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30 JAN 59

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FOREWORD

1 The contents of the text in this EO includes information relative to the following marks; Expeditors 3N, 3NM, 3T and 3TM.

2 In the text, words written in capital letters and quotations indicate actual markings on the controls concerned.

3 A record of Revisions is on page A. The holder of this book is to ensure that revisions which have been promulgated are incorporated in the book.

4 Comments and suggestions should be forwarded through the usual channels to Air Force Headquarters.

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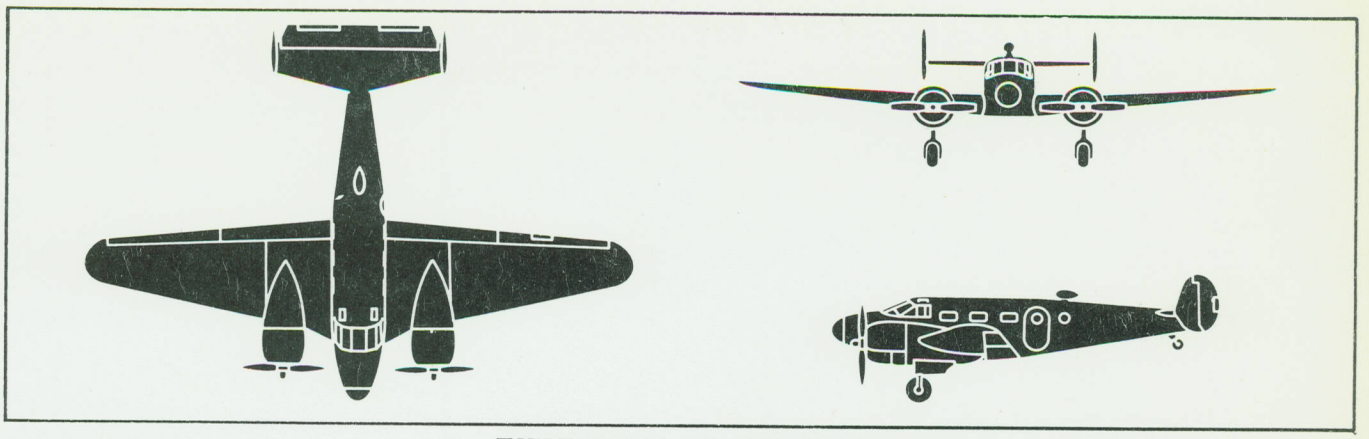
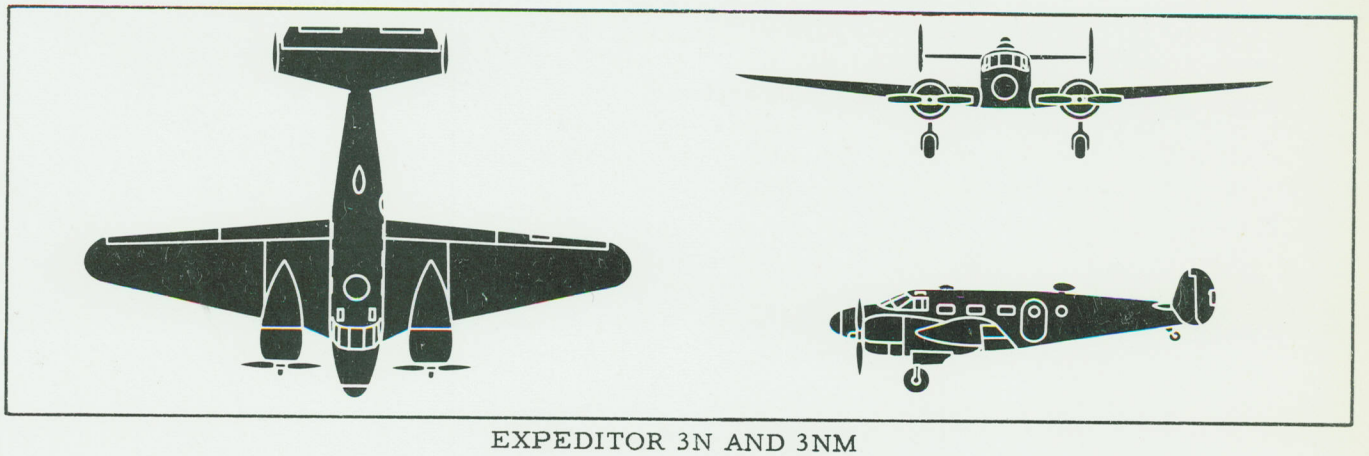
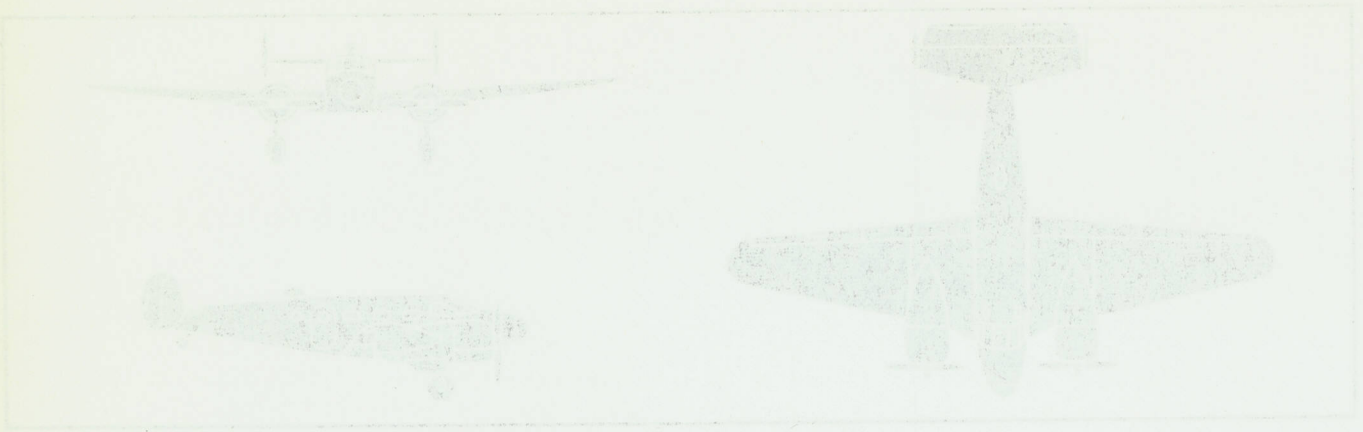


EXPEDITOR 3T AND 3TM



EXPEDITOR 3N AND 3NM



PART 1

INTRODUCTION AND GENERAL INFORMATION

SECTION 1

GENERAL DESCRIPTION AND LEADING PARTICULARS

GENERAL DESCRIPTION

1 The Expeditor 3 Series Aircraft is a twin-engine, low wing, all-metal land monoplane. It is powered by two Pratt and Whitney 450 HP, radial, air-cooled engines, which drive full-feathering Hamilton Standard Hydromatic propellers. The landing-gear and flaps are electrically operated. The flap system incorporates a handcrank, which is used to operate the flaps mechanically in the event of an emergency. Other features include dual flight controls and hydraulic brakes. The fuselage is of all-metal semi-monocoque construction. The wings are of all-metal construction. Control surfaces are of metal construction, fabric covered, except the flaps, which are metal covered on some aircraft. The primary structure of the centre section consists of a single, triangulated, welded steel tubular truss, which carries fittings for the engine mount, landing gear and outer wing-panel main spars. The remainder of the centre section structure consists of aluminum-alloy ribs, bulkheads, stringers and aluminum-alloy stressed skin covering. The cabin-door, located on the left side of the fuselage, aft of the wing, provides access to both the cabin and pilot's compartments. The following versions of the Expeditor Series 3 aircraft are in service:

(a) 3N - The Expeditor 3N is fitted as a navigation trainer with astrodome and two trainee stations in the cabin.

(b) 3NM - The Expeditor 3NM primarily a navigational trainer, is fitted with floor lugs to accept transport seats on removal of the navigation equipment.

(c) 3T - The Expeditor 3T aircraft is a personnel transport, fitted with five transport type cabin seats.

(d) 3TM - The Expeditor 3TM is normally fitted with transport-type seats but has the necessary wiring, plumbing and fittings for conversion to a navigation trainer, including provisions for fitting an astrodome.

(e) 3NMT - The Expeditor 3NMT is basically a 3NM, converted to a transport aircraft.

(f) 3NMT(S) - The Expeditor 3NMT (Special) navigation trainer personnel transport - First navigation training position retained, slightly modified ie: removal of API and replace with radio compass and indicator from removed second navigation position; in addition three reclining type chairs fitted.

LEADING PARTICULARS

GENERAL

Span	47 ft. 7 in.
Length (overall)	34 ft. 2-13/32 in.
Height of fuselage	9 ft. 2-1/2 in.
Height (tailwheel on ground, propeller blades vertical, main struts inflated to 2-1/2 in.)	10 ft. 8-1/16 in.
Height (vertical stabilizer to ground)	12 ft. 5 in.
Propeller ground clearance (flying configuration)	11 in.
Maximum landing gross weight	9,000 lbs.
Maximum take-off gross weight	9,300 lbs.

WINGS

Type	Low wing
Airfoil section at root	NACA 23020 (Modified)
Airfoil section at tip	NACA 23012 (Modified)
Chord at root (theoretical at centre line of fuselage)	135.116 in.

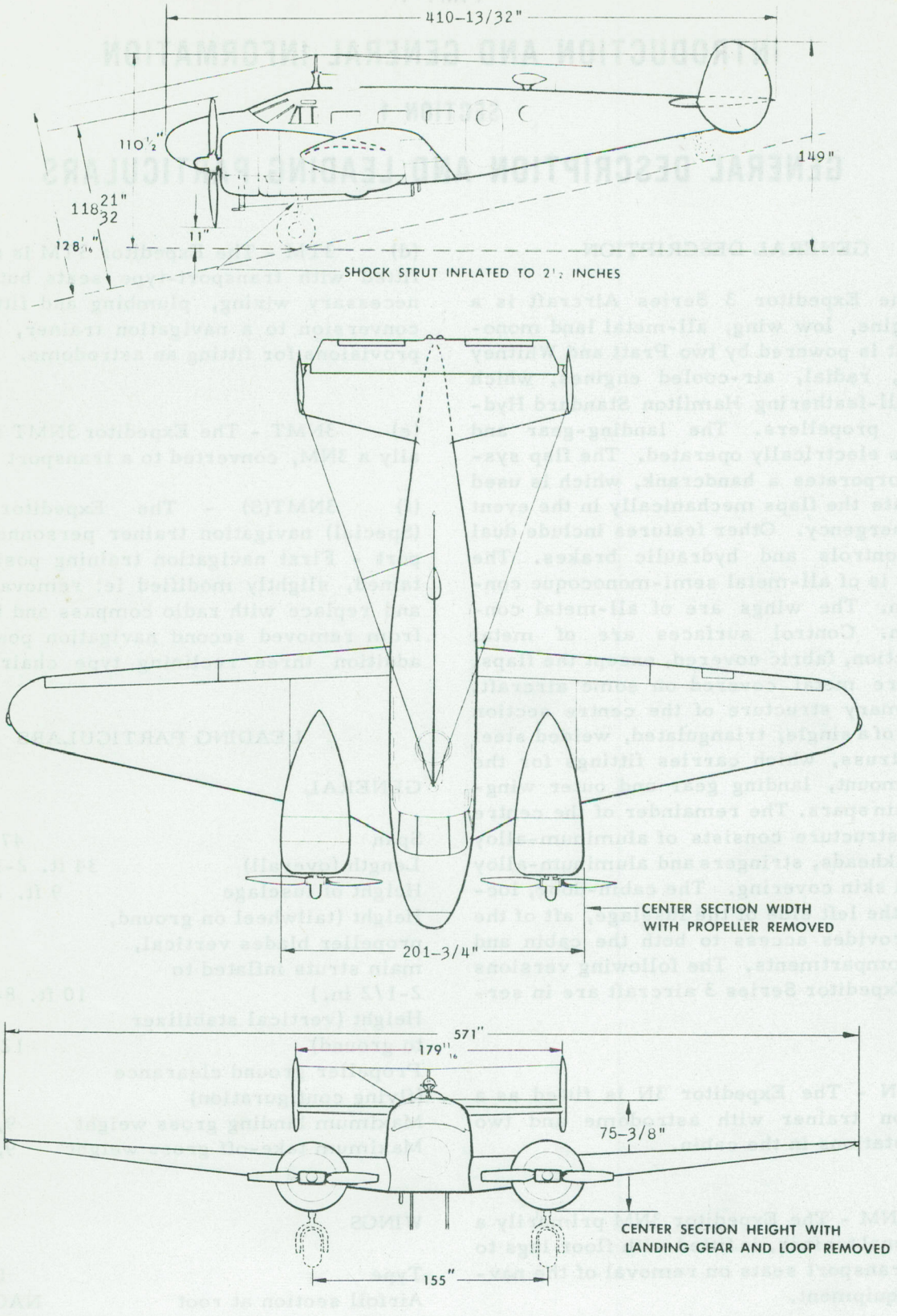


Figure 1-1 (Issue 1) Three View Dimensional Diagram

Chord at tip (theoretical at outer end of tip)	42 in.	Dihedral (at 25% of chord aft of leading edge)	6 deg.
M.A.C.	96.639 in.	Sweepback (at 25% of chord aft of leading edge)	8 deg. 23 min.
Incidence at root	3.922 deg.	Aspect ratio	6.35
Incidence at tip	1 deg.		

STABILIZER

Span (from centre line of each vertical stabilizer)	14 ft. 11-11/16 in.
Maximum chord	5 ft. 10 in.
Incidence	-2 deg.
Dihedral	None

FUSELAGE

Height (maximum)	5 ft. 5-3/4 in.
Length	33 ft. 9 in.
Width (maximum)	4 ft. 8 in.
Height of door level above ground (static)	31 in.
Total cubic foot stowage space available for baggage, cargo, etc	49.5 cu. ft.
Cabin Height (Internal)	5 ft.
Cabin Length	10 ft. 5-1/4 in.
Cabin Width (Internal)	4 ft. 2 in.
Door Dimensions	44-1/2 in. x 24-1/2 in.

AREAS

Wing (total including flap and aileron)	349 sq. ft.
Aileron (total including tab)	22.6 sq. ft.
Flaps (total)	37.6 sq. ft.
Horizontal stabilizer (including elevator)	65.4 sq. ft.
Elevator (including tab)	27.22 sq. ft.
Elevator trim tabs (total)	2.22 sq. ft.
Vertical stabilizers (including rudders)	33.58 sq. ft.
Rudder (including tabs)	17.28 sq. ft.
Rudder trim tabs (total)	1.70 sq. ft.
Aileron tab	0.427 sq. ft.

MAIN LANDING GEAR

Type	Electrically retractable
Shock Struts	Air-oil combination
Make and Part No.	Beech 404-188400-LH Beech 404-188400-3RH
Fluid Specification	3-GP-26a
Wheels	Goodyear 530884G
Tires	11.00-12, 8 ply
Brakes	Single disc, gear-type
Brake Fluid Specification	3-GP-26a

TAIL LANDING GEAR

Type	Electrically retractable
Shock Strut	Air-oil combination
Make and Part No.	Beech 404-188612
Fluid specification	3-GP-26a
Wheel	Hayes D3-180-M
Tire	14.50 smooth tread

ENGINE

Type	Pratt and Whitney Wasp Jr.
Designation	Model R985-AN-14B
No. of cylinders	9
Carburettor	Stromberg NAR9B-19
Fuel pump	Thompson TF-900-1 or 2P-R400-BRD
Vacuum pump	AN6111-1
Starter	Eclipse Pioneer 756-21
Magneto	American Bosch SB9RU-3 or Bendix SB9RN/W or Scintilla SB9RN-4
Generator	30E16-1-B
Tachometer Generator	AN5531-2
Spark plugs	Champion C26S
Propeller Hub	Hamilton Standard 22D30
Propeller blades	Hamilton Standard 6533A-21S and 6533A-22S
Propeller feathering pump	Hamilton Standard 404-189075(LH) and 66094-1(RH)
Propeller governor	Hamilton Standard 4B2-P6 or 4B2-P8
Fuel	Refer to EO 45-1-2 Power restriction - 1900 rpm or higher when using Limited and Emergency fuels at 280-296BHP
Oil	3-GP-100b

TANK CAPACITIES

Front main fuel tanks (2)	63 Imperial gallons (76 US gallons)
Rear auxilairy fuel tanks (2)	21 Imperial gallons (25 US gallons)
Nose fuel tank	67 Imperial gallons (81 US gallons)
Total fuel	235 Imperial gallons (282 US gallons)
Oil tank (RH)	6.6 Imperial gallons (8 US gallons)

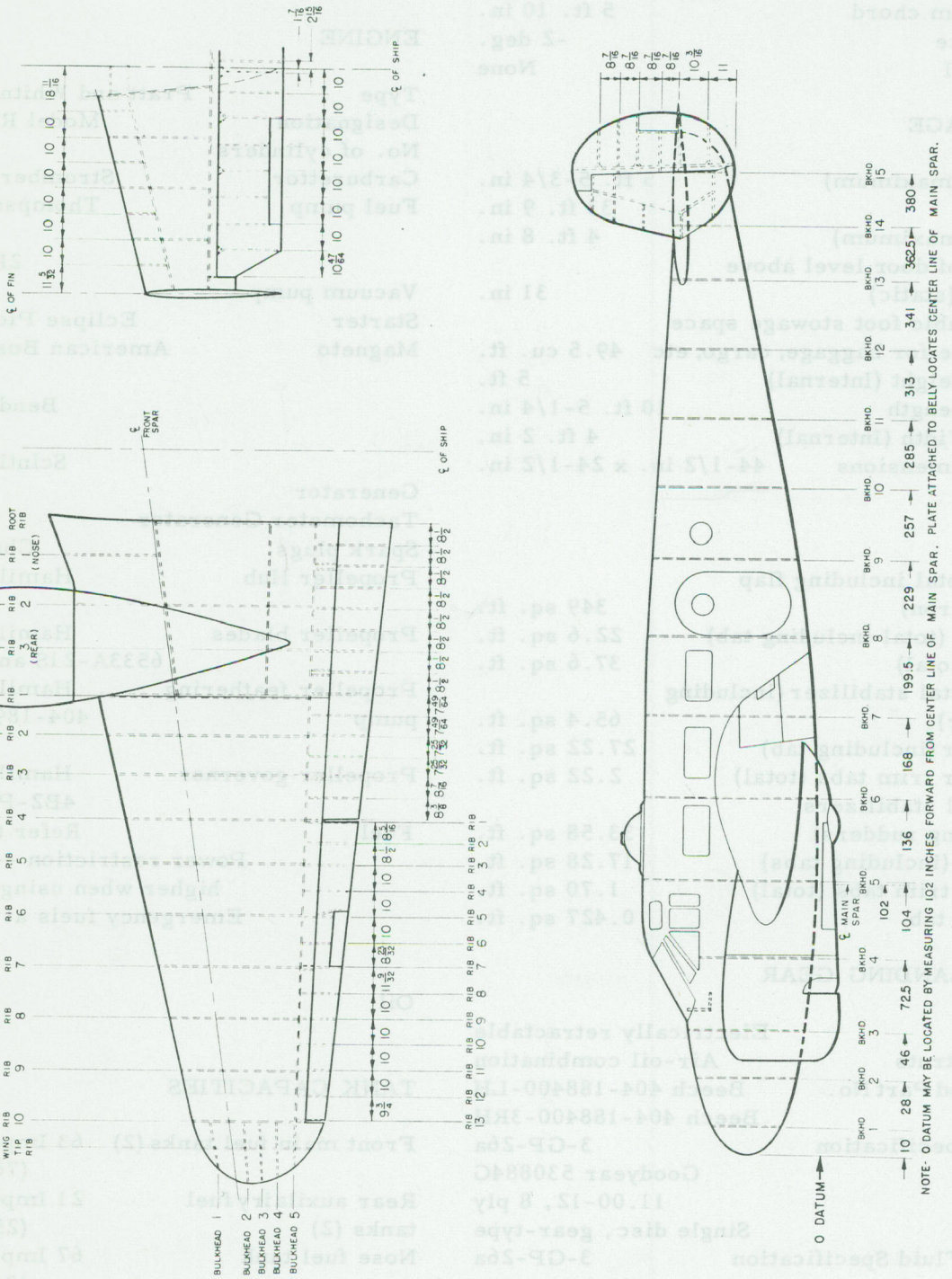


Figure 1-2 Station Diagram

Oil tank (LH)	6.6 Imperial gallons (8 US gallons)

WINDSCREEN ANTI-ICER SYSTEM

Fluid Specification	3-GP-525
Tank capacity	2.5 Imperial gallons (3 US gallons)

ELECTRICAL SYSTEM

Voltage	28 volts DC
Battery	24 volts
Generator	100 amps

AIRCRAFT WEIGHT

Basic weight	3N 6,450 lbs
	3NM 6,475 lbs
	3TM 6,475 lbs
	3T 6,375 lbs
	3NMT 6,475 lbs
Take off gross weight	9,300 lbs
Landing gross weight	9,000 lbs

PART 1

SECTION 2

GROUND HANDLING

GENERAL DESCRIPTION

1 This section contains information and instructions on towing, parking, mooring, protection covers, ground safety locks and pins, and dust excluders.

TOWING

2 Towing lugs are provided on the inboard side of the main landing-gear forks (Figure 1-3).

CAUTION

A crew member must always be in the pilot's seat when the aircraft is being towed to insure that the tail wheel is unlocked, the parking brake is off, and to operate the brakes if required.

PARKING

3 The parking brake handle is located on the lower part of the control pedestal (Figure 1-4). This parking brake handle operates a

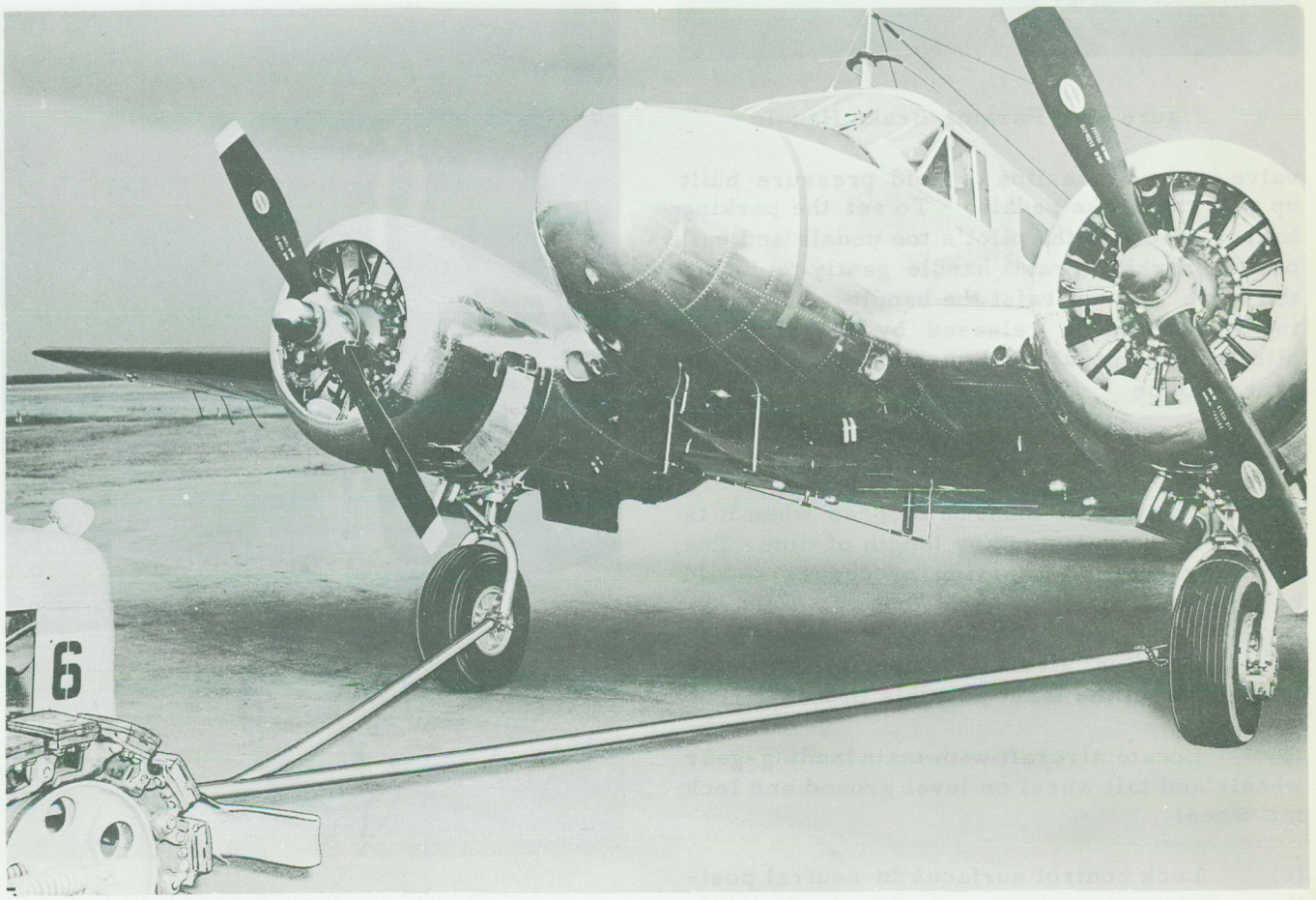


Figure 1-3 Towing

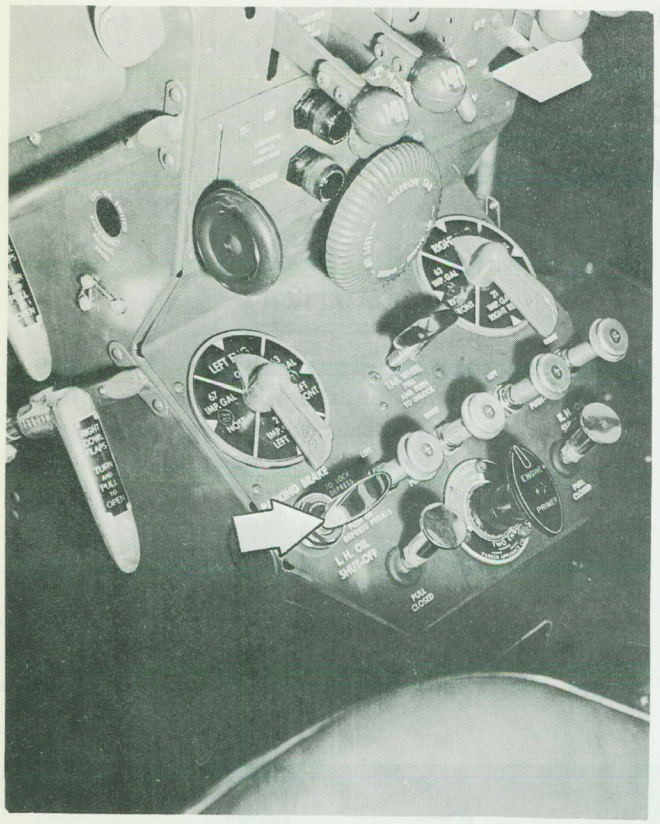


Figure 1-4 Parking Brake Handle

valve in the brake line to hold pressure built up with the brake pedals. To set the parking brakes, depress the pilot's toe pedals and pull out the parking brake handle gently to locate the valve. Do not twist the handle. The parking brake can be released by operating the pilot's brake pedals and pushing in the parking brake handle.

MOORING

4 The aircraft must be moored when it is parked in the open for any length of time. The following detailed mooring procedure should be followed:

(a) Position aircraft to permit changing its heading in the least possible time.

(b) Locate aircraft with main landing-gear wheels and tail wheel on level ground and lock tail wheel.

(c) Lock control surfaces in neutral position. External surface control locks, if available, should be used.

(d) Lock parking brakes and place wheel chocks at front and back of each main wheel.

(e) Attach mooring reels to the wing mooring lugs (Figure 1-5). If mooring reels are not available use 1/4-inch wire cable or equivalent.

(f) Pass a line around the tail wheel fork and secure (Figure 1-6).

NOTE

When high winds are expected, additional mooring lines should be attached to the main landing gear towing lugs.

COVERS AND BLANKING PLATES

5 Covers and blanking plates consist of:

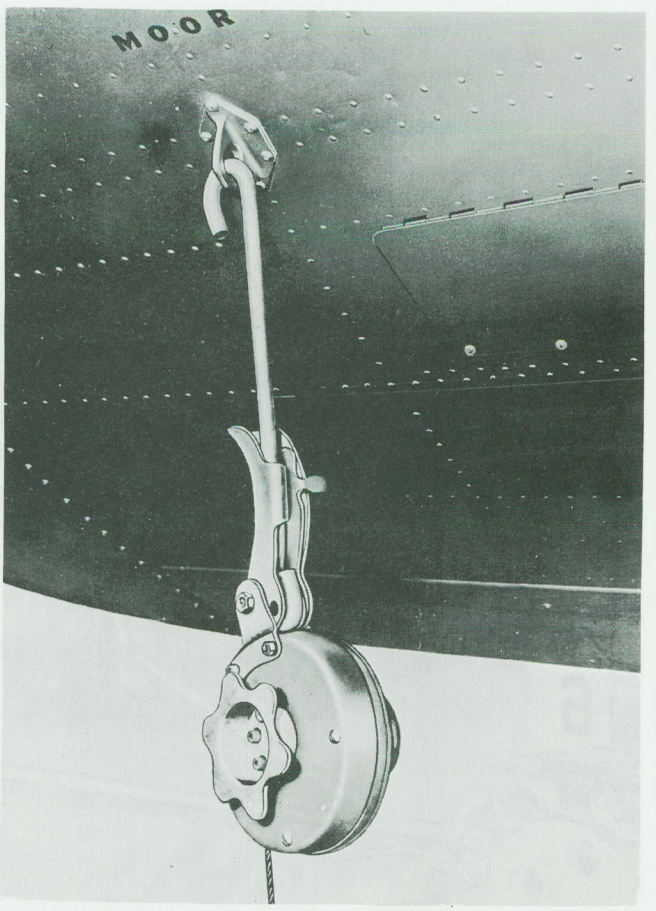


Figure 1-5 Wing Mooring

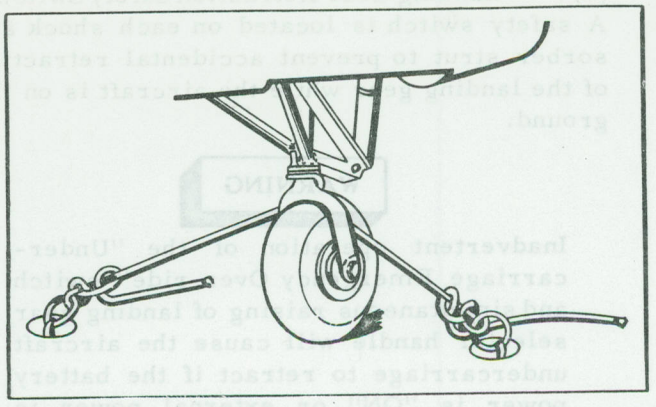


Figure 1-6 Tail Mooring

(a) Cockpit cover (RCAF Ref 24D/654).

(b) Wing and wheel covers (RCAF Ref 27D/644 and 27D/645).

(c) Tail cover (RCAF Ref 27D/646).

(d) Engine covers (RCAF Ref 27D/653).

(e) Wheel covers (locally manufactured).

(f) Carburettor air inlet covers (locally manufactured).

(g) Pitot head covers (locally manufactured).

(h) Heating and ventilating system air inlet plugs (locally manufactured).

(j) Oil cooler air inlet plugs (locally manufactured).

CAUTION

The Expeditor 3T aircraft must have a suitable covering installed over the generator control box ventilating louvers when parked outside during a snow storm.

GROUND SAFETY LOCKS

6 Ground safety locks consist of a flight control lock and a landing gear retraction safety switch.

(a) Flight Control Lock - The flight control lock is stored on the deck forward of the pilot's seat, secured at the aft end by a leather strap. To lock the control surfaces:

(1) Release aft end of flight control lock.

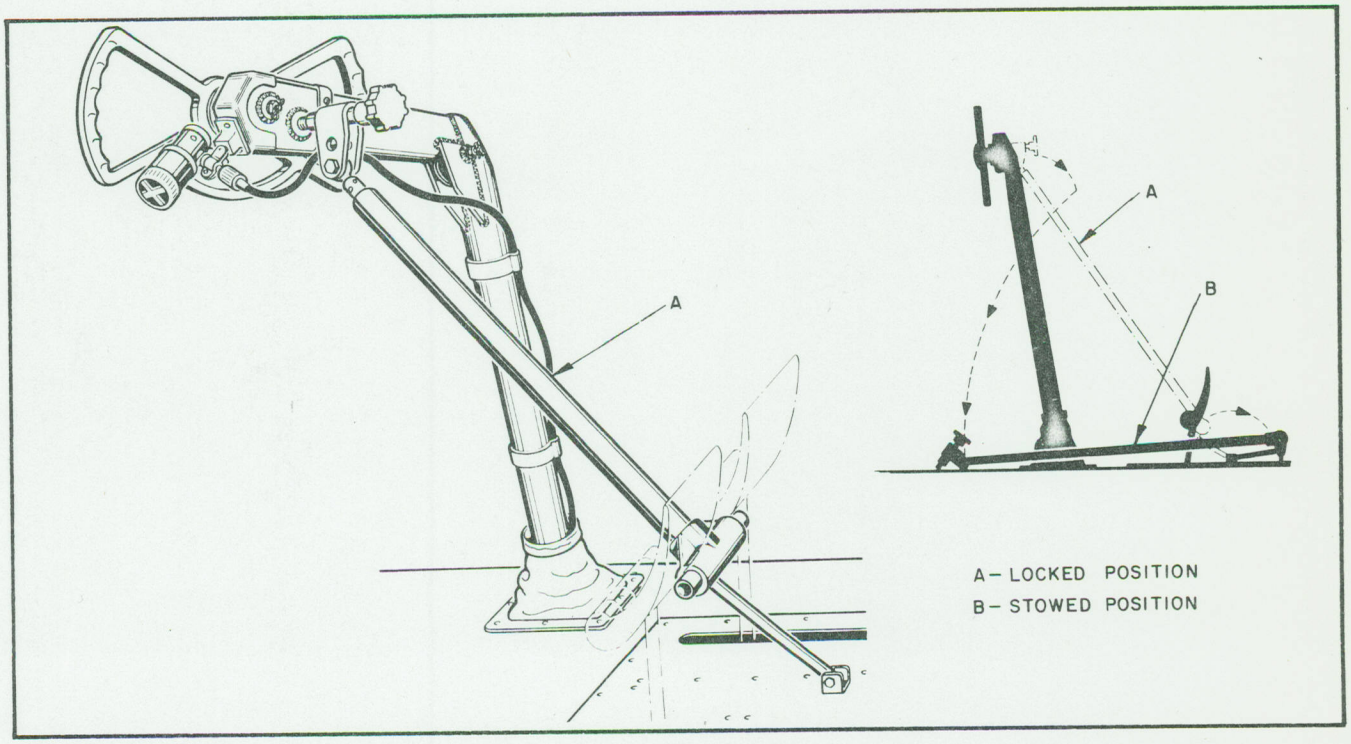


Figure 1-7 Flight Control Lock

(2) Place rudder pedals in neutral, then press rudder lock pins in and lift assembly until the lock pins will engage the holes in the rudder pedals (Figure 1-7).

(3) Place the aileron controls in neutral, then position the control column so the lock screw can be screwed into the hole.

NOTE

External surface control locks should be used, if the aircraft is subjected to strong variable winds.

(b) Landing Gear Retraction Safety Switch - A safety switch is located on each shock absorber strut to prevent accidental retraction of the landing gear while the aircraft is on the ground.

WARNING

Inadvertent operation of the "Undercarriage Emergency Over-ride" switch and simultaneous raising of landing gear selector handle will cause the aircraft undercarriage to retract if the battery power is "ON" or external power is applied to the aircraft whether or not weight is on the gear.

PART 1

SECTION 3

GENERAL SERVICING

GENERAL DESCRIPTION

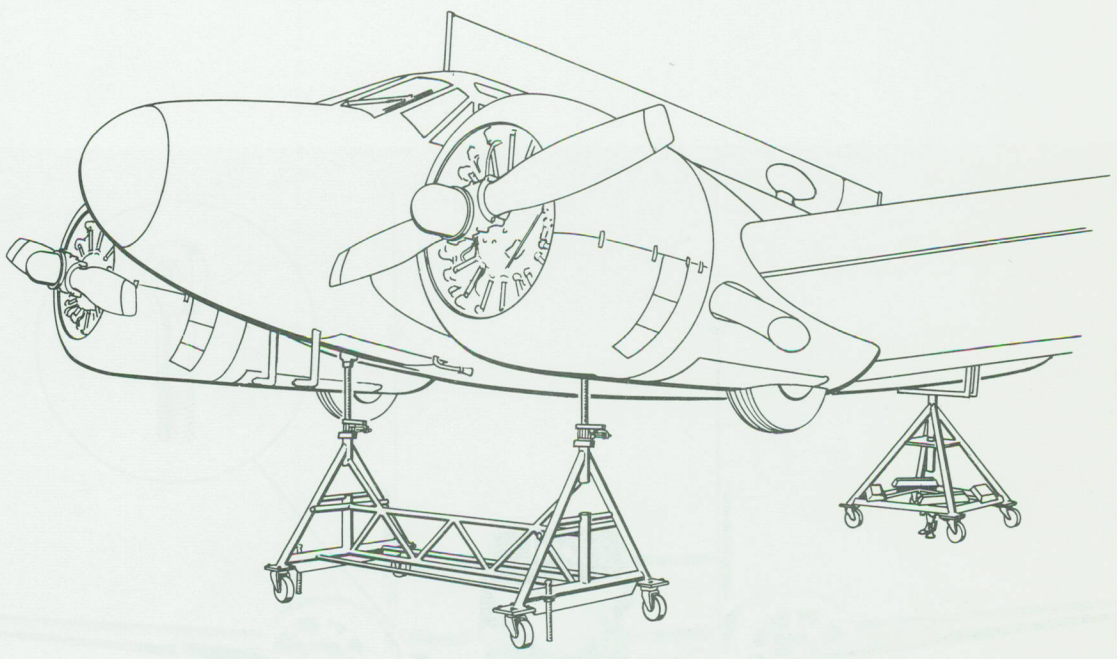
1 This section contains information and instructions necessary to service the aircraft.

HOISTING

2 The aircraft may be hoisted either with a single hoist and sling or with two hoists (Figure 1-9).

(a) Single Hoist - A hoist with a minimum capacity of five tons should be used. Remove the fabric patches over the hoisting bracket attaching holes and install the hoisting brackets, using the special bolts furnished with the brackets. The hoisting sling should be just long enough to clear the fuselage by approximately two inches.

