN-G-6	Grease; Lubricating Graphite	DTD 582	
AN-G-10	Grease; Extreme Pressure Low Temperature Lubricating		
AN-G-14	Grease; Gasoline and Oil Resistant	DTD 579	.34A/139
AN-O-3	Oil; Low Temperature Gear E.P. Lubricating	DTD 581 Med. Grade only	.34A/125
AN-O-4	Oil Gyro Instrument Lubricating	DTD 561	.34A/131
AN-O-6	Oil, General Purpose, Low Temperature Lubricating	DTD 44D	.34A/43, 141
AN-VV-O-366	Oil, Hydraulic Petroleum Base	DTD 585	.34A/159
AN-JJJ-O-316	Oil, Castor	DTD 72	.34A/5
AN-F-13	Fluid, Anti-Icing (Iso-Propyl Alcohol)		.33C/720
AN-C-52	Compound; Exterior-Surface Preventive	DTD 279B (for Type I only)	.33C/576, 584, 585
AN-VV-C-576	Compound; Corrosion-Preventive Aircraft-Engines	DTD 587	.33C/777
AN-VV-C-566	Compound; Anti-Seize, Mica-base (for Threaded Fittings)	DTD 589	
AN-C-53	Compound; Anti-Seize White Lead Base	DTD 392	.34A/88
AN-C-86	Compound; Anti-Seize & Sealing for Oxygen Systems		.33C/733
AN-C-116	Compass Liquid; Aircraft	Not equivalent to British Material	
AN-P-51	Petrolatum	DTD 55	.33C/512, 515
AN-E-2	Ethylene Glycol	DTD 344A	.33C/599

TABLE D

INSTRUMENTS

PILOT AND COPILOT

No. Req'd.	Name	Part No.
2	Air Speed Indicator	F.S.S.C. 88-I-350
2	Altimeter	F.S.S.C. 88-A-340
1	Clock	F.S.S.C. 88-C-590
	or	F.S.S.C. 88-C-573
*2	Directional Gyro	F.S.S.C. 88-I-970
**1	Directional Gyro	F.S.S.C. 88-I-970
***1	Dual Tachometer and Synchronizer	F.S.S.C. 88-I-2380
****2	Tachometer	F.S.S.C. 88-I-2500
****1	Synchronizer	F.S.S.C. 88-I-2200
*2	Gyro Horizon	F.S.S.C. 88-I-1350
**1	Gyro Horizon	F.S.S.C. 88-I-1350
*1	Hydraulic Pressure Gage	F.S.S.C. 88-G-620
*1	Hydraulic Pressure Gage	Pioneer 2402-6A
2	Manifold Pressure Gage	F.S.S.C. 88-G-773
1	Mark 8 Standby Compass	F.S.S.C. 88-C-800
1	Oil Pressure Gage (Automatic Pilot)	F.S.S.C. 88-G-855
*1	Pilot's Directional Indicator	Mark 15-5
**2	Pilot's Directional Indicator	Mark 15-5
1	Radio Altimeter	1D-14/APN
2	Rate of Climb Indicator	F.S.S.C. 88-I-725
2	Remote Indicating Compass Indicator	F.S.S.C. 88-I-800
2	Turn and Bank Indicator	F.S.S.C. 88-I-3255
*1	Suction Gage	F.S.S.C. 88-G-924

BOMBARDIER

1	Air Speed Indicator	F.S.S.C. 88-I-350
1	Altimeter	F.S.S.C. 88-A-340
1	Inclinometer	F.S.S.C. 88-I-100
1	Outside Air Thermometer	F.S.S.C. 88-I-2720

NAVIGATOR

1	Air Speed Indicator	F.S.S.C. 88-I-350
1	Altimeter	F.S.S.C. 88-A-340
1	Clock	F.S.S.C. 88-C-573
	or	F.S.S.C. 88-C-590
1	Compass (Aperiodic)	F.S.S.C. 88-C-845
1	Outside Air Thermometer	F.S.S.C. 88-I-2720

FLIGHT ENGINEER

No. Req'd.	Name	Part No.
1	Altimeter	F.S.S.C. 88-A-340
3	Anti-Icer Thermometer	F.S.S.C. 88-I-2650
1	Clock	F.S.S.C. 88-C-580
2	Engine Cylinder Thermometer	F.S.S.C. 88-I-2650
***1	Dual Tachometer and Synchronizer	F.S.S.C. 88-I-2380
****2	Tachometer	F.S.S.C. 88-I-2500
2	Engine Gage Unit	F.S.S.C. 88-G-1020
2	Fuel Flowmeters	C 1043 (L.H.) C 1045 (R.H.) (Fisher, Porter Co.)
2	Fuel Quantity Gage	CVAC 28 G 3002
1	Inclinometer	F.S.S.C. 88-I-100
2	Manifold Pressure Gage	F.S.S.C. 88-G-773
1	Oil Quantity Gage	F.S.S.C. 88-I-2137
1	Outside Air Thermometer	F.S.S.C. 88-I-2720

AUXILIARY POWER UNIT

**1	Cylinder Thermometer	F.S.S.C. 88-I-2650
**1	Oil Pressure Gage	F.S.S.C. 88-G-855
**1	Oil Thermometer	F.S.S.C. 88-I-2815

INSTRUMENT SYSTEM EQUIPMENT

3	Anti-icer Thermometer Thermocouple	F.S.S.C. 88-T-1060
3	Engine Cylinder Thermometer Thermocouple	F.S.S.C. 88-T-1060
**1	Eng. Cyl. Thermometer Thermocouple (APU)	F.S.S.C. 88-T-1060
1	Remote Indicating Compass Inverter	Pioneer 12117-O
1	Magnesyn Compass Transmitter	F.S.S.C. 88-T-1950
2	Oil Quantity Gage Potentiometer	Liquidometer EA 1611-A
2	Oil Thermometer Bulb	F.S.S.C. 88-B-890
3	Air Thermometer Bulb	F.S.S.C. 88-B-890
**1	Oil Temperature Bulb	F.S.S.C. 88-B-900
***2	Tachometer Generator	F.S.S.C. 88-G-1330
****2	Tachometer Generator	F.S.S.C. 88-G-1380

* PBY-5A airplanes.

** PBY-5 airplanes.

*** PBY-5A airplanes with serial numbers 46624 and on.

**** PBY-5 airplanes and PBY-5A airplanes with serial numbers up to 46624.

TABLE E

TUBING COLOR CODE

SYSTEM	COLOR BAND
Air Pressure (Compressed)	
Max. 20 lb/sq in.	Light Blue—Light Green
Min. 25 lb/sq in.	Yellow—Light Green
Air Ducts (Cabin Heater)	
Cold	Yellow—Red—Yellow
Hot	Light Blue—Red
Anti-Icing (Alcohol)	White—Yellow
Exhaust Lines from Combustion Type Heater	Brown—Red
Gasoline	Red
Air Vapor Supply Lines to Combustion Type Cabin Heater	Light Green—Red
Hydraulic Pressure Oil	Light Blue—Yellow—Light Blue
Manifold Pressure	White—Light Blue
Oil (Lubricating)	Yellow
Pitot Pressure (Airspeed)	Black
Purging	Light Blue—Yellow
Smoke Screen Equipment	Brown—White
Static Pressure (Airspeed, Altimeter, Rate of Climb)	Black—Light Green
Vent (Closed Compartments)	Red—Black

All bands shall be one-half inch wide and shall encircle the tube. Bands shall be located near each end of the tube and at such intermediate points as may be necessary to follow through the system.

TABLE G

RADIUS OF BEND FOR RIGID HYDRAULIC TUBING PER AN-H-2 SPECIFICATION

Tube OD	Nominal Bend Radius Measured to the Tube Center Line
Inches	Inches
*1/8	3/8
*3/16	7/16
*1/4	9/16
*5/16	11/16
3/8	15/16
1/2	1-1/4
5/8	1-1/2
3/4	1-3/4
1	3
1-1/4	3-3/4
1-1/2	5
1-3/4	7

* Larger bend radii will be permitted for hand-bent tubing.

TABLE F

TUBING THREAD COMPOUNDS

Installation	Specification or Product: Straight Threads	Specification or Product: Pipe Threads
Aluminum Alloy Bolts	Zinc Dust Compound	(none used)
Air Speed and Vacuum System	*AN-P-51	AN-C-53
Fluid Anti-icing System	*AN-A-18	AN-C-53
Electrical Conduit	Zinc Dust Compound	(not used)
Fuel System	*AN-P-51	Parker Sealube
Heater System	*Bestolife No. 270	Crane Lead Seal
Hydraulic System	**AN-VV-O-366	AN-C-53
Oil System	*Engine Oil	Parker Sealube
Water System	AN-P-51	AN-C-53

The compounds listed are approved for use on pipe threads in the various systems as indicated in above table.

*No anti-seize nor sealant compound shall be used on straight threads or flared tube ends on plumbing installation throughout the airplane. In case of seizing or galling on installation, the application of a little material noted above shall serve as sufficient lubrication to insure tightening.

**Straight thread installation using gaskets AN 902 shall be made using thread compound. (Specification AN-C-53.)

Products corresponding to above listed specifications are identified as follows:

Specification	Product
AN-A-18	Alcohol, Specially Denatured Ethyl
AN-C-53	Compound, Anti-seize (White Lead Base)
AN-P-51	Petrolatum. (Supersedes AN-VV-P-236)
AN-VV-O-366	Oil, Hydraulic (Petroleum Base)

Zinc dust compound is a 50-50 mixture of zinc dust and petrolatum (Specification AN-P-51) which may be mixed at repair base.

Commercial products may be procured as follows:

Product	Source
Sealube	Parker Appliance Company
Lead Seal	Crane Company
Bestolife No. 270	Ducommun Metals & Supply Company

The compounds shall be used and applied in accordance with the manufacturers' recommendations. Caution shall be exercised to insure that the compound is carefully and sparingly put only on the male threads, making sure that none enters the system.

TABLE H

FLEXIBLE CABLE MANUFACTURING CHART

The following cable charts (figure 307-14 sheets) list every flexible cable assembly used in the airplane. This includes all cables used in the surface control, power plant control, and bomb release control systems, as well as cables used in the handling of the airplane and other miscellaneous applications.

All cables listed are fabricated according to Specification AN-RR-C-43 excepting corrosion-resistant steel cable assemblies, 22H1544 and 28H073-6, which are fabricated according to Specification AN-RR-C-48.

The charts, which list the cables in numerical order, give the following information for each cable assembly: part number, part numbers of fittings, illustration number showing the location of the cable assembly in the airplane, length of cable assembly, and diameter of cable.

