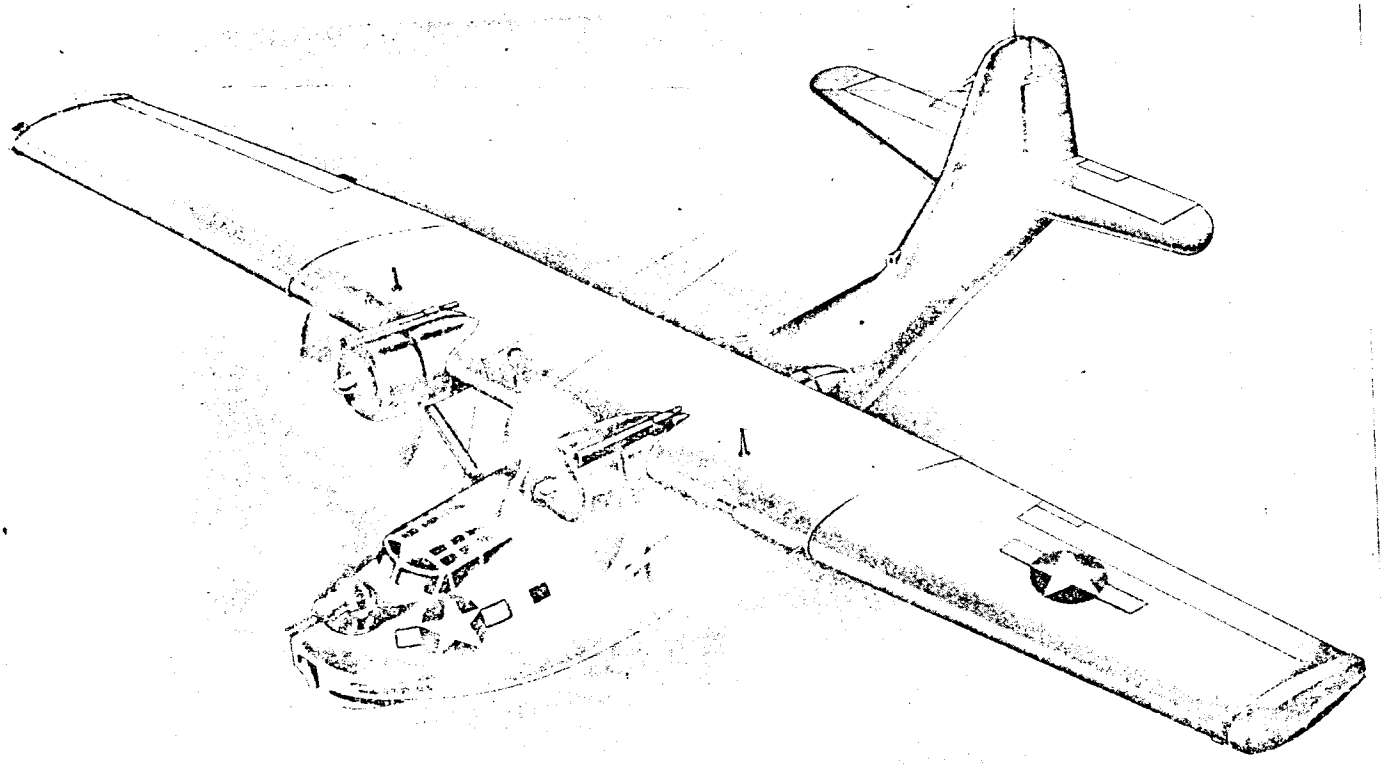


SECTION I
DESCRIPTION, DIMENSIONS, AND LEADING PARTICULARS

1. DESCRIPTION.

The PBY-5 and PBY-5A airplanes are twin engine flying boats whose main difference is that the PBY-5A is equipped with a retractable tricycle type landing gear whereas the PBY-5 is not.

Both the PBY-5 and PBY-5A type of airplanes, which may be used as bomber, patrol, or torpedo airplanes, are manufactured by Consolidated Vultee Aircraft Corporation under contracts 91876 (PBY-5) and NOa(s)-464 (PBY-5A).

Both types of airplanes are powered by two R1830-92 engines and are equipped with floats which retract to form wing tips.

The wing is mounted on a superstructure built up from the hull and is braced by four struts, two on each side, extending from the hull to the under surface of the wing.

Accomodations for an eight man crew are provided.

2. PRINCIPAL DIMENSIONS.

(Aircraft in level flight position.)

a. GENERAL.

Span	104 ft 00 in.
Length (over-all)	63 ft 10-7/16 in.
Height (over wing)	13 ft 5½ in.
Height (PBY-5A on landing gear with propeller blade vertical at top)	21 ft 1 in.
Height over propellers with airplane on beaching gear	17 ft 11 in.

b. WINGS.

Airfoil Sections (curve identification)	NACA 21
Chord at root	15 ft 00 in.
Chord at tip	10 ft 00 in.
Incidence	+ 6°
Dihedral (outer panel taper only)	2° 20′
Sweepback at outer panel	2° 58′

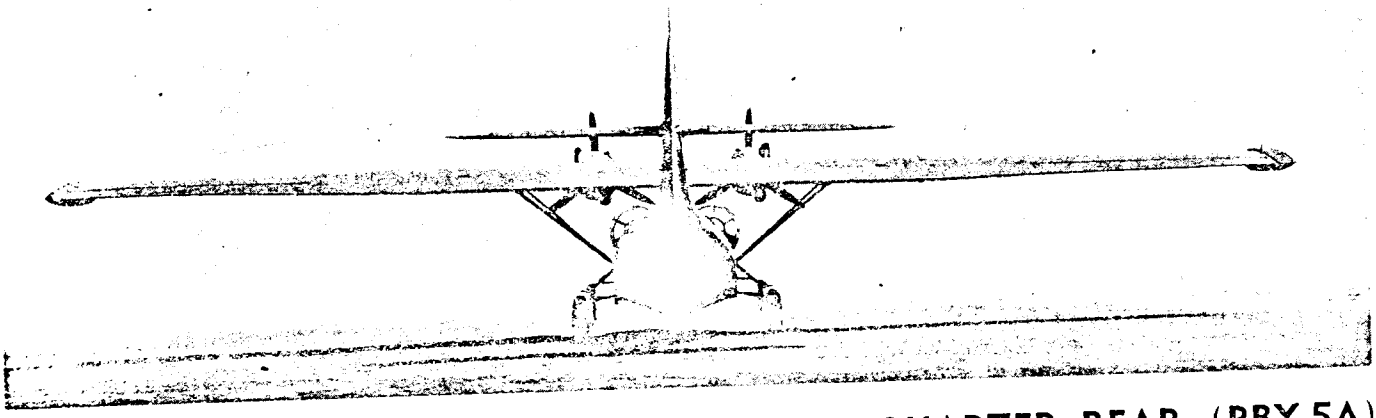
c. STABILIZER.

Span	30 ft 6 in.
Maximum Chord	8 ft 7 in.
Incidence	+ 4°

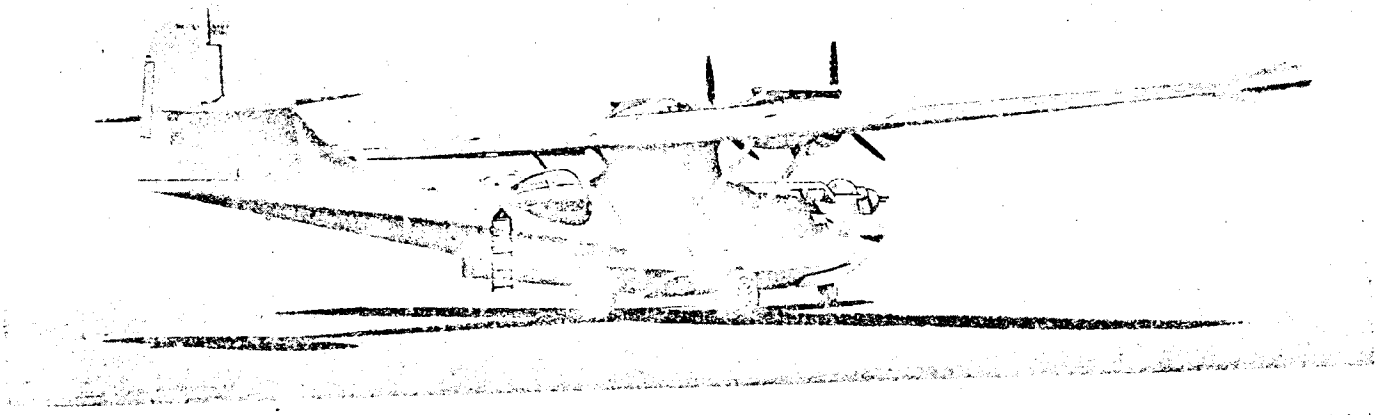
d. HULL.

Width (maximum)	10 ft 2½ in.
Height (maximum)	8 ft 4 in.
Length	63 ft 10 7/16 in.

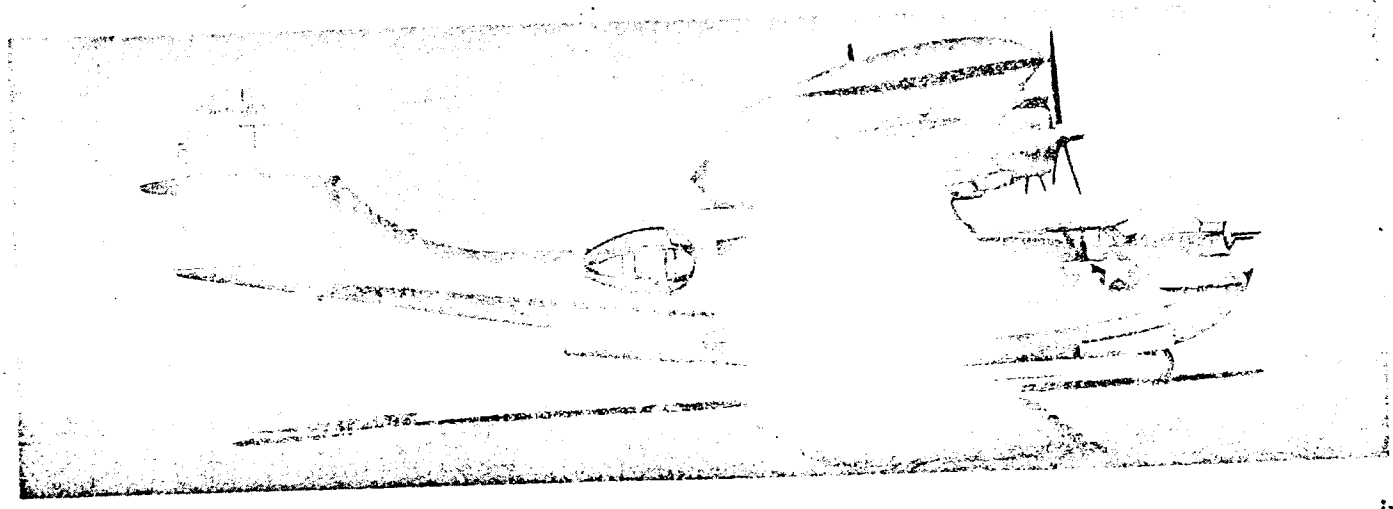
REAR VIEW (PBY-5A)



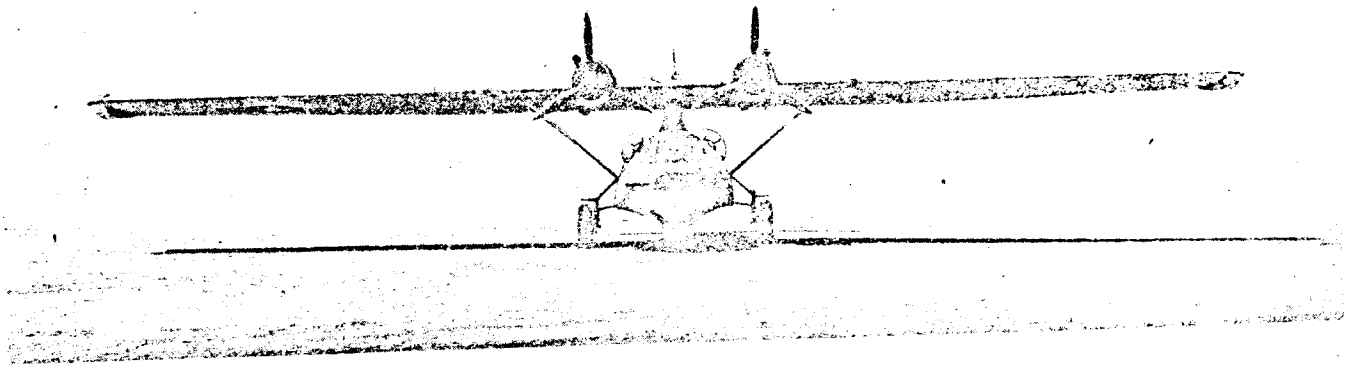
THREE-QUARTER REAR (PBY-5A)



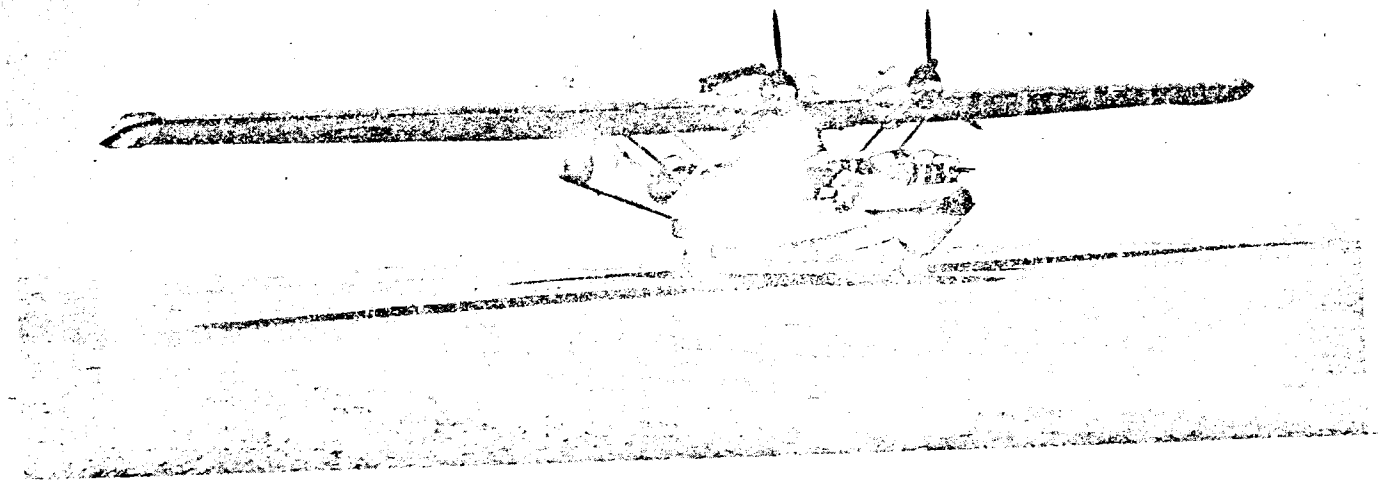
STARBOARD SIDE (PBY-5A)



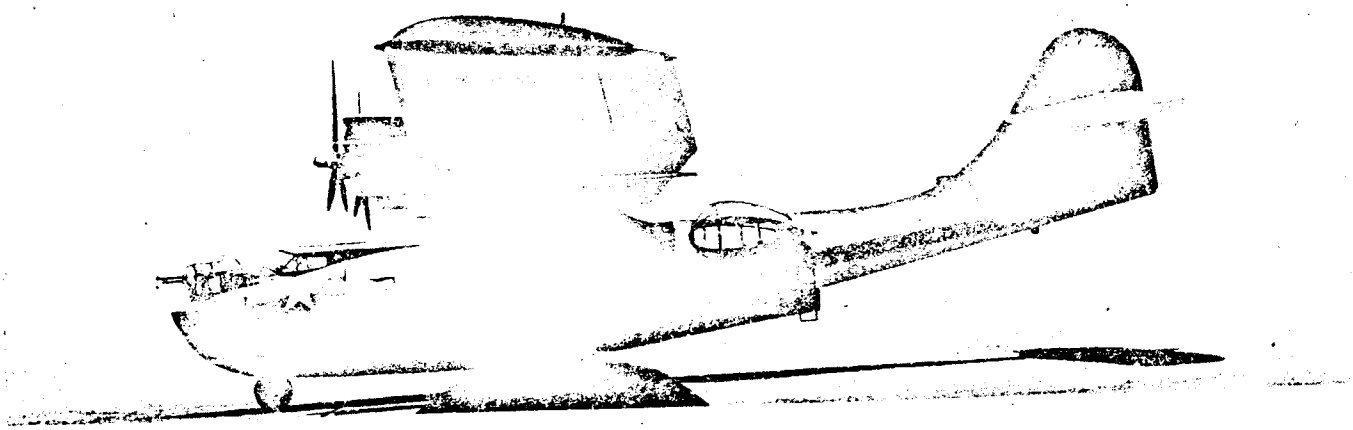
FRONT VIEW (PBY-5A)



THREE-QUARTER FRONT (PBY-5A)



PORT SIDE (PBY-5A)



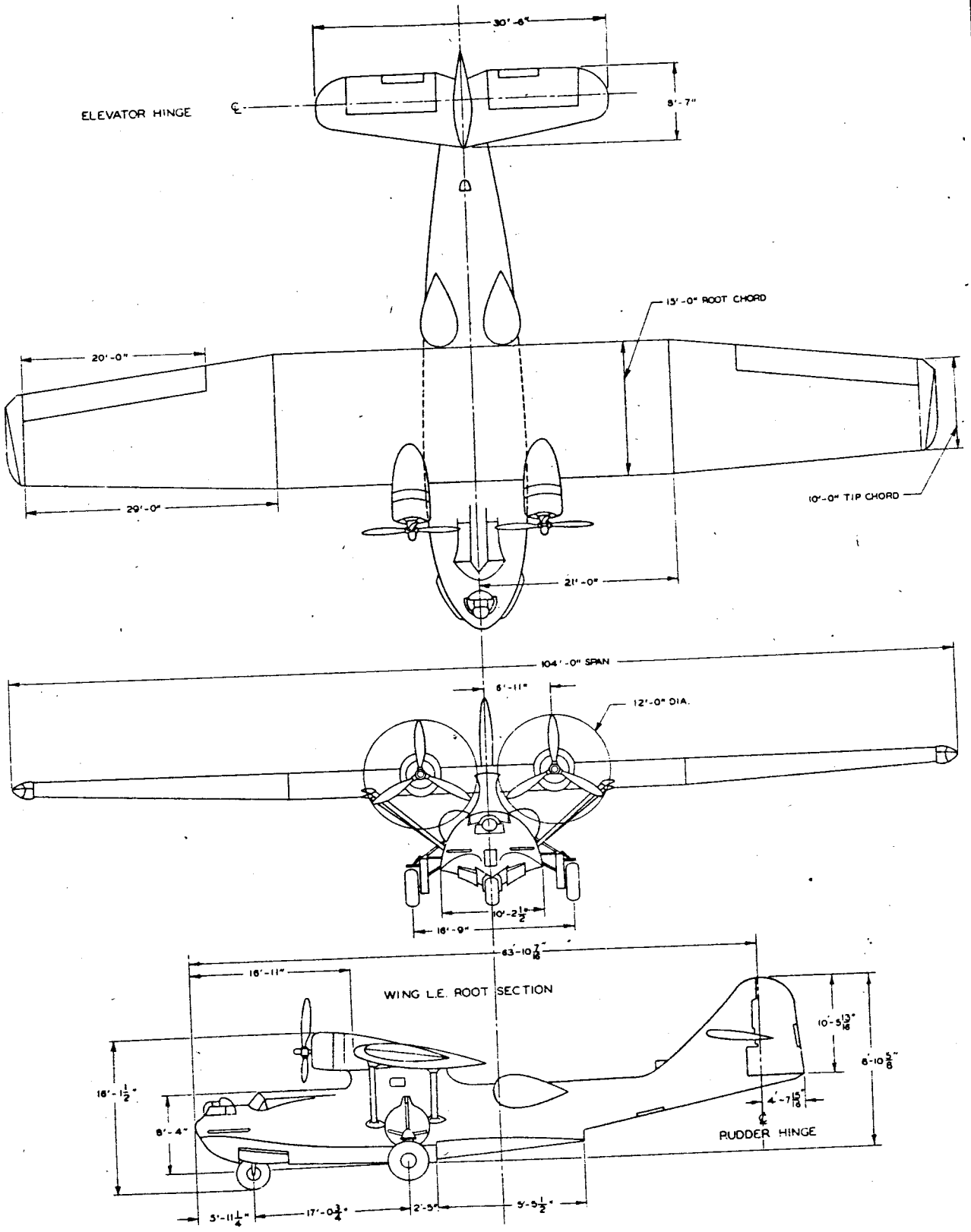


Figure 1—Three View Drawing of PBY-5A Airplane (PBY-5 Similar)

3. AREAS.

Wings (less ailerons)	1300 sq ft
Ailerons (total)	100 sq ft
Stabilizers (including 3.5 sq ft hull-fin area and 18.4 sq ft of contained elevator balance)	138.2 sq ft
Elevators, two, including tabs	66.6 sq ft
Elevator trim tabs (total)	3.9 sq ft
Fin	3.5 sq ft
Rudder (including tabs)	40.4 sq ft
Rudder trim tab	2.6 sq ft

4. SETTINGS AND RANGES OF MOVEMENT OF CONTROL SURFACES.

	Degrees	Inches
Ailerons—up (from neutral)	21(±1½)°	12⅜(±29/32)
Ailerons—down (from neutral)	19¾(±1½)°	11-21/32(±29/32)
Elevators—up (from streamline with stabilizer)	30(±1½)°	21-15/16(±1-3/32)
Elevators—down (from streamline with stabilizer)	20(±1½)°	14-23/32(±1-3/32)
Rudder—right (from streamline with fin)	(+2)° 22(—0)°	21-11/32 (+1-15/16 —0)
Rudder—left (from streamline with fin)	(+2)° 22(—0)°	21-11/32 (+1-15/16 —0)

Trim Tabs:

Elevator—up (from elevator trailing edge)	5(±1)°	¾(±5/32)
Elevator—down (from elevator trailing edge)	10(±1)°	1½(±5/32)
Rudder—right (from rudder trailing edge)	15(±1)°	1⅞(±⅛)
Rudder—left (from rudder trailing edge)	20(±1)°	2½(±⅛)
Aileron—up (from aileron trailing edge)	15(±1)°	2-7/32(±5/32)
Aileron—down (from aileron trailing edge)	15(±1)°	2-7/32(±5/32)

Note

Inches throw of aileron measured at inboard trailing edge; elevator at inboard trailing edge; rudder at bottom trailing edge. Inches throw of elevator tab measured at inboard trailing edge; rudder tab at bottom trailing edge; aileron tab at outboard trailing edge. All control surfaces are assumed to be in line with fixed surface when in neutral.

5. ALIGHTING GEAR.

a. WHEEL TYPE LANDING GEAR. (PBY-5A ONLY.)

Type	Hydraulically retractable
Tread (width from center of tire to center of tire)	16 ft 9 in.
Shock Struts (main)	
Type	Air-oil
Maker and Part No.	Cleveland Pneumatic Tool Co. No. 8103
Fluid required	Oil (Petroleum Base)
Trade name identification (Commercial)	Aerol Strut Mineral Oil
AN Specification No.	AN-VV-O-366
Approximate maximum air pressure	Per nameplate
Wheels (main)	
Type (trade name, size and Part No.)	Goodyear—25¾ in.—No. 530144A
Tire (trade name, type tread and size)	Goodrich—smooth contour—47 inch
Tire pressure	At 27,300 lb gross weight, 54 lb/sq in.
Brakes	
Type (trade name and actuating medium)	Goodyear, Hydraulic fluid

b. NOSE WHEEL UNIT (PBY-5A ONLY).

Type	Hydraulically retractable
Shock struts:	
Type	Air-oil
Make and Part No.	Cleveland Pneumatic Tool Co.—No. 8104

Fluid Required:	
Trade name, identification (Commercial)	Aerol Strut Mineral Oil
AN Specification	AN-VV-O-366
Air Pressure	Per nameplate

Wheel (s)

Type (trade name, size and part No.)	Hayes—12⅜ in. G-3-96
Tire (trade name, type tread and size)	Goodrich—smooth contour 30 inch
Tire pressure	35 lb/sq in.

c. FLOAT TYPE ALIGHTING GEAR.

Type of floats (trade name and material)	Consolidated Design, Aluminum Alloy
Tread (from keel to keel)	89 ft 4 in.
Length of float	10 ft 3⅞ in.

d. HULL.

Type construction—material	Aluminum Alloy and Alclad
Wing tip floats	Retractable

6. ENGINES.

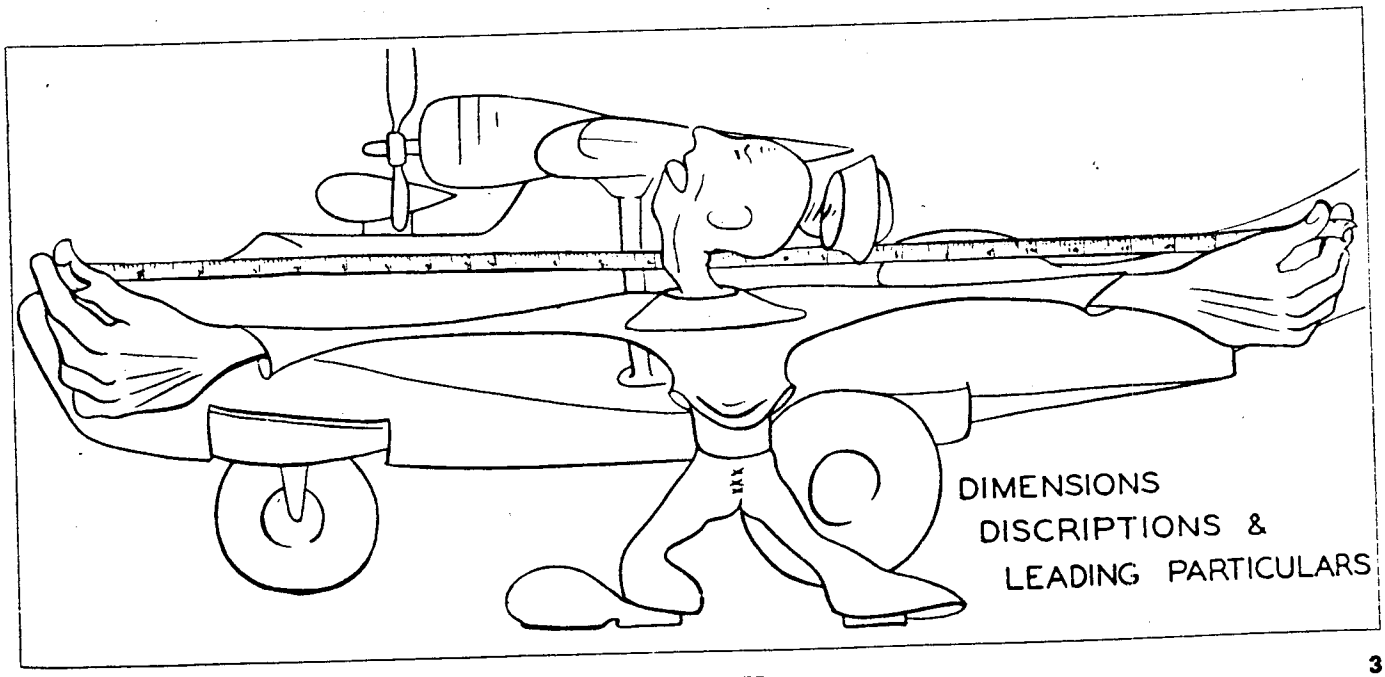
Number	2
Designation	R1830-92
Gear ratio (propeller drive)	16:9
Fuel	Spec. AN-F-28, Gr 100/130
Oil	Spec. AN-VV-O-446, Gr 1110/1120
Impeller gear ratio	7.15:1

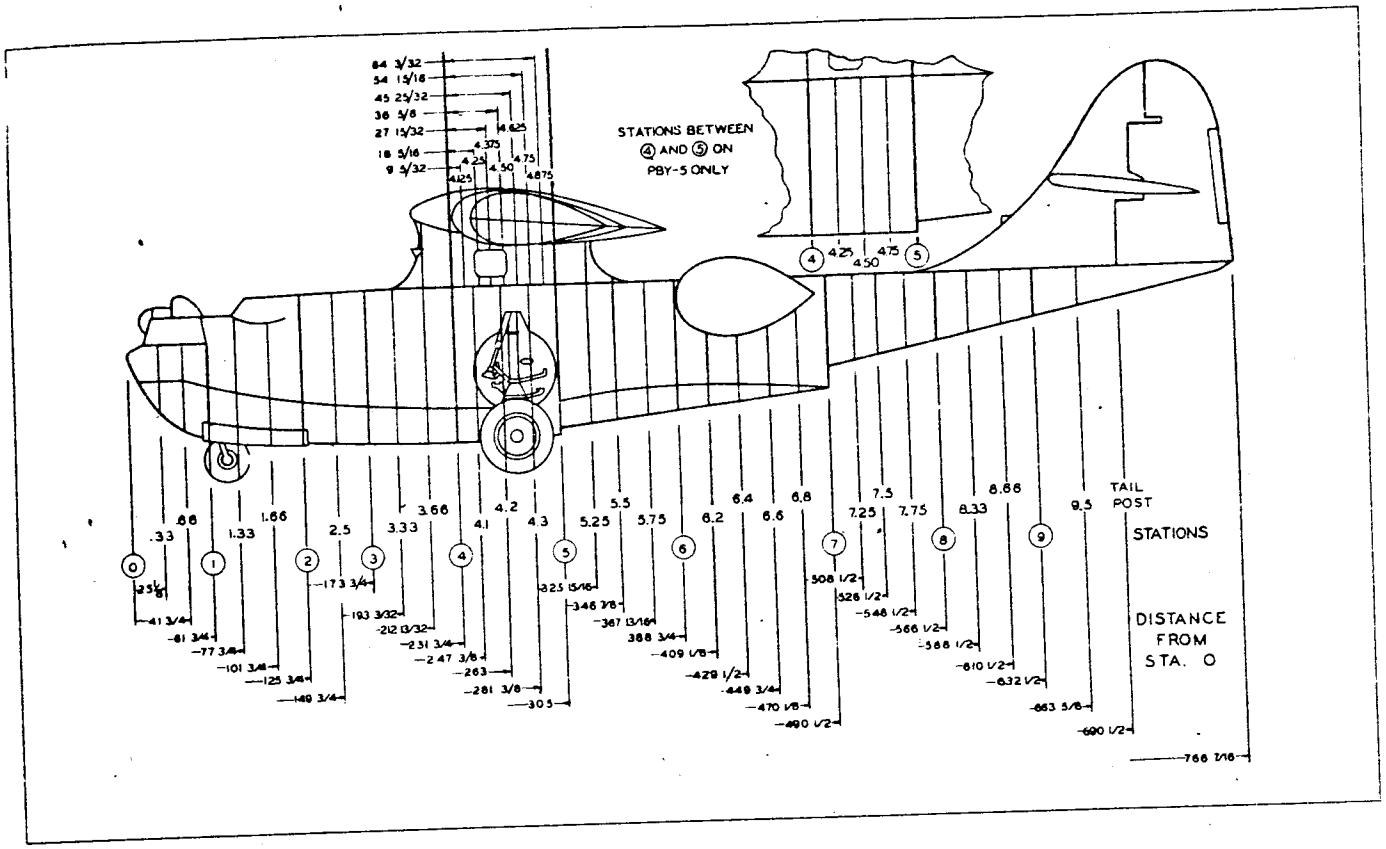
7. PROPELLER.

Manufacturer	Hamilton-Standard
Type	Hydromatic (3 blades)
Hub	23E50-473
Blade (3)	6353A-12
Diameter	12 ft
Control (governor)	4-L-11
Pitch Setting	
Low (fine)	17°
High (coarse)	88°

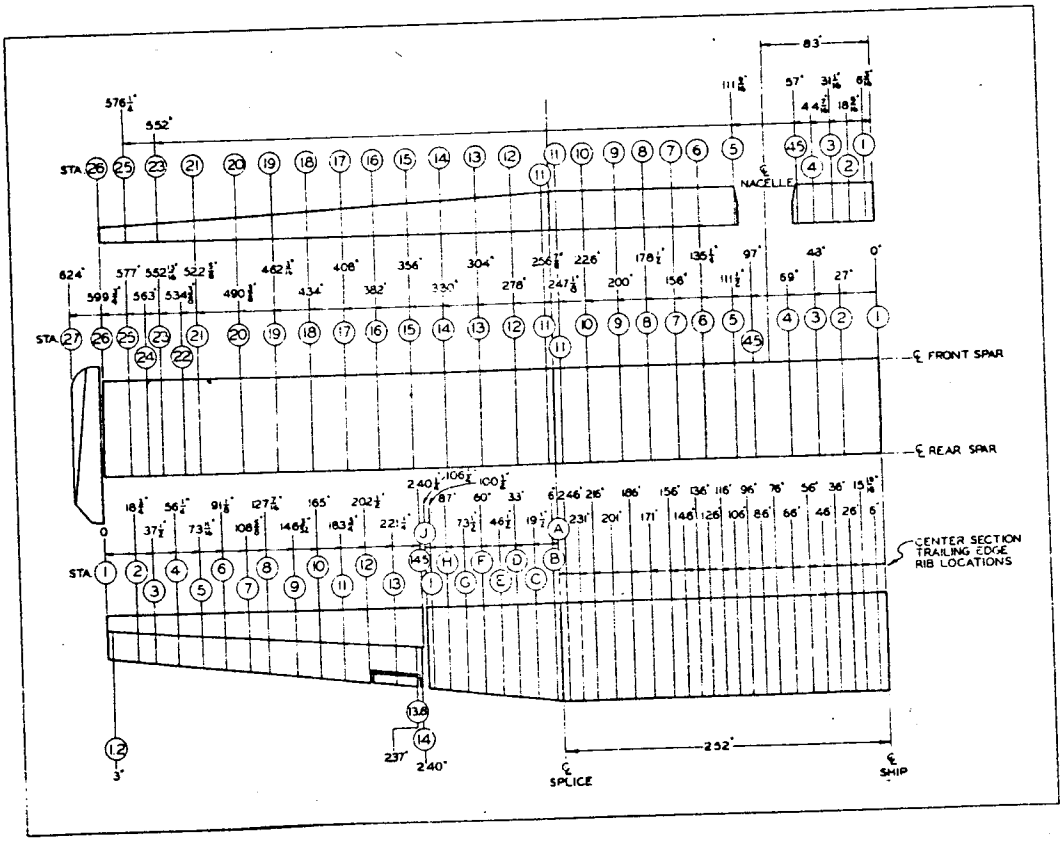
8. TANK CAPACITIES.

	Gallons
a. FUEL.	
Integral tank	875 U. S. (728.6 IMP.)
Fuel cells	622 U. S. (516 IMP.)
Total (integral one side, cells on other)	1478 U. S. (1230.7 IMP.)
b. OIL.	
Tank	65 U. S. (54.1 IMP.)
Expansion space (each tank)	11 U. S. (9.2 IMP.)
Total oil	76 U. S. (63.3 IMP.)
Total both tanks	152 U. S. (126.6 IMP.)





Hull Station Diagram

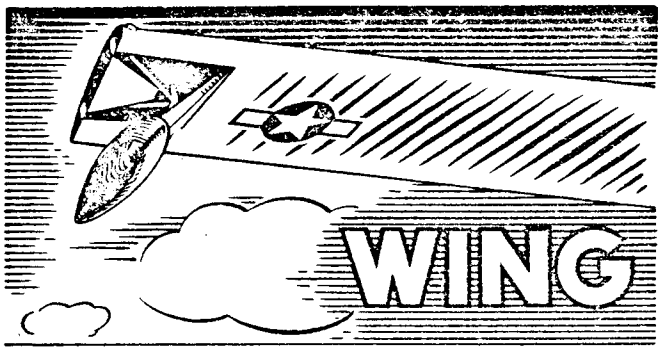


Wing Station Diagram

Figure 2—Wing and Hull Station Diagrams

SECTION IV
MAJOR COMPONENTS, SYSTEMS AND INSTALLATIONS

PARAGRAPH 1.



1. WING.

a. GENERAL. *(See figure 41.)*—The wing consists of three major assemblies,—the center section and a right and left outer panel. Outer panels bolt to the center section, permitting removal for repair or overhaul.

The center section is composed of five units: the interspar structure, three leading edge assemblies, and a trailing edge assembly.

Each outer panel is built in six units: the interspar structure, leading edge, trailing edge, aileron cut-out trailing edge, aileron, and a wing tip which serves as a float when in the lowered position.

Leading edges, trailing edges, and ailerons are removable for repair and overhaul. Leading edges are of all metal construction, while the trailing edges are of a fabric covered, internally braced design. The ailerons are fabric covered, with dural internal structure.

The interspar structure of the center section is constructed in such a way as to provide two gas tight chambers, one on each side of the airplane center line. These interspar tank areas may contain either the gasoline itself, or rubber self-sealing cells.

Walkways are provided on the wing as follows: along the front spar across the entire span; at the airplane center line from the rear spar to the trailing edge; between the front and rear spar to the wing splice.

The entire center section forward of the rear spar, including the leading edge, is braced for walking. Hand grips are provided on each side of the wing center line. Pull up on the grips to use them.

b. CENTER SECTION.

(1) GENERAL. *(See figure 41.)*—The center section is composed of the interspar structure (4), center leading edge (2), left and right-hand outer leading edges (3), and left and right-hand trailing edges (12). The center section is attached to the hull by two fittings at the airplane superstructure and two struts on each side of the hull.

The interspar structure is box-shaped, and consists of front spar and rear spar, truss and web ribs, and upper and lower surface skin reinforced with extruded zee stringers.

The structure is sealed between wing station 5.0 and the center line on both port and starboard sides providing two gas tight chambers. These tanks may contain either the gasoline itself, or five self-sealing fuel cells.

A 10 x 20 inch manhole located in the wing upper surface on each side of the center line provides access for inspection and repair inside each fuel tank. A 23 x 70 inch access door is located on the upper surface on each side of the center line for installing fuel cells.

The nacelle aft of the rear face of the oil tank is an integral part of the center section interspar structure. Two hoisting fittings are located on the wing upper surface at the airplane center line for hoisting the entire airplane. (See Section III, Par. 2, *a*, (3).)

(2) ERECTION.—The center section may be removed or installed as a complete assembly. In some cases it may be more practical to remove the leading edges and trailing edges from the center section interspar structure, and remove the interspar structure separately. The wing may be completely assembled or disassembled on the airplane or on cradles at floor level. Hoisting provisions for the wing are such that the entire wing including engines may be handled. In any case the handling of the center section will be the same.

(a) REMOVAL.

1. Remove radio sense antenna from wing as outlined in Par. 23, *h*, (3), *(b)*.

2. Remove wing outer panels as described in paragraph *c*, (2), *(a)*.

3. Drain fuel tanks. Drainage procedure is

outlined in Section III, Par. 2, *h*, (1), *(d)*. Drain fuel lines as outlined in Par. 15, *b*, (3), *(b)*, *1*.

4. Inside superstructure, remove fuel sight gages. Removal procedure is outlined in Par. 15, *b*, (10), *(b)*.

5. Through access door to fuel sump, located in center superstructure, disconnect lines at twin fittings, the forward one being the main fuel line outlet, the aft one being the tank drain and refuel line connection. Removal procedure is outlined in Par. 15, *b*, (3), *(b)*.

6. At forward superstructure fairing, remove access doors and removable fairing as described in Par. 3, *c*, (2), *(b)* and *(c)*.

CAUTION

When making disconnections of control cables and piping, be sure to tag ends to insure proper connections at installation.

7. At airplane centerline at front spar, break the following control cables by disconnecting turnbuckles: propeller control cables (see Par. 11, *c*, (2), *(b)*), cowl flap control cables (see Par. 11, *f*, (2)), engine throttle control cables (see Par. 11, *b*, (2), *(b)*), carburetor air control cables (see Par. 11, *e*, (2), *(b)*), bomb and torpedo release cables (See Section V. Par. 4, *b*, (3), *(c)*), and cable for arming fuse for MK 42 bomb rack. (See Section V, Par. 4, *b*, (3), *(c)*.) Break dump valve control cable at turnbuckle (5) in leading edge. Remove fairlead (4) and pull lower part of cable through hole in leading edge skin. *(See figure 151.)* Break mixture control cables (26) at turnbuckles in superstructure. *(See figure 46.)*

CAUTION

Before breaking any electrical connections, be sure to shut off main battery switch on main distribution panel on forward face of bulkhead 4.

Note

On PBY-5 airplanes prior to serial number 08349, a rubber boot de-icer system was installed. In these planes, detach Arens control from lever arm of distributing valve by removing clevis bolt from arm at leading edge.

8. Disconnect electrical system and piping from wing leading edge to hull superstructure as follows:

a. Remove cover to ignition junction box 4), D. C. power junction box (19), A. C. power junction box (18), and main battery junction box (3). *(See figure 45.)*

Note

Wires may be identified by numbers taped on wires near terminals.

b. Disconnect the four wires leading to the ignition junction box.

c. Disconnect wires 674, 677, 680, 710, 713, 718, 721, and 724 in D. C. power junction box (19).

d. Disconnect wires 538, 527, 523, 500, 542, 545, 563, and 566 in A. C. power junction box.

e. Disconnect the following wires in center wing junction box:

1035	203	586	96
997	107	582	93
991	106	581	92
985	105	532	72
915	104	529	33
914	103	528	30
662	102	568	1039
661	95	494	745
945	94	1031	654
946	73	492	534
533	28	277	191
531	27	276	189
530	1053	200	185
567	913	101	80
666	912	100	69
465	867	99	
357	878	98	
356	879	97	

f. Disconnect flex conduit (5), (15), (16), and (17) in superstructure by unscrewing conduit coupling nuts. *(See figure 45.)* Pull wires down allowing wires to hang free from open end of conduits in superstructure.

g. Disconnect anti-icer thermocouple wires from wing anti-icer gage at port side of engineer's seat. Disconnect engine thermocouple wires at engine temperature gages on engineer's instrument panel. Remove, up to the wing, clips holding thermocouple wires in place. Return empty clips to position as an aid in subsequent assembly. Tape wire ends and carefully pull them into wing leading edge in a coil. (See Par. 22, *s*, (3).)

Note

All fluid lines may be identified by colored bands on lines. (See Section IX, Table E.)

h. At fitting where hydraulic lines go through the skin between hull station 3.66 and 4.0, break and drain lines. After draining, reconnect lines.

Note

Tape ends of tubing after making disconnections to prevent dirt from getting in lines.

i. At lower surface of leading edge at center line of airplane, disconnect hydraulic lines (2), (3), (4) and (27), propeller anti-icer lines (12) and (16), manifold pressure lines (6) and (18), pitot lines (20) and (21), fuel vent lines (11) and (17), engine primer lines (13) and (15), and oil pressure lines (7) and (19) by unscrewing coupling nuts. By breaking hose connections, disconnect main fuel lines (9) and

(24), cross feed fuel lines (10) and (23), and fuel pressure lines (8) and (22). *(See figure 46.)*

Note

On PBY-5 airplanes, there are only two hydraulic lines to disconnect.

On PBY-5 airplanes prior to serial number 08349 at lower surface of leading edge at centerline of airplane, disconnect two rubber boot de-icer air lines leading into superstructure by unscrewing coupling nuts.

9. At bottom of front spar, near wing bolt, disconnect float torque tube linkage by removing bolt (11). *(See figure 92.)*

10. At aft superstructure fairing, remove removable panels as described in Par. *3, c, (2), (b).*

11. At rear spar, break the aileron tab control cables by disconnecting turnbuckles (See Par. 18, *i,* (3), *(b)*) and the aileron cables by detaching from the aileron push-pull tube. (See Par. *18, e, (2).*)

12. At rear face of bulkhead 5 in the hull, remove nut disconnecting smoke control cable from handle, and pull cable up into superstructure. Break tube to smoke tank at pipe union on rear spar near centerline.

13. Disconnect purging lines at pipe union (35). *(See figure 151.)*

14. Remove loop antenna, wiring and shaft as described in Par. 23, *h,* (4), *(b).*

15. Remove armor plate on aft face of hull bulkhead 5. (See Section V, Par. 4, *d.*)

16. To prevent tilting of wing, place a support under each side of center section. (Hand lines on each end of the wing will serve the same purpose.)

17. Remove transmission lines of IFF and radio altimeter from front struts, starboard and port, as follows:

a. Remove IFF antenna and disconnect transmission lines as outlined in Par. 23, *h,* (9), *(b).*

b. Remove radio altimeter antenna and disconnect transmission lines as outlined in Par. 23, *h,* (5), *(b).*

c. Detach three clips holding IFF line to interior wing structure.

d. Detach four clips holding radio altimeter line to bottom of interior wing structure.

e. Remove upper fairings from front struts as outlined in paragraph *d,* (2), *(b), 1.*

f. Remove lower fairings from front struts as outlined in paragraph *d,* (2), *(b), 2.*

g. Detach clips at upper and lower fairings.

h. Pull Vinolite tubing containing transmission lines down so that connector plugs are pulled through grommets at wing intersection. Coil tubing at hull intersections.

Note

On PBY-5A airplanes prior to airplane 48352 and on PBY-5 airplanes, radio altimeters are not installed. On PBY-5A airplanes prior to 48252 and PBY-5 airplanes, IFF antenna transmission lines do not run through wing or wing struts.

18. Remove wing struts as outlined in paragraph *d,* (2).

19. Remove wing bolts (1) and (6). *(See figure 42.)* These bolts may be removed by removing nut on inside of hull; to overcome tight fit, use large caliber drift punch for driving out the bolts. At front wing hull fitting, a special socket wrench (7) is to be used for removing nut.

20. Lift wing off superstructure with hoist sling as outlined in Section III, Par. 2, *a,* (3).

(b) INSTALLATION.

1. See that hull is leveled. (The wing hoist holds the wing at an angle of 6°. The hull must be leveled, otherwise the hull fittings will not align with the wing fittings.) On PBY-5A airplanes, the fore-and-aft leveling blocks are located between bulkheads 5 and 6 on the port side and transverse blocks on the forward port face of bulkhead 6. On PBY-5 airplanes, the fore-aft leveling blocks are located between bulkheads 4 and 5 on the port side and transverse blocks on the forward port face of bulkhead 5.

2. Hoist the wing as described in Section III, Par. 2, *a,* (3) into position above the hull, and lower slowly; pull flexible conduits through openings provided in lower surface of the wing leading edge.

CAUTION

Fuel sumps must not be permitted to rest on any part of hull superstructure. If power plants are attached, engine and nacelle controls must be kept clear.

3. When the wing rests against the hull and the front and rear fittings are engaged, insert the front wing bolt (6) in a fore-and-aft direction, and the aft wing bolt (1) in a forward direction. *(See figure 42.)* A special socket wrench (7) is provided for tightening the nut on the front wing bolt.

4. Insert Vinolite tubing containing IFF and radio altimeter transmission lines in front struts, and then install wing struts as outlined in paragraph *d,* (3).

5. Install IFF and radio altimeter transmission lines and antennae by reversing procedure as outlined in paragraph *b, (2), (a), 17.*

6. Install armor plate on aft face of hull bulkhead 5. (See Section V, Par. 4, *d.*)

7. Connect purging lines at pipe union (35). *(See figure 151.)*

8. At rear face of bulkhead 5 in hull, and rear spar, connect smoke tank control cable and tube, fol-

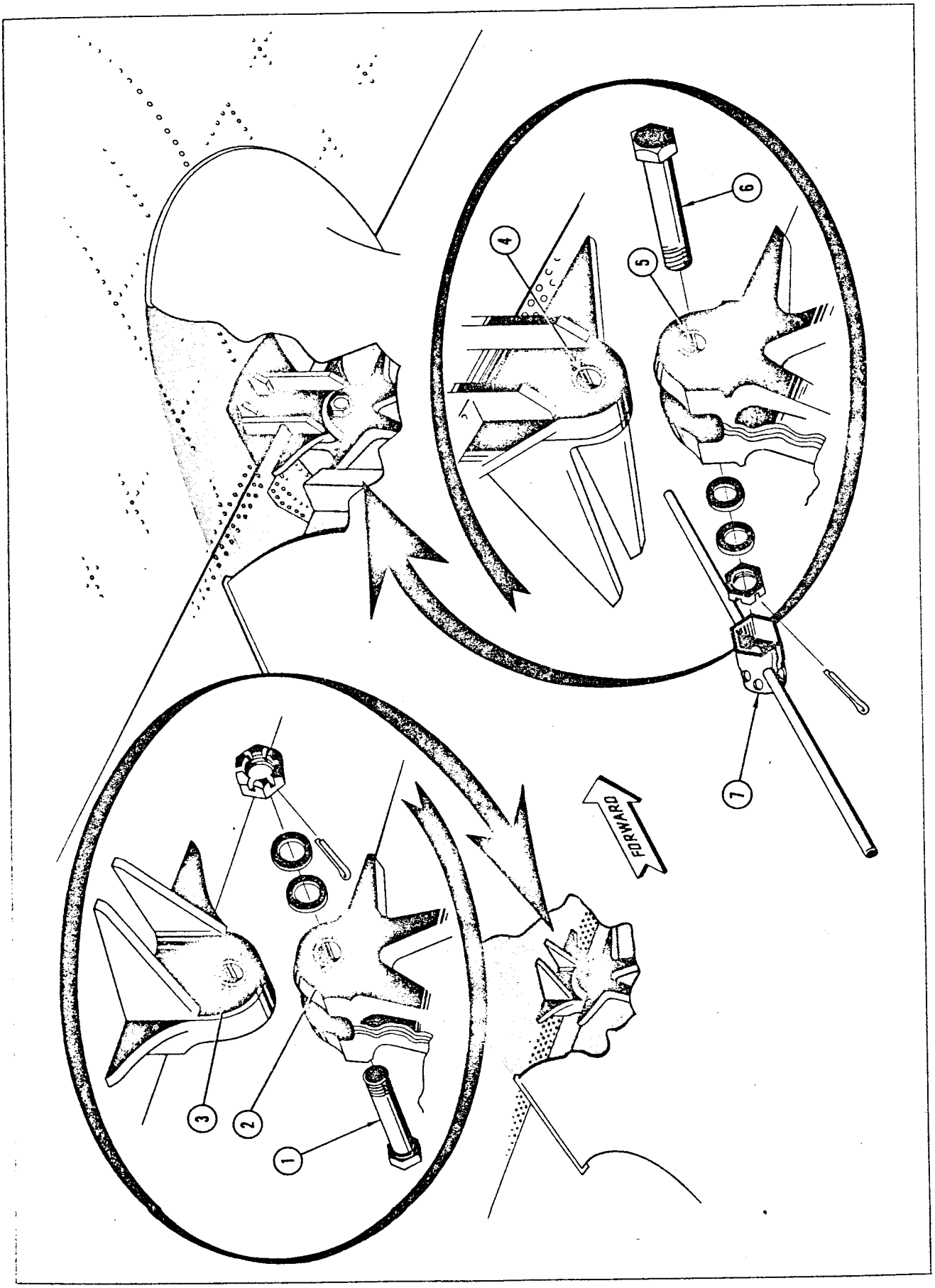


Figure 42—Wing to Hull Attachment

No.	PART No.	NAME
1	28W181	Bolt-Wing-Center Attaching Rear
	AN960-1416	Washer-Plain
	Q7102-AL1416	Washer-Plain
	AN320-14	Nut
	AN380-4-5	Cotter Pin
2	Q632-28-23	Bushing-Hull-Bulkhead No. 5
3	Q632-28-42	Bushing-Wing-Aft
4	Q632-28-44	Bushing-Wing-Front
5	Q636-32-28.5	Bushing-Wing-Bulkhead No. 4
6	28W182	Bolt-Wing-Center-Attaching Front
	AN960-1616	Washer—Plain
	Q7102-AL1616	Washer—Plain
	AN320-16	Nut
	AN380-4-6	Cotter Pin
7	28U1048	Wrench-Socket-Wing Attaching

lowing reverse procedure to that described in paragraph *a*, (12).

9. At rear spar, connect the aileron tab control cables (see Par. 18, *i*, (3), *(d)*), and the aileron cables to the push-pull tube. (See Par. 18, *e*, (4).)

Note

Tighten all cable turnbuckles to give required tensions as outlined in Section IX, Table A. For safetying of turnbuckles, see paragraph 18, *d*, (4), *(b)*, 6.

10. At bottom of front spar, near wing bolt, connect float torque tube linkage by inserting bolt (11). *(See figure 92.)*

Note

All control cables and piping are tagged when connections are broken. Fluid lines may be identified by colored bands on lines. (See Section IX, Table E.) A diagram is located on the inside of each junction box cover for hooking up wires.

11. String wires hanging from flex conduits (5), (15), (16) and (17) in superstructure through corresponding conduits hanging from leading edge to junction boxes (3), (4), (18), and (19) in leading edge. *(See figure 45.)* Connect all wires in junction boxes and connect conduits in superstructure.

12. At airplane center line connect the following control cables: propeller control cables (See Par. 11, *c*, (2), *(d)*; cowl flap control cables (See Par. 11, *f*, (2), *(d)*; engine throttle control cables (See Par. 11, *b*, (2), *(d)*; carburetor air control cables (See Par. 11, *e*, (2), *(d)*; bomb and torpedo release cables (See Section V, Par. 4, *b*, (3), *(c)*, *4*, a.); cables for arming fuse for MK 42 bomb rack. (See Section V, Par. 4, *b*, (3), *(c)*, *4*, b.)

Push dump valve control cable (3) through cut-out in lower surface leading edge skin, and connect to cable hanging loose from pulley (17). *(See figure 151.)* Connect mixture control cables at turnbuckles (26) in superstructure. *(See figure 46.)*

13. On PBY-5 airplanes prior to serial number 08349, a rubber boot de-icer system was installed. In these airplanes, attach Arens control to lever arm of distributing valve by means of clevis bolt.

14. Uncoil thermocouple wires in leading edge, carefully pull wire ends through opening in leading edge at airplane center line. Pass wires down through cut-outs on bulkhead 4 on port side of ship near the deck line. Connect engine thermocouple wires to engine temperature gages on engineer's instrument panel. Connect anti-icer thermocouple wires to wing anti-icer gage at port side of engineer's seat. Empty clips in this area are to be used to hold wires in place.

15. At lower surface of leading edge at airplane center line connect hydraulic lines (2), (3), (4), and (27); propeller anti-icer lines (12) and (16); manifold pressure lines (6), and (18); pitot lines (20) and (21); fuel vent lines (11) and (17); engine primer lines (13) and (15); oil pressure lines (7) and (19); fuel lines (9) and (24); fuel cross feed lines (23) and (10); and fuel pressure hoses (8) and (22). *(See figure 46.)*

Note

For compounds to be used on threads for making piping connections, see Section IX, Table F.

16. Install loop antenna by reversing procedure described in Par. 23, *h*, (4), *(b)*.

17. Through access door to the fuel sump, located in center superstructure, connect fuel lines at twin fittings on sump. (See Par. 15, *b*, (3), *(d)*.)

18. Install fuel sight gages as outlined in Par. 15, *b*, (10), *(d)*.

19. Install wing outer panels as outlined in paragraph *c*, (2), *(b)*.

20. Install radio sense antenna as outlined in Par. 23, *h*, (3), *(d)*.

(c) MAINTENANCE.—If the interspar structure comprising the integral fuel tanks suffers damage, it is important that gas fumes be removed from the tank area before undertaking repairs. Adequate ventilation should be provided to eliminate any possibility of personnel being overcome by the fumes, and to preclude danger of fire. This caution is to be observed even though self-sealing fuel cells have been installed in the area to be repaired.

Provisions are made for preventing corrosion to the wing internal structure and equipment. Drain holes are placed in the lower surfaces of the leading,

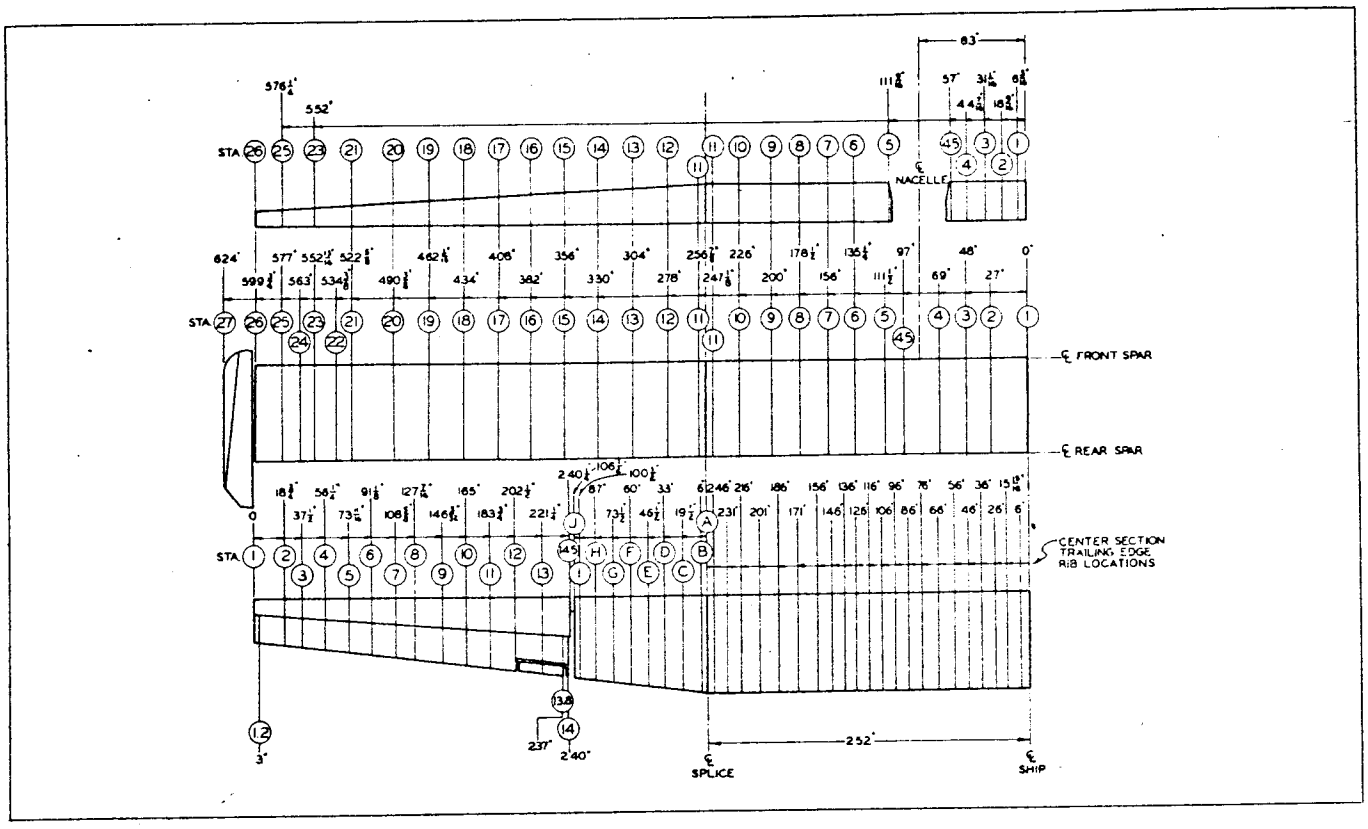


Figure 43—Wing Station Diagram

trailing edges and interspar structure. Keep the holes free of dirt and extraneous matter at all times. Rubber plugs are provided for the bomb and torpedo hoist slots in upper surface of wing, bomb release bell crank slots in lower surface of wing, torpedo hoists cable slots in lower surface of wing and work platform slots in wing leading edge.