(b) Double Hoist - When using two hoists, each should have a minimum capacity of three tons. Remove the fabric patches over the hoisting-lug attaching holes. Install the special

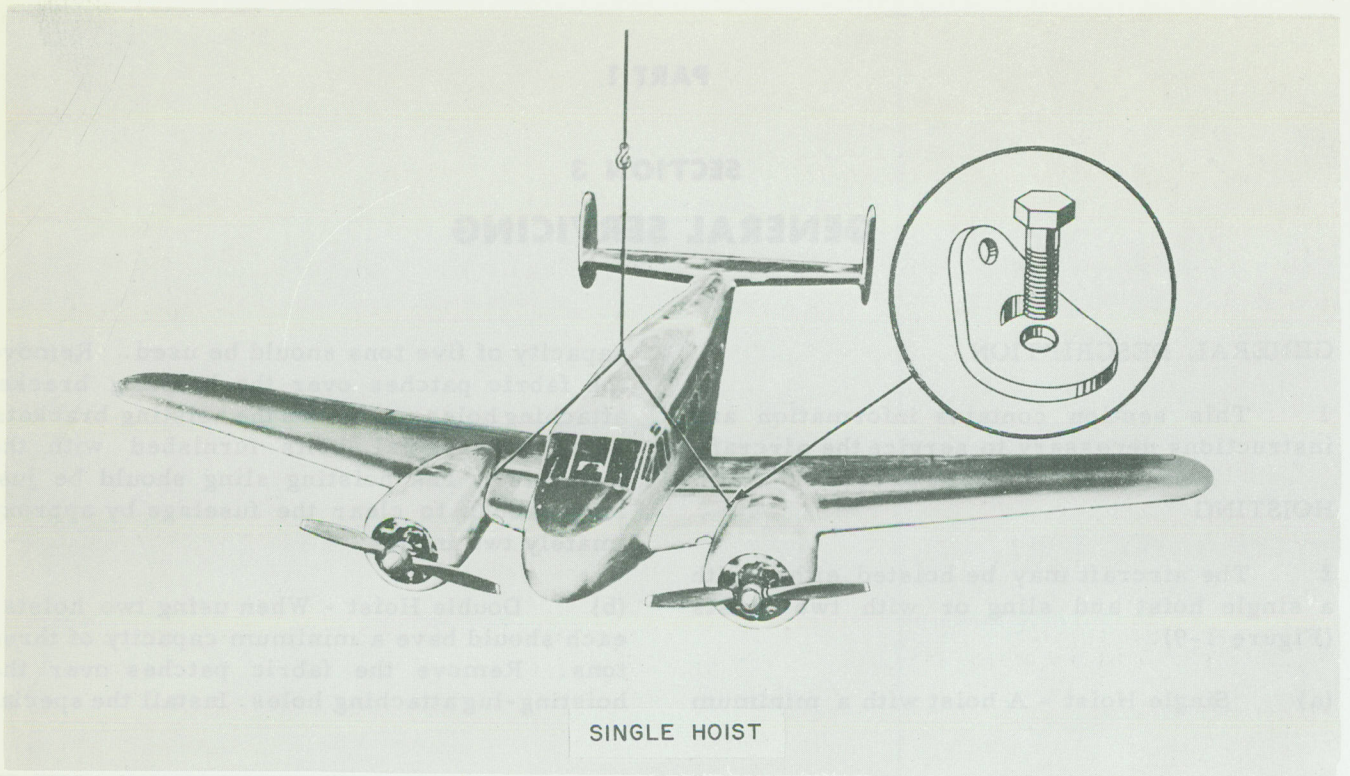


JACKING CLEARANCES

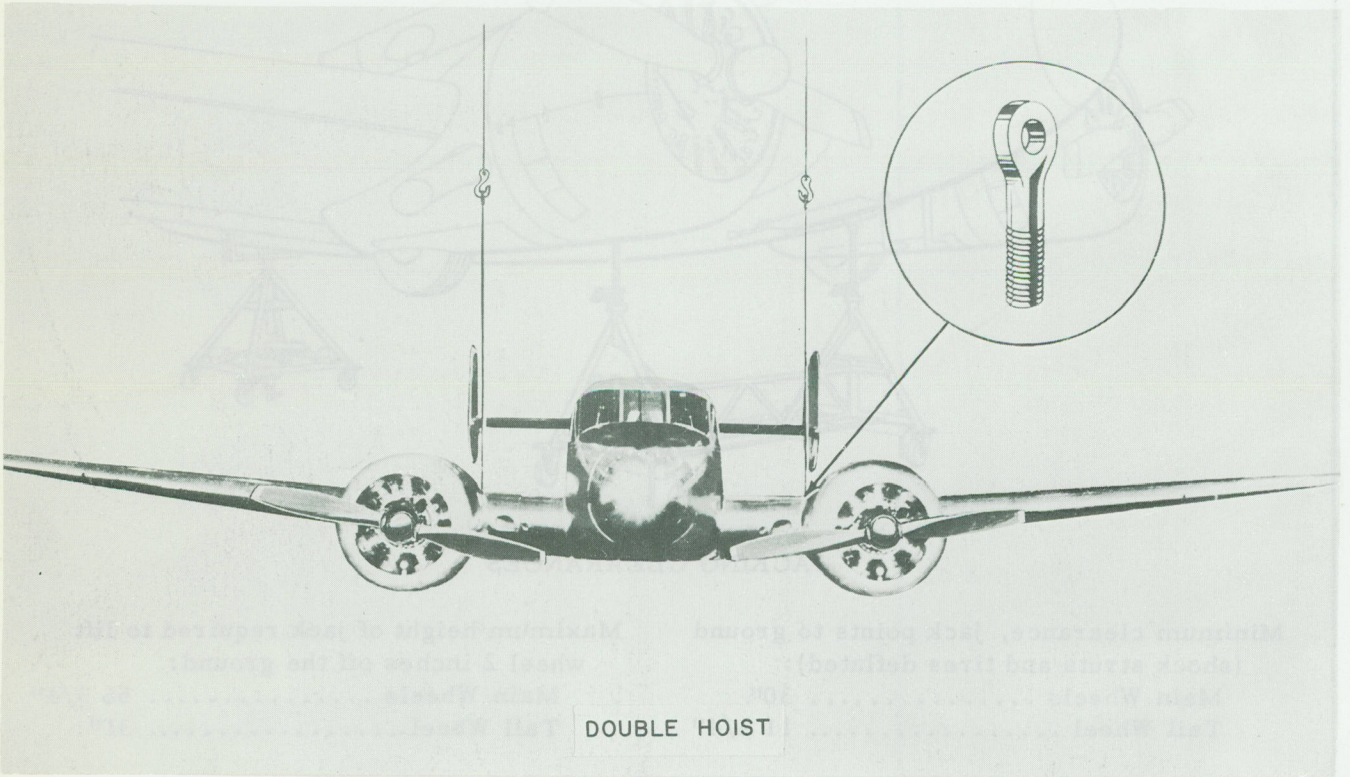
Minimum clearance, jack points to ground (shock struts and tires deflated):
Main Wheels ..... 30"
Tail Wheel ..... 11 3/4"

Maximum height of jack required to lift wheel 2 inches off the ground:
Main Wheels ..... 56 3/4"
Tail Wheel ..... 31"

Figure 1-8 Jacking



SINGLE HOIST



DOUBLE HOIST

Figure 1-9 Hoisting

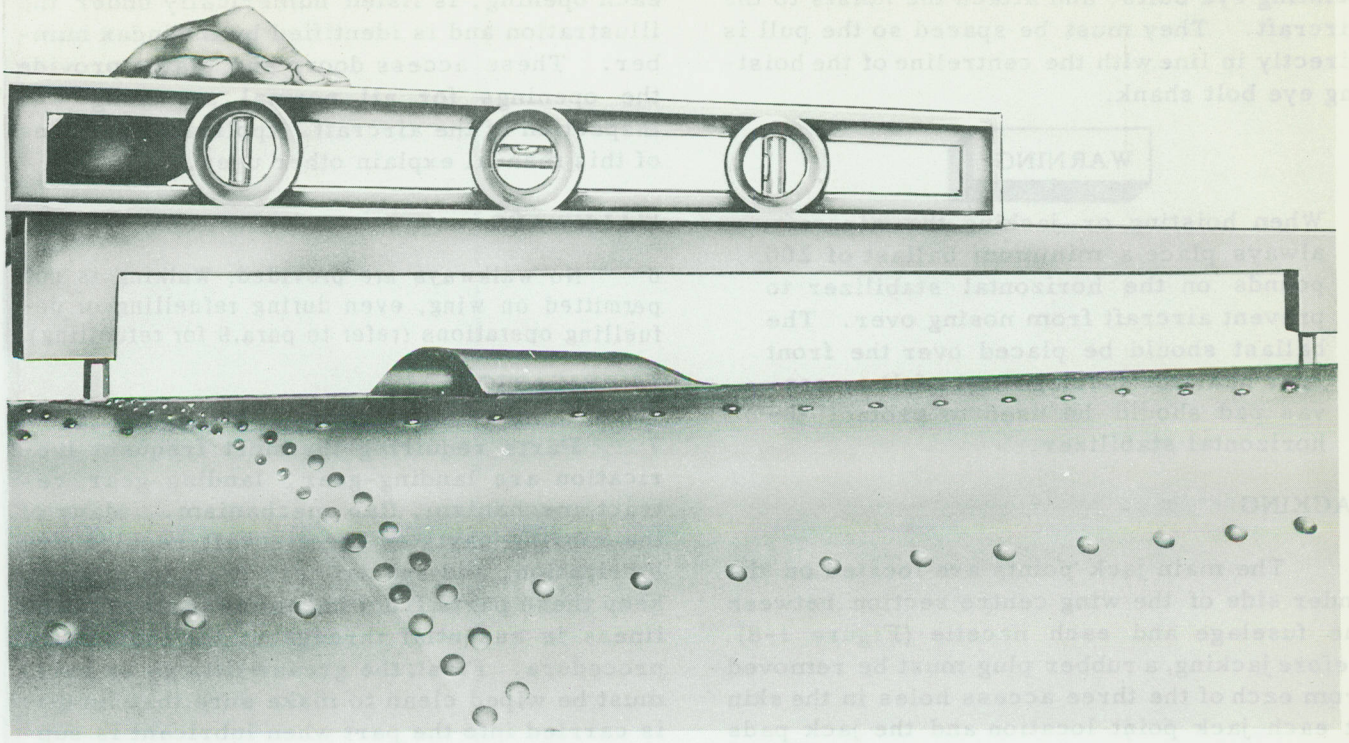


Figure 1-10 Longitudinal Levelling

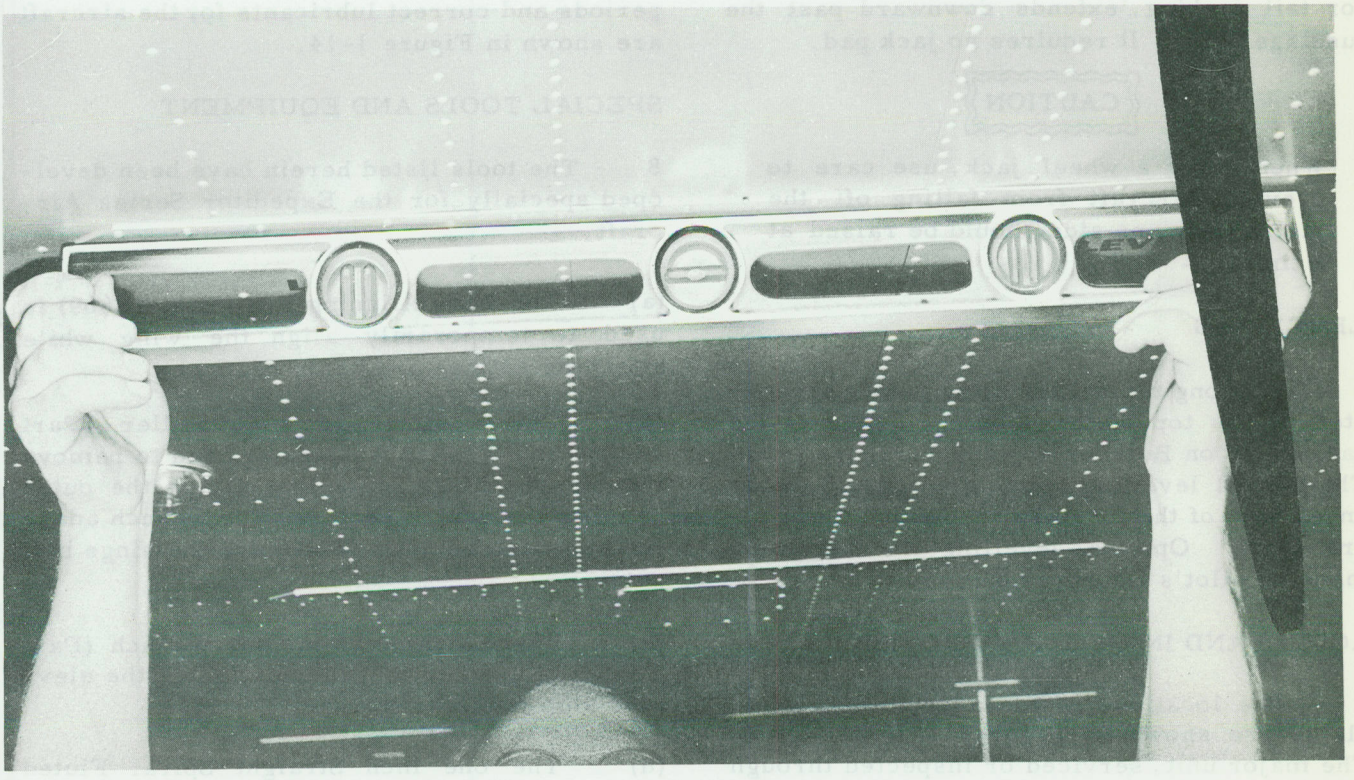


Figure 1-11 Lateral Levelling

hoisting eye bolts, and attach the hoists to the aircraft. They must be spaced so the pull is directly in line with the centreline of the hoisting eye bolt shank.

WARNING

When hoisting or jacking the aircraft, always place a minimum ballast of 200 pounds on the horizontal stabilizer to prevent aircraft from nosing over. The ballast should be placed over the front spar near the fuselage and a felt or canvas pad should be used to protect the horizontal stabilizer.

JACKING

3 The main jack points are located on the under side of the wing centre section between the fuselage and each nacelle (Figure 1-8). Before jacking, a rubber plug must be removed from each of the three access holes in the skin at each jack point location and the jack pads (Part 84-180930) installed. These pads are attached to the aircraft by three bolts furnished with each jack pad. Jack points incorporated in each main wheel fork permit individual wheel jacking. A jack point at Bulkhead 15, for tail jacking, extends downward past the fuselage skin. It requires no jack pad.

CAUTION

When using a wheel jack, use care to prevent aircraft from falling off the jack. Only one side should be raised at a time.

LEVELLING

4 The longitudinal levelling points are located on the top of the fuselage ahead of the cabin door on Bulkheads 6 and 7 (Figure 1-10). The lateral levelling points are located on the under side of the fuselage on Bulkhead 6 (Figure 1-11). Optional levelling check may be made on pilot's floorboards.

ACCESS AND INSPECTION PROVISIONS

5 The locations of the access doors and plates are shown in Figures 1-12 and 1-13. The major unit, serviced or inspected through each opening, is listed numerically under the illustration and is identified by the index number. These access doors and plates provide the openings for all normal servicing and inspection of the aircraft. Applicable sections of this manual explain other uses.

WALKWAYS

6 No walkways are provided. Walking is not permitted on wing, even during refuelling or defuelling operations (refer to para.9 for refuelling).

LUBRICATION

7 Parts requiring the most frequent lubrication are landing-gear, landing-gear retract mechanism, flap mechanism. Many of the moving parts on the aircraft require dry lubrication, and special care must be taken to keep these parts from becoming dirty. Cleanliness is essential throughout the lubrication procedure. First, the grease fittings or parts must be wiped clean to make sure that no dirt is carried into the part when lubricant is supplied. Lubricant should always be applied sparingly, but with the assurance that the bearing surfaces are adequately covered. Excess lubricant must be wiped off to prevent accumulation of dirt and dust. The lubrication periods and correct lubricants for the aircraft are shown in Figure 1-14.

SPECIAL TOOLS AND EQUIPMENT

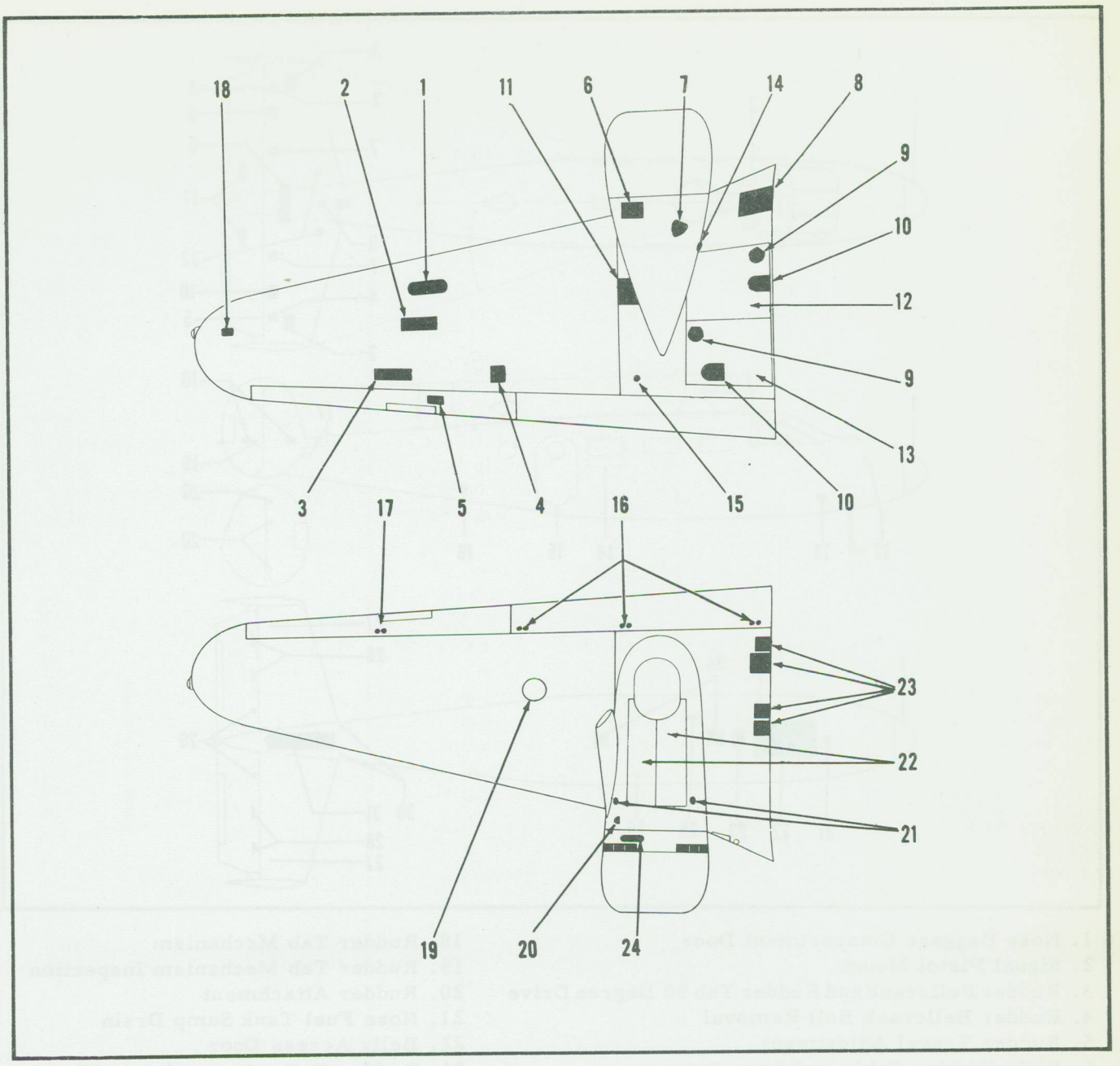
8 The tools listed herein have been developed specially for the Expeditor Series Aircraft.

(a) The Wing Aligning Pin (Part TS669) is used to temporarily align the wing while attaching fittings are being reamed.

(b) The Wing Hinge Bolt Puller (Part 182061) and Wrench Adapter is used to remove the tapered hinge bolts that attach the outer panel to the centre section. The wrench adapter may also be used to remove the hinge bolt nuts.

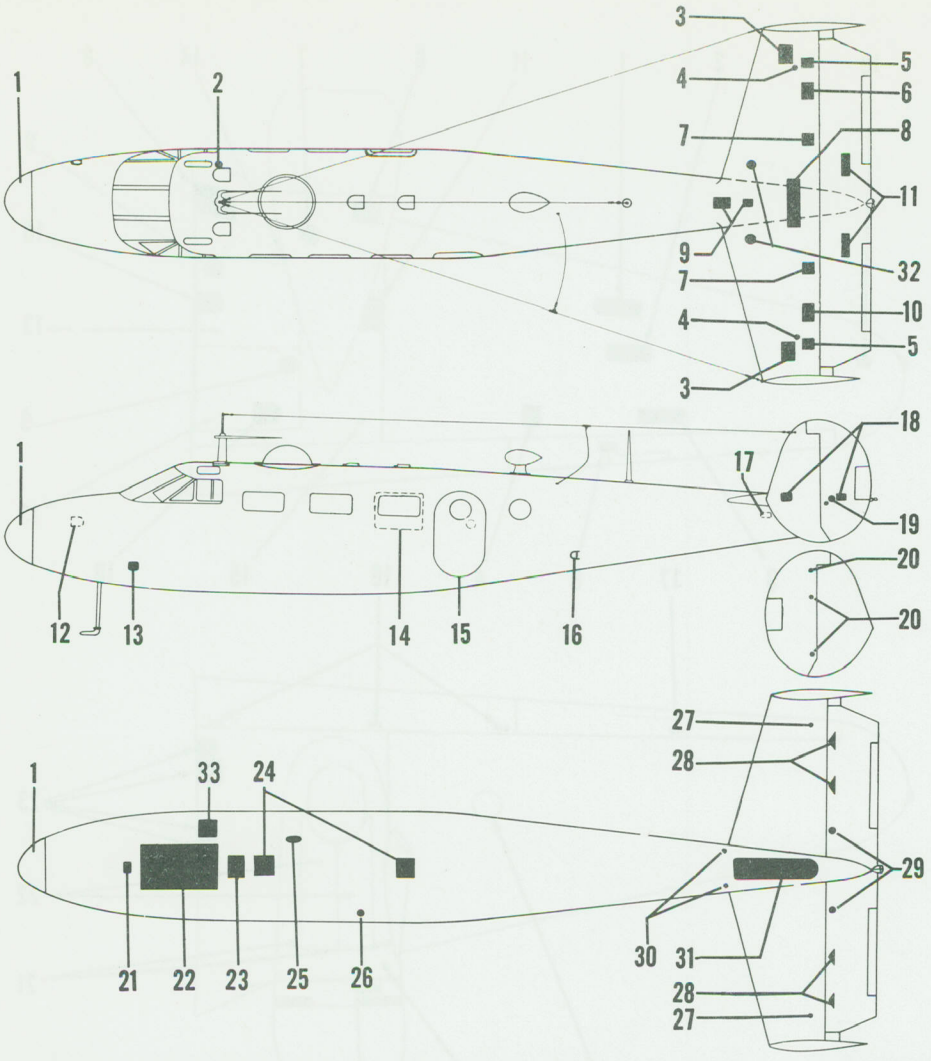
(c) The Elevator Jam Nut Wrench (Part TS588) is used to loosen and tighten the elevator stop jam nut.

(d) The one inch Straight Spiral Fluted



1. Aileron Cable and Pulley Inspection
2. Aileron Cables
3. Aileron Bell Crank
4. Aileron Tab Mechanism
5. Aileron Tab Actuator
6. Oil Dilution Solenoid Valve
7. Oil Tank Filler Neck
8. Battery Compartment
9. Fuel Tank Filler Neck
10. Liquidometer Adjustment
11. Wing Hinge Pins
12. Front Fuel Tank Cover
13. Rear Fuel Tank Cover
14. Hoist Attachment Point
15. Flap Acutator Lubrication
16. Flap Attaching Bolts
17. Aileron Actuating Link
18. Gyrosyn Compass (Right Wing Only)
19. Landing Light
20. External Power (Left Nacelle Only)
21. L. G. Hinge Pin Removal
22. Landing Gear Doors
23. Fuel Tank Sumps
24. Fuel Strainer

Figure 1-12 Wing Access Doors



1. Nose Baggage Compartment Door
2. Signal Pistol Mount
3. Rudder Bellcrank and Rudder Tab 90 Degree Drive
4. Rudder Bellcrank Bolt Removal
5. Rudder Travel Adjustment
6. Right Rudder Cable and Rear Balance Cable Turnbuckle
7. Phenolite Spacer and Elevator Tab 90 Degree Drive
8. Rudder Pulleys and Front Balance Cable Turnbuckle
9. Horizontal Stabilizer Forging Attachment
10. Left Rudder Cable Turnbuckle
11. Elevator Tab Mechanism
12. Nose Fuel Tank Filler Neck
13. Rudder Pedal Shaft and Air Mixer Inlet
14. Emergency Escape Panel
15. Cabin Door
16. Lavatory Vent
17. Tail Gear Oleo
18. Rudder Tab Mechanism
19. Rudder Tab Mechanism Inspection
20. Rudder Attachment
21. Nose Fuel Tank Sump Drain
22. Belly Access Door
23. Rudder Pulley Inspection and Rudder Pulley Bolt Removal
24. Rudder Cable Inspection
25. Aerial Flare and Smoke Float Chute (3N & 3NM)
26. B-3 Driftmeter (3N & 3NM)
27. Rudder Bellcrank Bolt Removal
28. Elevator Attachment
29. Elevator Tab Mechanism Inspection
30. Tail Gear Suspension Bolts
31. Tail Gear Well
32. Rubber Plugs (Horizontal Stabilizer Attachments)
33. Gyrosyn Compass Inverter Access

Figure 1-13 Fuselage Access Doors

Reamer is used to ream the rear spar attaching fitting bolt hole.

(e) The Adjustable Expansion Reamer, 15/16 to 1-1/16 inch, is used to start the tapered wing hinge joint reamer.

(f) The Roughing Wing Hinge Joint Reamer (Part TS101R) is used to rough out the tapered wing hinge joint bolt holes.

(g) The Wing Hinge Joint Finishing Reamer (Part TS101) is used to finish the tapered wing hinge joint bolt holes.

(h) The Hydraulic System Servicing Tank (4G/2349) is used for bleeding the brake system. It is attached to the system at the reservoir end of the fluid supply line.

(j) The Cowl Installing Hook Wrench (Part TS724) is used to assist in the installation of the engine cowling fasteners.

(k) The Landing-Gear Clutch Overload Wrench (Part 180131) is a spanner type wrench used to adjust the tension on the landing-gear overload clutch spring.

(m) The Rudder Tab Drive Wrench (Part TS657) is an offset spanner wrench used to hold the rudder tab torque drive while tightening the jam nut.

(n) The Rudder Tab Drive Open End Wrench, one inch, (Part TS658A) is a crowfoot type wrench used to tighten the jam nut on the rudder tab torque drive.

(p) The Rudder Tab Drive Open End Wrench, 7/8 inch, (Part TS658B) is a crowfoot type wrench used to tighten the flexible drive to the torque drive.

(q) The Shock Absorber Wrench (Part 180130) is a double end spanner wrench. The small end is used to tighten the packing nut on the tail wheel shock strut. The larger end is not used on the Expeditor Series.

(r) The Lord Bushing Puller (Part TS691, consisting of two sizes of pullers) is used to remove the shock absorbers from the engine mount.

(s) The Wing Jack Pad (Part 84-180930 LH and 84-180930-1 RH) is attached to the wing centre section to adapt the jack to the jack point.

(t) The Main Landing-Gear Towing Bar (Part 4MBA13570) when attached to the towing lugs on the main landing-gear is used to either tow or push the aircraft.

(u) The Aircraft Hoisting Eyebolts (Part 18092, set of 2) are used when two hoists are employed.

(v) The Aircraft Hoisting Lugs (Part 18091, set of 2) are used when a single hoist is employed.

(w) The Aircraft Wing Jack (Part TK121) is a screw type jack operated by a ratchet type handle. This jack has two screws and is used on the wing jack points.

(x) The Aircraft Wing Jack Adapter (Part TK116, LH) attaches to the top of the jack screw and is used in lieu of the jack pad (Part 84-180930).

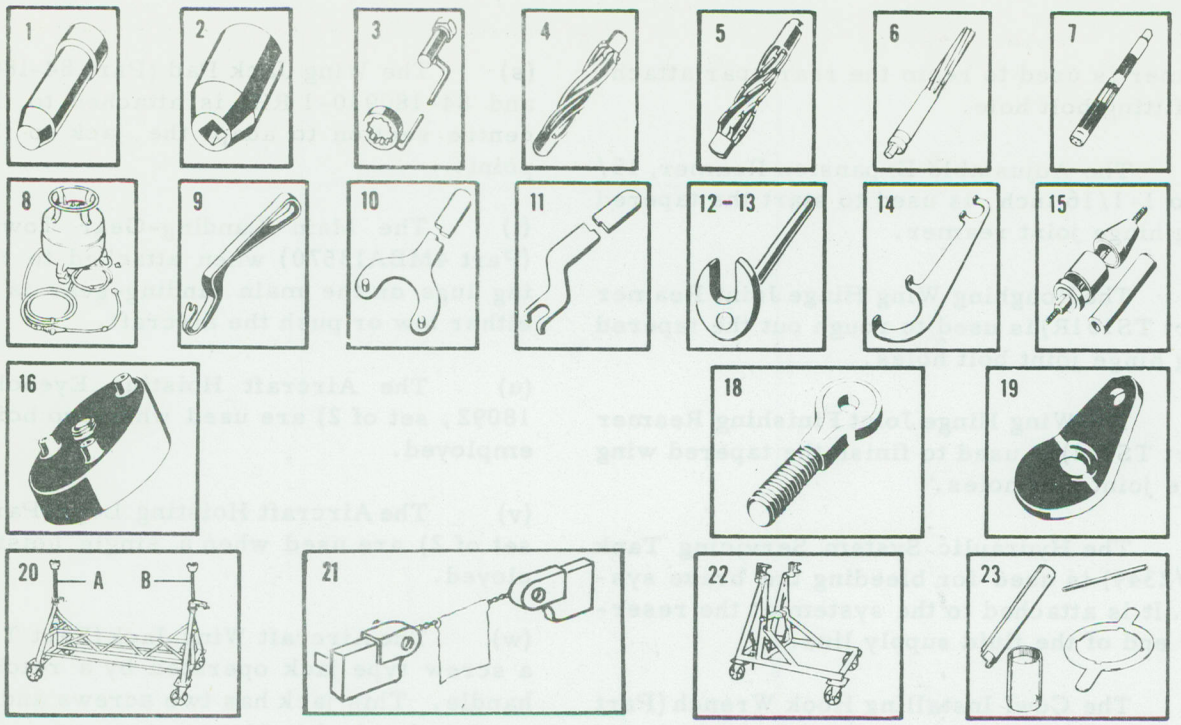
(y) Same as (x) except for right hand (Part TK116, RH).

(z) The Aircraft Tail Jack (Part TK828) has two pins which fit into the tail hoisting holes and is used to raise the tail of the aircraft.

(aa) The Aircraft Engine Dolly (Part TK111) has fittings in the same position as the firewall fittings on the aircraft so that the engine and mount may be removed from the aircraft in one piece and mounted on the dolly, utilizing the engine mount.

RE-FUELLING

9 The fuel capacity is 235 Imperial (282 US) gallons. Fuel is carried in two main tanks and two auxiliary tanks on each side of the fuselage, within the inner wing, and one auxiliary nose tank located in the nose baggage compartment. Filler caps for the centre section fuel tanks are located in the upper surface of the wing centre section beneath quick-release covers. The filler cap for the nose



INDEX NO.	NOMENCLATURE	PART NO.
1	Pin - Wing Aligning, 15/16 x 3-3/8 in.	TS669
2	Puller - Wing Hinge Bolt	182061
3	Wrench - Elevator Jam Nut	TS588
4	Reamer - Spiral, Wing Hinge Joint, Finishing	TS101
5	Reamer - Spiral, Wing Hinge Joint, Roughing	TS101R
6	Reamer - Straight Spiral Fluted 1 in. (Morse Taper)	
7	Reamer - Adjustable Expansion 15/16 to 1-1/16 in.(Morse Taper)	
8	Tank, Hydraulic System, Servicing and Bleeding	4G/2349
9	Wrench - Installing Cowl Fastener, Hook	TS724
10	Wrench - Overload Clutch, Landing Gear	180131
11	Wrench - Rudder Tab Drive	TS657
12	Wrench - Rudder Tab Drive, Open End 1 in.	TS658A
13	Wrench - Rudder Tab Drive, Open End 7/8 in.	TS658B
14	Wrench - Shock Absorber, Tail Strut	180130
15	Puller - Lord Bushing (Set of 2 - Upper and Lower)	TS691
16	Pad - Wing Jack LH (84-180930-1 Pad - Wing Jack RH)	84-180930
17	DELETED	
18	Eyebolt - Aircraft Hoisting (Set of 2)	18092
19	Lug - Aircraft Hoisting (Set of 2)	18091
20	Jack - Aircraft Wing	TK121
20A	Adapter - Jack to Aircraft	TK116L
20B	Adapter - Jack to Aircraft	TK116R
21	Adjusting Tool - Reduction Pulley Rudder Control	37388-1
22	Dolly - Aircraft Engine	TK111
23	Propeller Tool Kit - Hydromatic Propellers	KS22D30IK

Figure 1-15 (Issue 2) Special Tools and Equipment

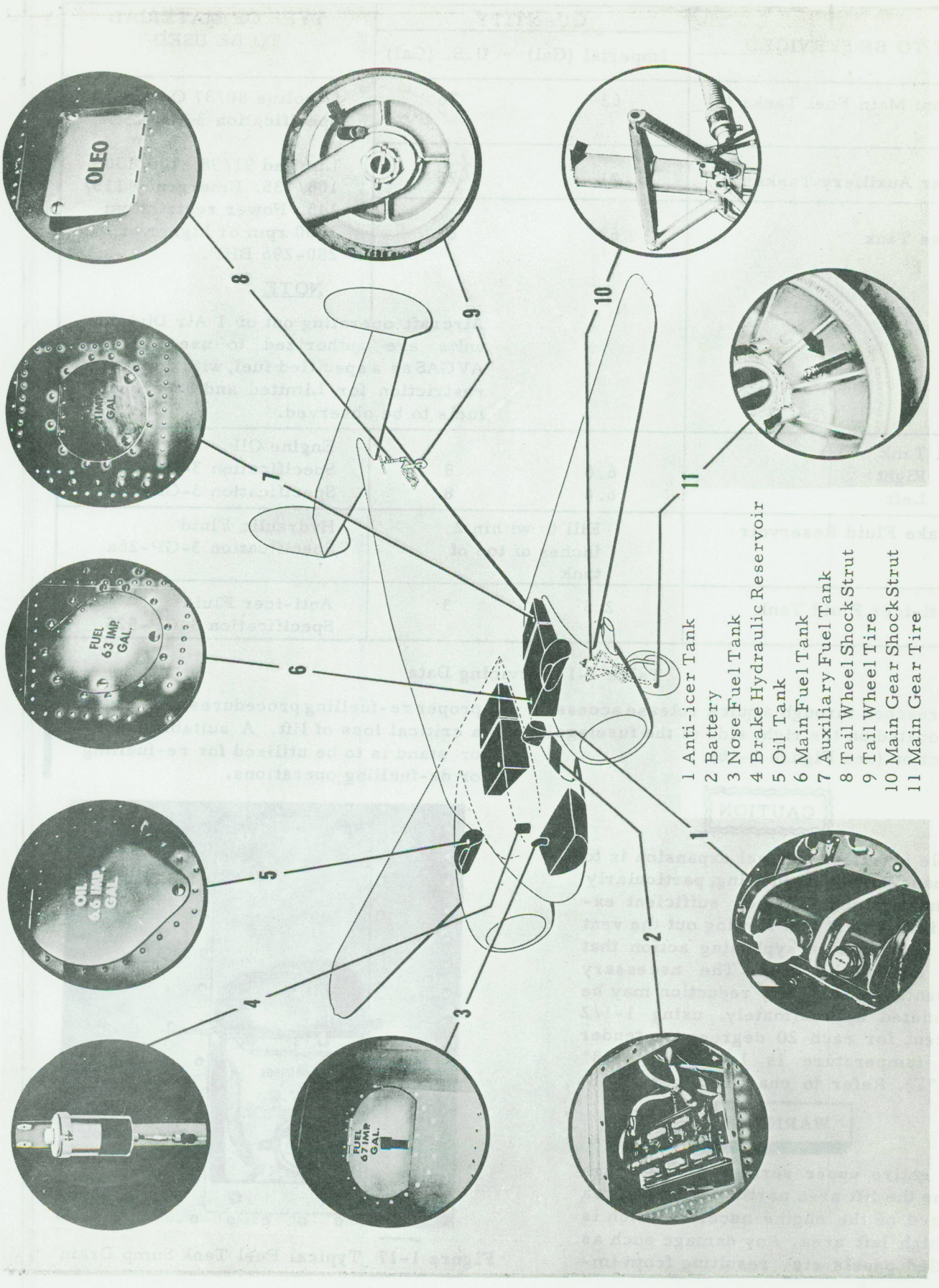


Figure 1-16 Servicing Points

UNIT TO BE SERVICED	QUANTITY		TYPE OF MATERIAL TO BE USED
	Imperial (Gal)	U.S. (Gal)	
1. Front Main Fuel Tanks (2)	63	76	Gasoline 80/87 Octane Specification 3-GP-25C Limited 91/98, 100/130, 108/135. Emergency 115/145. Power restriction: 1900 rpm or higher at 280-296 BHP. NOTE Aircraft operating out of 1 Air Division units are authorized to use 115/145 AVGAS as a specified fuel, with the power restriction for Limited and Emergency fuels to be observed.
2. Rear Auxiliary Tanks (2)	21	25	
3. Nose Tank	67	81	
4. Oil Tank Right Left	 6.6 6.6	 8 8	Engine Oil Specification 3-GP-100A Specification 3-GP-100A
5. Brake Fluid Reservoir	Fill to within 2 inches of top of tank		Hydraulic Fluid Specification 3-GP-26a
6. Anti-icer Fluid Tank	2.5	3	Anti-icer Fluid Specification 3-GP-525

Table 1-1 Servicing Data

tank is reached through a quick release access cover located on the right side of the fuselage nose section (see Figure 1-16).

CAUTION

Ample provision for fuel expansion is to be made during re-fuelling, particularly the nose fuel cell since sufficient expansion to start fuel flowing out the vent line may start a syphoning action that will empty the tank. The necessary percentage of capacity reduction may be calculated approximately, using 1-1/2 percent for each 20 degrees the tender fuel temperature is less than 37.8° (100°F). Refer to chart in Figure 1-18.

WARNING

The entire upper surface of the wings forms the lift area particularly the area inboard of the engine nacelles which is the high left area. Any damage such as buckled panels etc resulting from improper re-fuelling procedures will cause a critical loss of lift. A suitable ladder or stand is to be utilized for re-fuelling or de-fuelling operations.

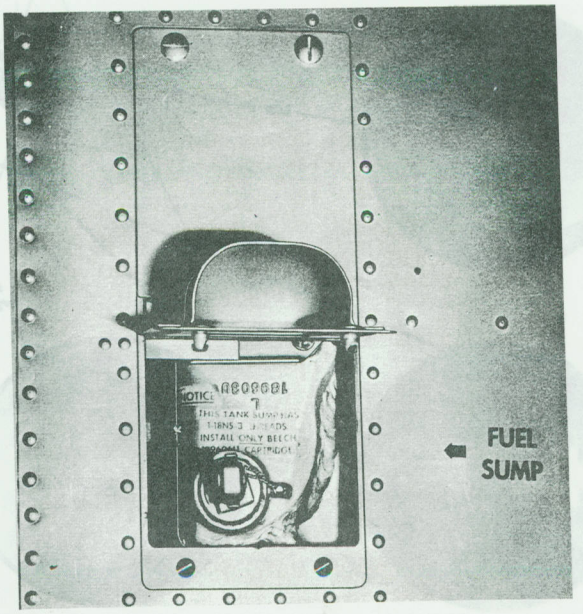


Figure 1-17 Typical Fuel Tank Sump Drain

DE-FUELLING

10 The centre section fuel tank sump drains are serviced through access doors located on the under side of the wing centre section just outboard of the fuselage (Figures 1-16 and 1-17). The nose tank sump drain is serviced through an access door located on the under side of the nose section. A small quantity of fuel should be drained from each sump before and after servicing. Fuel grade and specification are given in Table 1-1.

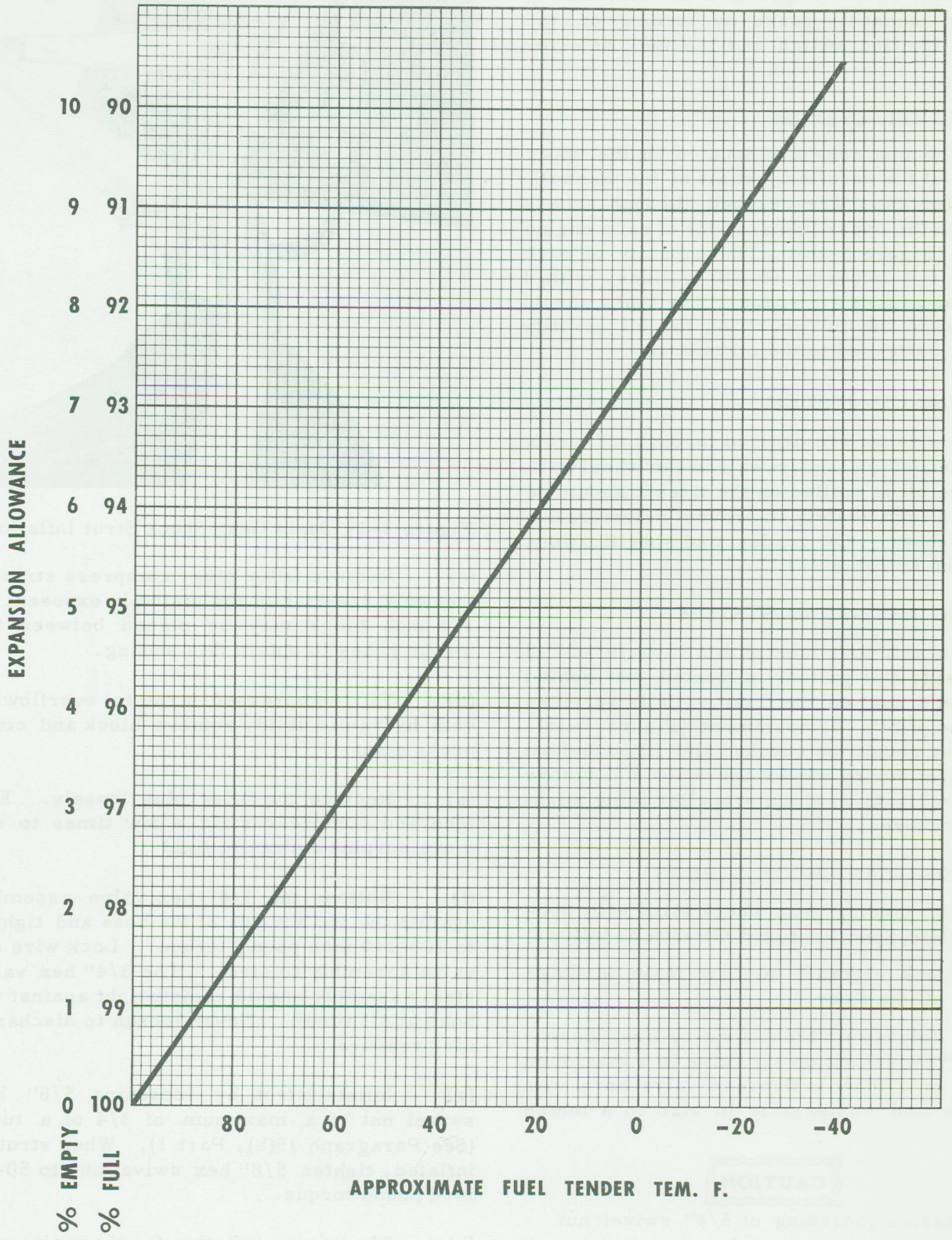


Figure 1-18 Fuel Expansion Allowance Chart

CHECKING OPERATION OF FUEL GAUGE

11 After re-fuelling, check the operation of the fuel quantity gauge by turning on the master ignition switch and the fuel selector switch.