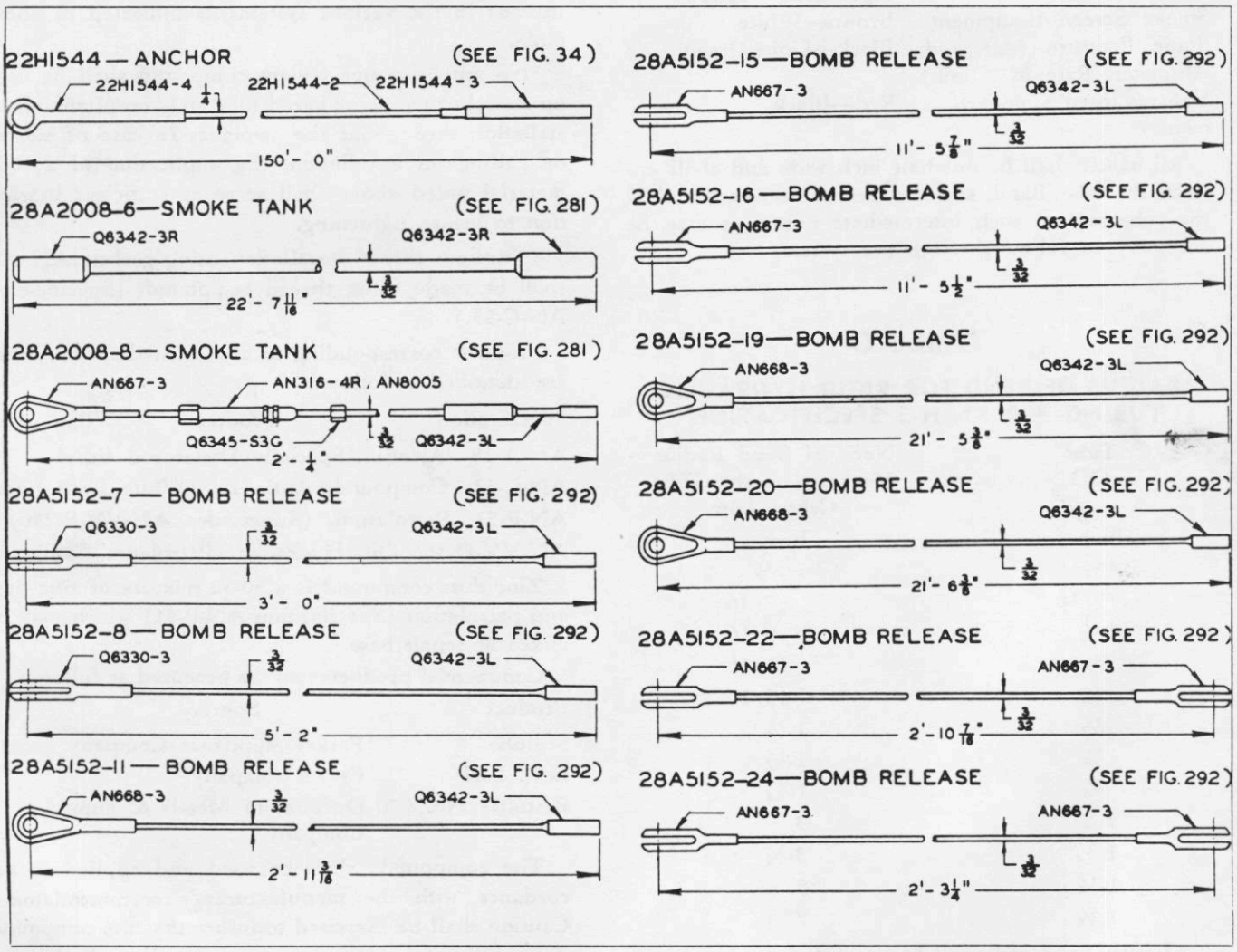


Figure 307 (Sheet 1 of 14 sheets)—Flexible Cable Chart

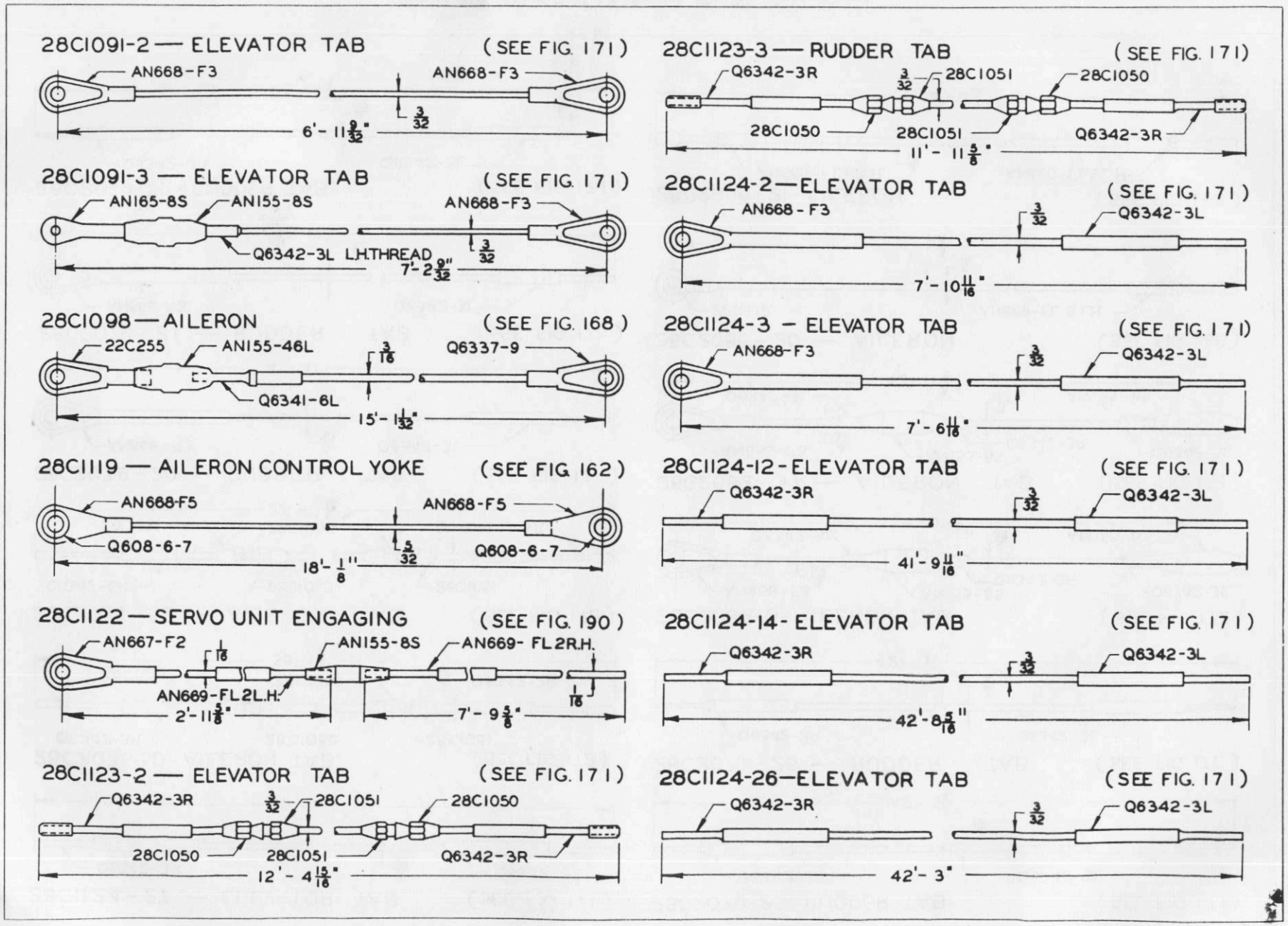


Figure 307 (Sheet 2 of 14 sheets)—Flexible Cable Chart

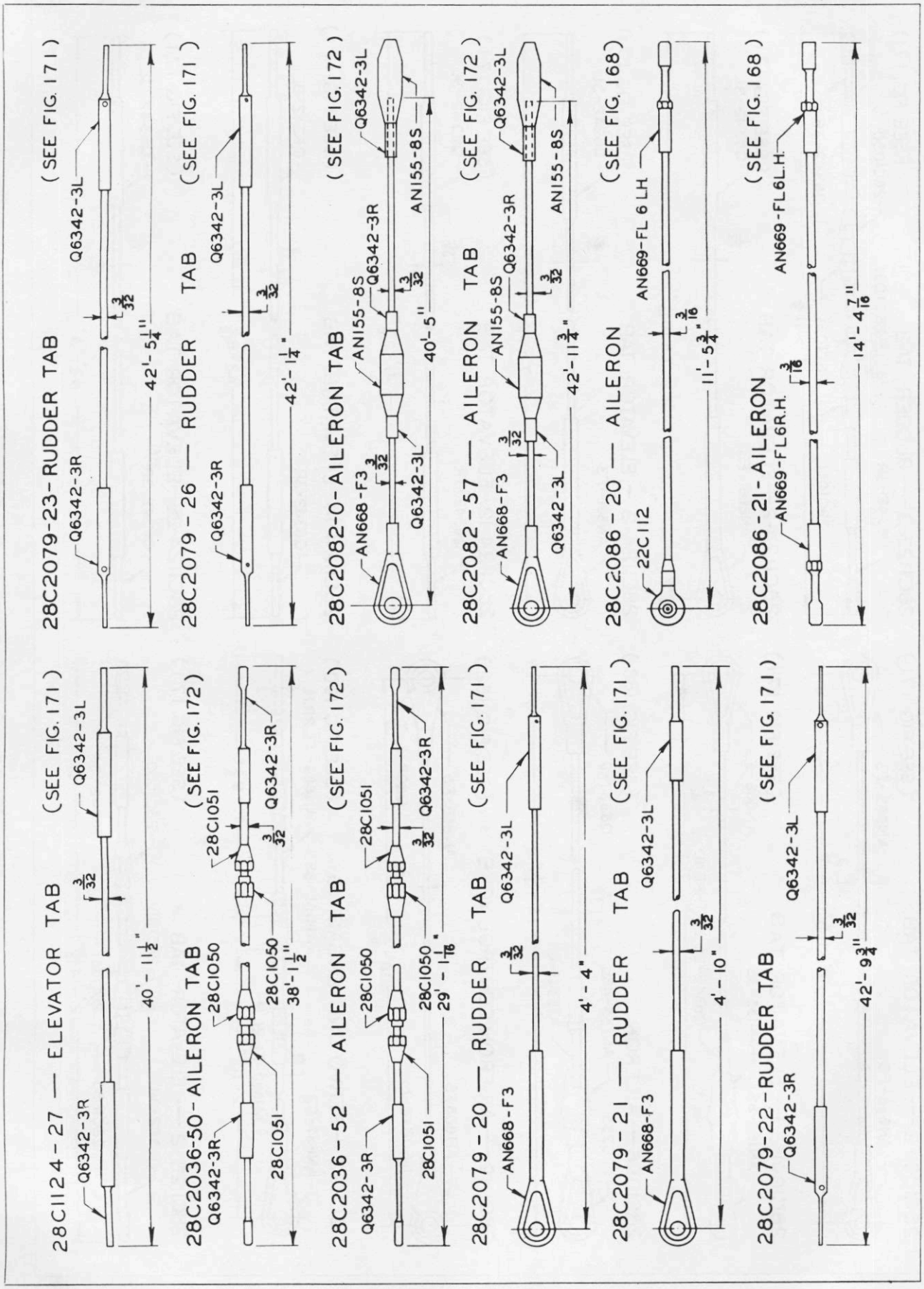


Figure 307 (Sheet 3 of 14 sheets)—Flexible Cable Chart

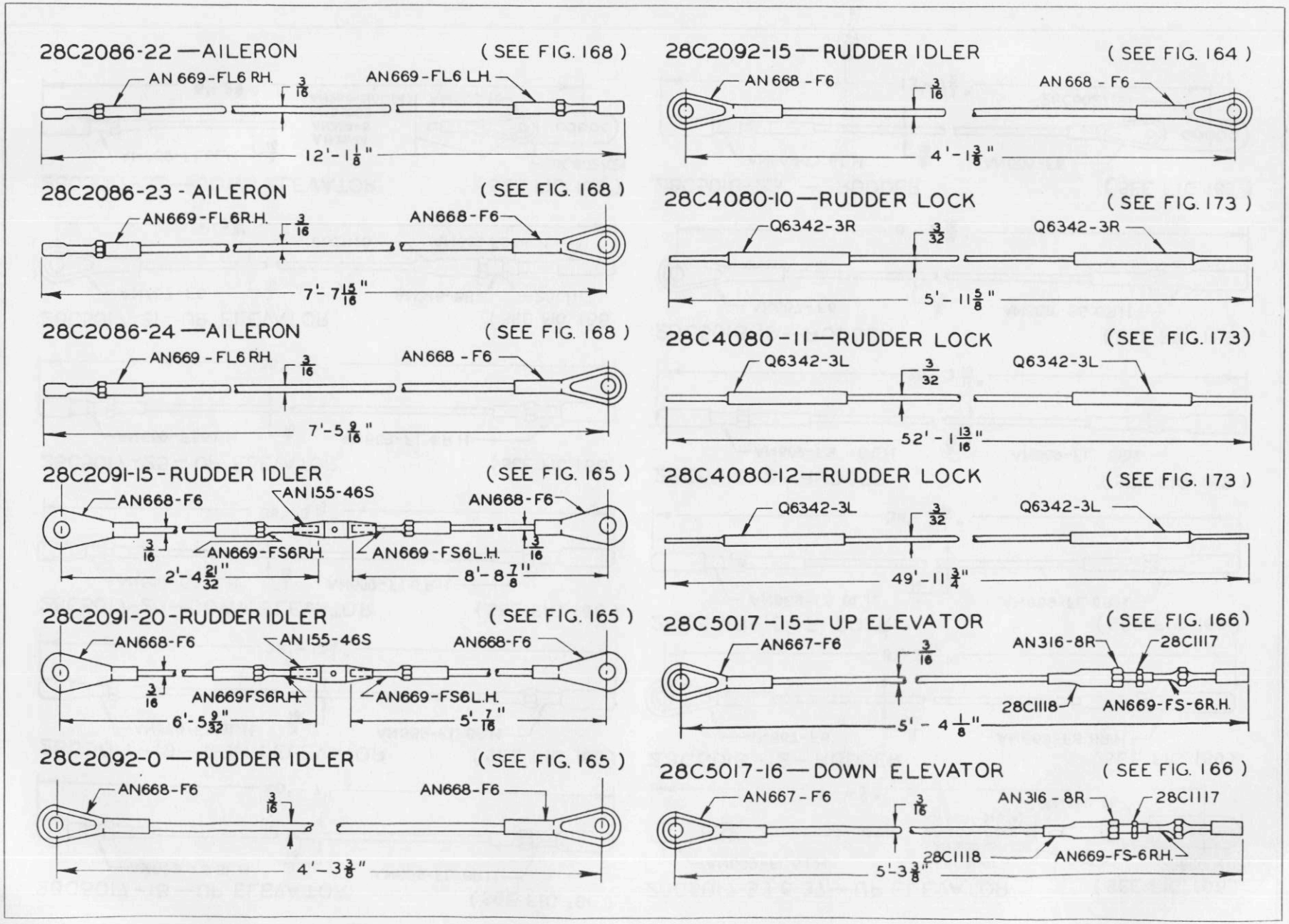


Figure 307 (Sheet 4 of 14 sheets)—Flexible Cable Chart

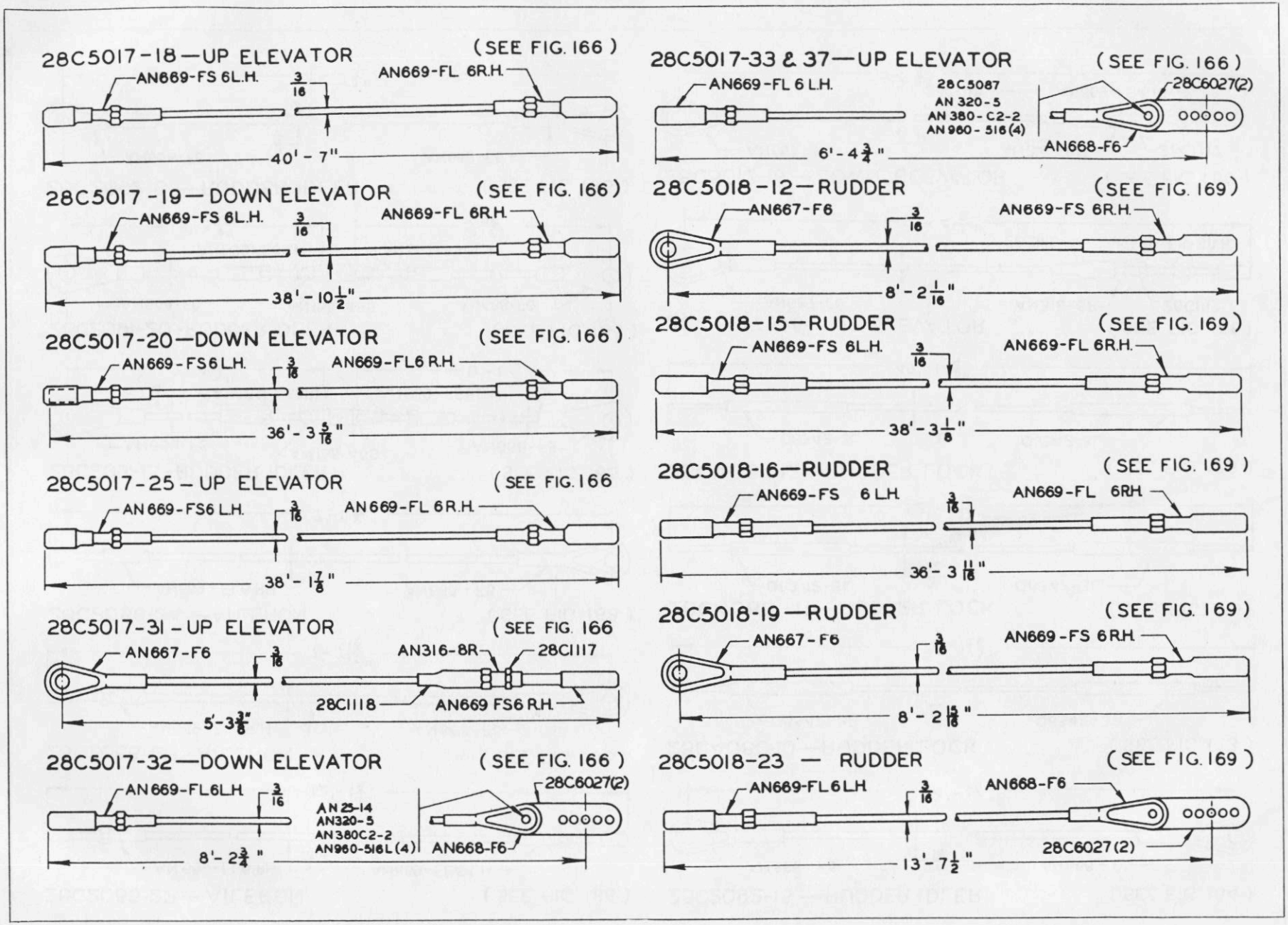


Figure 307 (Sheet 5 of 14 sheets)—Flexible Cable Chart

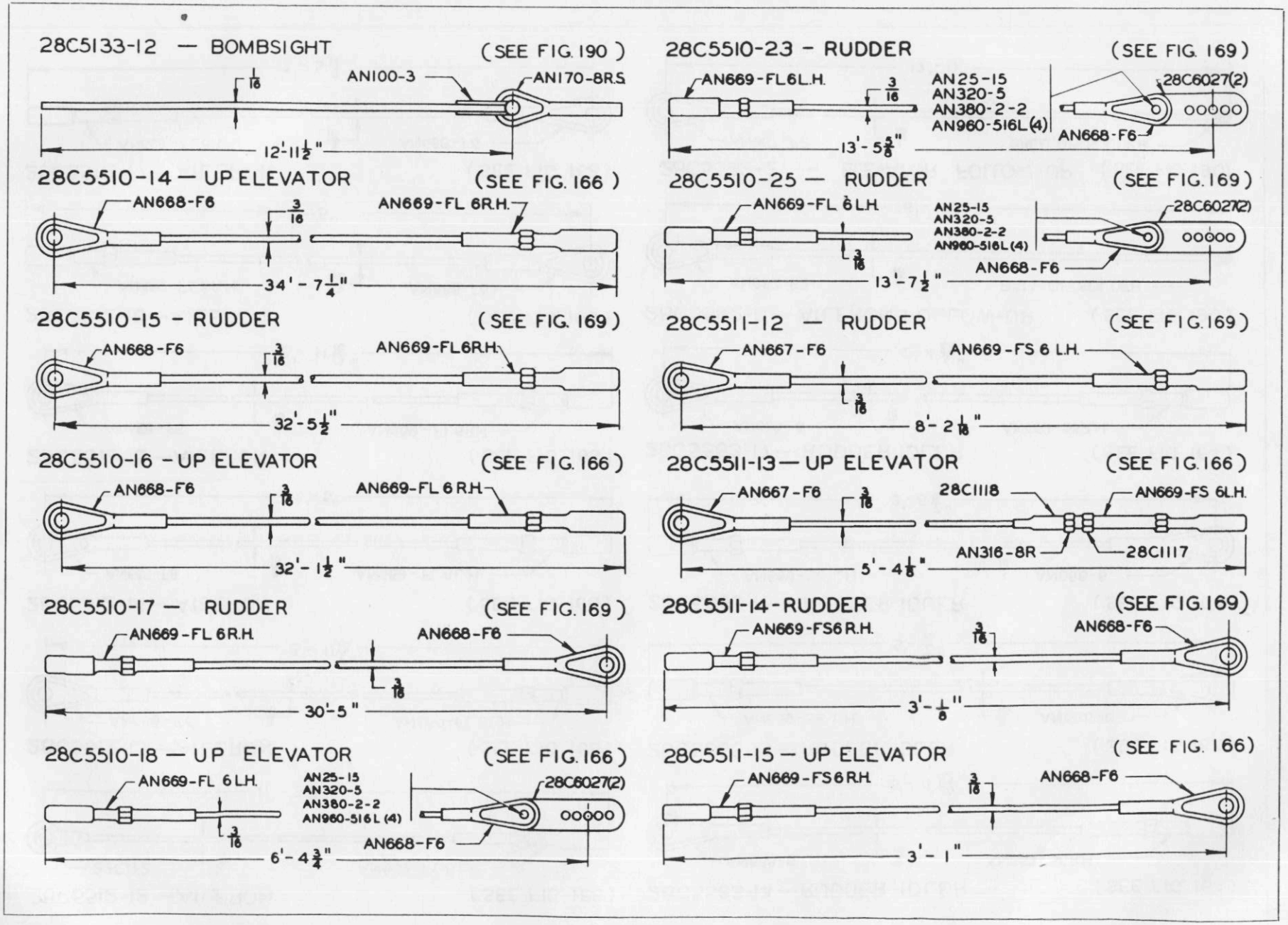


Figure 307 (Sheet 6 of 14 sheets)—Flexible Cable Chart

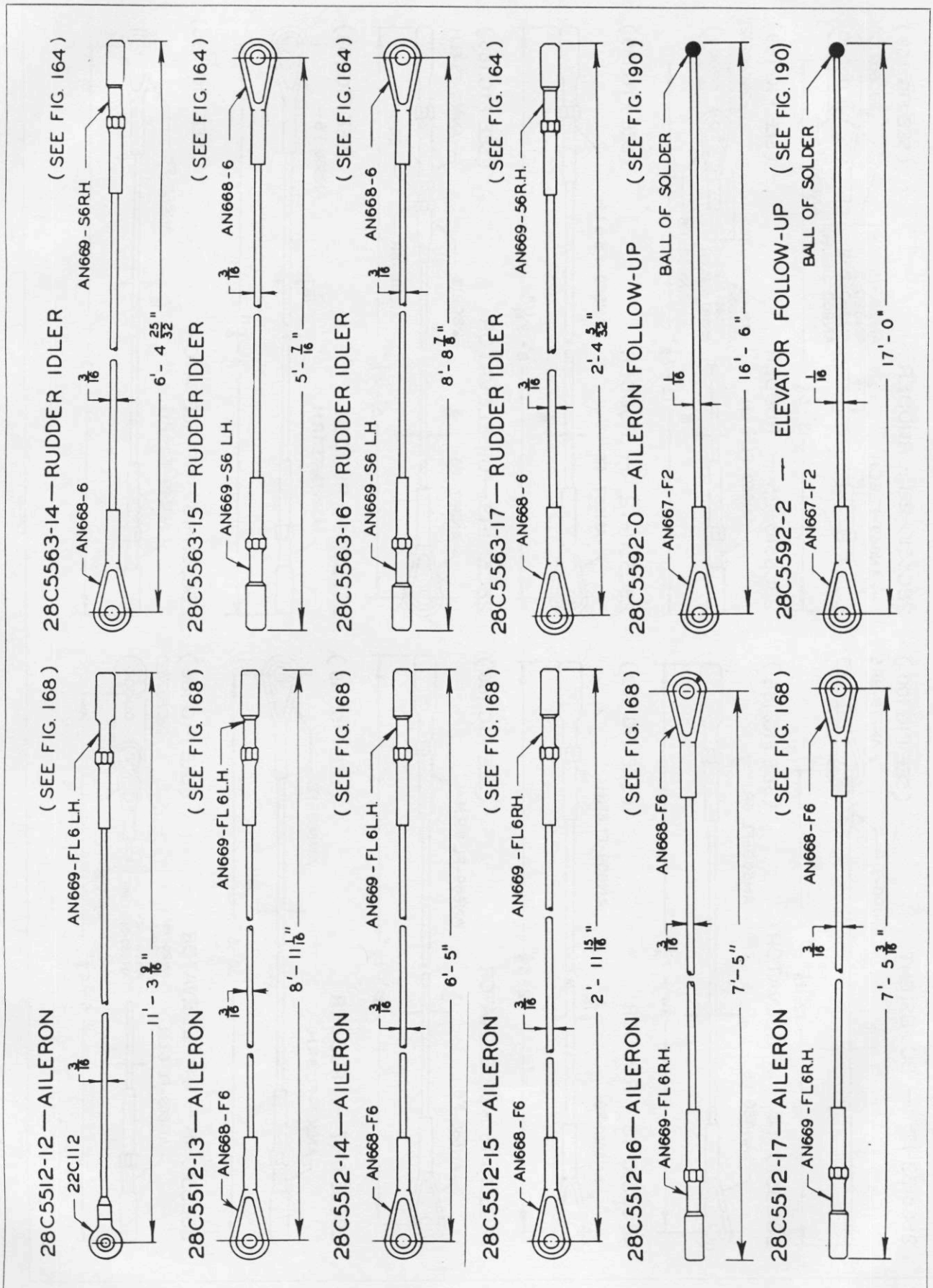


Figure 307 (Sheet 7 of 14 sheets)—Flexible Cable Chart

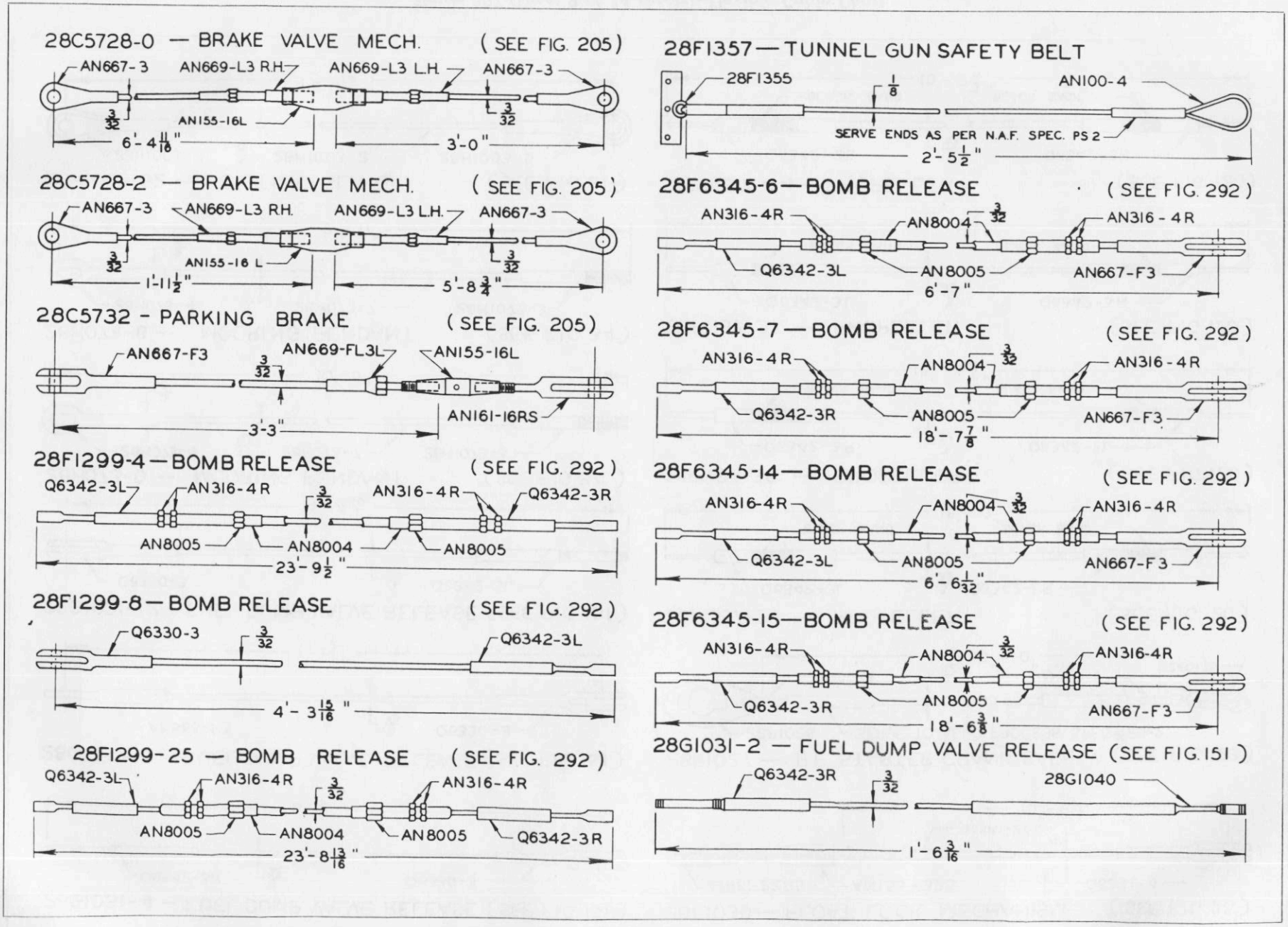


Figure 307 (Sheet 8 of 14 sheets)—Flexible Cable Chart

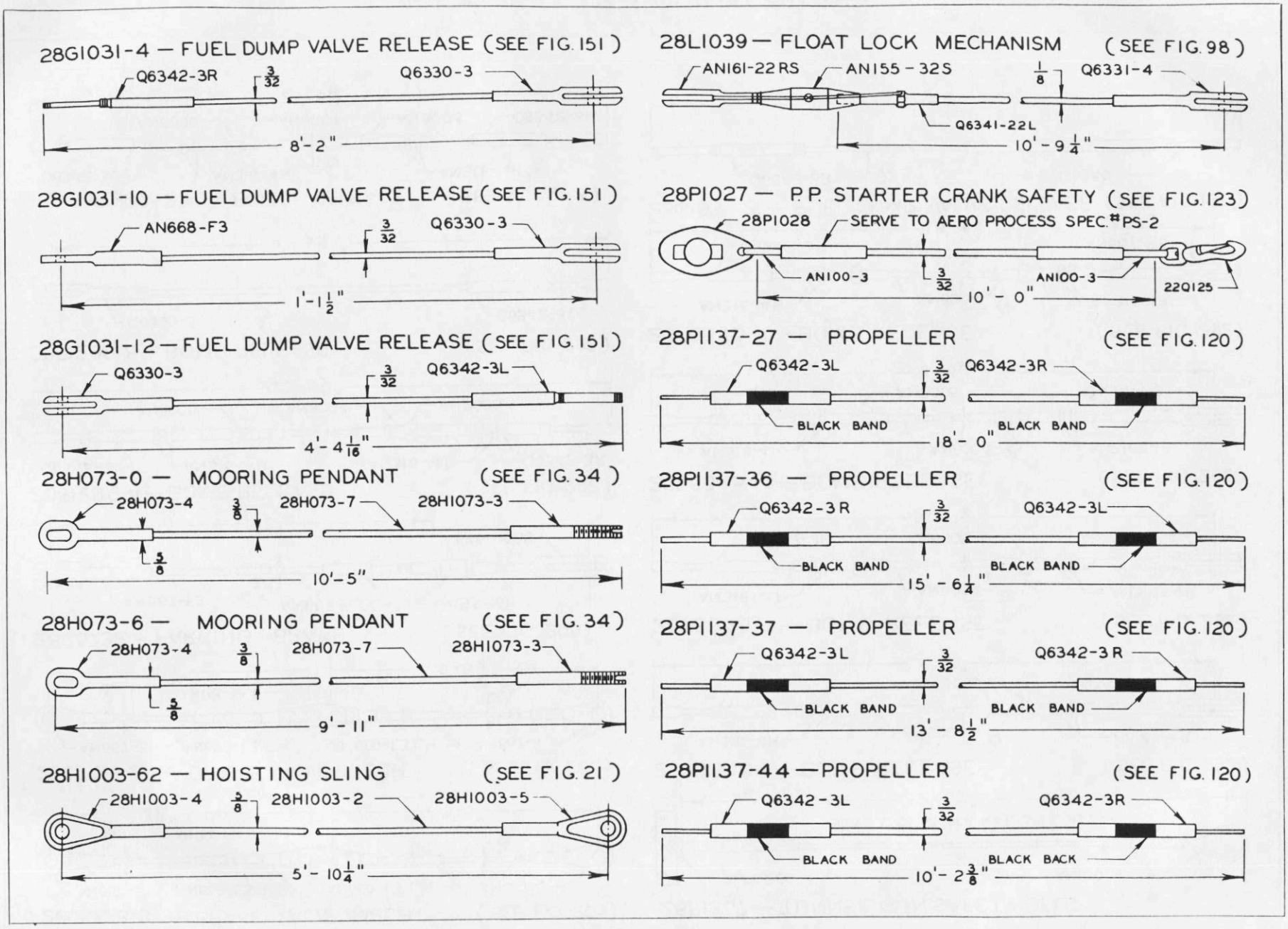


Figure 307 (Sheet 9 of 14 sheets)—Flexible Cable Chart

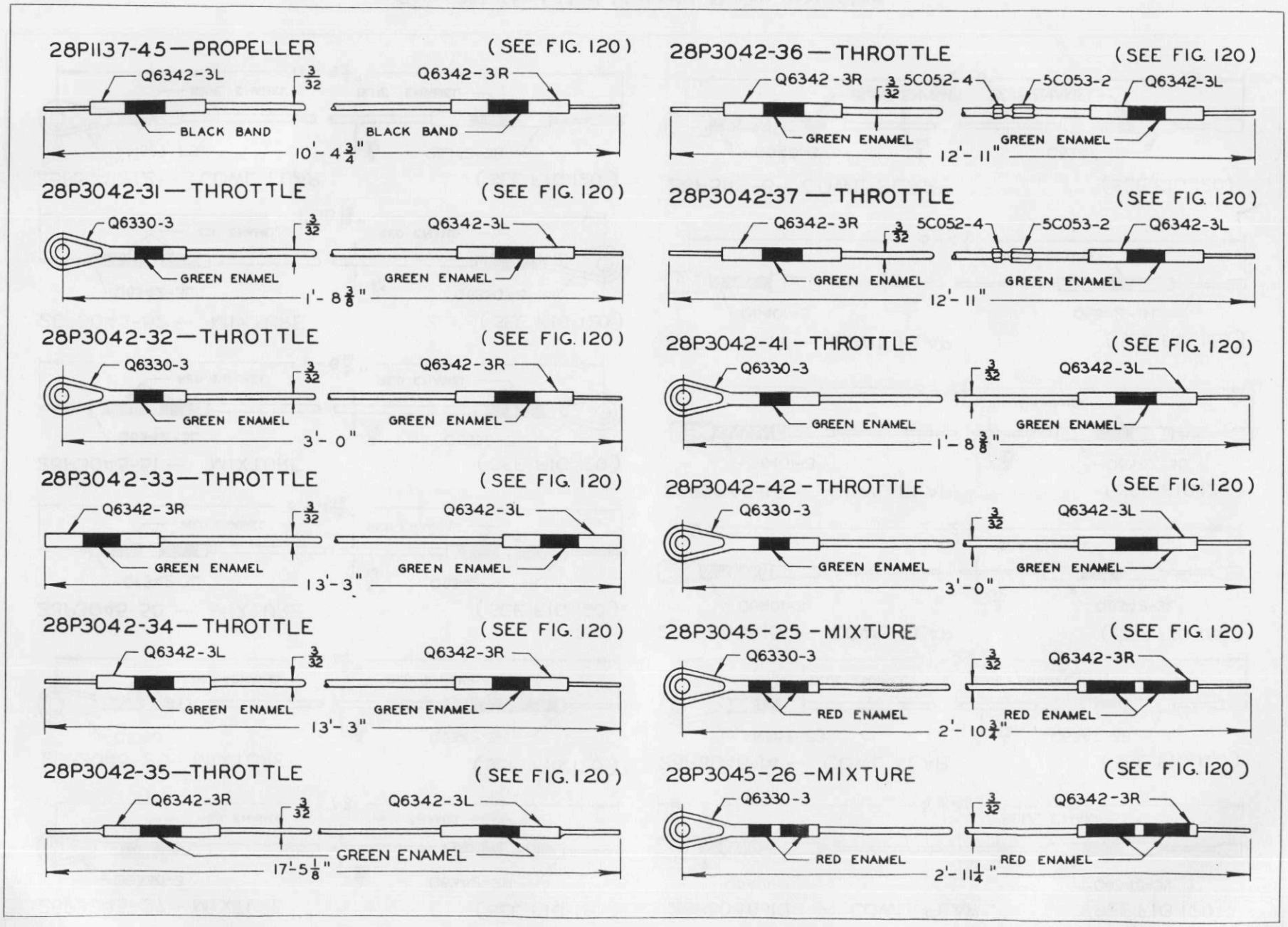


Figure 307 (Sheet 10 of 14 sheets)—Flexible Cable Chart

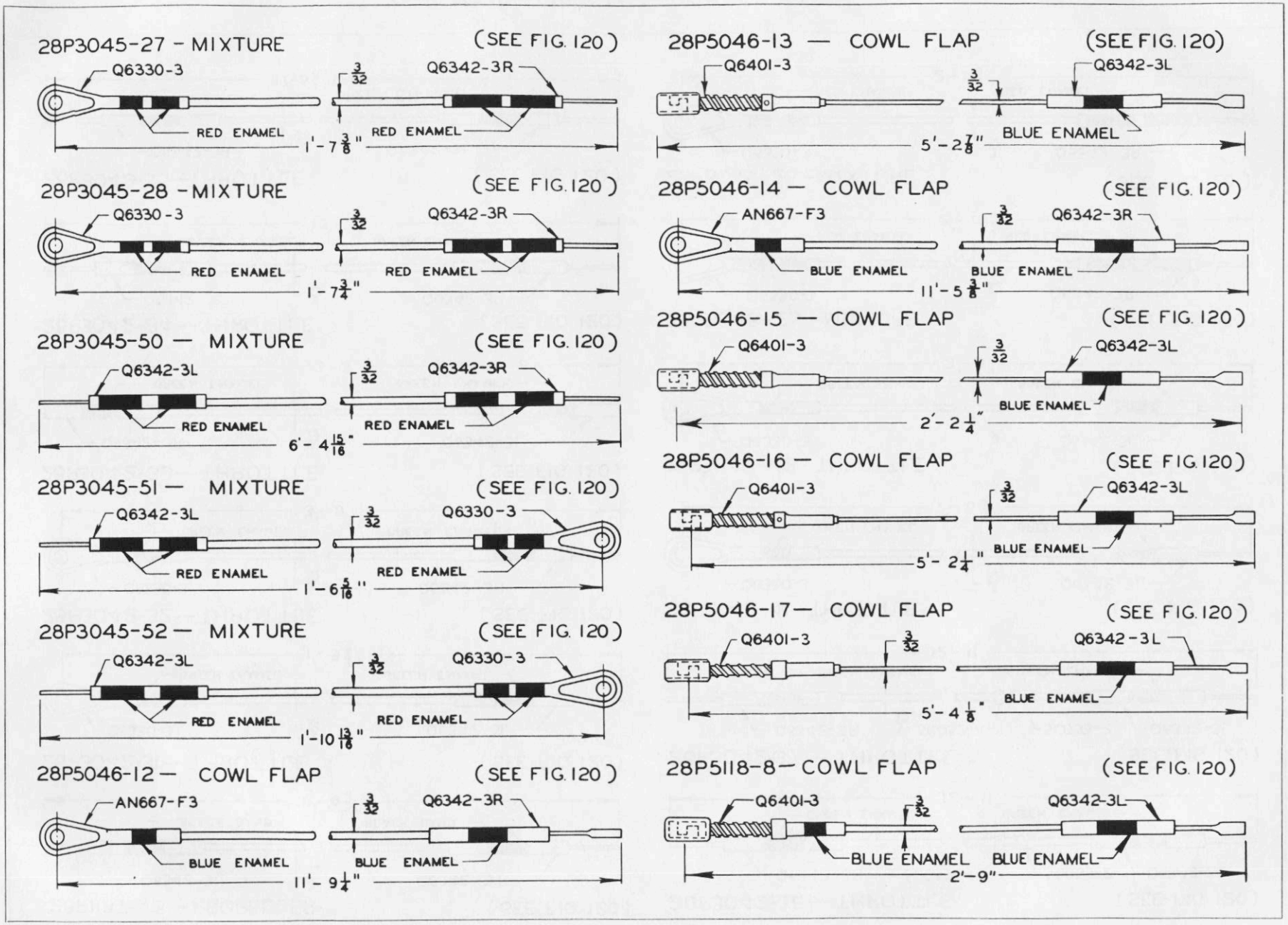


Figure 307 (Sheet 11 of 14 sheets)—Flexible Cable Chart

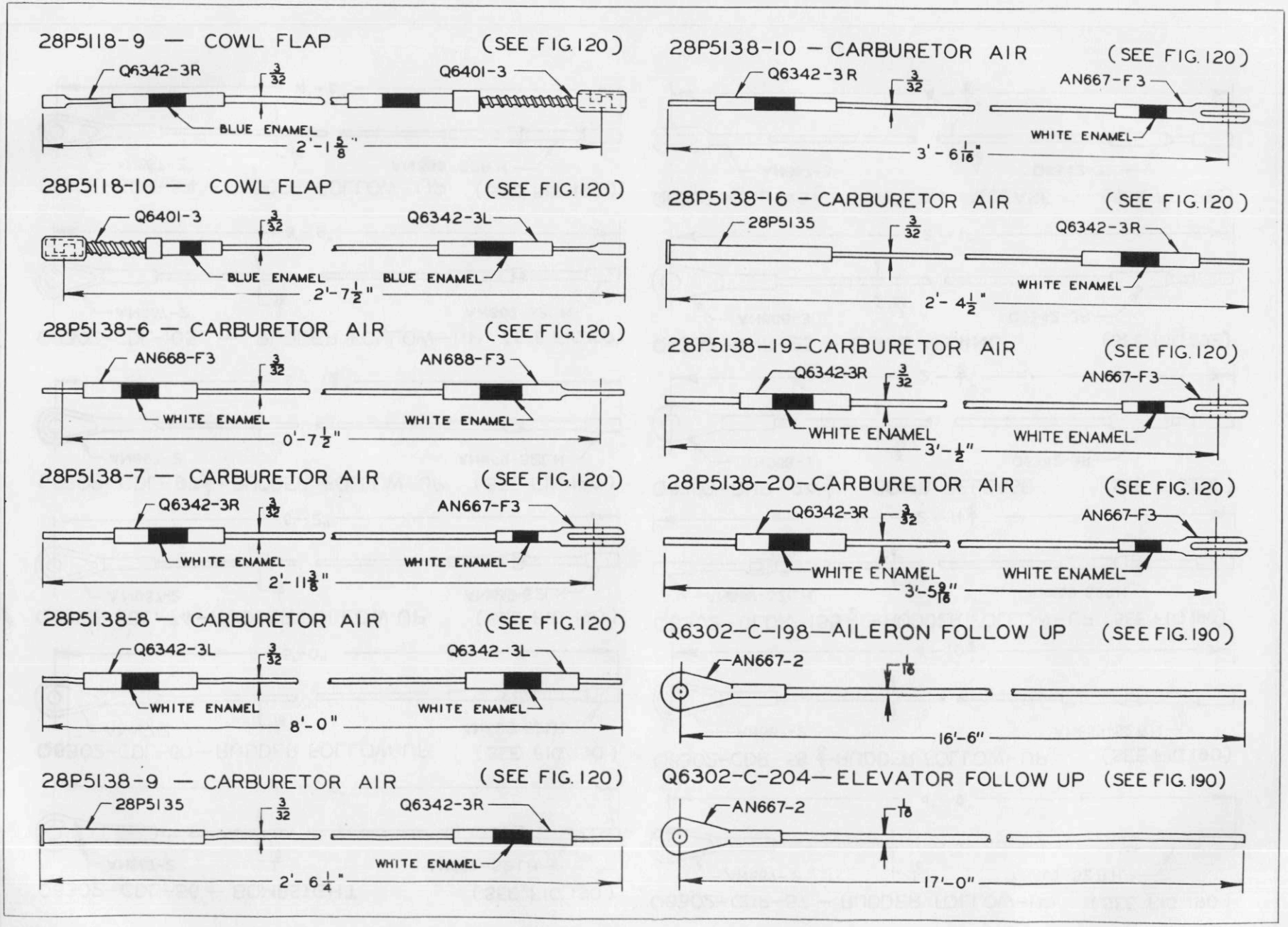


Figure 307 (Sheet 12 of 14 sheets)—Flexible Cable Chart

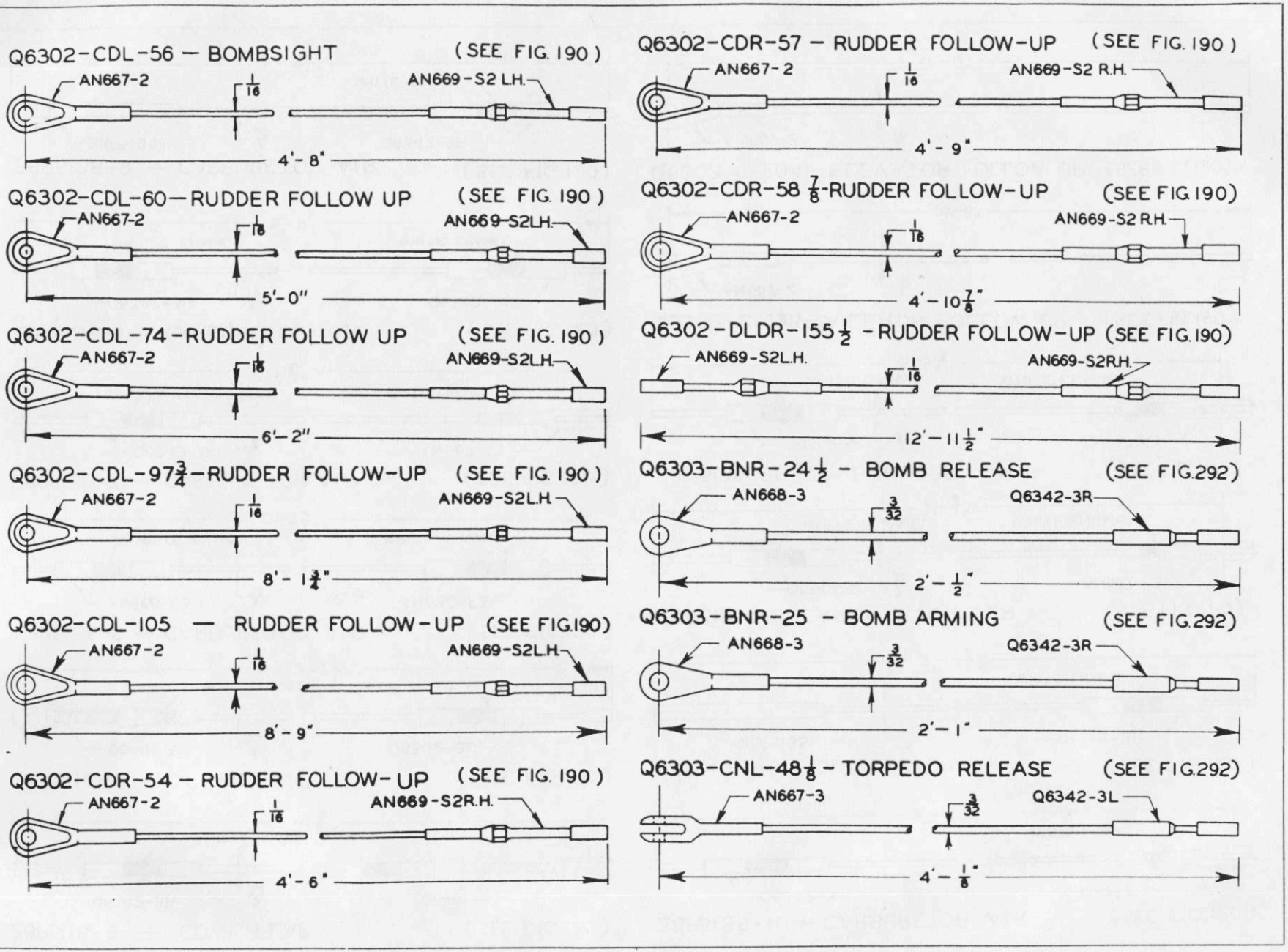


Figure 307 (Sheet 13 of 14 sheets)—Flexible Cable Chart

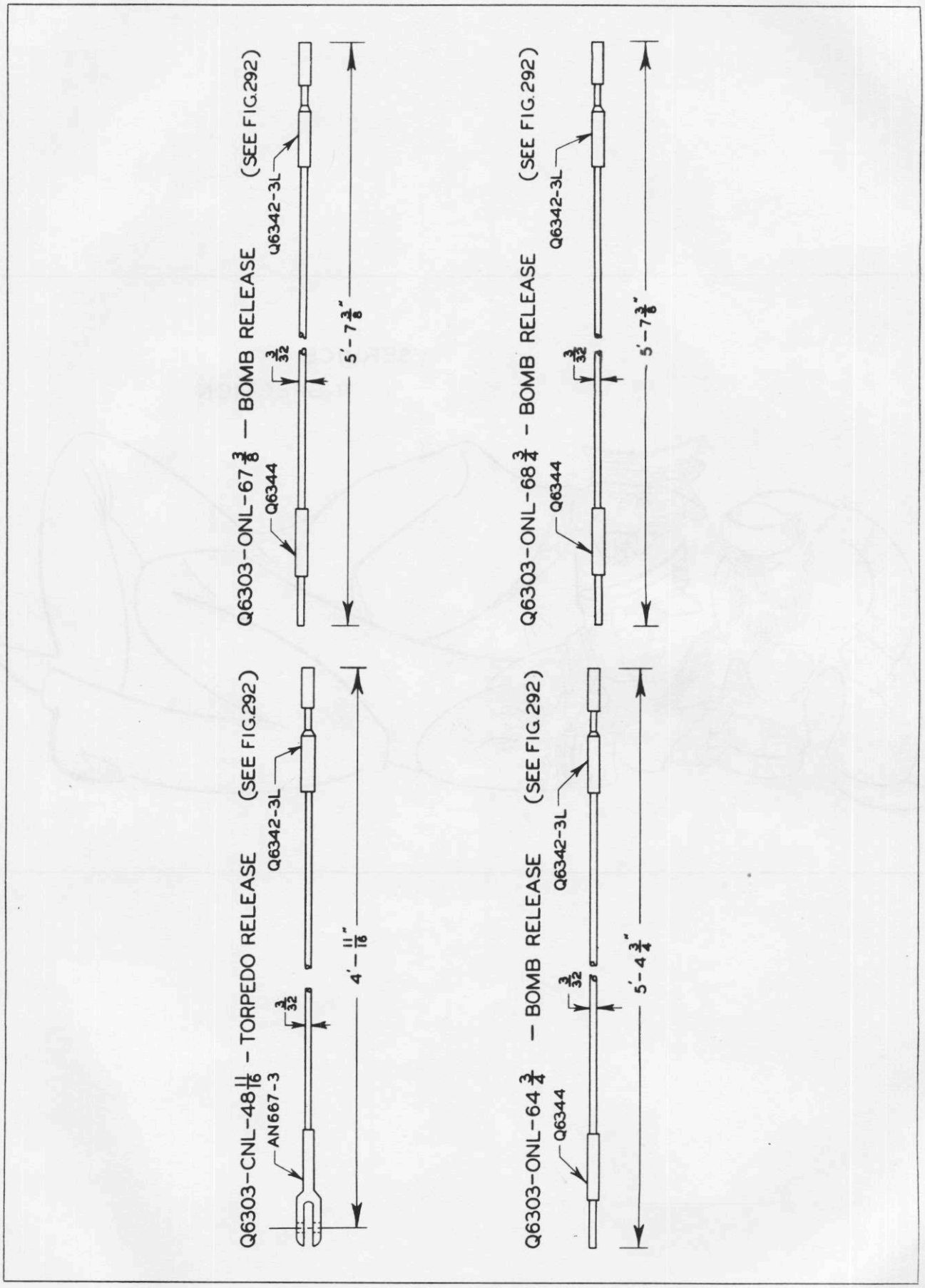
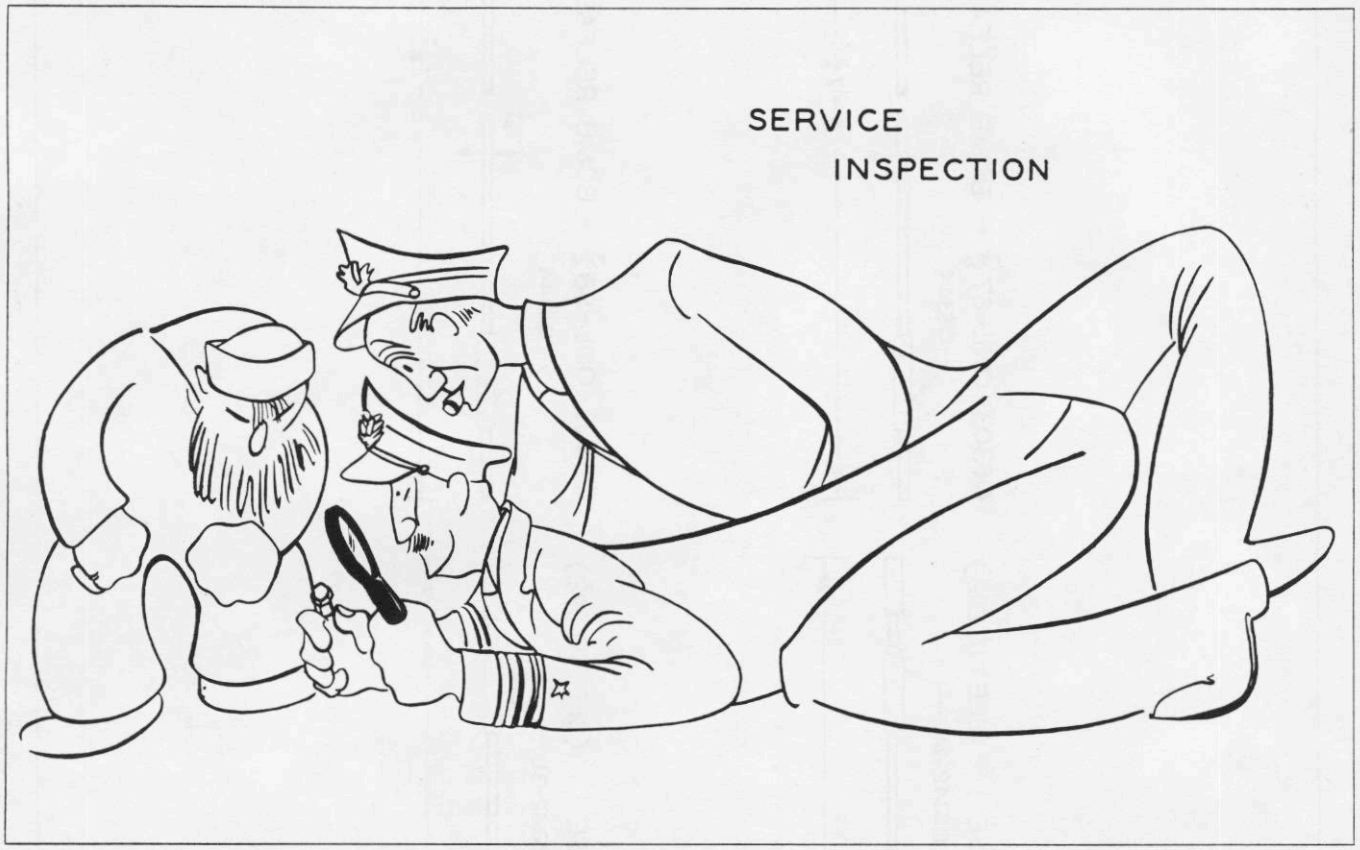


Figure 307 (Sheet 14 of 14 sheets)—Flexible Cable Chart



SECTION X
SERVICE INSPECTION

1. GENERAL.

This section does not specify all inspections and maintenance work necessary to maintain the airplane, but is intended to cover what to inspect and when to inspect. It does not cover the details of how to inspect, the tolerances permitted, or the adjustments to be made, as it was written on the assumption that persons making the inspections have received training in inspection and possess mechanical knowledge and experience.

Inspection of the airplane should be divided into inspections of groups of related items, each group being handled by an inspector who is familiar with the items in the group. Check lists should be prepared for these inspections so the fact that an inspection has or has not been made will be recorded, together with any defects discovered and any corrective action that has been taken.

A record should be made of work required which the inspector cannot perform. After this work is done, a notation should be made indicating who performed the work and who inspected the completed work.