The wing's structural strength lies primarily in the interspar structure, all failures in this section are to be repaired carefully in order to maintain original structural strength. Instructions for making repairs on the component parts of the wing are fully set forth in the Structural Repair Manual (An 01-5MA-3).

(3) CENTER SECTION LEADING EDGE (BETWEEN NACELLES).

(a) DESCRIPTION. *(See figure 44.)*—The leading edge is of all metal construction with aluminum alloy skin, aluminum alloy extruded zee stringers, and truss ribs. Contained in the leading edge are various functional installations such as, engine control cables, electrical wiring, junction boxes, fuel lines, hydraulic lines, various instrument lines, and other equipment. To gain access to these installations, door (2), (9), and (11) are located on the upper surface. Mounted on the upper surface at airplane center line is the loop antenna, and at the starboard side is the sense antenna mast. The leading edge is attached to the front spar and to the nacelles, with screws.

(b) REMOVAL.

1. To disconnect wires, conduits, control cables, etc., open access doors (2), (9), and (11); remove access doors (3) and (4) *(See figure 64.)* on both sides of forward superstructure fairing, and removable part of fairing as outlined in Par. 3, *c*, (2), *(c)*. Open access doors (1), (7), (8), and (12) *(See figure 44.)* in nacelle cowl.

2. Disconnect the electrical system as follows: (if possible, two men should work together).

CAUTION

Before breaking any electrical connections, be sure that main battery switch on main distribution panel, forward face of bulkhead 4, is off.

Note

Wires may be identified by numbers taped on wires near terminals.

a. Remove cover of center wing junction box (3). *(See figure 45.)* Disconnect all wires in this box.

b. Remove cover to ignition junction box (4) and disconnect all wires.

c. Remove cover to D. C. power junction box (19) and disconnect all wires.

d. Remove cover to A. C. power junction box (18) and remove all wires.

e. Remove cover to LH engine terminal junction box (6). Disconnect all wires in this box.

f. Remove cover to RH engine terminal junction box (2). Disconnect all wires in this box.

g. Disconnect conduit (7) from outboard face of box (2) and (6) by unscrewing conduit coupling nut. Pull wires through opening in box allowing wires to hang from open end of conduit.

h. At outboard leading edge ribs on port and starboard side, disconnect conduits and flex conduits by removing conduit coupling nuts. Pull all wires through conduit couplings in ribs allowing wires to hang from open ends of conduits.

i. Disconnect flex conduits (5), (15), (16), and (17) in superstructure by unscrewing conduit coupling nuts. Pull wires to hang from open end of conduits in superstructure.

j. Remove loop antenna from leading edge as described in Par. 23, *h*, (4), *(b)* and pull wires down into superstructure.

k. Disconnect antenna wire from top of sense antenna mast.

l. Coil all loose ends of wires and tape.

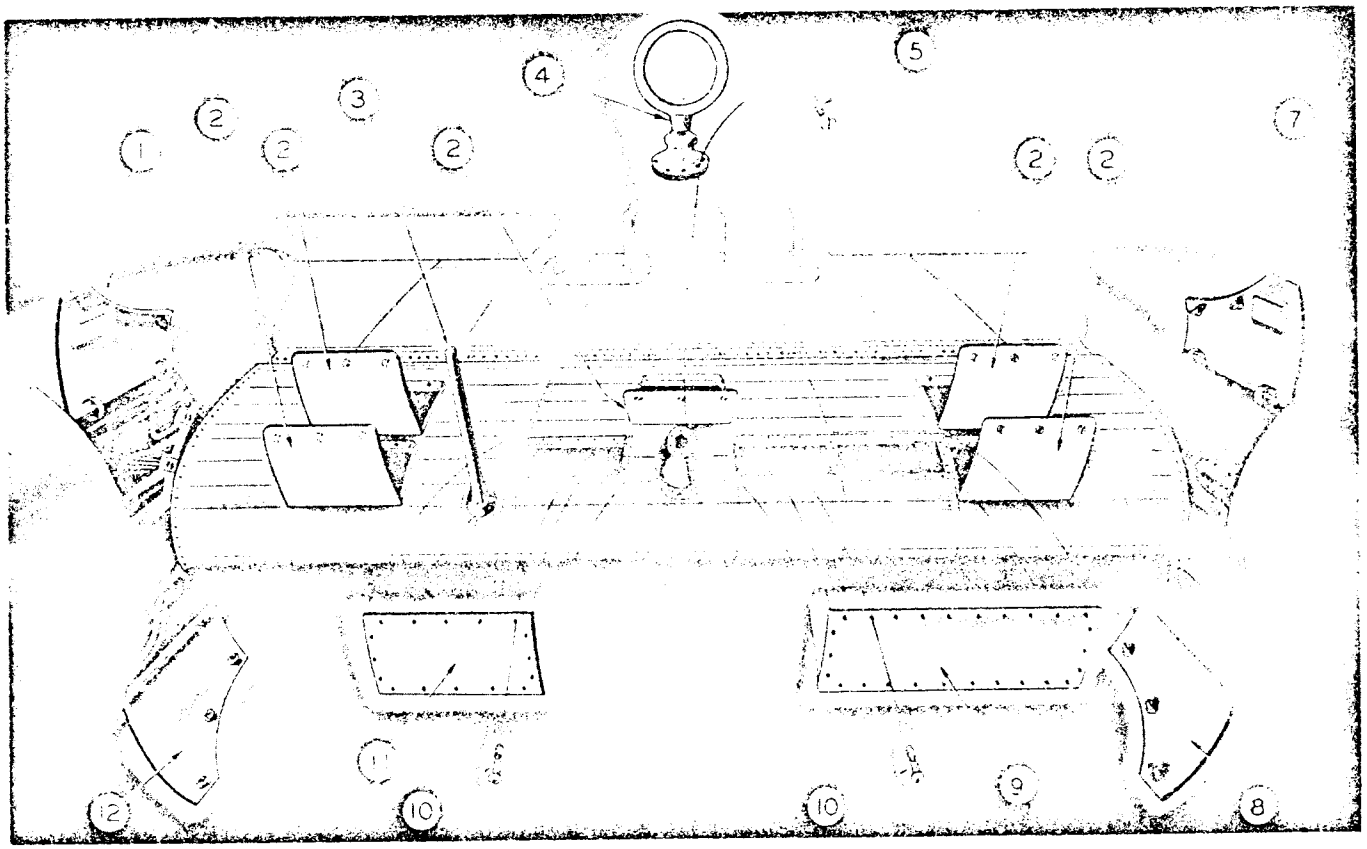
CAUTION

When breaking connections of control cables and piping, be sure to tag ends to insure proper connections at installation.

3. Break dump valve control cable at turnbuckle (5) in leading edge. *(See figure 151.)* Remove fairlead (4) and pull lower part of cable down into superstructure. Remove pulley (17) and pull upper cable back allowing it to hang free from spar.

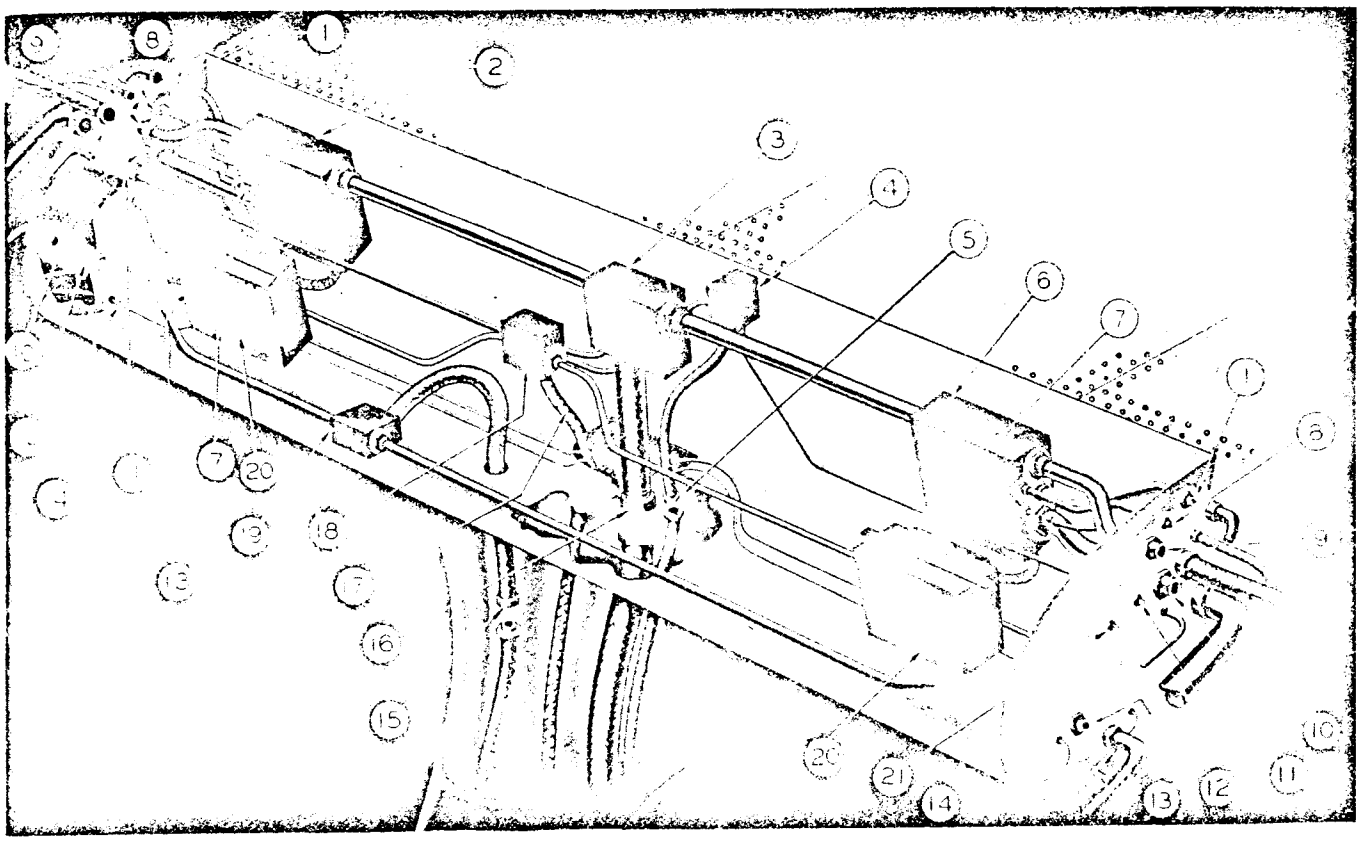
Note

On PBY-5 airplanes prior to serial number 08349, remove Arens control from distributing valve lever arm by detaching the clevis bolt.



No.	PART No.	NAME	No.	PART No.	NAME
1	28D2006-41	Nacelle Cowl Door Subassembly R.H. Inboard—Upper	8	28D2006-5	Nacelle Cowl Door Subassembly Rear Lower
2	28W173-6	Leading Edge Access Door	9	28W3017-60	Leading Edge Access Door
3	28F7096	Sense Antenna Mast	10	Q5103-3	Screw
4	CRR50053	DW-1 Loop Antenna	11	28W5010	Leading Edge Access Door
5	AN510-D10-12	Screw	12	28D2006-4	Nacelle Cowl Door Subassembly Rear Lower
7	28D2006-3	Nacelle Cowl Door Subassembly L.H. Inboard—Upper			

Figure 44—Center Section Leading Edge Access Doors



No.	NAME	No.	NAME
1	Conduit—Fast Feathering	11	Conduit—Ignition
2	Junction Box—R. H. Engine Terminal	12	Conduit—D. C. Power
3	Junction Box—Main Battery	13	Thermocouple—Anti-Icer
4	Junction Box—Ignition	14	Thermocouple—Engine
5	Flex Conduit—Ignition	15	Flex Conduit—D. C. Power
6	Junction Box—L. H. Engine Terminal	16	Flex Conduit—Main Harness
7	Conduit—Liquidometer	17	Flex Conduit—A. C. Power
8	Flex Conduit—Anti-Icer Actuator	18	Junction Box—A. C. Power
9	Flex Conduit—Outer Wing	19	Junction Box—D. C. Power
10	Conduit—General	20	Main Batteries
		21	Flex Conduit—A. C. Power

Figure 45—Center Section Leading Edge Electrical Equipment

4. Break mixture control cables at turnbu kles (1) outboard of leading edge ribs and at turnbu kles (26) in superstructure. *(See figure 46.)*

5. Check to see that main fuel shut off valve in :uperstructure is in "OFF" position, and drain lines as described in Par. 15, *b*, (3), *(b)*. At fittings where hy draulic line goes through the deck skin between hu l stations 3.66 and 4.0, break lines, drain, and reco nect.

6. On outboard side of leading edge ribs, on pc t and starboard side and at center line of ship on lo er side of leading edge, make the following tubing di :onnections: *(See figure 46.)*

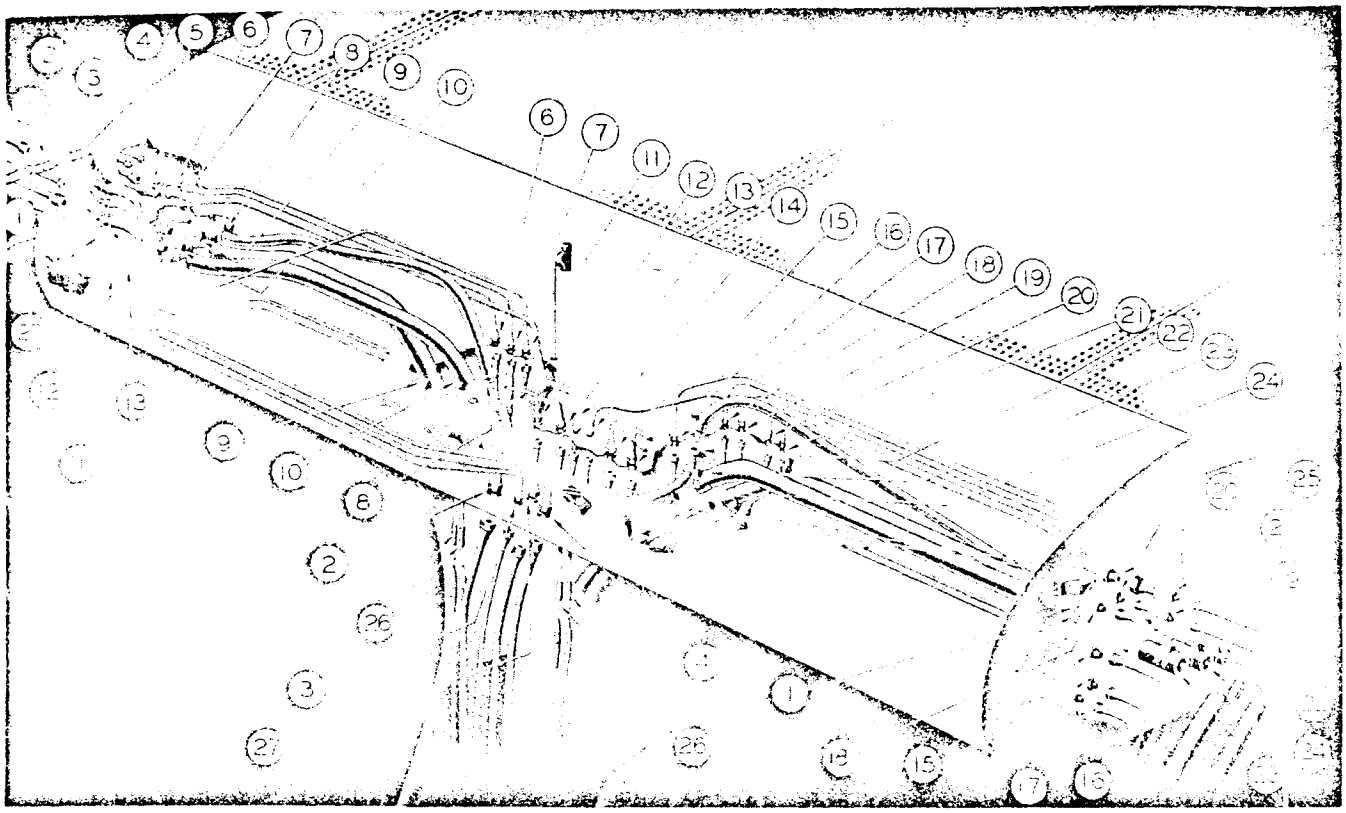
a. By unscrewing bulkhead coupling nuts di :onnect hydraulic lines (2), (3), (4), and (27); vacuum lines (5), (14), and (25); anti-icer lines (12) and (16); manifold pressure lines (6) and (18); pitot lines (20) and (21); fuel vent lines (11) and (17); engine primer lines (13) and (15); oil pressure lines (7) and (19).

Notes

On PBY-5 airplanes there are only two hydraulic lines.

On PBY-5 airplanes prior to serial number 08349, disconnect de-icer air lines by breaking connections below leading edge at center line of airplane and outboard of leading edge ribs on port and starboard sides.

b. Disconnect main fuel lines (9) and (24), cross feed fuel lines (10) and (23), and fuel pressure



No.	NAME	No.	NAME
1	Outboard Turnbuckle—Mixture Control Cables	15	Engine Primer Line (LH)
2	Hydraulic Line (RH)	16	Anti-Icer Line (LH)
3	Hydraulic Line (RH)	17	Fuel Vent Line (LH)
4	Hydraulic Line (RH)	18	Manifold Pressure Line (LH)
5	Vacuum Line (RH)	19	Oil Pressure Line (LH)
6	Manifold Pressure Line (RH)	20	Pitot Pressure Line
7	Oil Pressure Line (RH)	21	Pitot Static Line
8	Fuel Pressure Line (RH)	22	Fuel Pressure Line (LH)
9	Main Fuel Line (RH)	23	Cross Feed Fuel Line (LH)
10	Cross Feed Fuel Line (RH)	24	Main Fuel Line (LH)
11	Fuel Vent Line (RH)	25	Vacuum Line (LH)
12	Anti-Icer Line (RH)	26	Center Turnbuckles—Mixture Control Cables
13	Engine Primer Line (RH)	27	Hydraulic Line
14	Vacuum Lines—Center		

Figure 46—Center Section Leading Edge—Tubing and Cables

lines (8) and (22) by breaking connections below leading edge at center line of airplane, and outboard of leading edge ribs on port and starboard sides.

Note

Tape ends of tubing after breaking connections to prevent dirt from getting into lines.

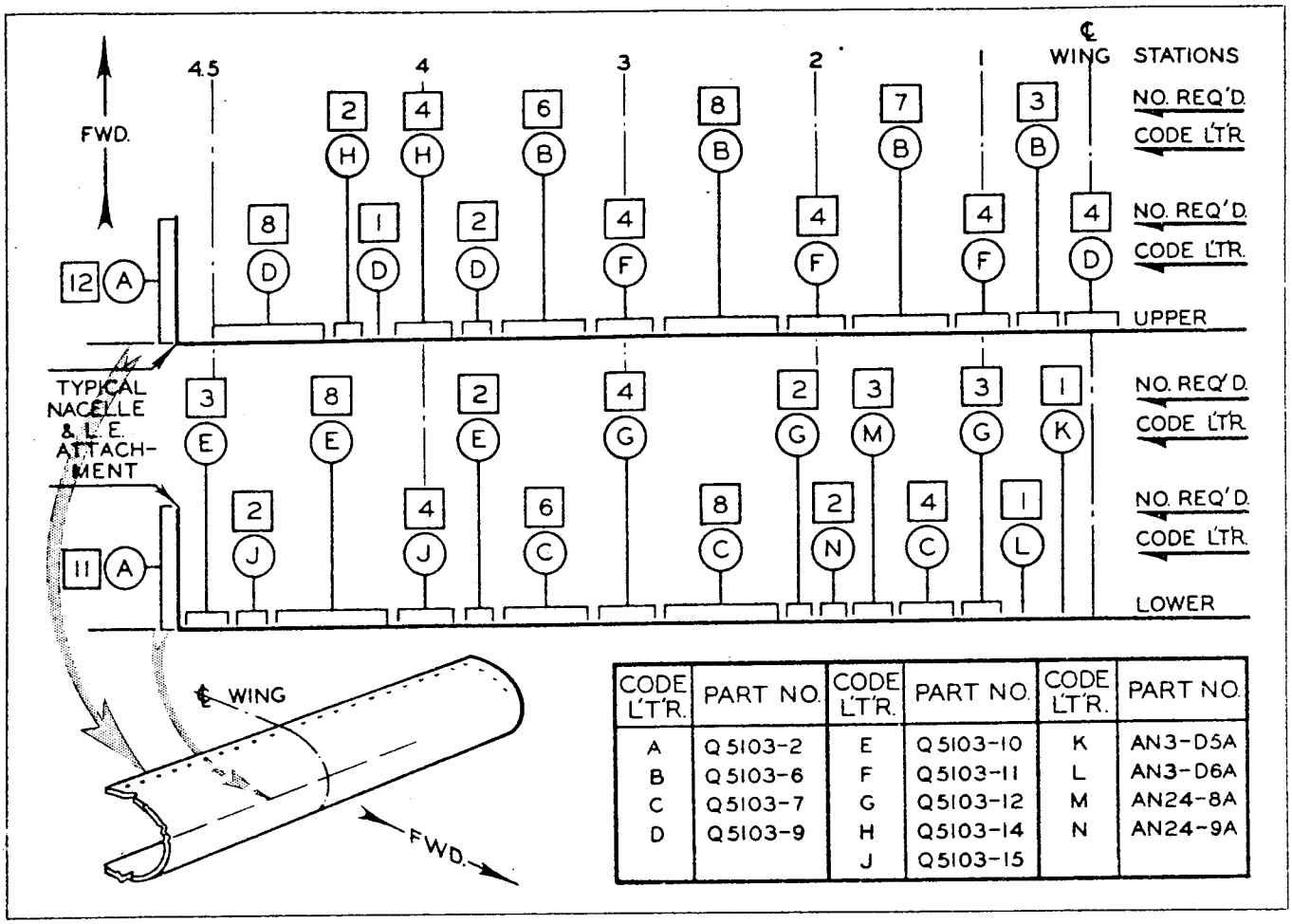
7. Disconnect anti-icer thermocouple wires (13) from anti-icer duct at outboard side of each nacelle, and from wing anti-icer gage at port side of engineer's seat. Disconnect engine thermocouple wires (14) at each nacelle firewall, and from engine temperature gages on engineer's instrument panel. Tape wire ends and carefully pull them into the wing leading edge and coil. (See Par. 22, *s*, (3).)

8. Disconnect tubing bonding braid outboard of leading edge ribs on port and starboard sides.

9. At inboard side of each nacelle, remove screws (1) and (2) and remove flange assembly (3). *(See figure 48.)*

10. Remove all screws and bolts attaching leading edge to front spar except two or three screws on upper side to hold leading edge in place. At inboard side of each nacelle remove screws. *(See figure 47.)*

11. For removal of center leading edge, to



CODE LT'R.	PART NO.	CODE LT'R.	PART NO.	CODE LT'R.	PART NO.
A	Q5103-2	E	Q5103-10	K	AN3-D5A
B	Q5103-6	F	Q5103-11	L	AN3-D6A
C	Q5103-7	G	Q5103-12	M	AN24-8A
D	Q5103-9	H	Q5103-14	N	AN24-9A
		J	Q5103-15		

Figure 47—Center Section Leading Edge Screw Diagram

prevent damage in handling, at least four men are required. Three men should hold the leading edge while the fourth man removes the remaining screws.

(c) INSTALLATION.

1. Apply a coat of zinc chromate paste to the faces of the upper and lower attaching bars where they will contact surfaces of the front spar flanges.

2. Place leading edge in position on wing between nacelles.

3. Install leading edge attaching screws and bolts at front spar, and screws at inboard side of nacelle shown on figure 47.

4. Install nacelle flange assembly (3) at inboard side of each nacelle by putting parts into place and securing with five screws (1). Install screws (2) attaching flange assembly to leading edge. *(See figure 48.)*

Notes

1. Every control cable and each piece of tubing is tagged when connections are broken.
2. Fluid lines may be identified by colored bands on lines. (See Section IX, Table E.)
3. Tighten at all turnbuckles to give required tensions as outlined in Section IX, Table A. For safetying of turnbuckle, see paragraph 18, *d*, (4), *(b)*, *6*.
4. All wires are taped with a number for identification.
5. A diagram is located on the inside of each junction box for hooking up wires.

5. Push dump valve control cable (3) through cut-out in lower surface leading edge skin. Thread cable (6) through pulley bracket (18), install pulley (17), and connect cable at turnbuckles (5). Install fair-lead (4). *(See figure 151.)*

Note

On PBY-5 airplanes prior to serial number 08349, attach Arens control to distributing valve lever arm by means of the clevis bolt.

6. Connect mixture control cables in superstructure at turnbuckles (26) and on inboard side of

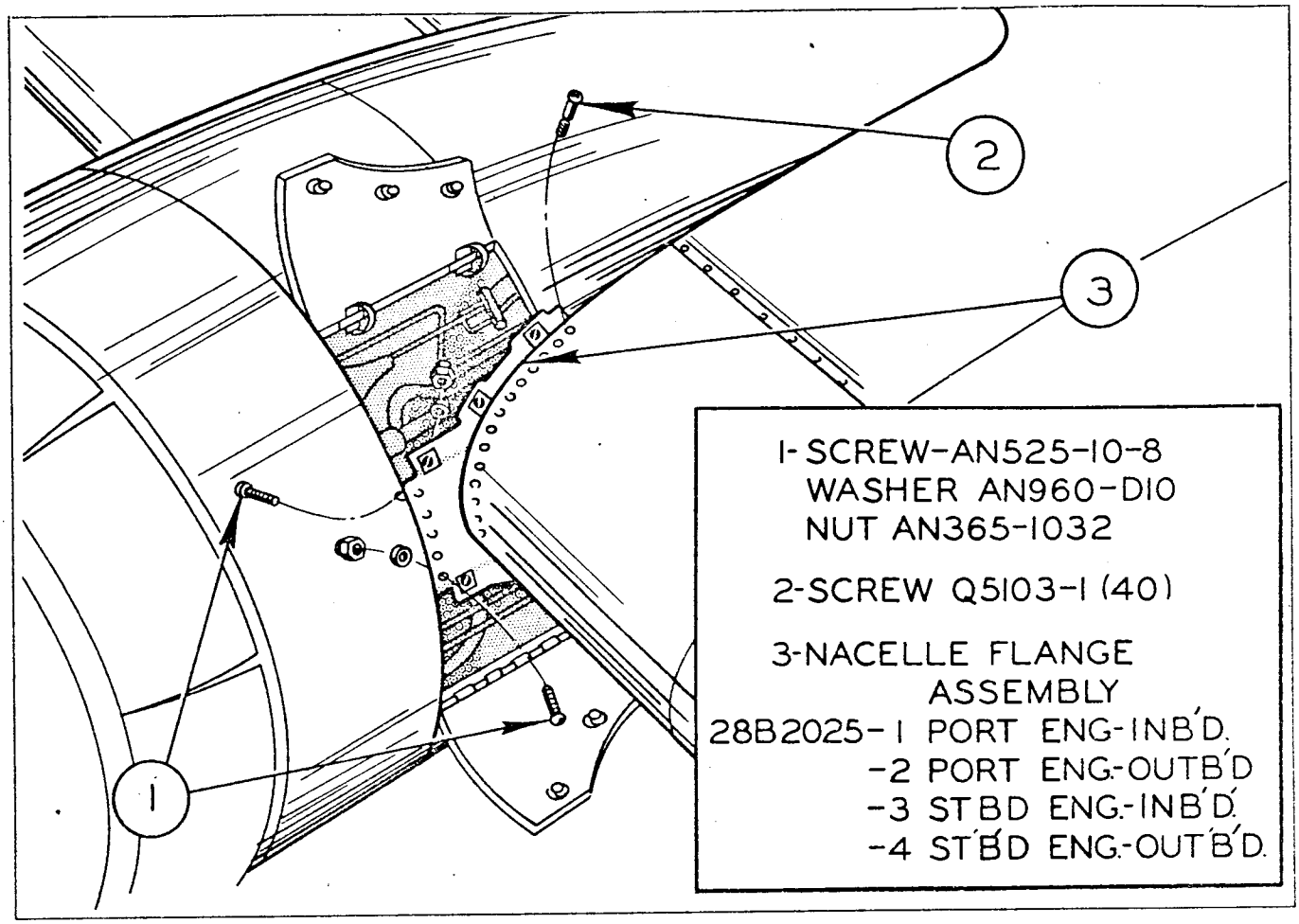


Figure 48—Screw Diagram—Leading Edge—Nacelle Flange Assembly

each nacelle aft of firewall at turnbuckles (1). *(See figure 46.)*

7. String wires hanging from flex conduits (5), (15), (16), and (17) in superstructure through corresponding conduits hanging from leading edge to junction boxes (4), (19), (18), and (3) in leading edge. *(See figure 45.)* Connect all wires in junction boxes and connect conduits in superstructure.

8. String wires hanging from conduits at nacelles through the corresponding conduits which lead inboard. Connect all wires in junction boxes (2), (3), (4), (6), (18), and (19). Connect all conduits at coupling fittings.

9. Uncoil anti-icer and engine temperature thermocouple wires in leading edge, and thread through cut-outs in leading edge ribs. Connect anti-icer wires at anti-icer ducts on outboard side of each nacelle. Connect engine thermocouple wires at each nacelle firewall. Connect ends of thermocouple wires at mechanic's station as described in paragraph *b*, (2), *(b)*, 14.

Note

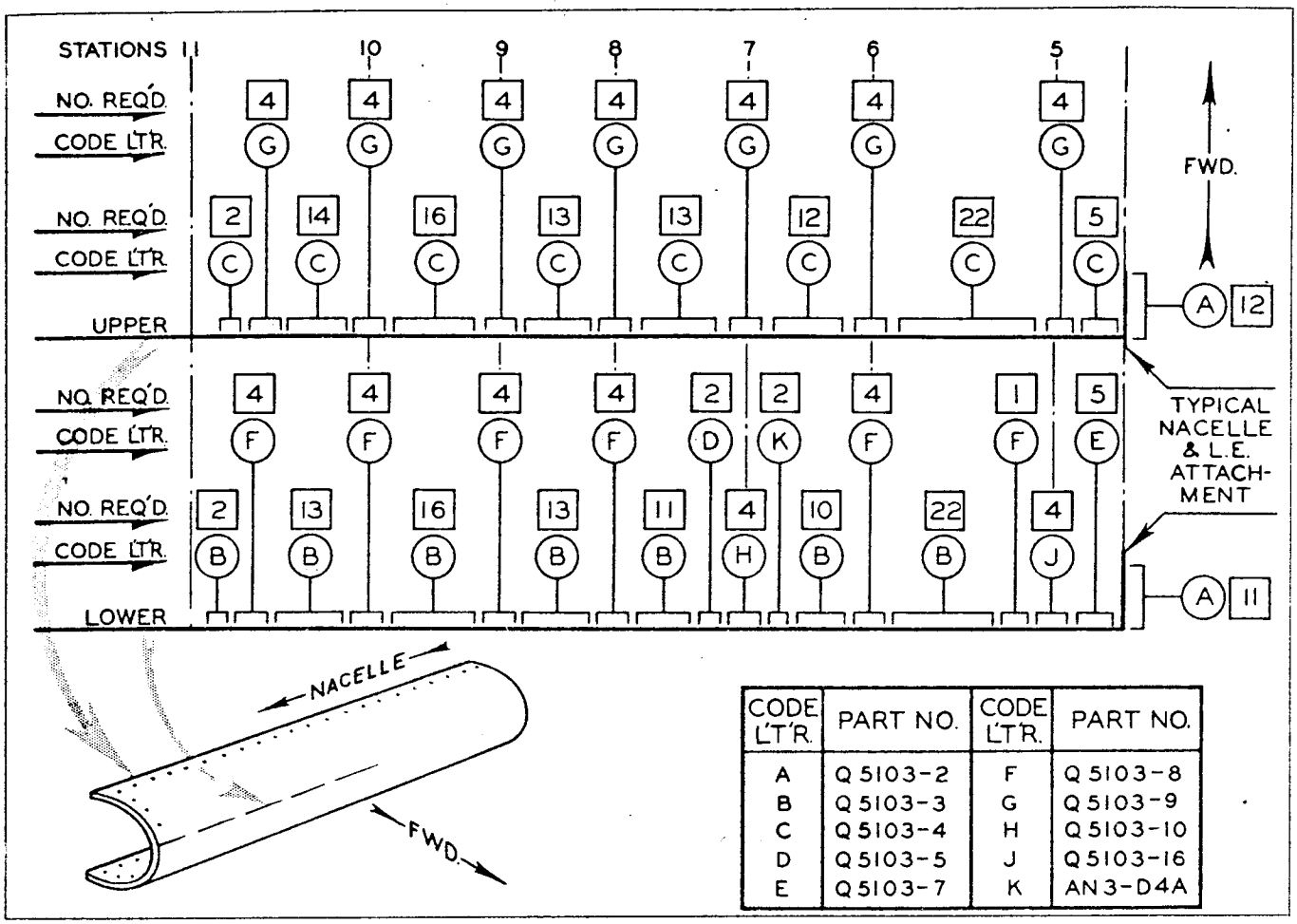
For compounds used on pipe threads, see Section IX, Table F.

10. At lower surface at airplane center line and at leading edge ribs adjacent to nacelles, connect hydraulic lines (2), (3), (4), and (27); propeller anti-icer lines (12) and (16); manifold pressure lines (6) and (18); pitot lines (20) and (21); fuel vent lines (11) and (17); engine primer lines (13) and (15); oil pressure lines (7) and (19); main fuel lines (9) and (24); cross feed fuel lines (10) and (23); fuel pressure lines (8) and (22) and vacuum lines (5), (14) and (25). *(See figure 46.)*

Note

On PBY-5 airplanes prior to serial number 08349, connect rubber boot de-icer line below leading edge at center line of airplane and outboard of leading edge ribs on port and starboard sides.

11. Connect bonding braid at tubing outboard of leading edge ribs at port and starboard sides.



CODE LTR.	PART NO.	CODE LTR.	PART NO.
A	Q 5103-2	F	Q 5103-8
B	Q 5103-3	G	Q 5103-9
C	Q 5103-4	H	Q 5103-10
D	Q 5103-5	J	Q 5103-16
E	Q 5103-7	K	AN 3-D4A

Figure 49—Screw Diagram—Center Section Leading Edge—Outer

12. Install and connect loop antenna as outlined in Par. 23, *h*, (4), *(d)*.

13. Connect antenna wire to top of sense antenna mast.

(4) OUTER LEADING EDGE (CENTER SECTION).

(a) DESCRIPTION.—The leading edge is of all metal construction with aluminum alloy skin, aluminum alloy extruded zee stringers, and truss type ribs. This assembly is attached to the front spar of the wing extending from the outboard side of the nacelle to the panel splice. Enclosed in the leading edge is a heat anti-icing duct on port and starboard side, a landing light on each side, and a pitot-static mast on port side only. There are five access doors located on the upper surface and three access doors in the lower surface to provide access to equipment. *(See figure 20.)*

(b) REMOVAL.

1. Through outboard nacelle doors (1) and (2) *(See figure 50.)* break the following connections:

a. Disconnect anti-icer duct by removing screws (16).

b. At actuator motor disconnect flex conduit (18) and pull out plug.

c. Disconnect anti-icer exit door actuator arm by removing bolt (17).

d. Break capillary tube to duct connection by removing screws (13).

e. Disconnect pitot lines (15) at inboard leading edge rib on port side by unscrewing coupling nuts.

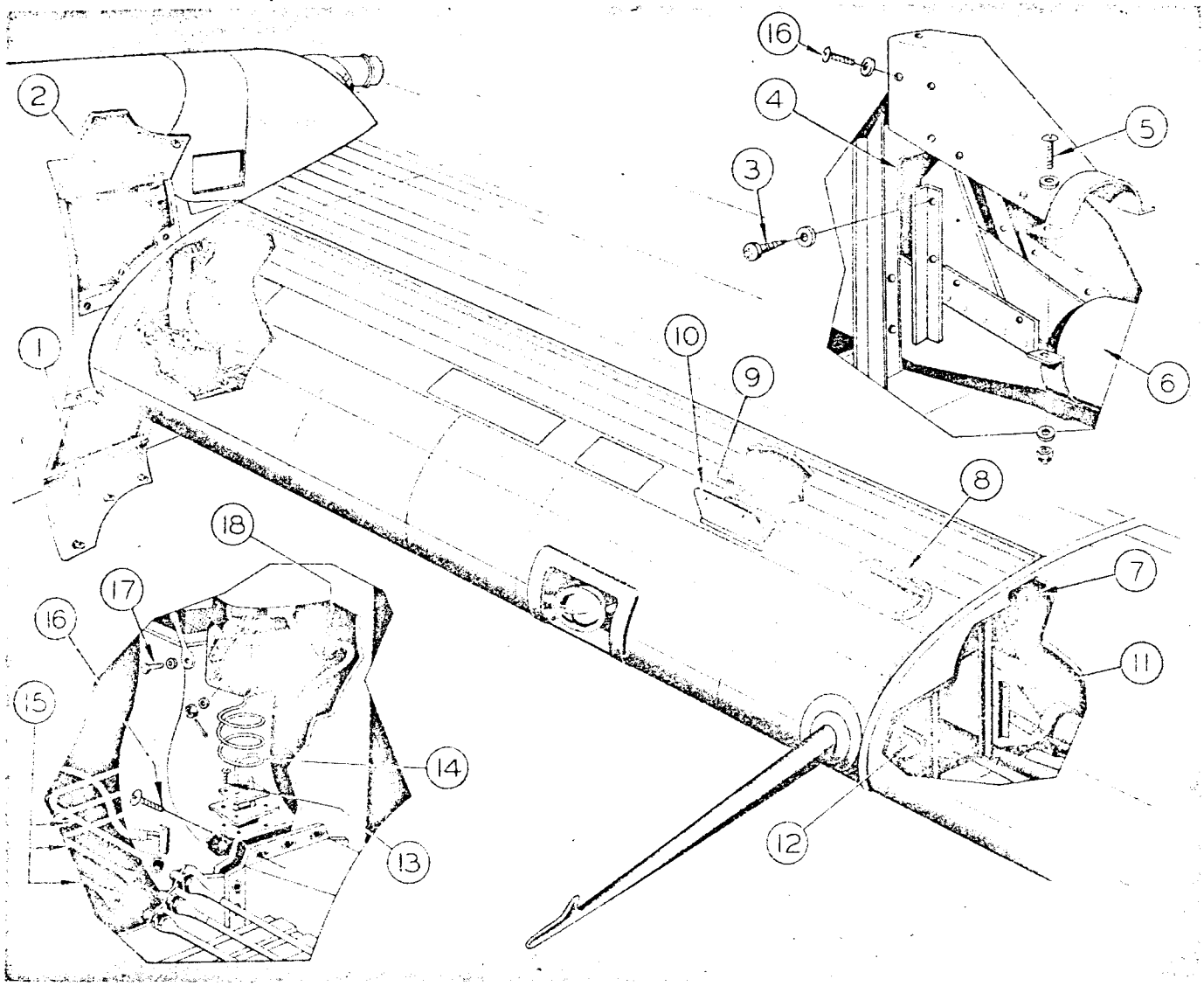
Note

PBY-5 airplanes prior to serial number 08349 contained no heat anti-icing ducting. On these airplanes, break the four de-icer hose connections outboard of each nacelle and three tube de-icer connections at each panel splice by unscrewing coupling nuts.

2. Through leading edge access doors (6), (57), and (58) *(See figure 20.)* remove heat anti-icer transition duct as follows: *(See figure 50.)*

a. Remove screws (5) disconnecting transition duct (11) from duct (6).

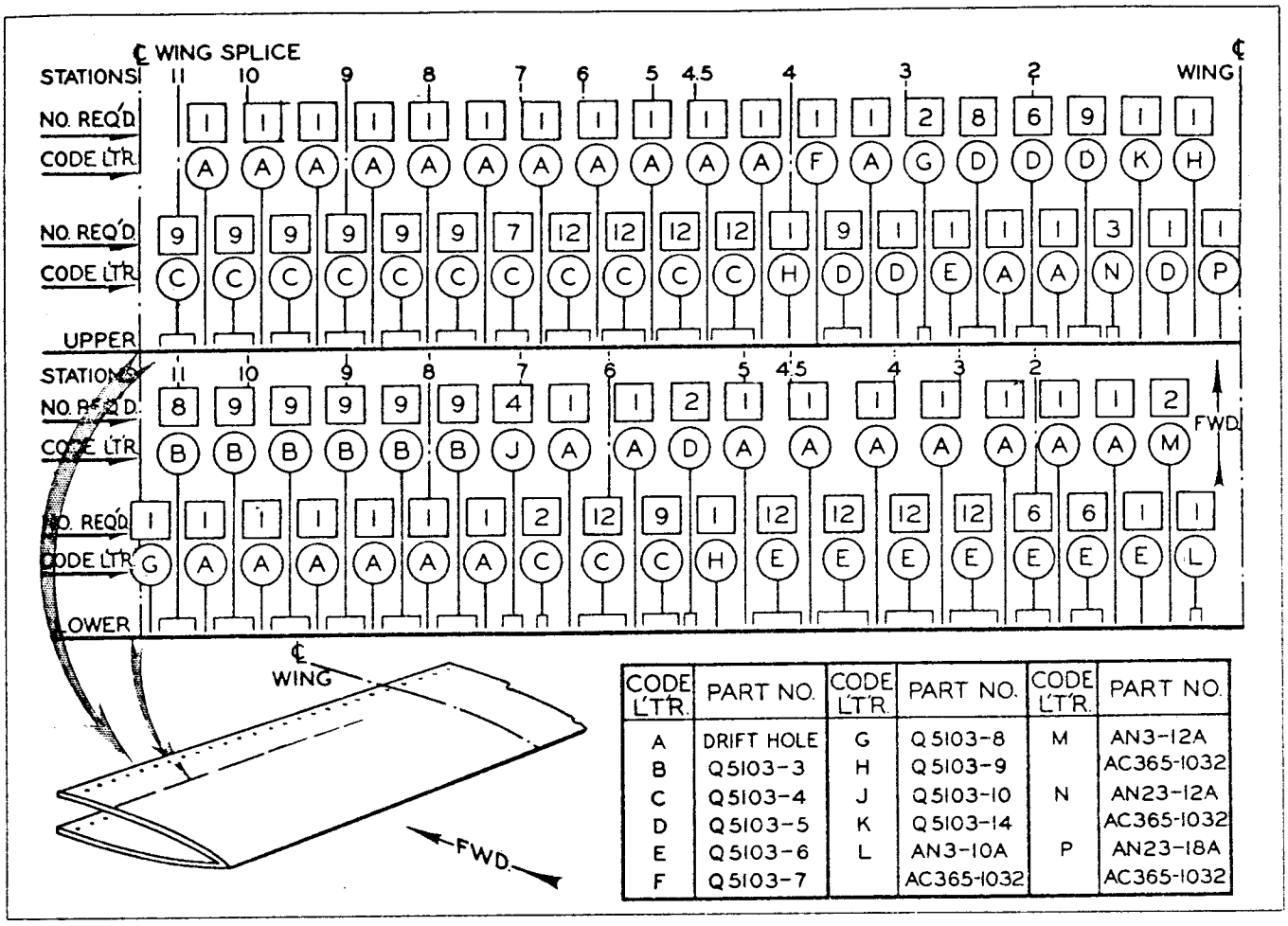
b. Disconnect transition duct from inboard side by removing screws (16).



No.	PART No.	NAME
1	28D2006-4(LH)	Nacelle Door—Lower Outboard
	28D2006-5(RH)	
2	28D2006-31(LH)	Nacelle Door—Upper Outboard
	28D2006-41(RH)	
3	AC530-10-8	Screw
	Q7103-A10	Washer
4	28F6733	Duct Installation—Center Section Leading Edge
5	AN526DD1032-8	Screw
	AC372-D1032	Nut
6	28F6736	Duct Installation—Outer Panel Leading Edge
7		Pitot Heater Flex Conduit
8	28W016-11	Access Door
9		Landing Light Flex Conduit

NO.	PART NO.	NAME
10		Access Door
11	28F6750	Anti-Icing Transition Duct
12	28W016-11	Access Door
13	AN515-D6-8	Screw
	AC372-D632	Nut
14		Capillary Tube
15		Pitot Lines
16	AN526-D1032-8	Screw
17	AN3-5	Bolt
	AN320-3	Nut
	AN380-2-2	Cotter
	AN960-AL10L	Washer
	Q810-D6-10	Spacer
18		Actuator Motor Flex Conduit

Figure 50—Center Section Leading Edge—Outer



CODE LTR.	PART NO.	CODE LTR.	PART NO.	CODE LTR.	PART NO.
A	DRIFT HOLE	G	Q5103-8	M	AN3-12A
B	Q5103-3	H	Q5103-9		AC365-1032
C	Q5103-4	J	Q5103-10	N	AN23-12A
D	Q5103-5	K	Q5103-14		AC365-1032
E	Q5103-6	L	AN3-10A	P	AN23-18A
F	Q5103-7		AC365-1032		AC365-1032

Figure 51—Center Section Trailing Edge Screw Diagram

c. Remove screws (3), split transition duct (11) in half and remove.

3. Remove splice fairing as outlined in paragraph *c*, (2), *(a)*, *4*, a.

4. Remove leading edge bolts (1) and (9) at panel splice. *(See figure 55.)*

5. Enter wing through manhole (22) *(See figure 20.)* and break the following connections:

Note

Wires may be identified by numbers taped on wires near terminals.

a. On port side only, remove cover to junction box mounted on upper surface of wing between stations 10 and 11, and disconnect pitot heater wires 869 and 1149.

Note

On PBY-5 airplanes, only one wire (869) leads to the pitot tube.

b. Remove cover to bomb bay junction box located on the lower surface between station 9.0 and 10.0, and disconnect landing light wires 294 and 296 on port side, and wires 374 and 376 on starboard side.

6. Through access door (8) *(See figure 50.)* on port side, disconnect pitot heater flex conduit (7) at front spar, and pull wires through spar leading edge.

7. Through access door (10) disconnect landing light flex conduit (9) at front spar, and pull wires through spar into leading edge.

8. Remove outboard nacelle flange assembly. At outboard side of each nacelle, remove screws (1), and (2), and remove flange assembly (3). *(See figure 48.)*

9. Remove screws (5) and (6) at upper front strut fairing, and slip fairing down strut. *(See figure 59.)*

CAUTION

Pitot-static mast must be well protected by a wooden fixture before removing leading edge.

10. Remove all screws attaching leading edge to front spar and nacelles, except two or three screws on upper side to hold leading edge in place until removal of leading edge is desired. *(See figure 49.)*

(c) INSTALLATION.

1. Apply a coat of zinc chromate paste to the faces of the upper and lower attaching bars where they will contact surfaces of the front spar flanges.

2. Put leading edge into place and install screws attaching leading edge to front spar and nacelles. *(See figure 49.)*

3. At leading edge panel splice, install bolts (1) and (9). *(See figure 55.)*

4. Put outboard flange assembly into place, and install screws (1) and (2). *(See figure 48.)*

Note

All wires are taped with a number for identification. A diagram is located on the inside of each junction box cover to show how the wires are to be hooked up.

5. The connection of the wires to the pitot-static heater, which is located on the port side of the airplane, can be more easily performed as a two man operation. By means of manhole (22), one man should be stationed within the wing at the junction box mounted on upper surface between stations 10.0 and 11.0; the other man should be stationed on the wing upper surface at leading edge access door (58). *(See figure 20.)* Connect wires as follows: Through leading edge access door, uncoil wires and push through conduit fitting on front spar; from inside of wing, pull wires into the junction box, and connect wires at terminals; on forward side of spar, connect flex conduit to conduit fitting.

Note

On PBY-5 airplanes, only one heater wire is connected to the pitot tube.

6. The connection of the wires to the landing lights can be more easily performed as a two man operation. By means of manhole (22), one man should be stationed within the wing at bomb bay junction box mounted on lower surface of wing between stations 9.0 and 10.0; the second man should be stationed on the wing at leading edge access door (59). Connect wires as follows: Through leading edge access door, uncoil wires and push through conduit fitting on front spar; from inside of wing pull wires into junction box; connect wires at terminals in junction box; on forward side of front spar, connect flex conduit fitting.

7. Install anti-icer transition duct (11), *(See figure 50.)* working through access doors (6), (57) and (58). *(See figure 20.)* as follows:

Note

On PBY-5 airplanes prior to serial number 08349, rubber boot de-icing was installed instead of heat anti-icing. On these airplanes, connect the three tube de-icer lines at each wing outer panel splice and the four de-icer hose lines outboard of each nacelle by means of coupling nuts.

a. Insert bottom half of transition duct into leading edge through access door (6), and place in position with the inboard end of transition duct inside of duct (4). *(See figure 50.)*

b. Insert top half of transition duct in leading edge through access door (6) *(See figure 20.)*, and place in position with inboard end inside of duct (4) *(See figure 50.)* so that screw holes line up with corresponding screw holes in bottom half of duct.

c. Install screws (3), and (6).

d. Install screws (5) attaching transition duct to outboard duct (6).

8. Through outboard nacelle doors (1) and (2) make the following connections:

a. Connect anti-icer duct in leading edge to duct in nacelle by installing screws (16). *(See figure 50.)*

b. Place anti-icer exit door actuator arm in position and connect to actuator motor by installing bolt (17).

c. Plug in wires at back side of actuator motor and connect flex conduit (18).

d. Place capillary tube from actuator motor in position on anti-icer duct and install screws (13).

e. On port side, connect pitot lines (15) at inboard leading edge rib by connecting coupling nuts.

9. Place upper front strut fairing in position and install screws (5), and (6). *(See figure 59.)*

10. Install panel splice fairing as outlined in paragraph *c*, (2), *(b)*, *6.*

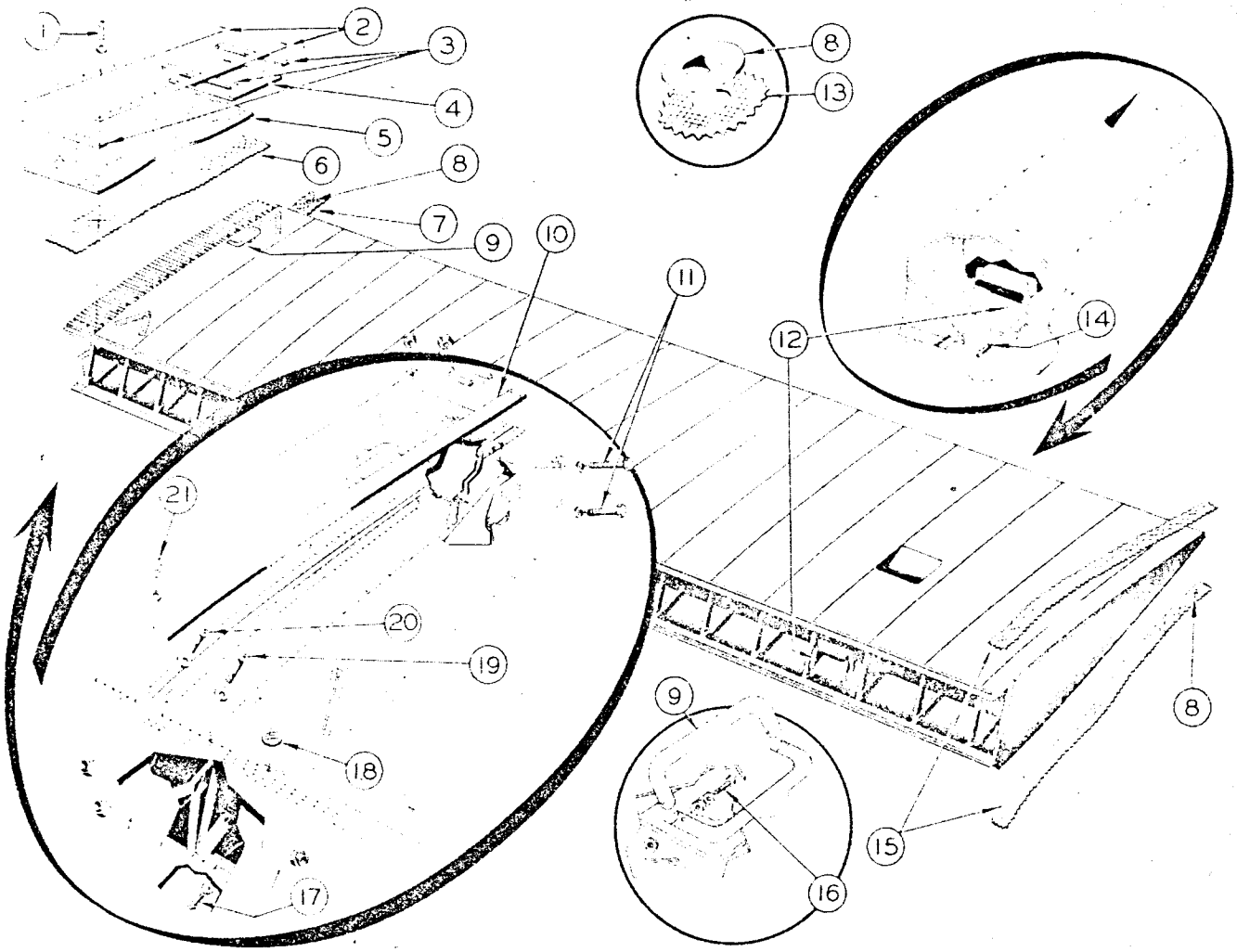
(5) CENTER SECTION TRAILING EDGE. *(See figure 52.)*

(a) DESCRIPTION.—The center section trailing edge is composed of a left and right-hand assembly, joined at the center line of the airplane. Each assembly is a fabric-covered framework of aluminum alloy truss ribs, formed trailing edge section, and extruded aluminum alloy tapping strips for attachment to the rear spar flanges. Access to the interior in installed position is made through three access flaps in the fabric. At the center line of the airplane, the upper surface is braced to provide a 13 inch wide walkway from rear spar aft to the trailing edge. Retractable handgrips are installed at each side of this walkway.

(b) REMOVAL.

1. Remove superstructure aft fairing. Use procedure of Par. *3*, *c*, (2).

2. Withdraw screws (1) and remove walkway molding strips (2) and (3). *(See figure 52.)* Pull off matting (4) and corkprene (5) and the 5½ inch wide fabric tape doped to upper surface. Withdraw the two self-tapping screws (21) from each end of metal gap plate (10) and remove plate. From the lower surface center line, strip the 3½ inch wide fabric gap tape (7).



No.	PART No.	NAME
1	AN515-6-10	Screw
	Q7102-AL6	Washer
2	28W005-150	Molding Strip
3	28W005-170	Molding Strip
4	28W005-153	Rubber Matting
5	28W005-152	Corkprene Matting
6	28W3005-114	Gap Tape
7	28W3005-116	Gap Tape
8	NAF1093-4	Grommet
9	28W1072	Handgrip
10	28W3005-115	Gap Cover
11	AN3-12A	Bolt
	AN365-1032	Nut
	AN960-A10	Washer
	Q612-D7-32	Spacer
12	28F6798	Anti-Icer Exhaust Duct
13	28W011-29	Fabric Patch
14	AN526-D1032-10	Screw
15	28W4001-2	Gap Tape

No.	PART No.	NAME
16	AN393-41	Pin
	AN380-2-2	Cotter
	Q610-D6-1	Spacer
	Q610-D6-5	Spacer
	Q608-D3-3	Spacer
17	AN3-12A	Bolt
	AN365-1032	Nut
	AN960-A10	Washer
	Q7102-AL10	Washer
18		½ inch diameter fabric patch
19	AN23-12A	Bolt
	Q7102-AL10	Washer
	AN365-1032	Nut
20	AN23-18A	Bolt
	Q7102-AL10	Washer
	AN365-1032	Nut
21	Q5033A-6-4	Self Tapping Screw

Figure 52—Center Section Trailing Edge

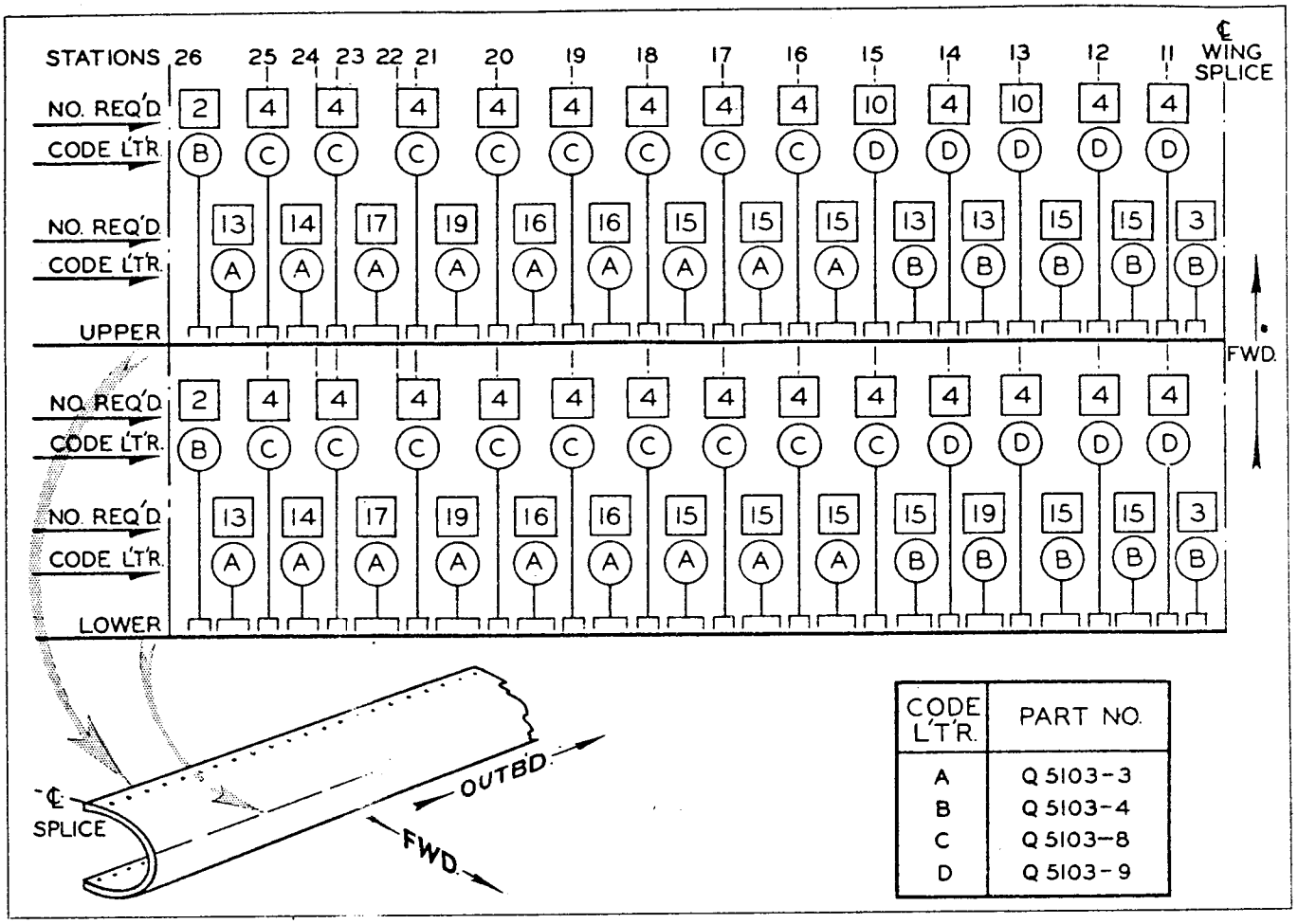


Figure 53—Outer Panel Leading Edge Screw Diagram

Note

Save the grommet (8) on gap tape for reapplication on assembly.