FILLING OIL SYSTEM

12 The oil tanks are located in the upper section of the nacelles just aft of the firewall. The filler caps are reached through access doors on the upper inboard side of each engine nacelle (Figure 1-16). The capacity of each tank is 6.6 Imperial (8 US) gallons, with 3 Imperial gallons air space. The tanks should be filled to the full mark on the oil quantity dip stick attached to the oil tank cap.

DRAINING OIL SYSTEM

13 The tanks are drained through a Y-drain valve located on the firewall in the wheel well. If engine oil is spilled on the tires it should be removed immediately to prevent deterioration of the rubber. Oil grades, and specifications are given in Table 1-1.

FILLING ANTI-ICING SYSTEM

14 An anti-icer tank with a capacity of 2.5 Imperial (3 US) gallons is located just behind the pilot's seat on the floor. It is serviced from the pilot's compartment (Figure 1-16). The tank should be checked and filled before each flight during winter operation and before all other flights on which propeller icing might be encountered.

LANDING-GEAR SHOCK STRUTS

15 Fill landing-gear shock strut with hydraulic fluid, Specification 3-GP-26a as follows:

(a) Jack aircraft so that main landing-gear is off the floor.

(b) Release air from strut by first loosening 5/8" swivel nut on air valve to a maximum of 3/4 of a turn. Depress valve core with suitable tool comparable in size to a match stick.

CAUTION

Excessive loosening of 5/8" swivel nut will cause damage to valve core housing and result in the stem dropping into strut.

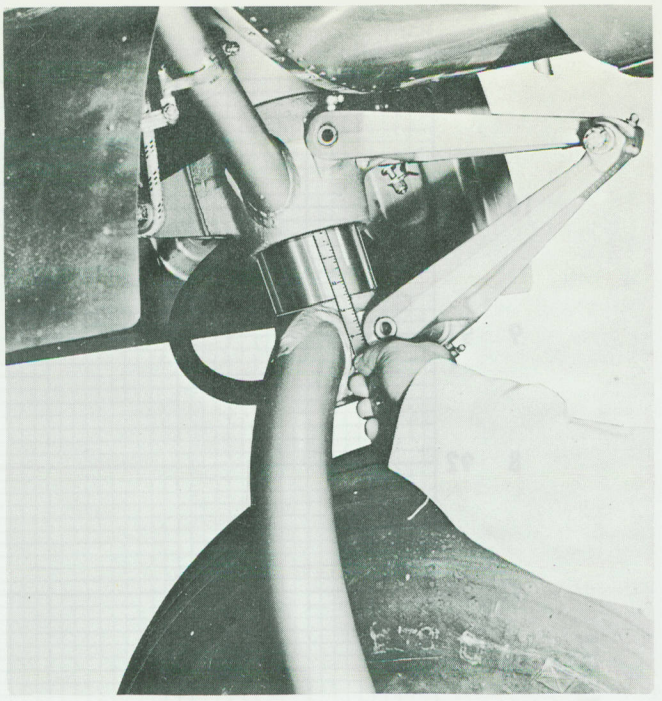


Figure 1-19 Main Gear Shock Strut Inflation

(c) Remove filler plug, compress strut so that only 3/4-inch of the piston is exposed. A 3/4-inch block may be placed between the torque knees to obtain this setting.

(d) Fill compressed strut to overflowing with hydraulic fluid, remove block and compress strut.

(e) Replace the filler plug loosely. Extend and compress strut a few times to remove surplus hydraulic fluid.

(f) Bottom the 3/4" hex valve assembly against the top surface of the boss and tighten to 100-110 inch pound torque. Lock wire air valve assembly to strut. The 3/4" hex valve stem assembly should remain tight against the boss at all times. Never loosen to discharge air pressure.

(g) Inflate strut by loosening 5/8" hex swivel nut to a maximum of 3/4 of a turn. (See Paragraph 15(b), Part 1). When strut is inflated, tighten 5/8" hex swivel nut to 50-70 inch pound torque.

(h) The proper inflation for the main gear shock strut is 2-1/2 inches (Figure 1-19).

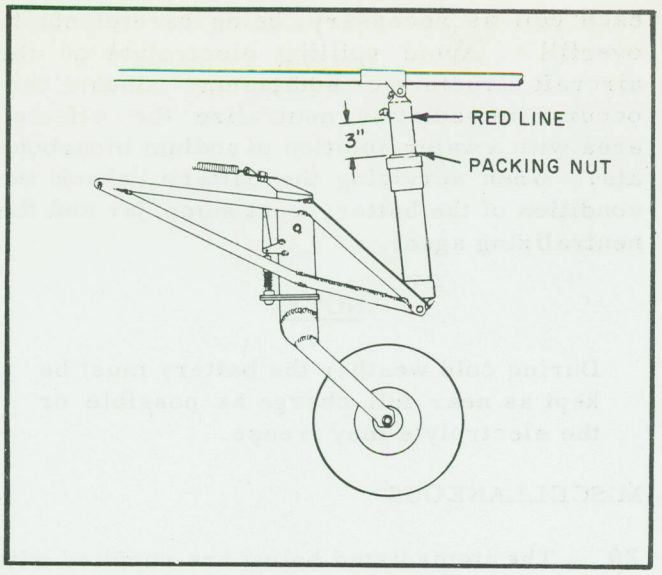


Figure 1-20 Tail Gear Strut Inflation

TAIL GEAR SHOCK STRUTS

16 Fill tail-wheel shock strut with hydraulic fluid, Specification 3-GP-26a, as follows:

(a) Jack tail of aircraft so tail wheel is off the ground.

(b) Release air from strut by first loosening 5/8" swivel nut on air valve to a maximum of 3/4 of a turn. (Excessive loosening will cause damage to the valve core housing and will result in the stem dropping into the strut). Depress valve core with suitable tool comparable in size to a match stick.

(c) Remove filler plug and fully compress shock strut.

(d) Fill compressed strut to overflowing with hydraulic fluid.

(e) Slowly extend and compress strut a few times to remove trapped air.

(f) Compress strut and add more fluid if it is not level with the filler hole.

(g) Install air valve in strut, bottom the 3/4" hex valve stem assembly against the top surface of the boss and tighten to 100-110 inch pound torque. Lock wire air valve assembly to strut. The 3/4" hex valve stem assembly should remain tight against the boss at all times. Never loosen to discharge air pressure.

(h) Inflate strut by loosening 5/8" hex swivel nut to a maximum of 3/4 of a turn. (See Paragraph 16(b)). When strut is inflated, tighten 5/8" hex swivel nut to 50-70 inch pound torque.

(j) The tail-wheel shock strut inflation is three inches. Measure inflation from the red line on the piston shoulder to the inside edge of the packing nut (Figure 1-20).

BRAKE FLUID RESERVOIR

17 The brake fluid reservoir is attached to the centre support on Bulkhead 3 forward of the instrument panel (Figure 1-16). The fluid level should be maintained about two inches from the top of the filler neck with hydraulic fluid, Specification 3-GP-26a. The fluid reservoir can be drained by removing a bleeder plug from one of the wheel brakes and pumping the fluid out with the brake pedal.

TIRE INFLATION

18 The main-wheel tire inflation is given by the 11.00-12 tire line in Figure 1-21. The

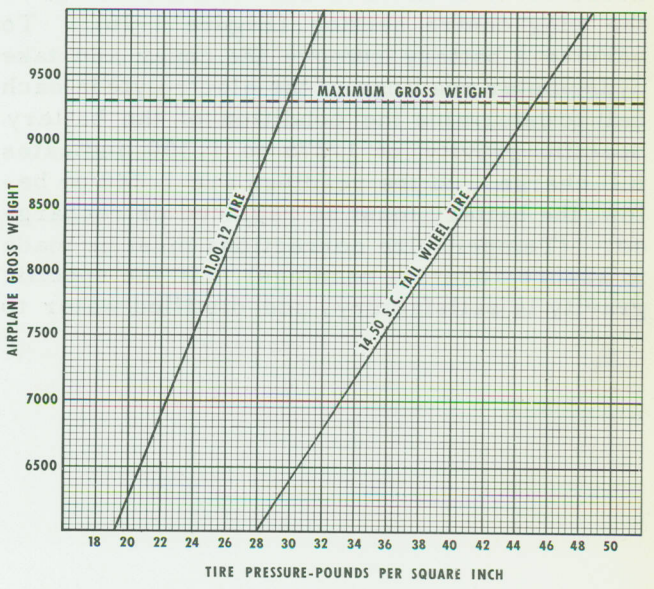


Figure 1-21 Tire Inflation Graph

tail-wheel tire inflation pressure is given by 14.50 smooth contour tire line. If a gauge is not available, inflate the tires so the distance from the ground to the centreline of the axle is 12-3/4 inches for the main wheels (Figure 1-22) and 6 inches for the tail-wheel.

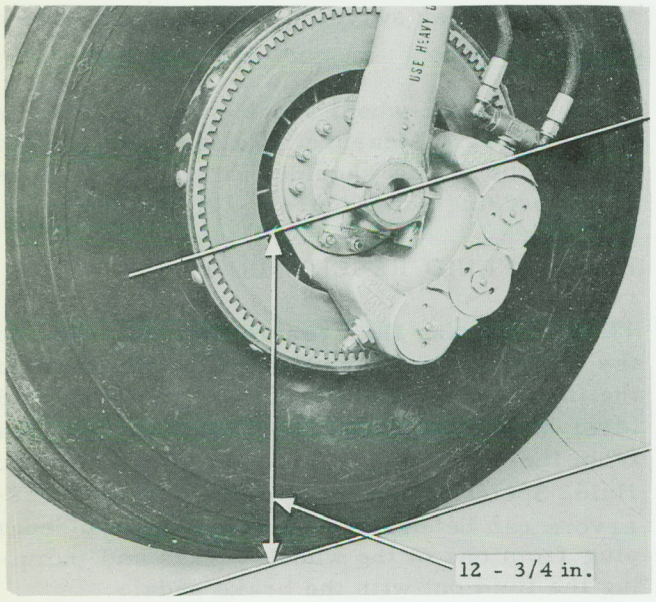


Figure 1-22 Main Wheel Tire Inflation

BATTERIES

19 The batteries are accessible from access doors located on each side of the fuselage in the wing centre section (Figure 1-16). To service a battery remove the cover and take hydrometer readings of the electrolyte in each cell to determine the condition of the battery. Specific gravity of 1.275 to 1.300 indicates full charge. If the readings are 1.240 or below, the battery must be replaced or recharged. (Temperature corrections must be made to assure accurate readings). If the specific gravity is satisfactory, add distilled water to each cell as necessary, being careful not to overfill. Avoid spilling electrolyte on the aircraft structure or equipment. Should this occur, immediately neutralize the affected area with a water solution of sodium bicarbonate. When servicing the battery, check the condition of the battery vent sump jar and the neutralizing agent.

NOTE

During cold weather the battery must be kept as near full charge as possible or the electrolyte may freeze.

MISCELLANEOUS

20 The items listed below are supplied with the aircraft at the time of delivery at the factory:-

(a) Weight and Balance Handbook.

(b) 644-180600 - Electrical Wiring Diagram (3N)
644-180602 - Electrical Wiring Diagram (3NM)
644-180603 - Electrical Wiring Diagram (3TM)

(c) 644-180606 - Navigation Equipment Wiring Diagram (3N)
644-180607 - Navigation Equipment Wiring Diagram (3NM)
644-180608 - Navigation Equipment Wiring Diagram (3TM)

(d) 111-72003 - (Modified 644-180674) RCAF Radio Control Panel Wiring Diagram (All aircraft)
111-72008 - Interphone and Radio Wiring Diagram (3T)

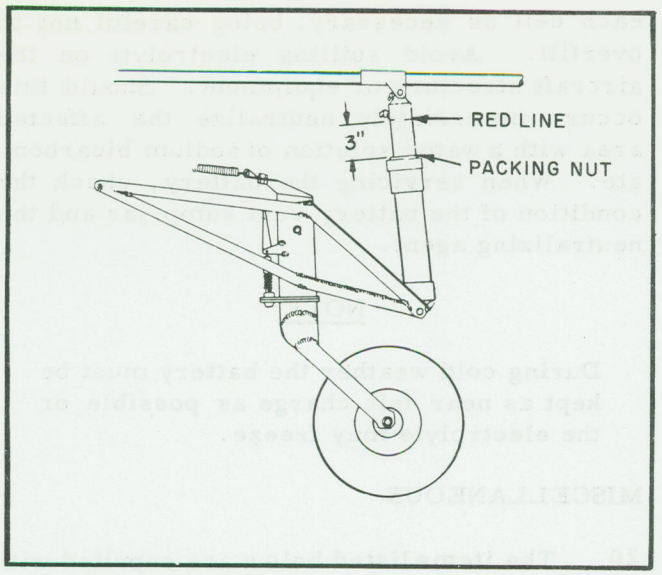


Figure 1-20 Tail Gear Strut Inflation

TAIL GEAR SHOCK STRUTS

16 Fill tail-wheel shock strut with hydraulic fluid, Specification 3-GP-26a, as follows:

(a) Jack tail of aircraft so tail wheel is off the ground.

(b) Release air from strut by first loosening 5/8" swivel nut on air valve to a maximum of 3/4 of a turn. (Excessive loosening will cause damage to the valve core housing and will result in the stem dropping into the strut). Depress valve core with suitable tool comparable in size to a match stick.

(c) Remove filler plug and fully compress shock strut.

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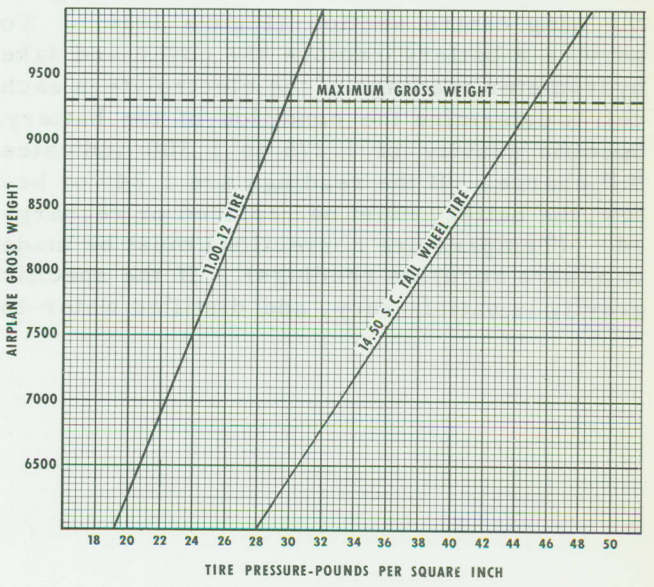

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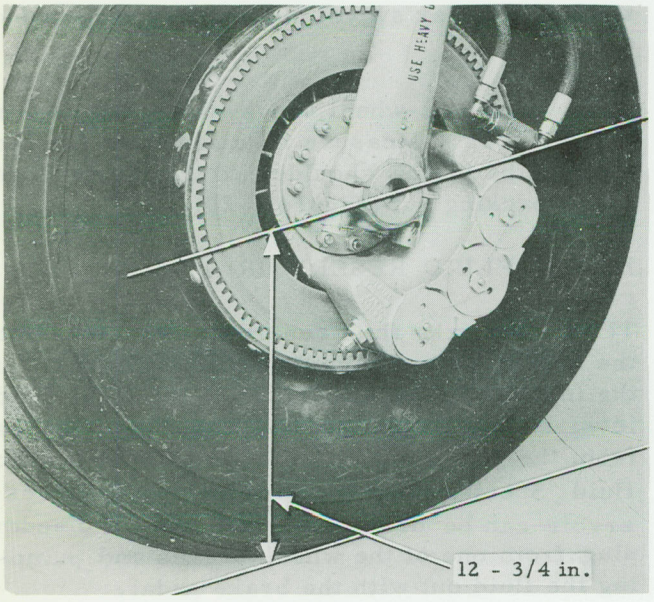

Figure 1-22 Main Wheel Tire Inflation

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111-72008 - Interphone and Radio Wiring Diagram (3T)

PART 2

AIRFRAME GROUP

SECTION 1

FUSELAGE

FUSELAGE

1 The fuselage is of semi-monocoque construction; the centre section is an integral part of the fuselage. The primary structure of the centre section consists of a single steel truss which carries fittings for attaching the engine and landing gear. This truss is attached to the fuselage and transmits the load from the fuselage to the wing. The fuselage is divided into the following compartments (Figure 2-2):-

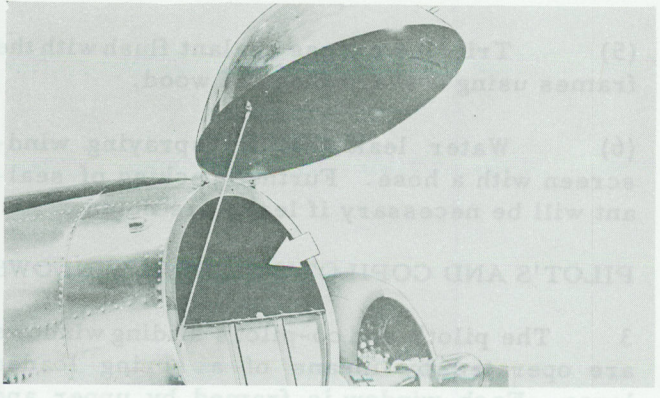


Figure 2-1 Front Baggage Door

(a) Nose Compartment - The nose compartment is located between fuselage Bulkheads 1 and 3. An auxiliary fuel tank in this compartment reduces its volume by about thirty per cent. The maximum capacity of this baggage compartment is 600 pounds including baggage and fuel (Figure 2-1). The weight of baggage which may be stowed in this compartment varies with the amount of fuel carried in the nose tank.

(b) Pilot's Compartment - The pilot's compartment, containing the pilot's and co-pilot's seats, instruments, and controls, is located between Bulkhead 3 and 5 just forward of the main cabin compartment. Access to this compartment is through the main cabin.

(c) Cabin Compartment - The cabin compartment is located between Bulkheads 5 and 9. In the 3N and 3NM aircraft, the cabin is fitted with a plastic astrodome equipped for astrocompass and sextant, and two navigation training stations with work tables, lamps and navigation instruments, on the right and a folding instructor's seat on the left. The rear training station has a Type B-3 driftmeter; behind it a Type B-5 driftmeter is mounted in the cabin wall. The 3T aircraft are equipped to fit five cabin chairs. The 3NM aircraft carry navigation equipment, as in the 3N, and floor lugs for attaching five cabin chairs, (Figure 2-3), while the 3TM aircraft carry five cabin chairs, with the necessary fittings, plumbing and wiring for astrodome and navigation equipment as in the 3N. The cabin door is equipped with an emergency release so it may be jettisoned in flight. An emergency escape panel is fitted in the right, aft side of the compartment.

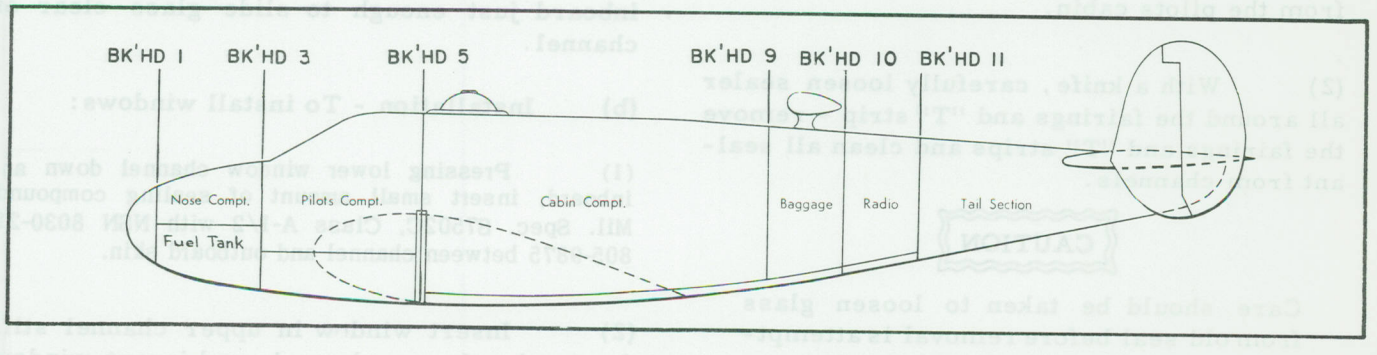


Figure 2-2 Fuselage Compartment Diagram

(d) Lavatory and Rear Baggage Compartment - The lavatory and rear baggage compartment is aft of the main cabin compartment between Bulkheads 9 and 10. It contains a chemical-type lavatory, vented through the left side. A relief tube is mounted forward of the lavatory on the left side. The right side of this compartment is used for baggage and miscellaneous tool stowage. This compartment is accessible from the main cabin through a door in Bulkhead 9.

CAUTION

Areas of skin which are affected by spray from relief tube venturi must be coated with a clear lacquer (Specification MIL-L-6806, RCAF Ref. 33A/443) and shall be rinsed with clean water after each flight.

(e) Tail Compartment - The tail compartment extends from Bulkhead 10 to Bulkhead 15. A removable panel on the upper half of Bulkhead 10 allows access to the tail compartment for servicing the flight control cables, pulleys, and radio equipment.

PILOT'S COMPARTMENT WINDSCREEN

2 The pilot's and co-pilot's windshields are constructed in nine sections. Each section is encased in removable channels or fairing sections and sealed.

(a) Removal - To remove the Windscreen:

(1) Remove the screws holding the upper and lower windscreen fairings and the vertical "T" strips. Access to the nuts may be obtained by working through the nose compartment and from the pilots cabin.

(2) With a knife, carefully loosen sealer all around the fairings and "T" strip - remove the fairings and "T" strips and clean all sealant from channels.

CAUTION

Care should be taken to loosen glass from old seal before removal is attempted, to avoid breaking the glass.

(b) Installation - To install windscreen glasses:

(1) Apply a thin even coat of adhesive sealant Mil. Spec. S7502C, Class A-1/2 with NSN 8030-21-805-9875 to all fitting surfaces.

(2) Lay the glass in place leaving a 1/8" clearance between the edge of the glass and all surrounding metal channels and press firmly into place.

(3) Pack sealant Mil. Spec. S7502C, Class A-1/2 with NSN 8030-21-805-9875 around the edges of the glass; ensure that no voids exist in the sealant and that the corners are well sealed.

(4) Install the "T" frame and upper and lower fairing, install screws and tighten snugly without undue strain. The screws in the frame should protrude through the stop nuts at least one thread and not more than three threads.

(5) Trim the excess sealant flush with the frames using a sharp piece of wood.

(6) Water leak test by spraying windscreen with a hose. Further packing of sealant will be necessary if leaks are noted.

PILOT'S AND COPILOT'S SLIDING WINDOWS

3 The pilot's and co-pilot's sliding windows are operated by means of a spring loaded lever. Each window is framed by upper and lower channel sections.

(a) Removal - To remove the windows:

(1) Remove lower window channel hold-down screws and nuts.

(2) Press lower window channel down and inboard just enough to slide glass clear of channel.

(b) Installation - To install windows:

(1) Pressing lower window channel down and inboard, insert small amount of sealing compound, Mil. Spec. S7502C, Class A-1/2 with NSN 8030-21-805-9875 between channel and outboard skin.

(2) Insert window in upper channel still depressing lower channel, and insert window

in lower channel.

(3) Replace lower channel hold-down screws and nuts.

(4) Remove excess sealer after it has set.

CABIN WINDOWS AND COCKPIT UPPERSIDE WINDOWS

4 A cockpit window is located immediately fore and aft of the pilot's and copilot's sliding window. Three cabin windows are installed on each side of the fuselage.

(a) Removal - To remove cabin windows:

(1) Remove the screws attaching the outer window moulding to the fuselage frame and remove moulding.

(2) Remove the screws attaching the inner window moulding to the fuselage and remove the moulding.

(3) Remove glass and glass seal.

(b) Servicing - Deep scratches to the window surface or checking of the surface will necessitate replacement of the entire window. Minor scratches, however, may be repaired without removing the window. Refer to EO 05-1-3.

(c) Installation - To install windows:

(1) Place a small amount of adhesive sealant Mil. Spec. S7502C, Class A-1/2 with NSN 8030-21-805-9875 around the inside edge of the window frame.

(2) Place seal around outer edge of glass and press firmly against frame, with glass centred.

(3) Install the inner moulding and tighten screws.

(4) Install the outer moulding and tighten screws.

(5) Remove excess cement and wipe clean.

CABIN EMERGENCY EXIT

5 The cabin rear window on the starboard side of the aircraft is an integral part of the cabin emergency exit.

(a) Removal - The removal of the window is similar to that described in paragraph 4.

(b) Installation - The installation procedure is similar to that outlined in paragraph 4.

ASTRODOME

6 An acrylic plastic astrodome, with fittings to accommodate the astro-compass and sextant, is installed in the cabin roof beside the forward navigator's station. The dome is held in place by a rubber seal around the base.

(a) Removal - To remove the astrodome, remove bonding strap, pull emergency release handle and remove seal. The astrodome will fall free.

(b) Servicing - Repairs shall be limited to the replacement of astrodome seal, removal and replacement of the compass and sextant mount, replacement of emergency release handle, or replacement of complete astrodome assembly.

CAUTION

Do not buff the astrodome. Wash with soap and water only and wax.

(c) Installation - To install the astrodome:

(1) Place astrodome in position with bonding strap approximately two inches from release handle clip.

(2) Place seal in the dome ring flange, either roll or press seal into position and refit bonding strap.

TAIL COWLING

7 The tail cowling consists of an outer and inner cowl, the outer (Figure 2-4) attached to the fuselage and the inner attached to the elevator. The cowling streamlines the fuselage and covers the elevator bellcrank and link rod.

(a) Removal - Remove tail cowling as follows:

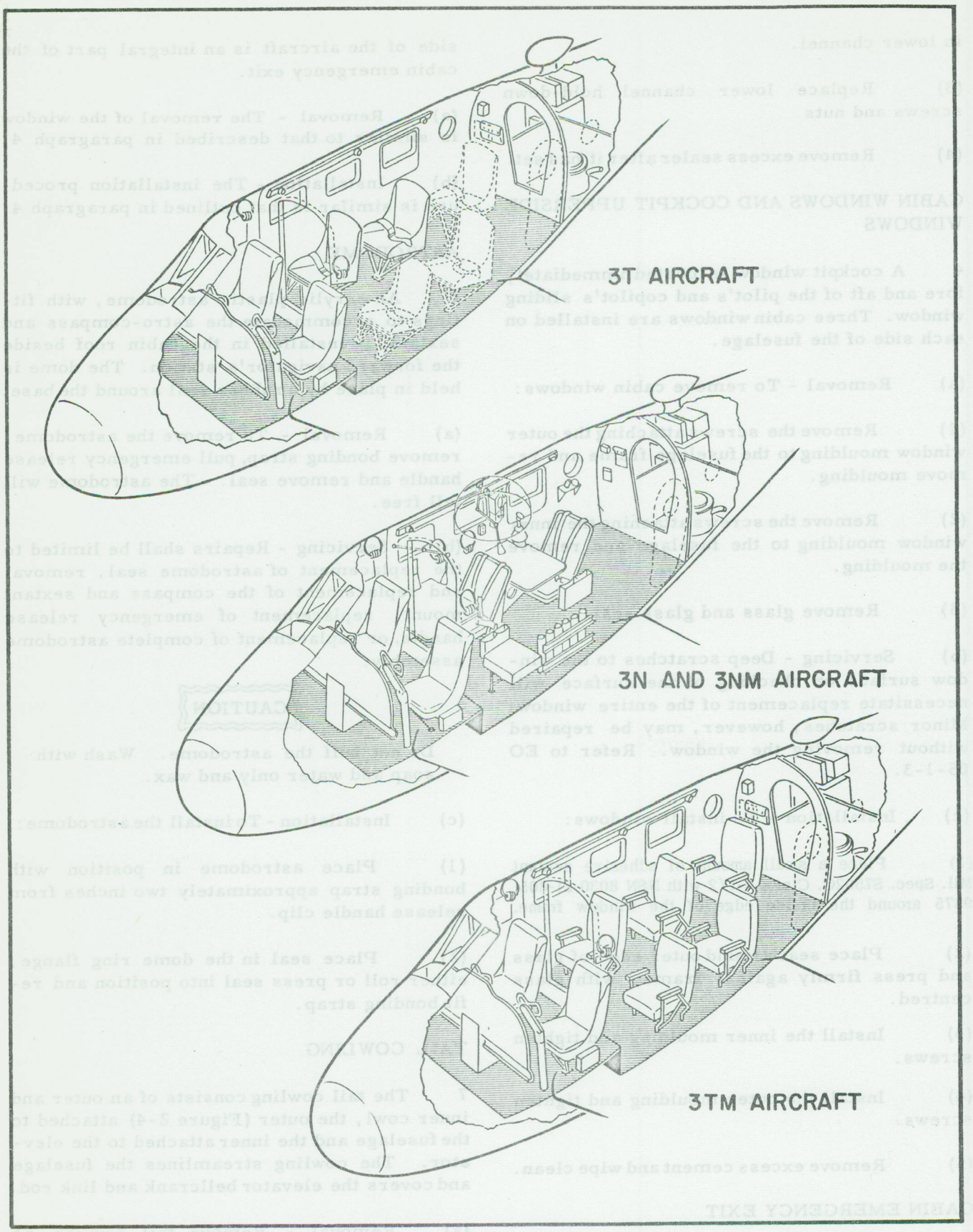


Figure 2-3 Seating Arrangement

(1) Remove the machine screws holding outer cowl to fuselage and remove cowl.

(2) Remove the machine screws holding the inner cowl to the elevator assembly and remove cowl.

(b) Servicing - Minor repairs consist of the removal and replacement of the felt strip around the upper part of the outer cowl. The felt strip should be impregnated with grease (Specification 3-GP-683 RCAF Ref. 34A/192) as specified in EO 05-45B-7A.

(c) Installation - To install tail cowling:

(1) Place inner cowl in position on the elevator assembly and install attaching screws.

(2) Fasten the outer cowl to the fuselage.

(3) Move the elevator up and down to check for binding. If necessary, loosen the machine screws attaching the outer cowl to the fuselage and adjust the cowl slightly to obtain more clearance. Retighten screws.

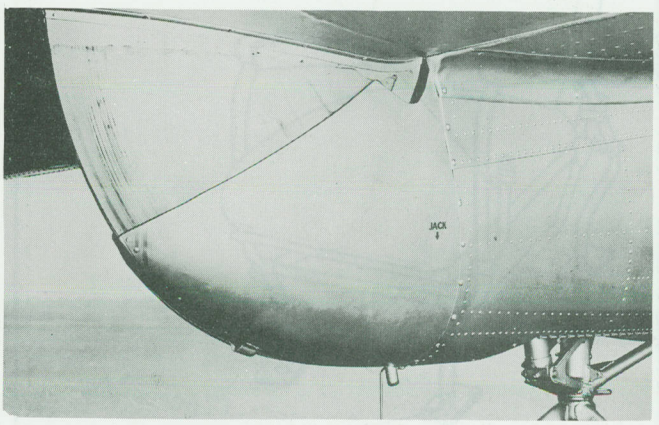


Figure 2-4 Tail Cowling

CABIN DOOR

8 The cabin door is located on the port side of the aircraft. The door hinge incorporates a quick release mechanism, making the door jettisonable in the event of an emergency.

(a) Removal - To remove the cabin door, push the cabin door quick release pin assembly upwards.

(b) Installation - Install the door, by pushing the cabin door quick release pin assembly upwards, align the door hinge to the upper and lower hinge pins and release the pin assembly.

FRONT BAGGAGE COMPARTMENT DOOR

9 The front baggage compartment door, forming the nose of the aircraft, is hinged at the top and locked at the bottom. When the door is open, it is retained in position by means of a stay.

(a) Removal - To remove the front baggage compartment door:

(1) Open the door and retain in position with stay.

(2) Release the screws retaining the door strap.

(3) Unscrew the two hinge bolts at the top of the door. Remove the door.

(b) Installation - The installation procedure is the reverse of that for removal.

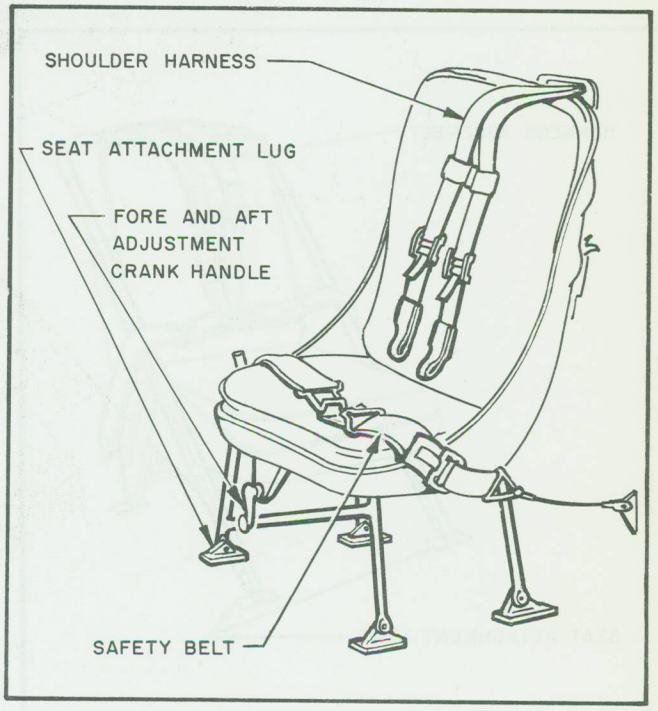


Figure 2-5 Pilots and Co'pilots Seat

PILOT'S AND COPILOT'S SEAT (Figure 2-5)

10 The pilot's and copilot's seats are identical. Each seat consists of a bucket assembly bolted to four tubular legs, which are interbraced. A crank handle situated at the front of each seat adjusts the seat fore and aft. A safety belt and shoulder harness is fitted to each seat. The seats are secured to four lugs anchored on the cockpit floor.

(a) Removal - Unscrew the 1/4 in. bolts from each of the four lugs securing the seat to the floor. Remove the seat.

(b) Installation - The installation of the seats is the reverse of that for removal.

NAVIGATOR'S SEAT (Figure 2-6)

11 Aircraft 3N and 3NM are fitted with a navigator's seat and table located on the starboard side of the aircraft. The seat is fitted with a shoulder harness and safety belt, and is secured to the four lugs anchored to the cabin floor. Directly in front of the navigator's seat is a folding table, which is hinged to the side of the cabin and supported by means of a bracket assembly hinged to the table.

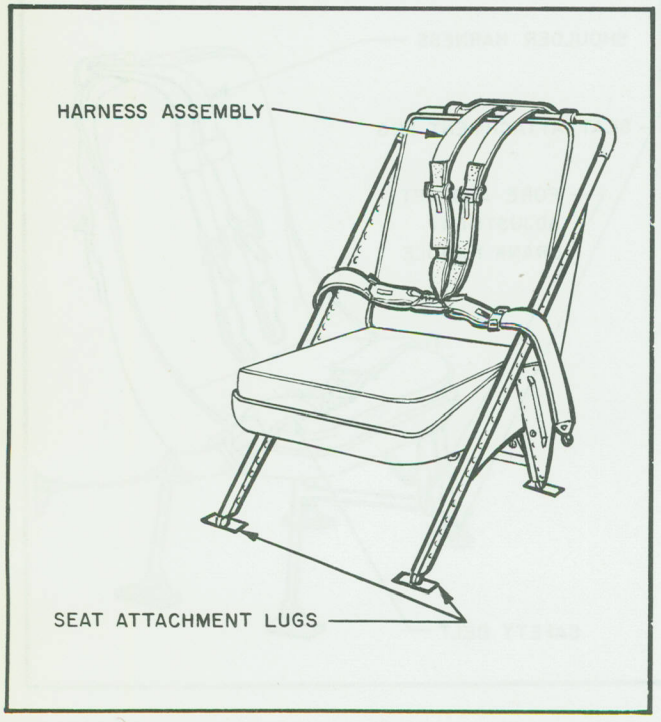


Figure 2-6 Navigators Seat

(a) Removal - Unscrew the 1/4 in. bolt from each of the four lugs securing the seat to the floor. Remove the seat.

(b) Installation - The installation of the seat is the reverse of that for removal.

PASSENGER'S SEAT (3NM and 3TM) (Figure 2-7)

12 Five passenger type seats are installed in the 3NM and 3TM aircraft. Each seat is basically the same, except that the seats installed in the 3NM are green and in the 3TM they are blue. Each seat may be reclined forward or aft by means of a lever located on the right hand side of the seat. A lap type safety belt is fitted. The leg of each seat is clipped to the floor boards by Wedjit assemblies.

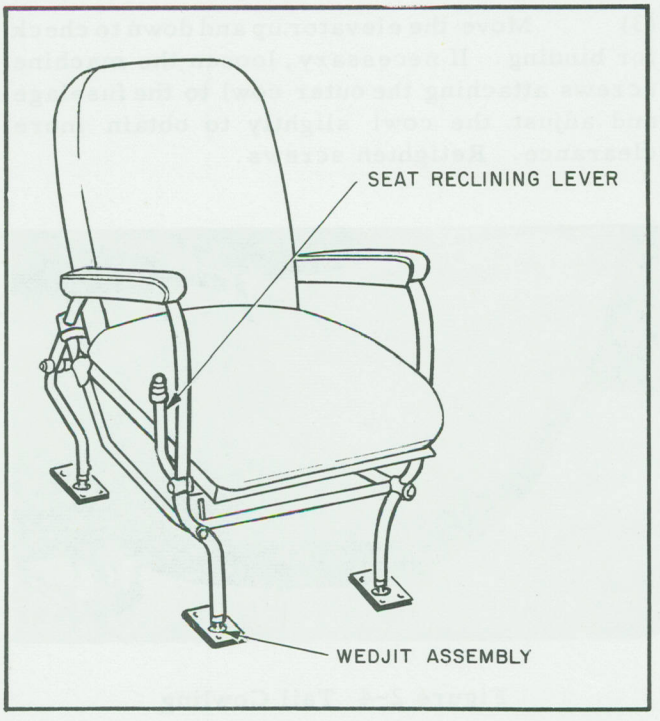


Figure 2-7 Passengers Seat (3NM and 3TM)

(a) Removal - Unscrew the screw adjacent to each seat leg; this releases the clip retaining the leg to the floor. Remove the seat.

(b) Installation - Screw tight the screw fitted to the Wedjit assembly in the floor board. Push each seat leg into the appropriate clip; the legs will automatically lock in position.

PASSENGER'S SEAT (3T) (Figure 2-8)

13 A maximum of five passenger seats may be installed in the 3T aircraft. Each seat consists of an upholstered bucket type seat, which is supported by a tubular leg assembly. The seats are secured to the cabin floor at three points. A lap type safety belt is fitted.

(a) Removal - Unscrew the four bolts attaching each of the legs to the floor and remove the seat.

(b) The installation of the seat is the reverse of that for removal.

COCKPIT AND CABIN FLOOR

14 The cockpit floor consists of two main sections; the pilot's floor and the co-pilot's floor. Bolted to each floor is the control column boot assembly. The two main floors and the associated panels are secured to the cockpit structure by means of Truss head screws. The cabin floor is divided into four sections; floor (LH), floor (RH) floor (rear centre) and floor (forward centre). On the 3TM, 3N and 3NM aircraft, provision is made in the cabin floor for fitment of a driftmeter, drift signal chute and Wedjit assemblies to take passenger seats. On the 3T aircraft, provision has been made for the attachment of the seats only. The cabin floor is secured to the cabin structure with Truss head screws.

CAUTION

Care must be taken in removing the cockpit flooring as it is easily distorted.

INERTIA LOCKING REEL
(MODEL 0-3903 NN SERIES)

General

15 The shoulder harness on the pilot and co-pilot seat is attached by a cable to an inertia reel. The inertia reel permits free fore and aft movement of the upper part of the body under normal flight conditions, but is designed to lock the harness on sudden deceleration to prevent bodily contact with the controls or airframe structure.