As a check on the standard of maintenance, a system of "spot checks" should be made. Three or more parts of the airplane which the inspection record indicates are in good condition should be chosen at random and inspected by a competent and disinterested mechanic. If the condition of the parts is found to be in accordance with the conditions indicated on the inspection record, it may be assumed that the airplane is being properly maintained. If discrepancies are found, further investigation should be made.

Note

Where a 50 to 60 hour inspection is indicated in the following paragraphs, it is understood that this inspection includes the items listed under the 25 to 30 hour and preflight inspections for the same system. Similarly, a 100 to 120 hour inspection includes the items listed under both the 25 to 30 hour and the 50 to 60 hour inspections.

2. STRUCTURAL.

a. WING.

(1) PREFLIGHT.

(a) Inspect wing for damage, security of openings, and condition of covering.

(b) Inspect trailing edge of wing for damage such as looseness of fabric, buckled ribs, and defective attachment screws.

(c) Inspect ailerons, including hinges, for cleanliness and signs of excessive wear.

(d) Check all rubber plugs.

(e) Inspect struts for damage and security.

(2) 25-30 HOUR.

(a) Inspect exterior for corrosion, cracks, and deformation of structure.

(b) Check wing struts, fittings, and fairings for cracks and wear.

(c) Inspect all access doors for condition, evidence of corrosion, condition of hinges. Lubricate if necessary.

(d) Check interior of wing for corrosion, cracks, and deformation of members.

(e) Inspect internal bomb racks and U-bracket stringer splices for condition and security of attachment.

(f) Touch up bare rivets where necessary with zinc chromate primer.

(g) Inspect wing tip floats for corrosion, leaks, loose rivets, and security of attachment.

b. TAIL.

(1) PREFLIGHT.

(a) Inspect covering for damage, buckled ribs, and bruised edges. Check access doors and zippers.

(b) Check control surface hinges, pins, and tabs for cleanliness, condition, security of attachment, proper lubrication, and position.

(2) 25-30 HOUR.

(a) Inspect rudder and stabilizer attachments, fittings, and fairings.

(b) Inspect for corrosion and cracks.

(c) Touch up any bare rivets with zinc chromate primer.

(d) Check operation of pull-out steps.

c. HULL.

(1) PREFLIGHT.

(a) Inspect hull for leaks, presence of water, and security of hand hole covers, anchor pocket, hatches, and ventilators.

(b) Check windows for cleanliness.

(c) Check bow turret and side gun blisters for operations and water seals.

(d) Inspect bombardier's window and inside cover.