3. Through adjacent access flap in the upper surface near the center line, remove two bolts (11) attaching left hand and right trailing edges together at aft end.

Note

Care should be taken that washers are not lost when removing bolts (11)

4. Remove three bolts (7). Procedure: Man on upper surface of wing uses ½ inch socket ratchet wrench, while man below wing reaches inside aft superstructure to hold bolt with ⅜ in. open-end wrench.

5. Remove two clevis bolts (19), (20), by reaching through adjacent access flap to hold ⅜ inch open-end wrench on nuts, and unscrewing bolt from upper surface.

6. Remove fuel dump tube from wing lower surface. For procedure, see Par. 3, *c*, (2), *(a)*.

7. Enter wing through upper surface access door (22). *(See figure 20.)* and, at rear spar, remove fourteen screws (14) freeing anti-icing exhaust duct (12) from rear spar web. *(See figure 52.)*

Note

Heat anti-icing ducting was not installed on PBY-5 airplanes prior to serial number 08349.

8. At upper end of rear strut remove screws (8) and (9). *(See figure 59.)* Sliding fairing (11) down the strut.

9. Remove panel splice fairing and fairing end cap in accordance with paragraph *c*, (2), *(a)*, *4*, a.

10. At outer end of trailing edge, pull off gap tape (15) from upper and lower surfaces where it covers crevice between center section and outer panel trailing edges.

Note

Save the grommet (8) on gap tape for reapplication on assembly.

11. Make provision to support trailing edge, then remove all attaching screws shown in figure 51.

12. To remove handgrip (9) from trailing edge, reach through adjacent access flap and withdraw cotter pins and remove two pins (16). *(See figure 52.)*

(c) INSTALLATION.

1. If handgrip (9) was removed, install by placing in position and inserting and cottering two clevis pins (16).

2. Remove ½ inch diameter fabric discs (18) covering trailing edge drift holes in the line of trailing edge attaching holes through the rear spar upper and lower flange.

3. Coat, with zinc chromate paste, the faces of the upper and lower attaching bars where they will contact surfaces of the rear spar flanges.

4. Place trailing edge in positions on wing, using 3/16 inch diameter drift pins in drift holes to locate and hold the trailing edge. Three men are required for this operation.

5. Insert all trailing edge attaching screws shown in figure 51.

6. Apply gap tape (15) at outer end of trailing edge. Tape is 3¾ inches wide, pinked-edge, pre-acetate-doped tape, grade A fabric, specification 49C13. Dope to inner and outer trailing edges over crevice between upper and lower surfaces. Cut 11/16 diameter hole in lower gap tape in line with aft drain holes in trailing edge. Dope grommet (8) with nitrate dope and place over 11/16 diameter hole. The grommet is to be secured in place by doping patch (13) over the grommet. Finish to match adjacent color. *(See figure 52.)*

7. Perform, in reverse order, removal steps of paragraphs *b,* (5), *(b), 3* through *b,* (5), *(b), 8.*

8. Place metal gap cover (10) in position and secure with two self-tapping screws (11) at each end. *(See figure 52.)*

9. Dope fabric tape (16) over the gap cover on upper surface.

10. Dope 3¾ inch wide, pinked-edge, pre-nitrate-doped tape (7) over gap on lower surface.

11. Cut 11/16 diameter hole in lower gap tape in line with aft drain holes in trailing edge. Dope grommet (8) with nitrate dope and place over 11/16 diameter hole. The grommet is to be secured in place by doping patch (13) over the grommet.

12. Cement corkprene walkway (5) to upper surface at center line, using following procedure:

a. Apply to wing one coat of Vulcalock cement, then one coat of Minnesota Mining Co. cement EC-3L.

b. Apply to corkprene walkway two coats of Minnesota Mining Co. cement EC-31.

c. When cement is tacky, smooth walkway onto prepared surface of trailing edge.

13. Place walkway molding strips (2) and (3) in position and insert hold-down screws (1).

14. Replace superstructure aft fairing. Use procedure described in Par. 3, *c,* (4).

15. Cover all drift holes with ½ inch dia. discs (18) of pre-doped balloon cloth applied to surface with clear lacquer. When dry, finish patches with lacquer to match adjacent color.

16. Install panel splice fairing as outlined in paragraph *c,* (2), *(b), 6.*

c. OUTER PANEL.

(1) GENERAL. *(See figure 41.)*—The wing outer panel is the section of the wing attached outboard of the center section, which is composed of the outer panel interspar structure (9), outer panel leading edge (5), outer panel trailing edge (11), aileron cut-out trailing edge (8), aileron (7), and float.

The retractable float forms the tip of the wing when in retracted position.

The outer panel interspar structure is box shaped, and consists of front spar and rear spar; truss ribs; and upper and lower surface skin, reinforced with extruded zee stringers. The lower surface is recessed from station 21 outboard to station 26 to provide a space for the float brace and strut assembly, when the float is in retracted position.

A 10 x 20 inch manhole is located on the upper surface between station 13.0 and 14.0. This manhole gives access to the inside of the interspar structure for inspection and repair as far inboard as the fuel tank (station 5.0), and as far outboard as station 21.0 (the float hinge point).

Hoisting lugs are provided for hoisting the outer panel assembly. See Section III, Par. 2, *a,* (4).

(2) ERECTION.
(See figure 54.)

(a) REMOVAL.—The outer panel may be removed as an assembly or the major units comprising the assembly may be removed from the interspar structure while it is still attached to the wing center section. The following description is for the removal of the outer panel as an assembly.

1. Disconnect radio antenna wire (5) by removing bolt (4) from top of "V" antenna masts at port and starboard wing tips.

2. Unhook thimble of voice antenna from hook on leading edge outboard of starboard outer panel wing splice.

3. Disconnect equipment at panel splices.

a. AILERON PUSH-PULL TUBE.

(1) Open access hole (18) on upper surface of stubby trailing edges near panel splice to give access to joints between aileron push-pull tubes (10) and bell cranks (8).

(2) Remove self-tapping screws (6) to disconnect bonding braid (7).

(3) Remove bearing bolt (9) from end of push-pull tube (10).

b. AILERON TAB CABLES.

Note

The aileron tab control cables are on the port side only.

CAUTION

Before loosening tab cables, move cable stops aft of hull bulkhead 2 to rest against bulkhead and clamp them securely to cables. Failure to heed this caution will result in a violent unwinding of cable around tab drum in control box, causing damage to cable.

(1) Open access hole on lower surface of center section trailing edge aft of port nacelle.

(2) Remove safety wire from tab cable turnbuckles and break cables by unscrewing turnbuckle barrels.

(3) Detach fairlead cap strip from tab cable fairlead at wing station 5.0 to allow tab cables to be pulled out of center section.

(4) Open access hole (22) on lower surface of stubby trailing edge near panel splice. Draw aileron tab control cables from center section trailing edge and lay it in a coil in stubby trailing edge.

c. FLOAT TORQUE TUBE.

(1) Raise float to full up position and see that it is locked.

CAUTION

Do not operate float with float torque tube splice bolt missing, as the torque tube splice connections may shift in operation and become damaged.

(2) Working through access door in upper surface of leading edge inboard of panel splice, remove clevis bolt (16) from joint in float torque tube (17).

d. ELECTRICAL CONNECTIONS.

(1) Remove screws (13) attaching manhole covers (14) on upper surface of wing outer panel near panel splices and climb into interior of wing.

(2) Remove covers from junction boxes mounted on upper surface stringers near panel splice and front spar, and disconnect the following wires from the binding posts.

(a) In box on port side of airplane, disconnect wires 298, 297, 748, 488, 485 and 1051. Disconnect conduits (27) and (29) leading to outer panel from junction box by loosening knurled nuts (28) and (30). Pull ends of wires out of junction box and lay conduit in outer panel.

(b) In box on starboard side of airplane disconnect wires 378, 377, 997, 993, 461, 999, and 749. Disconnect conduit from junction box by loosening knurled nut. Pull ends of wires out of junction box and lay conduit in outer panel.

(3) In port side of wing at station 14.0, disconnect cable (12) from magnesyn compass transmitter (11). Remove screws attaching clips to bulkhead and outer panel spar. Roll cable into a coil and lay in center section where it will not be damaged during subsequent operations.

Note

The magnesyn compass transmitter was installed in the wing on PBY-5A airplanes, serial numbers 46588 and on.

e. HEAT ANTI-ICING DUCT. (See paragraph *b*, (4), *(b)*.)

4. BREAK WING AT PANEL SPLICE.

a. Remove fairings as follows:

(1) Remove screws (24) to detach upper and lower rear panel splice fairings (21).

(2) Cut safety wire and loosen set screws (23) on rear ends of panel splice fairings (32) and (26) to allow removal.

Note

The upper and lower fairings may be separated by removing screws (31) for convenience in handling.

(3) Pull pinked-edge tape (20) from both upper and lower surfaces trailing edge at panel splice.

WARNING

Before proceeding with the removal of panel splice bolts, provide a support for the outer panel.

Note

Hoisting fittings have been provided in the upper surface, two at the panel splice, and one under the access door at station 19.0 for the attachment of a hoisting sling. (See Section III, Par. 2, *a*, (4).)

b. Remove leading edge splice bolts as follows: *(See figure 55.)*

(1) Working through access doors in leading edge at panel splice remove leading edge stringer splice bolts (9).

(2) Remove leading edge skin splice bolts (1) and (9).

c. Remove bolts from interior of wing as follows:

(1) Enter wing through manhole in upper surface of outer panel near splice.

(2) Remove upper and lower stringer splice bolts (6).

(3) Remove three ⅜ dia. bolts (2) from bottom of each front and rear spar splice.

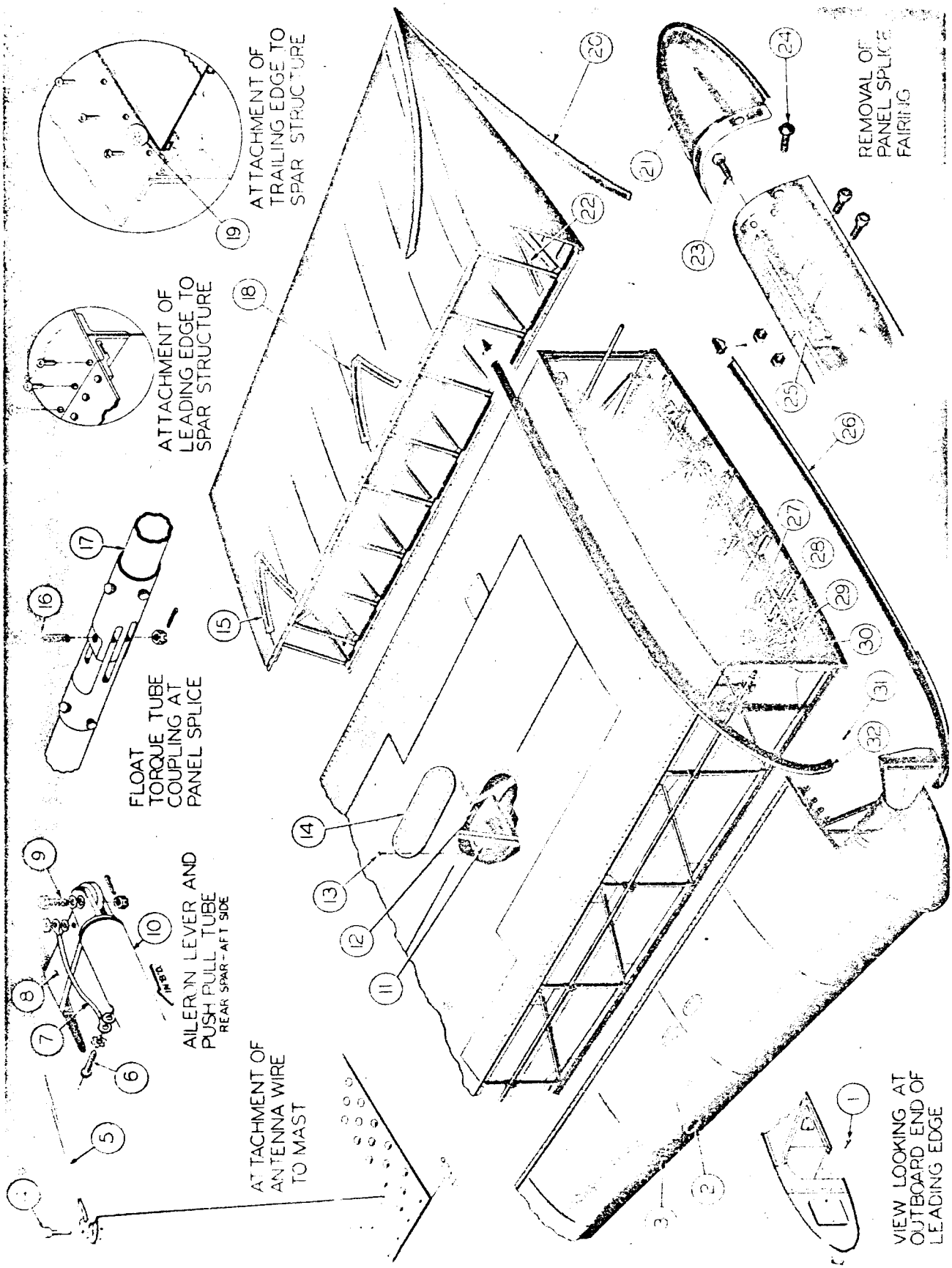


Figure 54—Outer Panel Assembly

No.	PART No.	NAME
1	AN510-D10-7	Screw
2	28W169-68	Access Door
3	28W1012	Wing Line Fitting
4	AN73-5	Bolt
	AC995-40-3	Lock Wire
5	28U5004-3	Antenna
6	Q5033-A8-8	Self Tapping Screw
	AN936-B8	Lock Washer
	AN960-A8	Washer
7	Q506A-2-5	Bonding Braid
8	28C065	Aileron Control Lever
9	AN4-12	Bolt
	AN960-416	Washer
	AN310-4	Nut
	AN380-2-2	Cotter
10	28C021-50	Aileron Push Pull Tube
11	88-T-1950	Magnesyn Compass Transmitter Port Side Only
12	AN3106-14S-2S	Magnesyn Compass Cable Port Side Only
13	AN520-D10-8	Screw
14	28W004-63	Access Door
15		Access Flap
16	AN23-21	Clevis Bolt
	AN320-3	Nut
	AN380-2-2	Cotter
17	28L095	Float Torque Tube
18		Access Flap
19	28W4005-18	Patch
20	28W4001-2	Gap Tape
21	28W2018-10	Panel Splice Fairing—End Assembly—Lower
	28W2018-43	Panel Splice Fairing—End Assembly—Upper
22		Access Flap
23	28W5042	Screw
	AC995-32-2	Lockwire
24	AN526-1032-7	Screw
25	28W2018-20	Upper Splice Fairing Fitting
	28W2018-21	Lower Splice Fairing Fitting
26	28W2018-36	Lower Splice Fairing Assembly (Port Side)
	28W2018-37	Lower Splice Fairing Assembly (Starboard Side)
27	NAF1150-6A	Flexible Conduit
28		Nut
29	NAF1150-12A-108	Flexible Conduit
30		Nut
31	AN526-1032-7	Screw
32	28W2018-34	Upper Splice Fairing Assembly (Port Side)
	28W2018-35	Upper Splice Fairing Assembly (Starboard Side)

Item number 11 is a Federal Standard Stock catalogue part number.

(4) Remove three 5/16 dia. bolts (4) from the top of each front and rear spar splice.

(5) Remove eight ¼ dia. bolts (3) from each front and rear spar splice.

(6) Check carefully that all bolts have been removed from inside of wing splice and that no equipment or wiring is left across panel splice.

d. Remove external panel splice bolts.

(1) Working through access hole (22), *(See figure 54.)* in stubby trailing edge and through access hole in center section trailing edge, remove three ⅜ dia. bolts (2), three 5/16 dia. bolts (4), and eight ¼ dia. bolts (3) from each rear spar splice. *(See figure 55.)*

(2) Working through access doors in outer panel and in center section leading edges, remove three ⅜ dia. bolts (2), three 5/16 dia. bolts (4), and eight ¼ dia. bolts (3) from each front spar.

(3) Remove two 5/16 dia. bolts (8) and splice fairing fitting from lower skin splice.

(4) Remove 52 5/16 dia. skin splice bolts (4) from lower skin splice angles.

(5) Remove two 5/16 dia. bolts (5) from upper skin splice angle at front spar.

(6) Remove two 5/16 dia. bolts (2) and splice fairing fitting from upper skin splice angles.

(7) Remove 49 ¼ dia. bolts (1) from upper skin splice angle.

(8) By means of hoisting sling, swing outer panel outboard approximately three feet to clear end of aileron push-pull tube and lower to a suitable cradle for disassembly.

(b) INSTALLATION.

1. See that all equipment is placed in the wing panels so that it will not interfere with the mounting of the outer panel. The float should be locked in the up position.

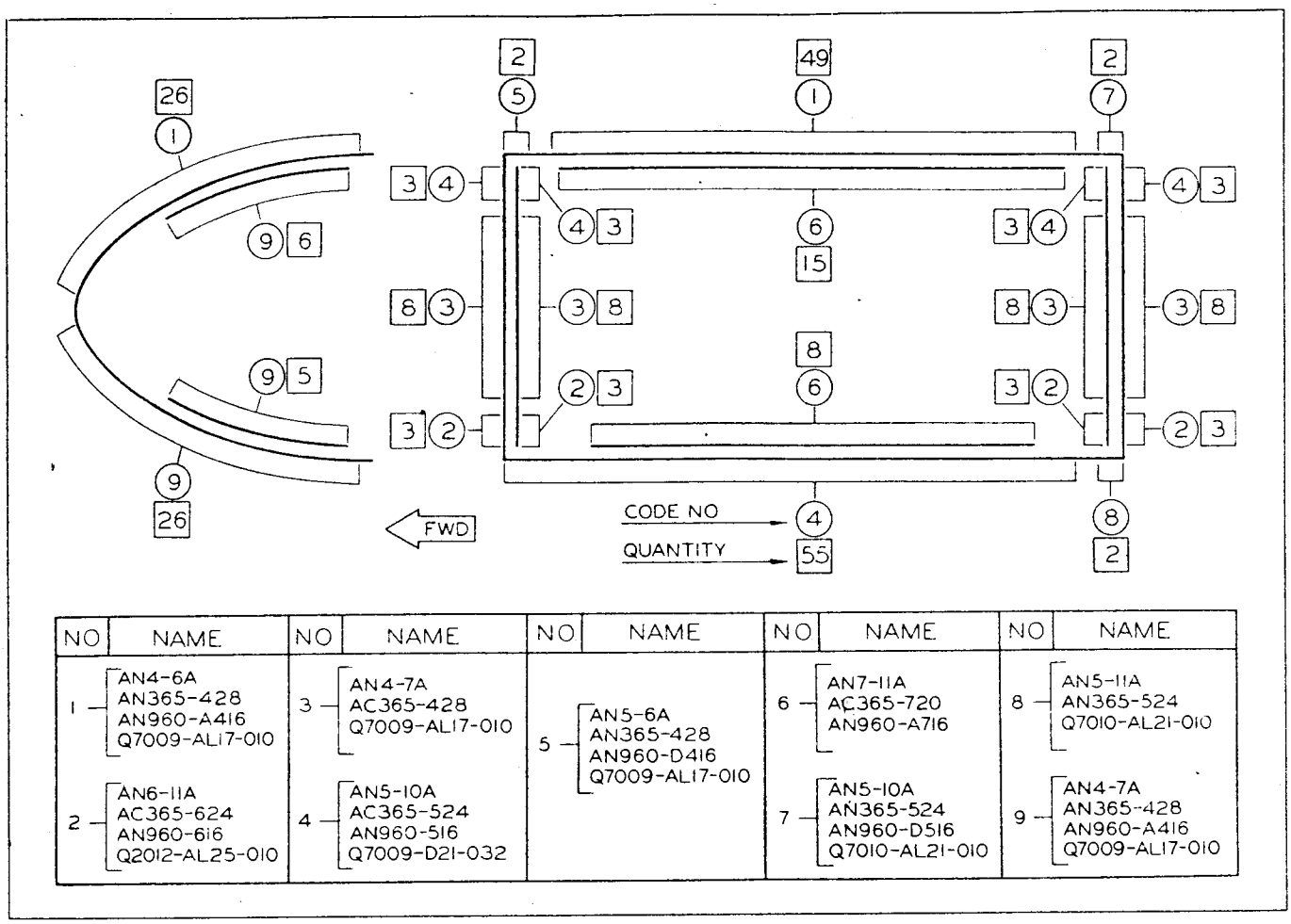
2. Attach the hoisting sling to the three fittings provided, two at the panel splice and one under the access door near the center of the interspar section at station 19.0, and hoist the outer panel to the level of the center section. (See Section III, Par. 2, *a*, (4).) Swing the outer panel inboard until the skin splice angles are approximately three inches apart, being careful not to bump the aileron push-pull tube.

3. Install interspar splice bolts as follows:

a. Working through the access door in the upper surface of the center section leading edge at the panel splice, turn the float inboard torque tube until the torque tube splice fittings are in alignment. Swing the outer panel into position and guide the torque tube splice fittings together.

b. Insert the upper skin splice bolts (1) and the lower skin splice bolts (4). Attach the lower splice fairing fitting with bolts (8), and the upper splice fairing fitting with bolts (2).

c. Working through access doors in outer panel and center section leading edges, install bolts (2), (3) and (4) in the front spar.



NO	NAME	NO	NAME	NO	NAME	NO	NAME	NO	NAME
1	AN4-6A AN365-428 AN960-A416 Q7009-AL17-010	3	AN4-7A AC365-428 Q7009-AL17-010	5	AN5-6A AN365-428 AN960-D416 Q7009-AL17-010	6	AN7-11A AC365-720 AN960-A716	8	AN5-11A AN365-524 Q7010-AL21-010
2	AN6-11A AC365-624 AN960-616 Q2012-AL25-010	4	AN5-10A AC365-524 AN960-516 Q7009-D21-032			7	AN5-10A AN365-524 AN960-D516 Q7010-AL21-010	9	AN4-7A AN365-428 AN960-A416 Q7009-AL17-010

Figure 55—Panel Splice Bolt Diagram

d. Working through access openings in trailing edge at panel splice, install bolts (2), (3) and (4) in aft splice angle of rear spar.

e. Enter wing through manhole in upper surface of outer panel near panel splice and install upper and lower stringer splice bolts (6) and front and rear spar splice bolts (2), (3) and (4).

4. Install leading edge splice bolts as follows:

a. Install leading edge skin splice bolts (1) and (9) through splice angles.

b. Working through access holes in leading edge at panel splice, install leading edge stringer splice bolts (9).

5. Connect equipment crossing panel splice as follows: *(See figure 54.)*

a. Connect float torque tube by working through access door in upper surface of leading edge at panel splice and installing bolt (16) in torque tube fittings.

b. Attach aileron push-pull tube to bell crank as follows:

(1) Working through access opening (18) on upper surface of stubby trailing edge, attach push-pull tube (10) to bell crank (8) with bolt (9), tighten nut and lock with cotter pin.

(2) Connect bonding braid (7) to push-pull tube (10) with self-tapping screw (6).

c. Install aileron tab cables as follows:

(1) String aileron tab cables from outer panel through center section trailing edge and attach to inboard cables with turnbuckle by working through access opening in lower surface of center section trailing edge aft of port nacelle.

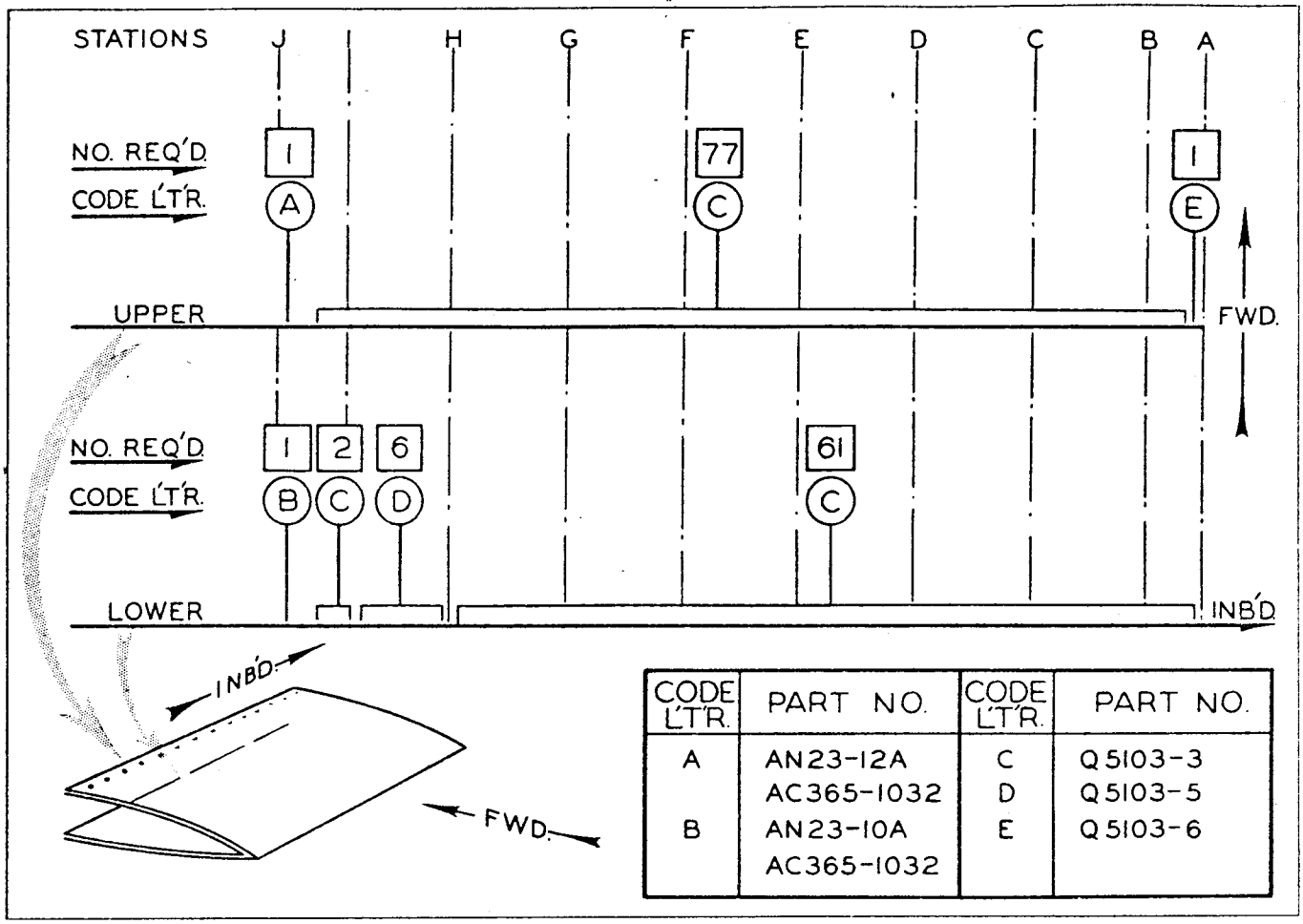
(2) See that the cables are not twisted or fouled, and take up the slack by tightening the turnbuckles. Attach fairlead cap to fairlead at station 5.0.

(3) Move cable stops to their correct position aft of hull bulkhead 2 and rig trim tabs as directed in Par. 18, *i*, (3), *(d)* 6.

d. Install heat anti-icing transition duct in leading edge as directed in paragraph *b*, (4), *(c)*, 7.

e. Connect electrical equipment as follows:

(1) Enter wing through manhole and connect conduits (27) and (29) to junction box on



CODE L'TR.	PART NO.	CODE L'TR.	PART NO.
A	AN23-12A	C	Q5103-3
	AC365-1032	D	Q5103-5
B	AN23-10A	E	Q5103-6
	AC365-1032		

Figure 56—Outer Panel Trailing Edge Screw Diagram

port side of wing by tightening knurled nuts (28) and (30). On starboard side, connect conduit to junction box with knurled nut. Attach wires to binding posts as shown on wiring diagrams on under side of junction box covers. After checking all connections, attach junction box covers to boxes.

(2) In port side of wing, connect electrical cable (12) to magnesyn compass transmitter (11). Attach the cable to the structural members of the wing with mounting clips and screws.

Note

The magnesyn compass transmitter was installed in the wing on PBY-5A airplanes, serial numbers 46588 and on.

6. Install panel splice fairing as follows:

a. At trailing edge, dope pinked-edge tape (20) over gap between outer panel and center section trailing edges, and finish in accordance with instructions given in Section VII, Par. 7 of this manual.

b. At bolted splice, coat external splice bolts with paralketone, Specification AN-C-52.

c. Place splice fairings (26) and (32) over bolted panel splice and engage set screws (23) with fittings (25). Tighten set screws (23) until the fairing fits snugly over the bolted splice and lock set screws with lock wire.

d. Attach caps (25) to rear ends of (26) and (32) fairings with screws (24).

7. Close access openings as follows:

a. Inspect all attachments and remove debris before closing access openings.

b. Attach manhole cover (14) in upper surface of outer panel with screws (13).

c. Attach leading edge access hole covers with screws.

d. Close openings in trailing edge.

8. Attach "V" antenna (5) to masts at starboard and port wing tips with bolt (4).

9. Hook voice antenna thimble to hook on starboard outer panel leading edge.

(3) OUTER PANEL LEADING EDGE.

(a) DESCRIPTION.—The structure of the

outer panel leading edge is made up of formed sheet metal skin, zee stringers, and formed metal ribs. A heat anti-icing duct for de-icing runs inside the leading edge and is spliced at the outer panel connection. A towing clevis is installed about 6½ ft outboard of the panel splice and is used for handling the airplane in the water and tying down on the ground. A running light is located on the outboard end.

(b) REMOVAL.

1. Unhook voice antenna thimble from hook on starboard outer panel leading edge.

2. Remove outboard leading edge running lights. (See Par. 22, *n*, (3), *(b)*, *2.*

3. Remove transition duct at panel splice. (See paragraph *b*, (4), *(b)*, *2.*)

4. Remove panel splice fairing. (See paragraph *c*, (2), *(a)*, *4*, a.)

5. Remove leading edge panel splice bolts (1) and (9). *(See figure 55.)*

6. Lower float approximately two feet and remove six screws (1) at outboard end. *(See figure 54.)*

7. Remove all front spar attaching screws shown on figure 53.

8. To loosen outer panel leading edge, pull down lightly on forward end of leading edge, releasing top side first; then lift up and forward.

9. Towing clevis (3) may be removed before taking off leading edge by removing access door (2), then reaching in, breaking lock wire and removing AN 74-43 bolt.

(c) INSTALLATION.

1. If towing clevis (3) has been removed, install by placing clevis in recess provided in leading edge, and through access door (2) insert AN 74-43 bolt from the outboard side. Lock bolt to angle with AC 995-47-A lock wire.

Note

Coat the faces of the upper and lower attaching bars with zinc chromate paste, where they will contact surfaces of the front spar flanges.

2. Put leading edge in place using drift pins to align screw holes.

3. Install all front spar attaching screws, top and bottom. *(See figure 53.)*

4. With the float lowered approximately two feet, install six screws (1) at outboard end. *(See figure 54.)*

5. Install leading edge panel splice bolts (1) and (9). *(See figure 55.)*

6. Install panel splice fairings. (See paragraph *c*, (2), *(b)*, *6.*)

7. Install transition duct at panel splice. (See paragraph *b*, (4), *(c)*, *7.*)

8. Install outboard leading edge running lights. (See Par. 22, *n*, (3), *(b)*, *4.*)

9. Hook voice antenna thimble to hook on starboard wing outer panel leading edge.

(4) OUTER PANEL TRAILING EDGE. *(See figure 54.)*

(a) DESCRIPTION.—The outer panel trailing edge is a fabric-covered framework of aluminum alloy truss ribs, formed trailing edge section and extruded attaching strips. Access to the interior in installed position is through two access flaps in the upper surface and one in lower surface fabric.

(b) REMOVAL.

1. Remove panel splice fairing and end cap in accordance with paragraph *c*, (2), *(a)*, *4*, a.

2. Pull off fabric gap tapes (22) and (35), which are doped to the upper and lower surfaces over splice to aileron cut-out trailing edge on outboard end *(See figure 57.)* and fabric gap tape (15) across crevice between center section and outer panel trailing edge assemblies at inboard end. *(See figure 52.)*

Note

Save the grommet (8) on gap tape (15) for reapplication on assembly.

3. If the aileron is in place, remove inboard aileron hinge bolt and bonding braid as outlined in paragraph *c*, (5), *(b)*, *4.*

4. Remove four bolts (33) between outer panel trailing edge and aileron cut-out trailing edge, making provision to catch the spacer (21) on each bolt between the surfaces. Bolts and their nuts are reached through access flaps adjacent to splice in upper fabric of each of these trailing edges. *(See figure 57.)*

5. Make provision to support trailing edge, then remove all attaching screws shown in figure 56.

Note

The number of screws of each type may vary from the normal requirements. Repair of stripped threads in a hole is made by adding a new tapped hole and screw into the row, adjacent to the stripped hole.

(c) MAINTENANCE.

1. Clean orifice in any drain grommet which may have become plugged.

2. For repair of stripped threads on the trailing edge to spar connections, refer to the Structural Repair Manual (AN 01-5MA-3).

(d) INSTALLATION.

1. Remove fabric discs (19) along aft flange of rear spar, upper and lower, covering fourteen drift holes. *(See figure 54.)*

2. Coat with zinc chromate paste the faces of attachment tapping strips where they will contact surfaces of the rear spar flanges.

3. Place trailing edge in position using 3/16 inch diameter drift pins in the drift holes to locate and hold trailing edge in place.

4. Install all attaching screws shown on figure 56.

5. Withdraw all drift pins. Cover drift holes with ½ inch diameter discs (19) of pre-doped balloon cloth applied to surface with clear lacquer. When dry, finish patches with lacquer to match adjacent color.

6. Apply gap tapes (22) and (35) *(See figure 57.)* and gap strip (15) of 3¾ inch wide pink-edge, pre-acetate-doped tape, grade A fabric, Specification 49C13. Dope to trailing edge structures over gap at each end, on top and bottom surfaces. Cut 11/16 diameter hole in lower gap tape (15) in line with aft drain holes in trailing edge. Dope grommet (8) with nitrate dope and place over hole. The grommet is to be secured in place by doping patch (13) over the grommet. *(See figure 52.)* Finish to match adjacent color.

7. If the aileron is in place, install inboard aileron hinge bolt and connect bonding braid as outlined in paragraph *c*, (5), *(c)*, *3*.

8. Install panel splice fairing as outlined in paragraph *c*, (2), *(b)*, *6*.

(5) AILERONS.

(a) DESCRIPTION.—The ailerons are located in the trailing edge on the outer panel of the wing. Their structure consists of a truss type spar and ribs, and a sheet metal formed nose cover. The entire aileron is fabric covered. The left aileron contains two counter-balance weights attached on the inside of the nose section by screws and is located in the farthest bay outboard, and in the fourth bay from the inboard end. The right aileron has no counterbalance weights. The left aileron is equipped with a movable trim tab while the right aileron has a fixed trim strip which may be adjusted on the ground. The aileron is attached to the wing by means of five hinges and is actuated by a push-pull rod.

(b) REMOVAL.

(See figure 57.)

1. Through the inboard zipper (32) on the upper surface of the aileron cut-out trailing edge, unbolt (29) the aileron tab torque tube (31) and disconnect bonding braid (30). This procedure is necessary on the left-hand aileron only.

2. Disconnect the aileron push-pull rod (14) by removing bolt (16) and nut. Detach bonding braid (15).

3. Lower the tip float approximately two feet to provide access to the outboard aileron hinge and remove bolt (7) holding nut thru outboard access flap (26). Disconnect bonding braid (11).

4. Disconnect aileron at inboard hinge point. Two men are required. The head of the hinge bolt (36) is reached through the outboard access flap (34) of the stubby trailing edge; the nut is reached through the inboard access flap of the aileron. After nut has been removed push bolt back just enough to clear the aileron. (This procedure will eliminate the difficulty of replacing the bolt in the stubby trailing edge.) Disconnect bonding braid (37) at inboard hinge.

Note

Before proceeding with balance of disassembly, support the aileron at each end and at the center to prevent damage.

5. Through the center three access flaps (3), (46) and (48) disconnect bonding braids (2) and (47) at each hinge point.

6. Complete the removal of the aileron by removing the bolts (1) attaching the aileron to the three intermediate hinges (49).

CAUTION

In removing the left-hand aileron take care that the tab control rod is free of the aileron cut-out trailing edge.

(c) INSTALLATION.

(See figure 57.)

1. Lift aileron into place, guiding tab torque tube (31) on the left-hand aileron through the hole provided in the aileron cut-out trailing edge.

2. With float lowered approximately two feet for access, connect outboard hinge by inserting bolt (7), head outboard, and tightening nut through outboard access flap (26). Connect bonding braid.

3. Make inboard hinge connection holding bolt head through access flap (34) and nut through access flap (28). Two men are required for this operation. Connect bonding braid (37).

4. Through the center access flap (48) make the center hinge connection by installing bolt (1) and connecting bonding braids (2) and (47).

Note

Supports for the aileron may be removed at this point.

5. At the mid span of the aileron connect the push-pull rod (14) by installing bolt (16). Connect bonding braid (15).

6. Make the last two hinge connections by installing bolts (1). Connect bonding braids (2), and (47).

7. Through the inboard access flap on the aileron cut-out trailing edge connect the tab control rod with bolt (29). Connect bonding braid (30).

8. Close all access flaps.

9. Through access flap (48) shim bumpers (50) to give the aileron the correct throw. See Section 1, Par. 4.

(d) MAINTENANCE. — Make a periodical

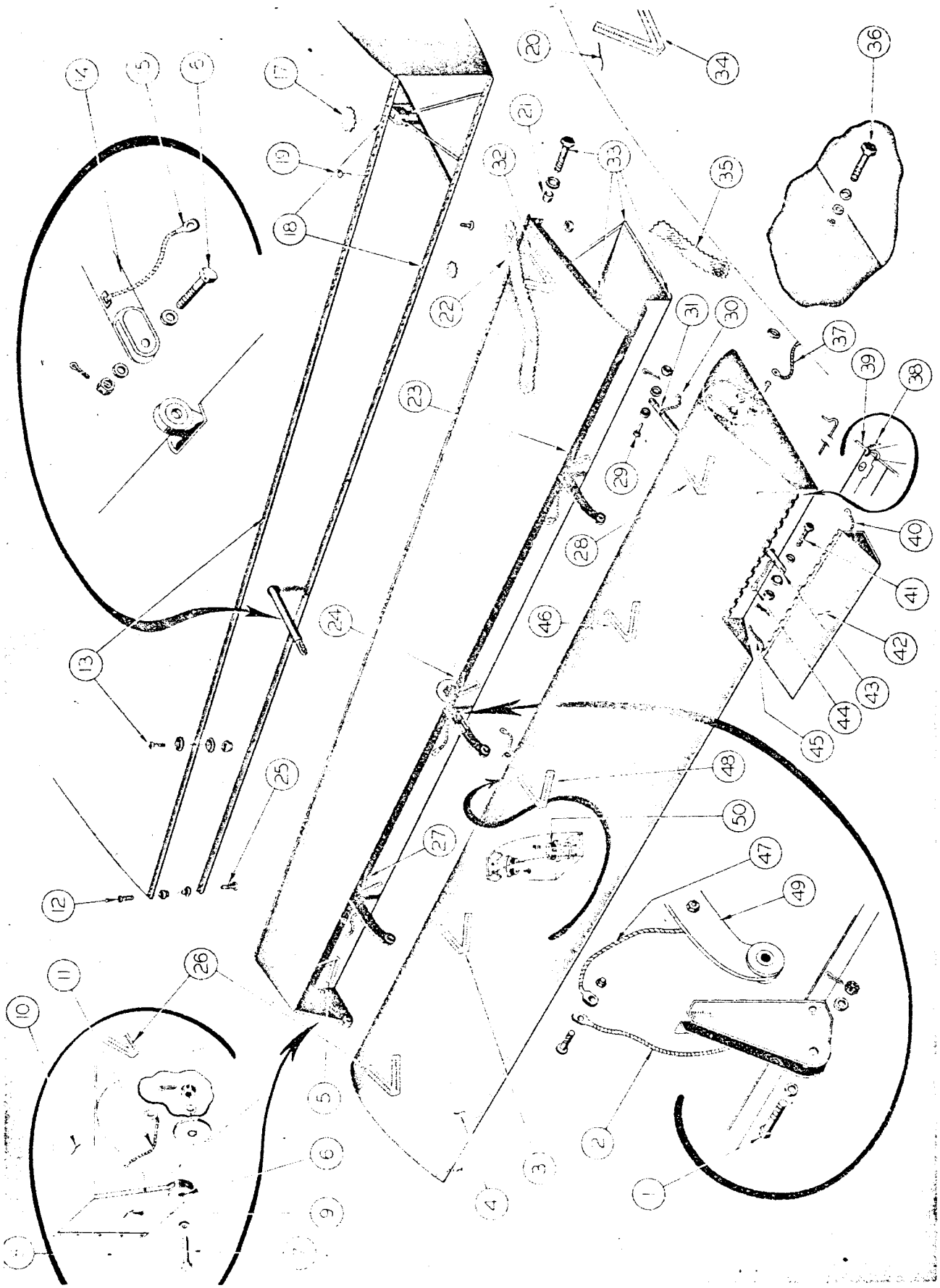


Figure 57—Aileron, Aileron Cut-out, Aileron Tab

No.	PART No.	NAME
1	AN4-12	Bolt
	AN960-416	Washer
	AN310-4	Nut
	AN380-2-2	Cotter
2	Q506A-2-3	Bonding Braid
3		Access Flap
4	28W011	Aileron
5		Access Flap
6	28W021-171	Bearing—Fafnir SIK—6
7	AN4-16	Bolt
	AN960-416	Washer
	AN310-4	Nut
	AN380-2-2	Cotter
8	Q510-D10-8	Screw
	AN365-D1032	Nut
9		Hinge—Sta. 1.0 Trailing Edge
10	28W022	Trailing Edge—Aileron Cut-out
11	Q506A-2-3	Bonding Braid
12	Q5103-4	Screw
	AN365-D1032	Nut
13	AN24-12A	Bolt
	AN364-428	Nut
14	28C024	Aileron Push-Pull Rod
15	Q507A-2-2	Bonding Braid
16	AN4-13	Bolt
	AN960-416-0156	Washer
	AN310-2-2	Nut
	AN380-2-2	Cotter
17	28W4005-18	Drift Hole Patch
18		Drift Hole
19	Q5103-4	Screws
20	28W024	Outer Panel Trailing Edge
21	Q812D-6-7	Spacer
22	28W024-19	Fabric Gap Tape
23		Access Flap
24		Access Flap
25	Q5103-4	Screw
	AN365-D1032	Nut
26		Access Flap
27		Access Flap
28		Access Flap
29	AN3-7	Bolt
	AN960-10	Washer
	AN310-3	Nut
	AN380-2-2	Cotter
30	Q508A-7	Bonding Braid
31	28C2047	Tab Push-Pull Tube
32		Access Flap
33	AN3-6A	Bolt
	Q7102-AL10	Washer
	AN365-1032	Nut
34		Access Flap
35	28W024-19	Fabric Gap Tape
36	AN4-17	Bolt
	AN960-416	Washer
	AN310-4	Nut
	AN380-2-2	Cotter
37	Q506A-2-3	Bonding Braid
38	AC995-47-2	Lockwire
39	28W2082-8	Hinge Pin
40	Q507A-2-8	Bonding Braid
41	AN3-7	Bolt
	AN960-10	Washer
	AN310-3	Nut
	AN380-2-2	Cotter
42	28W2082	Aileron Tab
43	28C2046	Tab Push-Pull Rod
44	Q508A-3	Bonding Braid
45	Q507A-2-8	Bonding Braid
46		Access Flap
47	Q508A-7	Bonding Braid
48		Access Flap
49	28W176	Aileron Hinge
50	28C2021	Bumper

check of aileron for fabric tears, loose connections, and clogged drain holes.

(6) AILERON CUT-OUT TRAILING EDGE.

(a) DESCRIPTION.—The aileron cut-out is the part of the trailing edge directly forward of the aileron. Its structure consists of truss type ribs held together with angle sections, and is fabric covered. It is readily removable being assembled to the rear spar with screws, and to the outer panel inboard trailing edge (stubby trailing edge) with four splice bolts to insure alignment with the aileron hinge arms.

(b) REMOVAL.

(See figure 57.)

1. Remove the aileron as outlined in paragraph *c*, (5), *(b)*.

2. Remove the fabric gap strips, (upper and lower surface) (22) and (35) between the aileron cut-out and the stubby trailing edge.

3. Remove four bolts (33) which tie the stubby trailing edge to the aileron cut-outs. Two men are required for this operation; one working through the outboard access flap (34) on the upper surface of the stubby trailing edge, and one working through the inboard access flap (32) on the upper surface of the aileron cut-out.

Note

Care should be taken that spacers are not lost when removing bolts (33).

4. Lower float approximately two feet and remove five bolts (8) working through access flap (5) located at the outboard end of the cut-out on its forward surface. In the same manner remove 2 bolts (12) through the upper spar flange and the outboard aileron hinge bracket (9) and 2 bolts (25) through the lower spar flange and the aileron hinge bracket.

5. At each of the 3 hinge brackets on the aileron cut-out is an access flap (23), (24) and (27).

Each of the three hinge arms is held to the rear spar with 2 bolts (13) through the upper spar flange and 2 bolts through the lower spar flange. Working through the access flaps remove four bolts at each hinge location.

6. Remove all the attaching screws (19) from the upper rear spar flange and all the attaching screws from the lower rear spar flanges.

7. Remove the aileron cut-out by pulling aft being careful to guide the aileron push-pull rod (14) through the hole in the trailing edge of the cut-out.

(c) INSTALLATION.

1. Lift aileron cut-out into place guiding aileron push-pull rod through the hole in the cut-out trailing edge.

2. Remove fabric discs (17) covering drift holes through upper and lower spar flanges.

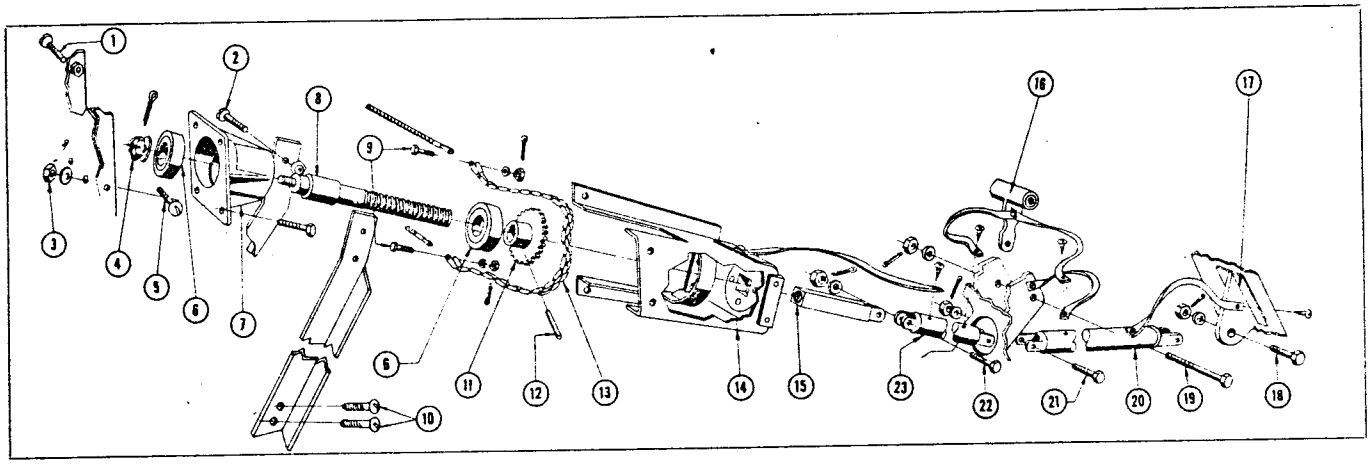
3. Locate and hold cut-out in place using pins through drift holes (18). These drift holes are identified by a painted circle at each hole. There are 10 drift holes on the lower surface and 11 drift holes on the upper surface.

4. Install screws (19) through the aileron cut-out and the upper and lower rear spar flanges.

5. Through access flaps (23), (24) and (27) install four screws (13) tying each aileron hinge to the rear spar.

6. With the float lowered approximately two feet, and working through access flap (5), install five bolts (8). Also install two bolts (12) through the upper rear spar flange and the aileron hinge brackets and two bolts (25) through the lower rear spar flange and the aileron hinge bracket.

7. Install four bolts (33) which tie the stubby



No.	PART No.	NAME
1	AN515-D8-8	Screw
	AN365-D832	Nut
2	AN515-D8-8	Screw
	AN365-D832	Nut
3	AN3-5	Bolt
	AN310-3	Nut
	AN380-2-2	Cotter
	AN960-10	Washer
4	AN310-6	Nut
	AN960-616	Washer
	AN380-3-3	Cotter
5	AN515-D8-8	Screw
6	Fafnir K8-A	Bearing
7	28C2044	Tab Control Mechanism Support (Housing)
8	28C2042	Tab Operating Screw
9	AN23-10	Bolt
	AN320-3	Nut
	AN380-2-2	Cotter
	AN960-10	Washer
10	AN515-D8-8	Screw
	AN365-D832	Nut
11	Boston Gear Works H-964	Sprocket

No.	PART No.	NAME
12	28C2045-2	Pin
13	28C1100-6	Chain
14	28C3016	Socket Guide Assembly
15	28C048-2	Tab Operating Socket
16	28C2040	Idler Lever
17	28W2081	Aileron Tab Horn
18	AN3-7	Bolt
	AN310-3	Nut
	AN380-2-2	Cotter
	AN960-10	Washer
19	AN6-27	Bolt
	AN310-6	Nut
	AN380-3-3	Cotter
20	28C2046	Tab Operating Rod
21	AN3-11	Bolt
	AN310-3	Nut
	AN380-2-2	Cotter
	AN960-10	Washer
22	AN3-7	Bolt
	AN310-3	Nut
	AN380-2-2	Cotter
	AN960-10	Washer
23	28C2047	Tab Operating Rod

Figure 58—Aileron Tab Control Mechanism

trailing edge to the aileron cut-out. Two men are required for this operation; one working through access flap (34) on the stubby trailing edge, and one working through access flap (32) on the upper surface of the aileron cut-out.

Note

When inserting bolts (33) be sure that spacers (21) are in position.

8. Over gap between stubby trailing edge and aileron cut-out, dope a 3 in. wide piece of fabric (22) over the upper gap and a similar piece of fabric (35) over the lower gap.

9. Close all access flaps.

10. Dope small fabric discs (17) over all drift holes on the upper and lower surface.

11. Install the aileron as outlined in paragraph *c*, (5), *(c)*.

(7) AILERON TAB.

(a) DESCRIPTION.—The aileron tab, movable in flight, is located at the inboard end of the port aileron. Its structure consists of a zee-shaped spar formed from sheet stock, four formed sheet metal ribs and a formed sheet metal skin. It is hinged along its upper surface.

(b) REMOVAL.

(See figure 57.)

1. Move aileron to "full up" position.

2. Adjust tab to "full up" position. If the tab controls are connected, the tab may be moved by adjusting the tab control in the pilot's compartment. If the tab controls are not connected, move tab by manipulating the control cables through the outboard access flap (34) on the stubby trailing edge.

Note

Access for performing the operations for removing the tab is through the gap between the lower surface of the tab and the trailing edge of the aileron. If the tab is trimmed in the down position closing this gap, it must be trimmed to the neutral or up position.

3. Disconnect the tab push-pull tube (43) and bonding braid (44) at the tab.

4. Disconnect bonding wires (40) and (45) at the outboard end of the tab.

5. Break safety wire (38) which holds hinge pin (39) to the structure.

6. Withdraw hinge pin from the inboard end and remove tab.

(c) INSTALLATION.

(See figure 57.)

1. Adjust aileron and tab to the "full up" position for each.

2. Locate tab in position, aligning hinge teeth and insert hinge pin (39) from the inboard end lubricating with a light oil to facilitate insertion. Wipe excess oil from hinge.

3. Safety wire (38) pin (39) to structure.

4. Connect bonding wires (40) and (45) at the outboard and inboard ends of the tabs.

5. Connect the tab push-pull tube (43) to the tab and attach bonding wire (44).

(8) AILERON TAB CONTROLS.

(a) DESCRIPTION.—The lateral trim of the airplane is secured by means of an adjustable tab on the port aileron which is operated by a control located on the pilot's panel. The knob turns a drum and operates cables that run aft, up through the superstructure, and along the rear spar to a point near the aileron. The cable is attached to a chain, routed around a sprocket. This sprocket drives a jack screw which in turn operates the tab actuating rod.

(b) REMOVAL AND DISASSEMBLY.

1. Clamp both aileron tab cables against bulkhead No. 2 in the hull by means of a cable clamp. This prevents cables, when released at turnbuckles, from raveling around drum.

Note

Clamp can consist of two metal bars with adjacent cut-out, a bolt through the center of both bars, and a wing nut for tightening.

2. Through the first access flap from airplane center line on the lower surface of center section trailing edge, disconnect tab control cables at turnbuckles.

3. Through outboard access flap (34) *(See figure 57.)* in outer panel trailing edge, disconnect control cables from chain (13) by removing bolts (9). *(See figure 58.)*

4. Through access flap (32) *(See figure 57.)* on the upper surface of aileron cut-out trailing edge, break the following connections:

a. Disconnect actuating rod (23) from socket (15) by removing bolt (22) and disconnecting bonding braid. *(See figure 58.)*

b. Disconnect bracket angle braces at bottom of rear spar by removing screws (10).

c. Remove socket guide attaching screws (1) and (5) and remove socket guide assembly. After removing the guide assembly from the wing, the angle braces may be taken off by removing screws (2).