Description

16 This mechanism consists of a spring-loaded ratchet reel housed in a metal drum attached at the rear of the seat. The ratchet is controlled by a lever located on the side of the seat. The lever, when in the rear (unlocked) position, allows the harness to move freely in a fore and aft direction. Moving the lever forward engages the ratchet and thus locks the harness, permitting the harness to retract, but locks it against any extension.

17 In both the locked and unlocked positions, the reel retracting spring takes up slack in the harness and keeps it taut.

18 If the aircraft is subjected to deceleration in excess of 2-1/2G, inertia of the reel overcomes the force exerted by the ratchet disengaging spring, and throws the reel forward. As a result the ratchet engages, locking the reel and preventing any forward movement.

19 In the event the ratchet is engaged by a G-force while the control lever is in the unlocked position, the control lever must be moved to the locked position and then returned to the unlocked position before free harness movement can be obtained.

Operation Check

20 To ensure proper operation of the reel mechanism, the following check is to be carried out:

(a) With the control lever in the rear (unlocked) position, grasp the shoulder harness, pull forward and release slowly. Unrestricted movement with a slight spring tension should be obtained.

(b) Repeat (a) while slowly moving the control lever forward. A slight clicking sound should be heard from the reel when the handle has reached 1/2 to 2/3 of full forward travel. If the clickling is heard before the control

handle reaches 1/2 of full travel, release any tension on the shoulder harness and return the control handle to the aft (unlocked) position. Loosen the control cable casing clamp at the mechanism drum and slip the casing 1/32" away from the drum. Tighten the clamp securely.

(c) Repeat (b) till the clicking sound becomes audible between 1/2 to 2/3 of full forward travel of the control handle.

(d) With the control handle in the aft (unlocked) position, extend the harness approximately 10". Maintaining a constant load, move the control handle to the forward position. If the reel is properly locked the harness should not move forward more than a further 1/2".

(e) Release the load on the harness and move the control handle to the unlocked position. The harness cable should retract freely.

(f) Inspect the cable and housing for evidence of fraying and corrosion.

(g) Lubricate by applying a graphite-oil mixture (1 lb. of graphite powder Spec. MIL-G-6711 to one gallon of oil, low temperature, anti-corrosive, General Purpose Spec. 3-GP-335 or MIL-L-7870) sparingly on the cables and conduit openings.

NOTE

The inertia reel assembly is a sealed unit and must not be opened for inspection or repairs.

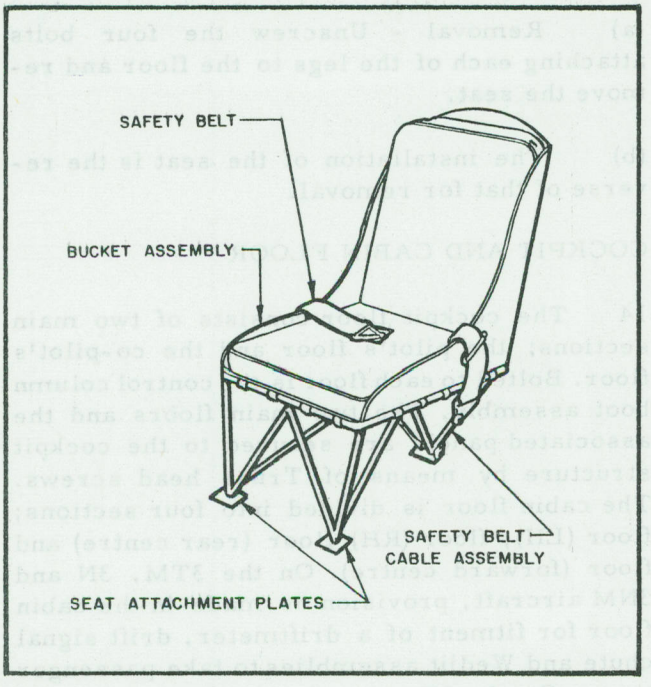


Figure 2-8 Passengers Seat (3T)

PART 2

SECTION 2
WINGS

GENERAL DESCRIPTION

1 The wing is an all-metal, stressed skin, full cantilever structure, consisting of a centre section, engine nacelles and two outer panels.

(a) Centre Section - The primary structure of the centre section consists of a single, heat-treated, welded steel tubular truss. This truss carries the fittings for the engine mounts, landing-gear, and outer wing panel main spars. The remainder of the centre section structure consists of aluminum-alloy ribs, bulkheads, stringers, and a stressed skin covering. The rear spar is a shear beam and supports the centre and inboard flap hinges. Removable panels are provided over the fuel tanks and battery access compartments (See Figure 2-9.

NOTE

Because of the stressed-skin construction of the airframe and the heat-treated tubular main truss, repairs should be attempted only at a designated overhaul unit.

(b) Engine Nacelles - The engine nacelles house the engine mounting structures and landing-gear. They are built as an integral part of the centre section and are not removable. The bottom of each nacelle is equipped with automatically operated doors, which partially enclose the landing-gear when it is retracted.

(c) Outer Wing - The outer wings are constructed of single, load-carrying front spars and aluminum-alloy sheet skin covering. Rear

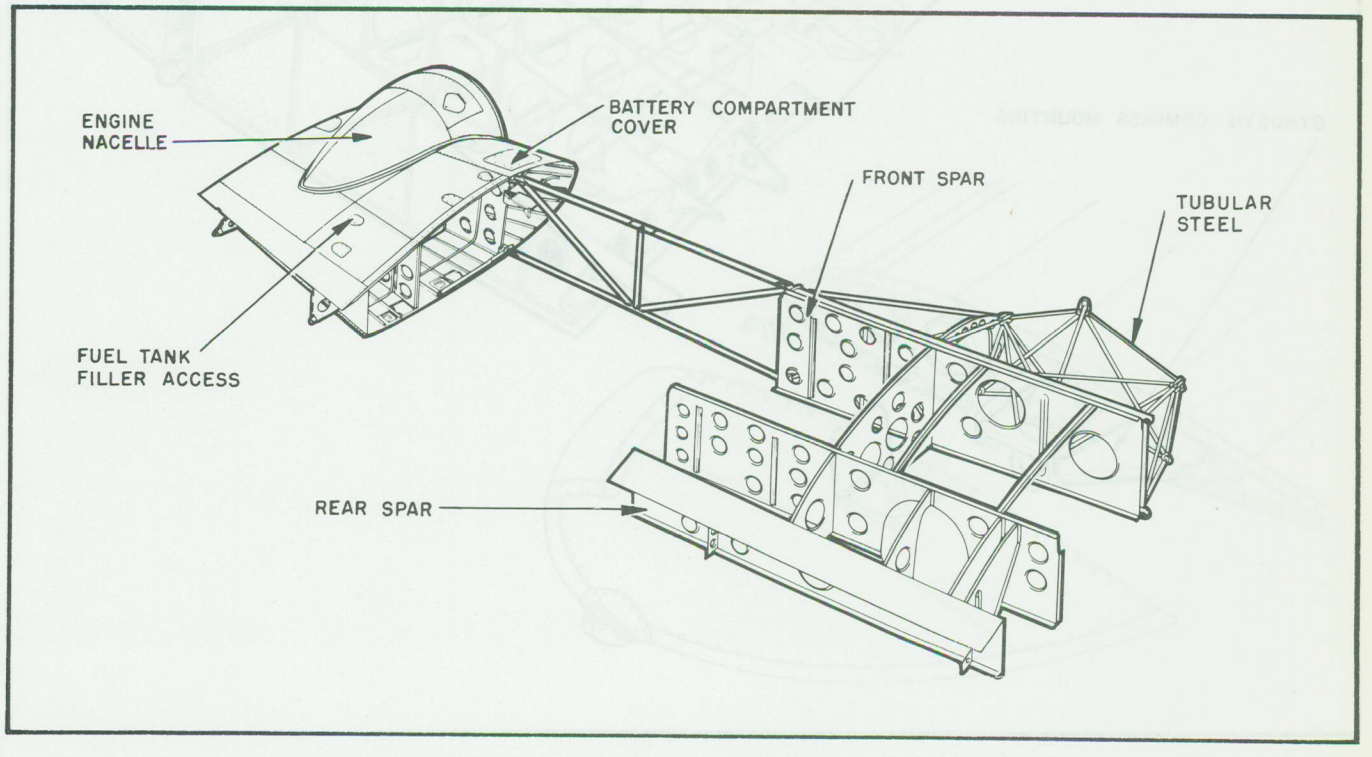


Figure 2-9 Centre Section Wing

spars transfer the shear load between upper and lower skin. The remaining structure consists of ribs and stringers covered by alclad skin. The outer wing front spar attaches to the centre section truss at upper and lower spar fittings with specially tapered spar bolts and nuts. A special nut and bolt also secures the wing rear spar to the rear spar of the centre section wing stub. A fairing strip, riveted to the outer wing skin and attached to the centre section skin with machine screws and elastic stop nuts, is installed over the gap between the wing and centre section (Figure 2-10).

OUTER WING

2 Instructions for the removal, servicing and installation of the outer wing are contained in the following paragraphs.

(a) Removal - To remove outer wing proceed as follows:

(1) Remove wing flap (see Paragraph 6).

(2) Disconnect aileron control cables at turnbuckles in the wheel well.

CAUTION

Aileron cables should be carefully stowed in outer wing panel and wing stub to avoid damage when panel is removed from centre section.

(3) Disconnect aileron tab control cables at turnbuckles in rear centre section just forward of the rear spar (left wing only). Turnbuckles are accessible by removing the doped fabric patches covering the lightening holes in the rear spar at the inboard section of the wing.

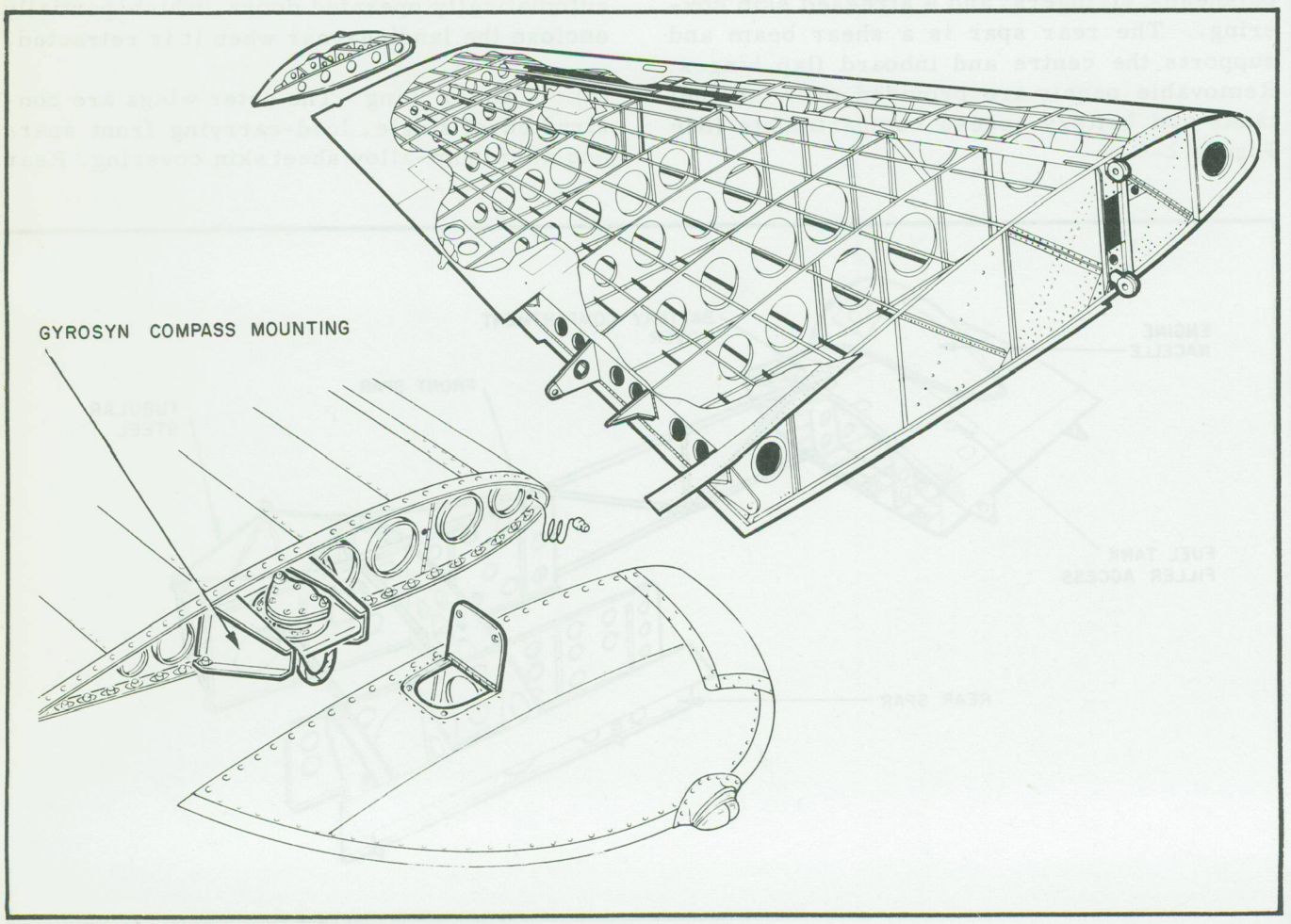


Figure 2-10 Outer Wing Panel and Tip

(4) Disconnect electrical wiring at the disconnect plug in the outer wing root rib located just forward of the centre section truss inside the nacelle.

NOTE

Remove de-icer boots before removing outer wing.

(5) Remove leading edge fairing by removing machine screws from outer wing and nacelle skin.

(6) Remove machine screws from the gap strip between outer wing and centre section.

CAUTION

Support outer wing prior to removing it. If wing is to be removed by hand at least five men should be used, two at wing tip and three at the root. If a hoist and sling are used to support the wing, the sling should be located on the wing ribs to avoid damaging the skin.

(7) Remove the rear spar bolt and nut.

(8) Remove the nuts from the upper and lower front spar bolts located inside the nacelle. Remove the spar bolts with a spar-bolt puller, Beech Aircraft Part 182061.

(9) Remove wing by slipping it clear of centre section.

NOTE

The front spar bolts pass through replaceable bushings in the centre section and outer wing spars. The bushings are taper-reamed to a close fit. If it is necessary to replace the outer wing with a new one or if the bushings are damaged, new bushings must be fitted and taper reamed as outlined in paragraph 2(c)(1).

(b) Servicing - Minor repairs only may be made by operating units. Major repairs to the skin and ribs should be accomplished only by a designated overhaul unit because of the stressed-skin construction of the outer wing.

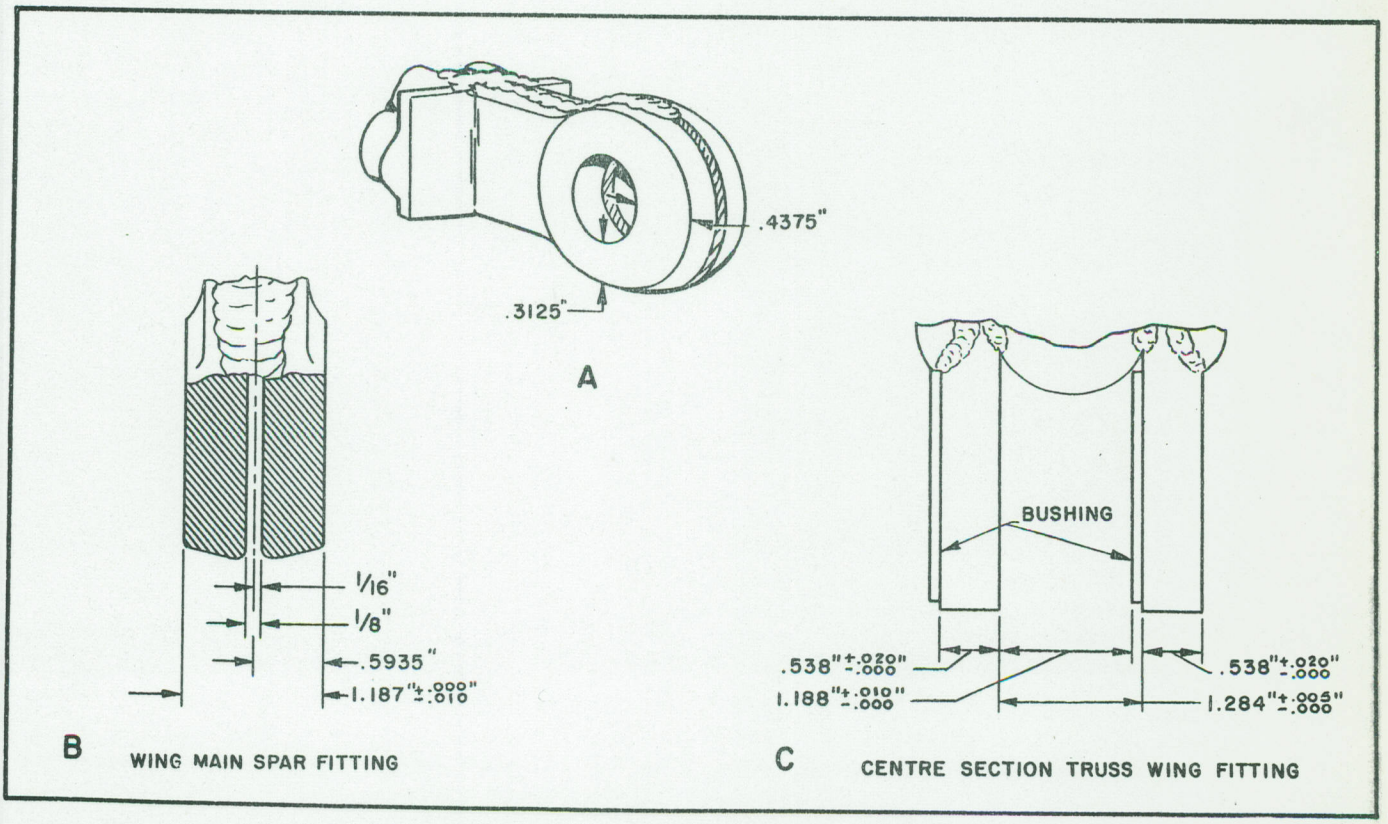


Figure 2-11 Wing Fitting Dimensions

The tubular structure of the wing front spar is corrosion proofed on the inside by slushing with linoil. This slushing is done after the assembly is complete, and the oil is allowed to drain from small holes which are later plugged with drive screws and from the two unwelded seams of the wing attachment fitting which are sealed with solder. Due to the many angles and joints in the structure, a considerable quantity of linoil may be trapped inside the tubes. In operation the drive screws and soldered seams may loosen up and allow the linoil to leak out. Such leaks are of course unimportant structurally and immediate corrective action is not warranted. Results of magnaflux of many hundreds of wing spars; which have had linoil seepage, have not revealed any cracks in the tubular structure or the hinge fitting.

(c) Installation - To install outer panel proceed as follows:

(1) When a wing is to be installed on an aircraft other than the one it was originally on, it will be necessary to replace the bushings in both the centre section truss and the main wing spar. Fit wing as follows:

a. In the centre section truss, the bushings are a press-fit and can be driven out. Do not remove the 1/8-inch pin in the fittings. Replace the old bushings with new bushings (Beech Part 184214) (see Figure 2-22). These bushings are to be pressed in securely.

b. The bushings in the wing spar are also a press-fit and can be driven out. Replace the old bushings with new ones (Beech Part 181417) (see Figure 2-22). After the new bushings are pressed in, relocate the pins used to prevent the bushings from turning while the reaming operations are being performed. This can be done by drilling the No. 31 (.120) hole in a new location and driving the pin in. The pins are 1/2-inch long and are made from 1/8-inch diameter steel rod.

(2) Oversize Bushing in Centre Section Truss - The following procedure is intended to be used on aircraft where the dimensions of the centre section truss wing fittings are the same as the dimensions shown in View C, Figure 2-11. Under no conditions is this procedure to be attempted on aircraft which have fittings of a lesser dimension than those shown in view C, unless a thorough stress analysis of the fitting is made. Install the oversize bushing as follows:

a. Check the centre section truss fitting to determine if the hole is oversize. If the hole is over 1.251 inches in diameter, the hole is oversize and an oversize bushing must be installed.

b. Ream the oversize hole to 1.281 plus .000 minus .001.

c. Check the centre section truss wing fitting wall thickness (0.4375 and .3125) as shown in View A, Figure 2-11. Note that the outer surface of the wing fitting is forged at an angle. Measure the wall thickness on the side of the fitting which has the lesser wall thickness.

WARNING

The wing fitting wall thickness (0.4375 and 0.3125) are extremely critical dimensions. If the wall thickness is less than that specified, failure of the wing fitting while in flight, may occur. If after reaming, the wall thickness is less than that specified, the centre section truss must be rejected and a thorough stress analysis must be made to see if the fittings can be used. If the fittings are unserviceable, the entire outrigger section of the centre section truss must be replaced. (See EO 05-45B-3).

d. If the wall thickness is correct as shown in View A, install oversize bushing, Part MRB A24491 in the centre section truss wing fitting.

e. Place wing in position for reaming and ream wing.

f. Remove wing and check the holes in the centre section truss wing fittings and the outer wing panel main spar fittings for correct reaming.

NOTE

The holes must be checked for correct reaming if it is believed that incorrect or over-reaming may have inadvertently enlarged the wing fitting holes. This repair procedure pertains to the installation of a special oversize bushing, Part MRB A24491, in the centre section truss wing fitting only.

(3) Oversize Bushing in Outer Wing Panel Main Spar - The following procedure is intended to be used on aircraft of which the dimensions of the outer wing panel main spar fittings are the same as the dimensions shown in View B, Figure 2-11. Under no conditions is this procedure to be attempted on aircraft which have wing fittings of a lesser dimension than those shown in View B, unless a thorough stress analysis of the fitting is made. Install the oversize bushing as follows:

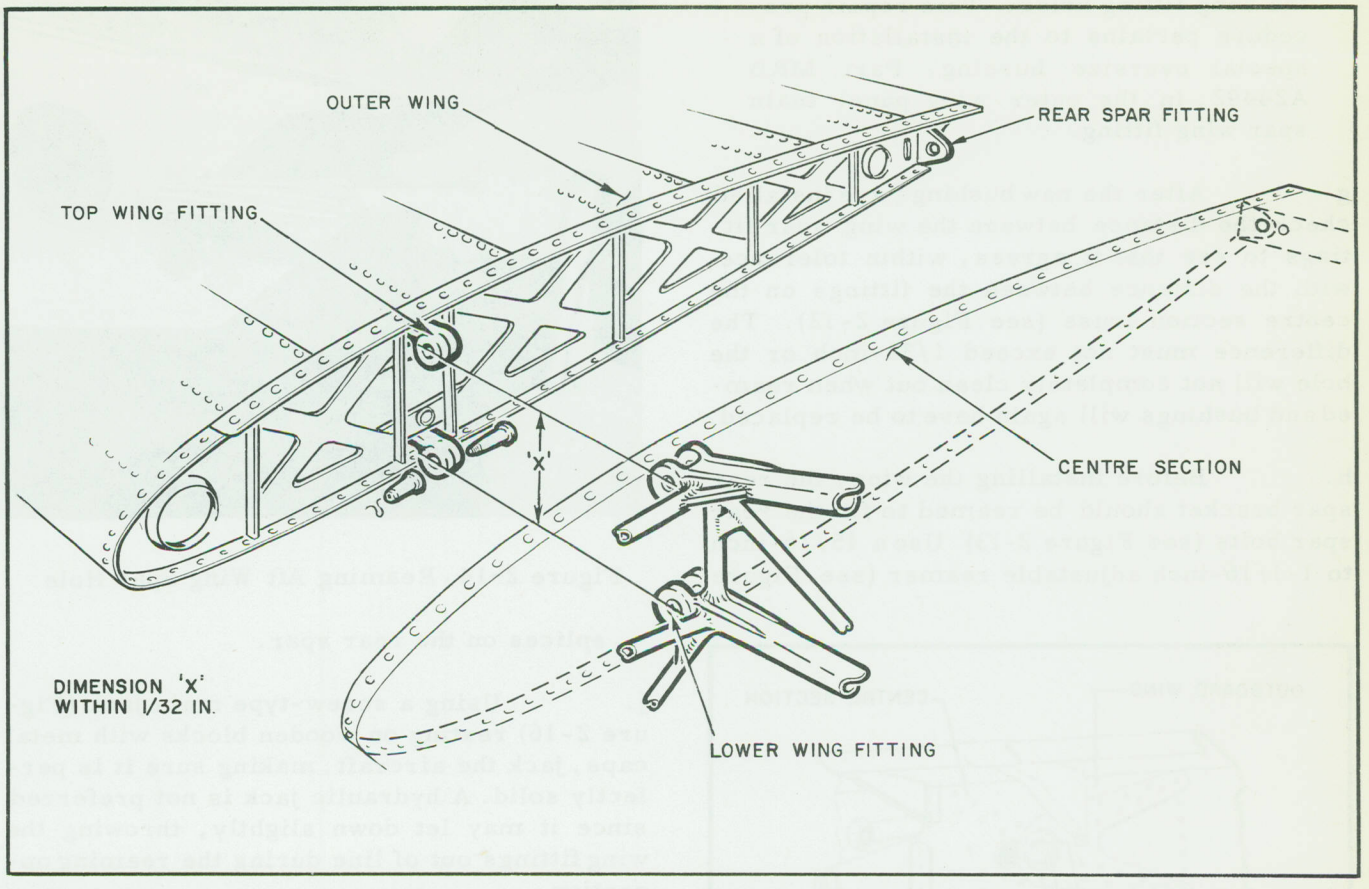


Figure 2-12 Wing Fittings

a. Check the spar fitting to determine if the hole is oversize. If the hole is over 1.250 inches in diameter, an oversize bushing must be installed.

b. Ream the oversize hole to 1.273 plus .0005 minus .001.

c. Check the wing fitting wall thickness (.4375 and .3125) as shown in View A, Figure 2-11. Note that the outer surface of the wing fitting is forged at an angle. Measure the wall thickness dimension on the side of the fitting having the lesser wall thickness.

WARNING

The wing fitting wall thickness (.4375 and .3125) are extremely critical dimensions. If the wall thickness is less than that specified, failure of the wing fitting while in flight, may occur. If after reaming, the wall thickness is less than specified, the outer wing panel must be rejected and a thorough stress analysis of the fitting must be made to determine if it can be used, or the main spar replaced.

d. If the wall thickness is correct, as shown in View A, Figure 2-11, press in oversize bushing, Part MRB A24492, into wing fitting.

e. Place wing in position for reaming, and ream wing.

f. Remove wing and check the holes in the outer wing panel main spar and the centre section truss for correct reaming.

NOTE

The holes must be checked for correct reaming if it is believed that incorrect reaming may have inadvertently enlarged

the wing fitting holes. This repair procedure pertains to the installation of a special oversize bushing, Part MRB A24492, in the outer wing panel main spar wing fitting.

g. After the new bushings are installed, check the distance between the wing spar fittings to see that it agrees, within tolerance, with the distance between the fittings on the centre section truss (see Figure 2-12). The difference must not exceed 1/32-inch or the hole will not completely clean out when reamed and bushings will again have to be replaced.

h. Before installing the wing, the rear spar bracket should be reamed to fit the rear spar bolts (see Figure 2-13). Use a 15/16-inch to 1-1/16-inch adjustable reamer (see Figure

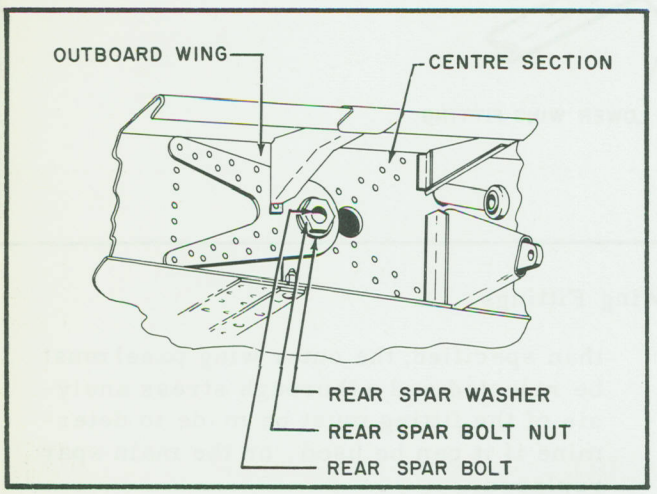


Figure 2-13 Rear Spar Fittings

2-19, Item 2), and enlarge the hole just enough to let the straight reamer start (Figure 2-12). Make several light cuts and hold the reamer steady during the operation to prevent a rough finish in the hole. With the proper size hand reamer (Figure 2-19, Item 1) and taking care to guide it properly, finish reaming the hole so the hinge bolt will fit snugly. The reamer must be turned smoothly and steadily and fed with an even pressure.

CAUTION

Take extreme care to use the correct size reamers. An oversize hole will necessitate replacement of the "V"

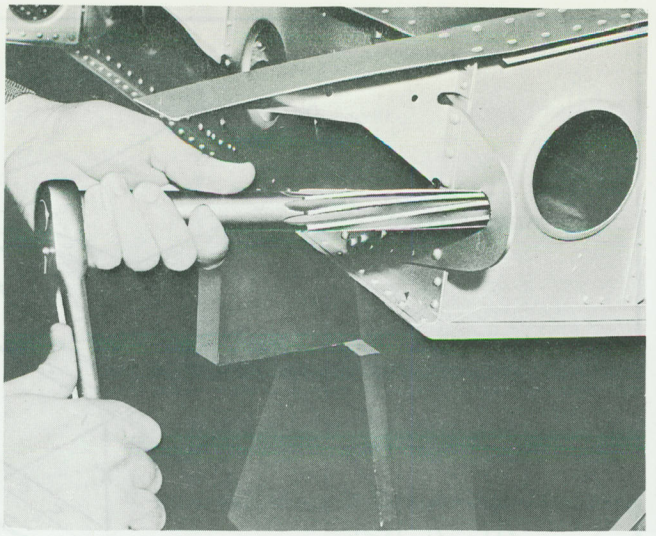


Figure 2-14 Reaming Aft Wing Spar Hole

splices on the rear spar.

j. Using a screw-type main jack (Figure 2-16) resting on wooden blocks with metal caps, jack the aircraft, making sure it is perfectly solid. A hydraulic jack is not preferred, since it may let down slightly, throwing the wing fittings out of line during the reaming operation.

k. Employing no less than five workmen, install the wing in position for reaming. Lift only on ribs and spars. Two workmen should be at the tip of the wing and three at the root end. One of the latter should face the leading edge and one the trailing edge, both near the root rib, and lift with their hands; the other man at the root end can stoop over, let

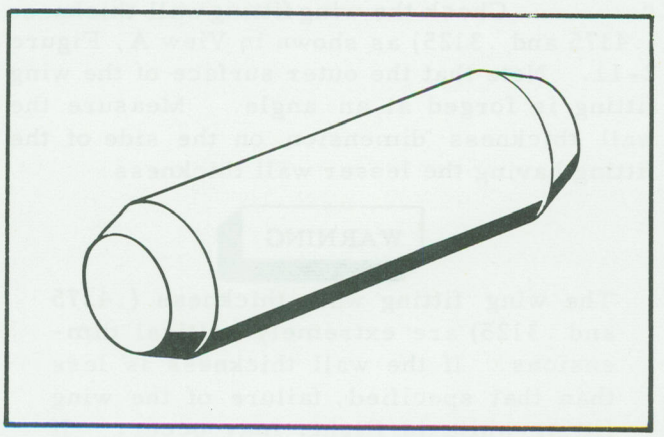


Figure 2-15 Temporary Hinge Pin

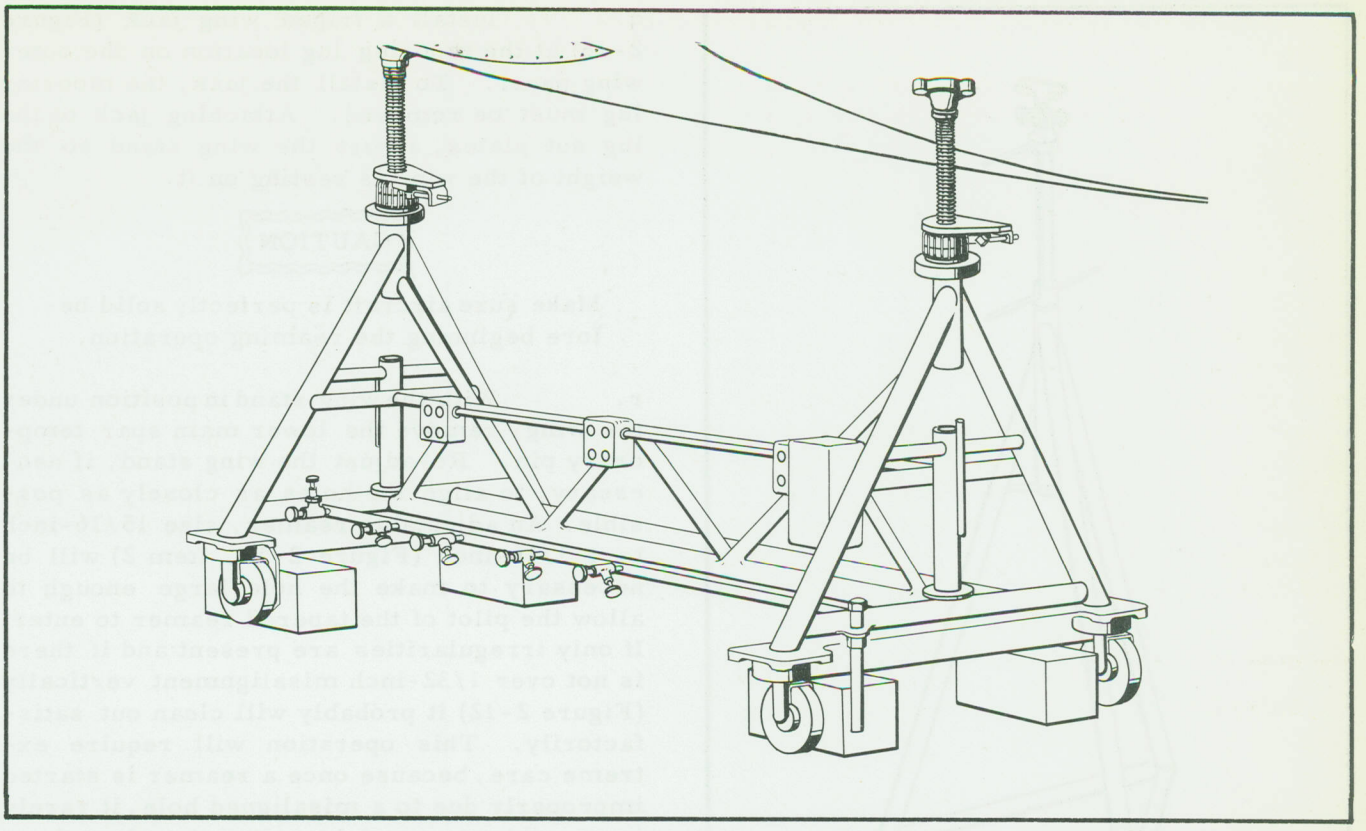


Figure 2-16 Main Jacks on Wooden Blocks

the wing rest against his back, and lift with his legs and arms by bracing his hands above his knees.

m. Align the lower spar fitting and insert the temporary hinge pin (Figure 2-15) in lower spar fitting.

NOTE

The temporary pin is 15/16-inch in diameter, bevelled at both ends, and can be inserted from inside the nacelle.

n. This pin will now totally support the root end of the wing, allowing the workman at the leading edge to guide the top wing gap strip over the stub skin by inserting a strip of metal about 4 inches wide between the stub skin and gap strip (Figure 2-17). The workmen at the root end trailing edge will, at the same time, help take care of the top guide strip and bottom gap strip. The two workmen at the tip will remain there to raise it into position and the man at the nacelle will remain there to install the upper pin and keep a careful watch to see that nothing binds or is damaged while the wing is being raised.

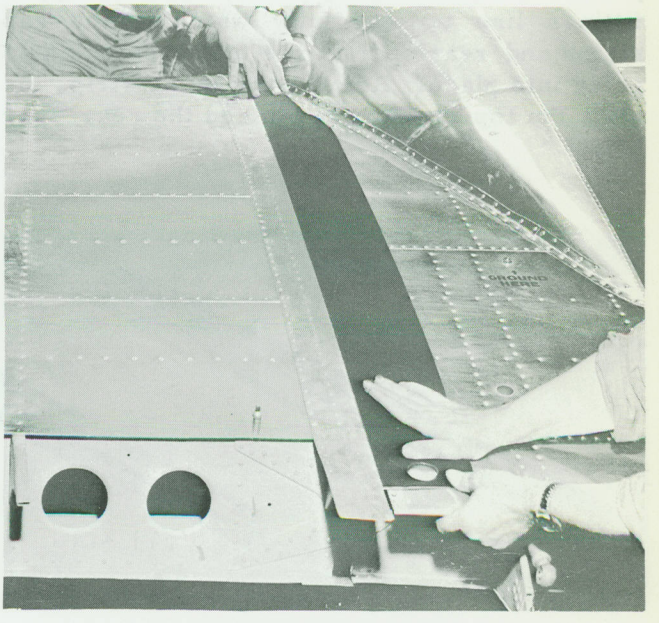


Figure 2-17 Guide Strip in Place

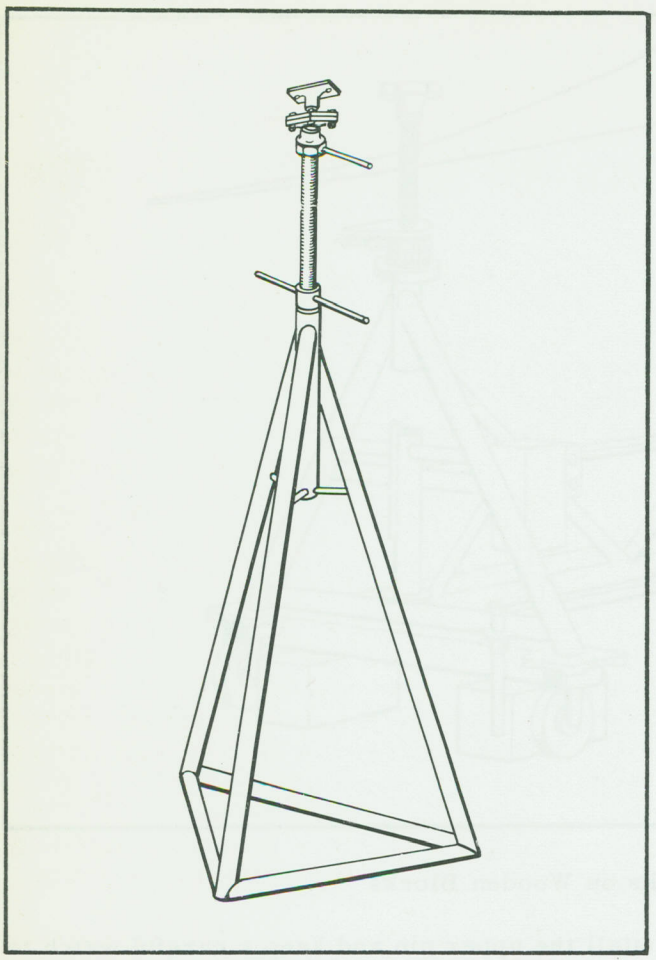


Figure 2-18 Tripod Wing Jack

p. Raise the tip slowly until the upper fittings line up, carefully watching the gap strips and rear spar to see that everything is going into place. Remove the guide strip, install the top temporary pin and the rear spar bolt.

q. Install a tripod wing jack (Figure 2-18) at the mooring lug location on the outer wing panel. To install the jack, the mooring lug must be removed. Attaching jack to the lug nut plates, adjust the wing stand so the weight of the wing is resting on it.