(e) Inspect bombardier's window outside cover. (Not installed on PBY-5A airplanes serial No. 46596 and on). Check operation.

(f) Inspect hydraulic lines of rudder control unit.

(g) Inspect follow-up cable of rudder control unit.

(h) Check emergency doors in wheel wells for security. (PBY-5A airplanes only.)

(i) Check pilot's director indicator for positive operation and correct direction.

(j) Check bombsight cover.

(k) Blow out or clean out all drain tubes, anchor box, each side of pilot's enclosure, window wells, snubbing post well, and side gun mount rings.

(l) Inspect all compartments for loose articles.

(2) 25-30 HOUR.

(a) Check bombardier's compartment for corrosion, deformation of members, and loose rivets.

(b) Check operation of nose turret and water seal; lubricate if necessary.

(c) Check pilot's compartment for corrosion, deformation of members, and loose rivets.

(d) Check operation of pilot's seats and lubricate if necessary.

(e) Check all windows for cracks and water tightness.

(f) Inspect rubber shock mountings on pilot's instrument panel.

(g) Check radio and navigator's compartment for corrosion, deformation of members, and loose rivets.

(h) Check windows and ventilators.

(i) Check seats in radio compartment. Lubricate if necessary.

(j) Check engineer's compartment for corrosion, deformation of members, and loose rivets.

(k) Check engineer's seat.

(l) Check mounting for engineer's instrument panel.

(m) Check living compartment for corrosion, deformation of members, and loose rivets.

(n) Check bunks in living compartment for condition and security of attachment.

(o) Check waist compartment for corrosion, deformation of members, and loose rivets.

(p) Check windows and operation of blisters. Replace glass if necessary. Lubricate if necessary.

(q) Check operation of water seal.

(r) Check entire compartment (aft of bulkhead 7) for corrosion, deformation of members, and loose rivets.

(s) Check operation of tunnel gun door and lock. Lubricate if necessary.

d. SURFACE CONTROLS.

(1) AUTOMATIC PILOT SYSTEM.

(a) PREFLIGHT.

1. Check vacuum pressure on engine run-ups —it should be approximately four inches of mercury at instruments.

2. Check oil pressure—it should be 150 ± 10 lb/sq in.

3. Uncage bank and climb gyro unit.

4. Set and uncage directional gyro unit.

5. Engage automatic pilot and check operation by rotating each control knob.

6. Check for air in servo units.

7. Disengage automatic pilot.

(b) 50-60 HOUR.

1. Inspect all tubing and fittings, including flexible hose.