5. To remove aileron tab control mechanism assembly is a two-man operation. One man is to work through access flap and the other man is to enter wing through manhole (22) *(See figure 20.)* and be stationed at rear spar between stations 15 and 16. Remove bolts and remove tab control mechanism assembly through access flap. The assembly may be further disassembled after removal from wing as follows:

a. Unscrew socket (15) and remove. *(See figure 58.)*

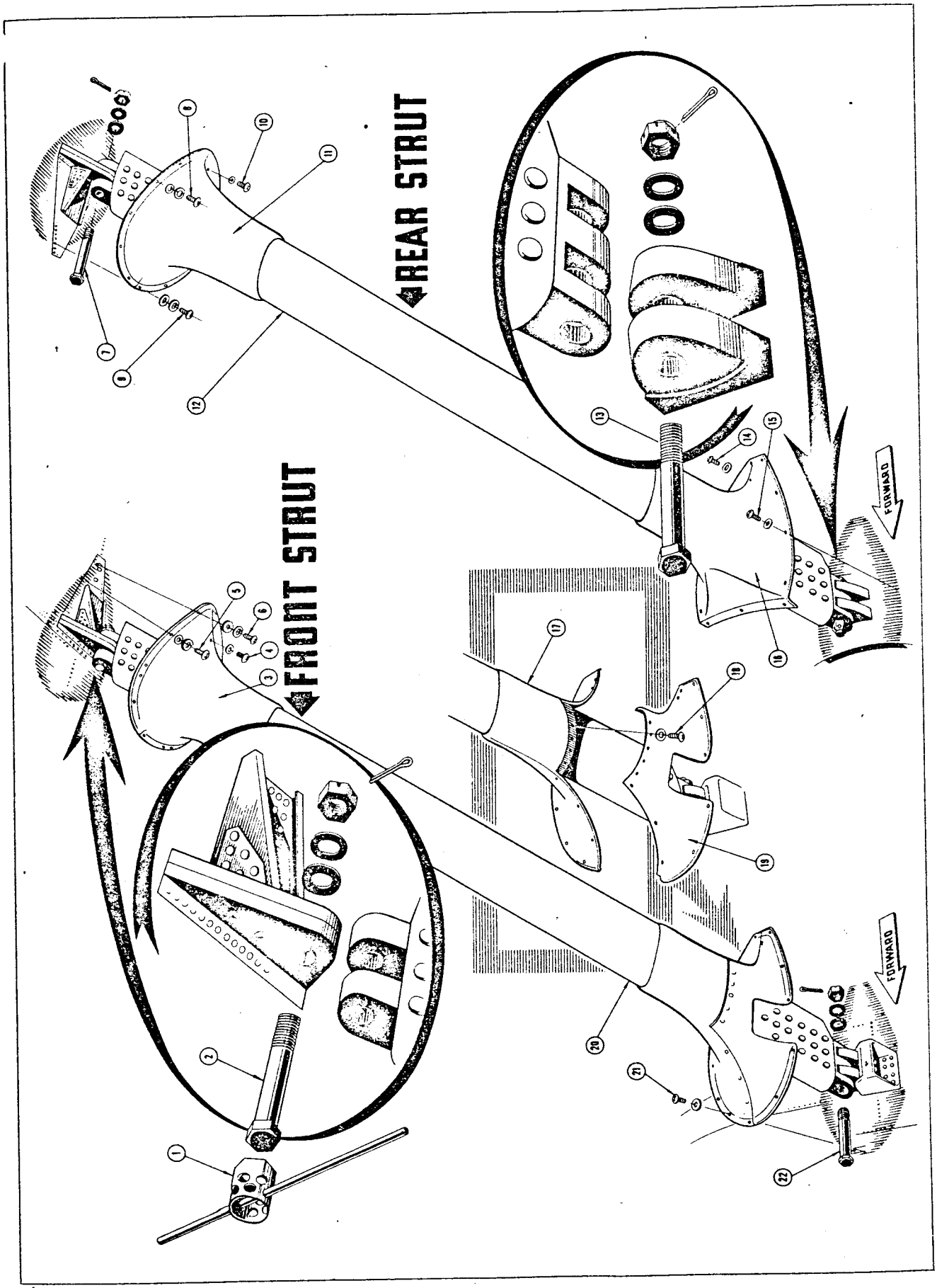


Figure 59—Wing Struts

No.	PART No.	NAME
1	28U1049	Wrench—Socket—Upper Wing Strut Fitting
2	AN16-50	Bolt—Upper—Forward
	AN960-1616	Washer—Plain
	Q7102-AL1616	Washer—Plain
	AN310-16	Nut
	AN380-4-6	Cotter Pin
3	28W5075	Fairing—Wing—Front Strut
4	AN526-DD1032-7	Screw
	AN960-AL10	Washer
5	AN515-6-8	Screw
	AN960-AL6	Washer—Plain
	AN935-6	Washer—Locking
6	AN526-DD832-8	Screw
	AN960-AL8	Washer—Plain
	AN935-8	Washer—Locking
7	AN14-43	Bolt—Upper—Rear
	AN960-1416	Washer—Plain
	Q7102-AL1416	Washer—Plain
	AN310-14	Nut
	AN380-4-5	Cotter Pin
8	AN515-6-8	Screw
	AN960-AL6	Washer—Plain
	AN935-6	Washer—Locking
9	AN526-DD832-8	Screw
	AN960-AL8	Washer—Plain
	AN935-8	Washer—Locking
10	AN526-DD1032-7	Screw
	AN960-AL10	Washer—Plain
11	28W5076	Fairing—Wing—Rear
12	28W040	Strut—Wing—Rear
13	AN12-54	Bolt—Lower—Rear
	AN960-1216	Washer—Plain
	Q7102-AL1216	Washer—Plain
	AN310-12	Nut
	AN380-4-5	Cotter Pin
14	AN526-DD832-6	Screw
	AN960-AL8	Washer—Plain
15	AN526-DD832-8	Screw
	AN960-AL8	Washer—Plain
16	28B5027	Fairing—Hull—Rear
17	28B1835	Fairing—Hull—Front
18	AN526-DD832-8	Screw
	AN960-AL8	Washer—Plain
19	28B1835-4-5	Fairing—Hull—Lower Front Strut
20	28W039	Strut—Wing—Front
21	AN526-DD832-8	Screw
	AN960-AL8	Washer—Plain
22	AN12-57	Bolt—Lower—Front
	AN960-1216	Washer—Plain
	Q7102-AL1216	Washer—Plain
	AN310-12	Nut
	AN380-4-5	Cotter Pin

b. Remove nut (4) and slip operating screw (8) out of housing (7).

c. Bearings (6) may be removed from housing by punching them out.

d. Sprocket (11) may be removed from operating screw by removing pin (12) and slipping sprocket off. To remove pin, drill peened head, chisel off, and drive pin out.

6. Remove tab control rod (23) as follows: through inboard aileron access flap, remove bolt (21), disconnect bonding braid at tab control rod forward of idler lever (18), and withdraw control rod.

7. Remove tab control rod (20) as follows: move tab into up position, remove bolt (18) disconnect bonding braid at tab control horn (17); through access flap in aileron, disconnect bonding braid at forward end of control rod, and withdraw rod.

8. Through inboard access flap in aileron, remove idler lever (16) by removing bolt (19).

(c) MAINTENANCE.

1. Inspect bearings for wear and replace if necessary.

2. Every 60 hours, lubricate as follows:

a. At pin joints where bolts (18), (19), (21), and (22) are located, apply oil (Specification AN-O-6).

b. On thread of operating screw (8), and on exterior of socket (15) apply grease (Specification AN-G-3).

(d) ASSEMBLY AND INSTALLATION.

1. Through access flap in aileron, place idler lever (16) in position and install bolt (19).

2. Through access flap in aileron, place tab control rod (20) in position. Move aileron tab in up position; attach rod to tab control horn (17) with bolt (18). Connect bonding braid from control horn to rod.

3. Through access flap in aileron, place tab control rod (23) in position and install bolt (21). Connect bonding braid at forward end of rod (20) and aft end of rod (23).

4. Assemble aileron tab control mechanism as follows:

a. Install sprocket (11) on operating screw (8) by slipping sprocket on screw and installing pin (12). Peen pin on both ends.

b. If bearings (6) have been removed from housing (7), scrape stake marks smooth in housing. Insert bearings and stake adjacent to old stake marks.

c. Slip end of operating screw into housing through bearings and install nut (4).

d. Apply grease (Specification AN-G-3) to threads of operating screw and screw on socket (15).

5. Through inboard access flap in aileron cut-out trailing edge, place control mechanism assembly in position and install bolts (3). The nuts are to be tightened on the forward face of the rear spar from the inside of the wing.

6. Wrap chain (13) around sprocket (11) and connect chain to control cables by installing bolts (9) through outboard access flap in outer panel trailing edge.

Note

Prior to installing chain, dip chain in solution of one part by weight of grease (Specification AN-G-10) and 3.25 parts by weight of naphtha or other suitable solvent, allowing sufficient time for thorough saturation, remove and drain. On installation, wipe dry of grease with a cloth to prevent accumulation of dust and dirt.

7. Clamp tab control cables with an equal length of chain on each side of sprocket.

8. Adjust socket (15) on operating screw so that when control rod (23) is connected to socket, the trailing edge of the tab will line up with trailing edge of aileron and outer panel trailing edge.

9. Install angle braces on socket guide (14) by installing screws (2).

10. Through inboard access flap in aileron cut-out trailing edge, place socket guide assembly in position and install screws (1), (5), and (10).

Note

Apply grease (Specification AN-G-3) to exterior of socket (15) prior to installation of guide assembly.

11. Remove control cable clamps installed according to instructions of paragraph *c*, (7), *(d)*, 7.

12. Connect control rod (23) to socket (15) by installing bolt (22), and connect bonding braid at socket guide to control rod.

13. At pin joints where bolts (18), (19), (21), and (22) are located, apply oil (Specification AN-O-6).

14. Through the first access flap from airplane center line on the lower surface of center section trailing edge, connect tab control cables at turnbuckles.

Note

Tighten turnbuckles to give required tension as outlined in Section IX, Table A. For safetying of turnbuckles, see Par. 18, *d*, (4), *(b)*, 6.

15. Remove clamp from aileron tab cables at bulkhead 2 in the hull.

WARNING

Check controls to insure that cables are not crossed.

d. WING STRUTS.
(See figure 59.)

(1) DESCRIPTION.—Two struts on each side of the air plane attach the wing to the hull. The front strut extends from an attaching fitting on the front spar of the wing at station 7.0 to an attaching fitting on the side of the hull at bulkhead 4. The rear strut extends from an attaching fitting at the rear spar of the wing at station 7.0 to an attaching fitting on the side of the hull at bulkhead 5. The front strut consists of a reinforced streamlined tube with an attaching fitting riveted in each end.

(2) REMOVAL.

(a) To prevent tilting of wing, place a support under each side of center section. (Handling lines on the ends of the wing will serve the same purpose.)

(b) Remove front strut as follows:

1. Remove screws (4), (5), and (6) at upper front strut fairing (3). Split fairing at aft edge and slip off strut.

2. Remove screws (18) and (21) at lower strut fairing.

3. Remove IFF and radio altimeter wiring, encased by Vinolite tubing, from the port and starboard front strut as outlined in paragraph *b*, (2), *(a)*, *17.*

4. Remove top bolt (2) using wrench (1), remove bottom bolt (22), and remove strut.

(c) Remove rear strut as follows:

1. Remove screws (8), (9) and (10) at upper rear strut fairing (11). Split fairing at aft edge and slip off strut.

2. Remove screws (14) and (15) at lower rear strut fairing (16). Split fairing at aft edge and slip off strut.

3. Remove bolts (7) and (13), take off top bolts first, and remove strut.

(3) INSTALLATION.—The struts are to be installed by reversing the procedure described in removal of struts. The bolts (2), (7), (13), and (22) are to be inserted in a fore-to-aft direction, bolting the lower ends of the struts first. The lower ends of the struts are marked with numbers corresponding to the number stenciled on the side of the hull in area of strut attaching fittings. After installing bolts, apply a coat of beeswax and grease (Navy Aero. Specification C-88-2) to strut attaching fittings and bolts.

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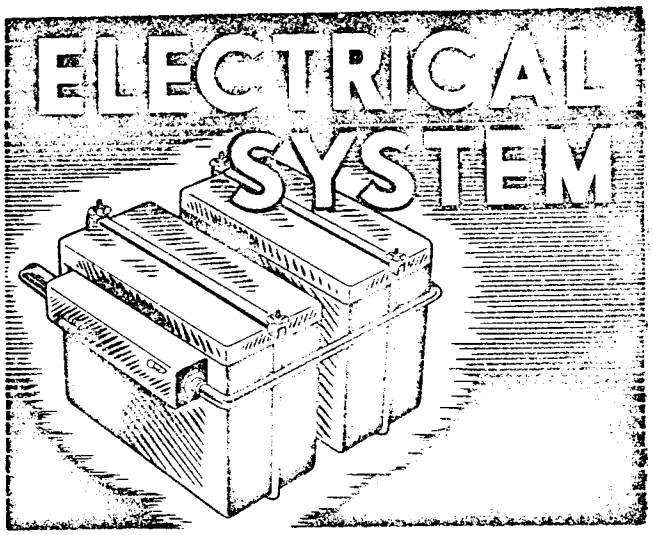
PARAGRAPH 22



22. ELECTRICAL.

a. GENERAL.—All electrical equipment other than radio and radar and the cooking stove is supplied with 24 volt direct current derived from three generators (one on each engine and the third on the auxiliary power unit) and two 12 volt batteries connected in series. The stove, radio, and radar equipment is provided with 120 volt, 800 cycle alternating current which is also obtained from the above mentioned engine and auxiliary power unit generators. Two additional 12 volt auxiliary batteries are installed in the airplane to supply current to the radio and radar equipment only.

All electrical wiring is protected by conduit.

All circuits are protected by fuses, limiters or either push-button or toggle type manual reset circuit breakers.

All wiring is provided with identifying numbers on each end to aid in tracing circuits and electrical continuity. All wire ends are protected with clear vinolite tubing, except those wires that are soldered in a plug.

To assist in the discussion of each circuit there is shown a wiring diagram, including a sketch showing the relative positions of the equipment, conduit, junction boxes, and wiring. See figure 207 for symbols used in the electrical wiring diagram.

b. GENERATORS.

(1) DESCRIPTION.—Three generators are used in the airplane, one driven by each of the two main engines, and the third driven by the auxiliary power unit. The function of the generators is to supply current for the operation of the various electrical systems of the airplane and to maintain the storage battery in a fully charged condition.

The engine-driven generators on both PBY-5 and PBY-5A airplanes and the auxiliary power unit generator on PBY-5 airplanes are Eclipse Type 716 A.C.-D.C. generators, whose D.C. output is 60 amperes at 28.5 volts and a speed of 2400-3600 rpm, and whose A.C. output is 10 amperes at 120 volts and 800 cycles at a speed of 2400-3600 rpm.

Note

The auxiliary power unit generator on PBY-5A airplanes is an Eclipse Type 638 A.C.-D.C. generator whose D.C. output is 60 amperes at 28.5 volts and whose A.C. output is five to seven amperes at 120 volts and 800 cycles.

The gear ratio between the main engines and the generator is 1 to 1.4 which means that to obtain the operating speed range of the generators, the main engines have to run at speeds of between 1714 and 2571 rpm.

The auxiliary generator, which is driven by the auxiliary power unit by means of a direct drive, is secured directly to the unit. *(See figures 160 and 161.)*

A main engine-driven generator is mounted on the rear of each engine between the two magnetos and under the starter, being attached by six studs and nuts. *(See figure 208.)* To provide a more secure mounting and to decrease vibration, one bracket is clamped near the rear of the generator and extends up and is bolted to the starter mechanism housing. Another bracket is located on the right side of the generator and is bolted to the oil screen housing.

Both A.C. and D.C. electrical connections are made by means of Cannon plugs and flexible conduit to two disconnect receptacles assembled to the middle section of the generator. (The Eclipse Type 638 generator has a terminal junction box mounted on top instead of the disconnect receptacles.)

The auxiliary generator is cooled by means of a fan which is an integral part of the auxiliary power unit. This fan draws air through the generator. The cool air enters the generator through the blast tube, flows through the generator, and exhausts through the ports and screen on the inboard end of the generator.

The main engine-driven generators are cooled by means of a flexible hose, which runs from the small air scoop located on the aft part of the oil cooler housing to the air blast tube on the rear part of the generator. *(See figure 130.)* The cool air enters through the scoop, flows through the flexible hose, and then through the ports and screen on the forward part of the generator.

The wires that attach to the main engine-driven generators run through flexible conduits to a disconnect

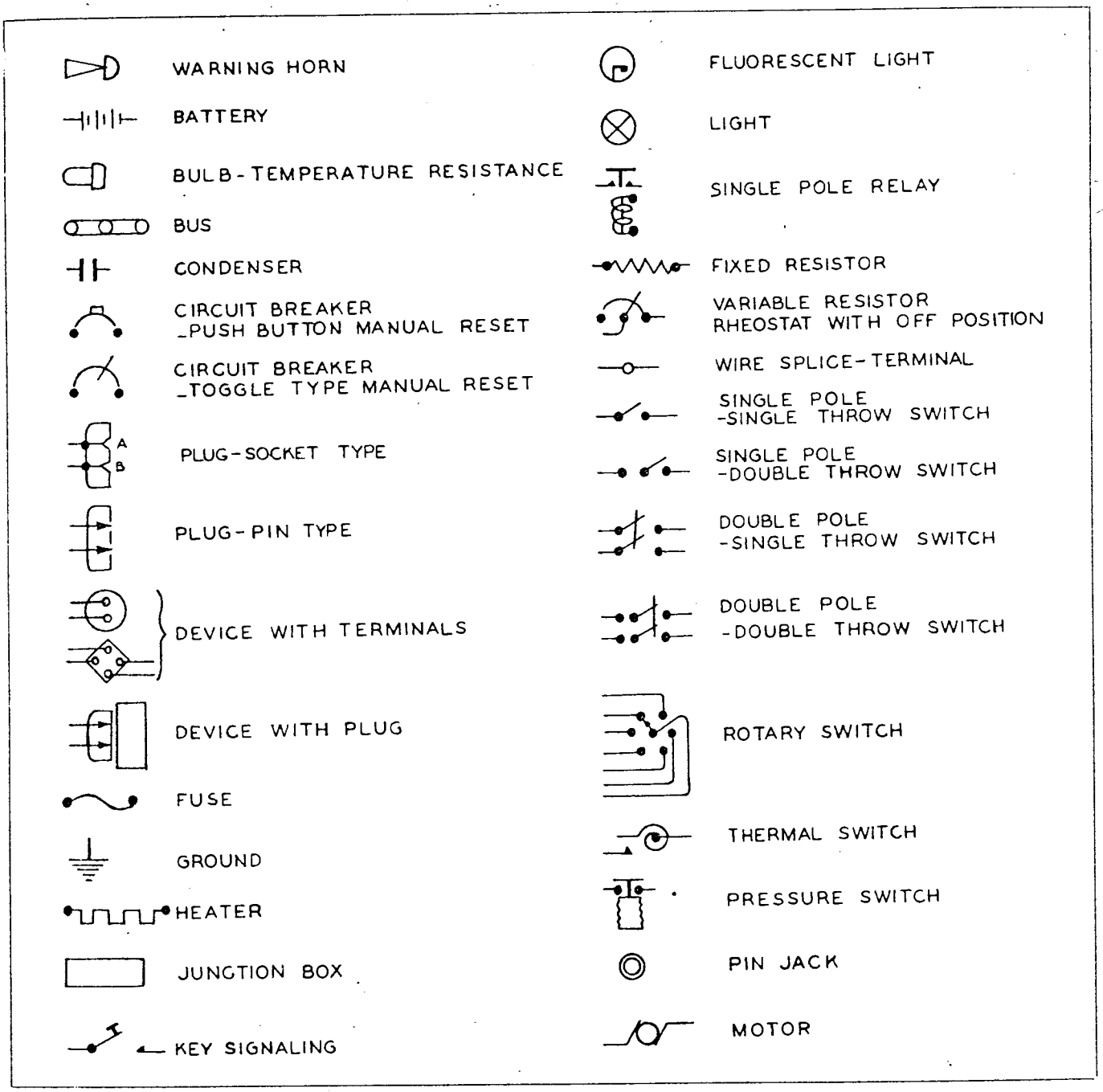


Figure 207—Wiring Diagram Symbols

plug mounted on the inboard side of the engine firewall.

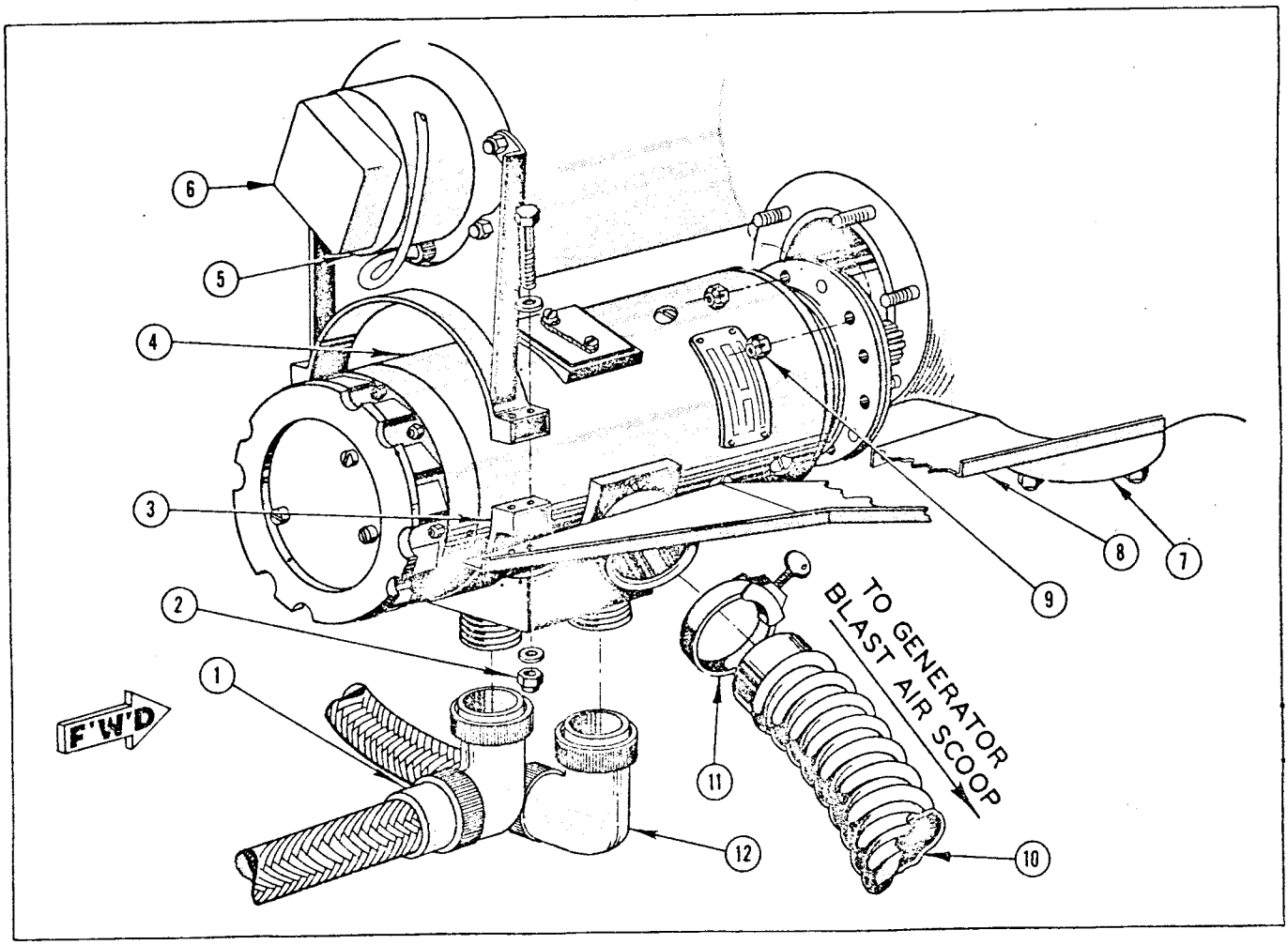
The wires that attach to the auxiliary generator, on PBY-5 airplanes, run through conduit to the auxiliary power unit control panel. This control panel is mounted beneath the starboard food locker. On PBY-5A airplanes the A.C. wires connect to receptacles in the A.C. distribution box on the forward face of bulkhead 4 outboard of the main distribution panel, while the D.C. wires run from the generator to a voltage regulator just above the auxiliary power unit and then to the main distribution panel.

The D.C. output of all generators is controlled by reverse current relays in the main distribution panel, and by voltage regulators. Voltage regulators are also provided to regulate the A. C. voltage of all generators.

(2) REMOVAL AND DISASSEMBLY.

For removal of the auxiliary power unit generator, see Par. 17, *c*.

(a) REMOVAL OF GENERATOR FROM PORT ENGINE.
(See figure 208.)



No.	PART No.	NAME	No.	PART No.	NAME
1		A. C. Conduit and Fitting	6		Starter
2	AN4-22A	Bolt	7		Oil Screen Chamber Cover
	AN365-428	Nut	8	28P5169	Bracket
	AN960-416	Washer	9		Nut
3	28P5529-11	Strap Assembly	10		Generator Blast Tube
4	Type 716 (Eclipse)	Generator	11		Clamp
5	28P5529-6	Strap and Support Assembly	12		D. C. Conduit and Fitting

Figure 208—Generator Installation

1. Raise short wrap cowl on both sides of nacelle. (See Par. 7, *e*, (1), *(b)*.)

2. Shut off oil supply to engine.

3. Shut off fuel supply to engine.

4. Remove engine "oil in" line from crankcase and drain valve.

5. Disconnect "oil return" line from engine.

6. Disconnect cross-feed fuel line from fuel pump.

7. Remove "oil in" and "oil return" flanges from crankcase.

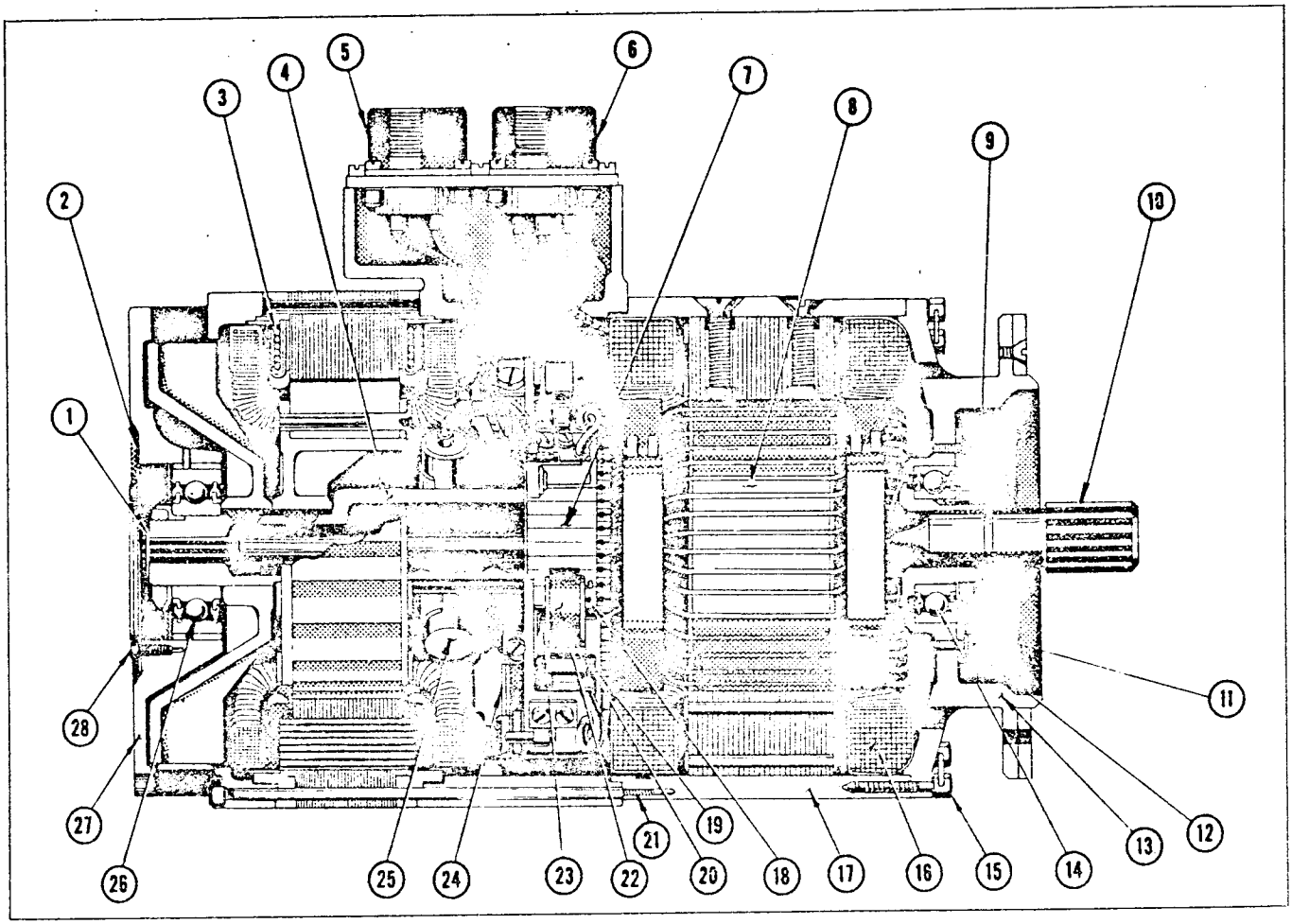
8. Remove starter brace (5) and strap (3) from generator by detaching nuts (2).

9. Disconnect electrical conduit (1) and (12) from generator (4).

10. Remove generator blast tube (10) by detaching clamp (11).

11. Remove top cowl panel (section between short wrap cowl panels).

12. Loop a rope sling or strap over aft end of generator case to support the generator while removing it from the nacelle.



No.	NAME	No.	NAME
1	Cover—End	15	Bolt
2	Ring—Lock	16	Coil Assembly—D-C Shunt Field
3	Coil—A-C	17	Yoke
4	Shaft—Armature	18	Sleeve—Brush Spring Adjusting
5	Receptacle—Disconnect (A-C)	19	Brush
6	Receptacle—Disconnect (D-C)	20	Arm—Brush Spring
7	Commutator	21	Stud
8	Armature	22	Spring—Brush
9	Gasket (Drive Shaft)	23	Box Brush
10	Shaft—Drive	24	Board—Brush
11	Retainer—Bearing	25	Condenser
12	Screw	26	Bearing—Ball (Front Head)
13	Flange—Mounting	27	Head—Front
14	Bearing—Ball (Mounting Head)	28	Screw

The above generator is an Eclipse type 716.

Figure 209—Generator Assembly

13. Loosen, but do not remove one upper elastic stop nut (9) on generator mounting flange until the other five nuts have been removed, and then only after provision has been made to prevent the generator from falling and causing damage to the spline coupling, the generator, or adjacent parts in the engine mount.

14. Support generator and remove remaining nut from mounting flange.

15. Lift generator back and out of nacelle on the left side between the fast feathering pump and engine crankcase.

16. Install cover over engine mounting pad

and make provisions to protect the generator spline coupling while it is removed from the engine.

(b) REMOVAL OF GENERATOR FROM STARBOARD ENGINE.—The procedure for the removal of this generator is essentially the same as for the generator removal from the port engine. The following differences, however, should be noted:

1. The generator is removed from the right side of the nacelle.

2. It is not necessary to disconnect the cross-feed fuel line from the fuel pump.

3. It is necessary to remove the cover (7) from the oil screen chamber on the engine crankcase and remove the generator support bracket (8).

(c) The generator should not be disassembled any further than is necessary to remove or replace the brushes (See paragraph *b,* (3),) Further disassembly should be attempted only at major repair bases.

(3) MAINTENANCE. *(See figure 209.)*—Maintenance of the generators consists of inspection of connections for tightness, replacement of brushes, and cleaning. If major repairs are necessary, replace generator with new or reconditioned generator and send old one to repair base for overhaul.

(a) Remove the air blast cover (1) and blow dust out of cover and out of generator with clean, dry, compressed air.

(b) Inspect the brushes (19). If they are oil soaked or are worn down to a length of ½ inch on the short side, replace with new ones.

(c) When replacing the brushes, lift the brush spring (22) with a hook only far enough to remove the brushes. Any further bending of the spring may distort the spring and change the tension.

CAUTION

Do not allow spring to snap down on the brush as it may chip or crack the brush.

When new brushes are installed, the spring tension should be checked with a spring scale. Hook the scale under the brush spring arm (20), and then lift the arm until the bottom surface of that part of the arm which normally rests on top of the brush is 3/16 inch above the top of the brush box (23). The tension should read 28 to 32 ounces. If the tension does not fall within these limits, the position of the adjusting sleeve (18) must be altered to give the correct tension.

(d) New brushes should be seated on the commutator (7) to make sure of the correct brush fit and to eliminate arcing and burning at the commutator. After the new brushes are installed, they should be seated with a seating stone or No. 000 sandpaper to secure the proper fit. With the generator running in its correct direction of rotation, insert the seating stone or sandpaper between the brush holders. Move the seating stone or sandpaper back and forth across the commutator so that an even sanding is obtained without grooving the commutator. Brushes should be seated until at least 80 per cent of their surface is seated to the commutator.

CAUTION

Do not seat brushes more than necessary.

Blow all sand and carbon dust out of the generator. The generator should then be run under load until the brushes contact the commutator over their entire contacting surface.

(e) Wipe away all oil with a clean lintless cloth.

(f) The generators are lubricated at the factory and therefore need no periodic lubrication. Bearings are repacked with grease (Specification AN-G-5) at time of overhaul of generator.

(4) INSTALLATION.—To assemble and install main generators, reverse procedure outlined in paragraph *b,* (2). To install auxiliary power unit generator, see Par. 17, *c.*

(5) OPERATIONAL CHECK.

(a) Run the two main engines within the rated speed of the generators. This is from 1714 to 2571 rpm for the main engines due to the 1 to 1.4 gear ratio between the main engines and the generators. The auxiliary generator operates at the same speed as the auxiliary power unit. The engines are to be run for a period of 15 minutes to warm up the voltage regulators.

(b) Place the voltage selector switch on the main distribution panel to "STB'D. GEN." If the voltage does not read from 28 to 28.5 volts, see paragraph *b,* (6) for locating the cause.

Repeat voltage test for port engine and auxiliary power unit generators. By means of a portable voltmeter, check the A.C. voltage of each generator in the A.C. power junction box. Failure to develop proper voltage does not necessarily mean that the generator is defective as the trouble may lie in the voltage regulator. Before removing generator for repair, carefully check all wiring between the generator and voltmeter to be sure the trouble does not lie in the wiring.

(6) TROUBLE SHOOTING CHART.

TROUBE	CAUSE	REMEDY
(a) Intermittent operation.	*1.* Loose connections (screws, solder lugs, Cannon plugs, etc.)	*1.* Check by twisting and pulling, and repair if necessary.
	2. Faulty adjustment of reverse current relay.	*2.* Check and readjust. (See paragraph *f,* (4).)

TROUBLE	CAUSE	REMEDY
	3. Faulty adjustment of voltage regulator.	3. Replace and return to repair base.
	4. Frayed or worn insulation.	4. Check and repair.
	5. Loose ground connection.	5. Clean and tighten. Replace lug and ground bus, if badly pitted.
	6. Intermitten grounds in wiring of connections.	6. Check and repair.
(b) Generator operates at rated rpm with low voltage output.	1. Defective voltage regulator.	1. Replace and return to base for repair.
	2. Loose or high resistance wiring connections.	2. Check and repair.
	3. Worn brushes.	3. Replace. (See paragraph *b*, (3).)
	4. Dirty, rough or pitted commutator, or slip rings.	4. Clean with No. 00 or finer sandpaper.
	5. Low brush spring tension.	5. Replace spring.
	6. Brushes not moving freely in holders.	6. Remove brushes. Clean brushes and holder with carbon tetrachloride.
	7. Shorted or open armature.	7. Replace generator and return to repair base.
	8. Excessive brush play.	8. Replace brush.
	9. Partial short in power wiring or connections.	9. Check and repair. Replace defective wires or parts.
(c) Generator operating at rated rpm with no voltage.	1. Generator field demagnetized.	1. Replace generator and return to repair base.
	2. Grounded or open field circuit.	2. Replace generator and return to repair base.
	3. Blown fuse.	3. Replace fuse.
(d) Generator operating at normal rpm with reversed D-C voltage.	Generator field magnetized in wrong direction.	Replace generator and return to repair base.
(e) Excessive arcing of generator brushes.	1. Dirty commutator or slip rings.	1. Clean with No. 00 or finer sandpaper.
	2. Worn out brushes.	2. Replace. (See paragraph *b*, (3).)
	3. Brushes stuck in holders.	3. See *(b)*, 6 above.
	4. Short circuit in system.	4. Check connections and insulation and repair.
	5. Open or shorted armature or field coil.	5. Replace generator and return to repair base.
(f) Generator D-C fuse blows during flight.	1. Overload on D-C generator.	1. Reduce load and replace fuse.
	2. Short circuit in main distribution panel.	2. Check and repair.
(g) D-C generator fuse blows on ground.	Reverse current relay stuck.	Open contacts by hand and clean with crocus cloth.

c. BATTERIES.

(1) DESCRIPTION.—The batteries consist of two AN3152, Type S-34 shielded main storage batteries connected in series, and two AN3153-1, Type S-17 auxiliary storage batteries connected in series. The main batteries are rated at 12 volts and 34 ampere hours capacity (based on a five hour discharge rate). Ordinarily, they are maintained in a fully charged condition by the surplus output of the generators.

The main batteries are located in the wing center section leading edge, one inboard of the port nacelle and the other inboard of the starboard nacelle.

The auxiliary batteries are rated at 12 volts and 17 ampere hours capacity. They are located on the floor of the radio compartment under the radio operator's seat.

The main batteries are connected to the ground in the main distribution panel and to the main engine-driven generators and the auxiliary power unit driven generator through busses "A" and "B" in the main distribution panel. The main batteries are connected to several of the more important units of the airplane in the main distribution panel and in other junction boxes in the airplane.

The main batteries are directly connected to the floats and engine starters and should not be used alone to operate these units, as the heavy current drain would discharge the batteries in a very short time. Operate these units only when the auxiliary power unit or main engines are running.

The main batteries are used to operate lights and smaller pieces of equipment for brief periods when the airplane is grounded, and for emergency standby service in the air. The batteries also assist in combating voltage drops when heavy loads are suddenly turned on during flight.

The auxiliary batteries are used for feeding the radio and radar circuits only. For charging, they are connected to busses "A" and "B" in the main distribution panel through a reverse current relay.

(2) REMOVAL. *(See figure 210.)*—Access to main batteries is obtained through access doors (13) *(See figure 20.)* in the wing leading edge. The auxiliary batteries are readily accessible under the radio operator's seat.

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

(b) Loosen the thumb screws (1) that hold the cross bar (28) on top of the battery.

(c) Push clip (2) up directly under the thumb screw; and then push tie rod (26) to one side to permit removal of the cover (27).

(d) Unscrew wing nuts (16) and then remove conduit terminal box cover (17).

(e) Using special wrench 28U2006 *(See figure 40.)*, remove wing nuts (15) and washers (13) and (14) that hold wire terminals to battery terminal posts (18) and (25). Remove negative or grounded wire first, then the positive wire.

(f) After disconnecting conduits (24) and (10) from the conduit terminal box (11), pull wires out of conduit terminal box and then remove battery from rack.

(3) MAINTENANCE.

(a) CHARGING.—Batteries should be kept in a full state of charge to insure them against freezing at low temperatures and to assure the delivery of their rated voltage and current. A fully charged battery should show the following readings on a hydrometer (specific gravity indicator), at the temperatures indicated. *(See figure 211.)*

TEMPERATURE	SPECIFIC GRAVITY
10°C (50°F)	1.285 to 1.310
27°C (80°F)	1.275 to 1.300
43°C (110°F)	1.265 to 1.290

To take a hydrometer reading: remove cover of battery (27); unscrew vent plugs (4) *(See figure 210.)*, and with the hydrometer held vertical, insert the nozzle of the hydrometer syringe into the battery through the vent plug hole; squeeze the bulb of the hydrometer syringe and release slowly until enough electrolyte is drawn up into the tube to float the hydrometer. The correct reading taken is at the level of the liquid on the hydrometer. *(See figure 211.)* Care should be taken to keep the hydrometer float and syringe clean to insure correct readings. The hydrometer must float freely to give correct reading. If the float sticks to the side of the syringe, shake gently to free the float. The electrolyte withdrawn for the test must be returned to the cell from which it was taken.

Note

In case the electrolyte has been permitted to fall below the taps of the plates, the battery may have to be tipped to one side in order to have enough electrolyte reach the nozzle of the syringe to float the hydrometer.

Hydrometer readings should never be taken immediately after adding water or electrolyte to the battery. When the battery is on charge and gassing, a hydrometer reading may be taken an hour after water or electrolyte has been added. When the battery is not being charged, allow 24 hours after adding water or electrolyte before taking a hydrometer reading.

When the specific gravity of any cell of the battery falls below the values given in the table for full charge hydrometer readings, the battery should be put on charge to restore it to a fully charged condition.

To charge a battery, connect the leads of the charging unit to the respective terminals of the battery (positive to positive and negative to negative). The charging voltage should be sufficient to maintain at least 2.33 volts per cell. If the battery is very low

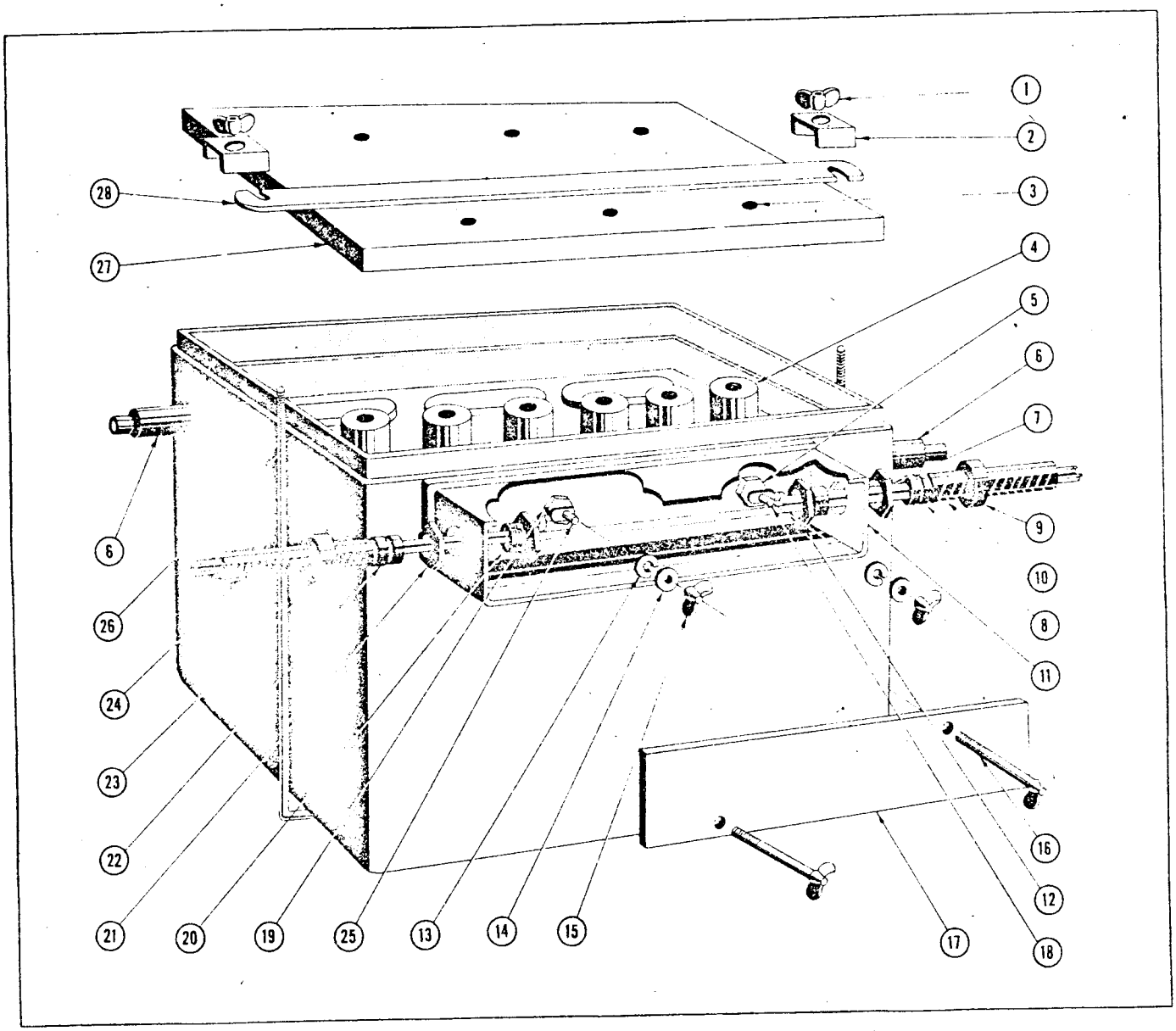


Figure 210—Battery Installation

on charge, a larger current (amperage) may be used until the cells start to gas or the temperature of the electrolyte rises to 43.5°C (110°F). When either of these two occur, reduce the current to 3.5 amperes, and continue charging until all cells gas or bubble freely. When three successive half hour hydrometer readings show no further increase in specific gravity, remove from charging unit.

Specific gravity and temperature readings should be taken every 30 minutes during charging of a battery.

After charging as outlined above, if the cell does not rise to 1.275 to 1.300 specific gravity, remove some of the electrolyte and replace with 1.325 specific gravity electrolyte. Charge for one hour and take reading again; if the cell still has not reached 1.275 to 1.300 specific gravity, repeat process until correct specific gravity is obtained.

Should the cell read too high after charging as outlined above, remove some of the electrolyte and replace with distilled water. Charge battery for one hour and if specific gravity is still too high, repeat this process until correct specific gravity is obtained.

CAUTION

Never adjust the specific gravity of a cell that does not gas or bubble on charge.

Do not remove vent plugs while charging,

No.	PART No.	NAME	No.	PART No.	NAME
1	AN350-1032	Thumb Screw	15		Wing Nut
2	28E2008-3	Clip	16		Wing Nut
3		Vent Hole	17		Conduit Terminal Box Cover
4		Vent Plug	18		Positive Terminal Post
5	Q6211-17	Wire Terminal	19	Q6211-17	Wire Terminal
6		Vent Tube	20	AN3054-16	Conduit Box Connector
7	AN3066-16	Coupling Locknut	21	AN3066-16	Coupling Locknut
8	AN3050-16	Ferrule	22	AN3050-16	Ferrule
9	AN3054-16	Conduit Coupling Nut	23	AN3054-16	Conduit Coupling Nut
10		Flexible Conduit	24		Flexible Conduit
11		Conduit Terminal Box	25		Negative Terminal Post
12	AN3064-16	Conduit Box Connector	26	28E10047	Tie Rod
13		Lock Washer	27		Cover
14		Washer	28		Cross Bar

except for addition of water, or the taking of hydrometer or temperature readings.

If the battery is left in the airplane while being recharged, disconnect the battery switch from the busses in the main distribution panel.

CAUTION

Ventilate battery compartment while charging to remove gases generated by battery. These gases form a combustible mixture and therefore flame, spark, lighted cigars, or cigarettes should not be brought close to the battery when charging or shortly afterward.

Water must be added from time to time to replace that lost by charging and evaporation. Be sure and use only distilled water, (not merely boiled water). The level of the electrolyte should not be lower than the tops of the separators and not higher than ½ inch above the protector on top of the separators. If too much water has been added, immediately withdraw enough solution (by means of a syringe) until proper level is reached.

CAUTION

If electrolyte is spilled on any of the surrounding surfaces, flush all affected areas with water, drain, and sponge with a solution of 0.9 pounds of chromic acid, or 1.32 pounds of potassium dichromate to each U. S. gallon of water. Use hot water if available.

If previous method cannot be used, apply baking soda (sodium bicarbonate) mixed with water to the consistency of a thin paste to the affected area until all bubbling action stops. Then wash with water and dry thoroughly. Do not allow any of the above neutralizing solutions to enter the cells of the battery.

If finish has been removed, paint area affected with clear acid resistant lacquer.

A battery fully charged will freeze at —63°C (—85°F) (1.275 specific gravity or higher), and a battery low on charge will freeze at —7°C (+19°F) (1.100 specific gravity).

CAUTION

In cold climates, add water only before charging as the water will freeze unless mixed with the electrolyte. Failure to do this may result in failure or damage to the battery.

If the electrolyte of a cell is lower than the other cells, inspect that cell for leakage.

A cell that shows a reading of more than 0.2 volts lower than the other cells of the battery should be considered defective and the battery replaced.

If the airplane is to remain idle for more than one week, remove the battery and send it to the battery room for proper maintenance. If the battery is damaged, do not attempt to repair it—replace with a fresh one.

(b) The terminals of the batteries must be kept clean and their connections tight. When dirty, scrape the terminals until clean and wash them and the top of the battery with bicarbonate of soda (one pound of soda to one gallon of water) to neutralize any electrolyte that may have been spilled. Keep vent plugs tight when washing. Rinse with water, dry, and apply a thin coating of "NO-OX-ID" grease or vaseline to the terminals.

(c) It is recommended that a card be kept recording the dates on which water was added, battery recharged, etc. This records a history of the battery and is helpful in analyzing any trouble encountered with the battery.

(4) INSTALLATION.

(See figure 210.)

(a) Place battery on rack.

(b) Place cover (27) over battery.

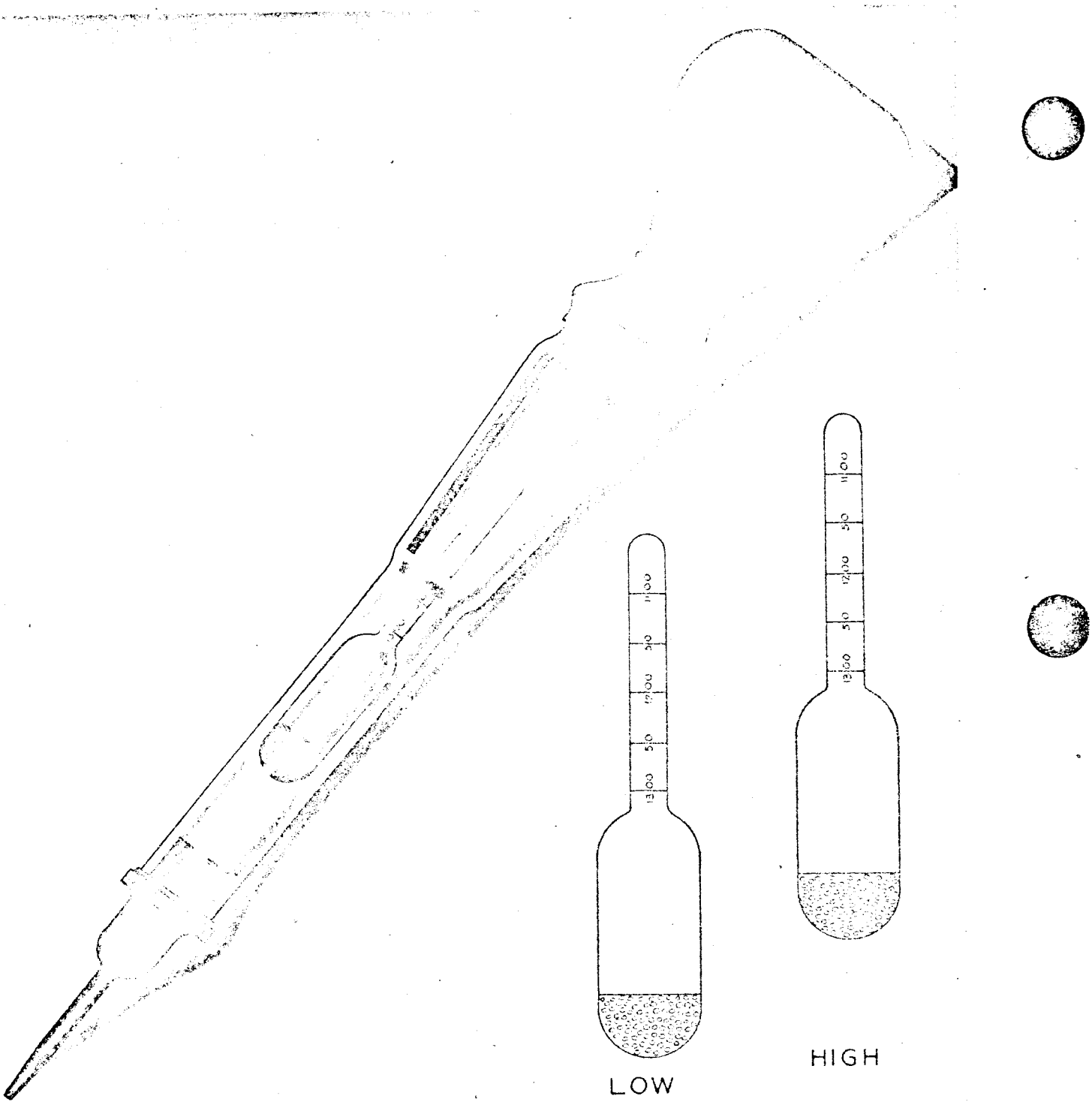


Figure 211—Hydrometer

(c) Engage notches in cross bar (28) with tie down rod (26); place clips (2) over tie rods and cross bar notches; and screw wing nuts (15) on tie down rod to secure cover (27).

(d) Connect conduits to each end of conduit terminal boxes (11) of both batteries.

(e) Connect the positive wire from one battery to the negative pole of the other battery.

(f) Connect the remaining two wires, one to the negative pole of the first battery, and the other to the positive pole of the second battery.

Note

To attach wire terminal to battery terminal post: slip wire terminal over battery terminal post; install lock washer (13) and washer (14); and then tighten with wing nut (15) using special wrench 28U2006. *(See figure 40.)*

(g) Apply a light coating of vaseline to all terminals to prevent corrosion.

(h) Place conduit terminal box cover (17) in position and secure with wing nuts (16).

(5) OPERATIONAL CHECK.—Throw voltmeter switch on main distribution panel to "MAIN BAT" and check voltmeter for 24 volt reading. Turn voltmeter switch to "OFF" and then momentarily operate floats as a further check. Check the auxiliary battery also by means of the voltmeter and the switch on the main distribution panel.

If the above checking procedure is fulfilled, the battery and connections are in serviceable condition.

d. ELECTRICAL POWER DISTRIBUTION.

(1) DESCRIPTION.
(See figures 212 and 213.)

(a) DIRECT CURRENT DISTRIBUTION.—Direct current from each generator is carried in a conduit through the wing center section to a junction box for both conduits at station 0.0 in the leading edge. One conduit carries both lines from this box to a small splice box on the forward face of bulkhead 4, above and slightly inboard of the main distribution panel. Separate flexible conduits connect each line from this box to a voltage regulator and from each regulator to the main distribution panel.

Both positive and negative (ground) wires from the generators run to the main distribution panel. The negative wires are connected directly to a ground bus in the back of the panel. Each positive wire runs through a reverse current relay, fuse, and ammeter, in the order named, to a bus selector switch on the face of the panel. There it may be connected by a switch to either of two buses (bus A or bus B) from which current is distributed throughout the plane by branch circuits.

Direct current from the auxiliary generator is fed through flexible conduit to a D-C voltage regulator on the port side of the galley compartment above the auxiliary power unit. From the voltage regulator, rigid conduit carries the feeders to the back of the float relay box. From this box they feed through the main pull box to the main distribution panel.

Both the negative and positive wires from the main batteries in the wing pass through conduit from the wing to the power junction box on the forward face of bulkhead 4 inboard of the main distribution panel. From here, the wires run through conduit to the main distribution panel. Here, the negative wire connects to a grounded terminal post, while the positive wire connects to either bus "A" or bus "B" through the main battery switch.

Both positive and negative wires from the auxiliary batteries run through conduit to the main distribution panel where the negative wire connects to a grounded terminal post while the positive wire connects to the auxiliary battery reverse current relay and thence to either bus "A" or bus "B" through the auxiliary battery switch.

The system is also provided with a voltmeter and voltmeter selector switch on the main distribution panel.

All other power leads such as lights, outlets, etc., receive their power from one of the buses in the main distribution panel as will be shown on diagrams to follow.

(b) ALTERNATING CURRENT DISTRIBUTION.—Alternating current is carried through the wing in conduits from each engine firewall to the A.C. junction box in the wing leading edge on center line of airplane.

From here (on PBY-5A airplanes) a single conduit carries the wires to the A. C. power distribution panel. The wires pass through this panel and then through conduit to a junction box on the outboard end of the radio locker. From the junction box, the wires pass through flex conduit to the two A.C. voltage regulators on a floor bracket beneath the radio locker. From the voltage regulators, the wires return through two other flex conduits to the junction box and thence through flex conduit to the A.C. power distribution panel on the forward face of bulkhead 4 outboard of the main distribution panel.

On PBY-5 airplanes, a single conduit carries the wires down from the wing to a junction box on the aft face of bulkhead 4, starboard side. From here, the wires pass through two A.C. voltage regulators located outboard of the junction box, and then through conduit to the A.C. power distribution panel on the forward face of bulkhead 4.

On both PBY-5 and PBY-5A airplanes, the wires pass through fuses in the A.C. power distribution panel and then to receptacles on the forward face of the panel.

Alternating current from the auxiliary power unit generator is fed directly from the generator to a fuse in the A.C. power distribution panel and then to a receptacle on the face of the panel.

(2) MAINTENANCE.

(a) Maintenance of the electrical power system consists of a thorough inspection of all the various parts that comprise this system and repairing, adjusting, or replacing the parts found to be defective as described below.

(b) Disconnect the battery leads before making an inspection as this will eliminate any possibility of an accidental short circuit while servicing the equipment.