CAUTION

Make sure aircraft is perfectly solid before beginning the reaming operation.

r. With the wing stand in position under the wing, remove the lower main spar temporary pin. Re-adjust the wing stand, if necessary, to align the holes as closely as possible. An adjustable reamer, size 15/16-inch to 1-1/16-inch (Figure 2-19, Item 2) will be necessary to make the hole large enough to allow the pilot of the tapered reamer to enter. If only irregularities are present and if there is not over 1/32-inch misalignment vertically (Figure 2-12) it probably will clean out satisfactorily. This operation will require extreme care, because once a reamer is started improperly due to a misaligned hole, it rarely is possible to straighten it out and make a clean hole.

s. The actual reaming operation is started with a "rough" reamer (Figure 2-19, Item 4) which is a used taper reamer, sharpened primarily for cutting and not to produce a smooth finish. The rough reamer is used until the shoulder on the small end of the hinge bolt lacks approximately 1/4-inch of being flush with the front surface of the bushing.

t. Change to the finishing reamer (Fig-

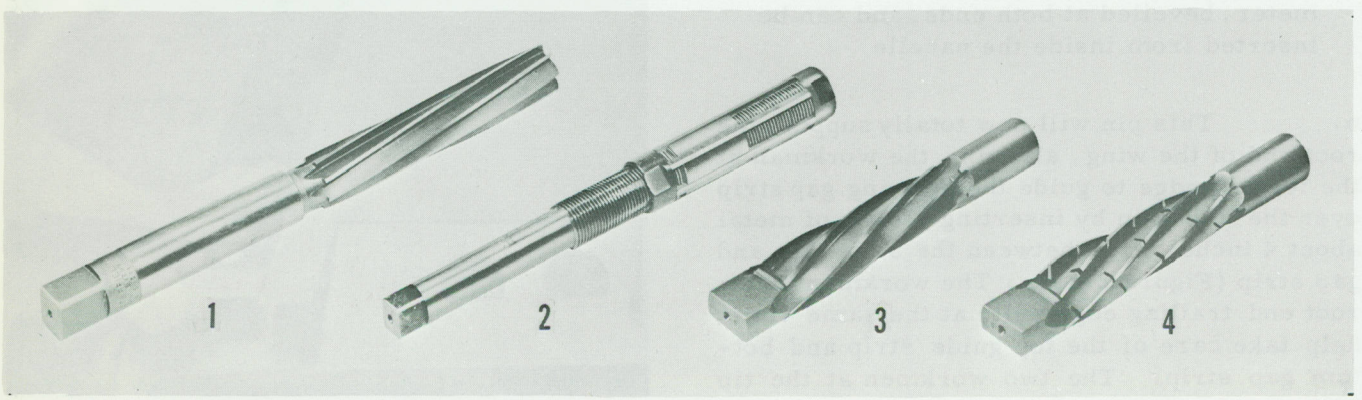


Figure 2-19 Wing Hinge Reamers

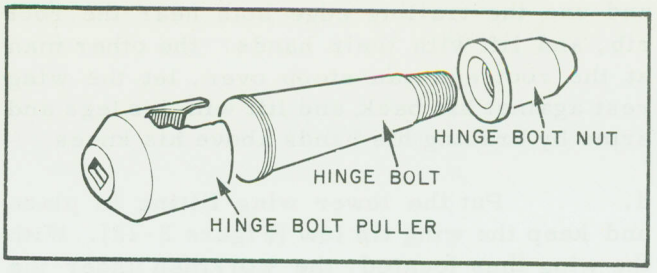


Figure 2-20 Wing Hinge Bolt and Puller

ure 2-19, Item 3) to give a smooth surface in the hole. This reamer is used until the shoulder on the tapered wing bolt is flush with the front surface of the bushing in the truss fitting, leaving about 3/16-inch clearance between the head of the bolt and the fitting. It is preferable to finish with the hinge bolt shoulder flush, but the bolt may extend beyond the bushing so long as it does not bottom in the nut or the head radius is not pulled into the bearing surface.

u. Clean out the hole, making sure all cutting oil and cuttings are removed. To check the bolt for proper fit and bearing surface, put a very thin coat of Prussian (bearing) blue or similar substance on the surface of the bolt. Then place the bolt in the reamed hole and hit it a solid blow with a rawhide mallet. Remove the bolt carefully with a bolt puller (Figure 2-20) so as not to distrub the blue coating. The blue coating will show where the bolt came in contact with the spar. If there is less than 85 percent of the surface touching, it is not acceptable and new bushings must be installed and reamed.

v. If the fit is satisfactory, insert the bolt, install the nut, and tighten it snugly to prevent the bolt from accidentally coming out.

w. Repeat steps r., s., t., u. and v. on the top joint.

x. Check and mark the gap strip and stub skin for the trimming necessary to have proper clearance between the wing and stub. The wing root rib must clear the wing stub by approximately 1/8-inch and the gap strip should clear the rivets on the stub by 1/8-inch, both top and bottom.

y. Using the 1/4-inch holes in centre-section stub as guides, drill 11/64-inch holes through gap strip for installation of screws.

z. Remove the wing. Trim the stub and wing to marks mentioned in Step (r), keeping proper edge distance in mind.

(4) Reaming Precautions - The following precautions should be observed:

a. It is important to note that "chatter marks" should not be allowed to develop, since once they occur, the condition tends to become worse. Generally, the best way to remove "chatter marks" is to use more pressure on the reamer and slow steady turning.

b. The air-driven "power vane" is used to operate the reamer (Figure 2-21) and a steady pressure is applied to feed the reamer into the work. However, the hand methods, using an extension handle on a hand ratchet wrench, with the proper adapter to fit the reamer, will suffice if a "power vane" is not available.

c. Keep reamers well lubricated with cutting oil (3-GP-344a, RCAF Ref. 34A/174).

d. Reamers must be removed to clean cuttings from hole at frequent intervals. Cuttings in the hole will often reduce the efficiency of the reamer and slow up reaming operations. Before removing the reamer from the hole, the pressure and speed must be reduced gradually

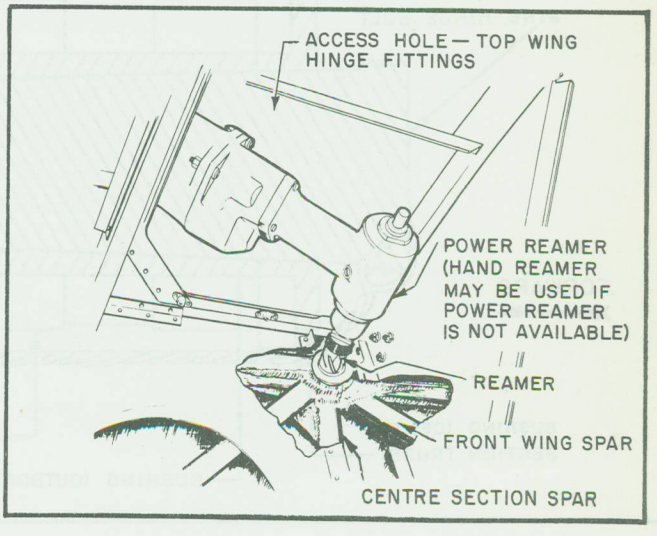


Figure 2-21 Reaming Truss Fitting

to prevent marking of bushings.

NOTE

All reaming operations on the wings, are done from the aft side.

(5) Outer Wing After Reaming - To Install outer wing after reaming proceed as follows:

a. Thoroughly clean the interior of the wing and stub; check for loose objects that may not have been picked up by the vacuum cleaner, or other cleaning methods, by shaking the wing. At least five workmen are required for this operation, two at the tip and three at the root end. Shake the wing up and down a few times, holding the cables taut to prevent their rattling, and listen for loose objects. Be sure lifting pressure to the wing is applied only at the ribs and spars.

b. Coat the main and rear spar bolts with powdered graphite (Specification 3-GP-805, RCAF Ref 34A/208. Use a small amount of thread lubricant (3-GP-802, RCAF Ref 34A/58) on the threads of the rear spar bolt.

c. Employing no less than five workmen, install the wing in position. Lift only on ribs and spars. Two workmen should be at the tip of the wing and three at the root end. One of the latter should face the leading edge and one the trailing edge both near the root rib, and lift with their hands: the other man at the root end can stoop over, let the wing rest against his back, and lift with his legs and arms by bracing his hands above his knees.

d. Put the lower wing fitting in place and keep the wing tip low (Figure 2-12). With the wing thus located, the workmen under the spar can get inside the nacelle through the wheel well and install the wing hinge bolt placing the safety wire hole straight up to facilitate safetying. Strike the bolt solidly with a rawhide mallet so it will stay in place.

e. Align the lower spar fitting and insert the temporary hinge pin (Figure 2-15) in lower spar fitting.

NOTE

The temporary pin is 15/16-inch in diameter, bevelled at both ends, and can be inserted from inside the nacelle.

f. This pin will now totally support the root end of the wing, allowing the workman at the leading edge to guide the top wing gap strip over the stub skin by inserting a strip of metal about 4 inches wide between the stub skin and gap strip (Figure 2-17). The workmen at the root end trailing edge will, at the same time,

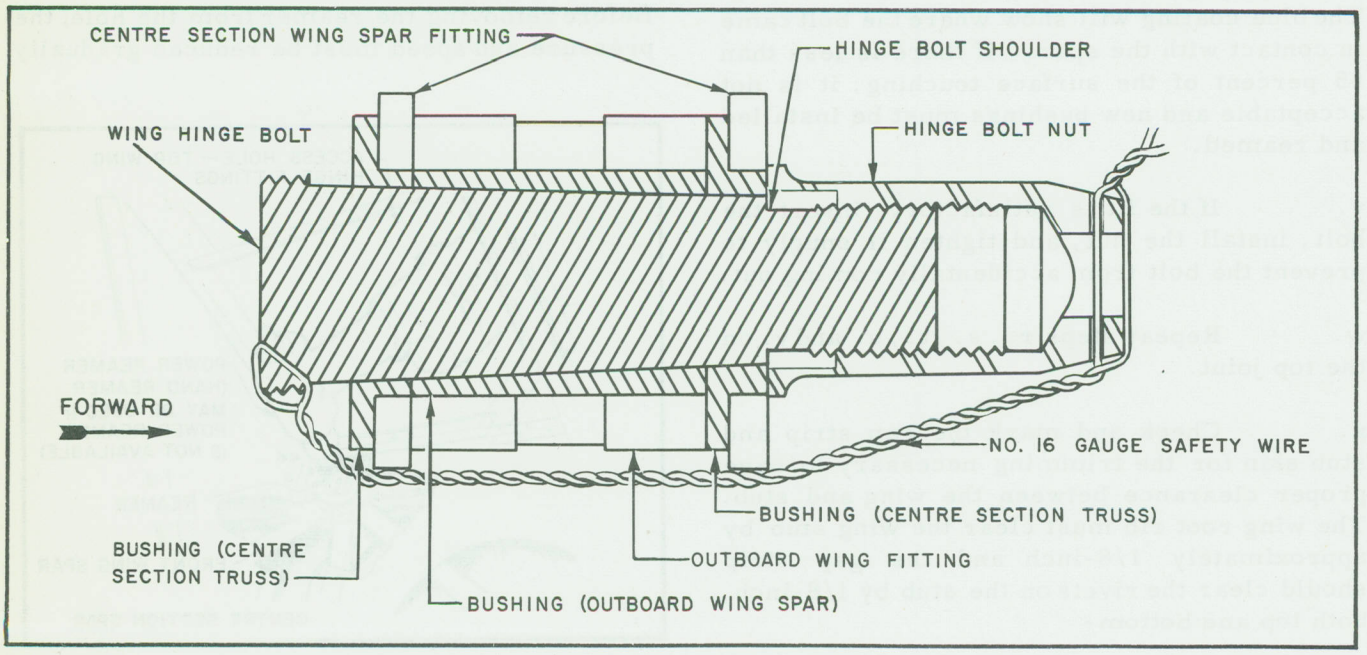


Figure 2-22 Cross Section Of Wing Mounting

help take care of the top guide strip and bottom gap strip. The two workmen at the tip will remain there to raise it into position and the man at the nacelle will remain there to install the upper pin and keep a careful watch to see that nothing binds or is damaged while the wing is being raised.

g. Raise the tip slowly until the upper fittings line up, constantly watching the gap strips and rear spars to see that everything is going into place properly. Remove the guide strip and install the top bolt with the safety wire hole down and slightly outboard.

h. Install the rear spar bolt, tighten, and safety. Install nuts on the main spar bolts. Tighten them securely and safety (Figure 2-22, and 2-13).

j. Install gap-strip screws. Tighten them and back off one-quarter of a turn to allow for wing fluctuation in flight.

k. Install the wing hinge inspection cover and check for a minimum clearance of 1/8-inch between it and the wing root rib.

m. Install the wing nacelle fillet around the leading edge of wing.

n. Connect electrical plugs.

p. Connect aileron and aileron tab cables. Rig cables.

q. Replace patches over lightening holes with pre-doped fabric, Specification MIL-C-5643, using nitrate dope, Specification 1-GP-31.

r. Install flap and inspect for proper rigging.

WING TIPS

3 The wing tips are of the same general construction as the outer wing. They are attached to the wing by a hinge wire through a hinge on the outboard wing rib, and by machine screws through the skin of the wing and the wing tip (Figure 2-10).

(a) Removal - Remove wing tip as follows:

(1) Remove that portion of the de-icer boot which extends over the wing tip.

(2) Remove the wing navigation light. Disconnect the electrical wiring at the navigation light socket. Remove the plexiglass plate.

(3) Remove the machine screws which attach the wing tip to the outer wing.

(4) Remove the screws holding the wing tip hinge-wire cap.

(5) While pulling upward on the hinge wire, move the wing tip slowly to free the hinge wire.

(6) Pull the wing tip outward until it is clear of the wing. When removing the right wing tip ensure that it clears the gyrosyn compass mounting, fitted to the outer wing outboard rib.

(b) Installation - Install wing tip as follows:

(1) Swing the wing tip into position and mate the hinge at the front spar. Drive in the hinge wire until the bent end of the wire is against the wing skin.

(2) Install the machine screws through the wing tip and outer wing skin.

(3) Place the cap over the hinge wire on the wing and tighten the screws.

(4) Insert the plexiglass plate behind the navigation light. Connect the wire socket and install the light.

(5) Replace the de-icer boot and attachment strips.

AILERONS

4 Ailerons are hinged to the outer wing by a piano-type hinge extending almost the full length of the aileron. The ailerons are fabric covered, with an aluminum alloy structure. (Figure 2-23).

(a) Removal - Remove aileron as follows:

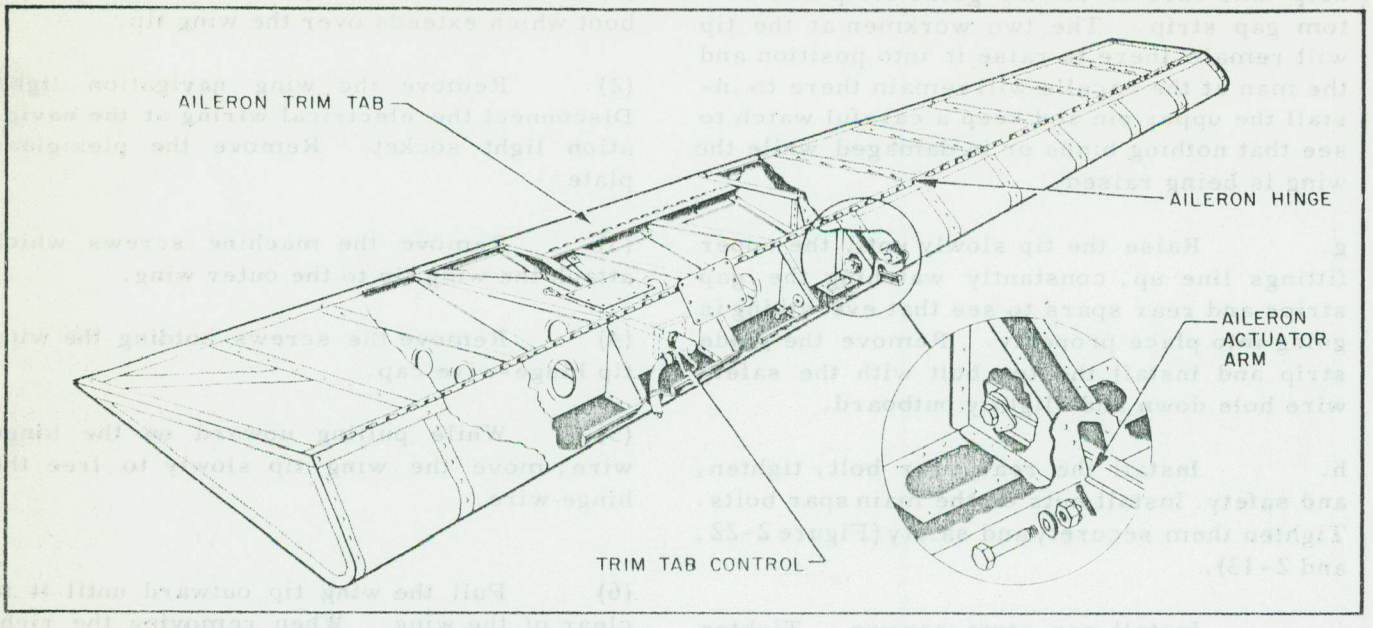


Figure 2-23 Aileron Assembly

(1) Disconnect the aileron actuating link by removing the bolt attaching the link to the aileron.

(2) Disconnect aileron tab flexible drive from the 90-degree drive in the outer wing. Detach protective boot.

(3) Disconnect bonding straps at the inboard and outboard ends of the aileron.

(4) Remove the aileron hinge wire by removing the safety lug and inserting end of wire in a drill chuck, rotating and pulling wire at the same time.

(5) Remove aileron by slipping it aft until hinges and tab flexible drive are clear of the wing.

(b) Servicing - Small tears or holes in the fabric may be repaired by doping a fabric patch in place. The patch should be Grade A cotton airplane cloth and should overlap the edges of the hole or tear a minimum of two inches. Nitrate dope, Specification 1-GP-31, should be used. Major repairs should be accomplished at a designated overhaul unit.

(c) Installation - Install aileron as follows:

(1) Place the aileron in position and mate the hinges.

(2) Drive in aileron hinge wire using a setup as shown in Figure 2-24.

(3) Fit hinge wire into safety lug at inboard end of aileron. Fit safety lug at outboard end and squeeze lug together to secure hinge wire.

(4) Connect the aileron tab flexible drive shaft to the 90-degree drive in the wing. Raise the left aileron to the full up travel, pull out the leather boot and tie to the flexible shaft with safety wire. Aileron travel must not be restricted by the flexible drive shaft or the boot.

(5) Connect bonding straps at inboard and outboard ends of aileron.

(d) Adjustment - To adjust aileron refer to Part 2, Section 4.

AILERON TRIM TAB

5 There is a controllable trim tab on the left aileron only.

(a) Removal - Remove aileron trim tab as follows:

(1) Disconnect actuator arm from tab horn.

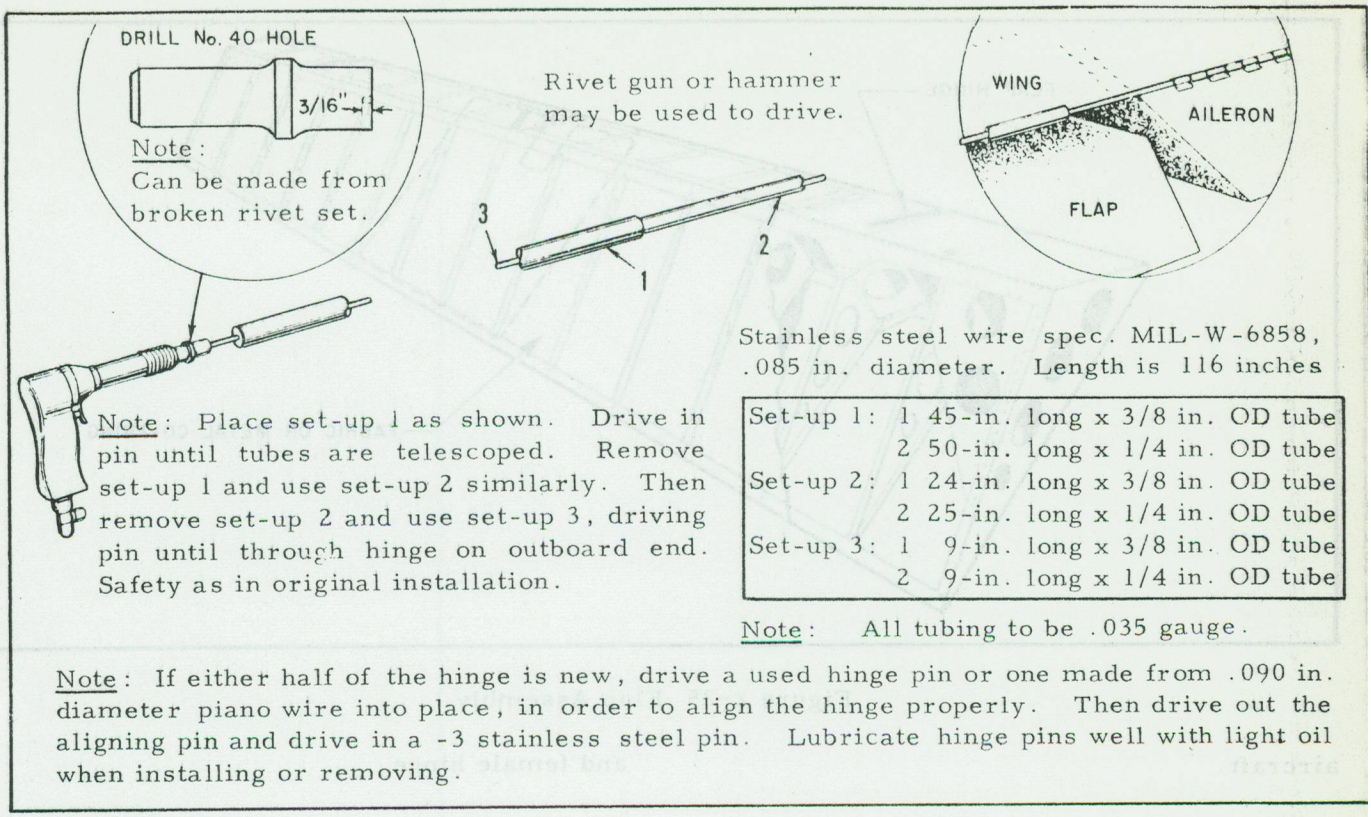


Figure 2-24 Aileron Hinge Wire Installation

(2) Remove hinge wire and tab.

(b) Servicing - Check for worn hinge. Repair at a designated overhaul unit if necessary.

(c) Installation - Install aileron trim tab as follows:

(1) Place tab in position and install new stainless steel hinge wire.

(2) Connect actuator arm to tab horn.

WING FLAPS

6 There are two types of wing flaps; all-metal and fabric-covered. Both types are constructed of aluminum alloy. The main and nose ribs are attached to a single spar. The all-metal flaps are covered with aluminum alloy sheet. The fabric-covered flaps are protected at the leading edge by a metal nose plate, and at the trailing edge by a rolled section. Further protection is provided by a metal plate attached to the under surface. This plate protects the flaps from the exhaust blast and debris thrown by the wheels. Both types of flaps are attached to the rear wing spar with three hinge brackets, (Figure 2-25). The metal and fabric covered flaps are interchangeable without effect on flying characteristics.

(a) Removal - Remove flaps as follows:

(1) Lower flaps and disconnect flap control screw assembly.

NOTE

To prevent accidental turning of the flap control screw assembly, secure with wire to the wing structure. This will ensure that the same rigging adjustment is maintained.

(2) Disconnect bonding straps at inboard and outboard ends of flap by removing attaching screws.

(3) Remove the inspection window patches from the lower side of the flap and remove the three hinge bolts. Slip flap aft until clear of

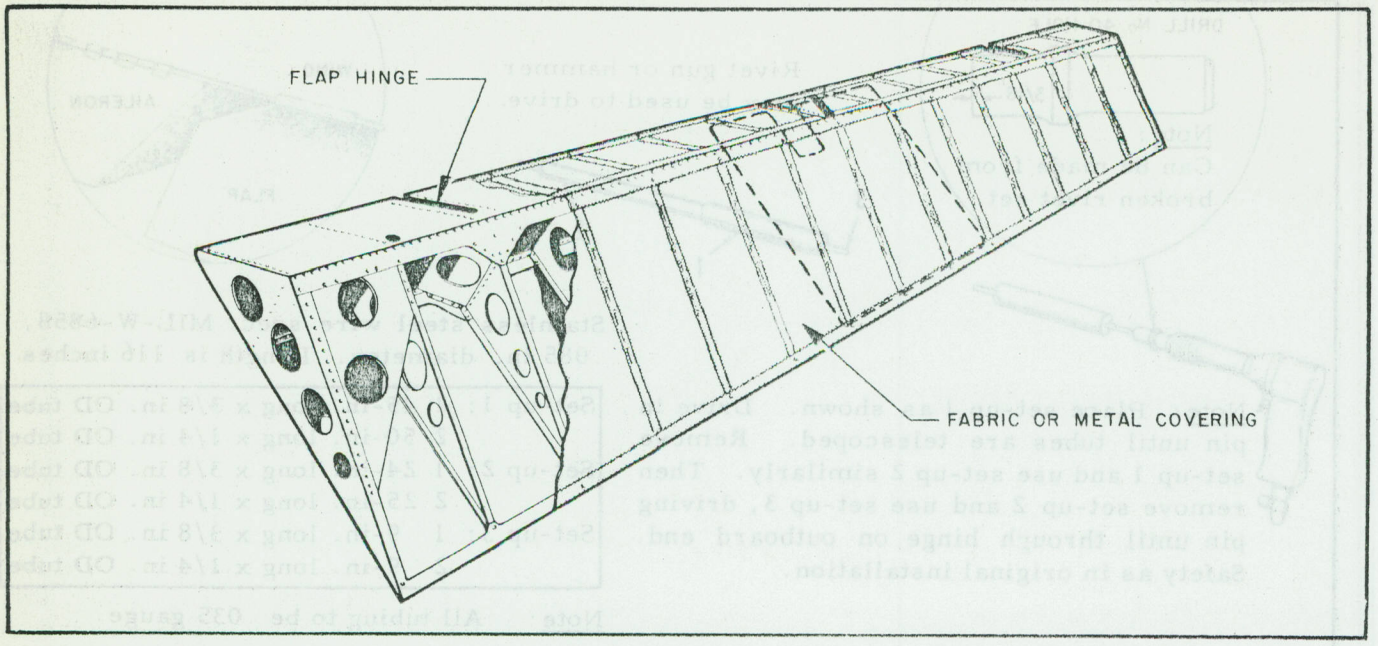


Figure 2-25 Flap Assembly

aircraft.

(b) Servicing - Minor repairs to the fabric may be accomplished by patching. Dope the patch in place with nitrate dope (Specification 1-GP-31). Major repairs should be accomplished at a designated overhaul unit.

(c) Installation - To install flap proceed as follows:

(1) Position flap on hinge brackets and insert hinge bolts.

(2) Move flap up and down to check alignment and clearance of the brackets with the slots in the flap.

(3) If clearance is maintained throughout full travel, install nuts on hinge bolts, tighten and install cotter pins.

(4) Insert bolt attaching the flap control screw assembly to the horn on the flap.

(5) Check the hinge bearing for any evidence of binding.

(6) When installing the flap, use shims to eliminate any gap between the bearing race and female hinge.

(7) Tighten the attaching bolts so that the female hinge flanges hold the inner bearing race firmly. The bolt should be drawn snug to prevent working in the female hinge. The use of 4 or 5-inch box-end or open-end wrenches is recommended, using a moderate force to tighten the bolt.

(8) After installation and each periodic inspection, the hinge bolts should be checked for any indication of working in the female hinge. This may be done by attempting to rotate the bolt with a 4 or 5-inch wrench. If wear or looseness is detected, determine if shims are necessary and reinstall as in (7) above.

CAUTION

A 4 or 5-inch midget-type wrench is recommended to tighten the flap hinge bearing bolts to prevent excessive torque. If only standard wrenches are available, maintenance personnel should be made aware of the risk of over-torquing.

(9) Connect bonding straps at inboard and outboard end of flap.

(d) Adjustment - To adjust wing flap travel refer to Part 2, Section 5.

PART 2

SECTION 3

EMPENNAGE

GENERAL DESCRIPTION

1 The empennage (Figure 2-26) consists of a horizontal stabilizer, two vertical stabilizers an elevator and two rudders.

(a) Horizontal Stabilizer - The horizontal stabilizer is of a conventional riveted sheet-metal construction and has two spars of aluminum-alloy sheet. The elevator hinges are attached to the rear stabilizer spar. The stabilizer is attached to the fuselage by fillister-head machine screws (Figure 2-28).

(b) Vertical Stabilizer - The construction of the vertical stabilizer is similar to that of the horizontal stabilizer. The vertical stabilizers are attached to the horizontal stabilizer by machine screws anchored in the vertical stabilizer with self-locking nuts (Figure 2-27).

(c) Elevator - The elevator construction is of aluminum-alloy with a main spar, formed ribs and fabric covering. It is attached to the horizontal stabilizer by five cast-aluminum hinge brackets. Two trim tabs are located on the trailing edge of the elevator (Figure 2-29).

(d) Rudder - The two rudders are similar to the elevator in construction. They are

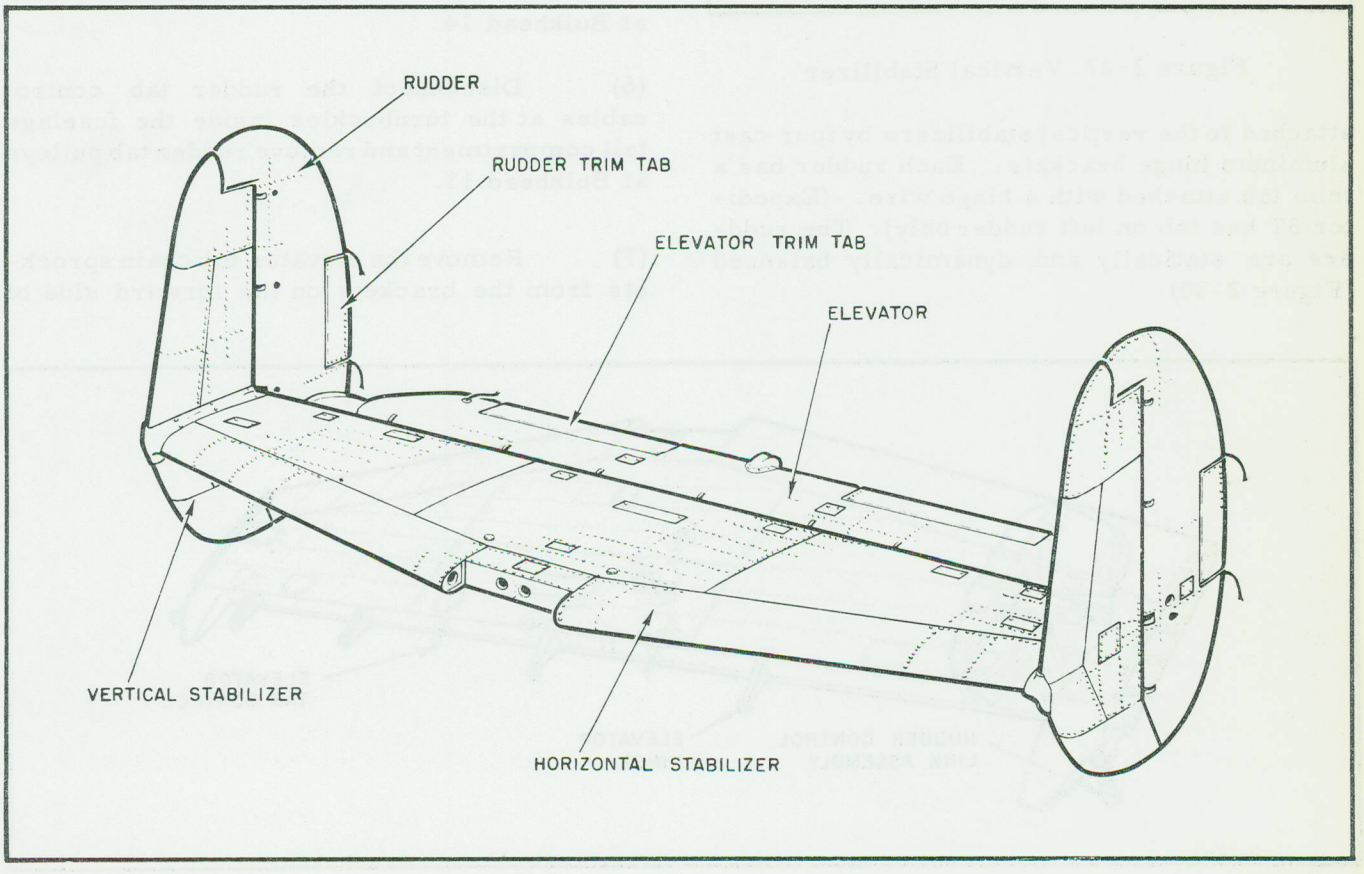


Figure 2-26 Empennage

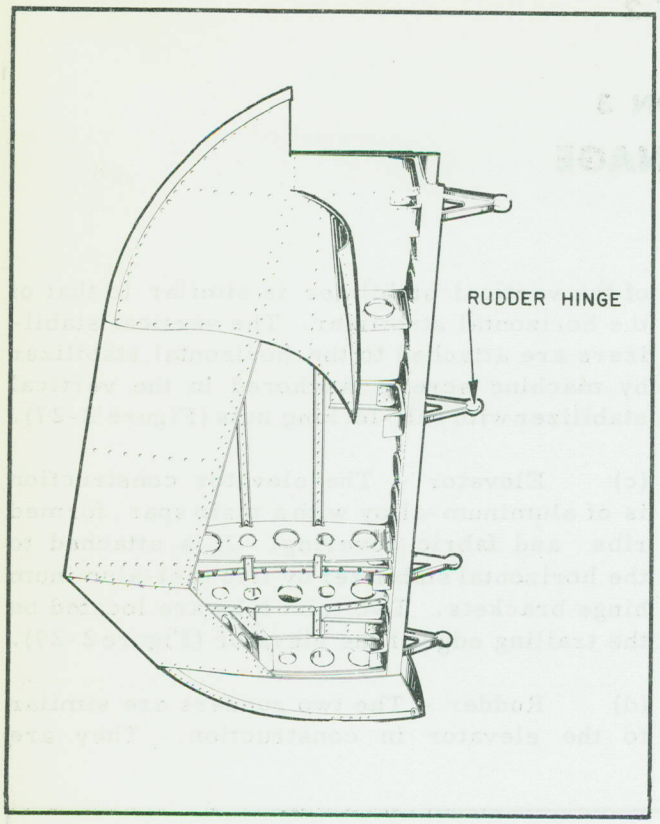


Figure 2-27 Vertical Stabilizer

attached to the vertical stabilizers by four cast aluminum hinge brackets. Each rudder has a trim tab attached with a hinge wire. (Expeditor 3T has tab on left rudder only). The rudders are statically and dynamically balanced (Figure 2-30).

HORIZONTAL STABILIZER

2 Instructions for the removal and installation of the horizontal stabilizer (Figure 2-28) are contained in the following paragraphs:

(a) Removal - Remove horizontal stabilizer as follows:

(1) Remove tail cowling (see Paragraph 7, Part 2, Section 1), and disconnect elevator link rod at bell crank.

(2) Disconnect elevator tab indicator and tail light wiring on aft side of Bulkhead 15.

(3) Detach fuselage fairings and upper surface fairing.

(4) Remove attaching bolts from the stabilizer fitting.

(5) Disconnect the elevator tab control cables at the turnbuckles inside the fuselage tail compartment and remove chain idler roller at Bulkhead 14.

(6) Disconnect the rudder tab control cables at the turnbuckles inside the fuselage tail compartment and remove rudder tab pulleys at Bulkhead 13.

(7) Remove the elevator tab chain sprockets from the brackets on the forward side of

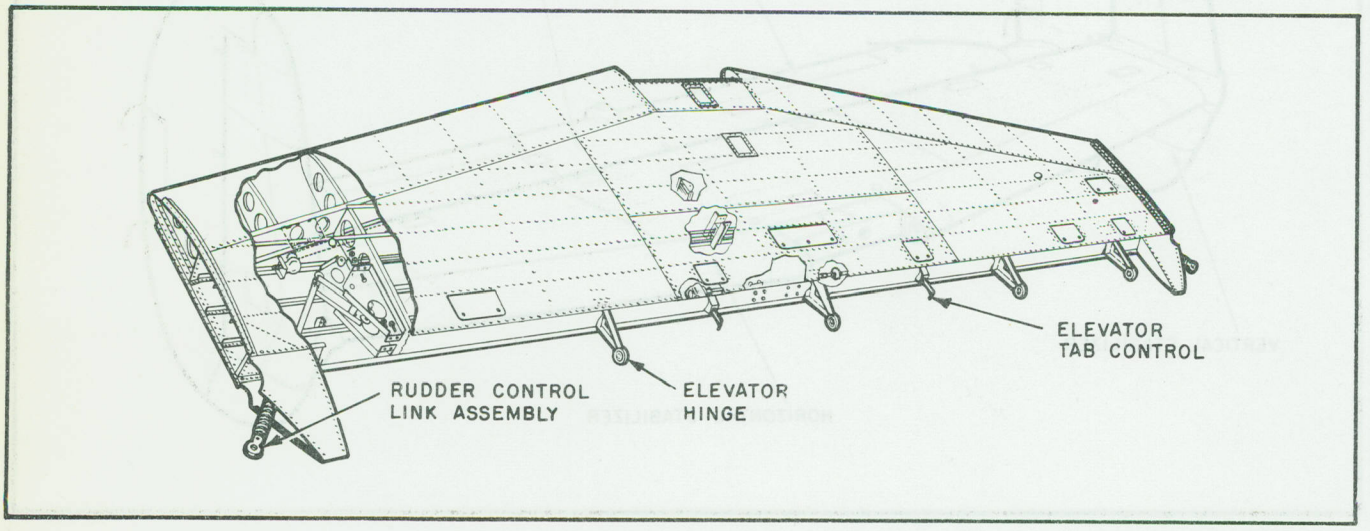


Figure 2-28 Horizontal Stabilizer

of Bulkhead 15, working through the tail wheel well.

(8) Remove rudder cable pulleys in the horizontal stabilizer, through the inspection door in the top forward part of the stabilizer (Figure 1-13).

(9) Disconnect the rudder control cables at the turnbuckles in the outboard ends of the stabilizer. Tie a lead line to the end of each cable before removing, to facilitate reinstallation.

NOTE

If a suitable supporting rack or dolly for the stabilizer is not available, the vertical stabilizers should be removed. (For removal procedure see Paragraph 3).

(10) Remove the fillister-head screws attaching the stabilizer to the fuselage mounting angles.

(11) Lift the stabilizer clear of the fuselage, allowing the control cables to feed through the stabilizer.

(b) Installation - Install horizontal stabilizer as follows:

(1) Lower stabilizer into position on the fuselage, feeding the control cables and tab chains into place by means of the attached lines, as the stabilizer is lowered.

NOTE

When installing the horizontal stabilizer a layer of 1/32 in. x 3/4 in. wide tape, Specification MIL-T-6841, must be

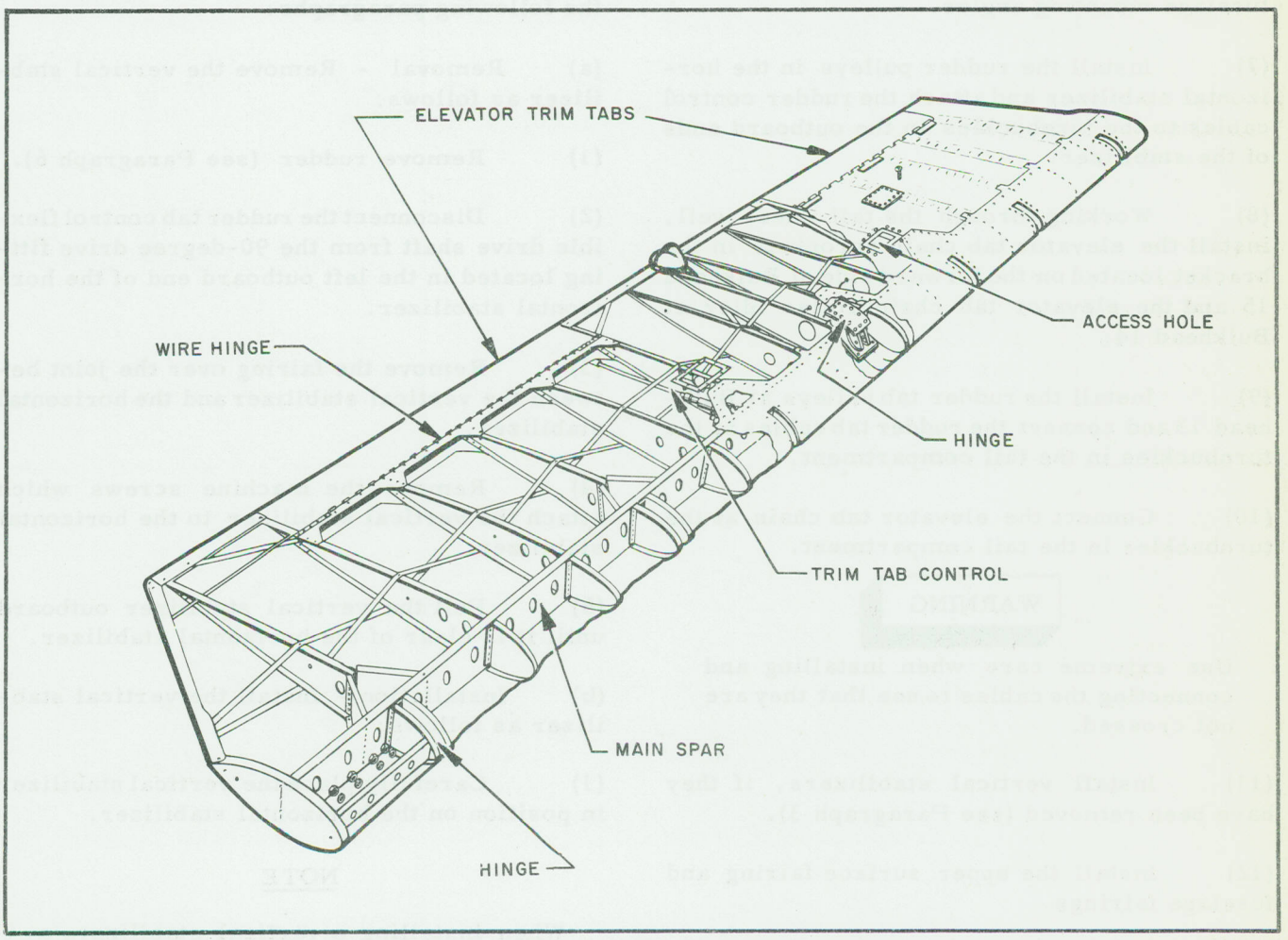


Figure 2-29 Elevator Assembly

placed between the horizontal stabilizer and the fuselage attaching angles.