2. Inspect all cables, cable connections, and pulleys for freedom of movement, positive motion, and freedom from fraying and wear.

3. Check follow up pulleys on mounting unit.

4. Check springs. Oil if dry.

5. Inspect filter element in air filter. Clean or replace if necessary.

6. Clean air intake screen in vacuum relief valve.

7. Drain oil from sump tank.

8. Clean filter element in oil filter.

9. Refill sump to ¾ full with hydraulic fluid. (Specification AN-VV-O-366.)

10. Check servo pistons for leaks.

(c) 400 HOUR OR ENGINE OVERHAUL.

1. Remove gyro control units and have bench check made in instrument shop. Overhaul if necessary. Replace rubber grommets if necessary.

2. Inspect shock absorbing bushings on gyro control mounting. Replace if necessary.

3. Remove hydraulic and vacuum pumps. Wash in gasoline. Inspect driving end for wear. Check for freedom of rotation. Do not disassemble, unless necessary. If facilities are available, have pressure checked for performance.

(d) 800 HOUR OR AT EVERY SECOND ENGINE OVERHAUL.—These operations should be performed only by persons trained in maintenance and overhaul of automatic pilot equipment, and who have the special tools and fixtures required.

1. Remove and overhaul the following units:

a. Directional gyro control unit.

b. Bank and climb gyro unit.

c. Proportional bank adapter.

d. Balanced oil valves.

e. Oil sump.

f. Pressure regulator.

g. Oil filter.

h. Hydraulic pump.

i. Vacuum pump.

j. Bombsight rudder control unit.

2. The following units should be removed and tested, but not disassembled for overhaul, unless their performance is unsatisfactory. The construction of these units is such that there is little chance for internal wear.

a. Air relays.

b. Speed control valves.

c. Vacuum relief valve.

d. Servo unit.

(2) CONTROLS.

(a) PREFLIGHT.

1. Check operation of all surface controls and adjustable tabs, operating them to both limits.

2. Check operation of control locks.

(b) 25-30 HOUR.

1. Check trim tab controls and surface controls (ailerons, elevator and rudder) for full throw and freedom of movement.

2. Inspect all pulleys and inspect full length of cable for proper bonding. Inspect for fraying, wear, corrosion, conditions of paralketone coating, and safety wire. Check aileron, elevator and rudder controls and trim tab controls.

3. Inspect and clean all fair-leads.

4. Inspect all bell cranks, hinges, and torque tubes for cracks, wear, and bonding.

5. Inspect all cockpit trim tab fittings and bearings.

6. Inspect control column assembly for freedom of movement, lost motions, security of attachment, and proper lubrication.