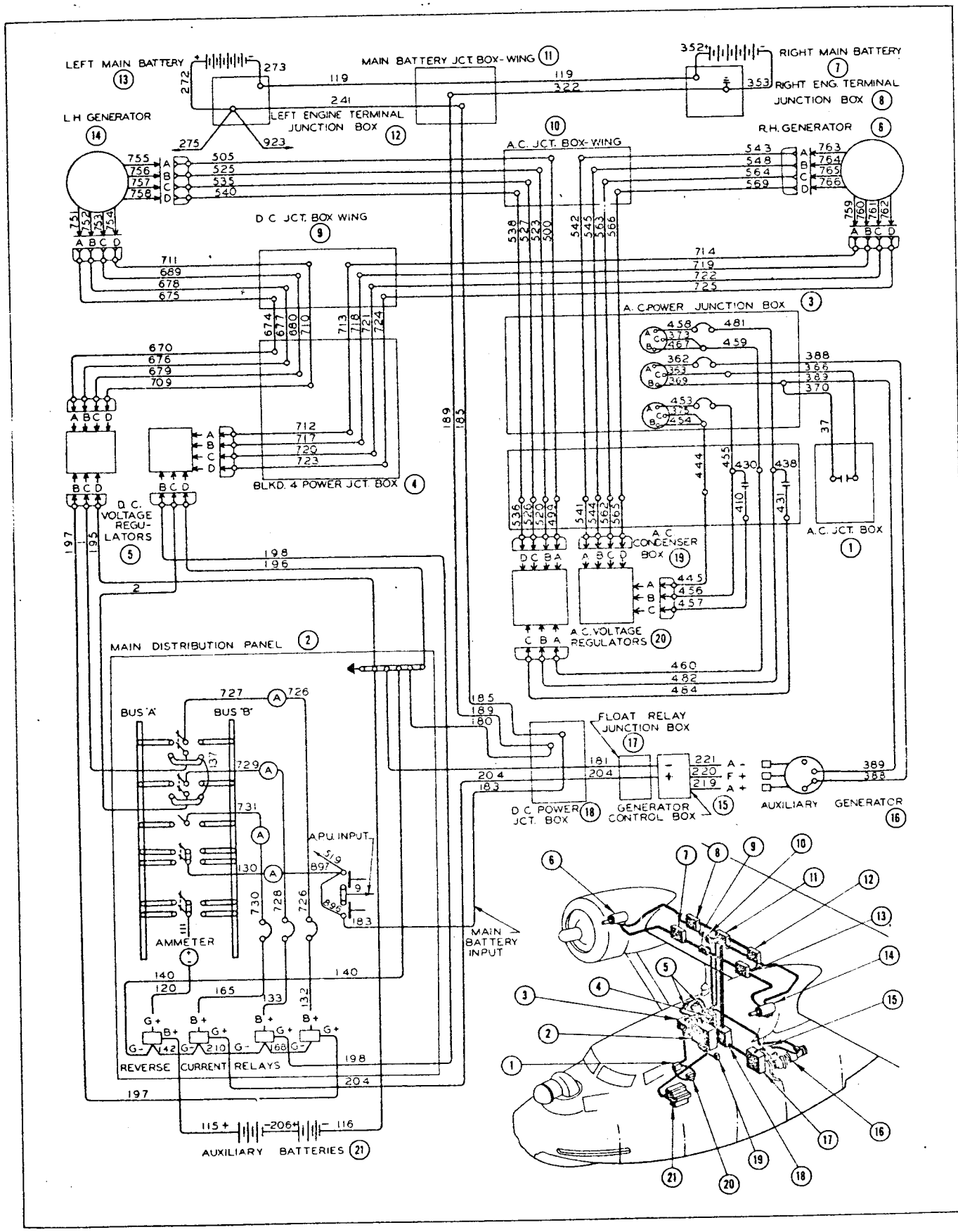


Figure 212—Electrical Power Distribution Circuit (PBY-5A Only)

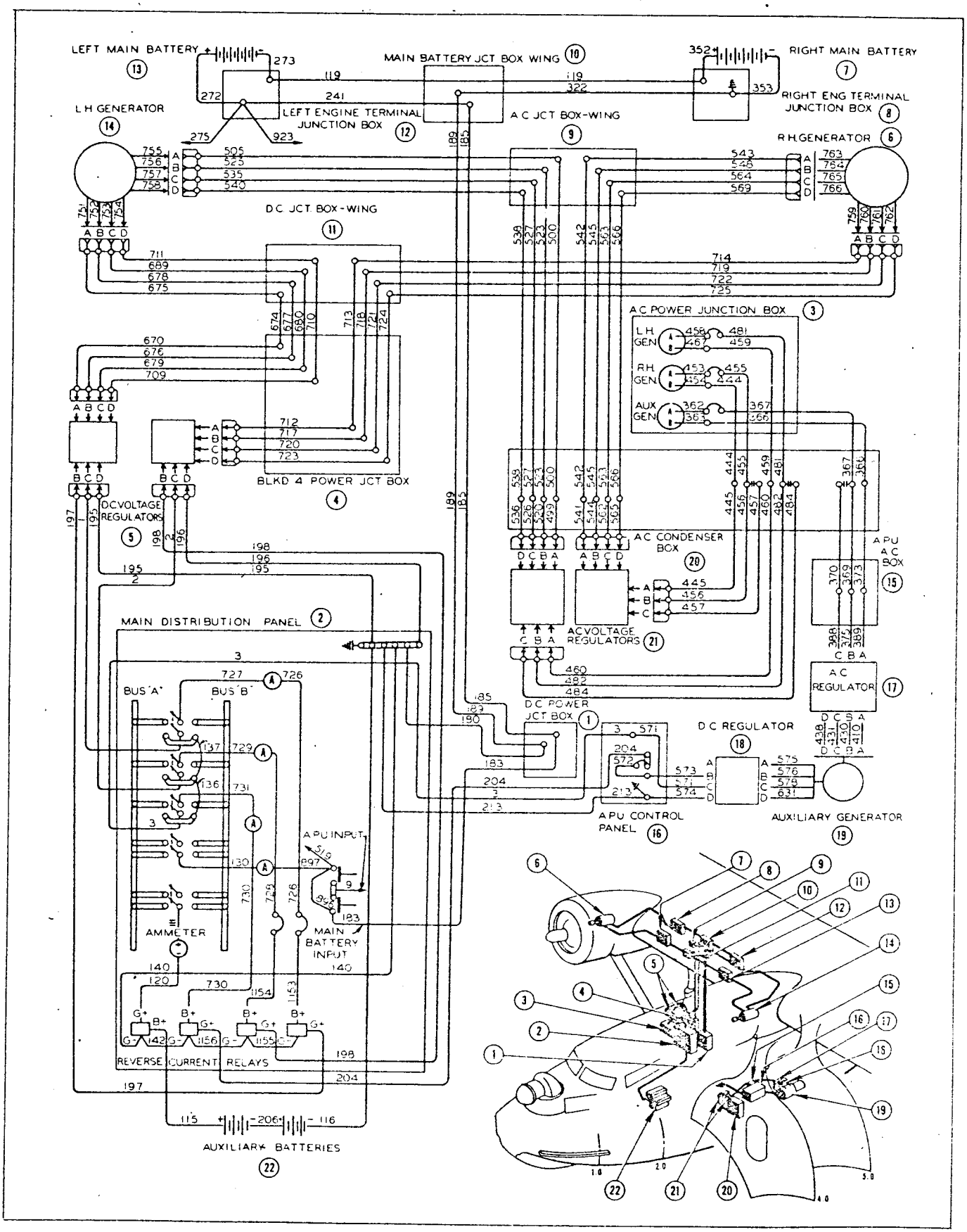


Figure 213—Electrical Power Distribution Circuit (PBY-5 Only)

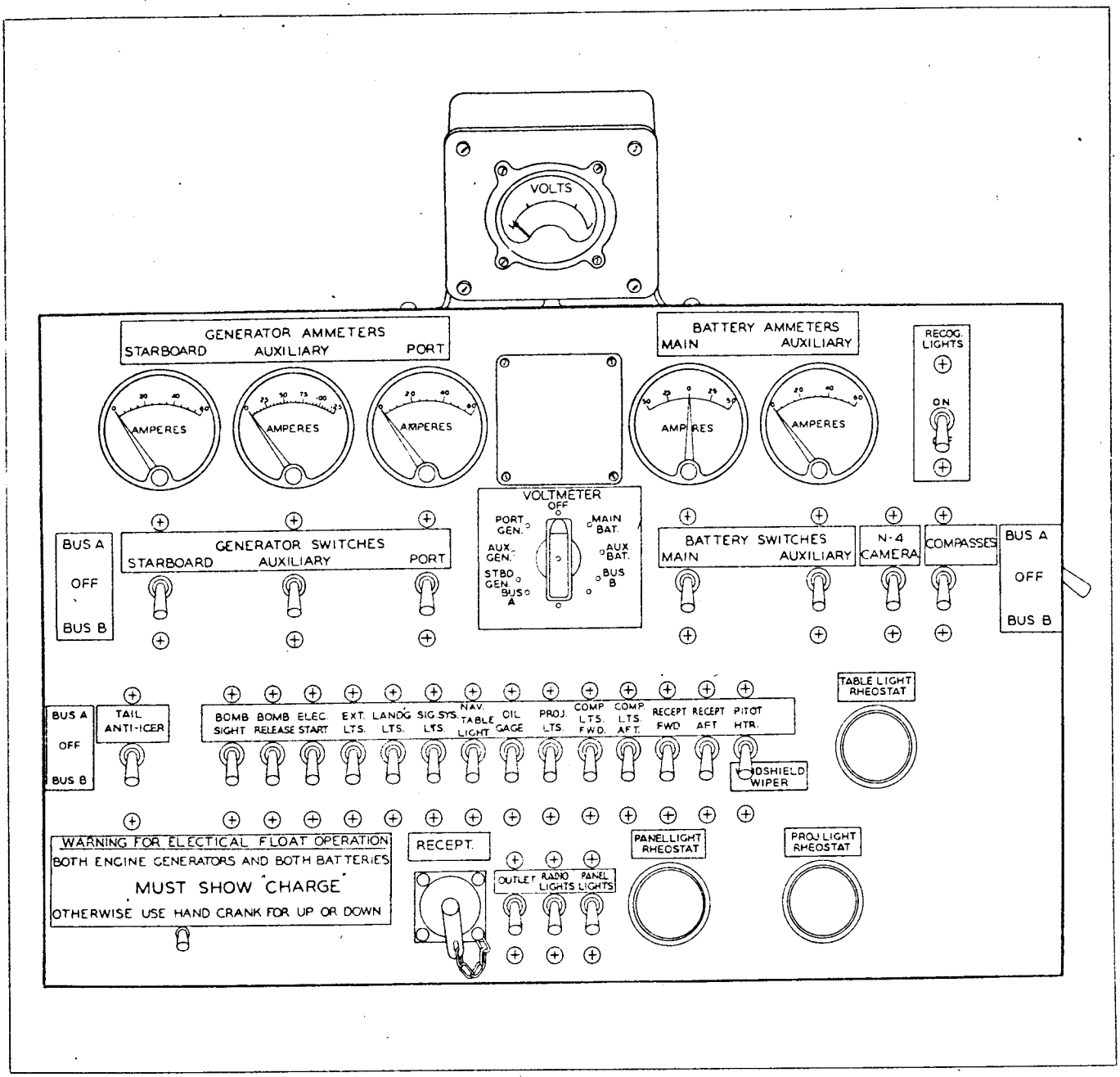


Figure 214—Main Distribution Panel

(c) Maintenance of the generators, batteries, voltage regulators, and reverse current relays is covered in the discussion of these parts under paragraphs *b, c, e,* and *f* respectively.

(d) Check all terminals and ground studs for corrosion and tightness of the nuts. If the terminals are corroded, clean with 000 sandpaper. After sanding, tighten nuts and blow all dust, etc., out by means of clean, dry, compressed air. If any parts are corroded, burned, or pitted too badly to be repaired, replace with new parts.

(e) Uncouple the connector plugs indicated on the wiring diagram. *(See figures 212 and 213.)* Remove any discoloration or corrosion from contact pins with crocus cloth. Blow out dust and particles of foreign matter with dry compressed air. If insulation is damaged, pins do not make good contact, or pins are pitted, remove the plug and replace with a new one. Recouple the connector and tighten the coupling nut firmly.

(f) Check wiring at conduit entrances and at solder pots on connector plugs for broken strands, frayed, broken, or chafed insulation and repair or replace if necessary.

(3) OPERATIONAL CHECK.

(a) On main distribution panel, turn main bat-

tery switch to either bus "A" or "B" and then turn the electric starter switch to the same bus.

(b) Turn either the right or left engine starter switch on the engineer's panel to "START" and hold it there for about five seconds. If the starter motor accelerates normally, it indicates that the main storage battery power circuit is functioning properly. An alternate check may be used as outlined in paragraph *c*, (5).

(c) Operate both main engines at 1800 rpm. Turn the right and left engine generator switches on the main distribution panel to either bus "A" or bus "B" position and the main battery switch to the "OFF" position.

(d) Switch on several circuits to the same bus to provide a load of between 150 amperes and 200 amperes.

(e) Check the right and left engine generator ammeters and the voltmeter located on the main distribution panel.

The voltmeter must read between 28 and 28½ volts. The ammeters will indicate the electrical output of the generators, and should give approximately equal readings.

e. GENERATOR VOLTAGE REGULATOR.

(1) DIRECT CURRENT REGULATORS. *(See figure 215.)*

(a) DESCRIPTION.—There are three direct current voltage regulators, one for each engine generator and one for the auxiliary power unit. The engine generator regulators are mounted vertically on the starboard side wall of the radio compartment, forward of bulkhead 4. The forward regulator is for the port generator. The auxiliary power unit regulator is the lower one of two mounted horizontally on the starboard side of the engineer's compartment, forward of the auxiliary power unit on the PBY-5. On the PBY-5A, it is mounted above the auxiliary power unit on the port side aft of bulkhead 4.

Each regulator, except the PBY-5A auxiliary power unit regulator, (which is a Navy type NF-1D regulator) is an Eclipse type 1002, Model 1, and operates on the carbon pile principle. It consists of a stack of carbon discs, a multi-leaved spring and armature assembly, and a solenoid coil with an adjustable core. The carbon discs are compressed by an adjustable screw against the center of the spring. Pressure of the spring is regulated by the attraction of the solenoid coil for the iron armature attached to the spring.

(b) PRINCIPLE OF OPERATION.—The carbon pile resistor is connected in series with the shunt field of the generator. The solenoid coil is connected through a resistor across the output of the generator. Whenever the generator current rises above 28.5 volts, the current in the solenoid increases. This increased current exerts a stronger pull on the armature, and decreases the tension on the attached spring, with a consequent decrease of pressure on the carbon discs. The discs tend to separate, thereby increasing the resistance in the generator shunt field winding, which results in decreased generator voltage. When the generator voltage falls, a reverse action takes place. Resistance of the field circuit is decreased and the generator voltage rises. Proper adjustment of the regulator should hold the generator voltage very close to 28.5 volts at any generator speed above 2400 rpm. Below that speed the generator will not put out 28.5 volts.

The regulator contains an equalizing coil to assist in equalizing the load when the generators are operated in parallel. The action of this coil is to increase the voltage of the generator carrying the heaviest load and decrease that of the one with the least load.

(c) REMOVAL AND DISASSEMBLY.

1. For removal of auxiliary power unit regulator, see Par. 17, *c*.

2. Disconnect Cannon plugs at each end of the main engine generator regulators.

3. Remove four bolts and nuts holding each regulator to the mounting bracket.

4. Do not attempt to disassemble regulators in the field, except to remove the perforated cover from the bottom of the box and the cylinder coil cover from the top, and for inspection and repair of breaks, burned or corroded terminals, or leads. Defective regulators should be returned to an authorized repair base, or to the manufacturer for inspection, repair and test.

(d) MAINTENANCE.

1. Remove the regulator from its mounting in the airplane.

2. Remove the perforated cover (32) from the bottom of the box (31) and the cylindrical cover (27) from the top.

3. Give the box a thorough visual inspection for broken mounting feet, cracked housings, broken spring leaves, loose screws and nuts, broken mica insulators, or burned resistors.

4. Tighten all loose screws or nuts.

5. Replace broken terminals and leads having worn, frayed, broken, or burned insulation.

6. Resolder all loose or corroded connections.

7. Replace any tie wire which has become loose or broken.

8. Replace the covers and remount the regulator. Reconnect the Cannon plugs and make sure they are securely screwed in place, and that the mounting bolts are tight.

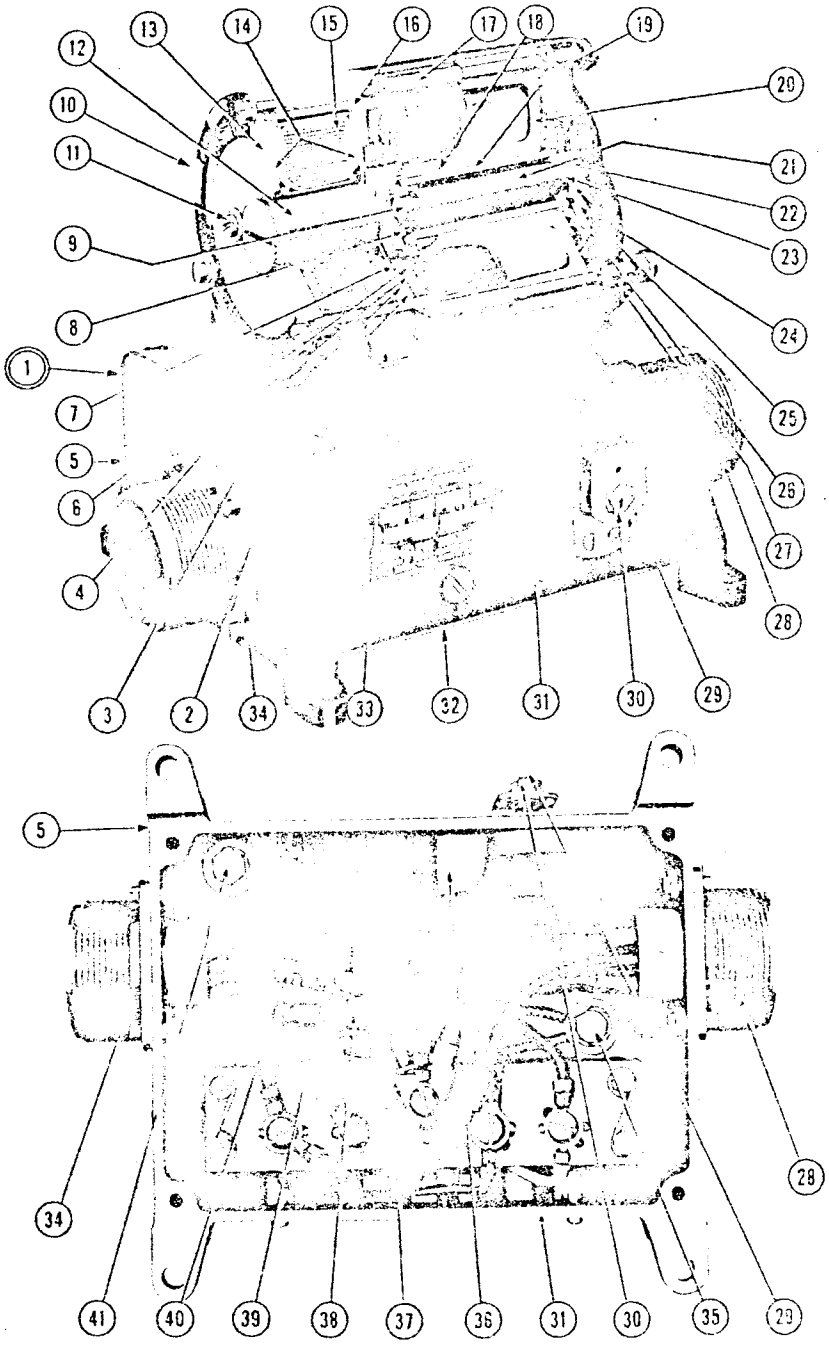


Figure 215—Generator Voltage Regulator (D. C.)

No.	NAME
1	Regulator Assembly—Carbon Pile
2	Washer
3	Shim—Armature Stop
4	Support—Spring
5	Armature Assembly
6	Springs
7	Armature
8	Ferrule
9	Plug—Contact
10	Case Assembly—Magnet
11	Screw—Core Locking
12	Core
13	Plate—End
14	Washer—Paper Packing
15	Coil—Magnet
16	Case—Magnet
17	Stud
18	Pin—Cotter
19	Tube—Carbon Pile
20	Support—Pile
21	Pile—Carbon
22	Screw—Pile Adjusting
23	Plug—Contact
24	Ferrule
25	Bracket—Pile Screw
26	Insulator—Mica
27	Cover—Regulator
28	Receptacle—Disconnect (Output)
29	Screw—Rheostat Adjusting
30	Nut—Rheostat Adjustment Locking
31	Box
32	Cover—Bottom
33	Strap—Regulator Mounting
34	Receptacle—Disconnect (Input)
35	Resistor
36	Rheostat
37	Board—Terminal
38	Resistor—Equalizer
39	Screw—Resistor Slider
40	Slider—Equalizer Resistor
41	Resistor

(e) TROUBLES AND REMEDIES.—In all cases of failure or improper operation, investigate the trouble immediately to prevent further damage to the unit. Do not attempt to operate a regulator that does not function properly. A chart of commonly found troubles and suggested remedies follows:

TROUBLE	CAUSE	REMEDY
1. Failure of movement of the adjusting screw to affect voltage.	Connections between generator and regulator are improperly made.	Check wiring for breaks, grounds, shorts or high resistance connections. See schematic power wiring diagram for connections.
	Defective regulator.	Return the regulator to a repair base.
2. Output voltage is zero.	Same causes as for trouble 1. Defective generator.	Same remedies as for trouble 1. Return generator to repair base.
3. Output voltage is about two volts.	Same causes as for trouble 1.	Same remedies as for trouble 1.
4. Output voltage is low.	Same causes as for trouble 1.	Same remedies as for trouble 1.
5. Output voltage is high.	Same causes as for trouble 1.	Same remedies as for trouble 1.
6. Output voltage fluctuates rapidly.	Defective regulator.	Return regulator to a repair base.
7. Output voltage does not stay within proper range when generator is under load.	Defective regulator.	Return regulator to a repair base.
8. Ammeter reads zero when load is applied.	Same as first cause for trouble 1.	Same as first remedy for trouble 1.
	Regulator not grounded properly.	Check ground connection for tightness and correct if necessary.
	Generator fuse blown in main distribution panel.	Replace the fuse.
	Defective reverse current relay.	See paragraph *f*, (6) for tests of the relay.
	Ammeter stuck at zero.	Tap ammeter lightly. Pointer should release and assume correct reading.

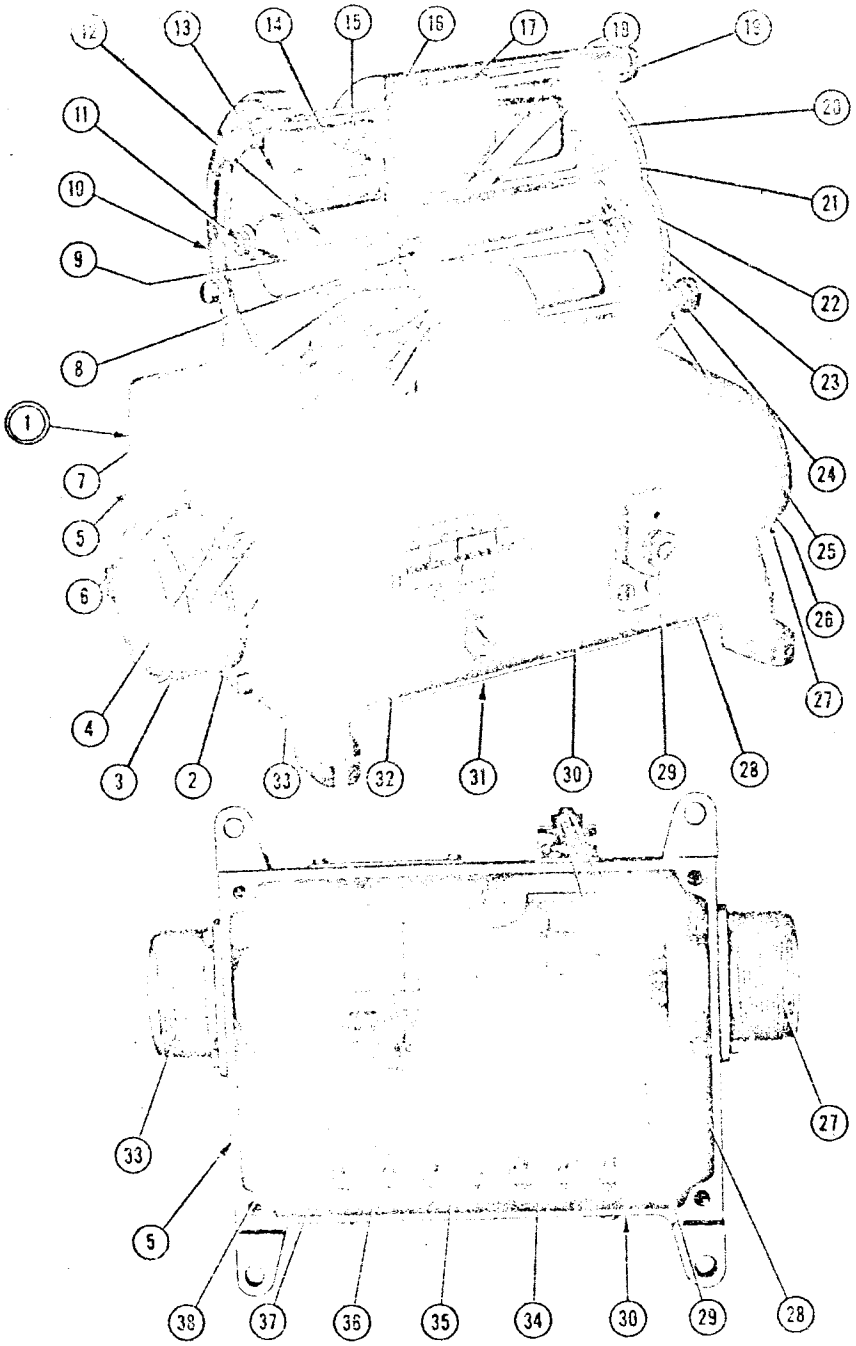


Figure 216—Generator Voltage Regulator (A. C.)

No.	NAME
1	Regulator Assembly—Carbon Pile
2	Washer
3	Shim—Armature Stop
4	Support—Spring
5	Armature Assembly
6	Springs
7	Armature
8	Ferrule—Armature
9	Plug—Contact
10	Magnet Assembly
11	Screw—Core Locking
12	Core
13	Plate—End
14	Washer—Paper Packing
15	Coil—Magnet
16	Case—Magnet
17	Stud
18	Pin—Cotter
19	Tube—Carbon Pile
20	Housing—Pile
21	Pile—Carbon
22	Screw—Pile Adjusting
23	Plug—Contact
24	Bracket—Pile Screw
25	Insulator—Mica
26	Cover Assembly—Regulator
27	Receptacle Assembly—Disconnect (Output)
28	Screw—Rheostat Adjusting
29	Nut—Rheostat Adjustment Locking
30	Box
31	Cover—Bottom
32	Strap—Regulator Mounting
33	Receptacle Assembly—Disconnect (Input)
34	Rheostat
35	Rectifier—Selenium
36	Resistor
37	Screw—Slider Clamping
38	Slider—Resistor

TROUBLE	CAUSE	REMEDY
	Ammeter connections defective.	Check connections and repair if necessary.
	Defective ammeter.	Replace ammeter and return to a repair base.
	Defective generator.	Return generator to a repair base.
	Defective regulator.	Return regulator to a repair base.
9. Adjustment of equalizer resistor produces no division of load when generators are in parallel.	Same as first cause for trouble 1.	Same as first remedy for trouble 1.
	Regulator not grounded properly.	Check ground connection for tightness and correct if necessary.
	Defective regulator.	Return regulator to a repair base.
10. Current does not divide evenly between paralleled generators.	Same as first cause for trouble 1.	Same as first remedy for trouble 1.
	Regulators not grounded properly.	Check ground connection for tightness. Correct if necessary.
	Defective regulator.	Return regulator to a repair base.

(f) INSTALLATION.

1. Install auxiliary power unit generator regulator by reversing removal procedure outlined in Par. 17, *c*.

2. Install main engine generator regulators to mounting brackets on starboard wall forward of bulkhead 4 by means of four bolts and nuts.

3. Connect Cannon plugs at each end of regulator.

(g) TESTS AFTER ASSEMBLY AND INSTALLATION.

(See figure 215.)

1. Connect a precision D.C. voltmeter, known to be in good operating condition, to the G+ terminal of the generator reverse current relay in the main distribution panel and to ground, or between either bus "A" or "B" and ground. If connected to a bus, throw the generator selector switch to the same bus.

2. Throw all other switches on the panel to "OFF" position.

3. Run the engine driving the generator up 1750 rpm. This is the minimum speed for development of rated generator voltage.

Note

As noted before, the speed of the auxiliary power unit generator cannot be changed, so the following described test for its regulator will have to be made at the speed of the power unit.

4. Read the voltage on the precision voltmeter. It should be 28.5 volts. If not 28.5 volts, loosen the locking nut (30) on the rheostat adjusting screw (29) on the side of the control box.

5. Adjust the voltage to exactly 28.5 by turning the adjusting screw. The adjustment should not exceed 0.7 volt.

6. Upon completing the adjustment tighten the locknut (30).

Note

This adjustment is made to compensate for the length of the airplane wiring. Once made, it should not be altered, unless some change which would affect the regulated voltage is made in the wiring.

7. The generators should now be tested for parellel operation. First run both generators for about 15 minutes to warm up the generators and regulators.

8. If only the engine-driven generators are being paralleled, the engines should be run at approximately 1750 rpm. If all three generators are to be paralleled, the engine speed should be increased to approximately 2600 rpm. In either case, when the generators have been brought to speed, connect them and the main battery to the same bus in the same distribution panel.

9. Switch on a D-C load equivalent to the rating of one generator, approximately 60 amperes.

10. Read the generator ammeters on the main distribution panel to determine if each generator is carrying its share of the load ± 10%. If this is not being done, adjust one regulator, if only the engine-driven generators are being tested. Adjust the regulators on the units with the highest and lowest ammeter readings, if all three generators are being tested. Proceed with these adjustments as follows:

a. Dismount the regulator box.

b. Loosen the screw (39), securing the slider (40) on the equalizer resistor (38) which is fastened to the wall of the regulator box.

c. To reduce the load carried by a generator move the slider about ⅛ inch toward the wall upon which the equalizer resistor is mounted.

d. To increase the load move the slider about ⅛ inch from the wall upon which the regulator box is mounted.

e. Test the adjustment and readjust if necessary, until each generator carries its share of the load ± 10%.

11. Switch on a load equal to the full rated load per generator. The generators should divide the load within ± 5%. If they do not, readjust the equalizer resistors as described above, and again test with full load.

12. When adjustment is completed, replace the perforated cover on the bottom of the box and remount the box on the airplane.

(2) ALTERNATING CURRENT REGULATORS.
(See figure 216.)

(a) DESCRIPTION.—On the PBY-5 there are three alternating current voltage regulators, (Eclipse type 1001), one for each engine-driven generator and one for the auxiliary power unit generator. The engine-driven generator regulators are mounted vertically on the aft face of bulkhead 4, starboard of the hatch and the A.C. junction box. Inboard regulator is for the port generator. The generator for the auxiliary power unit is on the starboard side of the engineer's compartment, forward of the auxiliary power unit. It is the upper one of two, mounted horizontally.

On the PBY-5A, there are two main engine generator regulators (Eclipse type 1001) but no auxiliary power unit A.C. voltage regulator. The A.C. voltage regulator from the auxiliary power unit is indirectly regulated by the Eclipse type 673 D.C. voltage regulator. The two engine-driven generator regulators are mounted on a floor bracket beneath the radio operator's locker and are connected to the A.C. power panel through a junction box on the outboard side of the locker.

(b) PRINCIPLE OF OPERATION.—The alternating current regulators operate on the same principle as the direct current regulators, discussed in paragraph *e*, (1), with the following exceptions:

1. The solenoid coil is connected across a rectifier.

2. Voltage regulation is for 115 volts ± three volts.

3. There are no equalizer coils. The alternators are never connected in parallel.

(c) REMOVAL AND DISASSEMBLY.

1. For removal of auxiliary power unit regulator, see Par. 17, *c*.

2. Disconnect Cannon plugs at each end of the main engine generator regulators.

3. Remove four bolts and nuts holding each regulator to the mounting bracket.

4. Do not attempt to disassemble regulators in the field, except to remove the perforated cover from the bottom of the box and the cylinder coil cover from the top, and for inspection and repair of breaks, burned or corroded terminals, or leads. Defective regulators should be returned to an authorized repair base, or to the manufacturer for inspection, repair and test.

(d) MAINTENANCE.—Refer to paragraph *e*, (1), *(d)*.

(e) TROUBLES AND REMEDIES.—In all cases of improper operation, investigate the trouble immediately to prevent further damage to the unit. Do not attempt to operate a unit that does not function properly. Following is a chart of more commonly found troubles and suggested remedies:

TROUBLE	CAUSE	REMEDY
1. Failure of adjusting screw to affect voltage.	Connections between generator and regulator are defective or improperly made.	Check wiring for breaks, shorts, grounds or high resistances, and correct if necessary.
	Defective regulator.	Return regulator to a repair base.
2. Improper operation of A.C. load mechanisms.	A.C.voltage at improper value.	Refer to troubles 3, 4, 5, 6, or 7 of this chart.
	Load mechanisms defective.	Check the connected loads for defects and repair if necessary.
3. A.C. output voltage is zero.	Connections on the output side of the regulator are open circuited.	Same as first remedy for trouble 1.
	Condenser open circuited.	Replace the condenser.
	Generator not in proper working condition.	Refer to generator trouble chart paragraph *b*, (6).)
	Defective regulator.	Return regulator to a repair base.
4. A.C. output voltage low.	Condenser or connections shorted.	Same as first two remedies for trouble 3.
	Generator not in proper operating condition.	Refer to generator trouble chart (paragraph *b*, (6).)
	Defective regulator.	Return the regulator to a repair base.
5. A.C. output voltage too high.	Terminals of disconnect receptacle on output side not properly connected.	Check connections and correct if necessary.
	Defective regulator.	Return regulator to a repair base.
6. A.C. voltage outside range of 112-118 volts under load.	Carbon pile regulator out of adjustment.	Return regulator to a repair base.
7. A.C. voltage fluctuates rapidly.	Carbon pile regulator out of adjustment.	Return regulator to a repair base.
8. Voltage shows a drift upward after 200 hours of operation.	Carbon discs worn.	Return regulator to a repair base.

(f) INSTALLATION.—Reverse removal procedure outlined in paragraph *e*, (2), *(c)*.

(g) TESTS AFTER INSTALLATION.
(See figure 216.)

1. Connect a precision voltmeter, known to be in good condition, across the A.C. output of the regulators on the load side of the condensers. On the PBY-5A airplanes, the voltmeter may be connected in the A.C. junction box outboard of the radio locker. On PBY-5 airplanes, the voltmeter may be connected in the A. C. junction box aft of bulkhead 4 on the port side.

2. Operate the generator at 1750 rpm engine speed, or in the case of the auxiliary power unit at normal operating speed.

3. Be sure no loads are connected to the circuit.

4. Read the A.C. voltage. If it does not fall within the range of 112-118 volts, proceed as follows:

a. Loosen the locking nuts (29) on the adjusting screw (28) on the side of the box (30).

b. Adjust the voltage by turning the adjusting screw. Clockwise rotation increases and counterclockwise decreases voltage. If the required adjustment is more than three volts in either direction, remove and send regulator to a repair base.

c. After adjusting voltage, tighten the locking nut (29).

f. REVERSE CURRENT RELAY.
(See figure 217.)

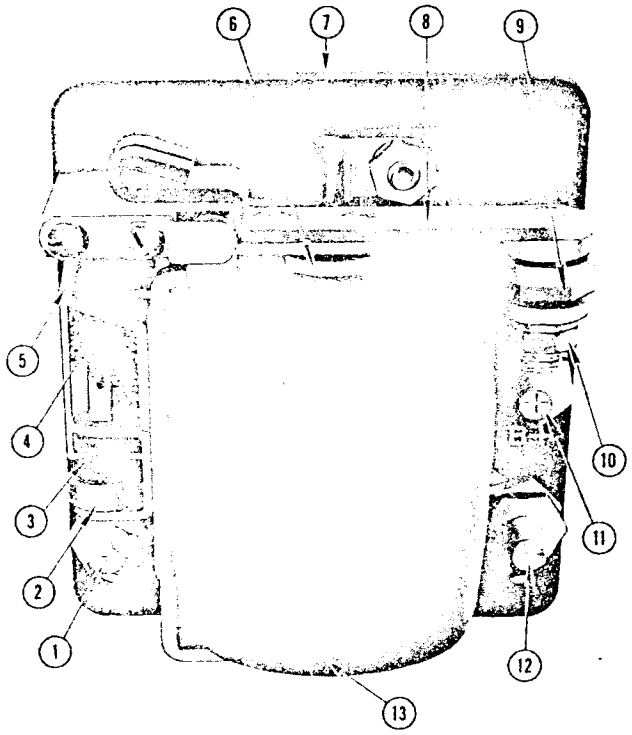
(1) DESCRIPTION.—Four reverse current relays are located in the airplane in the bottom of the main distribution panel. They are arranged from port

to starboard to control the following units respectively: port engine generator, auxiliary generator, starboard engine generator, and auxiliary batteries.

The relays are Struthers-Dunn type CXD 1535, with a rating of 24 volts D.C. and 100 amperes.

The purpose of the relay is to prevent reverse flow of current (from the main battery to a generator) when the generator is at rest or operating at low speed. Whenever generator voltage falls below 26.7 volts, current will flow toward the generator, causing the relay contacts to open and break the circuit. A subsequent rise in voltage to 26.7 or above will close the contacts and restore the circuit.

The auxiliary battery relay operates on the same principle, but for a somewhat different purpose. The battery has only half the capacity of the main batteries and is installed for use only on the radio and radar circuits. It must be connected to the generators for charging, but must not be allowed to discharge into the airplane's power system. Therefore the relay is connected in series between the battery and buses. When tripped, the relay contacts will not close again until reset by pushing the reset button on the lower left corner of the face of the main distribution panel. To prevent possible drain on the battery, it is recommended that this relay be tripped when the plane is grounded, by throwing on the auxiliary battery bus selector switch and turning on a few lights.



No.	PART No.	NAME
1		Terminal
2	4309	Adjusting Bushing
3	4319	Spring
4	4318	Spring
5	4471	Stop
6	2305	Core Assembly
7	2319	Base
8	4374	Yoke
9	3856	Contact Screw
10		Adjusting Screw
11		Terminal
12		Terminal
13	4396-24	Coil Assembly

All items listed are Struthers-Dunn part numbers.

The above assembly is a Struthers-Dunn type CXD 1535 (NAF 1116-4) Cutout.

Figure 217—Reverse Current Relay

(2) REMOVAL AND DISASSEMBLY.

(a) Turn battery and generator switches on main distribution panel to "OFF" position.

(b) Release the three snapslides and then hinge back panel of main distribution panel.

(c) Disconnect all wires from G−, G+ and B+ terminals of relay.

(d) Detach the four mounting screws and remove relay from mounted position.

(3) MAINTENANCE.
(See figure 217.)

(a) Remove the wire terminals from the relay and then inspect them as well as the relay terminals. If they are discolored or corroded, clean them with No. 000 sandpaper.

(b) Inspect the relay contacts; if they are rough, blackened, or pitted, re-surface them with crocus cloth or a small ignition file. After re-surfacing, adjust the gap. (See following paragraph *f*, (4).)

(c) If spring (3) or (4) is broken, replace with new one.

(d) If coil assembly (13) becomes inoperative due to overvoltage or any other cause, replace the relay.

(4) ADJUSTMENT.—The contact gap on the relay should be adjusted to give an approximate opening of .025 inches by screwing the adjusting screw (10) in or out. This gap opening allows the contacts to open when five amperes or less reverse current is flowing through the relay.

After adjustment of the contacts, test the voltage setting of the relay. To do this connect a variable resistance, such as a variable rheostat in series with the "G+" terminal. Connect a test lamp between "G+" and "B+," and a 30 volt or larger voltmeter between "G+" and "G−." Starting at a low value, gradually increase the voltage by decreasing the resistance until closing of the contacts is evidenced by lighting of the test lamp. The reading of the voltmeter should be 26.7 ± 0.10.

(5) INSTALLATION.—To install reverse current relay, reverse removal procedure outlined in paragraph *f*, (2) above.

(6) OPERATIONAL CHECK.

(a) With the engine running, turn the battery switches and the generator switches to the same bus ("A" or "B").

(b) Gradually increase the speed of the engine to 1800 rpm and check the relay contacts to see that they are closed.

(c) Gradually decrease the speed of the engine to 500 rpm or stop the engine and check the relay contacts to see that they are open.

g. BOMB AND TORPEDO CIRCUITS.

(1) DESCRIPTION.

(See figures 218, 219, and 220.)

(a) The bomb and torpedo circuits are such that bombs and torpedoes may be released electrically and the bombs armed electrically.

(b) The manual emergency release of bombs and torpedoes is discussed under Section V, Par. 4, *b*, (3), *(c)*.

(c) The bombardier, pilot, or copilot can release the bombs, while only the bombardier can arm the bombs.

(d) The releasing of torpedoes is controlled only by the pilot or copilot, who are provided with a torpedo director.

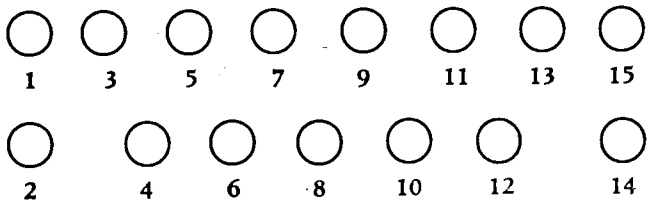
(e) All electrical circuits necessary for electrical release and arming are set up by the bombardier only. The bombardier also controls the selection of bombs to be released.

(f) The bombardier has the choice of two methods of electrical release, automatic and manual electric. In automatic release, the bombsight will initiate the electrical impulse which starts the working of the release system. In addition, the bombsight actuates the pilot's directional indicator (located on the pilot's instrument panel) electrically to provide the pilot with an indication such that he will know the course the bombardier desires that he follow.

(g) The automatic or the manual electric release will release bombs selectively (one bomb or a salvo of several bombs released by one electrical impulse) or in train (a series of bombs released by one electrical impulse which activates the intervalometer).

(h) The bombardier's switch panel, which consists of a front and side panel just forward of the anchor box, contains switches which permit the bombardier to set up the circuit so that one or more bombs may be released by any of the electrical methods described above.

(i) The MK 2-1 intervalometer, which is mounted on the anchor box, provides for the release of bombs in train. Its electrical mechanism is arranged so that the points of impact of successively released bombs will be separated by that number of feet set by the bombardier on the intervalometer panel. Jumper wires with pin plugs attached to each end are provided for the preselection of bomb releases. The red pin jacks on the intervalometer panel are the intervalometer impulse pin jacks. Although they are not numbered, they receive electrical impulses from the intervalometer in the following order:



Thus by connecting one of the jumper wires from the red impulse pin jack number one to the pin jack for any bomb desired to be released, this bomb would be released first. By connecting another jumper wire from red pin jack number two to another pin jack for the bomb desired to be released, this bomb would be released second, etc.

(j) In addition to a bombardier's and a pilot's firing key, which is used for manual electric bomb releasing, there are three indicator lights in the circuit.

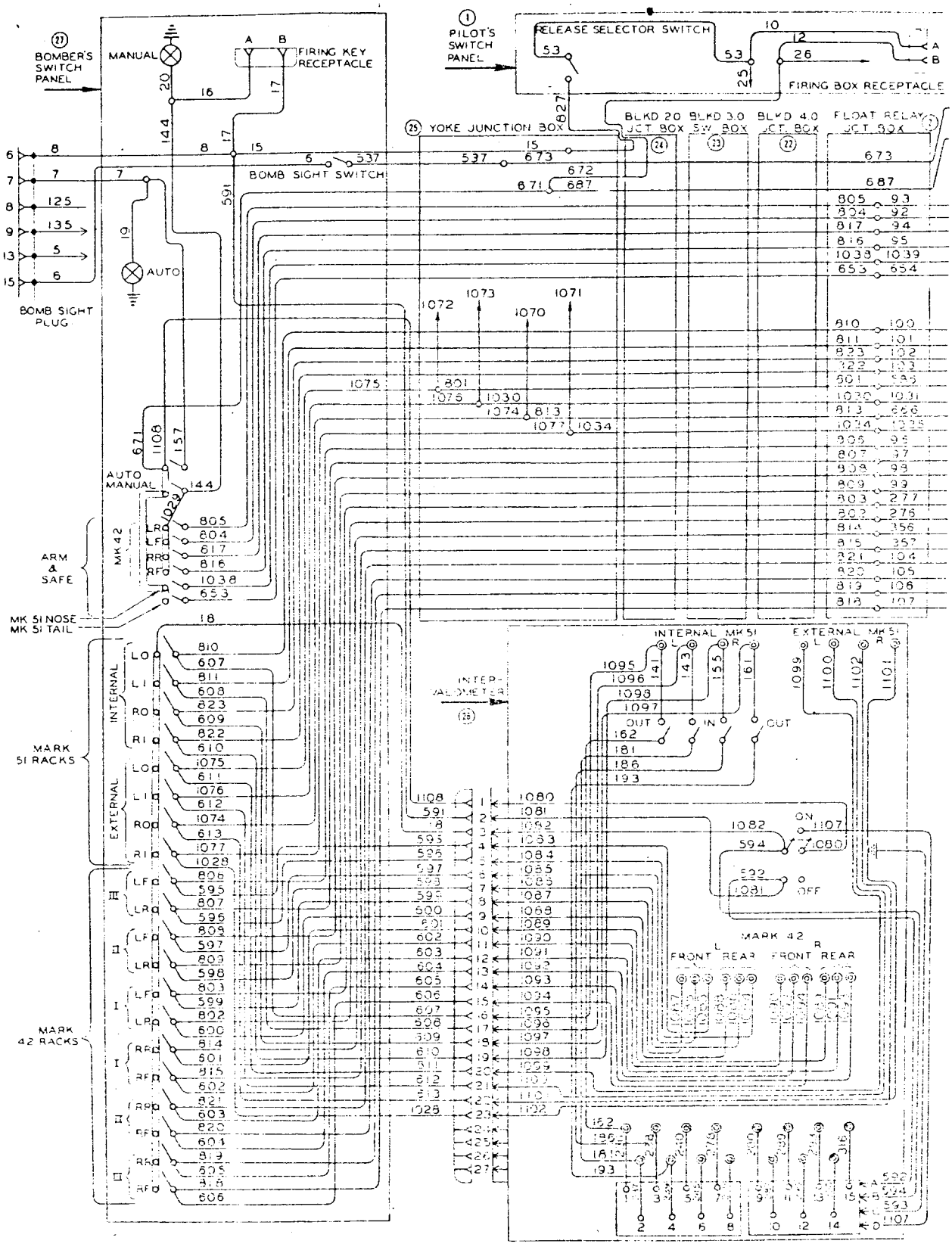
1. One red indicator light and one white indicator light, which are located on the bombardier's switch panel, indicate which of the electrical release systems, manual or automatic respectively, is operating.

2. The third indicator light, which is on the intervalometer, indicates when the intervalometer power is "ON."

(2) OPERATION.

(a) Either torpedo may be released individually or both together. Before either torpedo may be released, the switches and circuit breakers must be set as described below.

1. Either generator or both generator switches and the "BOMB RELEASE" master switch on the main


BOMBER'S SWITCH PANEL
MANUAL
A
B
FIRING KEY RECEPTACLE
PILOT'S SWITCH PANEL
RELEASE SELECTOR SWITCH
FIRING BOX RECEPTACLE
YOKE JUNCTION BOX
BLKD 2.0 JCT BOX
BLKD 3.0 SW. BOX
BLKD 4.0 JCT. BOX
FLOAT RELAY JCT. BOX
BOMB SIGHT SWITCH
BOMB SIGHT PLUG
AUTO
AUTO MANUAL
MK 42
ARM & SAFE
MK 51 NOSE
MK 51 TAIL
MARK 51 RACKS
INTERNAL
EXTERNAL
MARK 42 RACKS
INTERVALOMETER
INTERNAL MK 51
EXTERNAL MK 51
MARK 42
FRONT
REAR
ON
OFF
IN
OUT
CUT

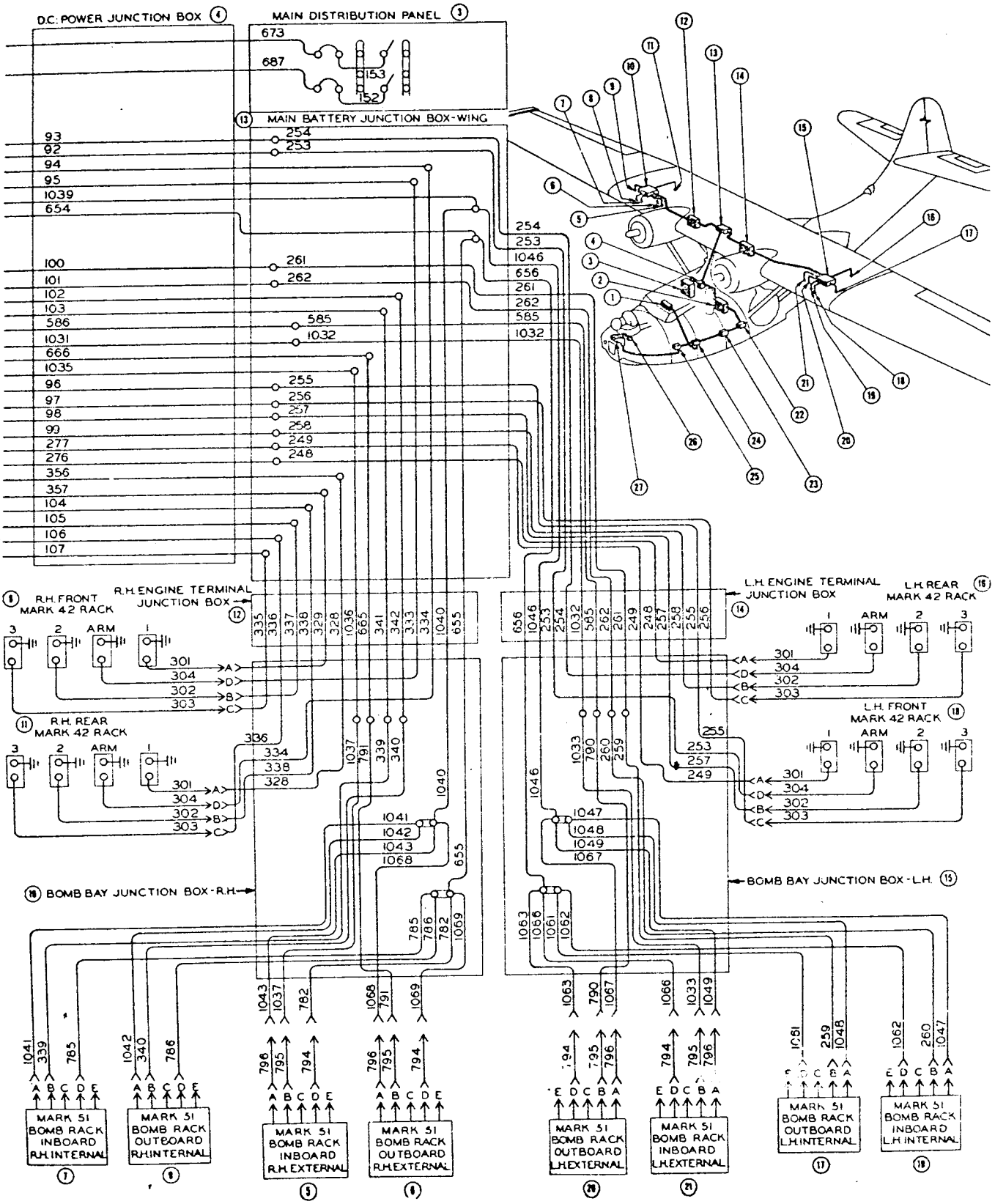


Figure 218—Bomb Circuit

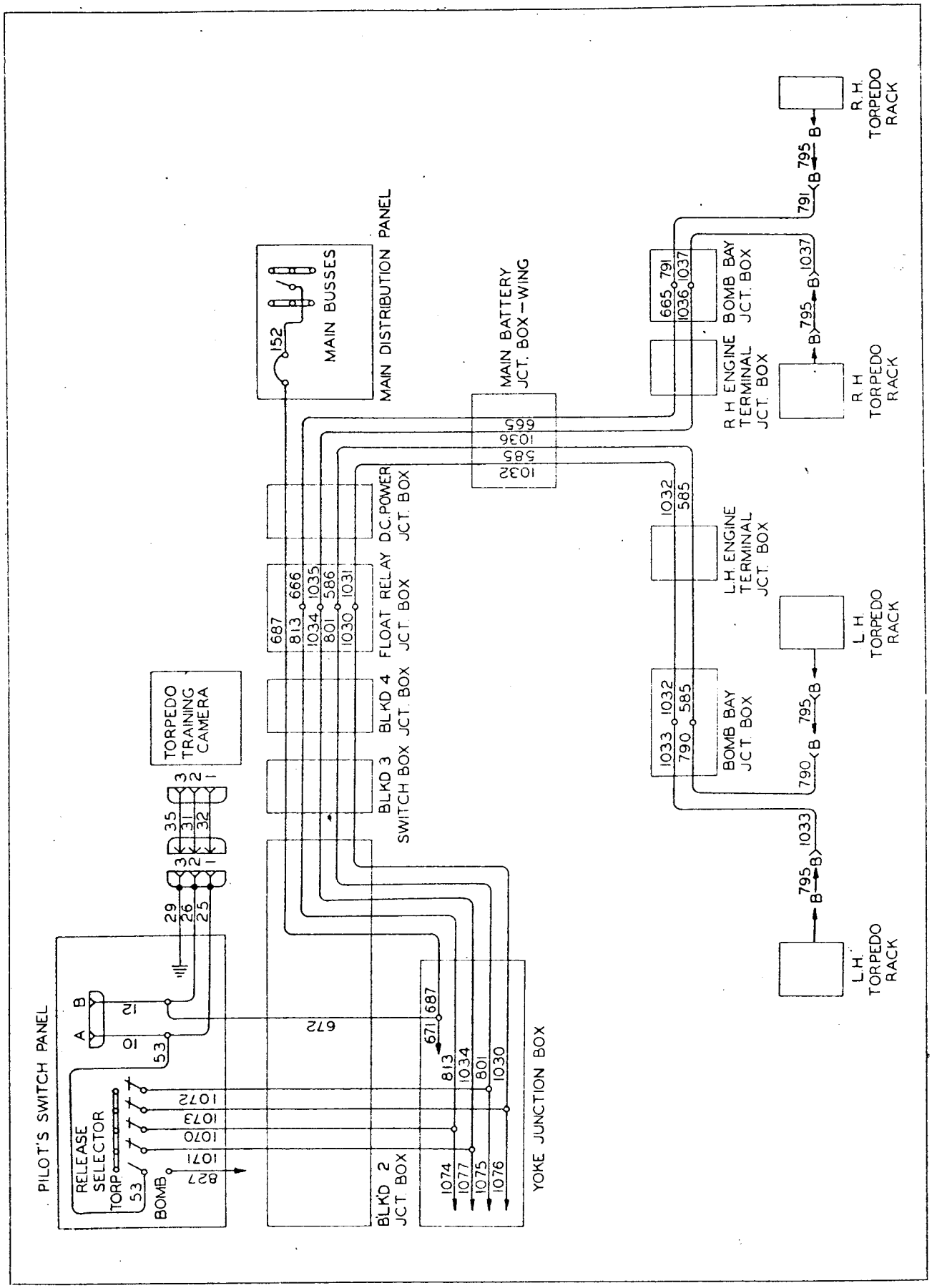


Figure 219—Torpedo Circuit

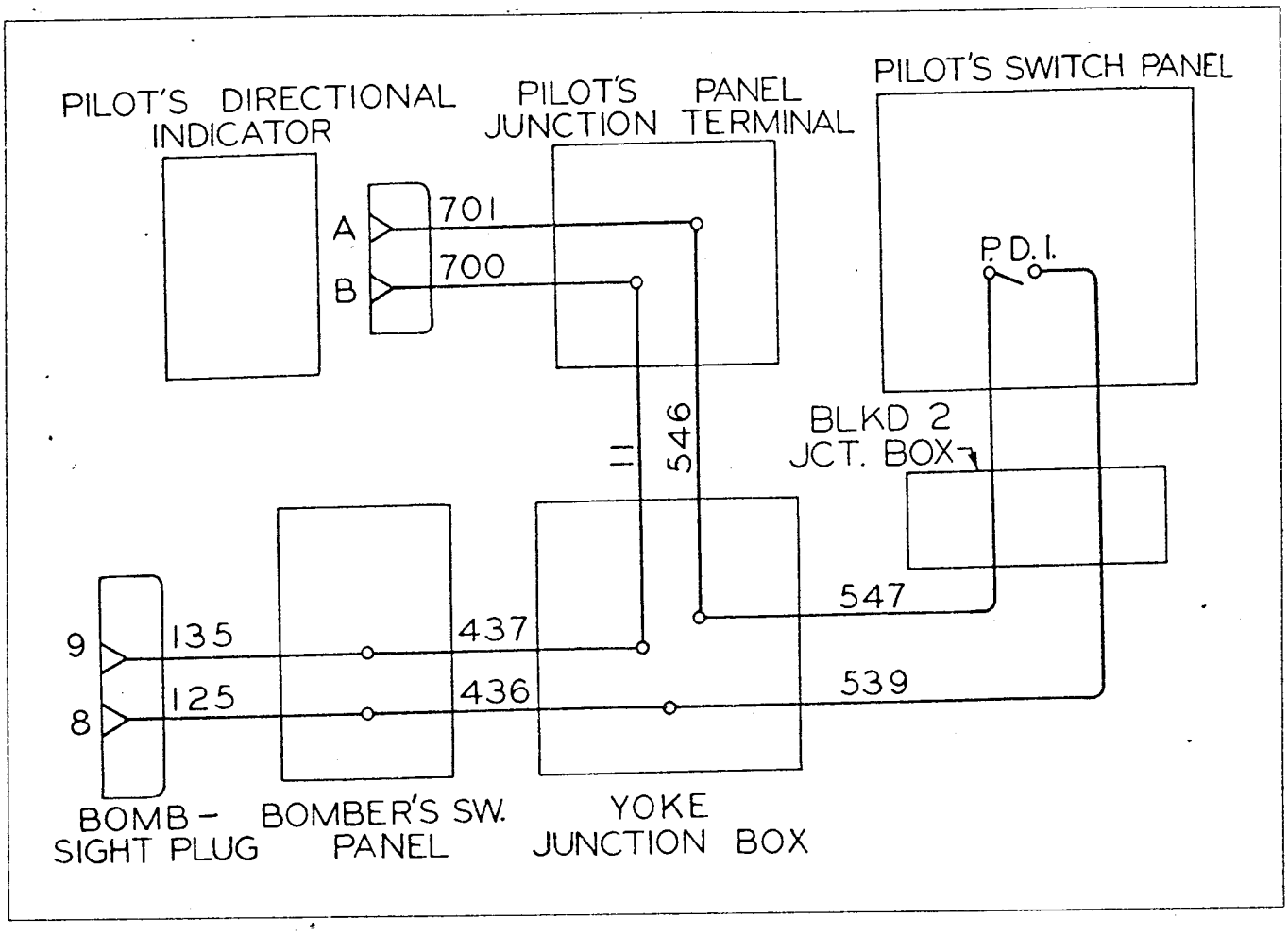


Figure 220—Pilot's Directional Indicator Circuit

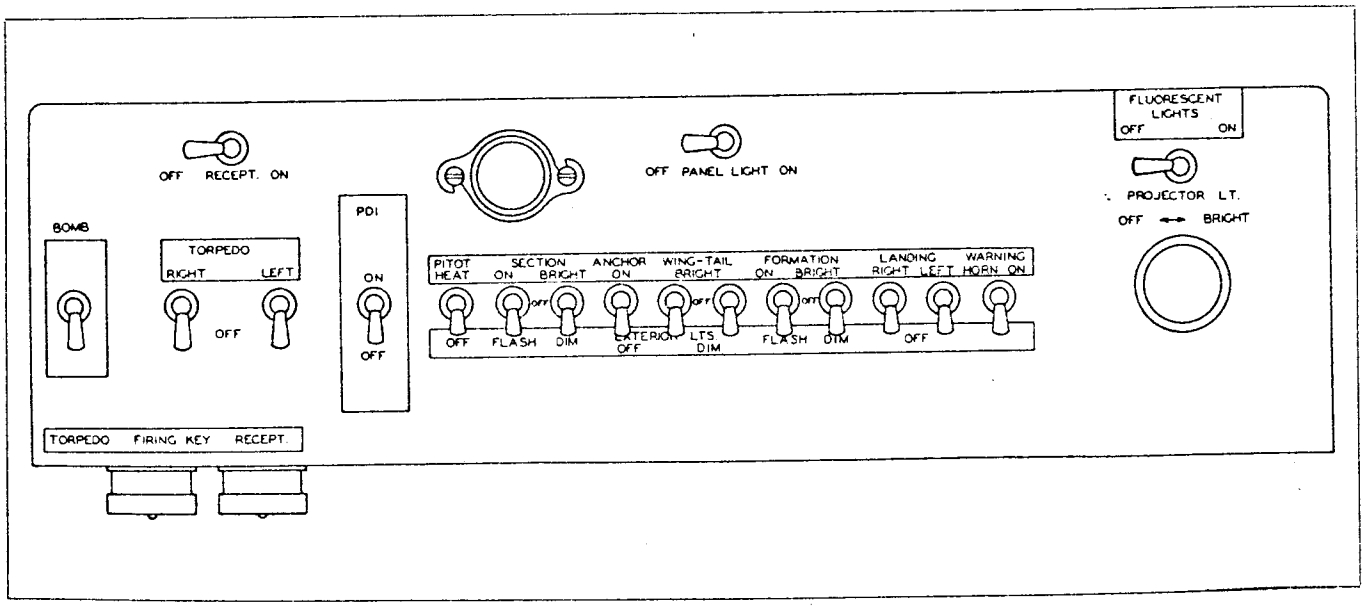
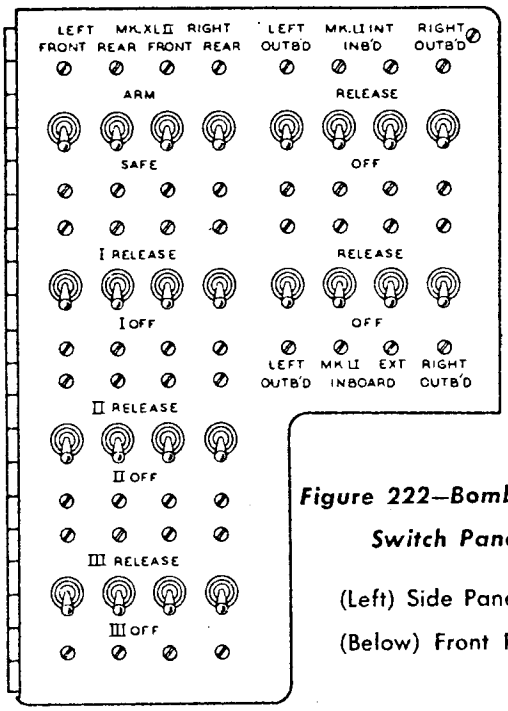


Figure 221—Pilot's Switch Panel



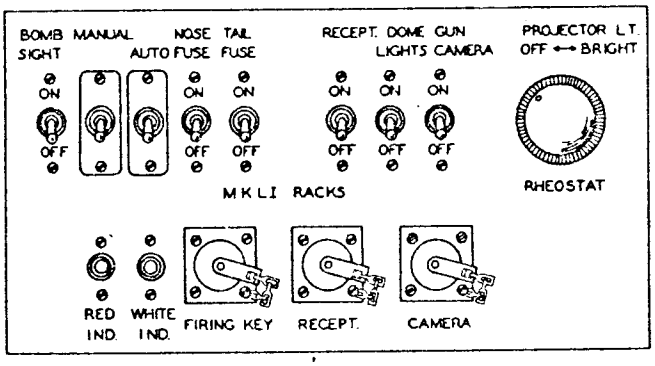


Figure 222—Bombardier's Switch Panels

(Left) Side Panel

(Below) Front Panel

distribution panel must be thrown to the same bus ("A" or "B").