(2) Secure the stabilizer on the fuselage mounting angles with the fillister-head screws. Tighten approximately three screws on each side of the fuselage.

(3) Pull the control cables into the proper position to be attached to the rudder bell crank in the outboard ends of the stabilizer. Remove lead lines.

(4) Route the elevator tab chain and the rudder tab cables into their proper positions in the fuselage tail compartment.

(5) Install and tighten the bolts in the stabilizer fittings.

(6) Tighten all fillister-head screws in the fuselage mounting angles.

(7) Install the rudder pulleys in the horizontal stabilizer and attach the rudder control cables to the turnbuckles in the outboard ends of the stabilizer.

(8) Working through the tail wheel well, install the elevator tab chain sprockets in the bracket located on the forward side of Bulkhead 15 and the elevator tab chain roller idler at Bulkhead 14.

(9) Install the rudder tab pulleys at Bulkhead 13 and connect the rudder tab cables at the turnbuckles in the tail compartment.

(10) Connect the elevator tab chain at the turnbuckles in the tail compartment.

WARNING

Use extreme care when installing and connecting the cables to see that they are not crossed.

(11) Install vertical stabilizers, if they have been removed (see Paragraph 3).

(12) Install the upper surface fairing and fuselage fairings.

(13) Connect link rod between elevator and bell crank.

(14) Connect elevator tab indicator wiring and tail light wiring.

(15) Rig rudder control system (see Paragraph 10, Part 2, Section 4).

(16) Rig rudder tab control system (see Paragraph 14, Part 2, Section 4).

(17) Rig elevator tab control system (see Paragraph 9, Part 2, Section 4).

(18) Install tail cowling (see Paragraph 7, Part 2, Section 1).

VERTICAL STABILIZER

3 Instructions for the removal and installation of the vertical stabilizer are contained in the following paragraphs:

(a) Removal - Remove the vertical stabilizer as follows:

(1) Remove rudder (see Paragraph 6).

(2) Disconnect the rudder tab control flexible drive shaft from the 90-degree drive fitting located in the left outboard end of the horizontal stabilizer.

(3) Remove the fairing over the joint between the vertical stabilizer and the horizontal stabilizer.

(4) Remove the machine screws which attach the vertical stabilizer to the horizontal stabilizer.

(5) Pull the vertical stabilizer outboard until it is clear of the horizontal stabilizer.

(b) Installation - Install the vertical stabilizer as follows:

(1) Carefully place the vertical stabilizer in position on the horizontal stabilizer.

NOTE

When installing a vertical stabilizer, a layer of tape 1/32 inch x 3/4 inch wide,

Specification MIL-T-6841 must be placed between the vertical stabilizer and the attaching angles on the horizontal stabilizer.

(2) Install and tighten the fillister-head attaching screws.

NOTE

In some cases it will be found that when installing a new right hand vertical stabilizer, there is no screw hole in that portion of the stabilizer which corresponds to the forward elongated hole in the attaching angle. Fitment of a screw is then unnecessary.

(3) Install fairing which covers joint between vertical stabilizer and horizontal stabilizer.

(4) Connect rudder tab control flexible drive shaft to 90-degree drive fitting located in outer ends of horizontal stabilizer.

(5) Install rudder (see Paragraph 6).

ELEVATOR

4 Instructions for the removal, installation and adjustment of the elevator are contained in the following paragraphs:

(a) Removal - To remove elevator proceed as follows:

(1) Detach outer tail cowling from the fuselage.

(2) Detach inner tail cowling from the elevator.

(3) Disconnect the elevator control mechanism by removing the bolt at the upper end of the connecting link between the bell crank and the elevator.

(4) Disconnect the tab indicator and tail light wiring on the aft side of Bulkhead 15.

(5) Disconnect tab actuator.

(6) Disconnect the bonding links at the outer ends of the elevator.

(7) Remove the hinge bolts. Access to bolts is gained by removing the inspection window patches on the underside of the elevator.

(8) Pull the elevator directly aft until the tab torque drives are free and the elevator clears the stabilizer.

CAUTION

The tab torque drives employ small half-moon keys at the connecting joints which are left loose when the drives are disconnected. Care must be taken not to lose these keys.

(b) Installation - Install elevator as follows:

(1) Move the elevator forward into position, making certain the tab torque drives are engaged properly.

CAUTION

Half-moon key must be installed in the elevator tab drive shafts.

(2) Install the elevator hinge bolts.

(3) Check the hinge bearing for any evidence of binding.

(4) Use shims to eliminate any gap between the bearing race and female hinge.

(5) Tighten the attaching bolts so that the female hinge flanges hold the inner bearing race firmly. The bolt should be drawn snug to prevent working in the female hinge. The use of 4 or 5-inch box-end or open-end wrenches is recommended, using a moderate force to tighten the bolt.

(6) After installation and at each periodic inspection, the hinge bolts should be checked for any indication of working in the female hinge. This may be done by attempting to rotate the bolt with a 4 or 5-inch wrench. If wear or looseness is detected, determine if shims are necessary and reinstall as in (5) above.

CAUTION

A 4 or 5-inch midget-type wrench is recommended to tighten the elevator bearing bolts to prevent excessive torque. If only standard wrenches are available, maintenance personnel should be made aware of the risk of over torquing.

(7) Connect the bonding links at the outer end of elevator.

(8) Connect the tab indicator and tail light wiring at the junction box on the aft side of the last fuselage bulkhead.

(9) Connect the elevator control mechanism by installing the bolt at the upper end of the connecting link between bell crank and elevator.

(10) Connect the tab actuators.

(11) Attach the inner tail cowling to elevator.

(12) Attach the outer tail cowling to the fuselage.

(c) Adjustment - To adjust the elevator travel, refer to Part 2, Section 4.

ELEVATOR TRIM TAB

5 Instructions for the removal, servicing, installation and adjustment of the elevator trim tab are contained in the following paragraphs:

(a) Removal - Remove elevator trim tab as follows:

(1) Disconnect actuator arm from tab horn.

(2) Remove hinge wire and tab.

(b) Servicing - Examine tab hinge for excessive wear. If hinge is worn and a new wire will not remove play, the hinge should be replaced. Tag old hinge as unserviceable and return to stores.

(c) Installation - Install elevator trim tab as follows:

(1) Place tab in position and install new stainless hinge wire.

(2) Connect actuator arm to tab horn.

(d) Adjustment - To adjust elevator trim tab refer to Part 2, Section 4.

RUDDER

6 Instructions for the removal, installation and adjustment of the rudder (Figure 2-30) are contained in the following paragraphs:

(a) Removal - To remove rudder proceed as follows:

(1) Detach the outer rudder horn box from the horizontal stabilizer.

(2) Detach the inner rudder horn box from the rudder.

(3) Disconnect the rudder control mechanism at the rudder horn connection.

(4) Disconnect rudder tab actuator.

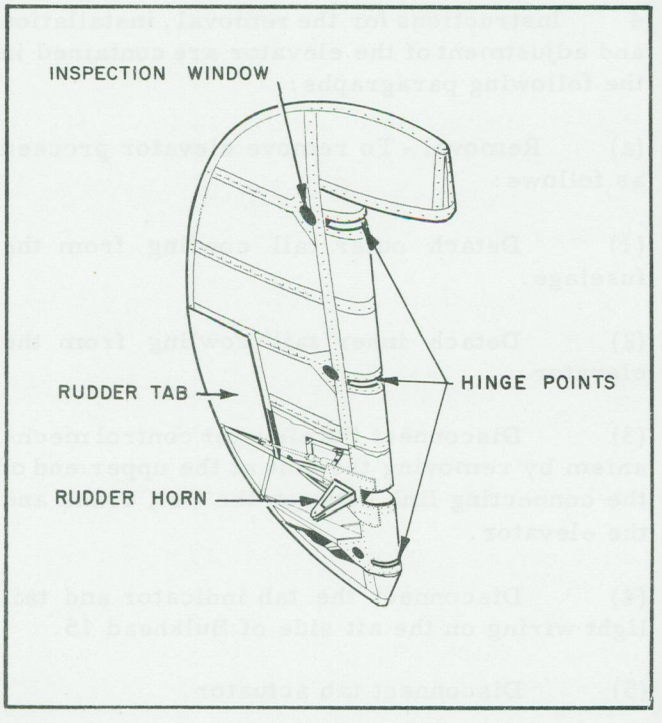


Figure 2-30 Rudder

(5) Remove the rudder hinge bolts. The bolts are accessible by removing the inspection window patches on the rudder (Figure 2-30).

CAUTION

Do not allow bolts, washers, and other parts to drop into the rudder.

(6) Pull the rudder directly aft until the tab torque tube drive is free and rudder is clear of vertical stabilizer.

CAUTION

The tab torque drive employs a small half-moon key at the connecting joint which is left loose when the drive is disconnected. Care must be taken not to lose the key.

(b) Installation - To install the rudder proceed as follows:

(1) Move the rudder forward into position. Care must be taken that the tab torque tube drives are properly engaged.

CAUTION

Half-moon key must be installed in tab drive shaft.

(2) Install the rudder bolts through the bonding cable lug and the hinge.

(3) Check the hinge bearings for any evidence of binding.

(4) Use shims to eliminate any gap between the bearing race and female hinge.

(5) Tighten the attaching bolts so that the female hinge flanges hold the inner bearing race firmly. The bolt should be drawn snug to prevent working in the female hinge. The use of 4 or 5-inch box-end or open-end wrenches is recommended, using a moderate force to tighten the bolt.

(6) After installation and at each periodic inspection, the hinge bolts should be checked for any indication of working in the female hinge. This may be done by attempting to rotate the bolt with a 4 or 5-inch wrench. If wear or looseness is detected, determine if shims are necessary and reinstall as in (5) above.

CAUTION

A 4 or 5-inch midget-type wrench is recommended to tighten the rudder hinge bearing bolts to prevent excessive torque. If only standard wrenches are available, maintenance personnel should be made aware of the risk of over torquing.

(c) Adjustment - To adjust rudder travel refer to Part 2, Section 4.

RUDDER TRIM TAB

7 Instructions for the removal, servicing, installation and adjustment of the rudder trim tab are contained in the following paragraphs:

(a) Removal - Remove rudder trim tab as follows:

(1) Disconnect actuator arm from tab horn.

(2) Remove tab hinge wire and remove tab (Figure 2-31).

(b) Servicing - Examine tab hinge for excessive wear. If hinge is worn and a new hinge wire will not remove play, the hinge should be replaced. Tag old hinge as unserviceable and return to unit stores.

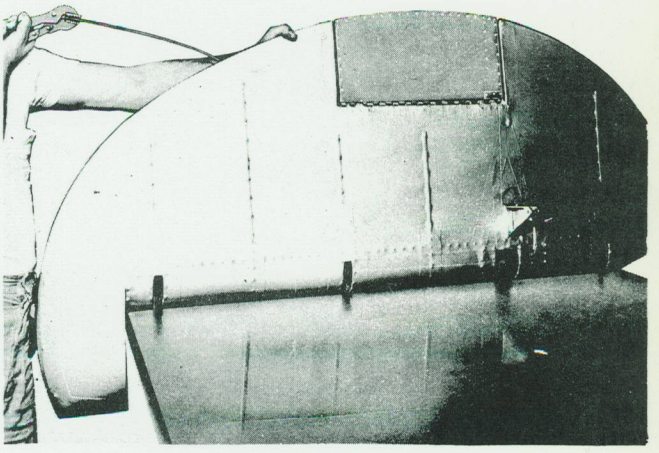


Figure 2-31 Rudder Tab Hinge Wire Removal

(c) Installation - Install rudder trim tab as follows:

(1) Lift tab into position on the rudder and install new hinge wire. Hinge wire may be installed by slowly tapping in place with a leather mallet or a light rivet gun.

(2) Connect actuator arm to tab horn.

NOTE

When installing a new rudder trim tab, it may be found that the actuator arm chafes against aft edge of cut out in the reinforcing patch. This may be rectified by enlarging the hole 3/4-inch aft.

(d) Adjustment - To adjust rudder trim tabs refer to Part 2, Section 4.

PART 2

SECTION 4

FLYING CONTROLS

GENERAL DESCRIPTION

1 All flight control surfaces are operated by means of cable systems attached to controls in the pilot's compartment. The main control cables are made of 7 x 19 pre-formed, extra flexible, corrosion-resistant steel. The rudder and aileron cables are 1/8-inch diameter, elevator cables are 5/32-inch diameter and 3/16-inch diameter, and trim tab cables are 3/32-inch. Turnbuckles are provided at access points to facilitate installation, adjustment, and removal of the cables. Anti-friction, pre-lubricated pulleys are used throughout the system.

CONTROL COLUMN AND TORQUE SHAFT

2 A torque shaft mounted forward of Bulkhead 4 is constructed in three sections; two outer sections joined by a centre section. The ends of the two outer sections are attached to the pilot's control columns. The centre section carries a horn assembly, which is connected to the elevator controls. The torque shaft incorporates a special universal joint to dampen vibration in the control columns. This joint should be checked for looseness or evidence of wear. Play in the universal joint will cause vibration in the control columns.

(a) Removal - To remove control column and torque shaft:

(1) Release tension on elevator cables and disconnect cables from the control arm in the belly.

(2) Release tension on aileron cables in nacelle openings.

(3) Release tension on control column balance cables at the turnbuckles in Bulkhead 5 and disconnect balance cables at connection links in Bulkhead 5.

(4) Remove pulleys in floor channel brackets at Bulkhead 5 (aft outboard section of belly.)

(5) Remove connecting bolts from the torque shaft flanges and remove the centre section of the torque shaft.

(6) Remove taper pins holding control column to the torque shaft.

(7) Remove the bolts securing the bearing retainer collars to the torque shaft. Remove paint from shaft so collars will slip. Mark collars before removal so they may be replaced in same position.

(8) Work with one control column and move the torque shaft toward the centre of the aircraft until the bearing retainer collars may be removed. Continue to work the torque shaft toward the centre of the aircraft until the shaft is free of the bearings.

(9) Lift control column up into pilot's compartment.

(b) Servicing - Check torque shaft bearings for wear. Check for play in universal joints between two outboard shafts and centre section of shaft.

(c) Installation - To install control column and torque shaft:

(1) Lower one control column down through the floorboards. Slide torque shaft outboard until it is near the control column and inboard of the outboard bearing.

(2) Place the bearing retainer collars in position on the torque shaft.

(3) Install taper pins holding column to shaft.

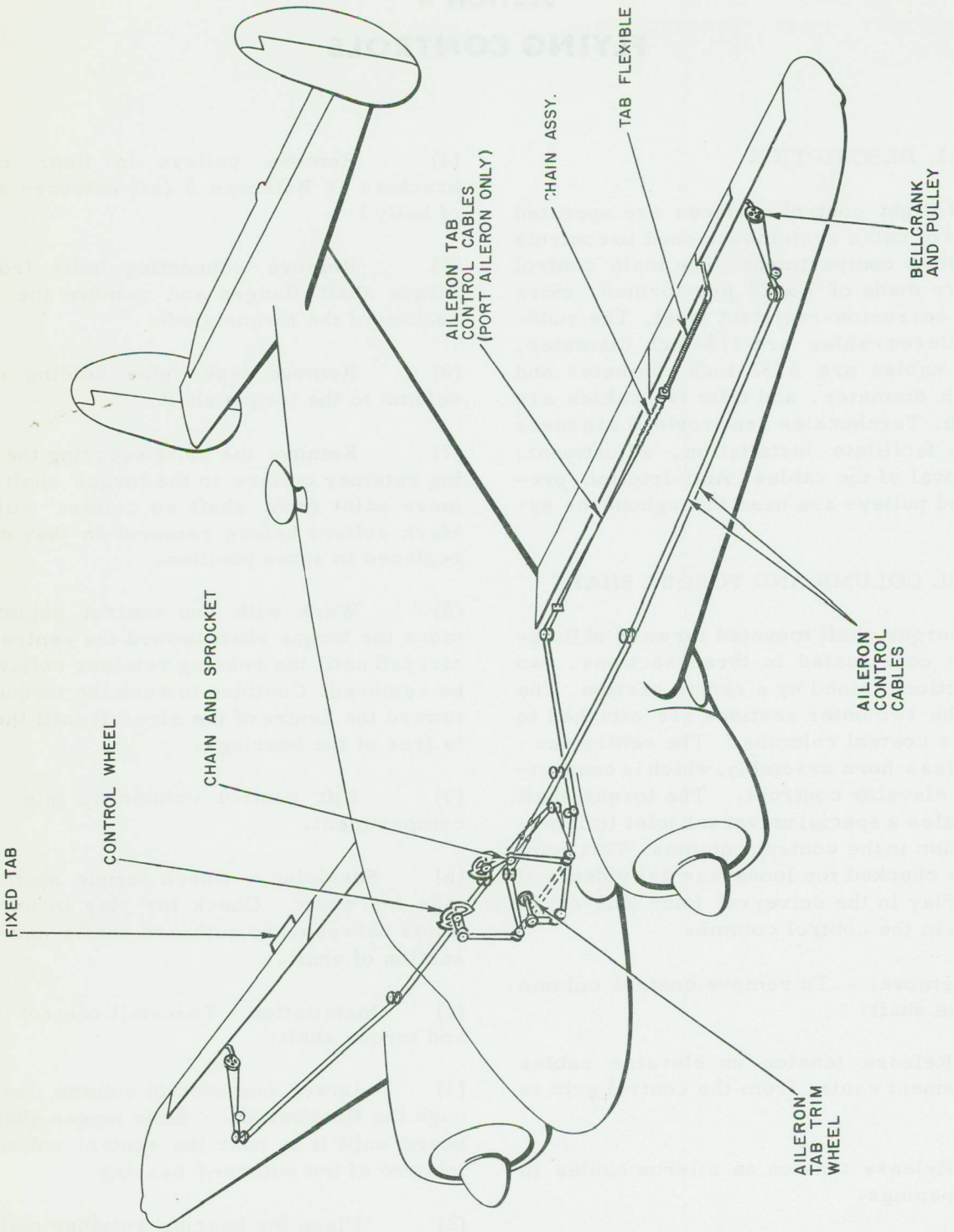


Figure 2-32 Aileron Control System

NOTE

In the event of installing a new control column to the torque shaft, the existing holes must be reamed to take over size taper pins AN386-6-15. New control columns are pre-drilled.

CAUTION

Taper pins must be reinstalled in the same holes or new pins installed.

(4) Install bolts in bearing retainer collars, tighten nuts securely and key.

(5) Repeat steps (1), (2), (3) and (4) for the other control column.

(6) Install the centre section of the torque shaft.

(7) Route control column cables aft to Bulkhead 5, and install pulleys in floor channel bracket, Paragraph 3(8), (9) and (13).

(8) Connect control column balance cables and main aileron cables to connecting links in Bulkhead 5.

(9) Rig aileron control system to proper tension (see Paragraph 3(d)).

(10) Rig elevator control system to proper tension (see Paragraph 6(d)).

(11) Safety all turnbuckles.

AILERON CONTROLS

3 The aileron system (Figure 2-32) is controlled by the wheels on each control column in the pilot's compartment. Each wheel is mounted on a shaft running through the top of the control column, which in turn, is keyed to a sprocket inside the column. Chains are routed over the sprockets to short cables running down through the control columns and aft under the pilot's floorboards (Figure 2-33). They are then routed inboard to connect with the main aileron control cables. The main aileron control cables run laterally through the centre section and outer wing panel to a point just inboard the seventh rib from the outer panel root. At this point they turn aft and attach to the aileron bell cranks. A link rod connects the bell crank to the aileron.

(a) Removal - The following procedure applies to the removal of aileron controls from both control columns and both ailerons.

(1) Disconnect the actuating rod from the aileron horn and from the bell crank in the wing.

(2) Disconnect the aileron cable turnbuckles located in the nacelle.

(3) Remove the bolt which anchors the cable on the bell crank.

(4) Remove the bell crank from the wing rib.

(5) Remove the clevis pins which hold the cable in position on the pulleys in the nacelle and outer wing panel.

(6) Attach a length of safety wire to the cable where it attaches on the bell crank. The wire should be long enough to reach from the bell crank to the nacelle and will be used in pulling a new cable through the wing.

(7) Pull the old cable out of the wing through the nacelle opening. Remove the cable carefully to prevent damage to the wing structure.

(8) Remove the access door in the centre of the pilot's floorboards. Also remove inspection plates on the aft side of Bulkhead 5 near the floor.

(9) Disconnect the balance cables and aileron control cables.

(10) Remove batteries.

(11) Remove the pulleys from the control column and the floor channel bracket. The bolt retaining the pulleys in the base of the control column may be removed through a hole in the fuselage skin (accessible through the battery well). On some aircraft this hole is not drilled. The bolt attaching the pulleys to the floor channel bracket may be removed through a small access cover in the floorboards, located just forward of Bulkhead 5 near the outboard edge.

(12) Remove the cap over the sprocket in the top of the control column. With the wheel in the neutral position (Figure 2-33), mark with paint, a tooth of the sprocket and the link of chain which it engages.

(13) Remove the nut from the end of the control wheel shaft. Remove the control wheel and shaft, and the rear bearing. Spacer and key will fall free.

(14) Press the front bearing from the control column.

(15) Remove sprocket from the control column.

(16) Attach a length of safety wire to the chain and lower the chain and cable assembly from the column.

(b) Servicing - Minor repairs and parts replacement will consist of replacement of rusted or corroded cables, cables having more than six broken strands in any one inch of cable, the control wheel, control wheel shaft bearing, and control column sprocket.

CAUTION

Do not attempt to repair defective control cables.

(c) Installation - To install aileron control system:

(1) Using the wire previously installed, pull chain and cable assembly up into the control column.

CAUTION

The chain and cable assemblies from the right and left control columns are not interchangeable. The cables must be routed as shown in Figure 2-33 to assure proper operation of the aileron control system. For both control columns, the chain should be installed on the sprocket so that when the control wheels are in neutral position, the ends of the chain will be of equal length.

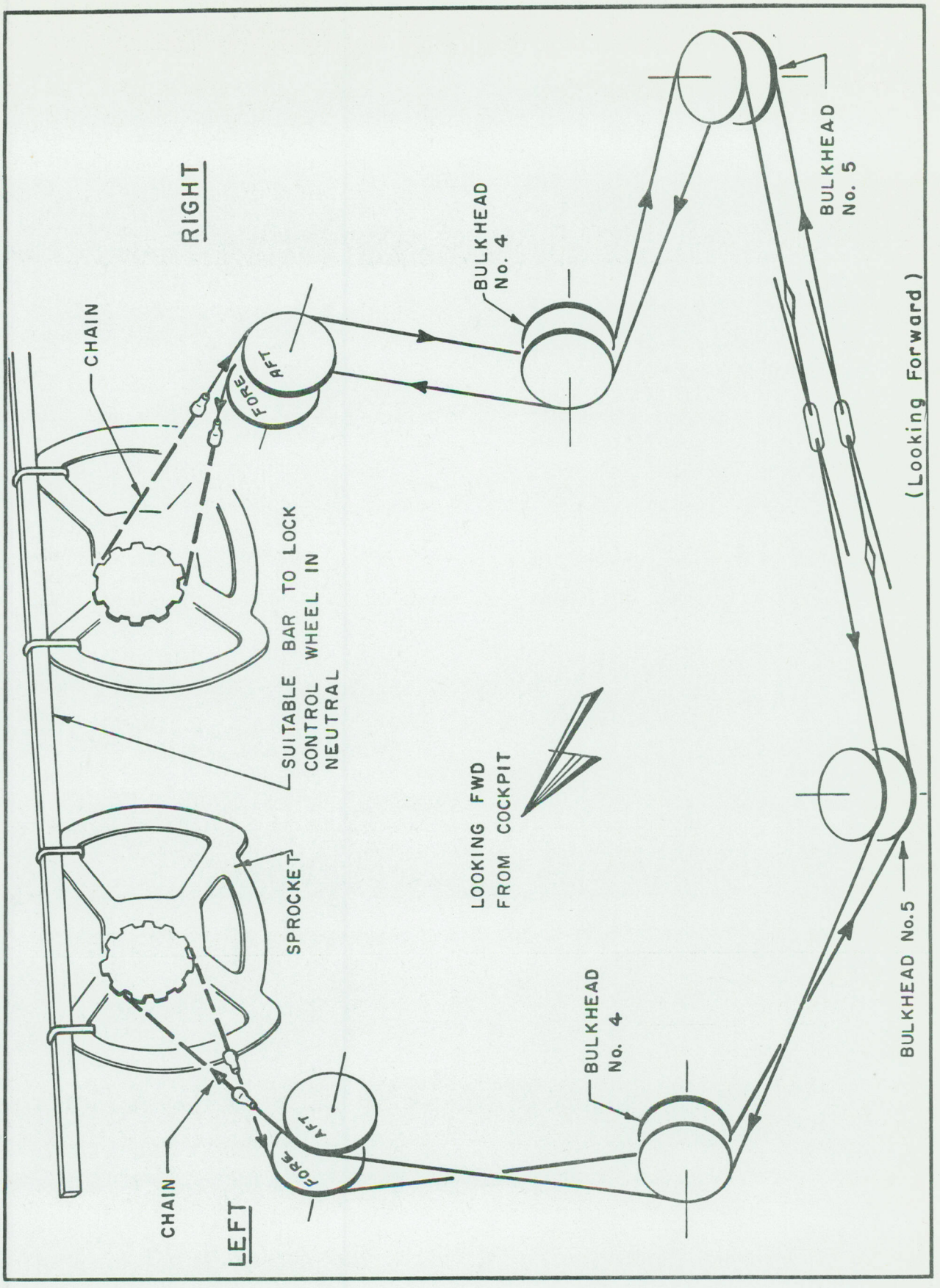


Figure 2-33 (Issue 1) Aileron Control Column System

THRU
AFT
FORE
CHAIN
NEUTRAL
CONTROL WHEEL IN
STATUS BAR TO LOCK
SPROCKET
FROM COCKPIT
LOOKING FWD
BULKHEAD
No. 4
BULKHEAD
No. 5
(LOOKING FORWARD)

(2) Install chain and cable assembly in the left control column by routing end of chain to which the short cable is attached under the control wheel sprocket, over the forward pulley at the top of the control column, and around the inboard pulley at the base of the control column. Route the remaining chain over the control wheel sprocket and the long end of the cable over rear pulley in top of the control column, and around the outboard pulley at the base of the control column.

(3) With the control wheel sprocket held in place temporarily, place chain in correct position on sprocket; see caution preceding Step (2). When installing a new chain count the links of the old chain from one end to the link marked with paint, and install the matching link of the new chain on the tooth of sprocket which is marked. Both ends of the chain then should be of equal length, with the control wheel in neutral position.

(4) Press the rear bearing into the control column.

(5) Insert key in shaft. Slide shaft through spacer and sprocket, install nut and key. Press front bearing into control column.

(6) Stake in both front and rear bearings. Install cap over top of control column.

WARNING

Take great care that the cables are not crossed inside the control column.

(7) Using great care to assure the cables are in correct position, install pulleys in the top and also the bottom of control column. Insert bolts, tighten nuts securely and key.

(8) Route the longer length of cable aft to Bulkhead 5 and position it to go around the top pulley in the floor channel bracket.

(9) Route the short end to go around the lower pulley.

(10) Take care to hold the cables in their correct positions and install pulleys. Insert bolt, tighten nut securely and key.

(11) Install chain and cable assembly in the right control column by routing end of chain to which the long cable is attached under the control wheel sprocket, over the forward pulley at the top of the control column, and around the inboard pulley at the base of the control column. Route the end of the chain to which the shorter length of cable is attached so it will pass over the control wheel sprocket, over the rear pulley at the top of the control column, and around the outboard pulley at the base of the control column.

(12) Using great care to ensure the cables are in the correct position, install the pulleys in the top and base of the control column, insert bolts, tighten nuts securely and key. With the control wheel sprocket in place, match the marked tooth on sprocket with the marked link of chain. Then install shaft, spacer, sprocket and bearings as for left column.

(13) Route the shorter length of cable aft to Bulkhead 5 and position it to go around the top pulley in the floor channel bracket. Route the longer cable to go around the bottom pulley in the floor channel bracket.

(14) Exercise great care to hold cables in their correct positions and install pulleys. Insert bolt, tighten nut securely and lock.

(15) Pull the main aileron cables through the wing stub, taking care not to damage the centre section structure.

(16) Install the right-hand long cable on the upper link and the short right-hand cable on the lower link.

(17) Install the left-hand short cable on the opposite end of the upper link and the left hand long cable on the opposite end of the lower link.

(18) Attach long cable on the left side and the short cable on the right side to the opposite ends of the upper connecting link.

(19) Attach the short cable on the left side and the long cable on the right side to the opposite ends of the lower connecting link. Install nuts on bolts in links, tighten securely and lock.

CAUTION

Be sure the bushings are installed in the links.

(20) Position cables over correct pulleys in battery compartment, taking care that the cables are not crossed. Install clevis pin.

(21) Install batteries.

(22) By means of the previously installed cord or wire, pull new cable assembly into the outboard wing panel. After new cable is in proper place, remove the attached line. The cable has a permanent 3/16 inch radius formed at the point where it attaches to the bell crank. If a cable is to be installed in the right wing, it must be installed so the longer length of the cable passes under the bell crank, and the shorter length over the top of the bell crank. In the left wing install the longer length of the cable over the bell crank and shorter length under the bell crank. A piece of tape should be wrapped around the longer length of cable for identification before it is pulled into the wing.

(23) Attach the cable to the bell crank, and attach the bell crank to wing rib.

(24) Install clevis pins at the pulleys in the nacelle, and at the pulleys in the outer wing panel.

(25) Connect the actuating rod to the aileron and to the bell crank in the wing.

WARNING

Take great care when installing the cables to see that they are not crossed.

(d) Rigging - Rig the aileron control system as follows:

(1) Attach a straight edge long enough to extend across the control column wheels, or provide other means to hold wheels in neutral position (Figure 2-33).

(2) Adjust the balance cable turnbuckles in Bulkhead 5 until both cables are rigged to the tension given in Table 2-1. (Turnbuckles are accessible through outboard inspection openings aft of Bulkhead 5).

CAUTION

During the rigging operation make frequent checks to see that the links in Bulkhead 5 lie perfectly vertical with the bolt heads facing aft.

(3) Run flaps to neutral (UP) position.

(4) Adjust aileron cable turnbuckles in wings until both cables are rigged to the tension given in Table 2-1; turnbuckles are accessible in each nacelle.

NOTE

During the rigging operation make frequent checks to see that the trailing edge of the aileron aligns with the trailing edge of the flap.

(5) Remove straight edge installed in step (1) and turn control wheel full travel each way several times, checking for proper travel and operation.

(6) Align control wheels in neutral position and check all cables and controls for proper alignment and tension.

(7) Make necessary adjustments and safety all turnbuckles.

(8) The aileron travel is set by adjusting the eccentric bell crank stop located on No. 7 wing rib adjacent to the aileron bell crank. The eccentric stop in the left wing, controls the up travel of the left aileron and the down travel of the right aileron. The eccentric stop in the right wing, controls the up travel of the right aileron and the down travel of the left aileron. Using a bubble protractor (Figure 2-34) to check the travel, adjust the eccentric stop in the wing in accordance with Table 2-2. Control Surface Travels. If a bubble protractor is not available the travel may be checked by measuring in inches. Place the flaps in up "Neutral" position and measure from inboard trailing edge of aileron to the outboard trailing edge of flap.

(9) On aircraft with wings which have a hex head bell crank stop, the travel is not adjustable. If both types of stops are used on the same aircraft, set the travel in accordance with the hex head bell crank stop travel measurements, given in Table 2-2.

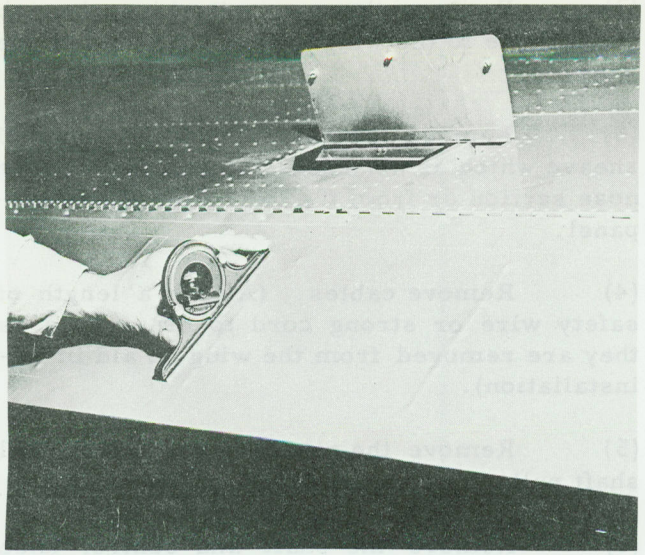


Figure 2-34 Aileron Travel Check

AILERON TRIM TAB CONTROLS

4 The left aileron is equipped with a trim tab operated by a control wheel on the lower face of the pilot's control pedestal. A mechanically-operated position indicator, adjacent to the control wheel, registers the position of the tab. The tab control cables pass around a pulley on the control wheel shaft to pulleys in the belly of the aircraft. From this point they angle aft toward the left side of the fuselage to a point just ahead of Fuselage Bulkhead 7, then turn outboard through the centre section. Just outboard from the fuel tank well, the cables pass through a block which acts as a stop, to limit the travel of the aileron tab (Figure 2-35). The cables attach to a chain which actuates a tab chain drive connected by a flexible shaft to the 90-degree drive and actuator mechanism in the aileron. The actuator is connected to the aileron tab horn.

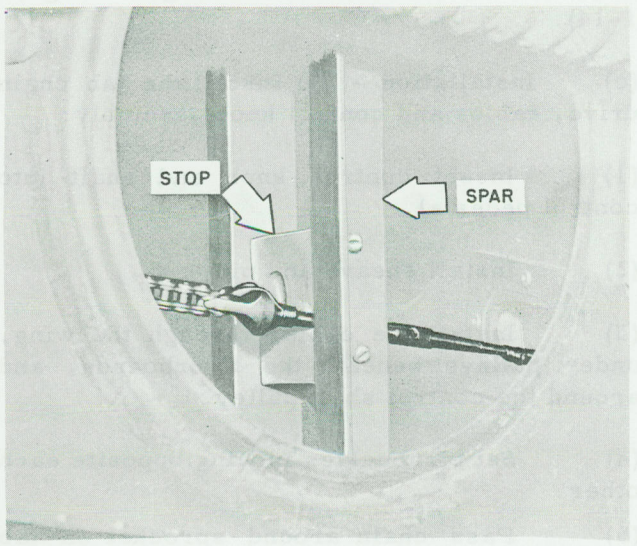


Figure 2-35 Aileron Tab Cable Stop

NOTE

Provision exists for an auxiliary fixed tab on the trailing edge of both ailerons. Fitting the fixed tab is necessary only on those aircraft where excessive movement of the adjustable tab is required to maintain level flight. Tab setting angles are to be determined by test flights of the aircraft under normal loading conditions and the adjustable tab in neutral.

WARNING

A maximum angle of 20 degrees up or down for each tab shall not be exceeded.

(a) Removal - To remove aileron tab actuator from aileron:

(1) Disconnect the left aileron from the bell crank actuating link.

(2) Remove the inspection plate from the leading edge of the aileron.

(3) Disconnect the tab actuator from the horn.

(4) Remove the pin from the tab hinge.

(5) Disconnect the flexible drive shaft from the actuator.

(6) Loosen lock nut and back off the setscrew securing the actuator in the mounting bracket.

(7) Lift the actuator out of the aileron through inspection opening.

(b) Servicing - Check condition of actuator. Replace if screw shows excessive wear. Check actuator mounting to see that mechanism moves freely in the mounting but does not have too much play. If excessive play

cannot be removed by tightening setscrew, the mounting bracket or setscrew probably will need replacement. Lubricate as required. Check aileron tab hinges for wear. If hinge is worn, it must be replaced at a designated overhaul unit.

(c) Installation - To install aileron tab actuator in aileron:

(1) Insert actuator in aileron through inspection opening.

(2) Move actuator into position in mounting bracket, install setscrew, and tighten. Actuator mechanism must pivot about setscrew freely without binding but should have no play.

(3) Connect flexible drive to tab mechanism.

(4) Lift tab into position and install hinge pin. The special stainless-steel pin may be slowly and carefully driven into the hinge with a leather mallet.

NOTE

New hinge pin must be installed each time the tab is removed.

(d) Rigging - Move aileron tab control to neutral. The ends of the aileron tab chain will be even when the tab control is in the neutral position. Adjust actuating screw so tab is in alignment with the aileron trailing edge. Install connecting bolt and safety. Safety all connections and install inspection covers.

TAB CHAIN DRIVE, CABLES AND CONTROL KNOB ASSEMBLY

5 The complete tab chain drive, cables and control knob assembly may be removed, serviced, installed and adjusted as follows:

(a) Removal - To remove the tab chain drive, cables and control knob assembly:

(1) Disconnect the aileron tab cables at the turnbuckles, located just inboard from the tab chain drive in the wing and disconnect the flexible shaft from the tab chain drive.

(2) Remove the nuts attaching the tab chain drive to the wing rib and lift it out of the wing.

(3) Remove the cable from the control sheave which is accessible either through the nose section or from the underside of the subpanel.

(4) Remove cables. (Attach a length of safety wire or strong cord to the cables as they are removed from the wing to aid in reinstallation).

(5) Remove the pin securing the control shaft pulley and remove it from the shaft.

(6) Remove the shaft and control knob from the pedestal.

(b) Servicing - To service the cables and drive:

(1) Cables that are frayed are considered serviceable unless there are more than six broken strands in any one inch of cable.

(2) Cables that are rusted or corroded are not considered serviceable.

(3) Cables not considered serviceable cannot be repaired.

(4) Check for binding of control knob, tab chain drive, or flexible shaft. Lubricate as required. (See Lubrication Diagram Figure 1-14).

(c) Installation - To install the tab chain drive, cables and control knob assembly:

(1) Insert control knob and shaft into control pedestal.

(2) Install sheave and pin.

(3) Install the cables through the wing, under pulleys beneath the floorboards, and around the control shaft pulley.

(4) Set turnbuckles in wing opposite each other.

(5) Pass chain around sprocket on tab chain drive, then install drive in wing.

(6) Connect aileron tab cables and drive chain. Set the aileron tab in neutral and keep turnbuckles opposite each other so the neutral setting will be maintained.

(7) Tighten turnbuckles to the tension set in Table 2-1, safety all connections.

(d) Rigging - To rig the chain drive, cables and control knob assembly proceed as follows:

(1) Turn control knob until the turnbuckles in the wing are directly over each other and accessible at a lightening hole in the rear spar of the centre section.

(2) Remove bolt connecting the actuator to the tab.

(3) Adjust the actuator so the trailing edges of the tab and aileron are aligned.

(4) Check the tab travel by means of a bubble protractor. Refer to Table 2-1 for cable tensioning and Table 2-2 for tab travels.

ELEVATOR CONTROLS

6 The lower ends of the control columns are attached to an elevator torque shaft under the pilot's floorboards (Figure 2-39). A horn attached to the torque shaft actuates the elevator cables. One cable runs from the horn directly aft, while the other passes around a large bull wheel in the forward section of the aircraft and then aft (Figure 2-36). Both cables run under the fuselage floor near the centreline to Bulkhead 10. From this point they run aft and upward and attach to the elevator bell crank aft of Bulkhead 15. The travel of the elevator is controlled by adjustable stop bolts (Figure 2-37) which strike against the arms of the bell crank. The torque shaft incorporates a special universal joint to dampen vibration in the control columns. This joint should be checked for looseness or evidence of wear. Play in the universal joint will cause vibration in the control columns. Pulleys and cables should also be checked for wear and the presence of dirt and grit (Figure 2-39).

(a) Removal - To remove elevator controls proceed as follows:

(1) Remove the centre aisle floorboards.

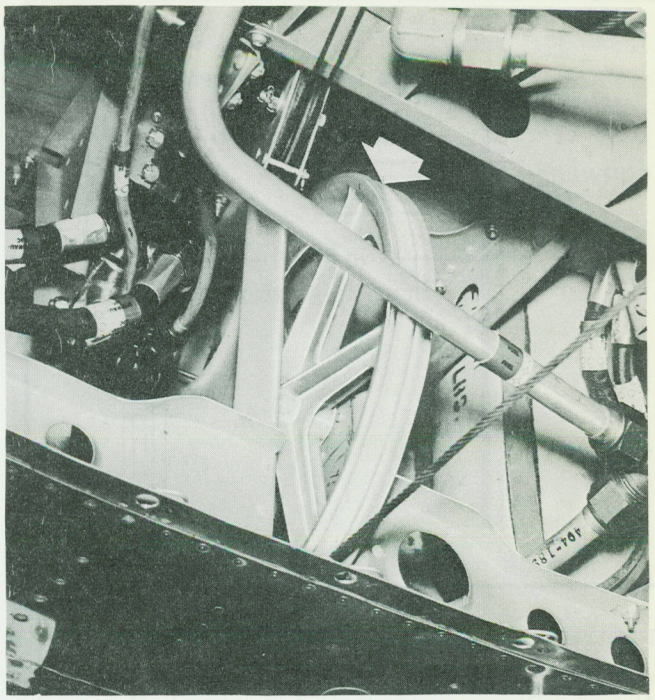


Figure 2-36 Elevator Control Bull Wheel

(2) Disconnect elevator cables at the turnbuckles located in the belly of the aircraft.