7. Inspect rudder pedal assembly and control system as above.

8. Lubricate all bearings and fittings with proper lubricant.

9. Check to determine that cables are rigged evenly, so as to result in proper flight attitude of airplane. Check all cable tensions.

e. HYDRAULIC SYSTEM.

(1) PREFLIGHT.

(a) Check level of fluid in reservoir. Add fluid if necessary.

(b) Check pressure of air charge in accumulators. Recharge if necessary (PBY-5A only).

(c) Check system for leaks.

(d) Check Cuno filter and turn filter handle one complete turn (PBY-5A only).

(e) Check hand pump for proper operation (PBY-5A only).

(f) Inspect brake valve control system (PBY-5A only).

(g) Check hydraulic system operation during engine run-up. Check system pressure. Check operation of unloading valve.

(2) 25-30 HOUR.

(a) Inspect entire system for leaks, sharp bends, cracks and security of mounting.

(b) Drain and clean filters.

(c) Check all fittings for cracks and wear.

(d) Check all hose connections and replace if deteriorated.

(e) Inspect all actuating cylinders, for operation, leakage, security of attachment, and freedom from corrosion (PBY-5A only).

(f) Inspect all lock jacks as above (PBY-5A only).

(g) Inspect all sequence valves for condition, leakage, and proper operation (PBY-5A only).

(h) Inspect brake valves and brake control system for condition, security of attachment, leakage and proper operation (PBY-5A only).

(3) 50-60 HOUR.—Drain condensate from accumulators (PBY-5A only).

3. POWER PLANT.

a. NACELLE AND COWLING.

(1) PREFLIGHT.

(a) Check cowling for condition and security of attachment.

(b) See that exhaust drains are not obstructed.

(c) Check cowl flaps for operation.

(2) 25-30 HOUR.—Check cowl flaps for proper action. Check for loose or broken support bolts. Lubricate hinges and moving parts if necessary. Check freedom of movement of toggle bolts.

b. PROPELLERS.

(1) PREFLIGHT.

(a) Inspect propeller blades for damage. Inspect for proper oil film.

(b) Inspect hubs and attaching parts for defects, tightness, and proper safetying.

(c) Check hub for oil leaks.

(d) Check governor for external leaks.

(e) During engine run-up, exercise propellers through limits. Feather propellers.

(2) 25-30 HOUR.

(a) Dress down propeller blades and check for cracks. Wipe down blades, hub, and dome with oil.

(b) Check propeller governor and cable.

(c) Check for adequate lubrication.

(d) Check blade setting field marks.

(e) Track propeller.

(3) 200-240 HOUR.—Check dome retaining nut for tightness.

c. OIL SYSTEM.

(1) PREFLIGHT.

(a) Check to determine that oil tanks are filled to proper level.

(b) Check liquidometer reading against oil level to within plus or minus two gallons.

(c) Check oil system for leaks.

(d) Check oil lines and fittings for security of attachment.

(e) Check tank caps for security.

(f) Inspect vents to see that they are open.

(2) 25-30 HOUR.

(a) Check for oil leaks at push-rod covers, oil pipe flanges, rocker box covers, and at sump.

(b) Check intake pipes for oil leaks.

(c) Inspect oil tanks for leaks and for security of cap and mounting bolts.

(d) Check all hose clamps for tightness.

(e) Check all tubing for cracks and abrasions.

(f) Check all hose connections for condition. Replace if necessary.

(g) Check oil separators for leaks.

(h) Check oil temperature regulator for leaks, security of attachment and condition of gaskets.

(i) Make sure that the main oil tank drain is safetied.

(3) 50-60 HOUR.

(a) Clean main oil screen. Clean accessory section oil scavenge screen.

(b) Drain the main oil sump and examine sump plug cavity for metal particles.

(c) Drain rocker sump and examine for metal particles.

(d) Drain oil cooler.

(4) 200-240 HOUR.—Drain oil and refill tank. The necessity for oil change depends upon the type of engine operations. The frequency of oil changes should be in accordance with service instructions of the operating agency but in no instance shall the interval between oil changes exceed 200-240 hours outside continental United States. Within continental United States, the oil need not be changed until time of engine overhaul.

d. FUEL SYSTEM.

(1) PREFLIGHT.

(a) Check to determine that all fuel tanks are filled to the proper level and that filler caps are properly closed and secured.

(b) Check to determine that all vents are open.

(c) Check for any evidence of gasoline leakage.

(d) Remove and clean A.E.L. strainers. Inspect for water and foreign matter.

(e) Check purging system—CO_2 bottle installed and charged—tubing connected—cable connected—and security of attachment.

(f) Check wobble pump operation and pressure, pressure relief valve set at 15 lb/sq in., pressure maintained by smooth, even strokes, 60 per minute.

(g) Check primer pump for full suction and pressure strokes (left and right), leaks, security.

(h) Check front and rear fuel sight gages for leaks, security, and correct reading.

(i) Drain small quantity of fuel from sight gage drain and inspect for water and foreign matter.

(j) Check to determine that all drain valves are safetied.

(k) Check fuel system valves, selector valves, cross feed valve, and shut-off valves during engine run-up.

(l) Check operation of flowmeters during engine run-up.

(2) 25-30 HOUR.

(a) Check all hose clamps to see that they are tight.

(b) Check all tubing for cracks and abrasions.

(c) Check all self-sealing fuel lines (especially cross-feed line at point of attachment to fuel pump) for ruptures, cuts, abrasions, and sharp bends.

(d) Check condition of all hose connections and replace if necessary.

(e) Build up fuel pressure with hand pump and check entire fuel system for leaks.

(f) Check vent hole of pressure relief valve on fuel pump to see that it is clear.

(3) 120-125 HOUR.

(a) Check control valves for tightness and for proper functioning. Operate and check selector valves and cross-feed valve.

(b) Clean hand pump fuel strainer.

(c) Check tank vents and fuel pump vents.

(d) Check fuel gages.

(e) Drain small amount of fuel through sump.

(f) Inspect dump valve gland for leaks.

(g) Check fuel lines for security of mounting clamps and bonding.

(h) Check purging system.

e. SELF SEALING FUEL CELLS.

(1) PREFLIGHT.—Inspect through access doors and drain openings for leakage of fuel cell and fittings.

(2) WEEKLY.—Check fuel strainers. Any accumulation of rubber particles is likely to be evidence of advance deterioration and a close inspection of the cell, inside and out, should follow immediately.

(3) MONTHLY.—Check capacity. If there is a decrease of more than 5 per cent of the capacity shown on the filler cap, the interior of the cell shall be immediately given a close inspection.

(4) TWO MONTHLY INTERVALS.—Inspect the interior of the cell with a mirror and safety light.

(5) 18 MONTHS.—Remove cells from the airplane after 18 months in service and install new cells. When removal of the cells is necessitated by major overhaul or other reason, the cells shall be inspected and reinstalled, provided that they have been in service less than 12 months; if longer, they shall be replaced.

f. ENGINE CONTROLS.

(1) PREFLIGHT.—Check operation of all engine controls during engine run-up.

(2) 25-30 HOUR.

(a) Check entire length of engine control cables for fraying, wear, corrosion and paralketone. (Throttle, propeller, mixture, cowl flaps, and carburetor preheated air.) See that turnbuckles are safetied.

(b) Check cable tensions.

(c) Check all pulleys.

(d) Lubricate all fittings with the proper lubricant.

g. ENGINE ACCESSORIES.—Inspection of generators is included under Par. 4. (ELECTRICAL.)

(1) PREFLIGHT.

(a) Inspect all following engine accessories for security of mounting; leakage where applicable; visual evidence of damage:

1. Starter.
2. Vacuum pump.
3. Fuel pump.
4. Tachometer generator.
5. Magneto.
6. Propeller governor.
7. Hydraulic pump.

(b) Check operation during engine run-up.

(2) 25-30 HOUR.—Check all braces in accessory section.

h. STARTING SYSTEM.

(1) PREFLIGHT.

(a) Check to determine that starter crank is stowed in the galley compartment.

(b) Check starter for security of mounting. Check starter housing for cracks.

(c) Check priming system for broken lines or leaks.

(d) Check operation of starters in connection with engine run-up.

(2) 50-60 HOUR.

(a) Lubricate starter hand crank extension.

(b) Check starter motor brushes and commutator.

i. IGNITION SYSTEM.

(1) PREFLIGHT.

(a) Inspect magnetos for security of mounting, blast tubes, electrical connections for tightness.

(b) Inspect spark plugs and elbows for evidence of burning.

(c) Inspect accessible ignition wiring and harness for security of mounting.

(d) Inspect spark plug terminal assemblies for cleanliness and tightness.

(e) Check operation of ignition system in connection with engine run-up.

(2) 25-30 HOUR.

(a) Inspect ignition harness for chafing and security of attachment.

(b) Check spark plug elbows for tightness.

(3) 60 HOUR.—Remove old spark plugs and install new plugs, using the approved spark plug thread lubricant.

j. AIR INDUCTION.

(1) PREFLIGHT.—Check for cracks, damage to air scoop and carburetor elbow. Check operation of alternate air valve in carburetor elbow.

(2) 25-30 HOUR.—Check for evidence of corrosion.

k. ENGINES.

(1) PREFLIGHT.—Follow instructions outlined in ENGINE SERVICE INSTRUCTIONS (AN-02-10CC-2).

(2) PERIODIC.—Follow instructions outlined in ENGINE SERVICE INSTRUCTIONS (AN-02-10CC-2). The time between periodic inspections is largely determined by the type and conditions of operations to which the engine is subjected, and should be in accordance with the regular intervals established by the operating agency. In any event it should not exceed 75 hours.

4. ELECTRICAL AND COMMUNICATIONS.

a. ELECTRICAL.

(1) GENERAL INSTRUCTIONS.

(a) CONDUIT.—Check for breaks in shielding and ferrules, for "boggling" where conduit crosses sharp edges or is rubbing, tightness of clamps, sharpness of turns, and routing. Prompt replacement should be made of engine conduit and radio conduit showing signs of deterioration.

(b) WIRES.—Check for breaks in insulation, evidence of corrosion, identification numbers, soldering of connections, and tightness where clamped to terminals and lugs.

(c) JUNCTION BOXES.—Check for condition of insulation and evidence of corrosion. Check fit

of cover, identification of cover, and condition of anchor lugs and screws. Check tightness of knurl nuts and locking wires on conduits entering boxes. Check security of mounting.

(d) MOTORS AND GENERATORS.—Check operation, security of mounting, evidence of corrosion, security of hold down bolts, and safety wiring to secure nuts where required. Check security of braces. Check for leakage at base. Check tightness of body flanges, and that Cannon plugs are properly assembled and tight.

(e) RELAYS.—Check for security of installation, breaks of insulation, tightness of lugs, soldered connections. Check contacts for clearance, evidence of corrosion, burring or pitting. Check free movement and absence of sticking.

(f) MICRO SWITCHES. — Check for free movement of plunger. Micro switches are sealed and are not to be opened.

(g) RECEPTACLES. — Check for installation and operation, and for polarity. The "A" terminal should always be positive. Test with a test light between "A" terminal and ground.

(h) LIGHTS.—Check for operation with proper switch; that lens is not broken, proper size bulb, and for proper size of fuse in circuit. Check for operation of circuit breaker in recognition light circuit.

(i) AIR TEMPERATURE INDICATORS.—Check bulbs for security of mounting through skin of airplane. Check plug at instrument and bulbs for security. Check instrument readings.

(j) CANNON PLUGS.—Make sure they are properly assembled, safety wired and securely mounted.

(k) CONNECTORS.—In order to prevent accidental separation, all electrical (AN type) low tension connectors installed forward of the firewall shall be safety wired or secured by one of the following methods:

1. Safety wired through nut to mounting screws.

2. Clamp attached to nut and safety wire to mounting screws.

3. Taping the coupling nut to the connector shell and coat with Glyptol.

(l) SWITCHES.—Check for security of mounting and security of wires. Check identification of switch and identification of wires. Check operation. Check for evidence of corrosion.

(m) FUSES.—Check fuses for proper seating in fuse clips, absence of corrosion, and proper value of fuse. Check spare fuses in main distribution panel.

(n) CIRCUIT BREAKER.—Check for corrosion of terminals. Clean with No. 000 sandpaper if discolored. Check for tightness of terminals.

(2) PREFLIGHT.

(a) Check operations of all switches and relays.

(b) Check light bulbs for operation.

(c) Check spare bulbs and fuses.

(d) Check accessible generator terminals and wiring for condition and security.

(e) Check operation of generators during engine run-up.

(f) Check voltage of battery under load.

(g) Check operation of motors.

(h) Check voltmeters and ammeters.

(3) 25-30 HOUR.

(a) BATTERIES.

1. Inspect batteries for electrolyte level (1½ inches above protector) and specific gravity; grounds.

2. Inspect containers for corrosion. Clean with a solution of one pound sodium bicarbonate per gallon of water. Rinse with water and dry.

3. Inspect battery hold-down bolts for security.

(b) BONDING.

1. Check and renew as necessary all bonding on gasoline and oil lines.

2. Check and renew as necessary all bonding on conduit.

(c) BOMBARDIER'S COMPARTMENT. — For detailed inspection of items, refer to Par. 4, *a,* (1).

1. Lights and switches (dome, projection, fluorescent, and indicator).

2. Utility receptacle.

3. Bombardier's switch panel.

4. Bombardier's instrument panel.

(d) PILOT'S COMPARTMENT.

1. Signal lights and switches.

2. Fluorescent lights.

3. Projection lights.

4. Anti-icer rheostat for propellers.

5. Magnetic compass light.

6. Recognition lights switch box. Switches up, steady light; switches down, lights work in conjunction with key.

7. External anchor light switch.

8. Ignition switches.

9. Feathering switches for hydromatic propeller.

10. Pilot's switch panel.

11. Marker beacon receiver light.

12. Warning horn switch.

13. Windshield wiper, motor, switch, and circuit breaker.

14. Float warning light.

15. Torpedo training camera receptacle.

16. Pitot heater switch. Check by noting battery discharge.

17. Landing gear warning lights and switch (PBY-5A only).

18. Switch and warning light for anti-icer. (Wing leading edge.)

19. Remote indicators, Magnesyn compass.

20. Automatic pilot and PDI switches and instruments.

(e) NAVIGATOR'S AND RADIO COMPARTMENT.

1. Lights, (dome, projection, indicator, radio table, panel, navigator's, radar operator's) and rheostats.

2. Receptacles. (Navigator's switch box and main distribution panel.)

3. Navigator's instrument panel.

4. Float relay junction box. Inspect float motor relay contacts.

5. Throttle warning switch and junction box.

6. Spare bulb stowage.

7. Float motor.

8. Navigator's switch.

9. Liquidometer voltage compensating unit.

10. Main distribution panel meters, switches, light rheostats, and utility receptacle. Inside panel, relay, and cut-outs for proper identification and fuses for general value and identification.

11. Radio trailing antenna standpipe and plug; check fit of plug and gasket.

12. Check wiring diagrams.

13. Auxiliary batteries and conduit. Check voltage and hydrometer readings.

14. Port and starboard D.C. voltage regulators for proper operations. Set at 28.5 volts.

15. Port and starboard A.C. voltage regulators. Set at 118 to 120 volts.

16. A.C. receptacles and fuse box. Check voltage for port and starboard generators during engine run. Set at 118 to 120 volts. Also check auxiliary power unit voltage.

17. Inspect switches for security of mounting.

18. Radio power junction box.

19. Magnesyn compass inverter.

20. Magnesyn compass inverter junction box.

(f) ENGINEER'S COMPARTMENT.