2. The selector switch on the pilot's switch panel must be in "TORPEDO" position.

3. To release the torpedo, the torpedo switch must be in "ON" position. In case both torpedoes are to be released at one time, both the "RIGHT TORPEDO" and the "LEFT TORPEDO" switches must be in "ON" position. *(See figure 221.)*

4. Install pilot's firing key by inserting it in the receptacle provided on the bottom face of the pilot's switch panel on the starboard side.

5. By pressing the pilot's firing key, the torpedos selected are released, and the torpedo training camera is actuated—continuing to operate after the firing key is closed.

(b) Before the bombs are released, the electrical circuits must be set up by the bombardier.

1. To arm the nose or tail fuse or both the nose and tail fuses of the bombs carried on either or both the MK 51 internal bomb racks, it is necessary for the switches on the bombardier's switch panel to be thrown to the "ON" position. If it is desired to return the bombs to safe condition, these switches must be thrown to "OFF" position. *(See figure 222.)*

2. To arm the fuses on the bombs carried on the MK 42 bomb racks, the "MANUAL" switch must be thrown to "ON" position, and the switches marked MK XLII must be thrown to "ARM" position. These switches are on the bombardier's switch panel. These bombs may be returned to safe condition by throwing these switches to"SAFE" position.

3. To release all or any number of bombs at one time, it is necessary to have the switches in positions as listed below:

a. "BOMB SIGHT" and "BOMB RELEASE" switches on the main distribution panel must be thrown to same bus as generators.

b. "BOMB SIGHT" switch on bombardier's switch panel must be in "ON" position.

c. Switches for the bombs to be released are located on the bombardier's switch panel and must be in "RELEASE" position.

d. The "STAND-BY" switch on the intervalometer must be in "OFF" position. *(See figure 223.)*

e. The "MAIN" switch on the intervalometer must be in "OFF" position.

f. The pilot's selector switch must be in "BOMB" position if the pilot or copilot wishes to release the bombs.

g. The "MANUAL" switch on the bombardier's switch panel must be in "ON" position.

h. If the bombsight is to be used to send the electrical impulse through the circuit, the "AUTOMATIC" switch will also have to be in "ON" position.

i. The bombs are then released by closing the bombardier's or pilot's firing key which sends an electrical impulse through the circuit.

Note

The bombardier's firing key is made ready for firing by inserting it in the firing key receptacle located on the bombardier's front switch panel.

4. To release a "train" of bombs automatically, the switches must be in the following positions:

a. The "BOMB SIGHT" and "BOMB RELEASE" circuit breakers on the main distribution panel must be in "ON" position.

b. "BOMB SIGHT" switch on the bombardier's switch panel must be in "ON" position.

c. "STAND-BY" switch on intervalometer panel must be in "ON" position.

d. The "MAIN" switch on the intervalometer panel must be in "ON" position.

e. The jumper wires from the intervalometer impulse pin jacks to the pin jacks for the bombs must be connected.

f. If the bombs are to be released by an

electrical impulse from the bombardier's firing key, the "MANUAL" switch must be in "ON" position.

g. If the bombs are to be released by the pilot's firing key, the selector switch on the pilot's switch panel must be set to "BOMB" and the "MANUAL" switch on the bombardier's switch panel to "ON" position.

h. If the bombs are to be released by an electrical impulse from the bombsight, the "AUTOMATIC" switch must be in "ON" position. For position of "MANUAL" switch, see paragraph *g*, (2), *(b)*, *2*.

i. With the switches set as described, an electrical impulse from either firing key or bombsight will set off the "train" of bombs, as selected by the jumper wires on the intervalometer panel.

5. To release bombs in a preselected order the switches must be set in the same manner as outlined in paragraph *g*, (2), *(b)*, *4* above with the following exceptions:

a. The "AUTOMATIC" switch is to be in "OFF" position.

b. The "STAND-BY" switch on the intervalometer panel is to be in "OFF" position.

c. By momentarily closing either the bombardier's firing key or the pilot's firing key, the first bomb preselected on the intervalometer panel is released. To release the second preselected bomb, the firing key is momentarily closed again, etc. If the firing key is held closed, the intervalometer will continue to operate in exactly the same manner as described in paragraph *g*, (2), *(b)*, *4* above, and the result will be a "train" of bombs.

6. When the MK 51 internal bomb racks are to be connected to the intervalometer impulse pin jacks by jumper wires, the four switches on the upper left-hand corner labeled "MK 51 INTERNAL" must be in "OFF" position.

(3) MAINTENANCE.

(a) Check the disconnect plugs and receptacles shown on schematic diagrams. *(See figures 218, 219, and 220.)*

1. Remove any discoloration or corrosion with crocus cloth.

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

(b) Remove bombardier's switch panel from the box and inspect the wiring, terminals, switches, and indicator lights shown on schematic diagrams.

1. Repair or replace any wire having worn or broken insulation.

2. Clean any terminals that are discolored or corroded with No. 000 sandpaper.

3. Make sure switches work properly and if their terminal posts are discolored or corroded, clean with No. 000 sandpaper.

4. Inspect all solder connections. If loose or if strands of wire are broken at joints, repair by resoldering or replace wire and resolder.

5. Remove indicator light lamps and inspect base for discoloration or corrosion; if present, remove with crocus cloth and then reassemble.

6. Be sure all nuts are tightened securely.

(c) Remove the covers from the following junction boxes and switch panels:

1. Bulkhead 2 junction box.

2. Pilot's switch panel.

3. Float relay junction box.

4. Main distribution panel.

5. Center wing junction box.

6. Bomb bay junction box.

Inspect the wiring shown on schematic wiring diagrams *(See figures 218, 219, and 220.)* for worn or broken insulation. Check for broken strands of wire and loose connections. If the wire terminals or terminals on switches or circuit breakers are discolored or corroded, clean with No. 000 sandpaper. Be sure to tighten all nuts securely.

(4) OPERATIONAL CHECK.

(a) TORPEDO RELEASE CIRCUIT.

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

2. Throw the selector switch on the pilot's switch panel to "TORPEDO" position.

3. Throw the right-hand torpedo switch and the left-hand torpedo switch to "ON."

4. If the torpedo racks are attached or the external MK 51 racks are attached to the wing, station an assistant to observe the release mechanism.

5. Connect the pilot's firing key to the firing key receptacle on the pilot's switch panel. The release mechanism on the bomb racks should then be actuated when the firing key is pressed.

6. If the torpedo racks or external MK 51 racks are not installed, the circuit may be checked by connecting a test lamp from pin "B" of the external MK 51 bomb rack receptacle to the ship structure (ground) for each rack. When the firing key is pressed the lamps will light if the circuit is operating correctly.

7. Connect a test lamp from pin No. 1 to pin No. 3 of the receptacle for the torpedo training camera. By pressing the firing key, this lamp should light.

(b) SALVO RELEASE.

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

2. Throw "SELECTOR" switch on pilot's switch panel to "BOMB" position.

3. Throw "MANUAL" switch on bombardier's switch panel to "ON" position.

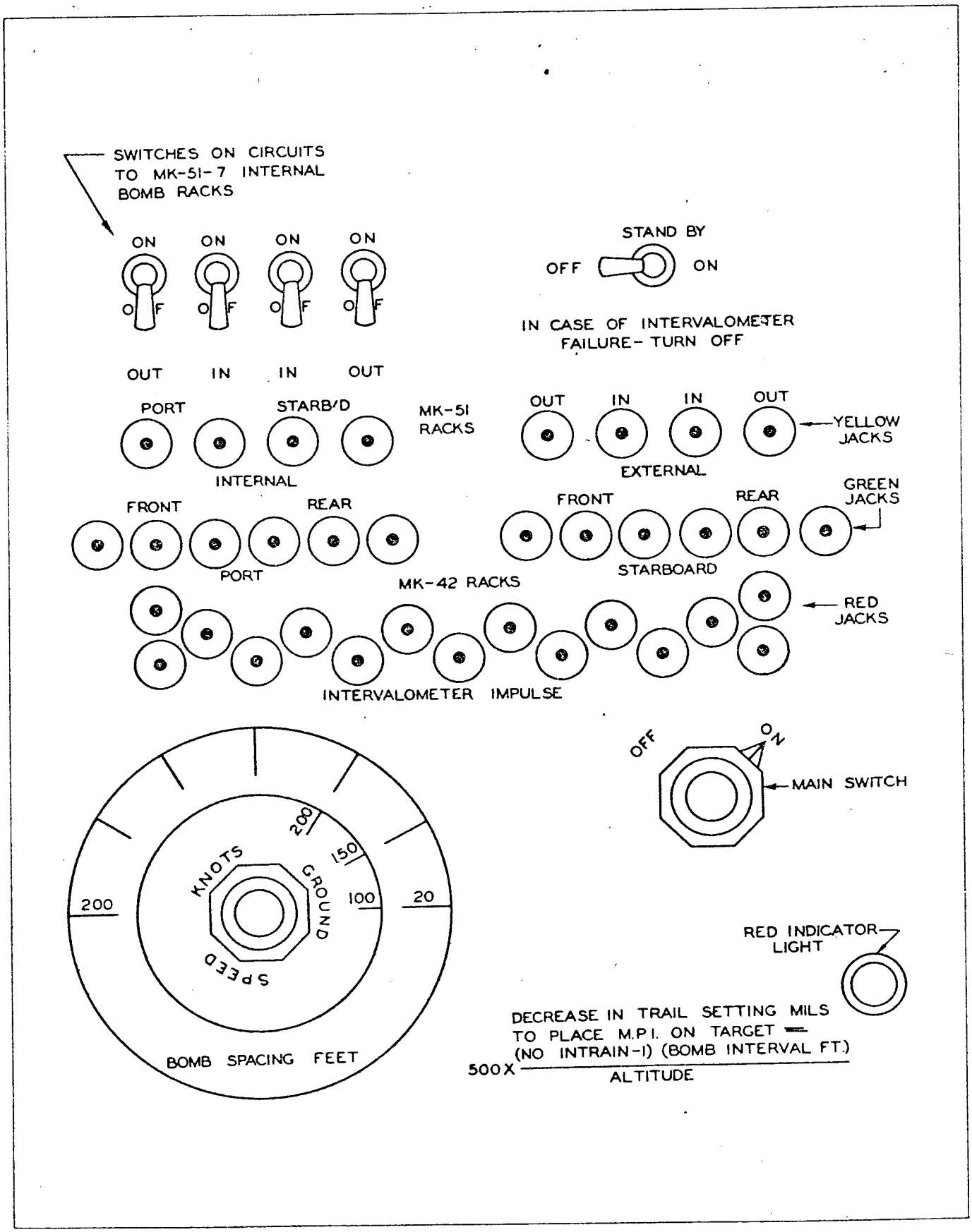


Figure 223—Intervalometer Switch Panel

4. Throw the rack selector switches on the bombardier's switch panel to "RELEASE" position.

5. Be sure the "STAND-BY" switch on the intervalometer panel and the "MAIN" switch on the intervalometer are in "OFF" position.

6. If the external MK 51 and MK 42 bomb racks are installed, station an assistant to observe the release mechanism of the bomb racks.

7. If the external MK 51 and MK 42 racks are not installed, an assistant can observe the action of the internal MK 51 bomb racks and test lamps may be connected to the pins of the other receptacles for the external MK 51 and MK 42 racks.

8. Connect the bombardier's firing key to the firing key receptacle on the bombardier's switch panel and connect the pilot's firing key to the pilot's firing key receptacle.

9. By pressing either the pilot's or bombardier's firing key, all the lamps should light at one time and the release mechanism of the bomb racks should be actuated if the circuit is functioning properly.

10. If test lamps are used, lamps should be connected as follows:

a. Between pin "B" of the external MK 51 rack receptacle and ground.

b. Between pins "A" and ground, "B" and ground, and "C" and ground of each of the receptacles for the MK 42 bomb racks.

(c) AUTOMATIC RELEASE.—With the same setting of switches as outlined in preceding paragraph *g*, (4), *(b)*, except as noted, and same condition of either bomb racks installed or test lamps connected, this circuit may be checked as follows:

1. Throw the "AUTOMATIC" switch on the bombardier's switch panel to "ON" position.

2. Throw the "BOMBSIGHT" switch on the bombardier's switch panel to "ON" position.

3. Throw the "STAND-BY" switch on the intervalometer panel to "ON" position and turn the "MAIN" switch on the intervalometer to "ON" position.

4. Throw the four switches on the top left-hand corner of the intervalometer panel for the MK 51 internal racks to "ON" position.

5. Send an electrical impulse through the circuit by actuating the bombsight. Repeat by using the bombardier's firing key and the pilot's firing key.

6. The release mechanism on the MK 51 internal racks should be actuated in the following order: first, the left-hand outboard; second, the left-hand inboard; third, the right-hand inboard; and fourth, the right-hand outboard.

7. The intervalometer can be heard running through its cycle (15 impulses). Turn the MK 51 internal rack switches on intervalometer panel to "OFF" position.

8. Connect jumper wires from the red intervalometer impulse pin jacks to the green pin jacks for the MK 42 racks.

9. Use red impulse jacks number four through number 15. Connect any three of the four yellow MK 51 external pin jacks to red impulse pin jacks numbered one, two, and three.

10. Send an electrical impulse through the circuit by actuating the bombsight. Repeat by pressing the bombardier's and pilot's firing key.

11. With an impulse from the bombsight or firing key, the intervalometer will automatically complete its cycle (15 impulses) and the release mechanism will be actuated in the same sequence as the sequence that was set up by the jumper wires on the intervalometer panel.

12. Repeat these two checks with different settings of the ground speed dial as a further check on the intervalometer.

(d) ARMING CHECK.

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

2. Throw the MK 51 "NOSE FUSE" and "TAIL FUSE" switches on the bombardier's switch panel to "ON" position.

3. Throw the "MANUAL" switch to "ON" position.

4. Throw the four MK 42 arming switches to "ARM" position.

5. If the circuits are correct, throwing the "BOMB RELEASE" switch on the main distribution panel alternately on the bus and "OFF" will cause the arming mechanism on the bomb racks to be actuated.

6. If the MK 51 external bomb racks or the MK 42 bomb racks are not installed, test lamps may be connected for this check as follows:

a. For the MK 51 racks, connect the test lamp from pin "A" of the MK 51 external receptacle to ground, and pin "D" to ground for each rack.

b. For the MK 42 racks, connect the test lamp from pin No. 4 of each MK 42 receptacle to ground.

7. The lamps should light each time the "BOMB RELEASE" master switch on the main distribution panel is thrown on the bus.

h. ENGINE OIL DILUTION SOLENOID VALVE CIRCUIT.

(1) DESCRIPTION. *(See figure 224.)*—One engine oil dilution solenoid is located on the forward side of each engine firewall. This solenoid opens a valve in a fuel line coming from the carburetor and allows the fuel to enter the oil system. (See Par. 16, *g*.)

The solenoid is actuated by "LH OIL DILUTE" and "RH OIL DILUTE" switches located on the engineer's panel. These two switches are the type

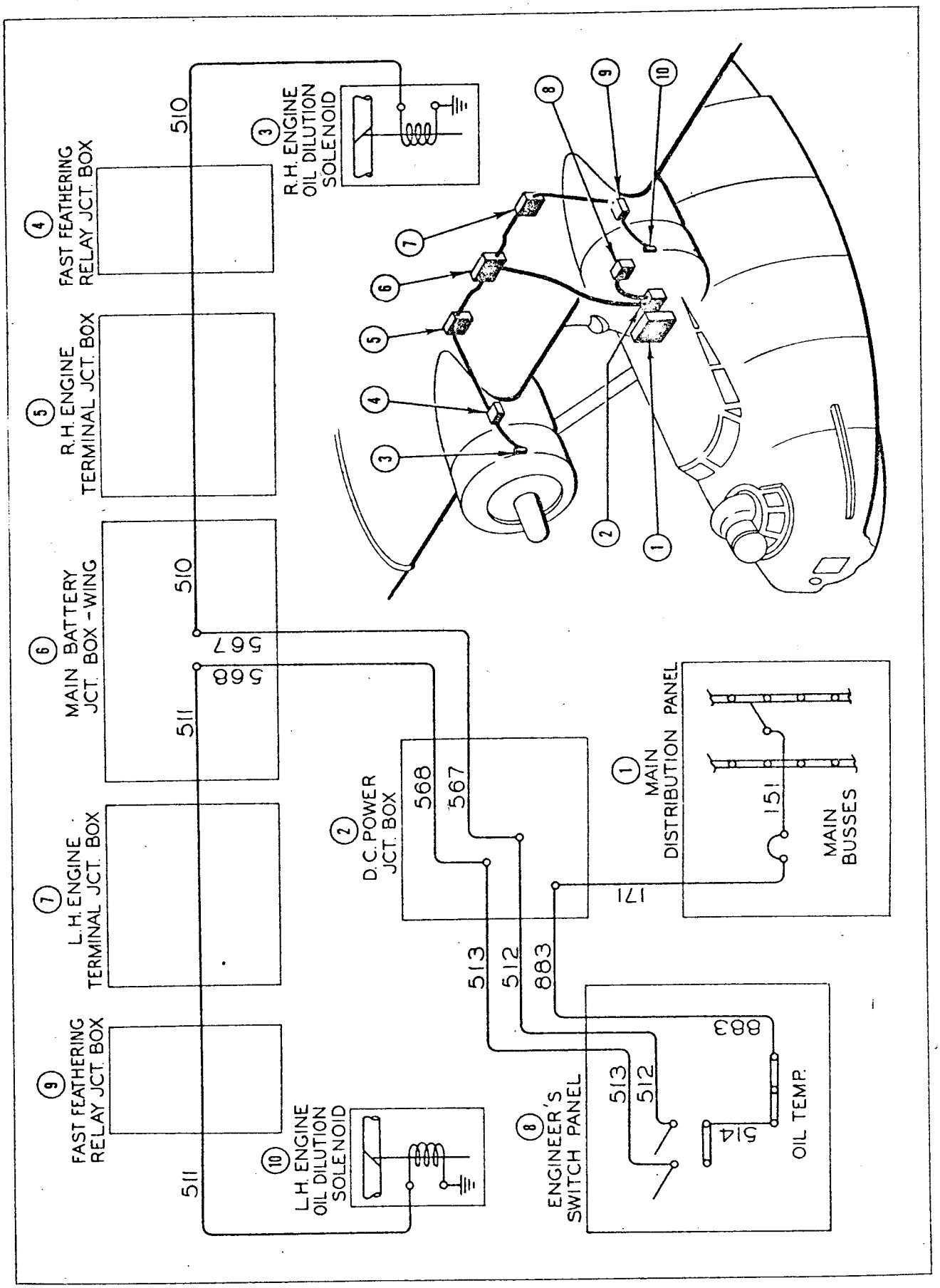


Figure 224—Engine Oil Dilution Solenoid Valve Circuit

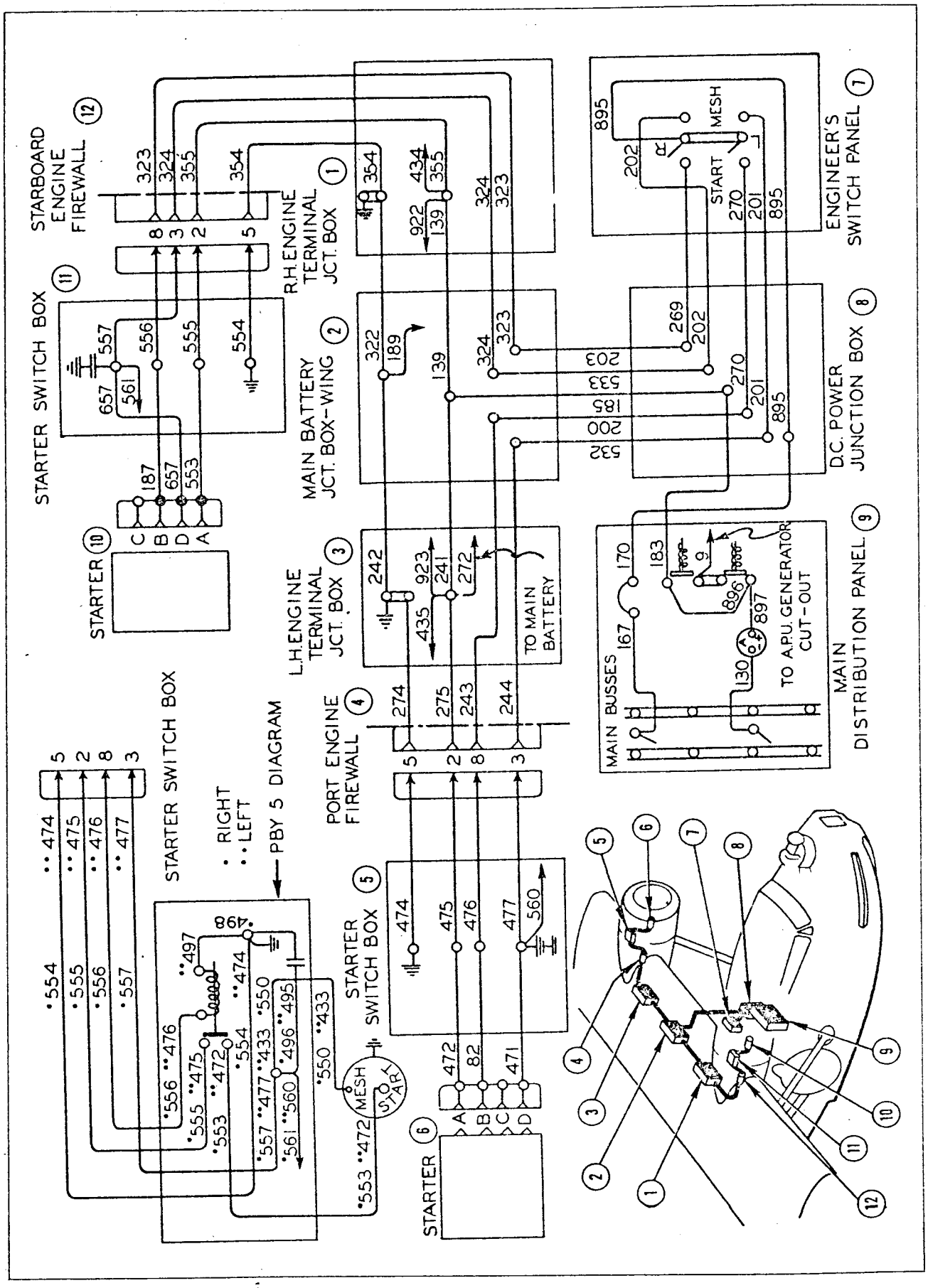


Figure 225—Engine Starter Circuit

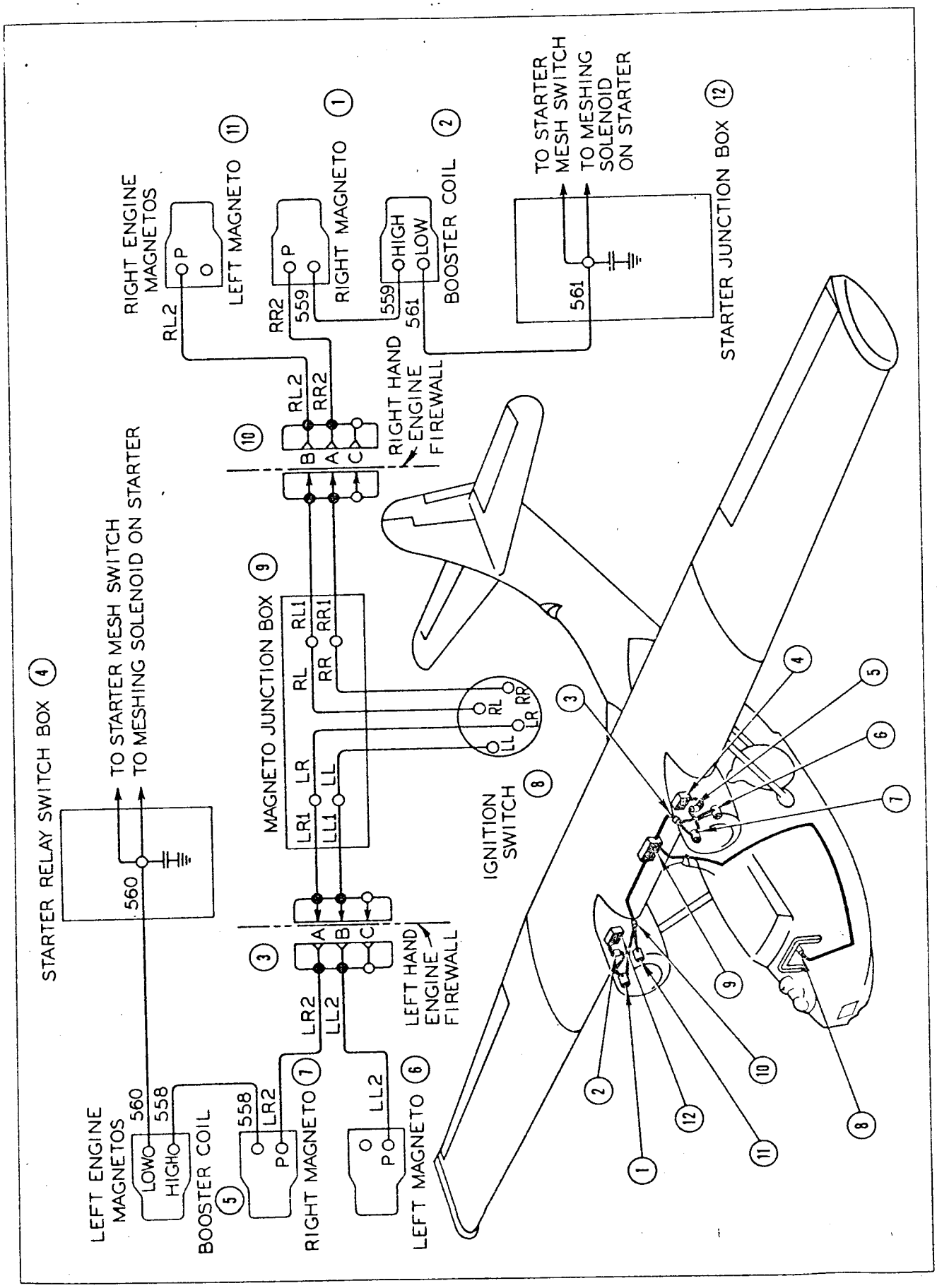


Figure 226—Ignition Circuit

that must be held in "ON" position. Releasing the switch handle opens the circuit.

The energy for the two oil dilute switches is provided by throwing the following switches as follows:

(a) Throw "MAIN BATTERY" switch on the main distribution panel to bus "A" or "B."

(b) Throw "OIL GAGE" switch on main distribution panel to same bus as the "MAIN BATTERY" switch.

(2) REMOVAL.
(See Par. 16, *g*, (2).)

(3) MAINTENANCE.—Inspect wires, terminals, switches and circuit breakers in junction boxes shown on wiring diagram *(See figure 224.)* by following procedure outlined in paragraph *g*, (3).

(a) Remove safety wire from top of solenoid; unscrew wing nut; remove washer; and pull cap and conduit away from solenoid far enough to check the condition of the terminals. If the terminals are discolored or corroded, clean them with No. 000 sandpaper. Reassemble in reverse order of disassembly, being sure to install a new safety wire.

(b) If the solenoid does not function properly electrically, replace the solenoid.

i. ENGINE STARTER CIRCUIT.

(1) DESCRIPTION. *(See figure 225.)*—Each engine is started by an inertia type starter which, after acceleration, is meshed with the engine by a meshing solenoid.

The starting system controls comprise two single pole, three position start and mesh switches (labeled "LEFT ENGINE START" and "RIGHT ENGINE START") on the engineer's switch panel, two solenoid switches in the main distribution panel, and two starting and two meshing solenoids. One starting and one meshing solenoid are a part of each starter mechanism.

(2) OPERATION.—Supply power to the system by starting the auxiliary power unit (See Par. 17, *b*, (1), *(b)*, and 17, *b*, (2), *(b)*.) and turn ignition switch "ON." (See paragraph *j*.)

(a) Throw both the "AUXILIARY GENERATOR" switch and the "ELEC. STARTER" switch on the main distribution panel to either bus "A" or bus "B."

CAUTION

Do not attempt to start engines on batteries alone.

(b) Throw either the "LEFT ENGINE START" or the "RIGHT ENGINE START" switch on the engineer's switch panel to "START."

Note

This causes the solenoid switch in the main distribution panel to connect the auxiliary generator directly to the main battery circuit at the same time that the starter switch on the engineer's switch panel connects the main battery circuit to the starter motor.

(c) Current is sent to the solenoid in the starter which drops the brushes onto the commutator of the motor, thus starting the starter motor and flywheel rotating.

(d) When the starter flywheel has reached its normal operating speed of approximately 22,000 rpm (approximately 12 seconds needed to reach this speed), the starter switch on the engineer's switch panel is thrown from "START" to "MESH." With the switch in this position, the electric circuits of the starter solenoid and motor are disconnected and the meshing solenoid is energized, causing the starter flywheel to mesh with and thus start the engine.

Note

The meshing switch also energizes the booster coil (See paragraph *j*.) thereby boosting the ignition voltage for starting.

CAUTION

Starter disengagement is automatic on firing of the engine. If the engine fails to start and the starter and engine jaws do not disengage, turn the ignition "OFF" and turn propeller by hand about 1/3 or 1/2 of a revolution in its proper direction of rotation, or turn the propeller in opposite direction of rotation for ½ turn. Either operation will release the starter jaw.

Do not operate the starter either manually or electrically while the starter and engine jaws are engaged.

Energize starter not longer than 12 seconds. If a third attempt to start the engine is unsuccessful, allow a five minute period before attempting to start engines again.

(3) MAINTENANCE.—Inspect wiring and terminals in junction boxes shown on wiring diagram *(See figure 225.)* by following procedure outlined in paragraph *g*, (3). Be sure all solenoid contacts are kept clean.

j. IGNITION CIRCUIT.

(1) DESCRIPTION. *(See figure 226.)*—This circuit provides control of the voltage to the engines by grounding the magnetos on each engine when they are not in use and automatically connecting the booster coils into the circuit when starting.

The dual ignition switch, located on the pilot's control yoke, includes the master magneto switch and individual magneto switch for each engine. The master magneto switch grounds all of the magnetos when it is pulled out to "OFF" position, regardless of the positions of the individual switches.

A disconnect plug is provided at each firewall for the quick-disconnect of the conduit.

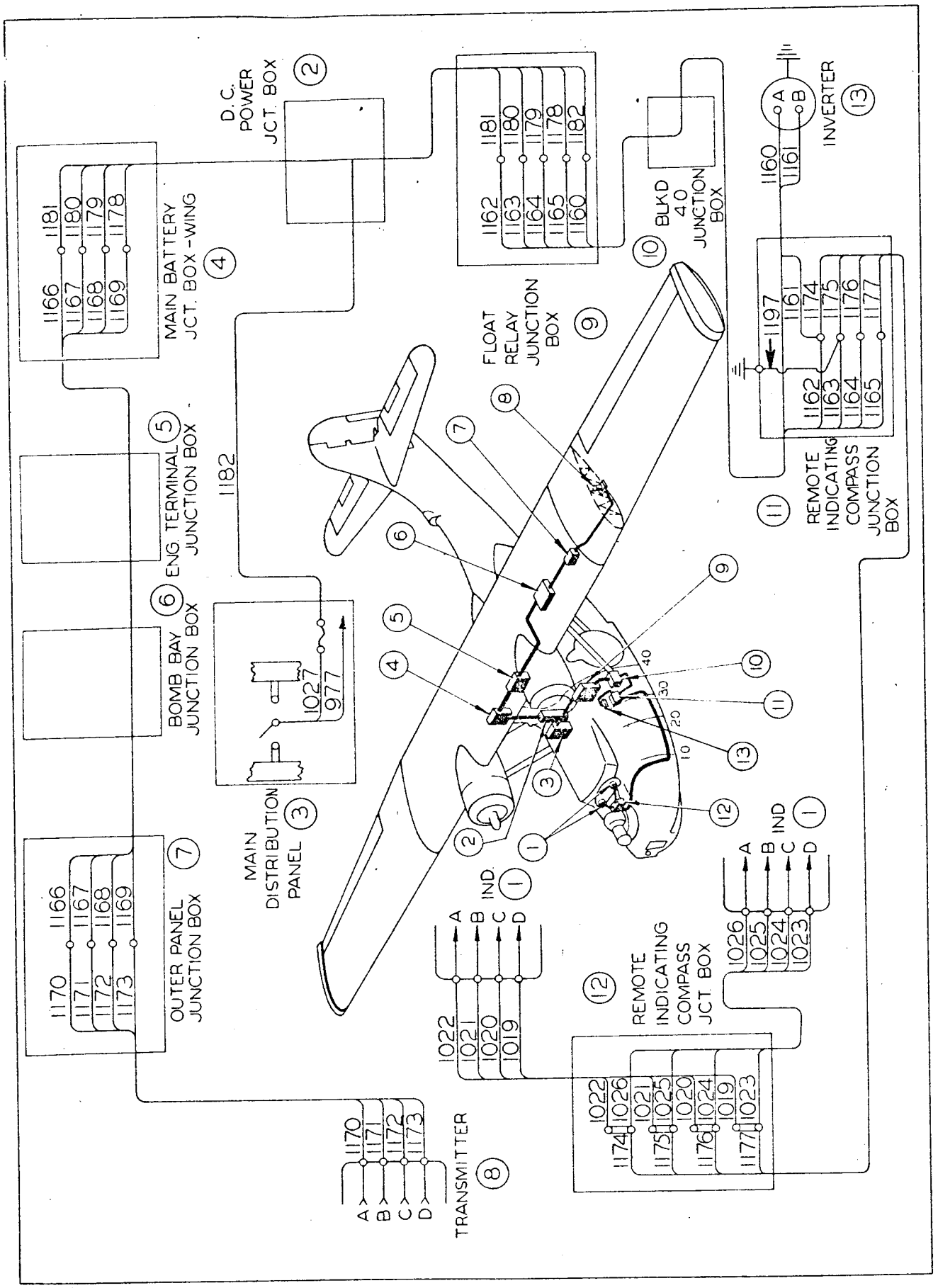


Figure 227—Magnesyn Compass Circuit

WARNING

Do not rotate propellers or engine when this plug is disconnected as the magnetos are not grounded and engine may start.

One magneto is located on the aft port side, and another on the aft starboard side of each engine.

Each magneto connects to a booster coil which is mounted on the under side of the engine starter junction box. The booster coil provides high voltage during starting, when the rpm of the engine is too low for the magnetos to function properly. When the starter switch on the engineer's switch panel is thrown to "MESH" position, current is automatically fed to the booster coil.

(2) MAINTENANCE.

(a) Remove shield from back of ignition switch and inspect wiring and terminals.

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

2. If insulation on wires is worn, frayed, or cracked, or the wire strands are broken, repair or replace wire.

(b) Uncouple each ignition disconnect plug on the engine firewalls and inspect the plugs, solder connections, and wires.

1. If the pins on the plugs are discolored or corroded, clean them with crocus cloth. If insulation is cracked or damaged, replace the plug.

2. If the solder connections at the disconnect plug are loose, resolder them.

3. If wires are damaged or insulation is worn or cracked, repair or replace wires.

(c) Remove cover from magneto junction box and inspect wires for worn or cracked insulation or broken wire strands. If any defects are noted, repair or replace the wire. If the terminals are discolored or corroded, clean with No. 000 sandpaper.

k. MAGNESYN COMPASS CIRCUIT.

(1) DESCRIPTION. *(See figure 227.)*—The two remote indicating compasses (F. S. S. C. NO. 88-I-800) on the pilot's instrument panel are actuated by a Magnesyn transmitting unit (F. S. S. C. No. 88-I-1950) located in the port wing outer panel.

Note

The transmitter was formerly located under the port bunk forward of bulkhead 6 but was moved to the wing location by service action. A third remote indicating compass which was located on the aft face of bulkhead 6 was deleted by service action.

24 volt direct current for the operation of the Magnesyn compass system is provided by a 26 volt, 400 cycle inverter (Pioneer type 12117) which is mounted on the port wall of the airplane, above the navigator's table, just aft of the navigator's instrument panel.

The input to the inverter connects to a switch on the main distribution panel which can be thrown to either bus "A" or "B" to obtain 24 volt D.C.

The output of the inverter is connected to the "A" terminals of the transmitter and the indicators. The "B" terminals of the instruments are connected to each other and to a common ground, while the "C" and "D" terminals are connected by the "C" and "D" phase wires, respectively.

(2) MAINTENANCE.

(a) Check wires and terminals shown on wiring diagram. *(See figure 227.)*

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

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

(b) Inspect disconnect plugs at transmitter and indicators.

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

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

(c) At every overhaul period, remove and check the inverter as follows:

CAUTION

Always break the D.C. supply lead before breaking the ground connection. Failure to do this will result in reduced output voltage.

1. Clean all wiring connections with carbon tetrachloride. Resolder any damaged connections.

2. Unscrew brush caps and remove brush assemblies. If the assemblies are not marked "positive" and "negative," mark them so, in order that they may be replaced in the proper brush guides.

3. Clean brushes with gasoline or Varnalene and dry thoroughly. Do not use carbon tetrachloride.

4. Check length of brushes. If they approach the length of 5/32 inch, replace with new.

5. Insure proper seating of new brushes by inserting a strip of No. 000 sandpaper between brush and commutator, sanded side toward the brush, and pulling in the direction of commutator rotation until the brush is fully seated. Blow out any grit or carbon particles. Do not use emery cloth.

6. Clean dirty commutators with a gasoline or varnalene moistened cloth. If rough, polish with No. 000 sandpaper.

(3) TROUBLES AND REMEDIES.—The accompanying chart lists trouble symptoms characteristic of various wiring faults. All indicator behavior is considered as referred to a transmitter pointed on a North heading. The letters in the chart refer to plug terminal pin markings at any instrument.

TROUBLE	CAUSE	REMEDY
(a) No torque.	"A" shorted to "B."	Check and repair.
	Blown fuse in main distribution panel.	Replace fuse.
	Loose or broken wiring connections between main distribution panel and inverter.	Check and repair.
	Defective inverter.	Replace inverter.
(b) Reverse rotation.	"A" and "B" reversed with "C" and "D" reversed.	Change connections.
(c) Erratic operation in the 90° arc between 300° and 30°.	"D" open.	Check and repair.
(d) Erratic operation in the 120° arc between 300° and 60°.	"C"–"D" phase open in either transmitter or indicator coils.	Replace faulty instrument.
(e) Pointer pulls in at 0° or 180°.	"A" and "C" reversed with "B" and "D" reversed.	Check and correct.
	"A" and "D" reversed with "B" and "C" reversed.	Check and correct.
(f) Pointer pulls in at 30° or 210°.	"A" wire open (power supply reaching one unit).	Check and repair.
	"D" shorted to "A" or "B."	Check and repair.
	"A"–"D" phase open in either transmitter or indicator coils.	Replace faulty instrument.
	"A" and "D" reversed.	Check and correct.
(g) Pointer pulls in at 60° or 240°.	"A" and "C" reversed.	Check and correct.
(h) Pointer pulls in at 90° or 270°.	"C" shorted to "D."	Check and repair.
	"C" and "D" reversed.	Check and correct.
	"A" and "B" reversed.	Check and correct.
(i) Pointer pulls in at 120° or 300°.	"B" and "D" reversed.	Check and correct.
(j) Pointer pulls in at 150° or 330°.	"B" wire open (power supply reaching one unit).	Check and correct.
	"C" shorted to "A" or "B."	Check and repair.
	"B"–"C" phase open in either transmitter or indicator coils.	Replace faulty instrument.
	"B" and "C" reversed.	Check and correct.

(4) ADJUSTMENTS.—Two men are required for the compensation procedure. One adjusts the compensator on the Magnesyn transmitter, the other observes and records the deviation errors of the indicator. The site chosen should be a section of the field completely free of artificial deviation sources such as power lines, steel piping, reinforced concrete structures, other aircraft, etc.

Before "swinging" the Magnesyn, check the power supply to determine that the proper amperage is being delivered to the system. Each unit, counting the transmitter as one, requires 40 to 100 milliamperes of current as measured by an "R.F." milliameter. If the current drawn is not within this range, the voltage and frequency are incorrect and the power supply equipment must be adjusted so that 26 volts, 400 cycles are delivered to the instruments.

While "swinging" the compass, switch on its power only when taking a reading. Always switch off the power before changing the heading of the plane. This avoids transmitter friction. Tap the indicator lightly while taking a reading.

Before "swinging," place the airplane in an attitude that simulates as closely as possible the attitude and conditions of the plane in straight and level flight. It should parallel the plane of level flight, or deviate at an angle not exceeding 5°. This is essential to prevent heeling of the compass card during compensation. To "swing the compass" proceed as follows:

(a) Head the plane due Magnetic North. A pelorus or other suitable instrument is employed to establish Magnetic North. Switch on the Magnesyn compass power. Observe the indicator reading. If it is not on North, turn the "NS" compensating screw (located on the top of the transmitter unit) with the non-magnetic screw driver, supplied with the instru-

ment. Turn until the indicator reads North, then switch off the Magnesyn power.

(b) Head the aircraft due East of Magnetic North. Turn on the Magnesyn switch. If the Magnesyn compass indicator does not show East, turn the "EW" compensating screw of the transmitter unit until the indicator reads East. Once more, switch off the Magnesyn power supply.

(c) Head the plane due South of Magnetic North. Turn on the Magnesyn power supply. If the indicator does not read South, turn the "NS" screw until the error is reduced by one half. For example, if the Magnesyn compass indicates 176° with the aircraft on a southerly heading, turn the "NS" screw until the reading is 178°. Again, turn off the Magnesyn power switch.

(d) Head the aircraft West of Magnetic North. Turn on the Magnesyn power supply. Repeat the operation described immediately preceding, this time turning the "EW" screw until the error is reduced by half. Switch off the Magnesyn power supply.

(e) Head the aircraft Magnetic North once more. Record the error of the northerly heading. Next, record the Magnesyn compass indications for each successive 15° heading around the compass rose. The resulting data are noted on the compass deviation chart and a copy is mounted in the airplane adjacent to each Magnesyn indicator.

(f) If there is an azimuth error, i.e., if the compass deviation error is all minus or all plus, loosen the compass transmitter mounting screws and rotate the unit the necessary number of degrees to distribute the deviation equally on the plus and minus sides.

l. LANDING GEAR POSITION INDICATOR SYSTEM (PBY-5A Only).

(1) DESCRIPTION. *(See figure 228.)*—The landing gear position indicating system is provided for the purpose of giving the pilot or copilot a visual indication of the positions of the main landing gear, the nose wheel, and the nose wheel doors. The indicating portion of the system is protected by a five ampere fuse located on the main distribution panel, and consists of three indicating lights labeled "WHEEL DOOR LOCKED," "WHEELS UP" and "WHEELS DOWN" and also a double throw toggle switch having two positions labeled "INDICATION LIGHTS" and "WARNING LIGHTS." The toggle switch and indicating lights are located on the starboard side of the pilot's instrument panel. The indicator lights and a number of micro-switches, located near the landing gear, are connected to the outer position of the double throw toggle switch as follows:

The "WHEEL DOOR LOCKED" (nose) indicating light is connected in series with a micro-switch located on the keel forward of bulkhead 1. When the nose wheel and the nose wheel door is retracted, the micro-switch is closed and the "WHEEL DOOR LOCKED" indicating light is then illuminated.

The "WHEELS UP" (main landing gear) indicating light is connected in series with two main landing gear "UP" position micro-switches located on the forward upper side of the up-lock structure of each main landing gear. When the main landing gear is locked in the "UP" position, the micro-switches are closed and the "WHEELS UP" indicating light is then illuminated.

The "WHEELS DOWN" (complete landing gear) indicating light is connected in series with the two main landing gear "DOWN" position micro-switches and the nose wheel "DOWN" and "DOWN AND LOCKED" position micro-switches. The main landing gear "DOWN" micro-switch is located a few inches above the hinges on the forward side of the main struts. The nose wheel "DOWN" micro-switch is located on the aft side of bulkhead 1 in front of and below the copilot's right rudder pedal. The "DOWN AND LOCKED" micro-switch is located on the starboard side and forward of bulkhead 1 on the underside of the keel stiffener. When all the landing gear is in the "DOWN AND LOCKED" position, the micro-switches are closed and the "WHEELS DOWN" indicating light is illuminated.

When on the "INDICATION LIGHTS" position, the toggle switch is connected to the hot side of the float control circuit. When the toggle switch is set in this position, any light whose micro-switches are closed will be illuminated.

When on the "WARNING LIGHTS" position, the toggle switch is connected to the "THROTTLE WARNING" switch located under the deck, forward of bulkhead 4 and on center line of airplane. When either throttle is retarded below safe flying speed, the "THROTTLE WARNING" switch is closed and the landing gear position circuit is energized causing an indicator light to be illuminated to indicate the position of the landing gear.

(2) MAINTENANCE.

(a) Check the terminals of the toggle switch on the pilot's instrument panel and the fuse in the main distribution panel; if the terminals are discolored or corroded, clean them with No. 000 sandpaper.

(b) Check the operation of the toggle switch and fuse; if they do not operate correctly, replace them.

(c) Inspect the throttle warning switch; if contacts on terminals are discolored or corroded, clean with No. 000 sandpaper.

(d) If any micro-switches do not operate properly, remove cover from micro-switch housing and replace micro-switch.

CAUTION

Micro-switch housings for the main landing gear "UP" and "DOWN" micro-switches are oil filled and must be held with the cover in an upward position to prevent spilling oil when cover is removed.

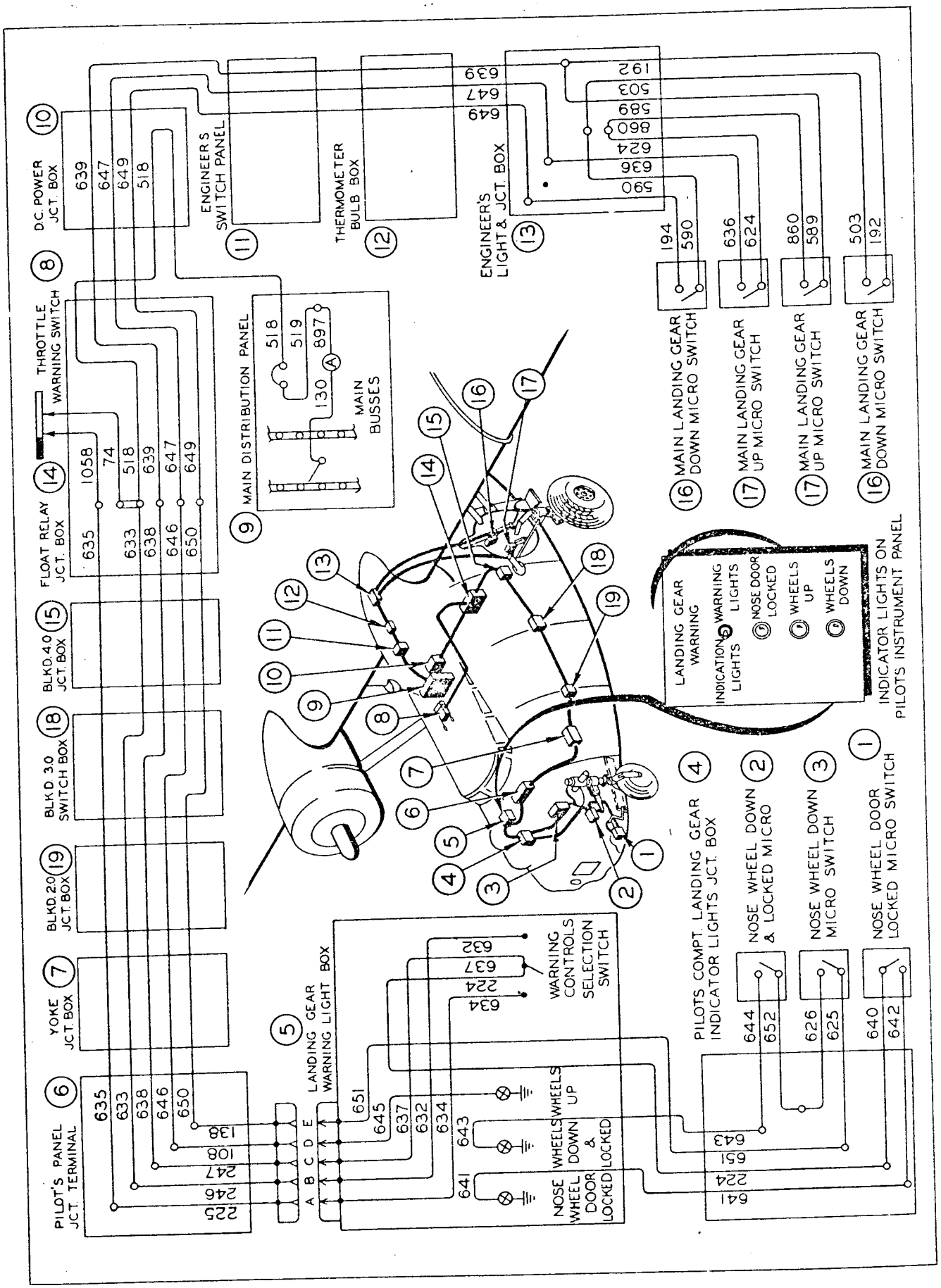


Figure 228—Landing Gear Position Indicator Circuit (PBY-5A Only)

(e) If more oil is needed for housing, fill with "Transyl" oil.

(f) Inspect the lamp in the indicator lights.

1. If the glass is fumed or darkened by use, replace the lamp.

2. If the base is discolored or corroded, clean with crocus cloth.

(g) Inspect disconnect plug on landing gear warning light box, which is located on forward side of pilot's instrument panel.

1. If insulation is cracked or damaged, replace plug.

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

3. If pins do not make good contact, replace plug.

4. Remove knurled nut from rear of plug and inspect solder connections, making sure all connections are tight and wires are not broken.

(h) Inspect wires and wire terminals in junction boxes shown on wiring diagram. *(See figure 228.)*

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

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

(i) Be sure that all terminals, plugs, and conduit fittings are tight.

(3) TROUBLES AND REMEDIES.—Investigate and correct failure of any unit of the system. Following is a list of more common troubles and suggested remedies:

TROUBLE	CAUSE	REMEDY
(a) Failure of all lights with control switch in either position.	Blown fuse.	Replace fuse.
	Defective or loose wiring connections between main distribution panel and float relay box.	Check and repair.
(b) Failure of all lights with control switch in "WARNING LIGHTS" position.	Defective throttle warning switch.	Repair or replace switch.
	Dirty contacts on throttle warning switch.	Clean contacts.
	Contacts on throttle cables out of adjustment.	Adjust contacts.
	Defective control switch.	Replace control switch.
	Defective or loose wiring connections between throttle switch and control switch.	Check and correct.
(c) Failure of all lights with control switch in "INDICATION LIGHTS" position.	Defective control switch.	Replace switch.
	Defective wiring connections between float relay box and control switch.	Check and repair.
(d) Failure of main landing gear "WHEELS UP" light.	Burned out bulb.	Replace bulb.
	Defective lamp socket.	Repair or replace socket.
	Defective "UP" micro-switch on main landing gear.	Replace switch.
	Defective or loose wiring connections in landing gear "UP" circuit.	Check and correct. *(See figure 228.)*
(e) Failure of landing gear "WHEELS DOWN" indicator light.	Same as first and second causes for trouble *(d)*.	Same remedies as for first and second causes for trouble *(d)*.
	Defective main gear "DOWN," nose gear "DOWN," or nose gear "DOWN AND LOCKED" micro-switch.	Replace defective switch or switches.

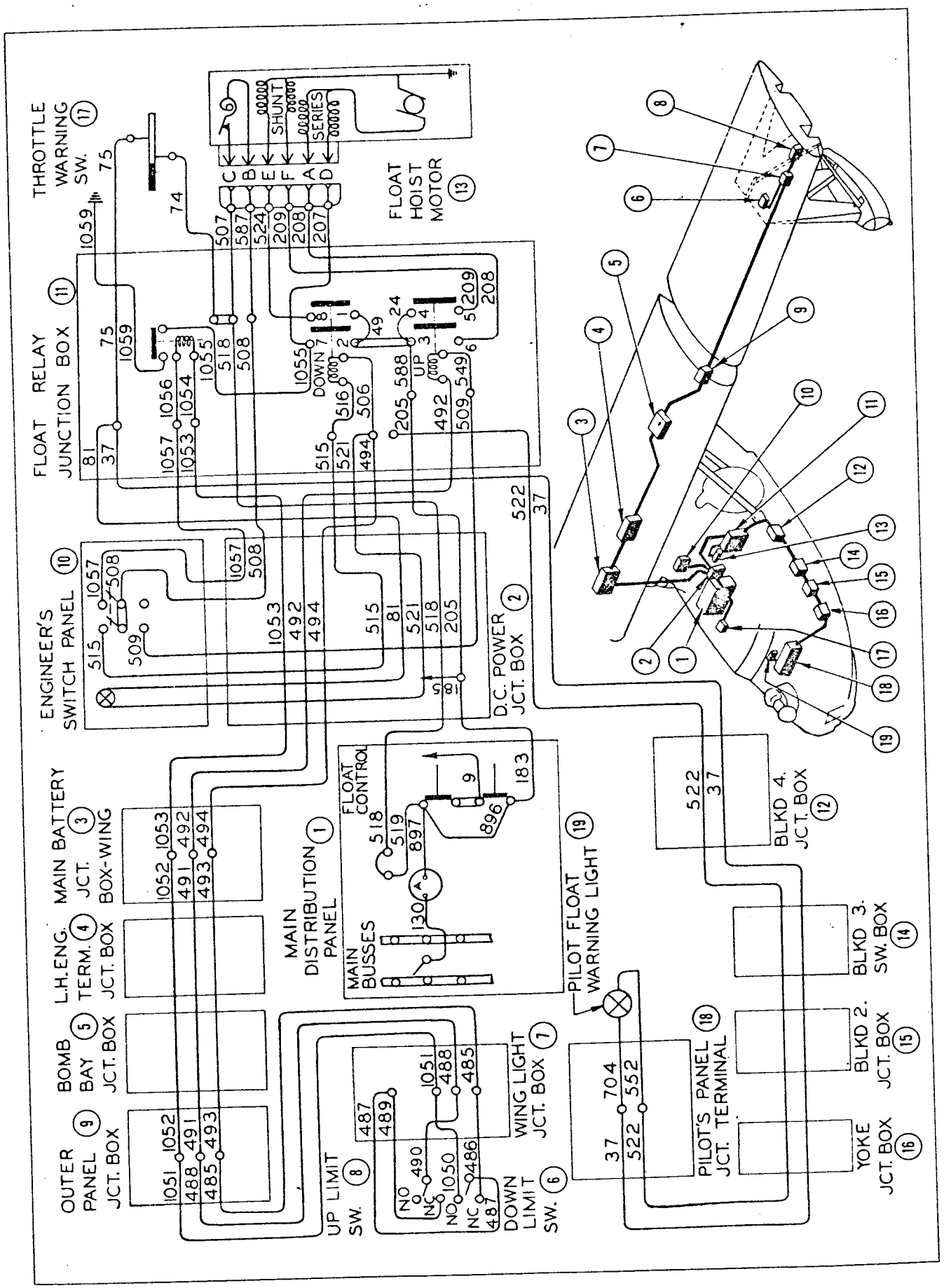


Figure 229—Float Operating and Indicating Circuit

TROUBLE	CAUSE	REMEDY
	Defective or loose wiring connections in landing gear "DOWN" circuit.	Check and correct. *(See figure 228.)*
(f) Failure of nose "WHEEL DOOR LOCKED" indicator light.	Same as first and second causes for trouble *(d)*.	Same remedies as for first and second causes for trouble *(d)*.
	Defective nose wheel door "LOCKED" micro-switch.	Replace switch.
(g) Intermittent or flickering operation of all lights.	Intermittent ground between main distribution panel and control switch.	Check and correct.
	Loose or defective wiring connections in above line.	Check and correct.
	Defective control switch.	Replace switch.
(h) Intermittent or flickering operation of any one light.	Bulb loose in socket.	Check and correct.
	Defective wiring or loose connections in circuit of lamp affected.	Check and correct.
	Intermittent ground in circuit of lamp affected.	Check and correct.
	Defective micro-switch in circuit of lamp affected.	Replace switch.