(3) Remove tail cone outer section.

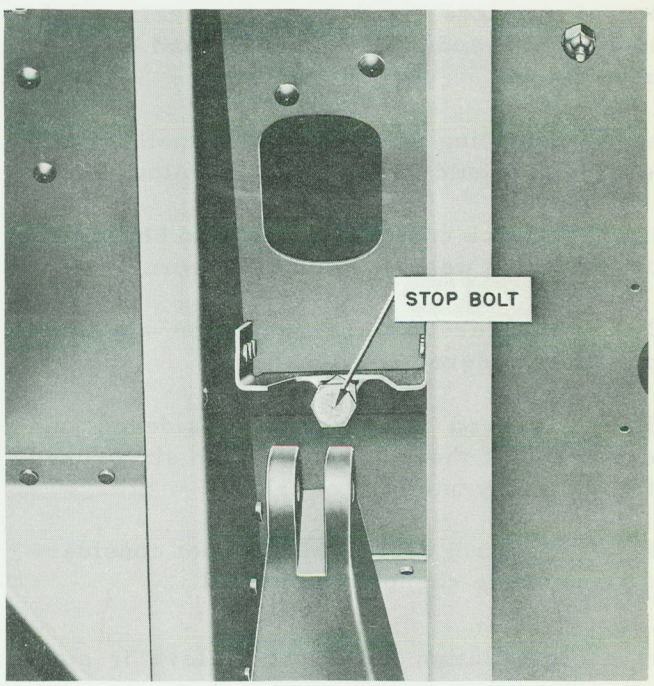


Figure 2-37 Elevator Travel Stop Adjustment

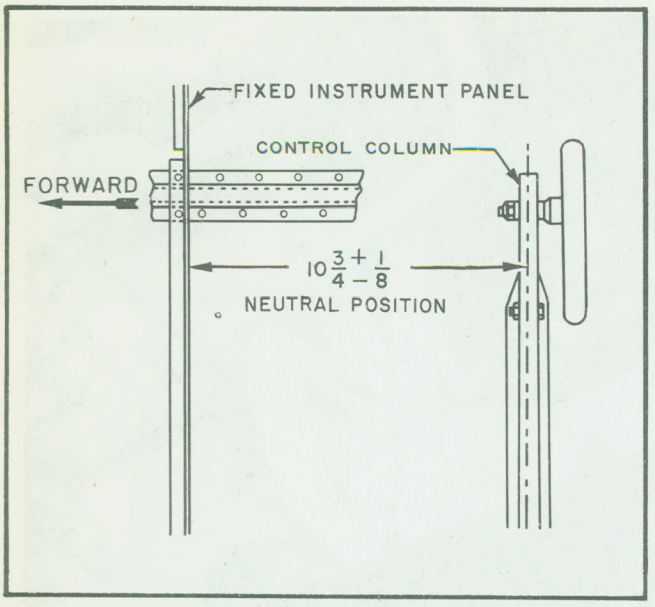


Figure 2-38 Control Column Neutral Setting

(4) Disconnect link between bell crank and elevator.

(5) Remove cables from bell crank.

(6) Disconnect the cable running forward from the actuating arm on the torque shaft.

(7) Remove large pulley in forward section of fuselage, pulleys under centre aisle floorboards, and pulleys on Bulkhead 14. Remove cables.

(b) Servicing - The cables, pulleys and bell crank should be serviced as follows:

(1) Check cables, pulleys, and bell crank for excessive wear. Replace if worn.

(2) Cables that are rusted or corroded are not considered serviceable.

(3) Frayed cables are considered unserviceable if there are more than six broken strands in any one inch of cable.

(4) Control cables that are not considered serviceable cannot be repaired.

(c) Installation - To install elevator controls proceed as follows:

(1) Install the bull wheel underneath the floorboards (Figure 2-36).

(2) Connect the longer cable (5/32-inch diameter) to the front of the actuating horn on the torque shaft.

(3) Install the 5/32-inch diameter cable in the left-hand groove of the bull wheel, so the point of attachment is 20-1/2 inches from the end of the swaged terminal sleeve.

(4) Attach the shorter cable (3/16-inch diameter) to the aft side of horn and then route the cable aft under the floorboards.

(5) Install pulleys and cable retaining clevis pins.

(6) Connect the cables to the bell crank on Bulkhead 15. The 5/32-inch diameter cable should be connected to the lower arm of the bell crank. Connect the 3/16-inch diameter cable to the upper arm.

(7) Rig cables to the tension set in Table 2-1.

(d) Rigging - Rig elevators as follows:

(1) Provide means to hold the elevator in neutral position.

(2) Adjust cable turnbuckles until both cables have 120 plus or minus 10 pounds tension. With both cables at the proper tension, check control column position in pilot's compartment. Control column position should be 10-5/8 to 10-7/8-inches from the instrument panel stationary mounting (Figure 2-38).

(3) The elevator travel may be adjusted by removing the tail cowling and adjusting the stop bolts (Figure 2-37) on the aft side of Bulkhead 15. Adjust the elevator to the settings given in Table 2-2.

(4) Check system for ease and smoothness of operation.

(5) Recheck cable tension and make any necessary adjustments. Safety all turnbuckles.

ELEVATOR TRIM TAB CONTROL

7 The elevator is trimmed by two tabs, one on each side of the elevator centreline. They are operated simultaneously by a control wheel in the pilot's compartment, mounted to the right and below the pilot's seat. A rheostat-operated position indicator, located on the instrument panel, registers the position of the tabs. The control cables are anchored around a sheave on the control wheel shaft. From the sheave the cables are routed down through the pilot's floorboard and aft under the centre aisle floorboards to the first bulkhead aft of the rear baggage compartment. At this point they angle upward and aft, connecting to a chain. The chain passes around a guide and stop block in Bulkhead 14 and up to a drive sprocket in the horizontal stabilizer. A cross-shaft extends from the sprocket in each direction and connects to 90-degree torque drives. Universal joints connect each of these 90-degree drives with actuators in the elevator, which in turn operate the tabs. (See Figure 2-39 for tab control cable routing).

(a) Removal of Elevator Tab Control Wheel - To remove elevator tab control wheel proceed as follows:

(1) Release tension from cable

(2) Remove cover from cable sheave and remove bearing caps. Note position of bearing caps. They are not interchangeable.

(3) Disconnect and remove cables from sheave.

(4) Remove control wheel and sheave.

(b) Servicing of Elevator Tab Control Wheel - Check cable sheave, bearings, caps, and shaft for damage; replace if necessary.

(c) Installation of Elevator Tab Control Wheel - To install elevator tab control wheel:

(1) Working in the pilot's compartment, connect the inboard cable to the inboard end of the sheave, wrap around the sheave to the left (looking outboard), and off the rear side of the sheave to attach to the upper end of the elevator tab drive chain. The outboard cable should attach to the inboard end of the sheave, wrap around the sheave to the right (looking outboard), and attach to the lower end of the elevator tab drive chain. Safety the connections.

(2) Mount the control wheel and sheave assembly and safety the bearing caps, install sheave cover and rig cables.

(d) Removal of Chain and Cable - To remove chain and cable proceed as follows:

(1) Jack up tail of aircraft.

(2) Unsnap tail-wheel boot on the left side and disconnect the chain and cables at the clevises.

(3) File off the end of the pin holding the stop to the chain on the lower end. Remove pin and stop. (If new chain is to be installed the pin in the upper end of the chain should be removed instead).

(4) Disconnect actuators from tabs.

(5) Pull chain through pulleys and sprocket and remove. A new chain can be installed easily by connecting it to the old chain. The new chain will be drawn into position as the old chain is removed.

(6) Remove the centre aisle floorboards, then remove the pulleys and cables.

(7) Disconnect cables from sheave in pilot's compartment and remove from aircraft.

(e) Servicing of Chain and Cable - Check the chain and cables as follows:

(1) Check chain for excessive wear in links. Replace if worn. Check for defective links, corrosion, or dirt and grit.

(2) Check cables for frays or corrosion.

(3) Frayed cables are considered to be unserviceable if there are more than six broken strands in any one inch of cable.

(4) Cables that are rusted or corroded are not considered serviceable.

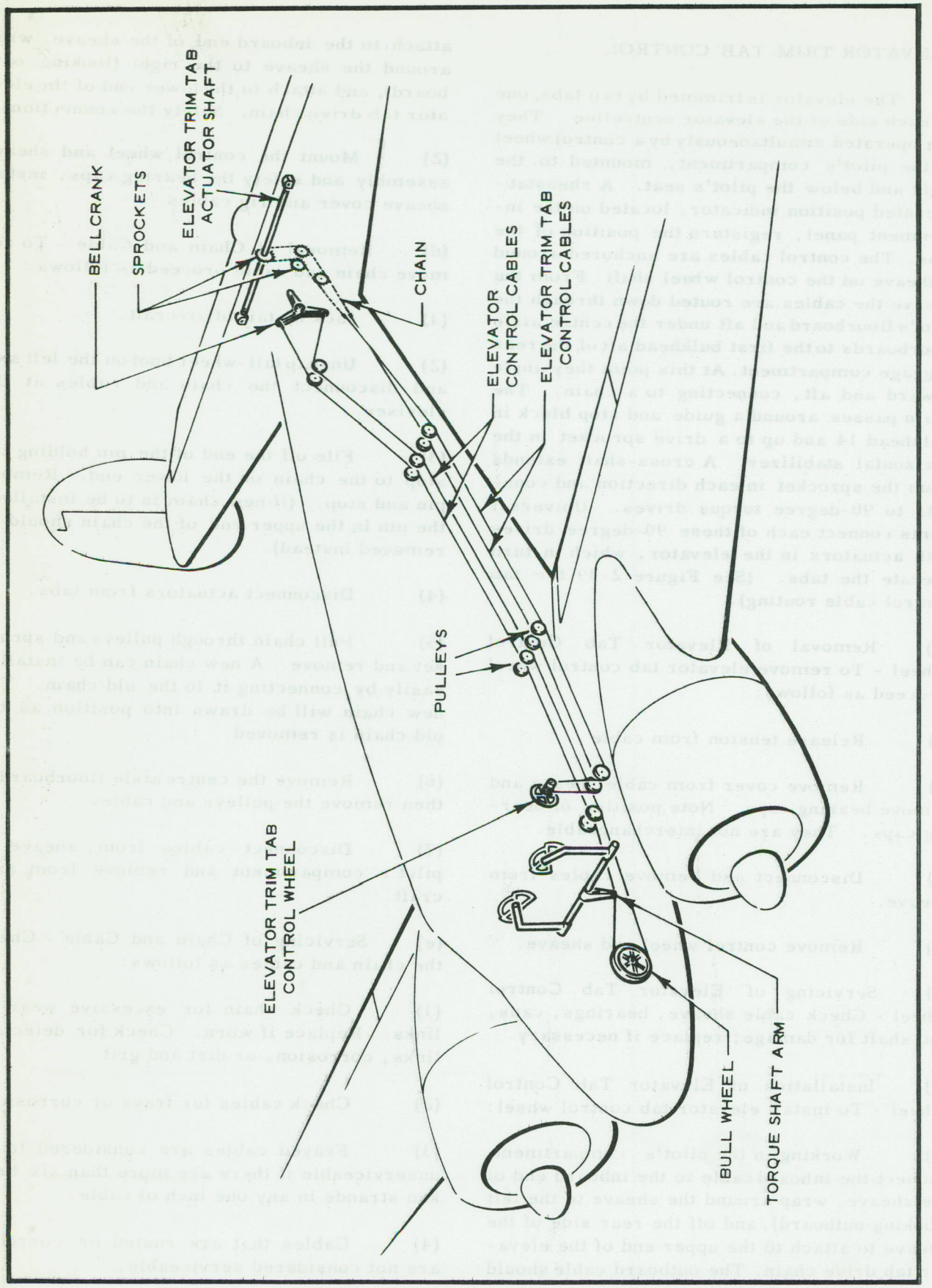


Figure 2-39 (Issue 1) Elevator Control System

(5) Cables that are not considered serviceable cannot be repaired.

(f) Installation of Chain and Cable - To install chain and cable proceed as follows:

(1) If old chain is to be reinstalled, begin with end of chain from which the stop has been removed and install as follows: run chain over the top of the pulley on Bulkhead 14, under the top sprocket on Bulkhead 15, over and around the drive sprocket in the horizontal stabilizer, and under the lower sprocket on Bulkhead 14 (see Figure 2-39 for tab cable routing).

NOTE

If a new chain is to be installed, the new chain should be attached to the end of the old chain and installed as the old chain is removed.

(2) Install stop on end of chain so that corner of stop is down. The stop must be installed in this manner for correct operation of tab.

(3) Install cables on sheave in pilot's compartment then route aft under floorboards and attach to the chain.

(4) Rig cables to the tension shown in Table 2-1. Safety all connections and check operation of tab.

ELEVATOR TAB MECHANISM (Horizontal Stabilizer).

8 Removal and installation of the elevator tab mechanism from the horizontal stabilizer is as follows:

(a) Removal - To remove the elevator tab mechanism from the horizontal stabilizer, proceed as follows:

(1) Remove elevator.

(2) Remove the horizontal stabilizer spar fairing strips on either side of the 90-degree drive assembly.

(3) Loosen the jam nut on the underside of the drive assembly bracket.

(4) Unscrew the torque-tube drive from the thrust nut.

(5) Unscrew the thrust nut which holds the 90-degree drive assembly to the phenolite block.

(6) Remove the nut connecting the cross-shaft to the 90-degree drive and remove the drive.

(7) Remove the taper pin from the collar at the right end of the cross-shaft and remove the collar.

(8) Working from the tail-wheel well, remove the taper pin holding the sprocket to the shaft. Drive the shaft out of the sprocket from right to left.

(b) Servicing - Check 90-degree drive for play and lubricate as required. (See Fig. 1-14)

(c) Installation - Install the elevator tab mechanism in the horizontal stabilizer as follows:

(1) Place sprocket in position in the bracket and push the shaft from left to right through the sprocket until the pin holes in the shaft and sprocket are in line.

NOTE

Two men are needed for this operation. One man works from the tail-wheel well and holds the sprocket in position while the other installs the shaft.

(2) Install pin through sprocket and shaft.

(3) Attach 90-degree drives to each end of shaft and install pins.

(4) Insert slotted drive pin and threaded thrust nut.

(5) Insert jam nut between thrust nut and top of bracket and screw collar through the bracket and jam nut into the thrust nut.

(6) Tighten thrust nut until the 90-degree drive moves freely but with no lost motion, then safety.

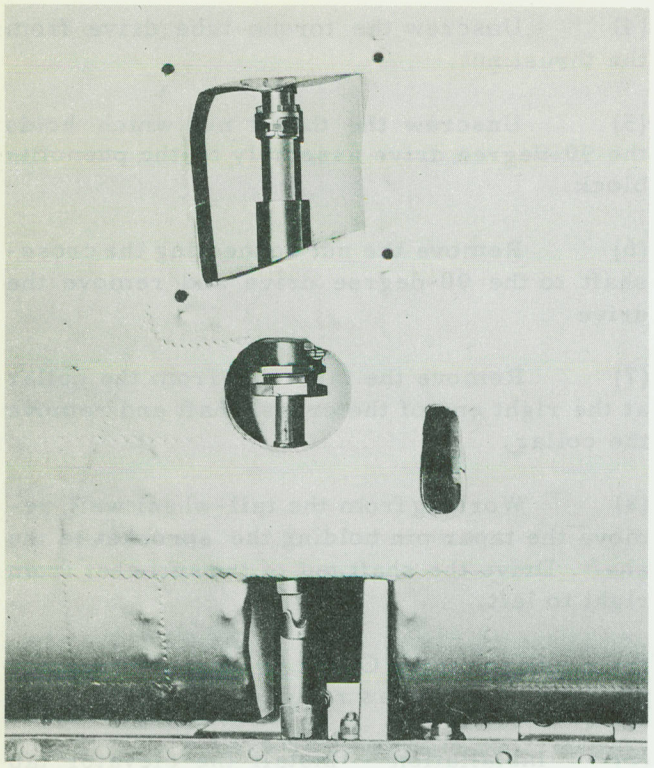


Figure 2-40 Elevator Tab Mechanism

(7) Install the stabilizer spar fairing strips on either side of the 90-degree drive assembly.

ELEVATOR TAB MECHANISM (Elevator)

9 Removal and installation of the elevator tab mechanism (Figure 2-40) from the elevator is as follows:

(a) Removal - To remove the elevator tab mechanism from the elevator, proceed as follows:

(1) Disconnect actuator from the elevator tab.

(2) Working through the elevator tab inspection door remove four bolts holding the actuator support to the elevator.

NOTE

If the necessary tools are not available for this operation, loosen the lock nut on the side of the support and back off the setscrew. This will release actuator from the support bracket.

(3) Pull actuator aft until it clears the bracket, then remove it through the inspection door.

CAUTION

Care must be used on the left elevator tab actuator to avoid damaging the rheostat mechanism as the actuator is removed. The elevator tab control drive between the bearing and the actuator will drop free as the actuator is removed.

(b) Servicing - Check actuator screw for excessive play. If tightening the thrust nut does not remove the play, the actuator should be replaced.

(c) Installation - Install the elevator tab mechanism in the elevator as follows:

(1) Insert tab actuator through inspection door, clevis end first.

(2) Move the actuator aft until it clears mounting bracket and then forward into position. Insert elevator tab drive between actuator and bearing as the actuator is moved forward into position.

(3) Secure actuator in position with bolts or setscrew. Tighten pivot setscrew until

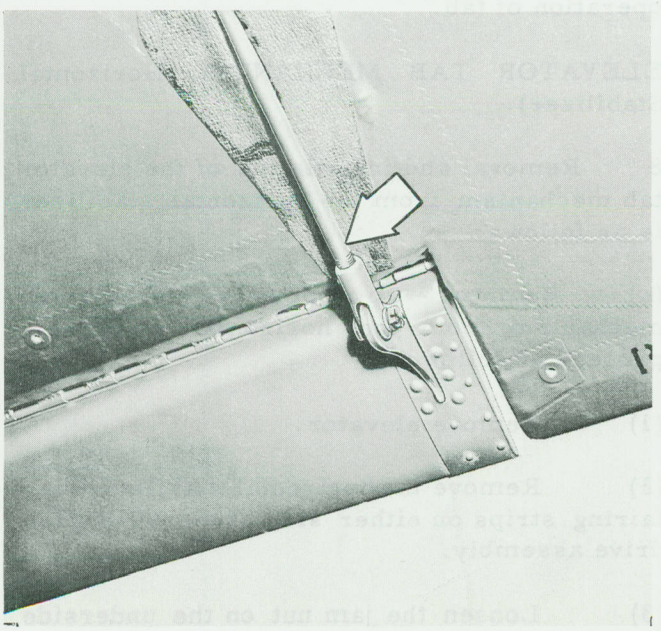


Figure 2-41 Elevator Tab Travel Adjustment

actuator pivots freely without play.

(d) Rigging Elevator Trim Tab - To rig elevator tab (Figure 2-41) proceed as follows:

(1) Set the trailing edge of the tabs even with the trailing edge of the elevator.

(2) Lift rack and move the rheostat gear until the indicator in the pilot's compartment reads zero (rack is on left side only).

(3) Loosen the clamps holding the rack to the tab actuator and move the rack until it is centred on the rheostat gear.

(4) Move the tab to the extreme position and check the rheostat to see that it does not travel too far.

(5) Check tab travel to the figure shown in Table 2-2, and rig the cables to the tension given in Table 2-1.

RUDDER CONTROLS

10 Rudder movement is controlled by dual sets of pedals, mounted on separate shafts (Figure 2-42). The shafts operate through slots in the cockpit floorboards. A rudder control balance cable connects the co-pilot's rudder pedals. Cables from the pilot's and co-pilot's pedals converge at pulleys on the centre section truss and pass aft where they are connected to the reduction pulleys. These pulleys reduce cable movements at the rudder pedals to one half that of the rudder control bell cranks. The long rudder cables are routed around these pulleys. One end is attached to Bulkhead 6; the other end runs aft to the rudder bell cranks in the stabilizer. The bell cranks are connected by two balance cables running laterally through the stabilizer. Link rods connect the bell cranks and the actuating horns on the rudders. Rudder travel is limited by the bell cranks contacting the stops (Figure 2-44).

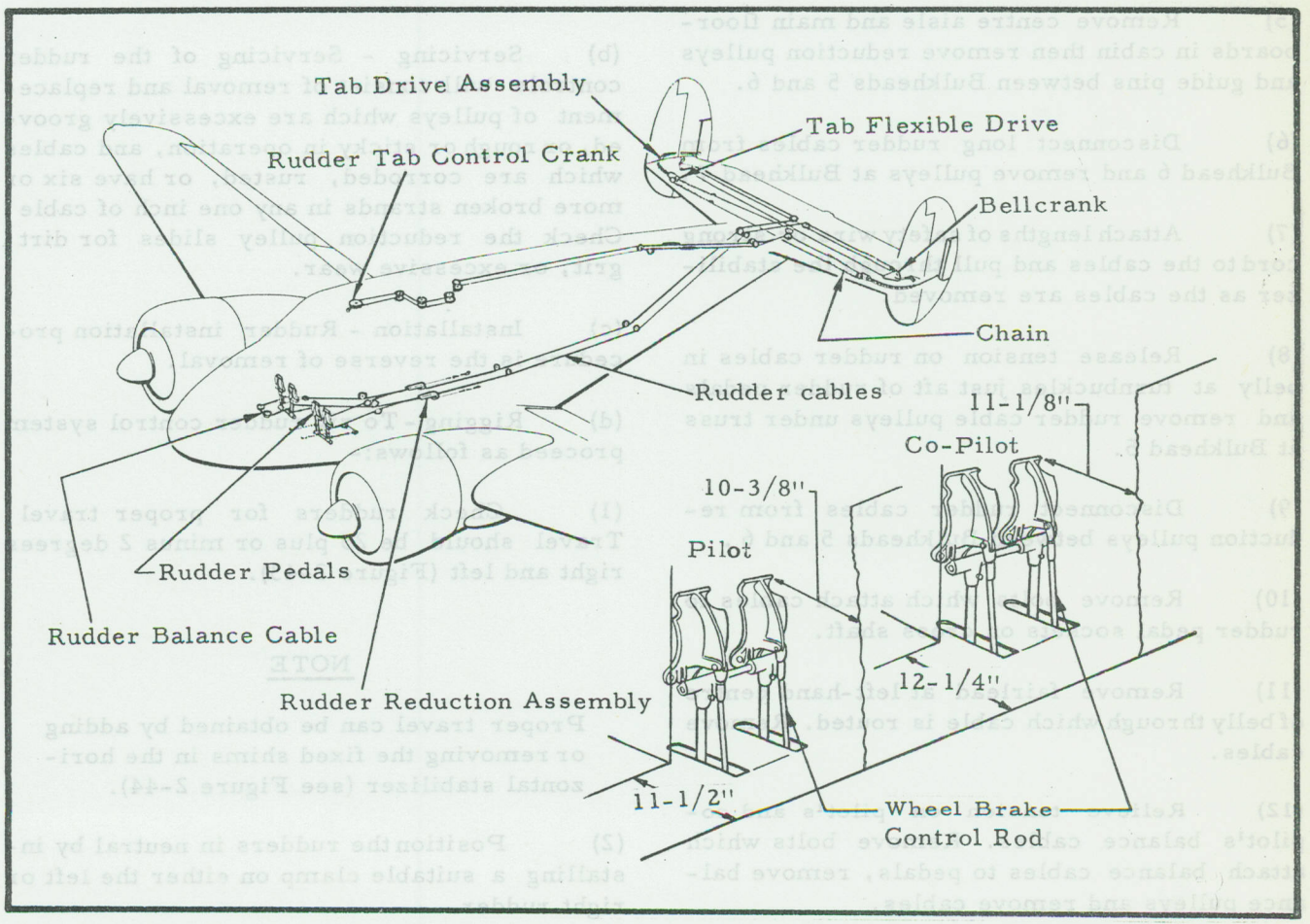


Figure 2-42 (Issue 1) Rudder Control System

(a) Removal - To remove rudder control system, proceed as follows:

(1) Remove the phenolite spacer between the long reduction cables and rear balance cable. (The spacers and cables are accessible through inspection doors on the top surface of the horizontal stabilizer, see Figure 1-13).

(2) Disconnect rudder cables at turnbuckles in the horizontal stabilizer.

(3) Relieve the tension on the balance cables by loosening the turnbuckle on the rear balance cable. Disconnect balance cable from bell crank. (Attach a length of safety wire or strong cord to the cables and pull through the stabilizer as the cables are removed).

(4) Remove the pulleys in aft centre of the horizontal stabilizer and the pulleys from Bulkheads 10 and 13, accessible from inside the tail compartment.

(5) Remove centre aisle and main floorboards in cabin then remove reduction pulleys and guide pins between Bulkheads 5 and 6.

(6) Disconnect long rudder cables from Bulkhead 6 and remove pulleys at Bulkhead 7.

(7) Attach lengths of safety wire or strong cord to the cables and pull through the stabilizer as the cables are removed.

(8) Release tension on rudder cables in belly at turnbuckles just aft of rudder pedals and remove rudder cable pulleys under truss at Bulkhead 5.

(9) Disconnect rudder cables from reduction pulleys between Bulkheads 5 and 6.

(10) Remove bolts which attach cables to rudder pedal sockets on cross shaft.

(11) Remove fairlead at left-hand centre of belly through which cable is routed. Remove cables.

(12) Relieve tension on pilot's and co-pilot's balance cables. Remove bolts which attach balance cables to pedals, remove balance pulleys and remove cables.

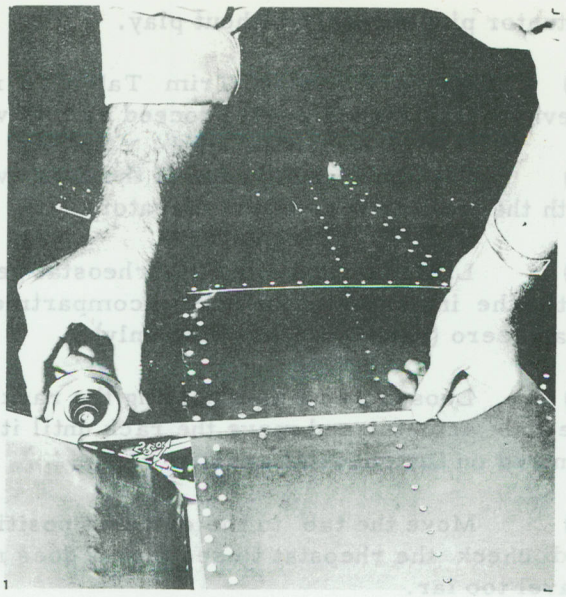


Figure 2-43 Rudder Travel Check

(b) Servicing - Servicing of the rudder controls will consist of removal and replacement of pulleys which are excessively grooved, or rough or sticky in operation, and cables which are corroded, rusted, or have six or more broken strands in any one inch of cable. Check the reduction pulley slides for dirt, grit, or excessive wear.

(c) Installation - Rudder installation procedure is the reverse of removal.

(d) Rigging - To rig rudder control system proceed as follows:-

(1) Check rudders for proper travel. Travel should be 25 plus or minus 2 degrees right and left (Figure 2-43).

NOTE

Proper travel can be obtained by adding or removing the fixed shims in the horizontal stabilizer (see Figure 2-44).

(2) Position the rudders in neutral by installing a suitable clamp on either the left or right rudder.

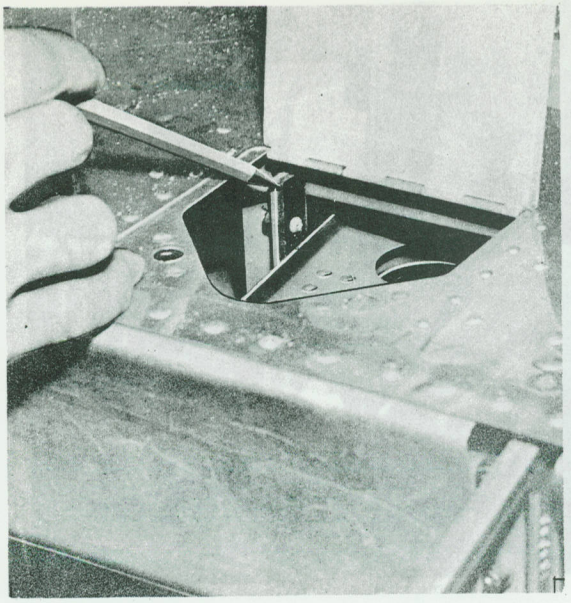


Figure 2-44 Rudder Travel Adjustment

(3) Using adjusting tool Part 37388-1 install through inspection opening below reduction pulleys and lock into position on the port and starboard reduction pulley slide. The adjusting tool is designed with a pre-determined measurement of 5/32-inch clearance required between the aft edge of each reduction pulley and the aft end of the slot in the slide, see Figure 2-45.

CAUTION

The red flag on the adjustment tool is to protrude through the reduction pulley inspection hole when installed.

(3A) An alternate method may be used by securing the reduction pulleys with "C" clamps so the aft edge of each pulley is 5/32-inch from the aft end of the slot in the slide, see Figure 2-45A.

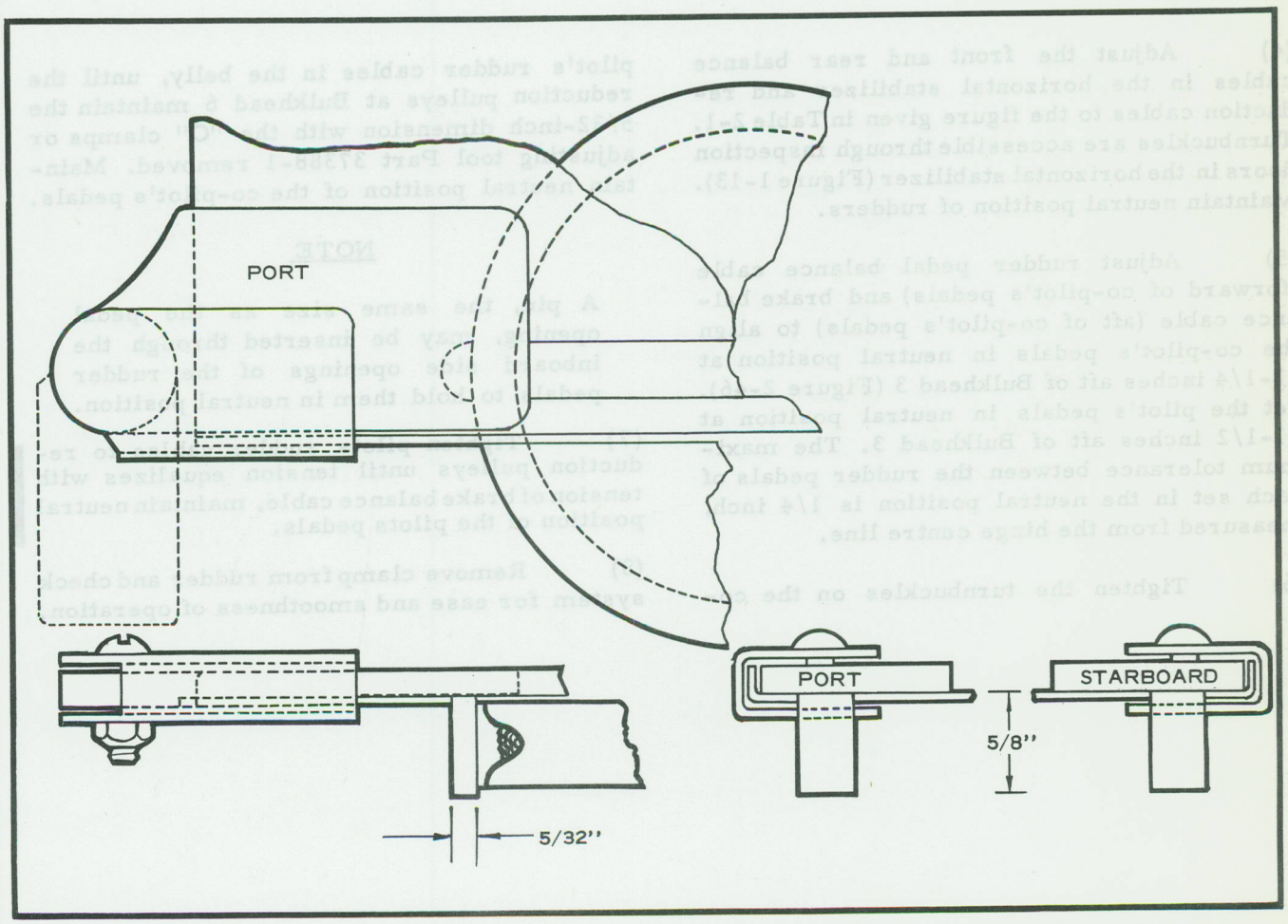


Figure 2-45 Adjusting Tool, Reduction Pulley Rudder Control

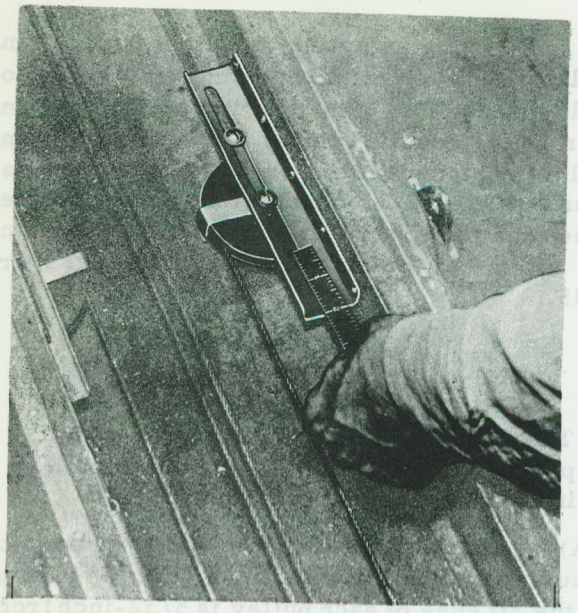


Figure 2-45A Rudder Reduction Pulley Setting

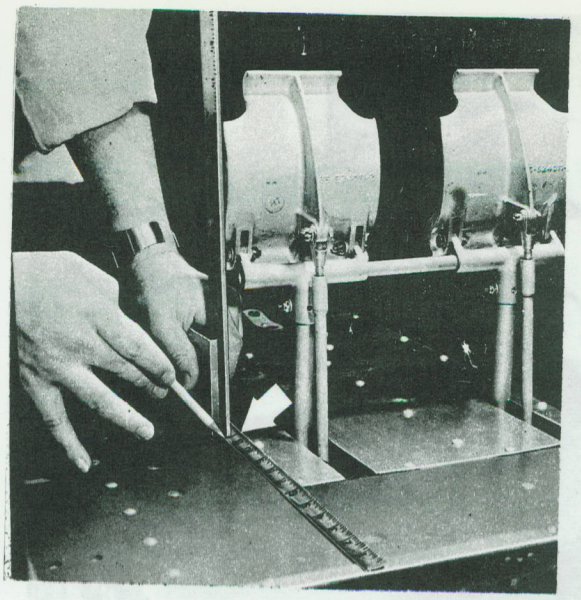


Figure 2-46 Rudder Pedal Neutral Setting

(4) Adjust the front and rear balance cables in the horizontal stabilizer and reduction cables to the figure given in Table 2-1. Turnbuckles are accessible through inspection doors in the horizontal stabilizer (Figure 1-13). Maintain neutral position of rudders.

(5) Adjust rudder pedal balance cable (forward of co-pilot's pedals) and brake balance cable (aft of co-pilot's pedals) to align the co-pilot's pedals in neutral position at 12-1/4 inches aft of Bulkhead 3 (Figure 2-46). Set the pilot's pedals in neutral position at 11-1/2 inches aft of Bulkhead 3. The maximum tolerance between the rudder pedals of each set in the neutral position is 1/4 inch, measured from the hinge centre line.

(6) Tighten the turnbuckles on the co-pilot's rudder cables in the belly, until the reduction pulleys at Bulkhead 6 maintain the 5/32-inch dimension with the "C" clamps or adjusting tool Part 37388-1 removed. Maintain neutral position of the co-pilot's pedals.

NOTE

A pin, the same size as the pedal opening, may be inserted through the inboard side openings of the rudder pedals to hold them in neutral position.

(7) Tighten pilots rudder cables to reduction pulleys until tension equalizes with tension of brake balance cable, maintain neutral position of the pilots pedals.

(8) Remove clamp from rudder and check system for ease and smoothness of operation.

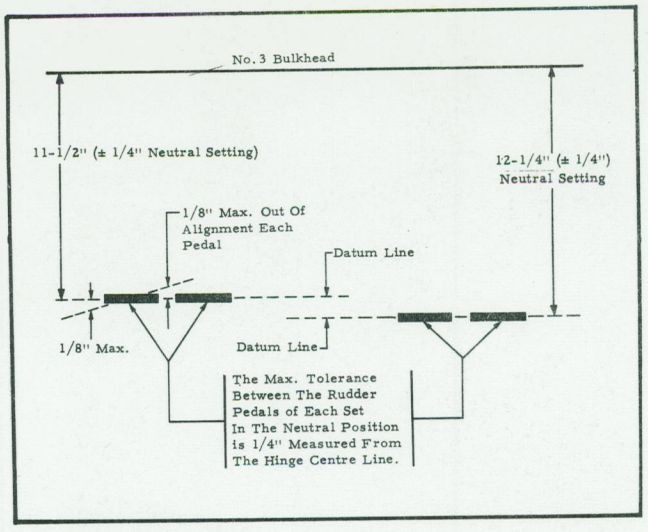


Figure 2-47 (Issue 1) Alignment of Rudder Pedals

(9) Check rudder reduction pulleys for the correct 5/32-inch dimension with the rudders in neutral. See Step (3).

(10) Re-check cable tension and make any necessary adjustments. Safety all turnbuckles and install centre aisle floorboards.

(e) Removal of Rudder Pedals - Remove the rudder pedals as follows:

(1) Relieve tension from cables and disconnect them from the pedals.

(2) Disconnect toe-brake rod from top of pedal.

(3) Remove pin from collar at bottom of pedal shaft and remove the pedal.

(f) Installation - To install rudder pedals, proceed as follows:

(1) Slip pedal shaft into collar on shaft and install pin.

(2) Connect toe-brake rod.

(3) Attach cables and safety. Rig to proper tension.

RUDDER TRIM TAB CONTROLS

11 Both the rudders are equipped with trim tabs, controlled by a hand crank mounted overhead in the pilot's compartment. A mechanically-operated position indicator adjacent to the hand crank, registers the position of the tabs. The tab control cable passes around the crank pulley and runs aft, routed around the astrodome on a series of pulleys. About the centre of the horizontal stabilizer it runs off to the right and to the left, connecting to a chain which actuates a 90-degree drive for each tab. Passing around the drive, it ties together again to form a continuous cable. From the 90-degree drives, flexible shafts turn actuators which move the tabs (Figure 2-42).

NOTE

Expeditor 3T is equipped with a trim tab on the left rudder only.

RUDDER TAB ACTUATOR (RUDDER)

12 The removal and installation of the rudder tab actuator installed in the rudder is as follows:-

(a) Removal - To remove the rudder tab actuator installed in the rudder, proceed as follows:-

(1) Disconnect tab actuator arm from horn.

(2) Remove nuts attaching actuator mount to rib in the rudder.

NOTE

If tools are not available for this operation, the actuator may be removed by loosening lock nut and backing off setscrew on the side of the mounting bracket.