1. Lights. (Float warning, dome, projection and signal.)

2. Dome light switches.

3. Oil dilution switches.

4. Warning horn outside receptacle.

5. Bulkhead 4 switch box.

6. Dome light and receptacle.

7. A.C. Stove. (Check operation.)

8. Float switch.

9. Starter switch.

10. Oil tank selector switch.

11. Anti-icer tank and motor. Check for leaks.

12. Engineer's switch panel junction box.

13. Auxiliary power unit generator.

14. Auxiliary power unit thermocouple (PBY-5 only).

15. Auxiliary power unit instrument panel, instruments, switches, 125-ampere fuse and one spare. Auxiliary power unit oil heater switch and warning light (PBY-5 only).

16. Auxiliary power unit A.C. voltage regulator (PBY-5 only). Set at 118 to 120 volts.

17. Auxiliary power unit D.C. voltage regulator. Set at 28.5 volts.

(g) LIVING COMPARTMENT.

1. Dome light.

2. Receptacle.

3. Check operation of warning horn and stowage. Check on 24 to 28 volts.

4. Portable electric bilge and refueling pump (PBY-5 only).

5. Portable electric refueling pump (PBY-5 only).

6. Station 6.0 junction box.

7. Station 6.0 switch box.

(h) WAIST COMPARTMENT.

1. Dome light.

2. Receptacle.

3. Camera gun receptacles and switches.

4. Gun sight receptacles and switches.

5. Ammunition feed motors, switches, and micro switches.

6. Tail anti-icer switches and indicator (PBY-5 airplanes with serial numbers 08349 and on, and PBY-5A airplanes up to serial number 46610).

7. Continuous feed assist motors.

(i) TUNNEL COMPARTMENT.

1. Dome light and switch.

2. Camera switch and receptacle.

3. Receptacle.

4. Section light socket. Check for security of mounting.

(j) ENGINES.

1. Generators, Cannon plugs, and flexes.

2. Starters, Cannon plugs, and flexes.

3. Feathering motor and conduits.

4. Feathering pressure switch, including security of mounting.

5. Magnetos, booster coil, and conduits.

6. Feathering relay junction box.

7. Feathering relay in junction box.

8. Dilution solenoid including security of mounting.

9. Tachometer generator and conduit.

10. Thermocouples and wiring.

11. Oil quantity gage resistor unit junction box.

12. Starter solenoids, for security of mounting and tightness of leads.

13. Starter junction box.

(k) WING CENTER SECTION.

1. Main center section junction box, and switches.

2. Ignition junction box.

3. Starboard engine terminal junction box, and landing light relay.

4. Port engine terminal junction box, and landing light relay.

5. Receptacles.

6. A.C. and D.C. terminal junction boxes.

7. All conduits through center section.

8. Landing lights.

9. Pitot heater.

10. Anti-icer actuator (PBY-5 airplanes with serial numbers 08349 and on, and PBY-5A airplanes).

11. Port and starboard batteries and conduits.

(l) STARBOARD WING.

1. Lights (running, anchor, formation, and recognition).

2. Bomb racks wiring.

3. Bomb rack receptacles.

(m) PORT WING.

1. Lights (running, anchor and formation).

2. Magnesyn compass transmitter.

3. Bomb rack wiring.

4. Bomb rack receptacles.

(n) TAIL AND EXTERIOR HULL.

1. Tail light.

2. Section light.

3. Paralketone on antenna lead in.

(4) 50-60 HOUR.

(a) BATTERIES.—Disconnect and clean terminals and connections.

(b) MOTORS, DYNAMOTORS AND INVERTERS. (EXCEPT STARTERS.)

1. Inspect bearings; lubricate if necessary.

2. Inspect brushes and commutators. Clean with compressed air.

3. Inspect starter motor relay contacts.

(c) GENERATORS.

1. Inspect bearings; lubricate if necessary.

2. Inspect brushes and commutators. Clean with compressed air.

3. Test reverse current relay cut-outs.

4. Inspect generator control boxes and relays.

(d) LANDING LIGHTS.—Inspect and test for corrosion, cleanliness of reflector, and operation of relays.

(e) BILGE AND REFUELING PUMP.

1. Check stowage for security.

2. Check hose assemblies for condition.

3. Check operation of motor and pumps.

4. Inspect motor for condition, electrical connections, brushes, and commutator.

5. Check switch cover packing for vapor tight seal.

6. Inspect pumps for valve adjustment, freedom of rotation, absence of leaks, and cleanliness of strainers.

(5) 120-125 HOUR.

(a) BATTERIES.—Remove batteries and send to shop for servicing.

(b) MOTORS AND DYNAMOS.

1. Clean and inspect commutators for excessive wear.

2. Clean out bearings. Fill with new grease.

3. Clean and grease float motor and gears.

4. Inspect starter motor solenoids and linkages for wear and adjustment.

5. Inspect brushes and clean starter motor with compressed air. Grease bearings if necessary.

(c) BONDING.—Check and renew as necessary all bonding throughout the airplane.

(6) 200-240 HOUR.—Inspect vibrator inverter as follows:

(a) Check inverter for proper output and satisfactory operation.

(b) Check vibrators for tightness in holders.

(c) Check fuses for value and continuity.

(d) Check all soldered joints and tighten connectors.

(7) ENGINE OVERHAUL PERIOD.—Overhaul the generator whenever the engine is changed or overhauled.

b. AUXILIARY POWER UNIT.

(1) GENERATORS.—For inspection of generators, see Par. 4, a, (1), (d).

(2) GASOLINE ENGINES.

(a) PREFLIGHT.

1. Check magneto ground connection (PBY-5 only). Check all other electrical connections for security of attachment.

2. Check engine and engine mounting bolts for security.

3. Check oil supply. Fill tank with lubricat-

ing oil. (Specification AN-VV-O-446, grades 1065 and 1080.)

4. Check fuel flow at carburetor and all fuel and oil lines for leaks.

5. Check carburetor throttle and control linkage for freedom of action and proper adjustment.

6. Start the engine and check the ignition on both magnetos and on each magneto separately (PBY-5 only).

7. Check oil pressure and temperature (PBY-5 only).

8. See that the generator voltage is correct and that the engine takes the generator load normally.

9. Check oil level in gear case (PBY-5A only).

(b) 50-60 HOUR.

1. Check spark plugs. Replace if necessary.

2. Check the ignition wiring and shielding for breaks or defective insulation.

3. Check the magneto breaker points for cleanliness and proper gap.

4. Remove and clean the oil pump strainers and magnet (PBY-5 only).

5. Drain the oil tank, flush with light oil, and then refill with fresh oil.

6. Remove and clean the carburetor fuel inlet strainers.

7. Check the intake and exhaust manifold flanges for secure attachment.

8. Check the security of all connections, bell cranks, and ball joints in the governor-throttle control linkage. Check for freedom of movement and full travel of throttle controls.

9. Remove the carburetor air intake backfire traps and clean (PBY-5 only). Check exhaust pipe.

10. Remove elbow strainer from fuel pump inlet and clean (PBY-5 only).

11. Check cylinder compression.

12. Check valve timing, and valve clearance (PBY-5 only).

13. Drain gear case and then flush with flushing oil. Refill to proper level with oil (PBY-5A only).

(c) 600 HOUR.—Remove engine from airplane and send to shop for complete overhaul.

c. COMMUNICATIONS.

(1) PREFLIGHT INSPECTION.

(a) RADIO EQUIPMENT.—Check the operation of the following radio equipment in accordance with procedure in pilot's handbook. (AN 01-5MA-1).

1. LIAISON RADIO.

a. IF transmitter (GO-9).

b. HF transmitter (GO-9).

c. Receiver (RU-19).

d. Frequency Meter (LM-10).

2. COMMAND RADIO.

a. Transmitter (ATB).

b. Receivers (ARB).

3. NAVIGATIONAL RADIO.

a. Radio Compass (DW-1).

b. Radio Altimeter—AN/APN-1 (PBY-5A's with serial numbers 48352 and on).

4. INTERPHONE (RL-24C).

a. Check operation of all stations.

b. Check amplifier for security of mounting.

c. Check to see that headphones and microphones are provided at all stations.

5. RADAR EQUIPMENT.

a. Radar—ABK (See applicable BuAer publication). (PBY-5 and PBY-5A's up to serial number 48252.)

b. Radar—AN/APX-[illegible] (See Navy AN-CO-AN-08-20-12). (PBY-5A's with serial numbers 48252 and on.)

c. Radar—ASB (See Navy Co-Nav-Aer08-5S-27). (PBY-5 airplanes with serial numbers 48252 to 46599 only.)

(b) ANTENNAE.—Check security of installation, tension, and condition of wire; condition of insulators, masts, rods, and housings.

1. FIXED WIRE ANTENNAE.

a. Liaison.

b. Command.

c. Sense.

2. WHIP ANTENNAE.

a. IFF Antenna.

b. ASB Antenna.

c. ABK Antenna.

3. COMPASS LOOP ANTENNA.—Check action of shaft and tightness of collar.

4. RADIO ALTIMETER DIPOLE ANTENNAE.—Check whether insulator ring at center of horizontal radiating member is clean and free of paint.

5. TRAILING ANTENNA.—Check antenna reel and reel brake.

(2) 25-30 HOURS INSPECTION PERIOD.—Radio Equipment.

(a) GENERAL.

1. Check all interconnecting conduits and wires for breaks and loose connections. Check cable connector plugs for tightness.

2. See that waterproof slip covers are in place on equipment not in use.

3. Check contacts on spring connector terminals.

4. Check for mechanical faults, loose nuts, screws, etc.

5. Check relay contacts for proper alignment, fit and corrosion.

6. Check security of mounting of all units.

(b) LIAISON RADIO.

1. Transmitter (GO-9).

a. Wires to receiver, antenna, ground, and switching and clock panel.

b. Mounting rack.

2. Rectifier unit.

3. Transmitter key.

4. Set HF transmitter on frequency to check with another station. Check operation.

5. Set IF transmitter on frequency to check with another station. Check operation.

6. With A.C. power supplied by engine generators, check A.C. from port and starboard generators by keying GO and noting fluctuation in filament voltage. One volt fluctuation is permissible.

7. RECEIVERS—RU-19.

a. Loop control switch.

b. Receiver switch box.

c. Coils: single—E, H, K, D; double—OP, QG, LN, QM, QF. Coils may change from time to time. In that case check packing sheets for proper number and type.

d. Plug a coil set into the receiver, corresponding to a frequency band in which signals will be available for test purposes. See that the full frequency range on the remote tuning control dial can be swept through for the chosen position of the pointer without encountering the stops on the remote tuning control. Tuning control should turn smoothly and easily.

e. Check operation of switch control. Listen to dynamotor noise with volume control advanced to maximum.

8. Receiver mounting base.

9. Connecting cables.

10. Plugs and receptacles.

11. Junction box.

12. Dynamotor.

13. Frequency meter.

a. Meter.

b. Power cable and plug.

c. Calibration book check serial number against meter number. See inside cover of calibration book for instructions.

(c) COMMAND RADIO.

1. Transmitter (ATB).

a. Dynamotor.

b. Mounting base.

c. Pilot's control box.

d. Metering kit.

e. Tuning units. Two 3.0 to 9.05 MC. One 2.3 to 4.2 MC with carrying base.

f. Check channel one and check with another station.

g. Check channel two with another station.

h. Check to see that transmitter is adequately bonded.

2. Receiver (ARB).

a. Dynamotor.

b. Mounting base.

c. Pilot's control box.

d. Mechanical linkage.

e. Tuning head.

f. Power cable.

g. Control cable.

(d) NAVIGATIONAL RADIO.

1. Radio Compass.

a. Mountings of control boxes and compass unit.

b. Plugs and couplings.

c. Headset plugs and cords.

d. Instrument lamps.

2. Radio Altimeter.

a. Transmitter and receiver unit and shock mount.

b. Limit indicator light.

c. Altitude indicator.

d. Altitude limit switch.

(e) INTERPHONE.

1. Check plugs for tightness at all stations.

2. Test switches for operation at all stations.

3. Check fuse in amplifier.

4. Clean and test microphones.

5. Clean and test head sets.

6. Test microphone and telephone jacks.

(f) RADAR EQUIPMENT.

1. Radar (ABK) (See applicable Bu/Aer publication).

2. Radar (AN/APX-2) (See AN-CO-AN-08-20-12).

3. Radar (ASB) (See Navy CO-NavAer 08-5S-27).

(3) 240-250 HOURS INSPECTION PERIOD.

(a) RADIO EQUIPMENT.

1. GENERAL.

a. Remove and check connector plugs for cleanliness; check contact points for discoloration.

b. Check dynamotors for conditions of

brushes and commutators. Check for lubrication of bearings that need servicing.

c. Check rubber shock mounts for deterioration and malfunctioning.

d. Check all interconnecting wiring for chafed spots, and attachment to the structure.

2. INTERPHONE.—Check moving parts of amplifier gang switch mechanism for lubrication.

(b) ANTENNAE.

1. FIXED WIRE ANTENNAE.

a. Check the antenna masts for cracks around the mounting and fittings.

b. Check all fittings and mounting screws and bolts for cracks and corrosion.

c. Check fin leading edge fittings for security.

d. Check antenna lead-in insulators for security of mounting.

e. Check rubber link for deterioration.

f. Check antennae wire and guy wire to see if replacement is required.

2. WHIP ANTENNAE.

a. Inspect electrical receptacle and plug for discolorations.

b. Check security of mounting screws.

3. COMPASS LOOP ANTENNA.

a. Remove loop and inspect cover.

b. Remove and check electrical connector plugs for cleanliness. Check contact points for discoloration.

c. Check loop for general cleanliness and corrosion.

4. RADIO ALTIMETER DIPOLE ANTENNAE.

a. Check the transmission line elbow connectors for cleanliness and freedom from corrosion.

b. Check the security of the mounting screws.

5. TRAILING ANTENNA.

a. Check the wire connection on the antenna reel for tightness.

b. Check antenna reel mounting for security.

c. Check the stowage clips for security.

d. Check the sealing washers in the tube through hull for condition.

e. Check the lower end of the fair-lead tube to see that it is not excessively worn from the action of the antenna wire rubbing against it.

5. ACCESSORIES.

a. INSTRUMENTS.

(1) PREFLIGHT.—Drain condensate from instrument lines.

(a) One pitot line and two pitot static lines: three drain points forward of bombardier's instrument panel, three drain points under left side of pilot's instrument panel.

(b) Two engine manifold pressure lines: two drain points under left side of pilot's instrument panel.

(c) Two vacuum system lines: two drain fittings in pilot's compartment at left of pilot's seat.

(2) 25-30 HOUR.

(a) Check faces of instruments for legibility of markings, security, and condition of glass face.

(b) Check all instrument tubing for condition, leakage, security of attachment.

(c) Check all electrical wiring and connections to instruments for condition and security of attachment.

b. OXYGEN SYSTEM.

(1) PREFLIGHT.

(a) Inspect portable oxygen cylinders. If cylinders are not charged to 1800 $\pm$ 50 lb/sq in., replace with charged cylinders.

(b) Check to determine that coupling nuts are tight and not leaking.

(2) AFTER FLIGHT. — Replace all cylinders which have been used, with charged cylinders.

c. FURNISHINGS.

(1) PREFLIGHT.

(a) LOAD ADJUSTER.—Check C. G. (center of gravity) location with LOAD ADJUSTER computer. Make changes in disposition of movable weights if necessary to bring the C. G. within the safe limits indicated by the LOAD ADJUSTER.