(4) OPERATIONAL CHECK.

(a) This may be accomplished during flight, on the water, or when the airplane is in any position such that the landing gear is free to operate.

(b) The starboard engine must be running to build up enough pressure in the hydraulic system to operate the landing gear.

(c) Throw the selector switch on the pilot's instrument panel to "INDICATION LIGHTS" and then operate landing gear. (See Par. 4.) If the system is functioning correctly, the indicator light marked "WHEEL DOOR LOCKED" will light when the nose wheel is in "UP" position. The indicator light marked "WHEELS UP" will light when the main landing gear is up. The indicator light marked "WHEELS DOWN" will light when the nose wheel and main landing gear are in "DOWN" position.

(d) Throw the selector switch to "WARNING LIGHTS" and with the throttle in a position that would produce a speed so low as to be unsafe for flying, operate the landing gear.

The indicator lights should operate as outlined in paragraph *l*, (4), *(c) above.*

m. FLOAT OPERATING AND INDICATING CIRCUIT.

(1) DESCRIPTION. *(See figure 229.)*—This circuit provides electrical control for raising and lowering the floats as well as a warning light system for giving the pilot and engineer an indication of the position of the floats.

An electric motor containing a thermal cut-out switch provides the necessary power for raising and lowering the floats. The motor is mounted on the forward face of bulkhead 4 between the main distribution panel and the float relay junction box. Current for the motor is taken from a connection to the main batteries in the D.C. power junction box located between the main distribution panel and the float relay junction box.

Power for the circuit is obtained through a connection to the main battery circuit in the main distribution panel and is protected by a five ampere fuse in the panel and the thermal cut-out switch which, in case the motor becomes overheated, breaks the control circuit and thus shuts off the motor.

An "UP" and "DOWN" relay and a "BRAKING" relay are provided in the circuit to control the flow of current to the motor. These relays are located in the float relay junction box which is mounted on the forward face of bulkhead 4 on the port side.

Two limit micro-switches are located in the port wing. The "UP" micro-switch is mounted in the forward float strut slot slightly inboard of the wing end. The "DOWN" micro-switch is mounted on the under side of the wing forward and adjacent to the trough that contains the screw jack, approximately five feet from the wing end. These switches are closed by the float when in the extended and retracted positions.

A control switch to raise and lower the floats completes the units in the control circuit. It is located on the upper part of the engineer's panel.

The indicating circuit consists of two "FLOAT WARNING" lights and the throttle warning switch.

One of the two "FLOAT WARNING" lights is located on the upper central portion of the pilot's

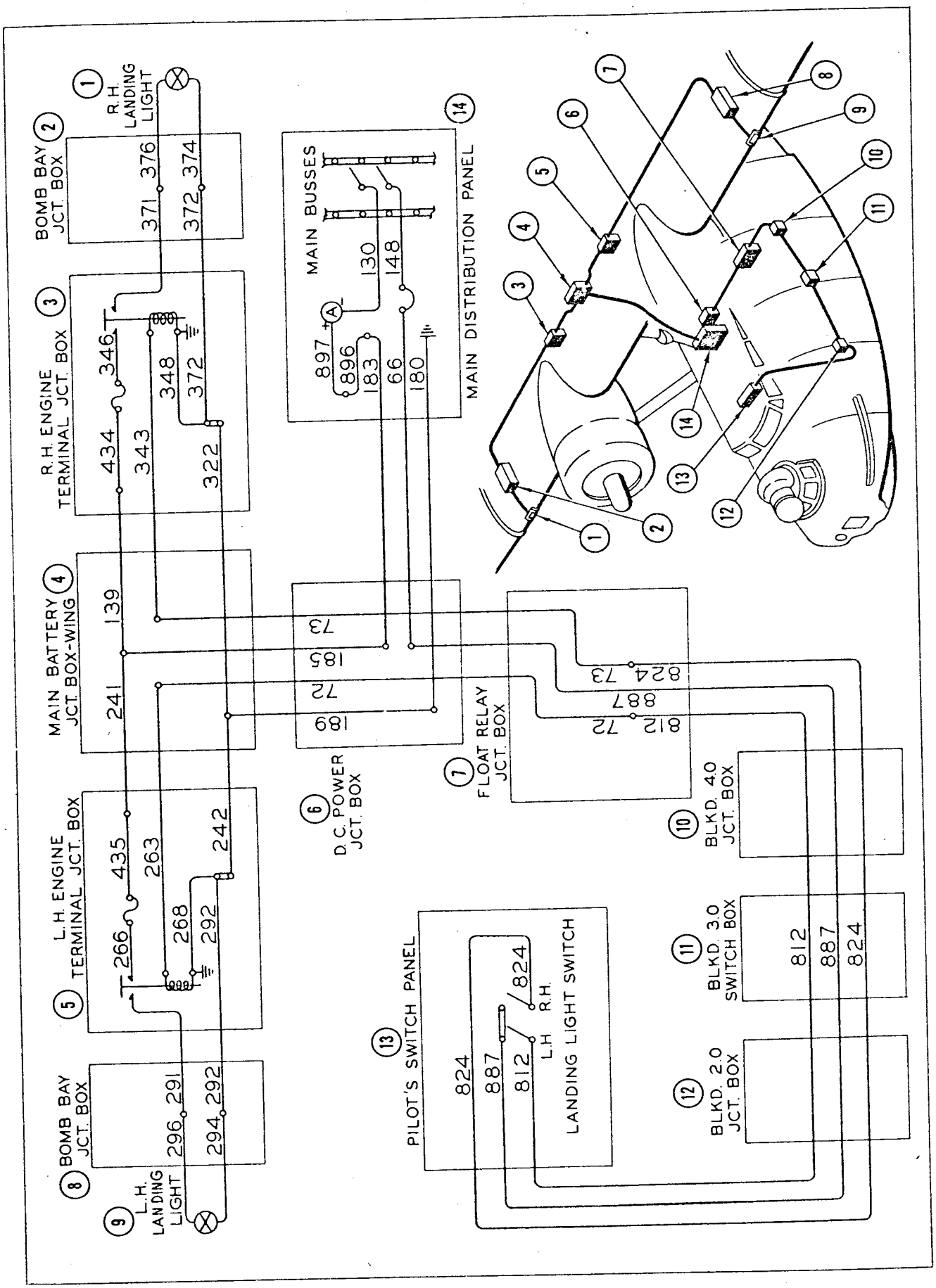


Figure 230—Landing Light Circuit

instrument panel, while the other indicating light is located on the engineer's instrument panel.

The throttle warning switch completes the indicating circuit. It is located just forward of bulkhead 4 on center line under the deck. Whenever the pilot retards either throttle below safe flying speed, the throttle warning switch is closed and if the floats are not latched down, the "FLOAT WARNING" lights will be illuminated.

To raise the floats from a "DOWN" position, proceed as follows:

Throw the control switch on the engineer's panel labeled "FLOATS" to the "UP" position.

When this switch is thrown, the "UP" coil of the "UP" and "DOWN" relay is energized. This closes its contacts and the power flows to two windings of the motor. The motor runs in the proper direction to raise the floats by means of the operating mechanism. (See Par. 6, *d*, (1).) As the port float latches in the upper position, it makes mechanical contact with the "UP" limit switch. This switch opens and breaks the "UP" coil circuit in the "UP" and "DOWN" relay; the coil is de-energized; and the contacts open thus stopping the motor.

To lower the floats, proceed as follows:

Throw the engineer's control switch to the "DOWN" position.

The "DOWN" coil of the "UP" and "DOWN" relay is thereby energized. The contacts are closed and the power flows to the "DOWN" winding of the motor. The motor runs in a reversed direction to what it ran to raise the floats, and lowers the floats by means of the operating mechanism. As the port float latches, it makes mechanical contact with the "DOWN" limit switch. The "DOWN" limit switch is a single pole, double throw switch normally closed and in series with the "DOWN" coil of the "UP" and "DOWN" relay and the throttle warning light circuits. When mechanically tripped, it opens these two circuits and closes the "BRAKING" relay coil circuit. The "DOWN" coil of the "UP" and "DOWN" relay is de-energized and the relay contacts open. The "BRAKING" relay grounds the "UP" series windings of the motor thus causing the motor to operate as a short circuited generator. Consequently, grounding the windings acts as a brake to stop the motor and to combat the floats while latching.

(2) MAINTENANCE.

(a) Inspect wires in junction boxes indicated on wiring diagram. *(See figure 229.)*

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

2. If wire strands are broken, replace wire.

(b) Inspect all wire terminals.

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

2. Make sure all terminal connections are tight.

(c) Inspect fuse and switches.

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

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

(d) Inspect disconnect plug at motor.

1. Uncouple plug and inspect insulation. If cracked or damaged, replace plug.

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

3. Make sure pins make good contact; if they do not, replace the plug with a new one.

4. Inspect the solder connections on rear of plug; if loose, resolder.

(e) If any micro-switches are defective, remove cover of micro-switch housing and replace switch.

(f) Remove lamps from indicator lights and inspect them.

1. If base is discolored or corroded, clean with crocus cloth.

2. If glass is discolored or darkened by use, replace lamp.

(g) Inspect the contact points on "UP" and "DOWN" relay and the "BRAKING" relay. Access to the contact points on the "UP" and "DOWN" relay is gained by removing the four nuts and lock washers from the black plastic caps on the lower side of the relay and then removing the caps. The contact points on the "BRAKING" relay are visible after the cover of the float relay junction box has been removed.

1. If the points are discolored or corroded, clean with crocus cloth.

2. If the points are pitted slightly, clean them lightly with No. 000 sandpaper.

3. If the points are badly pitted or burned, replace the relay.

4. If the armature sticks or the relay does not function properly, replace the relay.

(h) For maintenance of float motor, see paragraph *r*, (3).

(3) OPERATIONAL CHECK.

(a) Throw the engineer's "FLOAT" switch to "DOWN" position.

(b) Place either throttle in "CLOSED" position.

(c) If the system is operating properly, the floats will swing downward and the warning lights will be lighted until the floats reach the "DOWN" latch position.

When the floats hit the "DOWN" limit switch the lights will go "OUT" and the float motor will stop. There should be no back-lash of the floats as they reach their lower limit.

(d) Throw the engineer's "FLOAT" switch to "UP" position.

(e) If the system is operating correctly, the floats will swing upward and the warning lights will again light. When the floats hit the "UP" limit switch, the float motor will stop running.

(f) Advance the "Retarded" throttle. The warning light should then go out.

n. EXTERIOR LIGHTS AND CIRCUITS.

(1) LANDING LIGHTS.

(a) CIRCUIT.

1. DESCRIPTION. *(See figure 230.)*—Current for the port and starboard landing lights is provided by the main batteries in the wing. Before reaching the landing lights, the current passes through 35 ampere fuses and landing light relays located in each engine terminal junction box. The ground return is carried through to the main distribution panel where it is connected to a ground stud.

The controlling part of the circuit operates the landing light relays and is protected by a five ampere fuse located on the main distribution panel. The current for the controlling part of the circuit, taken from either bus "A" or "B" in the main distribution panel, passes through the "LANDING LIGHTS" master control switch and the fuse on the main distribution panel and feeds the bus for the landing light switches on the pilot's switch panel. When these switches are thrown to the "ON" position, current flows to the coils of the landing light relays which are energized; the relay contacts then closes, thus closing the main part of this circuit and lighting the landing lights.

To operate landing lights, throw "MAIN BATTERY" switch and "LANDING LIGHTS" master control switch on the main distribution panel to the same bus ("A" or "B") and then throw "LANDING LIGHT" switches on pilot's switch panel to "ON" position.

2. MAINTENANCE.

a. Check wires in junction boxes shown on wiring diagram. *(See figure 230.)*

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

(2) If wire strands are broken, replace wire.

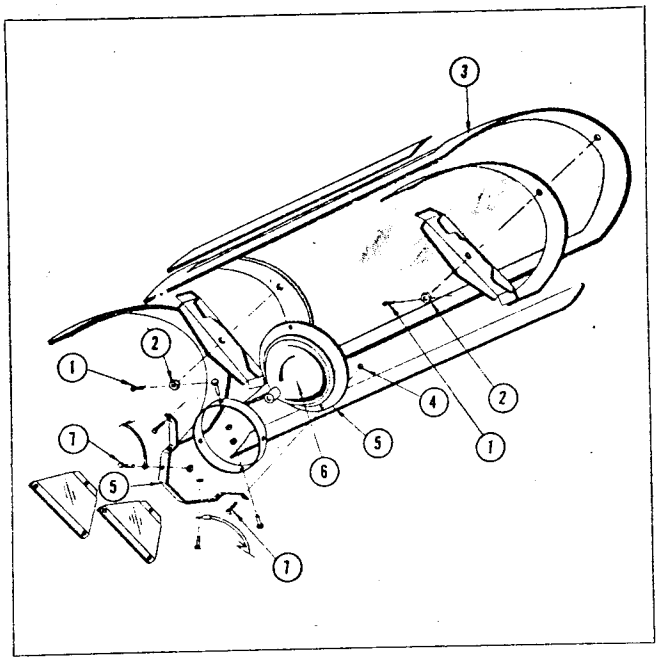
b. Check wire terminals and terminals of switches and fuse.

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

(2) Make sure all connections are tight.

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

d. Inspect terminals of fuse and fuse holder in engine terminal junction boxes; if discolored or corroded, clean with No. 000 sandpaper.



No.	PART No.	NAME
1	AN380-2-3	Cotter Pin
2	AN310-4	Nut
3	28E043	Cover Assembly
4	No. 10-24	Nut
5	K8279351-PT. 1	Clamp
	K8242399-PT.1	Adapter
6	4541	Lamp Assembly
7	No. 8-32 x 7/8 in.	Screw

Items number 5 and 6 are General Electric part numbers.

Figure 231—Landing Light

e. Inspect contact points of landing light relays in engine terminal junction boxes.

(1) If discolored or corroded, clean with crocus cloth.

(2) If slightly pitted or burned, clean lightly with No. 000 sandpaper.

(3) If badly burned or pitted, replace relay with new one.

Note

Bomb bay junction box may be reached for inspection only through the manhole (22) in the outer wing panel. *(See figure 20.)* The engine terminal junction boxes and the center wing junction boxes may be reached through access doors on the top side of the leading edge.

(b) LANDING LIGHTS.

1. DESCRIPTION.—Landing lights are the

sealed beam type, rated at 450 watts and manufactured by General Electric, and designed to operate on a 24 volt system. Two of these lights are mounted in wells in the center section leading edge, one outboard of each nacelle. A frame containing a Plexiglas window fits over the well and seals the light assembly from the weather.

2. REMOVAL.

(See figure 231.)

a. Remove the cotter pins (1) and nuts (2) from the outside of the cover that holds the Plexiglas to the leading edge and then remove the cover and Plexiglas (3).

b. Remove four nuts (4) (two on top and two on bottom) on the front of the fixture and carefully pull out the lamp assembly holder (5) and lamp assembly (6).

c. Disconnect the wires from the terminals on the back of the lamp assembly.

d. Remove three screws (7) from the lamp assembly holder and remove the lamp assembly.

e. The lamp assembly, consisting of a bulb reflector and lens, must be replaced as a unit as the bulb cannot be removed.

CAUTION

Do not attempt to remove the fixture bracket from its supports unless necessary for emergency repairs. It is set at installation at the correct angle and any loosening of the holding nuts will disturb the setting.

3. MAINTENANCE.

a. Inspect wires and terminals on the rear landing light; if they are corroded or discolored, clean with No. 000 sandpaper.

b. If wire insulation is worn or broken or wire stands are broken, repair or replace wire.

c. Make sure all connections are tight.

d. Clean Plexiglas cover.

e. If sealed beam unit does not operate properly, replace unit as it is not meant to be disassembled.

4. INSTALLATION.

a. Install landing lights by reversing removal procedure outlined in paragraph *n*, (1), *(b)*, 2 above.

b. If the fixture bracket has been removed, it must be installed before the lamp assembly and also adjusted in such a manner that the lamp assembly faces 25° outboard and 24° downward, measured from the face of the shield located behind the landing light assembly and bracket.

5. OPERATIONAL CHECK.

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

b. Throw "LANDING LIGHTS" switch on pilot's switch panel to "ON" position.

c. If system is operating correctly, the landing lights will light to full brilliancy when these switches are thrown to "ON" position.

CAUTION

When testing landing lights on the ground, do not have them on for a longer period than necessary to assure satisfactory operation. Because of lack of adequate cooling, they will become extremely hot in a few seconds, with resultant danger of warping the Plexiglas shield and shortening the life of the lamp.

(2) RECOGNITION LIGHTS.

(a) CIRCUIT.

1. DESCRIPTION. *(See figure 232.)*—This circuit provides current for the operation of four recognition lights. The circuit, which is protected by a 10 ampere circuit breaker located on the main distribution panel, is controlled by individual switches or a keying switch located on the recognition light switch box. The recognition light switch box is located on the pilot's signal panel on the control yoke.

The switch circuits are so arranged that one, all, or any combination of lights may be switched on and left on until turned off. This is done by throwing the desired combination of switches to the "STEADY" position. To switch lights off, throw switch to neutral position. The switch circuits are also arranged so that one, all, or any combination of lights may be switched on temporarily by throwing the desired combination of switches to the "KEY" position. At this position, the lights are turned on or off by depressing or releasing the keying switch.

The current to operate the lights passes from the main battery lead in the main distribution panel through the circuit breaker, and feeds the bus in the recognition light switch box. From the bus, the current passes through the switches and either directly to the lights or through the keying switch and then to the lights, depending upon the position of the switches.

2. MAINTENANCE.

a. Inspect wires and terminals in junction boxes shown on wiring diagram. *(See figure 232.)*

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

(2) If wire strands are broken, replace wire.

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

(4) Be sure all connections are tight.

b. Inspect circuit breaker and switches.

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

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

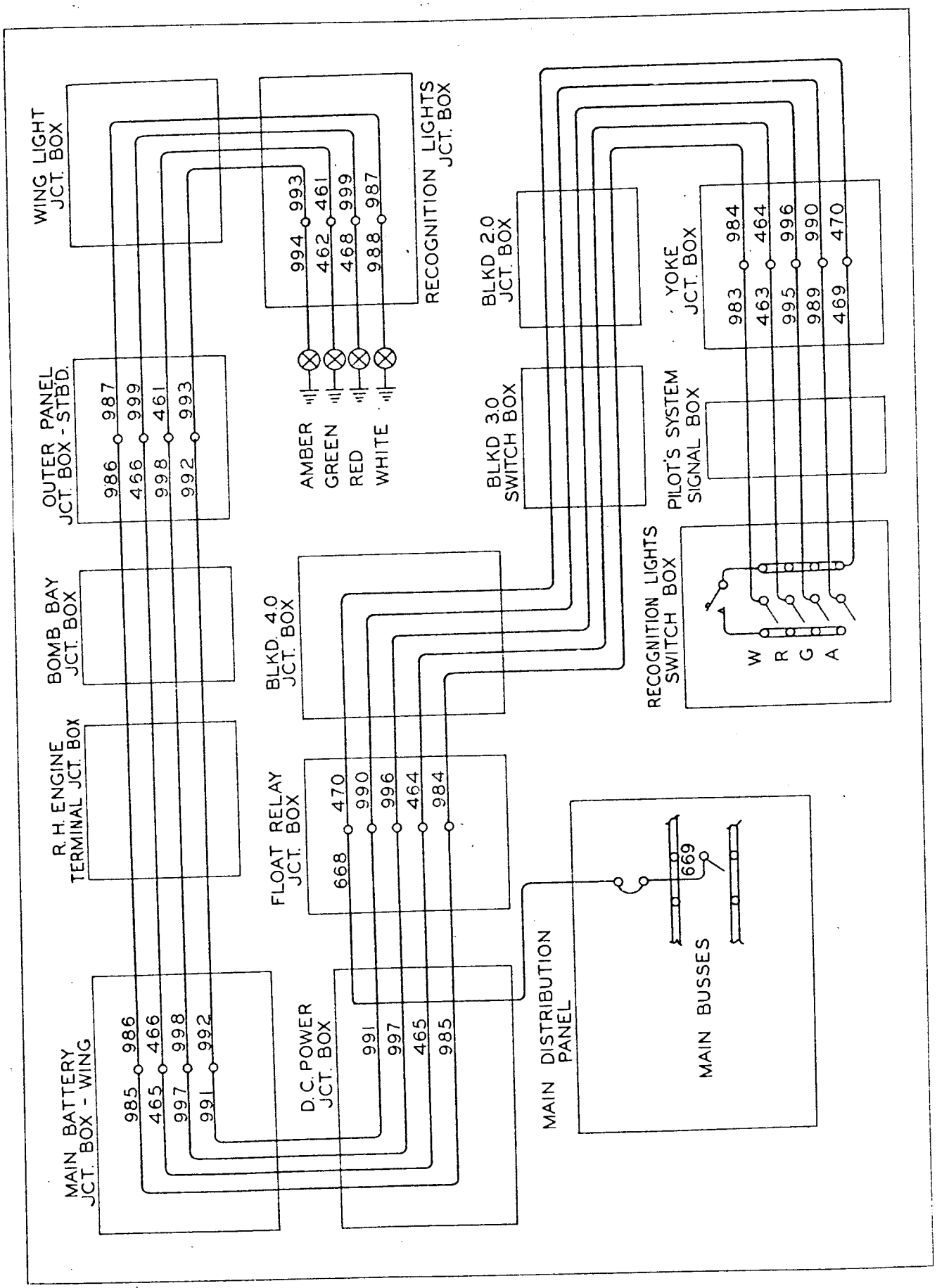


Figure 232—Recognition Lights Circuit

(b) RECOGNITION LIGHTS.

1. DESCRIPTION.—Three of the recognition lights, colored red, green, and amber respectively, (GRIMES MFG. CO. No. B2389) are located on the lower surface of the starboard wing near the wing tip. The fourth light, colored white (GRIMES MFG. CO. No. B2115), is located on the upper surface of the starboard wing near the tip.

2. REMOVAL.

a. Remove six screws from the outer ring of the light, and then detach light assembly and gasket from wing.

b. Disconnect the electrical connection after unscrewing the knurled nut.

c. Disassemble light assembly as follows:

(1) Remove six screws from inner ring that holds the glass lens.

(2) Remove ring, lens, and gasket.

(3) Push bulb in and turn counterclockwise to remove bulb.

(4) Remove three screws from bottom of the reflector and remove the circular plate through which the socket projects.

3. MAINTENANCE.

a. Inspect the bulb; if the base is discolored or corroded, clean with No. 000 sandpaper; if the glass is darkened, discolored or loose, replace the bulb.

b. Inspect the socket contacts; if the contacts are discolored or corroded, clean with No. 000 sandpaper; if contacts have lost their spring such that they cannot be adjusted, replace the light.

c. Clean the lens if dirty.

d. If gasket is not in good condition, replace with new one as a gasket that is not tight will allow moisture to enter light causing damage.

4. ASSEMBLY AND INSTALLATION.—Assemble and install lights by reversing removal procedure outlined in paragraph *n*, (2), *(b)*, *2* above.

5. OPERATIONAL CHECK.

a. Throw the switches on the recognition light switch box to "STEADY" position. If the circuit is functioning properly, the recognition lights will be illuminated.

b. Throw the switches on the recognition light switch box to "KEY" position, and then observe the lights as the "KEYING" switch is pressed.

The lights should light each time the "KEYING" switch is closed.

WARNING

The operation of the recognition lights should be checked before any flight that will be concluded after dark. These lights identify the plane when flying over or landing on friendly territory. Failure of these lights to operate may result in destruction of airplane.

CAUTION

When the plane is not in flight, do not leave the recognition lights burning continuously. The busses may be damaged if subjected to continuous heat of bulbs.

(3) RUNNING, FORMATION, ANCHOR, AND SECTION LIGHTS.

(a) CIRCUIT.

1. DESCRIPTION. *(See figure 233.)*—Current for the circuit passes from the main bus ("A" or "B") through the "EXTERIOR LIGHTS" master control switch and then through a five ampere fuse in the main distribution panel to the lights.

Except for the exterior anchor light switch, which is located on the port side of the airplane just forward of station 1.66 and below the pilot's enclosure, the control switches for the lights are located on the pilot's switch panel. *(See figure 221.)* Resistors are located in the pilot's switch panel to provide for dimming the wing and tail running lights, section lights, and formation lights. By throwing switches on the pilot's switch panel to "FLASH" or "ON," the formation and section lights may be illuminated momentarily or continuously.

Turning the exterior anchor light switch to "ON" position or the switch labeled "ANCHOR LIGHT" on the pilot's switch panel to "ON" position, sends current to the two anchor lights.

By throwing the "FORMATION" and "SECTION" light switches (on the pilot's switch panel) to "ON" position or holding them in "FLASH" position and throwing "FORMATION" and "SECTION" lights switches to "BRIGHT" positions, the current is sent from the bus through the switches to the two formation lights and the section light. When the switches are thrown to "DIM" position, the current follows the same route with the exception that it passes through the resistors and then to the formation and section lights.

By throwing the running lights switches, labeled "WING-TAIL," to "BRIGHT" positions, the current is sent from the bus through the switches and then to the running lights. When the switches are thrown to "DIM" position, the current follows the same path with the exception that it passes through the resistors before it reaches the lights.

2. MAINTENANCE.

a. Check wires in junction boxes shown on wiring diagram. *(See figure 233.)*

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

(2) If wire strands are broken, replace wire.

b. Check wire terminals in junction boxes shown on wiring diagram.

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

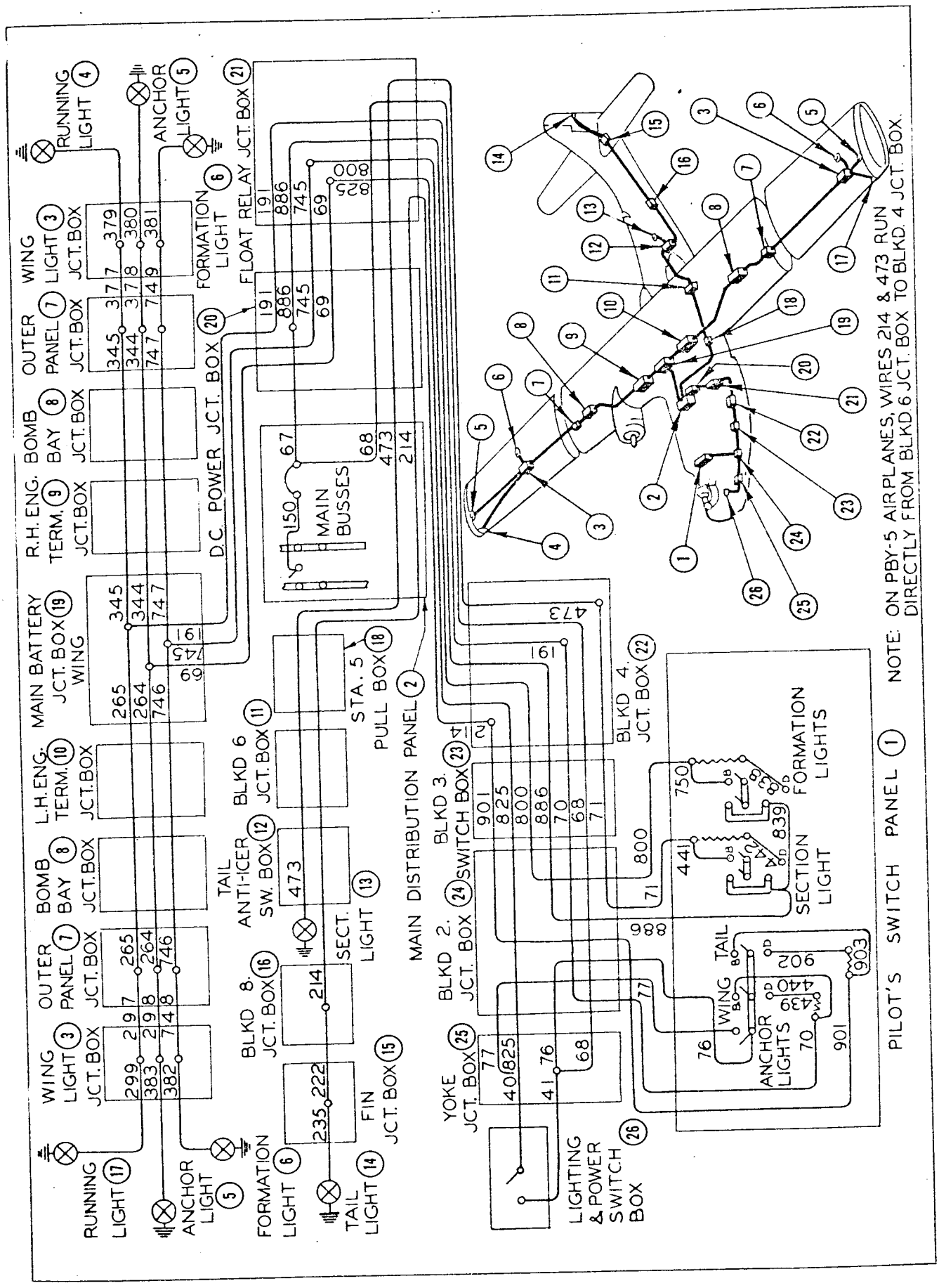


Figure 233—Running, Formation, Anchor, and Section Lights Circuit

(2) Be sure all connections are tight.

c. Inspect fuse and switches.

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

(2) If switches do not function properly, replace with new ones.

d. Inspect disconnect plug at tail post forward of rudder.

Note

The aft fairing must be removed on the port side under the horizontal stabilizer in order to reach this plug. See Par. 2 for removal of fairing.

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

(2) If contacts are discolored or corroded, clean with crocus cloth.

3. OPERATIONAL CHECK.

a. Throw the "MAIN BATTERY" and the "EXTERIOR LIGHTS" master control switch in the main distribution panel to the same bus ("A" or "B") and then from outside the ship turn the exterior "ANCHOR LIGHT" switch to "ON" position. If this part of the circuit is functioning correctly, the two anchor lights will be illuminated to full brilliancy.

b. Turn the exterior "ANCHOR LIGHT" switch to "OFF" position and then throw the "ANCHOR LIGHT" switch on the pilot's switch panel to "ON" position. If the anchor lights again light, this circuit is functioning properly.

c. With the "MAIN BATTERY" switch and the "EXTERIOR LIGHTS" master control switch still thrown to the same bus, throw the running lights switches labeled "WING-TAIL" to "BRIGHT" position. If the system is operating correctly, the running lights on the wing and tail will be illuminated to full brilliancy.

d. Throw above switches to "DIM" position. If the running lights are lighted but dimmer than when turned to "BRIGHT," this part of the system is also functioning correctly.

e. Next, throw the "FORMATION" and "SECTION" lights switches to "ON" position. If the two formation and one section lights are illuminated to full brilliancy when the "FORMATION" and "SECTION" lights control switches are thrown to "BRIGHT" position, this part of the system is functioning properly.

f. Throw the "FORMATION" and "SECTION" lights control switches from "BRIGHT" to "DIM" position. The lights should light as before except that they should be dimmer than they were when in "BRIGHT" position.

g. Repeat procedure outlined in paragraph *n*, (3), *(a)*, *3*, e and *n*, (3), *(a)*, *3*, f with the "FORMATION" and "SECTION" lights control switch held in "FLASH" position. If this circuit is operating correctly, the lights should be illuminated according to the settings of the "FORMATION" and "SECTION" lights control switches each time the control switch is pressed to "FLASH" position.

(b) RUNNING LIGHTS.

1. DESCRIPTION.—The airplane is equipped with three running lights; one white light (NAF 1023-13) located in the rudder; one red light (NAF 1021-11) located on the leading edge at the tip of the port wing; and one green light (NAF 1021-12) located on the leading edge at the tip of the starboard wing.

2. REMOVAL.

a. The running light in the rudder can only be removed by tearing the tail covering fabric around the light and drilling out the rivets that mount the light.

b. Disconnect the electrical connection after loosening coupling nut on back of light.

c. Remove globe and bulb by unscrewing globe and pressing in and turning counterclockwise to remove bulb.

d. Remove the wing running lights as follows:

(1) Remove outboard part of fairing around the light by removing four screws on top of and four screws on bottom of light. Inboard part of light fairing is riveted to leading edge and can only be removed by drilling the rivets out.

(2) Remove screw from center of lens retainer. This allows both lens and retainer to be removed.

(3) Remove bulb by pressing in and turning counterclockwise.

(4) Remove the three screws holding light to fairing and pull light out of fairing as far as possible.

(5) Disconnect electrical connections after unscrewing coupling nut on back of light.

3. MAINTENANCE.

a. Inspect bulbs; if base is discolored or corroded, clean with No. 000 sandpaper; if glass is darkened, discolored, or loose, replace bulb.

b. Inspect spring and socket contact. Make sure the spring is resilient enough to make a good contact. If the socket is corroded, clean with No. 000 sandpaper.

c. Clean lens, if dirty; if damaged, replace with new ones.

d. If socket of light is discolored or corroded, clean with No. 000 sandpaper.

4. INSTALLATION.—Install wing running light and tail lights in reverse order of removal described in paragraph *n*, (3), *(b)*, *2*. See General Man-

ual for Structural Repair (AN 01-1A-1) for repair of fabric.

(c) FORMATION LIGHTS.

1. DESCRIPTION. — The airplane is equipped with two formation lights, one located on each wing approximately five feet from each wing tip. The formation lights are NAF 1023-15 type with NAF 1023-16 reflector and NAF 1023-26 Lunor white lens.

2. REMOVAL.

a. Remove access door directly below formation light on underside of wing. This access door may be reached when floats are in down position.

b. Remove three nuts, screws, and washers that hold light in position.

c. Remove light through access door.

d. Disconnect electrical connections after unscrewing coupling nut on back of light.

e. To remove bulb proceed as follows:

(1) Remove the lens by unscrewing it from the light.

(2) Remove the gasket.

(3) Remove the bulb by pressing in and turning in a counterclockwise direction.

3. MAINTENANCE.

Same as for running lights. (See paragraph *n*, (3), *(b)*, *3.*)

4. INSTALLATION.

a. Install lights by reversing removal procedure outlined in paragraph *n*, (3), *(c)*, *2* above.

b. Apply zinc chromate paste between light flange and upper wing skin when installing light flange.

c. Install reflector so that opening faces aft.

(d) ANCHOR LIGHTS.

1. DESCRIPTION. — The airplane is equipped with two anchor lights, one mounted on the upper surface of the wing near each wing tip. These lights are NAF 1023-15 type lights and contain NAF 1023-19 white glass lenses.

2. REMOVAL.—The anchor lights are located in the forward float strut slots and are readily accessible when the floats are in down position.

a. Remove the three screws, nuts, and washers to remove the light assembly.

b. Disconnect the electrical connections after unscrewing the connector nut on the back of the light.

c. To remove bulb, proceed as follows:

(1) Remove lens by unscrewing it from light.

(2) Remove bulb by pressing in and turning counterclockwise.

3. MAINTENANCE.—Same as for running lights. (See paragraph *n*, (3), *(b)*, *3.*)

4. INSTALLATION.

a. Install lights by reversing removal procedure outlined in paragraph *n*, (3), *(d)*, *2* above.

b. Apply zinc chromate between light flange and upper wing skin when installing light flange.

(e) SECTION LIGHT.

1. DESCRIPTION. — The airplane is equipped with one section light which is located on the upper skin surface just aft of bulkhead 7. The section light is a NAF 1023-15 type light containing a NAF 1023-26 Lunor white lens.

2. REMOVAL.—Two men will be required to remove light; one located outside with a screw driver; and one inside to remove the three nuts.

a. Remove the light and gasket by detaching the three screws.

b. Disconnect the electrical connection by unscrewing the connector nut on the bottom of the light.

c. To remove bulb proceed as follows:

(1) Remove lens by unscrewing it from the light.

(2) Remove bulb by pressing in and turning in a counterclockwise direction.

3. MAINTENANCE.—Same as for running light. (See paragraph *n*, (3), *(b)*, *3.*)

4. INSTALLATION.—Install lights by reversing removal procedure outlined in paragraph *n*, (3), *(e)*, *2* above.

o. INTERIOR LIGHTS AND UTILITY OUTLETS CIRCUITS.

(1) CIRCUITS.

(a) DESCRIPTION. *(See figure 234.)*—This circuit provides for control and protection of the compartment lights, projector lights, table lights, fluorescent lights, panel lights, MK 8 compass light, and utility outlet receptacles.

All the lights and receptacles draw their current through fuses and master control switches in the main distribution panel. Secondary control switches are provided in the compartments in which the various lights are located.

Brightness of the projector lights is controlled by rheostats which also serve as "ON-OFF" switches.

Brightness of the navigator's and radio operator's table lights is also controlled by rheostats. However these lights are operated by separate "ON-OFF" switches.

The bombardier's and pilot's fluorescent lights are furnished alternating current by a vibrator inverter which converts 28 volt direct current to alternating current. The inverter is located under the pilot's seat.

(b) MAINTENANCE.

1. Check wires and terminals in junction boxes shown on wiring diagram. *(See figure 234.)*

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, fuses, rheostats and busses shown on wiring diagram.

a. If buses or terminals of switches, fuses, or rheostats are discolored or corroded, clean with No. 000 sandpaper.

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

c. If exposed section of wire core on rheostat has become discolored or corroded, clean with crocus cloth.

d. If enamel is cracked or rheostat does not work properly, replace rheostat with new one.

3. Inspect utility receptacles shown on wiring diagram.

a. Make sure dust caps can be removed and screwed back on easily.

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

c. If insulation is cracked or damaged, replace receptacle with new one.

d. Make sure pins make good contact with portable equipment plugs; if they do not, replace receptacle with new one.

e. Inspect solder connections on receptacles; if loose, resolder them.

4. Inspect disconnect plug on pilot's stand-by compass.

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

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

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

(c) OPERATIONAL CHECK.

1. FLUORESCENT AND PROJECTOR LIGHTS.

a. Throw "MAIN BATTERY" switch, "PROJ. LIGHTS" switch, and "COMP. LTS. FWD." switch on main distribution panel to same bus ("A" or "B").

b. Throw the "RADIO LIGHTS" and "PANEL LIGHT" switches on the main distribution panel to "ON." If the projector light for the main distribution panel alternately grows "BRIGHT" and "DIM," and then is extinguished when the "PANEL LIGHT RHEOSTAT" is rotated from "OFF" position to "ON" position and back to "OFF" position, this part of the circuit functions correctly.

c. If the radio operator's projector light alternately grows "BRIGHT" and "DIM" and then is extinguished when the "PROJ. LIGHT RHEOSTAT" located on the main distribution panel is rotated from "OFF" position to "ON" position, and then back to "OFF" position, this part of the circuit functions correctly.

d. If the pilot's and copilot's projector lights alternately grow "BRIGHT" and "DIM" and then are extinguished when the "PROJECTOR LT." rheostat on the pilot's switch panel is rotated from "OFF" position to "BRIGHT" position, and then back to "OFF" position, this part of the circuit functions properly.

e. If the engineer's projector light alternately grows "BRIGHT" and "DIM," and then is extinguished when the "PROJ. LT." rheostat on the engineer's switch panel is rotated from "OFF" position to "BRIGHT" position and then back to "OFF" position, this part of the circuit works correctly.

f. If the bombardier's projector light alternately grows "BRIGHT" and "DIM," and then is extinguished when the "PROJECTOR LT." rheostat located on the bombardier's switch panel is turned from "OFF" position to "BRIGHT" position and then back to "OFF" position, this part of the circuit functions properly.

g. Throw "FLUORESCENT LIGHTS" switch on pilot's switch panel to "ON" position. Test each fluorescent light separately by rotating the knurled knob on the light to vary the brilliancy. If the markings on the instruments and the panel glow when the control switch is in "ON" position and cease to glow shortly after the control switch is turned to "OFF" position, this part of the circuit functions correctly.

Note

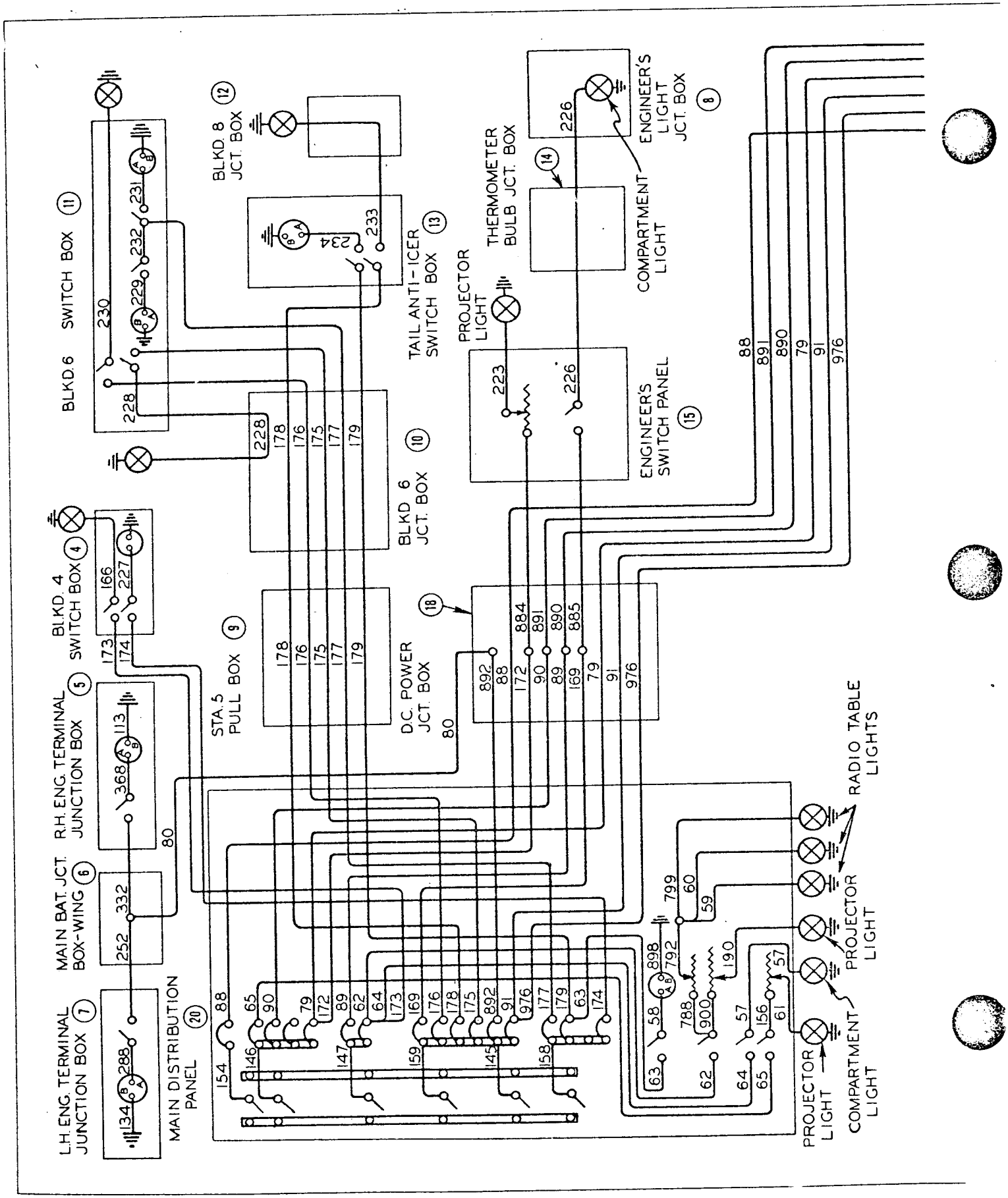
This check on the fluorescent lights may be best conducted either at night or with the bombardier's and pilot's compartment darkened .

2. UTILITY OUTLETS.

a. Throw the "MAIN BATTERY" switch and the "RECPT. FWD." and "RECPT. AFT." switches on the main distribution panel to the same bus ("A" or "B").

b. The utility outlets may be checked by means of a test lamp.

c. Throw the ten utility receptacle switches to "ON" position and check each outlet with the test lamp.


L.H. ENG. TERMINAL JUNCTION BOX (7)
MAIN BAT. JCT. BOX-WING (6)
R.H. ENG. TERMINAL JUNCTION BOX (5)
BLKD. 4 SWITCH BOX (4)
STA. 5 PULL BOX (9)
BLKD. 6 SWITCH BOX (11)
BLKD. 8 JCT. BOX (12)
BLKD 6 JCT. BOX (10)
TAIL ANTI-ICER SWITCH BOX (13)
D.C. POWER JCT. BOX (18)
PROJECTOR LIGHT
THERMOMETER BULB JCT. BOX (14)
ENGINEER'S SWITCH PANEL (15)
COMPARTMENT LIGHT
ENGINEER'S LIGHT JCT. BOX (8)
MAIN DISTRIBUTION PANEL (20)
RADIO TABLE LIGHTS
PROJECTOR LIGHT
COMPARTMENT LIGHT
PROJECTOR LIGHT

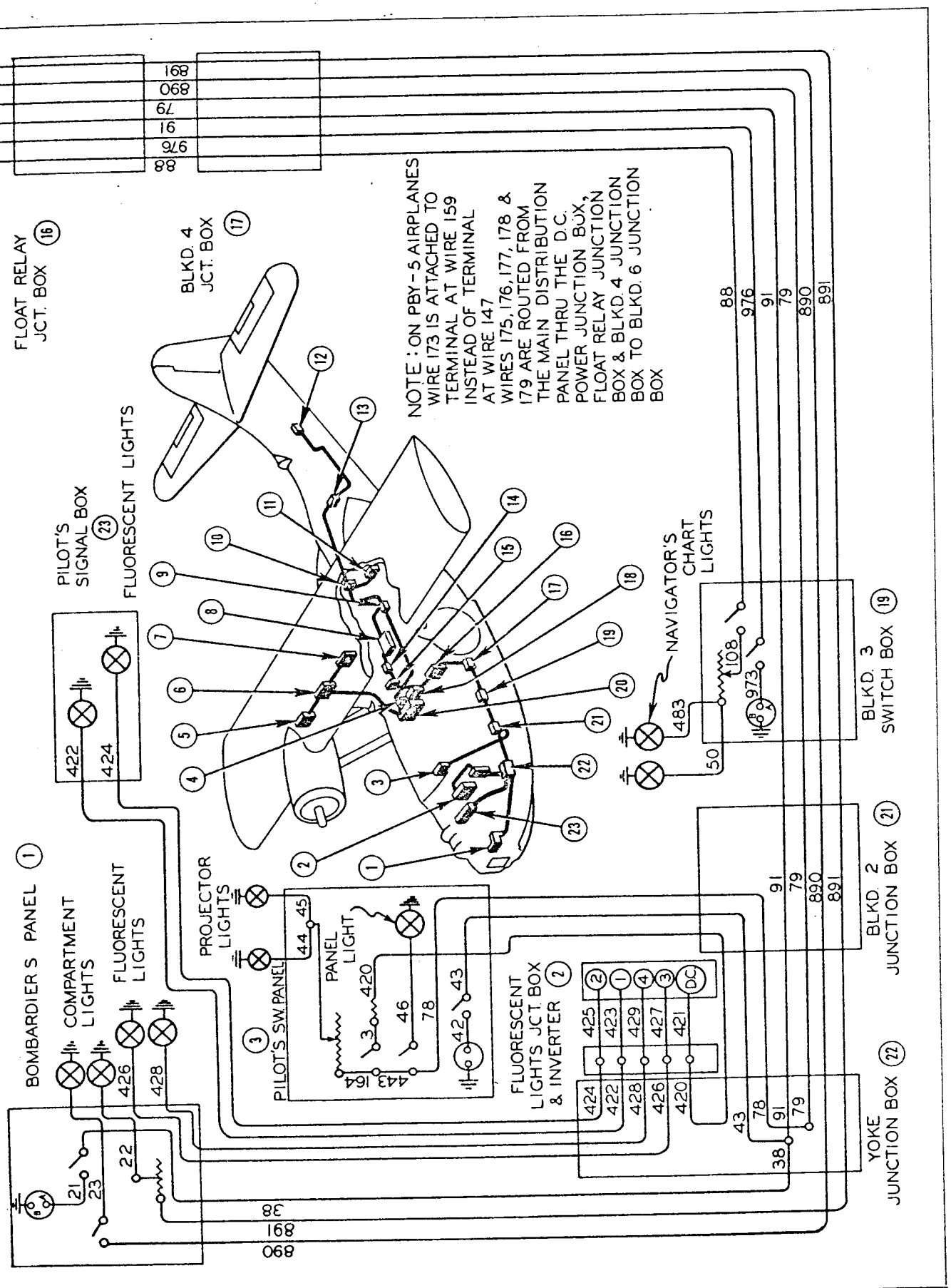


Figure 234—Interior Lights and Utility Outlets Circuit

Note

The ten utility receptacles and their switches are located as follows: Two receptacles and switches located one each on top of the left and right-hand engine terminal junction boxes in the wing; one receptacle and switch located on the bombardier's switch panel; one receptacle and switch located on the pilot's switch panel; one receptacle and switch located on bulkhead 3 switch box; one receptacle and switch located on bulkhead 6 switch box on the forward face of bulkhead 6; one receptacle and switch located on the aft face of bulkhead 6; one receptacle and switch located on the tail anti-icing switch box; one receptacle and switch located on the main distribution panel; and one receptacle and switch located on bulkhead 4 switch box which is on the aft face of bulkhead 4 and to the starboard side of the doorway.

d. If the test lamp is illuminated at each receptacle, these circuits are operating properly.

3. NAVIGATOR'S CHART LIGHTS.

a. Throw "MAIN BATTERY" switch and "NAV. TABLE LIGHT" switches on the main distribution panel to the same bus ("A" or "B").

b. Throw the switch on bulkhead 3 switch box to "ON" position. If the chart lights alternately grow "BRIGHT" and "DIM" and then are extinguished when the rheostat on the navigator's switch box is rotated from extreme counterclockwise position and then back again, this circuit is operating properly.

4. PILOT'S SWITCH PANEL AND STAND-BY COMPASS LIGHTS.

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

b. Throw "PANEL AND COMPASS LT." switch on pilot's switch panel to "ON" position. If light on panel and light on magnetic compass are illuminated, this circuit is operating properly.

5. COMPARTMENT LIGHTS.

a. Throw "MAIN BATTERY" switch and "COMP. LTS. FWD." and "COMP. LTS. AFT" switches on main distribution panel to same bus ("A" or"B").

b.Throw the "DOME LIGHT" switch on the bombardier's switch panel to "ON" position.

c. Throw the "RADIO COMP. LIGHT" switch on the inboard side of the main distribution panel to "ON" position.

d. Throw the "COMPT. LIGHT" switch on the engineer's switch panel to "ON" position.

e. Throw the compartment "LIGHT" switch on the bulkhead 4 switch box to "ON" position.

f. Throw the compartment "LIGHT" switch on bulkhead 6 switch box to "ON" position.

g. Throw the "COMPARTMENT LIGHT" switch on the tail anti-icer switch box to "ON" position.

h. With these switches in the positions indicated above, the bombardier's compartment, radio compartment, engineer's compartment, galley compartment, living compartment, waist gun compartment, and tunnel gun compartment lights will be illuminated if these circuits are operating properly.

6. RADIO TABLE LIGHTS.

a. Throw the "MAIN BATTERY" switch and the "COMPT. LTS. FWD." switch on the main distribution panel to the same bus ("A" or "B").

b. Throw the "RADIO LIGHTS" switch on the main distribution panel to "ON" position.

c. If the radio table lights grow alternately "BRIGHT" and "DIM," and then are extinguished when the "TABLE LIGHT" rheostat on the main distribution panel is rotated from "OFF" position to "ON" position and then back to "OFF" position, this circuit is functioning correctly.

(2) INTERIOR LIGHTS.

(a) DESCRIPTION.—The interior lights in the airplane are designed and located to meet the special requirements of the crew members at their respective stations. The type and function of the lights installed in each of the compartments is as follows:

1. BOMBARDIER'S COMPARTMENT.—The following lights are installed in the bombardier's compartment: two fluorescent lights, one located on each side of the airplane (one illuminates the bombardier's switch panel and the other illuminates the bombardier's instrument panel); one projector light used to illuminate either the bombardier's instrument or switch panels; and one compartment light used for general illumination.

2. PILOT'S COMPARTMENT.—The following lights are installed in the pilot's compartment: two fluorescent lights mounted on the control yoke for illuminating the pilot's instrument panel; two projector lights for additional illumination of the pilot's instrument panel; and one panel light for illuminating the pilot's switch panel.

3. RADIO COMPARTMENT.—The following lights are installed in the radio compartment: one compartment light for general illumination; two projector lights, one for illuminating the radar equipment and one for illuminating the main distribution panel; three radio table lights for illuminating the radio operator's table; and two chart lights for illuminating the navigator's table.

4. ENGINEER'S (MECHANIC'S) COMPARTMENT.—The following lights are installed in the engineer's compartment: one compartment light

for general illumination; and one projector light for illumination of the engineer's instrument panel.

5. GALLEY COMPARTMENT.—One compartment light is provided for general illumination.

6. LIVING COMPARTMENT.—One compartment light is provided for general illumination.

7. WAIST GUN COMPARTMENT.—One compartment light is provided for general illumination.

8. TUNNEL GUN COMPARTMENT.—One compartment light is provided for general illumination.

(b) REMOVAL.

1. COMPARTMENT LIGHTS.

a. Loosen the mounting screws in the base.

b. Turn the reflector in a counterclockwise direction and pull away from base.

c. Remove bulb by pushing in and turning in a counterclockwise direction.

d. Detach the mounting screws in the base and then remove the light and reflector retaining ring.

e. The electrical connections may be disconnected by loosening the coupling nut on the back of the light.

2. PROJECTOR LIGHTS.

a. Remove shield by rotating and pulling.

b. Remove bulb by pushing in and turning counterclockwise.

c. The electrical connections may be disconnected by loosening the coupling nut on the back of the light.

d. Detach the mounting screws, washers, and nuts from mounting base and then remove light.

3. FLUORESCENT LIGHTS.

a. Remove lens housing by detaching knurled knob and small screws on either side of housing and pulling housing straight off.

b. Remove bulb by pressing in and turning counterclockwise.

c. Remove housing base by detaching the four screws that secure it to the signal box on the control yoke.

4. PANEL LIGHT AND RADIO OPERATOR'S TABLE LIGHTS.

a. Loosen mounting screws and turn reflector clockwise to remove.

b. Remove bulb by pressing in and turning counterclockwise.

c. Detach mounting screws and remove light.

d. Electrical connections may be disconnected by removing connector nut on back of light.

5. CHART LIGHTS.

a. Remove bulbs by pressing in and turning in a counterclockwise direction.

b. Loosen screw at top of reflector and remove reflector.

c. Disconnect electrical connections by loosening and removing coupling nut on back of light fixture.

d. Remove light fixture by removing mounting screws and nuts.

(c) MAINTENANCE.

1. COMPARTMENT LIGHTS.

a. If a bulb is darkened or discolored, replace it.

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

c. If the socket of the light is discolored or corroded, clean with No. 000 sandpaper.

d. If the plunger contactor is corroded or discolored, clean with No. 000 sandpaper.

2. PROJECTOR LIGHTS.—Same maintenance as for compartment lights.

3. FLUORESCENT LIGHTS.

a. If bulbs do not light properly, replace bulbs.

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

c. If socket or light is discolored or corroded, clean with No. 000 sandpaper.

d. If contacts on lights are discolored or corroded, clean with No. 000 sandpaper.

4. PANEL LIGHTS.—Same maintenance as for compartment lights.

5. CHART LIGHTS.—Same as for compartment lights.

(d) INSTALLATION.—Interior lights are installed by reversing order of removal procedure. (See paragraph *o*, (2), *(b)*.)

p. PITOT HEAD HEATING CIRCUIT.

(1) DESCRIPTION. *(See figure 235.)*—This circuit supplies current to energize the heating unit in the pitot head to prevent icing. The circuit is protected by a 10 ampere fuse which also protects the anti-icer motor.

The circuit is controlled by the "PITOT HTR." switch on the main distribution panel and the "PITOT HEAT" switch on the pilot's switch panel. A small disconnect plug near the pitot head in the pitot mast is provided for a quick disconnect when removing the pitot head.

(2) MAINTENANCE.