(b) STOVE.—Inspect electric cooking stove in engineer's compartment.

(c) PERCOLATOR.—Inspect percolator in engineer's compartment.

(d) WATER TANKS.—Inspect two water tanks in engineer's compartment.

(e) MODIFIED HAND CRANK.—Check for presence of engine hand crank, modified for floats and anchor, in engineer's compartment.

(f) WATER TANKS.—Inspect two water tanks in navigator's compartment (PBY-5A only). Inspect two water tanks on forward face of bulkhead 6 (PBY-5 only).

(g) FIRST AID.—Inspect first aid kit in living compartment.

(h) SEA ANCHOR.—Inspect sea anchor, 100 feet of one inch circular line, and stowage straps in living compartment. (Waist compartment on PBY-5 airplanes up to serial number 08349.)

(i) LIFE RAFT.—Inspect life raft and stowage in waist compartment.

(2) 25-30 HOUR.

(a) Inspect bombardier's knee pad for condition.

(b) Inspect safety belt in bombardier's compartment.

(c) Inspect pilot's and copilot's seats for lubrication, condition, armor, and security of attachment.

(d) Inspect two safety belts in pilot's compartment.

(e) Inspect buoy hook with 100 feet of one inch circular line in bombardier's compartment on PBY-5A airplanes and in pilot's compartment on PBY-5 airplanes.

(f) Inspect flexible metal hose for defrosting windows in pilot's and bombardier's compartments.

(g) Inspect life jacket stowage in pilot's compartment.

(h) Inspect safety belts in radio compartment.

(i) Inspect seats in radio compartment for condition and security of attachment.

(j) Inspect parachute stowage in radio compartment.

(k) Inspect life jacket stowage in radio compartment.

(l) Check two lengths (150 feet each) of 1½ inch circular manila line in miscellaneous gear locker.

(m) Inspect engineer's seat for condition and security of attachment.

(n) Inspect safety belt in engineer's compartment.

(o) Inspect parachute stowage in engineer's compartment.

(p) Inspect life jacket stowage bag in galley compartment.

(q) Inspect life jacket stowage in living compartment.

(r) Inspect signal flag stowage.

(s) Inspect parachute stowage in living compartment.

(t) Inspect waist gunner's seats for condition and security of attachment.

(u) Inspect safety belts in waist compartment.

(v) Inspect safety belt in tunnel compartment.

(w) Inspect mooring pendant and fittings.

(x) Inspect signal light stowage.

(3) 50-60 HOUR.

(a) Check all CO_2 fire extinguishers, noting seal and last date filled.

(b) Inspect anchor cable and reel. Lubricate anchor cable if necessary.

d. ANTI-ICING EQUIPMENT.

(1) PROPELLER ANTI-ICING SYSTEM.

(a) PREFLIGHT.

1. Check to determine that reservoir is filled with anti-icing fluid. (Specification AN-F-13.)

2. Check that valve is open.

3. Check operation.

(b) 50-60 HOURS.

1. Check pump wiring and mounting, and all fluid supply lines and fittings for security of mounting and clip attachment, and for leaks.

2. Drain reservoir, clean, and refill.

(2) WING HEAT ANTI-ICING SYSTEM.

(a) PREFLIGHT.—At engine run-up, check operation of wing dump gates by use of switch on pilot's yoke.

(b) 50-60 HOUR.

1. Inspect ram air scoop intake and heater for evidence of salt water corrosion.

2. Inspect motors, including actuating arms and electrical connections.

3. Inspect ducting inside wing for security of mounting.

(3) TAIL HEAT ANTI-ICING SYSTEM.

(a) PREFLIGHT.

1. Inspect electrical connections.

2. Inspect fuel connections from cross-feed line to heater for leakage and security of attachment.

3. Check damper operation by operating push-and-pull rod at bulkhead 7.

4. Inspect heater exhaust tube at aft end of heater for burnout.

5. Check operation of heater by using a portable blower in front of the air scoop intake.

6. If anti-icing is not to be used during the flight, check to determine that canvas cover cap is in place over ram air scoop intake.

(b) 50-60 HOUR.

1. Check ram air scoop intake for evidence of salt water corrosion.

2. Remove cover plate above heater, and check heater and electrical connections for evidence of salt water corrosion.

3. Check operation of solenoid at heater.

4. Inspect connections of heater pick-off tube, combustion chamber draft tube and dust connections.

(c) 175-180 HOUR.—Remove heater for complete overhaul and inspections.

e. LANDING GEAR, BEACHING GEAR AND FLOATS.

(1) LANDING GEAR (PBY-5A only).

(a) PREFLIGHT.

1. Inspect tires for proper condition and inflation. Check valve caps.

2. Check operation of brakes for holding and release. Check that no brake plates drag.

3. Check oleo struts for oil level and proper inflation. Check oleo valve caps.

4. Check safety of landing gear.

5. Check emergency nose wheel well door linkage for safety.

6. Check lubrication.

7. Check all exterior wiring, switches, and conduits.

8. Inspect landing gear locks.

(b) 120-125 HOUR.

1. Disassemble wheels. Inspect, lubricate, and restore anti-corrosion protective coating where required.

2. Make a general inspection of brakes without disassembling. Check for corrosion and clearance between brake discs and adjusting nuts. Blow out any dirt with air. Inspect for security of nuts and cotter keys.

3. Inspect struts and fittings for bends, cracks, displacement, play, and security.

4. Inspect, clean, and lubricate retracting mechanism.

(c) 300 to 360 HOUR. — Disassemble brake units and inspect all parts. Replace worn parts if necessary.

(2) BEACHING GEAR.

(a) 25-30 HOURS.

1. Check tires for inflation.

2. Inspect tires for condition.

3. Inspect struts and braces for condition and evidence of corrosion.

4. Inspect brakes for operation and adjustment.

5. Check lubrication.

(b) 50-60 HOUR.—Disassemble and inspect for condition, lubrication, and evidence of corrosion.

(3) FLOATS.

(a) PREFLIGHT.—Inspect float assemblies for leaks, security of covers, and damage to structure. (Floats, panels and struts.)

(b) 25-30 HOUR.

1. Check float retraction mechanism for correct operation, manual and electric.

2. Check synchronization of float operation.

3. Inspect float latch at wing tip for easy functioning.

4. Check all joints and connections throughout the system for wear and looseness. Inspect for evidence of corrosion and lack of lubrication.

5. Check drag brace drain plugs to determine that water is drained from drag braces.

6. Inspect float retracting screws for wear.

7. Clean out drain pipes in float well.

8. Check floats and float struts for damage, water in floats, and corrosion.

9. Check potassium chromate sacks in floats.

10. Inspect moving parts of main gear box.

11. Lubricate moving parts, fittings, and bearings with the currently specified lubricants.

f. MISCELLANEOUS.

(1) WINDSHIELD WIPERS AND WINDSHIELD SPRAY.

(a) PREFLIGHT.

1. Check to determine that fluid jars are filled with water, water and alcohol mixture, or anti-icing fluid. (Specification AN-F-13.)

2. If supply in fluid jar will not be sufficient for the flight, see that extra fluid is carried.

3. Spray a small amount of fluid on the window, and check operation of windshield wipers.

(b) 25-30 HOUR.

1. Check fluid lines, pump, fluid jar, and discharge opening for leakage, freedom of flow, and security of mounting.

2. Check electrical connections, switches, motors, and windshield wipers for condition and operation.

(2) HEATING UNIT. — When properly installed and operated, a heater should operate over the entire cold weather period without requiring any attention between overhaul periods except as outlined below. All units on PBY-5A airplanes are properly lubricated at the factory and no further lubrication is necessary except at overhaul.

(a) PREFLIGHT INSPECTION.—After each flight, all electrical connectors and fuel connections should be checked for tightness.

(b) 25-30 HOUR INSPECTION (PBY-5 only).

1. Drain oil and refill with new oil. Do not flush with kerosene.

2. Check bearings at drive end of fuel-air blower for lubrication. Lubricate if necessary.

3. Remove and clean fuel filter.

(c) 50-60 HOUR INSPECTION (PBY-5A Only).

1. Check fan and pump motor brushes.

2. Replace brushes worn down to a length of 11/16 in. To insure proper use until next 50 hour inspection, replace brushes before maximum wear limit is reached.

3. Brushes should be free fit without excessive side play in the brush boxes. Replacement brushes are provided with correct curvature to assure operation without seating. Brushes that do not give a free fit shall be wiped clean with a gasoline moistened cloth.

4. Examine ignitor and replace if extremely distorted.

5. Check all tubing, wiring, and fittings, for tightness.

6. Especially, check resistor connections in junction box at the pump end of heater.

(d) SIX MONTH INSPECTION (PBY-5A Only).

1. Repeat all items in the 50 hour inspection.

2. Inspect the inner surfaces of the heat exchanger for indications of deterioration. To accomplish this inspection, the heater should be removed from the airplane.

(e) 200-240 HOUR INSPECTION. — Disassemble, clean and check Stewart-Warner heater. Reassemble.

6. ARMAMENT.

a. FLEXIBLE GUNS.

(1) BOW GUN.

(a) PREFLIGHT.

1. Disassemble and inspect machine gun.

2. Inspect sight. Check alignment of sight and gun bore.

3. Inspect gun mount for breakage and for security of attachment.

4. Inspect ammunition and belt links. Inspect magazines and racks.

5. Inspect enclosure. Check freedom of rotation. Check Plexiglas. Check operation of hand pump and water seal. Check operation of hatch.

6. Inspect shock absorber cords.

7. Check interphone operation.

8. Inspect enclosure to insure removal of all loose and stray tools and parts.

(b) AFTER FLIGHT.

1. Clean and inspect machine gun.

2. Remove empty shells and links. Inspect magazines and racks.

3. Report any damage which gunner cannot repair.

(2) SIDE WAIST GUNS.

(a) PREFLIGHT.

1. Disassemble and inspect machine guns.

2. Inspect sights. Check alignment of sights and gun bores.

3. Inspect gun mounts for breakage and for security of attachment.

4. Inspect ammunition and belt links. Inspect magazine and chutes for dents and cracks.

5. Inspect assist motors for proper operation.

6. Inspect Plexiglas enclosures. Check freedom of motion.

7. Inspect shock absorber cords.

8. Check operation of hand pumps and water seals.

9. Inspect armor for condition and security of attachment.

10. If cameras are to be used, check camera circuits.

11. Check interphone operation.

12. Inspect enclosure to insure removal of all loose and stray tools and parts.

(b) AFTER FLIGHT.

1. Clean and inspect machine guns.

2. Remove empty shells and links. Inspect continuous feed mechanism for condition, security, and operation.

3. Report any damage which gunner cannot repair.

(3) TUNNEL GUN.

(a) PREFLIGHT.

1. Disassemble and inspect machine gun.

2. Inspect sight. Check alignment of sight and gun bore.

3. Inspect gun mount for breakage and for security of attachment.

4. Inspect ammunition and belt links. Inspect magazines and racks.

5. Inspect tunnel door for condition, proper operation, and proper sealing when closed.

6. Inspect armor for condition and for security of attachment.

7. If camera is to be used, check camera circuit.

8. Check interphone operation.

9. Inspect enclosure to insure removal of all loose and stray tools and parts.

(b) AFTER FLIGHT.

1. Clean and inspect machine gun.

2. Remove empty shells and links. Inspect magazines and racks.

3. Report any damage which gunner cannot repair.

b. BOMB EQUIPMENT.

(1) PREFLIGHT.

(a) MECHANICAL.

1. MANUAL ARMING AND RELEASE CONTROLS.

a. Inspect accessible handles, pulleys, brackets, and cables for condition and security of attachment.

b. Inspect accessible cables for freedom of movement, fraying, and proper tensions.

2. BOMB AND TORPEDO RACKS.

a. Inspect for condition, cleanliness, and freedom from rust. Clean with kerosene if necessary, but do not lubricate.

b. Inspect for security of attachment.

c. Check operation of moving parts for freedom from binding.

d. Check operation of bomb supporting hooks.

e. Inspect frames, hooks, and levers for any bending, warping, or wearing of parts.

3. BOMB HOIST MK 6.

a. Inspect all parts for cleanliness, dryness, proper lubrication, and freedom from rust.

b. Inspect cable, including attachment to drum and end fitting, for condition and evidence of fraying or breaking.

4. ACCESS DOORS.—Inspect access doors on lower surface of wing for condition and spring tension.

(b) OPERATION.

1. MANUAL.

a. If MK 42 racks are installed, check operation of fuse arming controls.

b. Check operation of bombardier's emergency salvo releases.

c. Check operation of pilot's emergency salvo releases.

2. ELECTRICAL.

a. Check operation of bombsight.

b. Check operation of fuse arming switches.

c. Check operation of selective release switches.

d. Check operation of bombardier's firing key.

e. Check operation of intervalometer.

f. Check operation of lights.

g. Check interphone operation.

h. If torpedo racks are installed, check operation of pilot's torpedo selective switches.

i. Check operation of pilot's bomb-torpedo selective release switch.

j. Check operation of pilot's firing key.

(2) 50-60 HOUR.

(a) MANUAL ARMING AND RELEASE CONTROLS.—Make a complete inspection for condition, adjustment, security, lubrication, and operation. Replace parts if condition is questionable.

(b) ELECTRIC WIRING.—Inspect all bomb and torpedo system wiring, conduits, and connections for condition, security of attachment, positive contacts, and freedom from corrosion. Correct or replace any defects found.

(c) INTERVALOMETER.

1. Check the timing of train bomb release at settings for maximum and minimum bomb spacing. To find the time between successive bomb releases, measure the time interval between the first and last release and divide by the number of time intervals (one less than the number of releases).

2. The bomb spacing in nautical miles can be found by multiplying the time interval between successive releases (in seconds) by the ground speed in knots and dividing by 3600.

The spacing in feet = 6080.27 × spacing in nautical miles.

The intervalometer is to be accurate within 10 per cent.

c. ARMOR.—If airplane has been in combat, armor plate should be inspected for damage and for security of attachment.

d. PYROTECHNICS.—PREFLIGHT.

(1) SIGNAL PISTOL.

(a) Inspect pistol for cleanliness, proper operation, and freedom from rust.

(b) Inspect mounting adapter for condition security of attachment.

(c) Inspect cartridge bandolier and 24 rounds of ammunition.

(2) PARACHUTE FLARES.

(a) Inspect flare adapters for security of attachment and proper operation.

(b) Inspect release cables for fraying.

(c) Inspect pulleys for condition and security of attachment.

(d) Check operation of release handles.

(3) SMOKE GRENADES.

(a) Inspect pouch and two grenades stowed in pouch.

(b) Inspect grenade handle.

(4) AIRCRAFT FLOAT LIGHTS. — Inspect float light stowage racks and float lights.

(5) SMOKE TANK.

(a) Inspect tank for security of attachment.

(b) Check to determine that smoke tank is filled.

(c) Inspect attachment of control cables and CO_2 tube to smoke tank.

(d) Inspect control handle and attachment of cable to handle.

(e) Check operation of controls.

(f) Inspect CO_2 bottle and its attachment to CO_2 tube.

(g) Check CO_2 pressure gage to see that bottle is charged.

e. TOW TARGET REEL.—PREFLIGHT.

(1) Inspect reel and security of attachment to mount.

(2) Check freedom of rotation of reel.

(3) Inspect cable reel for fraying and for security of attachment to end fittings.

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