(a) Inspect wires in junction boxes shown on wiring diagram. *(See figure 235.)*

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

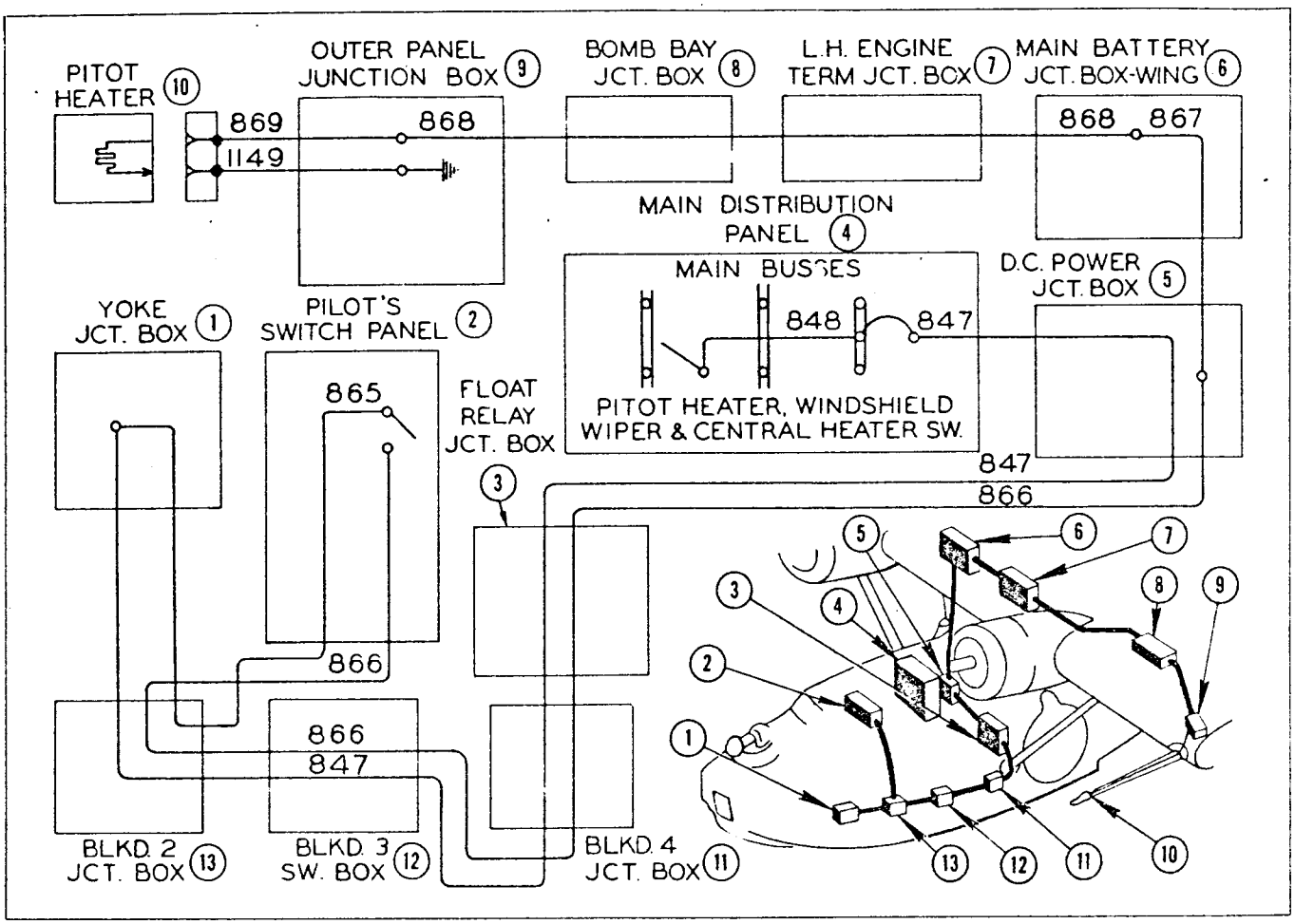


Figure 235—Pitot Head Heating Circuit

2. If wire strands are broken, replace wire.

(b) Inspect wire terminals in junction boxes; if terminals are discolored or corroded, clean with No. 000 sandpaper.

(c) Inspect switches and the fuse.

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

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

(3) OPERATIONAL CHECK.

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

(b) Throw "PITOT HEAT" switch on pilot's switch panel to "ON" position.

(c) Place hand on pitot head; if rapid increase in temperature is noted, the heater unit is functioning.

CAUTION

The pitot head heater must not be turned on for periods longer than necessary to check its operation while airplane is not in flight, or the unit will be damaged by overheating.

q. PROPELLER FEATHERING AND CONTROL CIRCUITS.

(1) CIRCUIT.

(a) DESCRIPTION. *(See figure 236.)*—This circuit supplies current to operate the port and starboard propeller feathering pump motors, which are located on the forward face and port side of each firewall. Each motor is controlled by a control switch, relay, and pressure switch system.

The control switch which is located on the ceiling of the pilot's cockpit forward of the throttle control, is a combination switch and relay. It contains a solenoid coil which is energized by pushing the switch button manually. Once energized, the coil holds the switch contacts closed until its circuit is broken.

In series with the coil are the pressure switch contacts, located adjacent to the propeller. They are normally closed, but will open when the oil pressure in the pressure switch which is located in a junction box on the forward face of each firewall builds up to sufficient pressure to open the switch. The motor relay coil is in series with the control switch contacts while

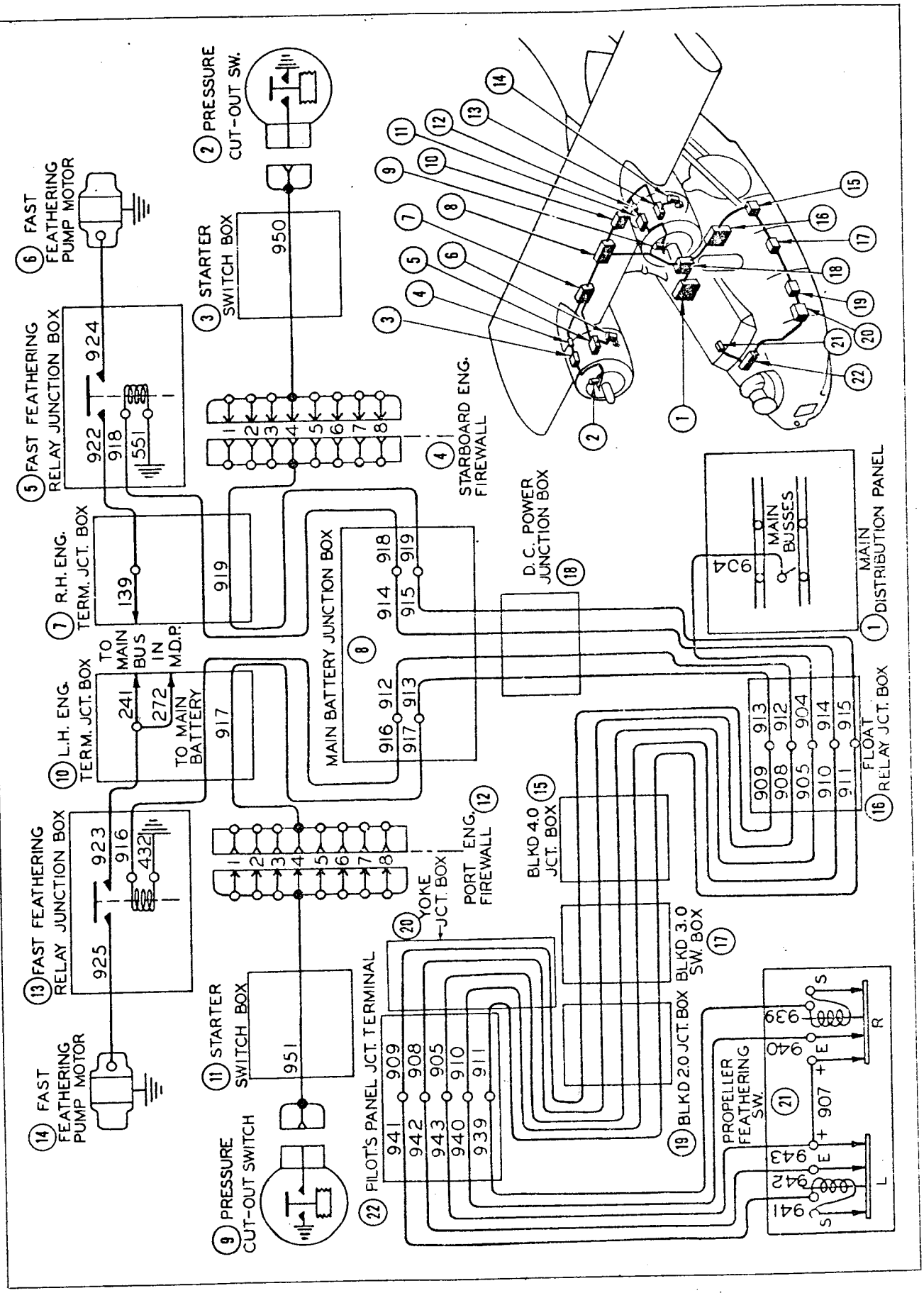


Figure 236—Propeller Feathering Control Circuit

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.

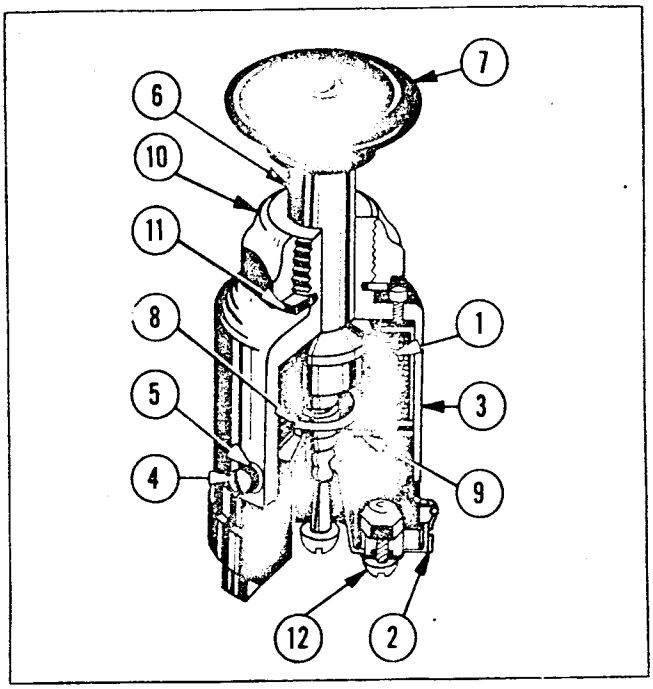
4. Inspect relays in fast feathering junction boxes on engine firewalls.

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.

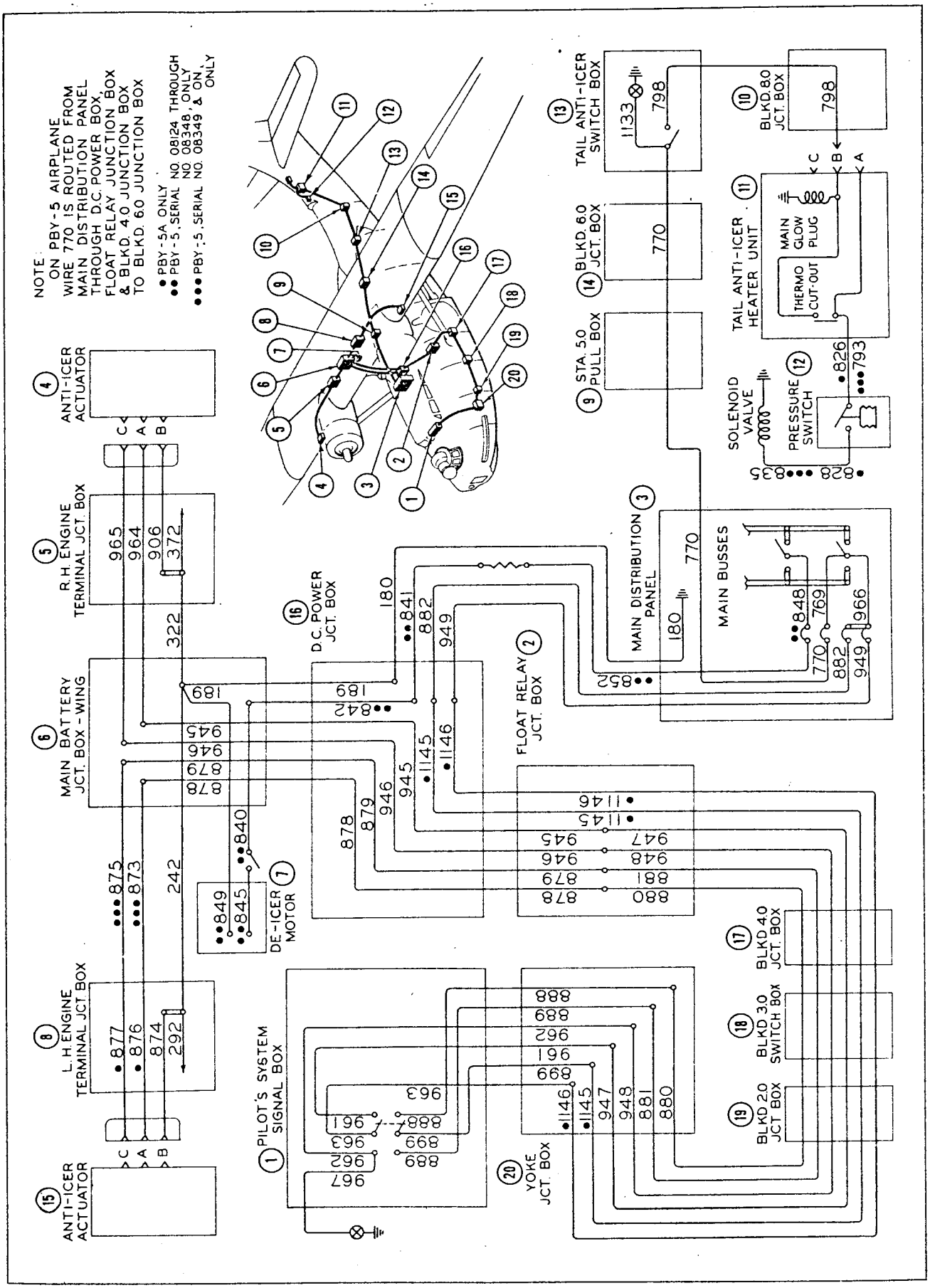


Figure 238—Wing and Tail Anti-Icing Circuit

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.

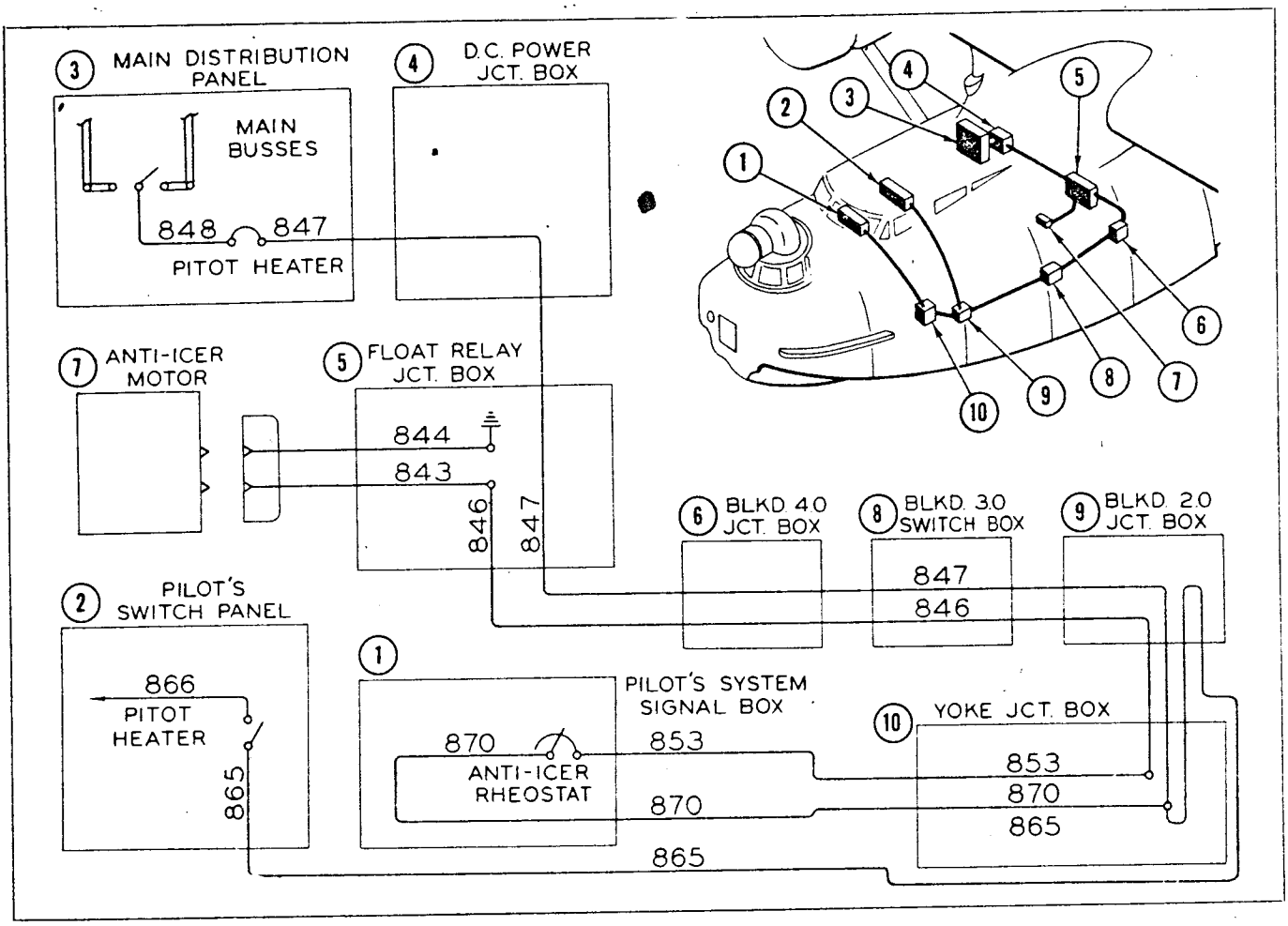


Figure 239—Propeller Anti-Icing Circuit

(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.

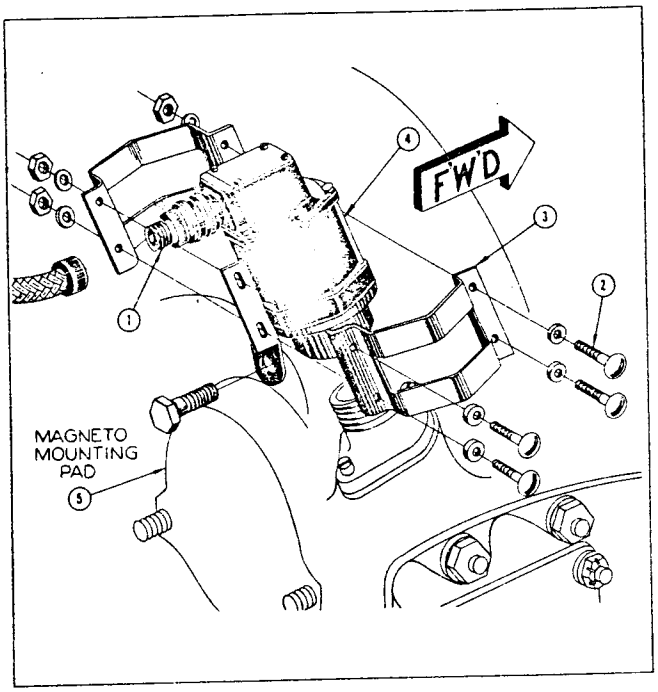
(b) MAINTENANCE.

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.

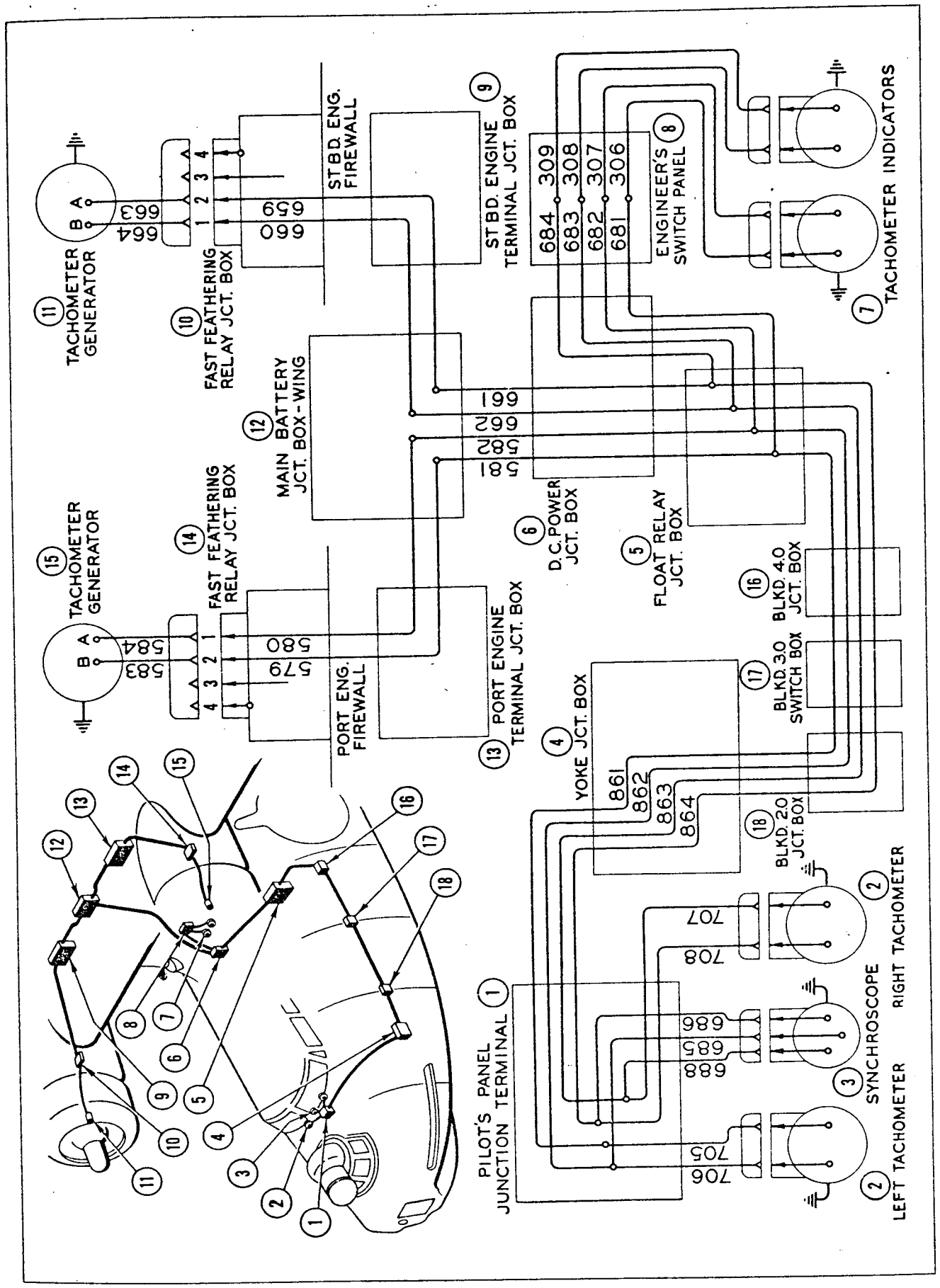


Figure 241—Tachometer Circuit

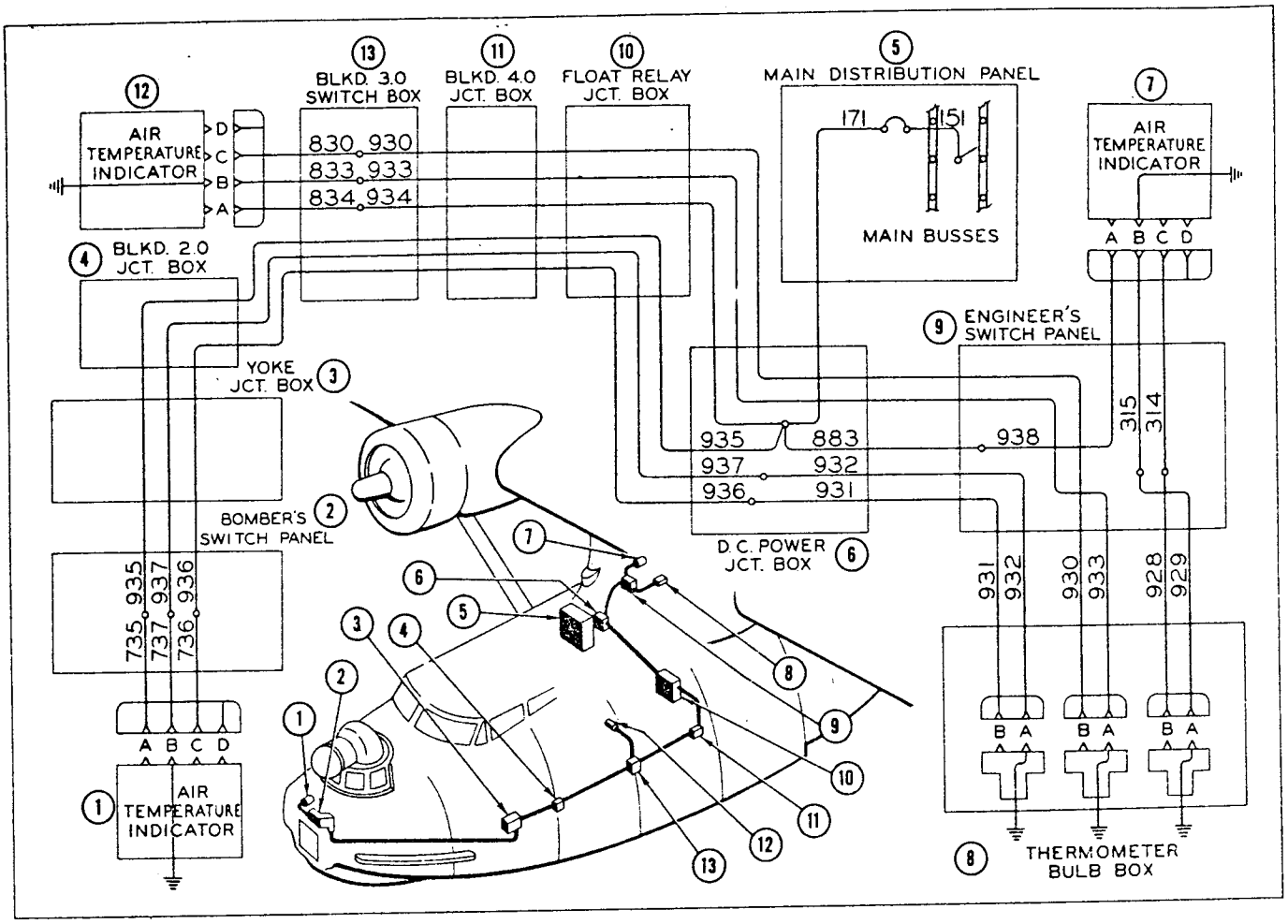


Figure 242—Outside Air Temperature Indicator Circuit

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-

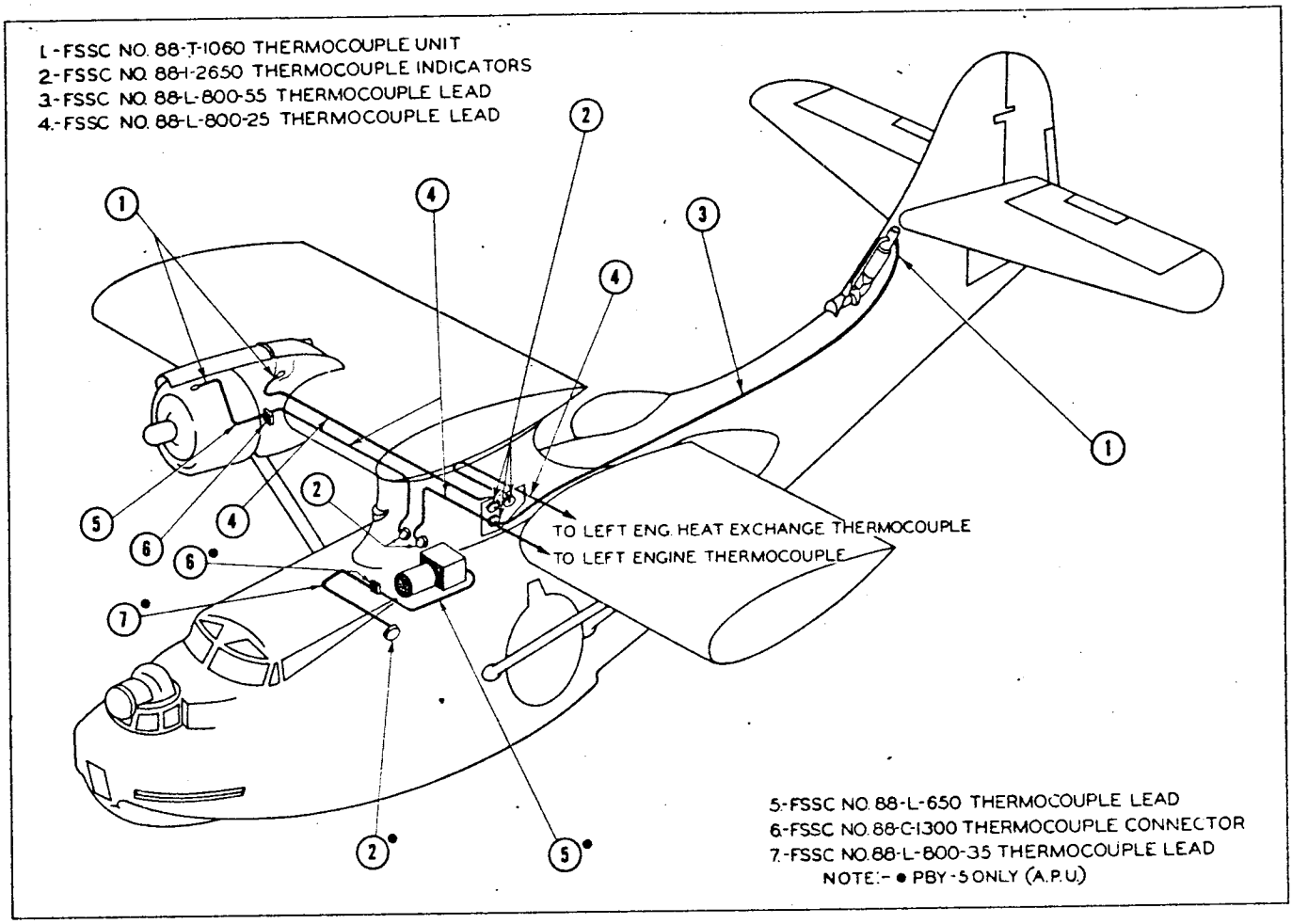


Figure 243—Thermocouple Circuits

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 INDITOR 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.

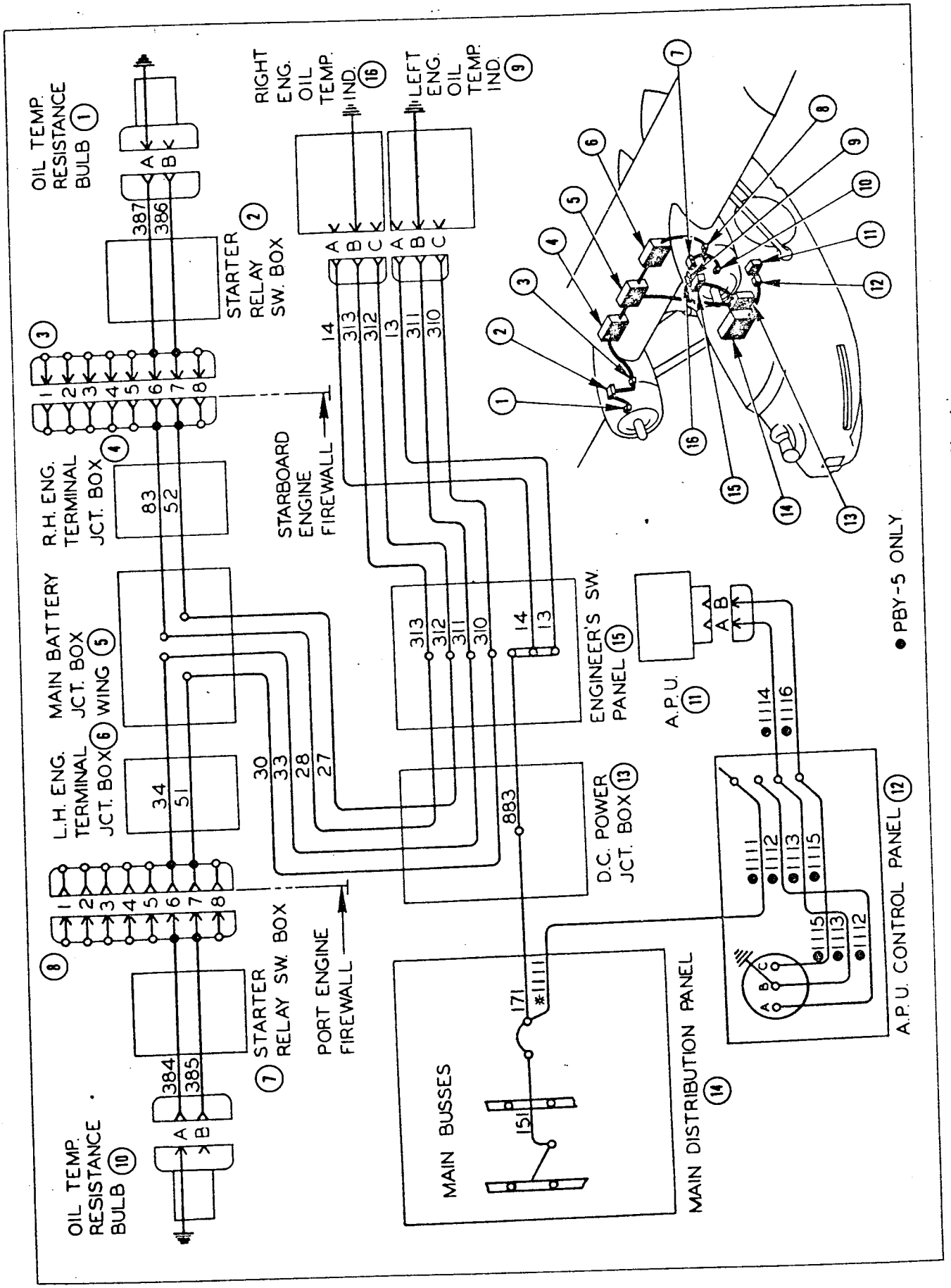


Figure 244—Engine Oil Temperature Indicator Circuit

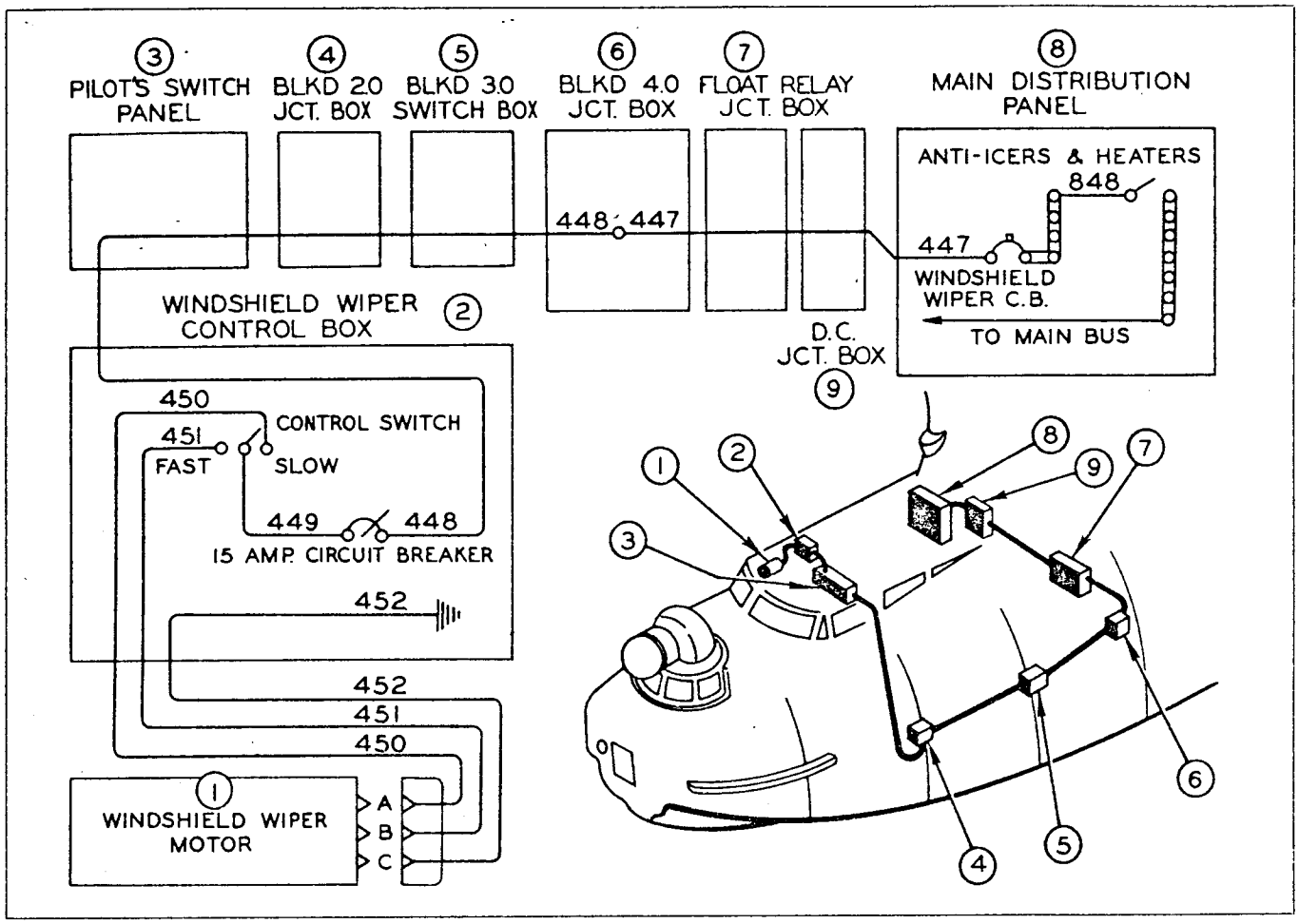


Figure 245—Windshield Wiper Circuit

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

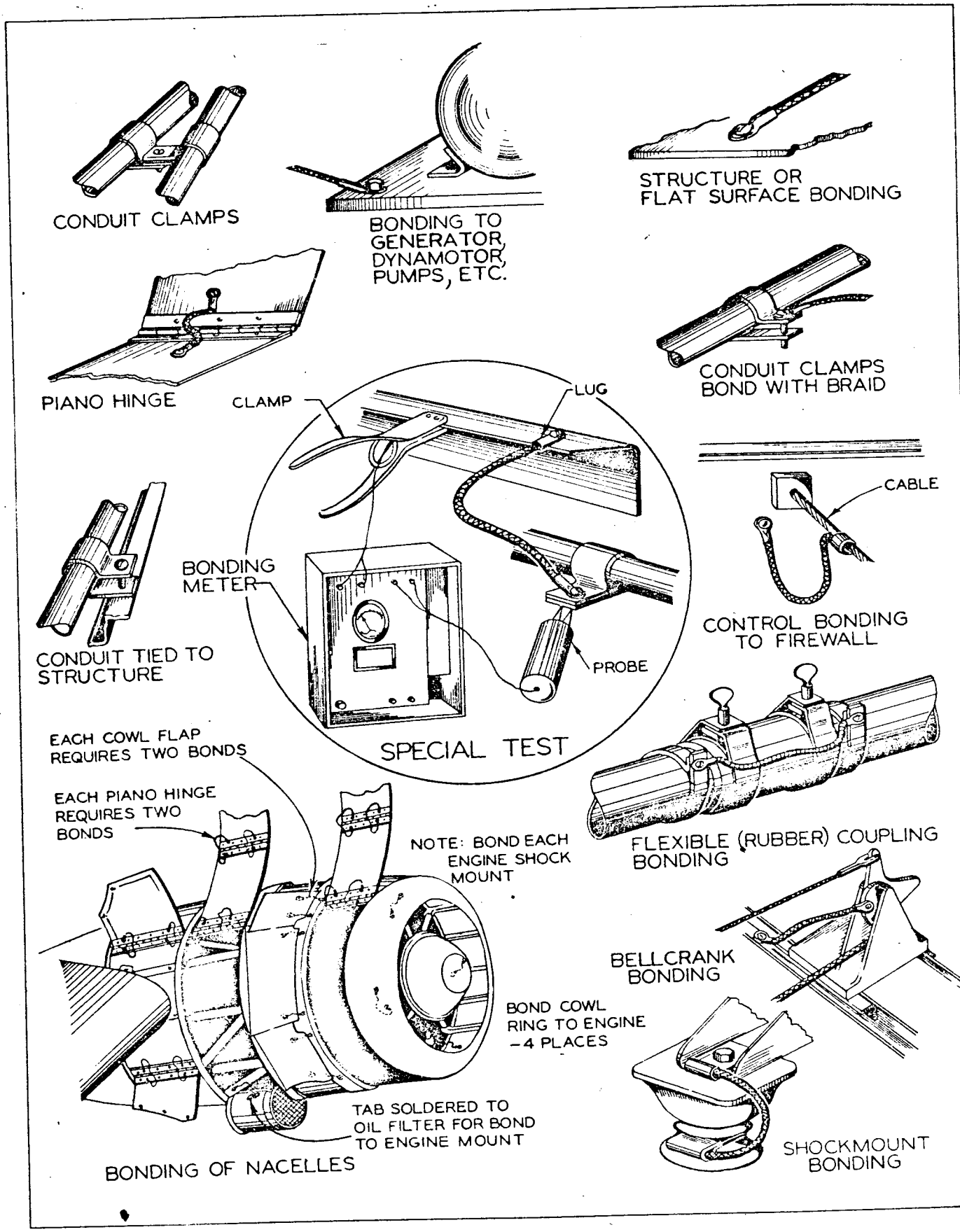


Figure 246—Typical Bonding

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-

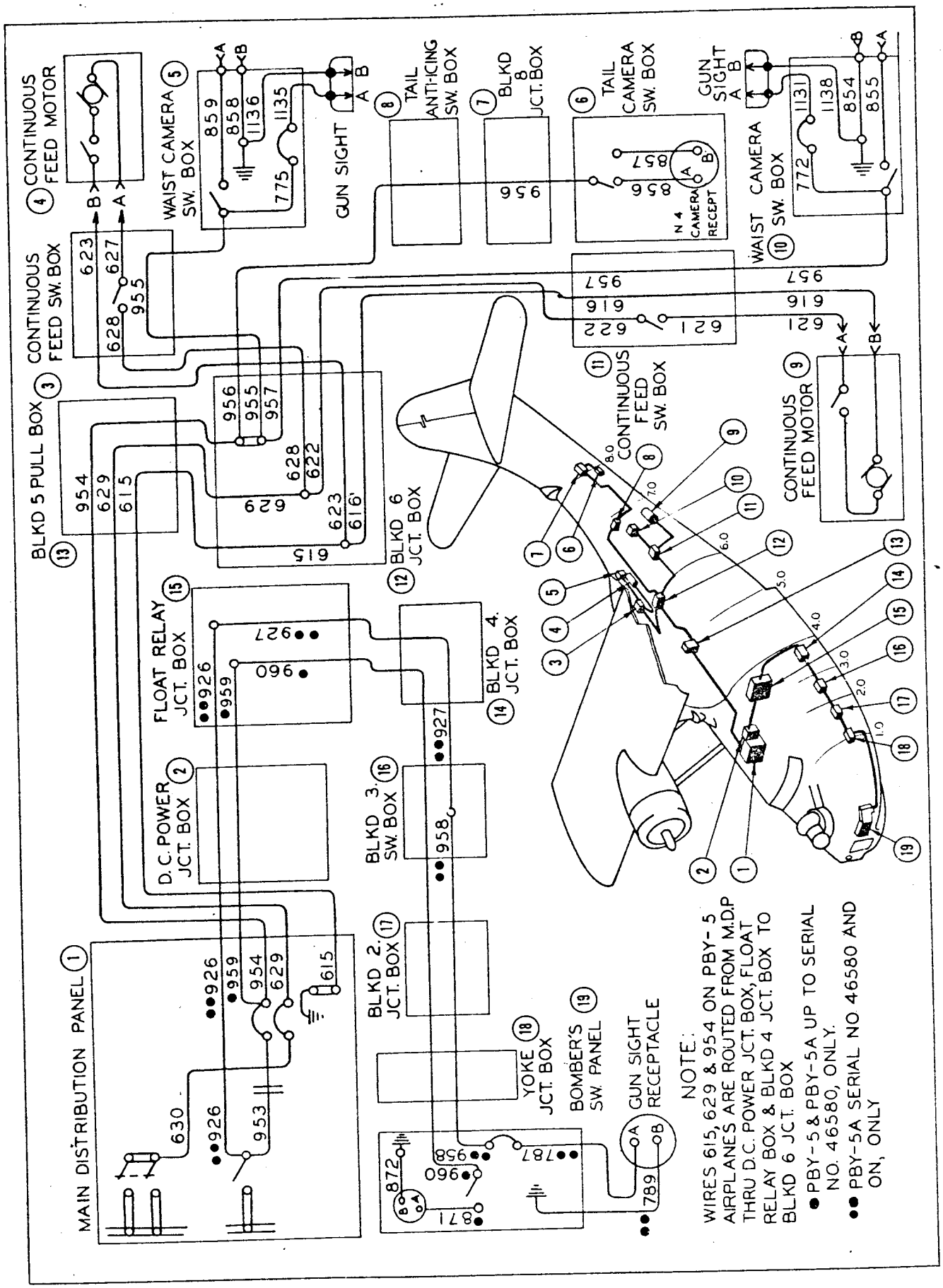


Figure 247—Firing Circuit

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

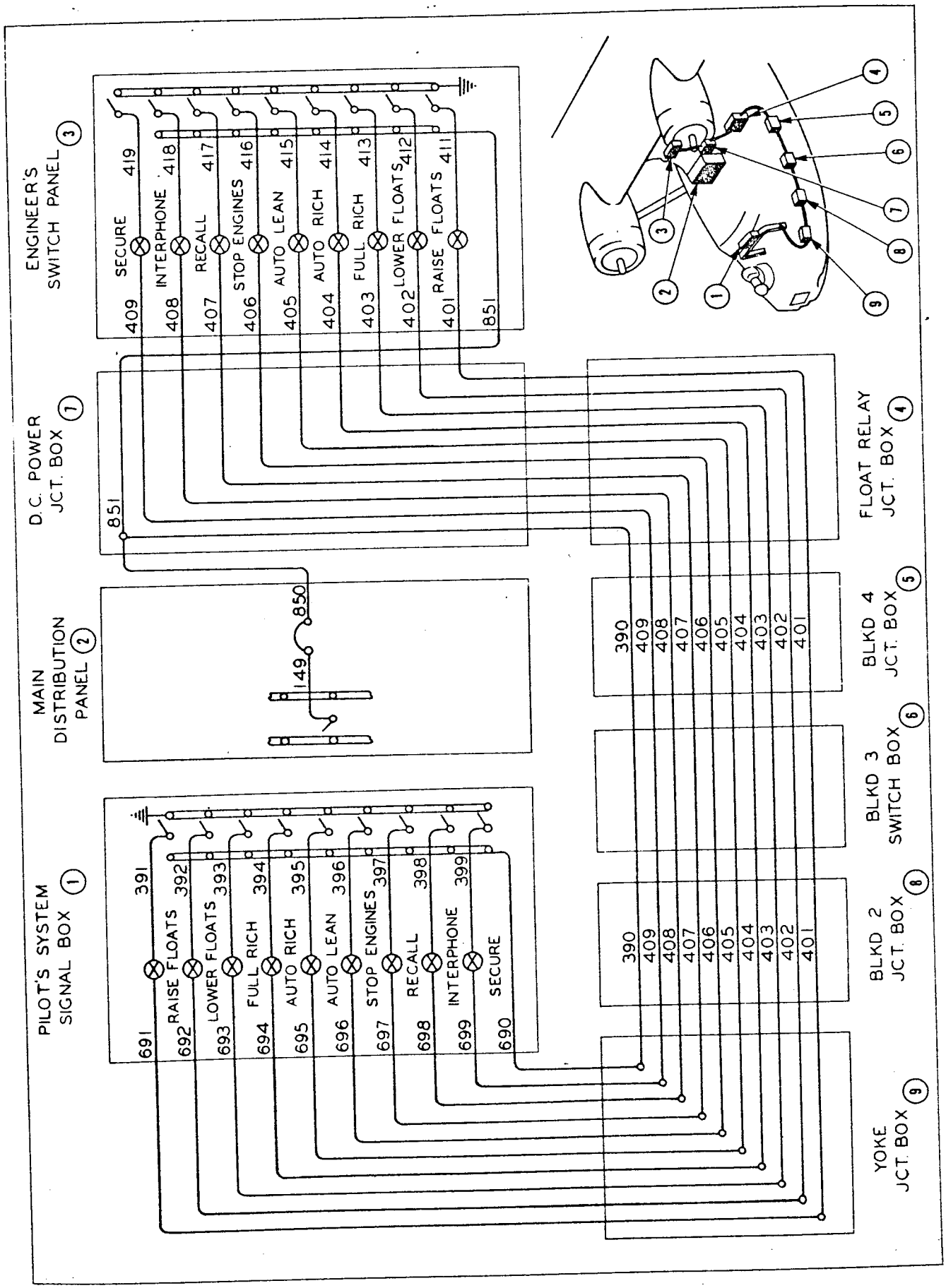


Figure 248—Signal System Light Circuit

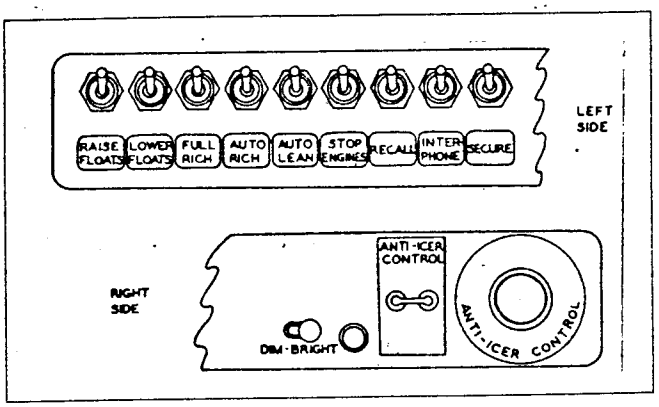


Figure 249—Pilot's Signal Panel

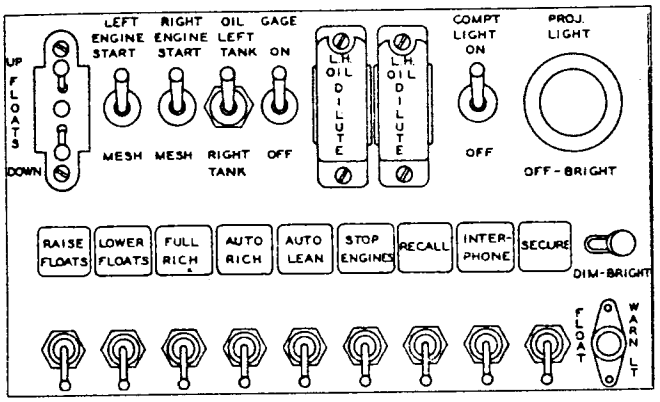


Figure 250—Engineer's Switch Panel

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.

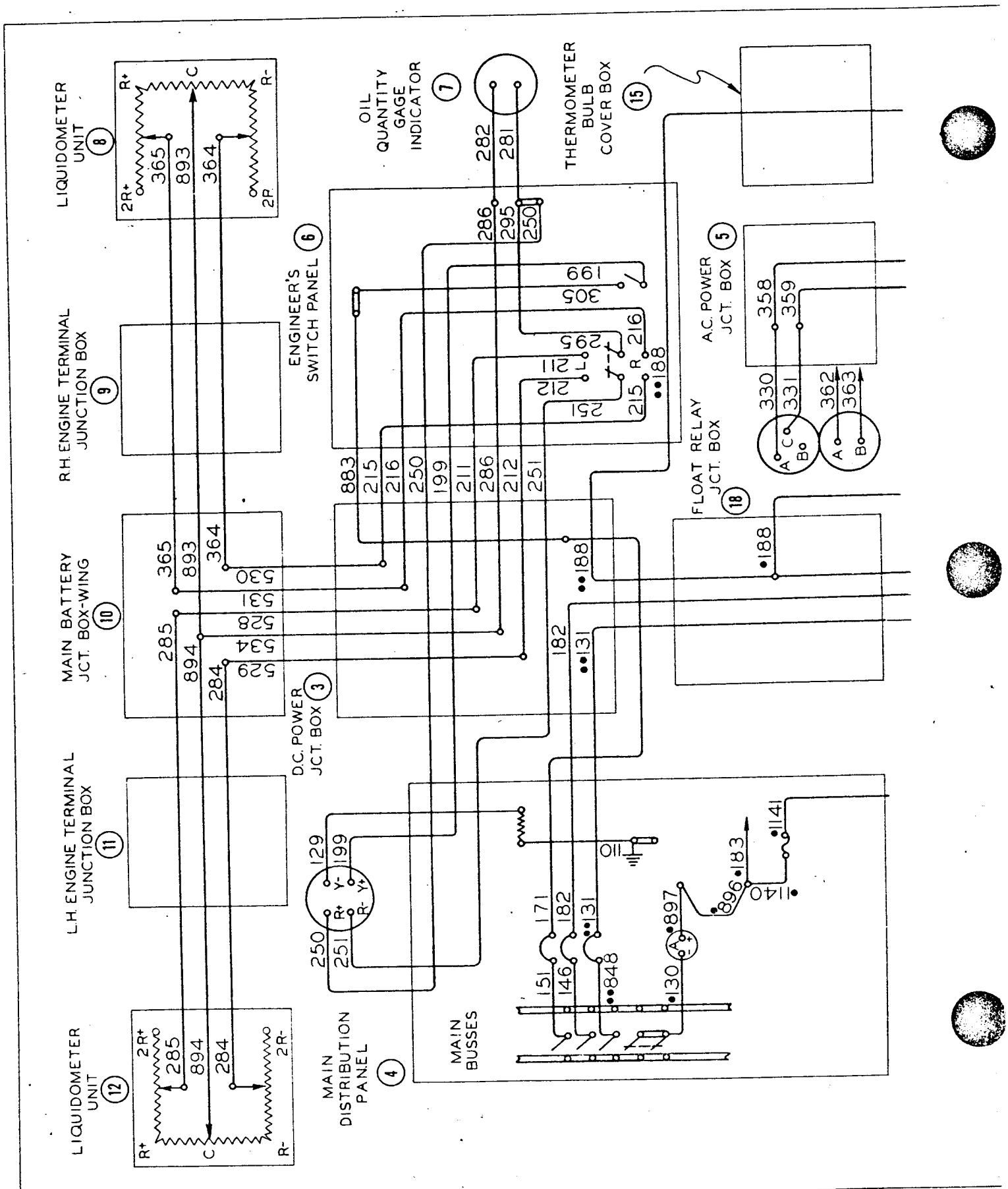
There are two tank units, one on each oil tank. The tank units contain a resistance strip and a movable contact arm. The position of the contact arm is varied by the motion of a float in the tank. This position is transmitted electrically to an indicator gage graduated in gallons. Two adjustment screws 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 ± 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.


LIQUIDOMETER UNIT (8)
R+
C
R-
2R+
2P
365
893
364
OIL QUANTITY GAGE INDICATOR (7)
282
281
THERMOMETER BULB COVER BOX (15)
ENGINEER'S SWITCH PANEL (6)
286
295
250
R.H. ENGINE TERMINAL JUNCTION BOX (9)
A.C. POWER JCT. BOX (5)
358
359
330
331
362
363
A
C
B
MAIN BATTERY JCT. BOX-WING (10)
FLOAT RELAY JCT. BOX (18)
883
215
216
250
199
211
286
212
251
188
285
894
284
182
131
D.C. POWER JCT. BOX (3)
L.H. ENGINE TERMINAL JUNCTION BOX (11)
129
199
Y-
R+
R-
Y+
250
251
171
182
131
151
146
848
130
897
183
896
141
140
LIQUIDOMETER UNIT (12)
2R+
2R-
MAIN DISTRIBUTION PANEL (4)
MAIN BUSSES

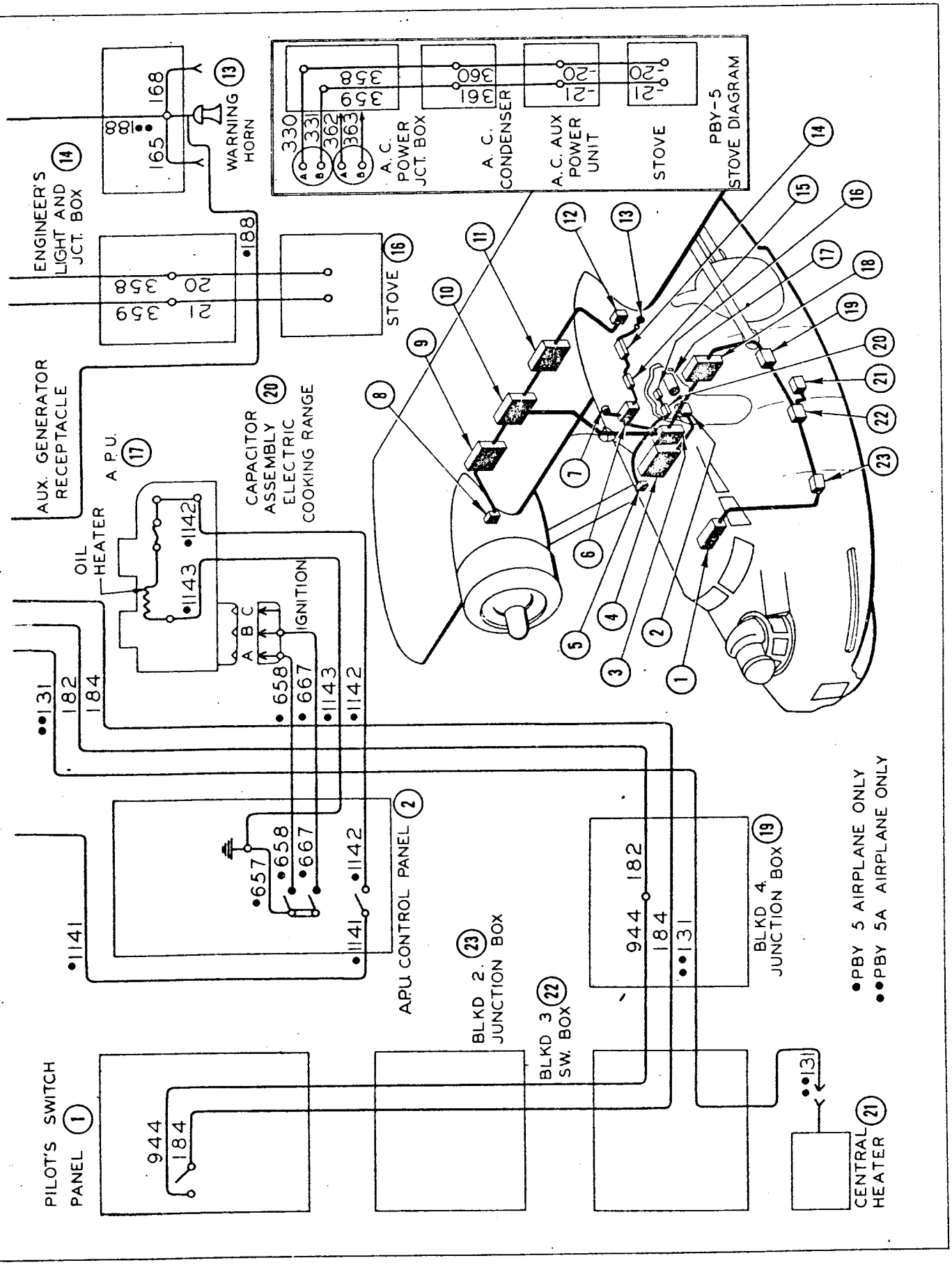


Figure 251—Miscellaneous Circuits