PART 2

SECTION 5

WING FLAP CONTROLS

DESCRIPTION

1 The wing flaps are operated by an electric motor installed near the centre of the floor structure under the pilot's compartment floorboards. The flap motor is controlled by the flap position switch, and a dynamic brake relay. The motor connects through a worm gear to a cross shaft. Connected to the ends of the shaft are 90-degree drive assemblies, which turn the flap-actuator screws. The centre part of the drive shaft has a threaded section on which a travelling arm moves to actuate the flap limit switches. In emergencies, the flap system may be operated with the hand crank. The hand crank is pushed toward the pilot's seat to engage the flap mechanism. A double spline drive on the shaft of the hand crank makes it possible for the crank to operate either the landing gear or flaps. The position indicator is operated by a rheostat located on the flap gearbox in the right wheel well (Figure 2-49). On some remanufactured Expeditor 3T aircraft a cone-type overload clutch is incorporated in the flap motor gearbox. The overload clutch was used prior to installation of dynamic braking equipment, on remanufacture, the clutch was tightened sufficiently to render

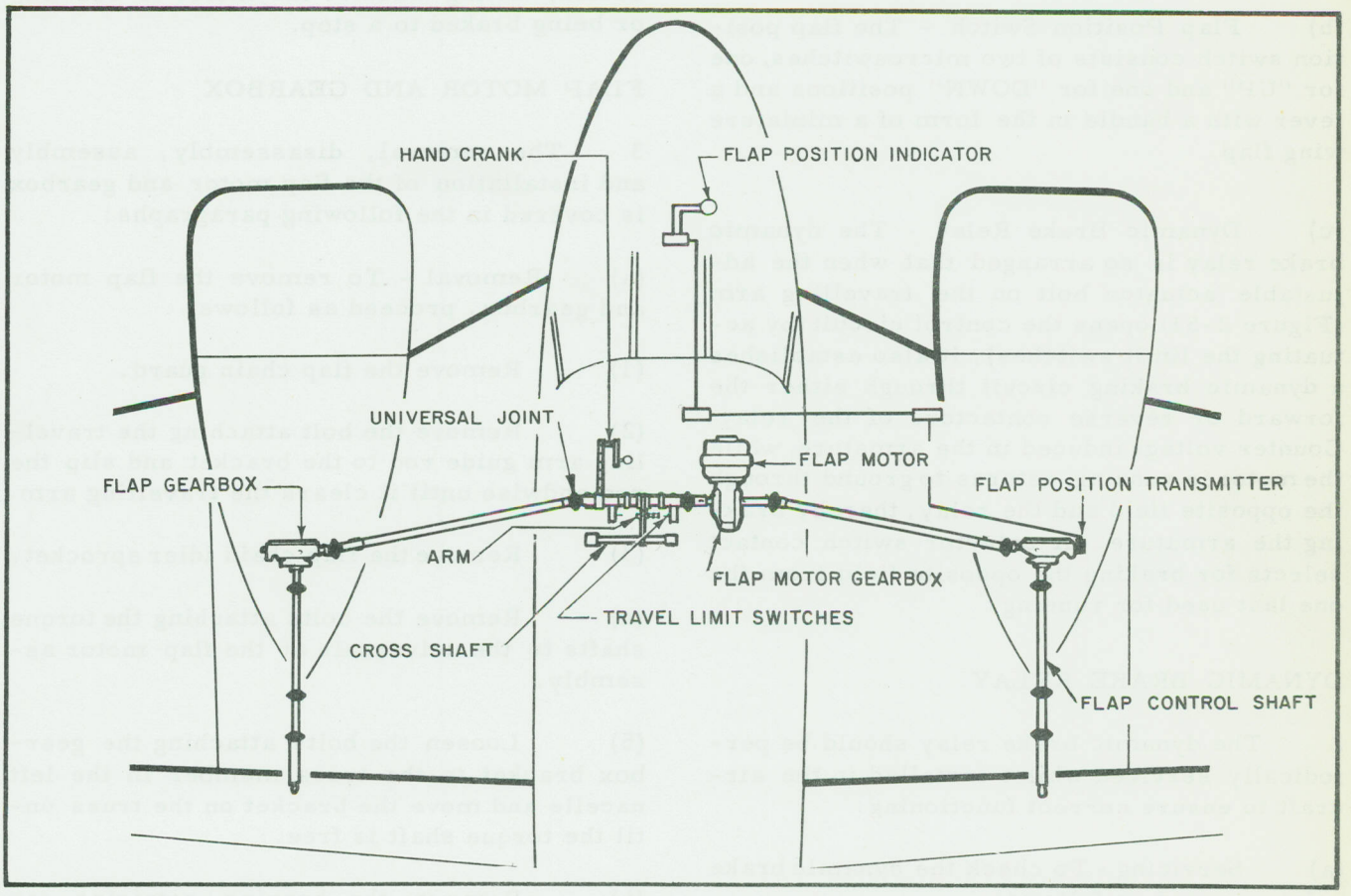


Figure 2-49 Wing Flap Control System

it inoperative.

(a) Wing Flap Electrical System - The flap position switch, shaped like a miniature flap, is mounted on the right front side of the control pedestal (Figure 6-2). This switch has three positions, "UP", "DOWN", and "OFF". The switch controls the flap motor located below the pilot's floorboard. Travel is governed by limit switches (Figure 2-51) and a dynamic brake. Position is registered by an indicator on the pilot's instrument panel. The indicator is connected to a rheostat on the flap gearbox in the right nacelle.

NOTE

With the exception of the flap position switch and the dynamic brake relay, the units described in the foregoing paragraph, will be discussed in the following text under Adjustments and Flap Service Information.

(b) Flap Position Switch - The flap position switch consists of two microswitches, one for "UP" and one for "DOWN" positions and a lever with a handle in the form of a miniature wing flap.

(c) Dynamic Brake Relay - The dynamic brake relay is so arranged that when the adjustable actuator bolt on the travelling arm (Figure 2-51) opens the control circuit (by actuating the limit switches), it also establishes a dynamic braking circuit through either the forward or reverse contactors of the relay. Counter voltage induced in the armature, while the motor is running, returns to ground through the opposite field and the relay, thereby braking the armature. A selector switch contact selects for braking the opposite field from the one last used for running.

DYNAMIC BRAKE RELAY

2 The dynamic brake relay should be periodically serviced whilst installed in the aircraft to ensure correct functioning.

(a) Servicing - To check the dynamic brake relay proceed as follows:

NOTE

No attempt to adjust or repair the dynamic brake relay, other than to check the electrical and ground connections, should be made, by other than authorized personnel. If the relay is malfunctioning, remove it, tag as unserviceable and return to stores.

(1) Remove access door in pilot's floorboard.

(2) Turn "ON" battery switch.

(3) Place flap position switch in "DOWN" position and actuate the "DOWN" limit switch by hand or with a screw driver and note whether the flap motor stops instantly or coasts to a stop. If the motor stops instantly the dynamic brake is functioning properly.

(4) Place the flap position switch in the "UP" position and actuate the "UP" limit switch, noting whether the motor is coasting or being braked to a stop.

FLAP MOTOR AND GEARBOX

3 The removal, disassembly, assembly and installation of the flap motor and gearbox is covered in the following paragraphs:

(a) Removal - To remove the flap motor and gearbox, proceed as follows:

(1) Remove the flap chain guard.

(2) Remove the bolt attaching the travelling arm guide rod to the bracket and slip the rod endwise until it clears the travelling arm.

(3) Remove the flap chain idler sprocket.

(4) Remove the bolts attaching the torque shafts to the universals at the flap motor assembly.

(5) Loosen the bolts attaching the gearbox bracket to the truss member in the left nacelle and move the bracket on the truss until the torque shaft is free.

(6) Remove the bearing retaining cap

supporting the left end of the flap motor shaft.

(7) Disconnect the electrical wiring and remove the screws attaching the flap motor to the supporting bracket.

(8) Remove the flap motor assembly. If necessary, disconnect the flap chain to obtain enough slack to remove it from the sprocket. The repair link must be removed to disconnect the chain.

(b) Disassembly - Remove the taper pins on each side of the flap gear housing and remove the universals.

(c) Servicing - Upon disassembly of the flap motor and gearbox, the following checks should be carried out:

NOTE

Limit the repairs on the motor to cleaning of commutator, external cleaning and replacement of brushes. Should any other repairs be needed, remove motor tag as unserviceable and return to stores.

(1) Repairs will consist of replacement of worn parts in gearbox assembly.

(2) If the bronze gear shows excessive wear on the teeth of the surface which contacts the clutch face, it should be replaced.

(3) The clutch should be replaced if the clutch face or keyway shows excessive wear, indicated by scratches, grooves or ridges.

(d) Assembly - Assemble the flap motor gearbox as follows:

CAUTION

Ensure that the worm is assembled on the motor shaft as shown in EO 05-45B-4 before inserting shaft into gear housing.

(1) Install bearing in gear housing.

(2) Insert shaft into gear housing.

(3) Install universals on each side of the housing and secure with taper pins.

(e) Installation - Install the flap motor and gearbox as follows:

(1) Install fibre block in bracket. Place flap motor and gearbox assembly in position on the bracket and install the mounting screws. Safety.

(2) Install bearing retaining cap on the left end of the flap motor shaft.

(3) Move the torque shaft into position on the flap motor universal. Tighten clamps holding the gearbox to the bracket in the left nacelle. (Be sure that chain is installed on sprocket).

(4) Install the flap chain idler sprocket.

(5) Install the travelling arm guide rod.

(6) Check operation of flap system limit switches.

FLAP SCREW ASSEMBLY (Outboard Wing)

4 The flap screw assembly is attached to the flap gearbox and flap control surface and may be removed, serviced and installed as follows:

(a) Removal - To remove the flap screw assembly, proceed as follows:

(1) Remove bolt connecting the flap actuator screw to the flap.

(2) Remove the bolt from the shaft at the gearbox in the nacelle.

(3) Remove patch from lightening hole in the rear wing spar just inboard from the flap actuator screw.

(4) Remove bolts holding bearing block to the mounting bracket just forward of the rear wing spar. Two men will be required for this operation. One man will work from a lightening hole in the aft bulkhead of the nacelle, while the other man will work from the lightening hole in the rear wing spar. There are two bolts to be removed from each actuator. They have castellated nuts with cotter keys.

(5) Move the shaft and the actuator screw aft until it clears the gearbox; then remove it through the nacelle.

(b) Servicing - Upon removal, the flap screw assembly should be serviced as follows:

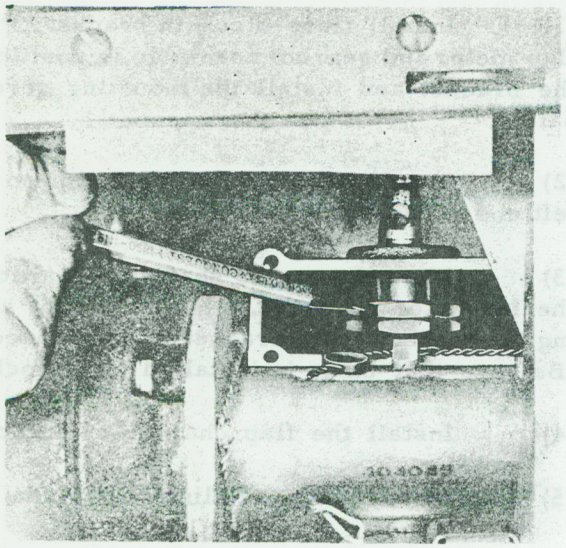


Figure 2-50 Flap Overload Clutch Adjustment

(1) Check screw assemblies for excessive wear.

(2) Shafts should be inspected for cracks and elongated bolt holes. Shafts may be straightened and welded. Cadmium plating after such repairs is recommended.

(c) Installation - To install the flap screw assembly, proceed as follows:-

(1) Install the torque shaft on the actuator screw. Install screw and shaft into position in the wing through the rear of the nacelle.

(2) Working through lightening holes in the rear spar of the wing and in the rear bulkhead of the nacelle, install bolts to hold bearing block in position. Block is installed just forward of the rear wing spar. Two men will be required for the operation.

(3) Install bolt in the shaft at the gearbox.

(4) Install patch on rear wing spar lightening hole.

(5) Connect the flap actuator screw to the flap.

(6) Safety all connections.

5 Lubrication of flap actuators during periodic checks is as follows:

(a) Handcrank the flaps to the full down position.

(b) Mark the outside of the flap housing to correspond with the trailing edge of the wing skin. This will aid in the proper re-installation of the actuator.

(c) Disconnect the actuator from the flap and unscrew the actuator until it bottoms.

(d) In this position a modified grease fitting can be inserted into the exposed hole and the actuator lubricated.

NOTE

Do not over fill since the excess lubricant will be forced out the vent when the actuator is at extreme opposite travel.

(e) Remove the fitting when lubrication is completed.

(f) Re-align the mark on the actuator with the wing trailing edge.

(g) With the actuator secured to prevent further rotation, the flap handcrank may be operated to check for misalignment or binding.

(h) Connect the actuator to the flap and check for proper rigging.

FLAP LIMIT SWITCHES

6 Adjustment of the flap limit switches is made by changing the position of the adjustable actuator bolt located on the travelling arm, refer to Figure 2-51. The amount of adjustment varies with the make of flap mechanism

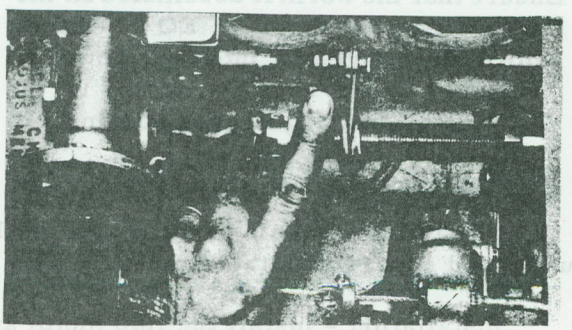


Figure 2-51 Flap Limit Switch

motor. The limit switches are accessible through the access door in the pilot's compartment floorboard. The applicable settings should be adhered to closely; if the stops are contacted before the limit switches are actuated, excessive strain will be put on the system and premature failures will result. Loosen the jam nuts on the actuator bolts and change their length as required.

CAUTION

Evidence of excessive thread wear and/or contact between the flap limit switch arm and stop nuts indicates possible malfunctioning of the flap motor dynamic brake relay.

NOTE

Where possible, the limit switches are to be set using an external power source delivering a full 28 volts.

(a) Dumore Motor - The adjusting bolt fitted to the flap limit switch arm (Figure 2-52), is adjusted as follows:-

(1) By use of the handcrank, raise the flaps to the "UP" (0°) position and "DOWN" position (46°) plus zero degrees minus one-half a degree, and check that the flap limit switch arm engages with the "UP" and "DOWN" stop on the cross shaft.

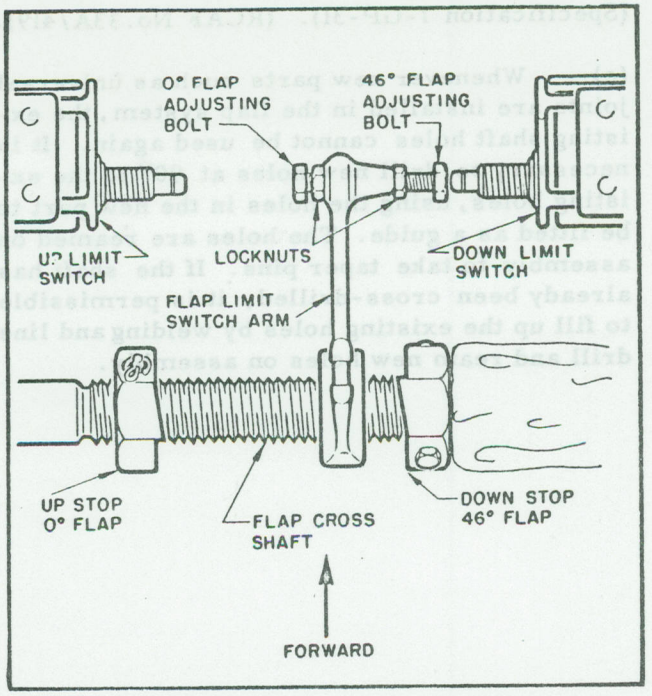


Figure 2-52 Flap Travel Adjustment

(2) Handcrank the flap to the "UP" (0°) position and check that the flap limit switch arm engages with the "UP" stop. Turn the handcrank in the opposite direction until the "UP" stop nut has rotated three hexes (or 1° of flap movement). Turn the adjusting bolt on the flap limit switch arm until it depresses the "UP" limit switch plunger.

(3) Repeat operation (2) for the "DOWN" (46°) flap position.

(b) Lamb or Black and Decker Motor - The adjustment procedure for when a Lamb or Black and Decker Motor is fitted is the same as for the Dumore motor, except that in the "DOWN" (46°) position the handcrank is turned back 1 hex of the stop nut.

NOTE

The above adjustments are calibrated in sixths, due to the presence of the hex-nut that rotates on the screw shaft. Each corner of the hex represents a sixth of the circumference when rotated and therefore presents a convenient and simple method of calibrating actuator travel.

FLAP ADJUSTMENT

7 The flap travel is adjusted as follows:

(a) Run flap mechanism to the "UP" position with hand crank. Back crank off one-sixth turn.

(b) Check the trailing edge of the flap for alignment with the flap fillet at the inboard aft end of the flap. Using a contour jig, or visually if no jig is available, check for alignment with the wing contour.

(c) If the flap does not align, adjust flap control screw until flap is in alignment.

CAUTION

Be sure to check the flap control screw after adjusting, to make sure it is not bottoming in the actuator or pulling out to the aft end. If evidence of binding can be felt when turning the flap control screw, an adjustment must be made by screwing the flap control screw shaft to relieve the binding, compensating for the change in the shaft length.

(d) Re-install flap control bolt. Place a bubble protractor on the surface of the flap adjacent to the centre rib. Adjust protractor until the bubble is centred.

(e) Remove protractor, run flaps down electrically and check for 46° plus zero degrees, minus a half a degree of travel.

(f) Install nut on flap control bolt and lock after the correct flap travel is obtained. Connect bonding straps to inboard and outboard ends of the flap. Replace inspection covers, windows and fabricoid patches at the hinge bolts. Apply the patches with nitrate dope, Specification 1-GP-31. (RCAF No. 33A/419).

(g) Check flap limit switches to be sure they are correctly set.

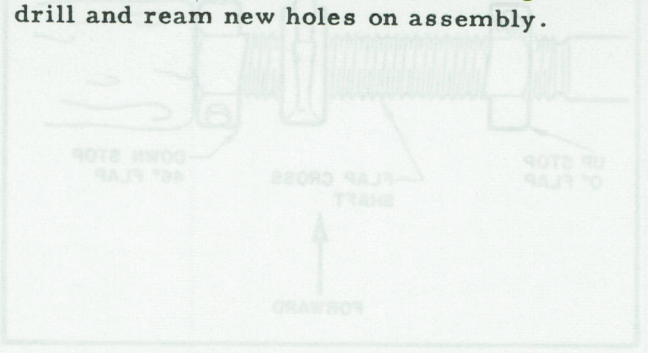
FLAP SERVICE INFORMATION

8 The flap position indicator may be set, and play removed from the flaps as follows:

(a) Flap Position Indicator - To set the flap position indicator, run the flaps to the full up position. Remove the rheostat from the gearbox in the right nacelle. Move shaft on the rheostat until the indicator in the pilot's compartment reads "UP". Replace rheostat.

(b) Flap Buffer Pads - Play may be removed from the flaps when in the up position by cementing buffer pads on the leading edge of the flaps where they make contact with the wing. These buffer pads are of fabricoid material and are applied with nitrate dope (Specification 1-GP-31). (RCAF No.33A/419).

(c) Whenever new parts such as universal joints are installed in the flap system, the existing shaft holes cannot be used again. It is necessary to drill new holes at 90° to the existing holes, using the holes in the new part to be fitted as a guide. The holes are reamed on assembly to take taper pins. If the shaft has already been cross-drilled, it is permissible to fill up the existing holes by welding and line drill and ream new holes on assembly.



PART 2

SECTION 6

LANDING GEAR

GENERAL DESCRIPTION

1 The main landing-gear (Figure 2-53) incorporates an air-oil shock absorber, equipped with a self compensating rebound control mechanism. The lower or piston portion of the shock absorber carries the wheel in a yoke type strut. The upper or cylinder portion is mounted in a V-brace, which is pivoted on bolts running through bushings in the centre section truss. The oleo drag leg, which dampens shock loads imposed on the gear and centre section truss, connects the shock absorber to the slide assembly, operating on a slide tube running forward and upward in the nacelle. The retracting chain driven by the landing-gear electrical motor through a system of gears and torque shafts, moves the slide along the slide tube drawing the gear backwards and upwards into the nacelle. The landing-gear motor is controlled by a switch on the pilot's control pedestal, and a dynamic braking relay. Limit switches in the left nacelle actuated by the slide assembly control travel of the gear in both directions. Similar switches in the right nacelle control position lights on the pilot's control pedestal, indicating position of the gear. Safety switches in the landing-gear control, and position switch-latch circuits prevent accidental retraction while the weight of the aircraft is on the gear. Safety switches in the landing-gear control, and latch solenoid circuits, normally prevent accidental retraction while the weight of the aircraft is on the gear. However depressing the undercarriage emergency over-ride switch mounted above the undercarriage selector handle and simultaneously raising the undercarriage selector handle will cause landing gear to retract if power is applied to aircraft.

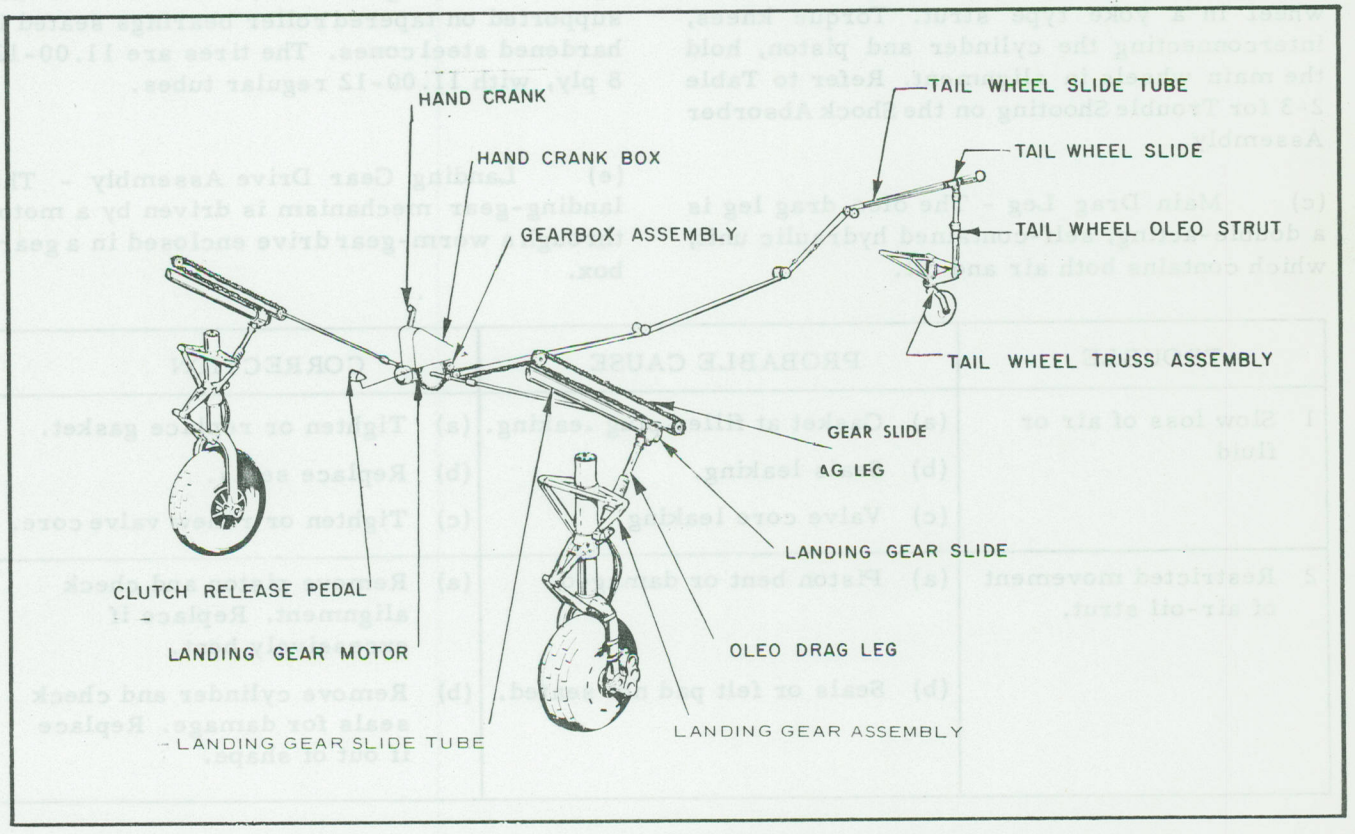


Figure 2-53 Landing Gear Retract System

Landing gear doors are automatically operated by actuating links between the shock absorber and the doors. The landing-gear retracting system is electrically driven and is equipped for emergency manual operation. Torque shafts connect an electric motor and worm-gear assembly to chain-driven slides in each of the main wheel wells. The tail-wheel retraction slide is operated by cables connected to a chain drive on the motor assembly. A spring-loaded, disc-type clutch is installed in the motor drive unit to protect the system against an overload and absorb the shock of starting and stopping. (Figure 2-53).

(a) Main Landing Gear Doors - The main landing-gear doors are of heat-treated aluminum-alloy skin which is riveted and spot welded to a die-formed, reinforced stiffener, holding the skin in the proper conforming contour to match the contour of the nacelle.

(b) Main Shock Absorber Strut Assembly - The main landing-gear shock absorber is equipped with a self compensating rebound control mechanism. It consists of a cylinder mounted in a V-brace pivoted to the centre section truss, and a piston which carries the wheel in a yoke type strut. Torque knees, interconnecting the cylinder and piston, hold the main wheels in alignment. Refer to Table 2-3 for Trouble Shooting on the Shock Absorber Assembly.

(c) Main Drag Leg - The oleo drag leg is a double-acting, self-contained hydraulic unit, which contains both air and oil.

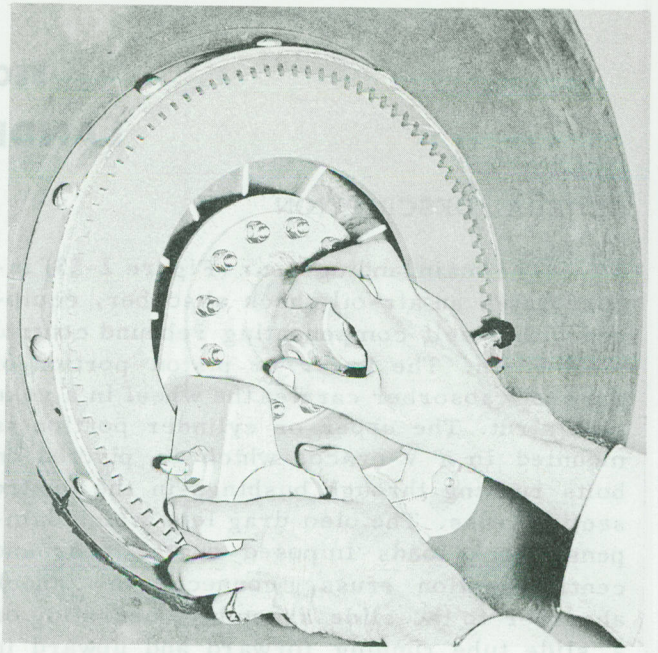


Figure 2-54 Brake and Wheel Assembly

(d) Brake and Wheel Assembly - The brake and wheel assembly consist of a single disc, gear-type brake and a twelve-inch balanced split wheel (Figure 2-54). The wheels are supported on tapered roller bearings seated in hardened steel cones. The tires are 11.00-12, 8 ply, with 11.00-12 regular tubes.

(e) Landing Gear Drive Assembly - The landing-gear mechanism is driven by a motor through a worm-gear drive enclosed in a gear-box.

TROUBLE	PROBABLE CAUSE	CORRECTION
1 Slow loss of air or fluid	(a) Gasket at filler plug leaking.	(a) Tighten or replace gasket.
	(b) Seals leaking.	(b) Replace seals.
	(c) Valve core leaking.	(c) Tighten or renew valve core.
2 Restricted movement of air-oil strut.	(a) Piston bent or damaged.	(a) Remove piston and check alignment. Replace if excessively bent.
	(b) Seals or felt pad not seated.	(b) Remove cylinder and check seals for damage. Replace if out of shape.

Table 2-3 Trouble Shooting, Shock Absorber

(f) Landing Gear and Flap Hand Crank Assembly - A manual clutch, operated from the pilot's compartment, disengages the motor and gearbox from the system for manual operation of the landing-gear. To manually operate the landing-gear, disengage the clutch, place the hand crank in the "out" position and turn.

(g) Dual Brake Installation - The brakes may be operated either from the pilot's or co-pilot's position. Fluid from the hydraulic reservoir is supplied to the four separate master brake cylinders; one for each brake pedal. Each pedal actuates the master brake cylinder by means of a rod attached to the cylinder. When the brake pedal is depressed, fluid pressure is furnished from the master brake cylinder to the corresponding brake operating cylinder. Each of the two brakes operate independently of the other, so that they may be applied singly or together.

(h) Tail Landing Gear - The tail-gear assembly is composed of a welded steel-tubing truss, a full swivel fork and an air-oil shock absorber. For trouble shooting of the tail-gear assembly, see Table 2-4.

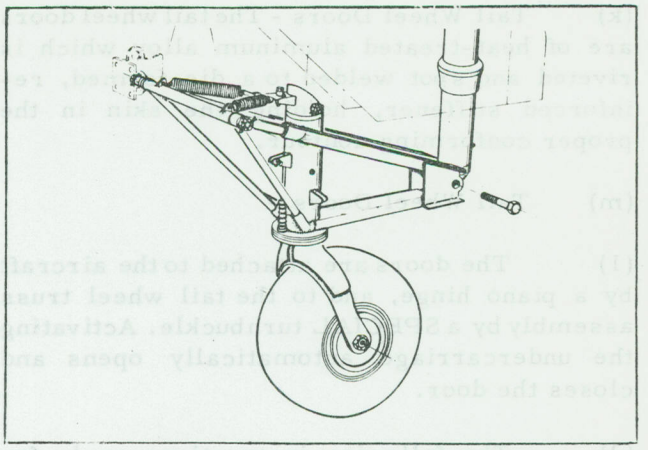


Figure 2-55 Tail Gear Assembly

(j) Tail Wheel Lock Assembly - A locking mechanism controlled from the pilot's compartment, locks the swivel fork in a stationary position for take-off and landing (Figure 2-55).

TROUBLE	PROBABLE CAUSE	CORRECTION
1 Tail wheel will not lock or unlock.	(a) Cable tension insufficient.	(a) Check and reset cable tension.
	(b) Lock plunger rusted or corroded.	(b) Remove plunger, clean with emery cloth or equivalent, replace and lubricate with powdered graphite, Spec. DTD-77, (Do not use oil).
	(c) Return spring broken.	(c) Replace spring.
2 Restricted movement of air-oil strut	(a) Bent or damaged piston.	(a) Remove piston, check alignment and replace if necessary.
	(b) Seals not seated properly.	(b) Remove piston, inspect seals, and replace if damaged.
	(c) Insufficient fluid.	(c) Refill strut to proper fluid level.
3 Leakage of air or fluid	(a) Seals leaking.	(a) Replace seal (tightening of packing nut will not stop leak).
	(b) Filler plug gasket leaking.	(b) Tighten or replace gasket.
	(c) Valve core leaking.	(c) Replace valve core.

Table 2-4 Trouble Shooting, Tail Wheel

(k) Tail Wheel Doors - The tail wheel doors are of heat-treated aluminum alloy which is riveted and spot welded to a die formed, reinforced stiffener, holding the skin in the proper conforming contour.

(m) Tail Wheel Doors -

(1) The doors are attached to the aircraft by a piano hinge, and to the tail wheel truss assembly by a SPECIAL turnbuckle. Activating the undercarriage automatically opens and closes the door.

(2) The following instructions apply for fitting and rigging tail wheel doors, provided the limit switches of the retract mechanism are set correctly and the tail wheel retract mechanism is in synchronization with the main landing gear retract mechanism.

WARNING

Inadvertent operation of the undercarriage emergency over-ride switch and simultaneous raising of landing gear selector handle will cause the aircraft undercarriage to retract if battery power is "ON" or external power is applied whether or not the weight is on the gear.

CAUTION

The applicable safety precautions are to be observed when lifting the aircraft and cycling the undercarriage.

REMOVAL AND INSPECTION

(n) Proceed as follows:

(1) Disconnect the actuator turnbuckle from the door.

(2) Support the door, remove piano hinge wire, disengage hinge by gently lowering door.

(3) Inspect door and repair if required, discard if distorted. Small cracks not exceeding 3/4 inch may be stopdrilled. Check attachment linkage for freedom of movement and wear. Worn linkage is to be replaced if the accumulated wear of the linkage allows a door movement in excess of 1/2 inch, measurement to be taken at the inboard edge of the door. Check attachment hinge for wear and replace if necessary. Replace bent turnbuckles.

INSTALLING AND FITTING NEW DOORS

(p) With the tail wheel retracted and the actuator turnbuckle removed from the tail wheel truss assembly, install a new door by the following method:

(1) Engage the attaching hinge and insert the piano hinge wire.

(2) Swing the door and check hinge for binding. Close door by hand until the leading edge of the door contacts the mating surface of the fuselage. If the leading edge of the door does not fit the curvature of the fuselage without forcing the door closed, the leading edge of the door is to be reworked. The rework is to be accomplished by supporting the metal outboard of the door webbing with a wedge shaped dolly, and using a rawhide or plastic hammer, rework the leading edge to conform to the curvature of the fuselage mating surface. Reworking the leading edge will also establish the required 1/16 inch to 1/8 inch clearance between the meeting edges of the doors.

(q) Attaching bolts are to be installed in door attaching linkage as follows:

NOTE

Ensure turnbuckles are installed with the light eyebolt toward the door.

(1) The bolt attaching the turnbuckle eye (light) to the link assembly at tail wheel truss assembly is to point UP.

(2) The bolt attaching the turnbuckle eye (light) to the link assembly at the door is to point DOWN.

(3) The bolts attaching the link assembly to the tail wheel truss assembly and the link assembly to the door are to point AFT.

RIGGING PROCEDURE

(r) Proceed as follows:

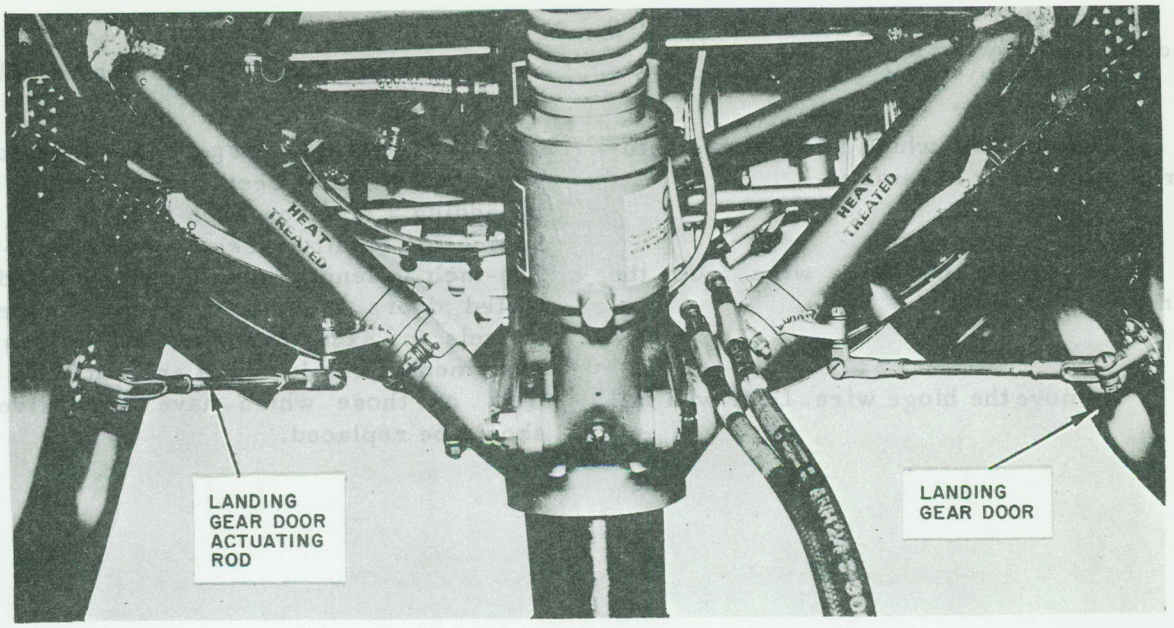


Figure 2-56 Landing Gear Door Adjustment

(1) Disconnect actuator turnbuckle at the tail wheel truss assembly of the opposite door and secure to prevent interference and damage.

(2) With the linkage correctly installed, extend the turnbuckle to ensure door will clear tail wheel axle. Cycle undercarriage and continue to adjust the turnbuckle after each cycling until the door fits snugly. DO NOT bow door by preloading.

CAUTION

Shortening of the turnbuckle to preload doors or absorb mechanical wear can result in the link rod passing centre and forming a geometric lock during operation. If the adjustment required for good door fit leaves the link rod in an almost vertical position with strut fully extended, abnormal wear of the linkage and door part is indicated and should be rectified by parts replacement rather than by adjustment.

(3) Check attachment bolts for security and lockwire turnbuckle.

NOTE

Ensure that the lower larger eye-end ONLY is wirelocked to the turnbuckle barrel assembly, and that the upper eye-end is free and can rotate in the turnbuckle barrel.

(4) Connect opposite door, secure attachment fittings, cycle undercarriage and check operation and clearance of doors.

(s) Tail Wheel Shock Absorber - The tail wheel air-oil shock absorber connects the aft end of the truss to the slide assembly for retraction purposes.

(t) Tail Wheel - The wheel assembly consists of a split hub assembly mounting a 14.50 smooth tire and tube.

MAIN LANDING GEAR DOORS

2 The doors are attached to the aircraft by a hinge, one-half of which is riveted to the lower portion of the nacelle, while its matching half is riveted to the door. A stainless steel hinge wire, inserted through the matching hinge lugs, attaches the door to the nacelle. When the landing gear is retracted the doors cover the wheel well openings. The doors should operate freely and fit snugly enough to avoid excessive vibration. Actuating rods, secured to the main gear assembly, automatically close the doors when the gear is retracted.

(a) Removal - Remove the main landing gear door as follows:

(1) Remove bolt which secures the actuator rod to the door assembly.

(2) Disengage the hinge wire from the slot in the nacelle skin.

(3) Remove the hinge wire. Door will fall free.

NOTE

Support the door while removing hinge wire.

(b) Servicing - Inspect the door for spot welds which have been broken loose. Repair by adding a rivet on each side of the broken spot weld. Small cracks, not over 1/2-inch to 3/4-inch in length, may be stop drilled. Distorted doors must be replaced. Inspect the swivels for excessive play and/or restricted movement. Swivels which are sticky in operation, or those which have excessive play, should be replaced.

(c) Installation - Install the landing-gear doors as follows:

(1) Position the door on hinge and insert the hinge.

(2) Insert the forward end of the hinge wire in the slot in the nacelle skin.

(3) Connect actuator rod to door and install bolt.

NOTE

Do not overtighten the bolt which attaches the actuator rod to the door. The bolt should be loose enough to be turned with the finger after the nut is installed and keyed.

(d) Rigging - The landing-gear doors are adjusted by varying the length of the actuating rods (Figure 2-56) which connect the doors to the shock strut and by moving the clamp up or down or rotating it on the V-brace Properly adjusted, the doors will fit snugly with about 1/8-inch clearance between them when fully retracted. Adjust the linkage to cause a slight bow (approximately 1/8-inch) in the lower forward nacelle skin with the gears fully retracted. This will eliminate vibration of the doors while in flight. The bolts in the attaching linkage should not be tightened to such an extent as to impair free action of the swivel or rod linkage. Rig the main landing-gear doors as follows:

(1) Support the aircraft on jacks.

NOTE

When hoisting or jacking the aircraft always place a minimum of 200 pounds ballast on the horizontal stabilizer to prevent the aircraft from nosing over. A felt or canvas pad should be used to protect the horizontal stabilizer, and the ballast should be placed over the front spar near the fuselage.

(2) Check the upper and lower limit switches to ensure they are correctly set.

(3) Disconnect the landing-gear door linkage on either left or right wheel, and secure the doors back and out of the way.

(4) Adjust the landing-gear door linkage (Figure 2-56), which has not been disconnected and set the doors approximately 12 plus or minus 1/2-inch from the landing-gear piston. Measure from the lower forward corner of each door.

NOTE

The landing-gear door linkage is adjusted by any one or all of the following methods.

a. Rotation of the clamps on the V-brace
b. Moving the linkage either up or down on the V-brace.
c. Adjusting the clevis on the door linkage rod

(5) Station one man in the pilot's compartment and another man at the landing-gear which is being rigged. The man in the pilot's compartment will operate the landing-gear position switch, and the man outside the aircraft will watch the doors very closely as the gear is being retracted and make adjustments as required.

CAUTION

Do not reverse undercarriage mid-cycle. Extensive damage to dynamic brake relay contacts can result.

(6) With the battery master switch in the "OFF" position, connect an auxiliary power unit to the ground supply socket. Pull out the landing-gear circuit breaker and select "UP" with the landing-gear position switch. By intermittent operation of the circuit breaker, slowly retract the gear.

NOTE

Check the landing-gear torque shafts (left and right) to be sure that they will clear all lines, tubing and structural members of the aircraft.

(7) Watch the doors closely as the gear is being retracted to ensure that clearance between the doors and the tire is maintained. If it is apparent that the doors will not clear the fork or tire, run-gear down and re-adjust the door linkage. Maintain the dimension given in step (d).

TROUBLE	PROBABLE CAUSE	CORRECTION
1 Door is too loose in "up" position.	(a) Linkage set too high on V-brace. (b) Clamp rotated too far aft on V-brace (c) Clevis unscrewed too far, making rod too long.	(a) Lower linkage on V-brace. (b) Rotate clamp forward. (c) Shorten rod by screwing clevis in.
2 Door is too tight in "up" position.	(a) Linkage set too low on V-brace. (b) Clamp rotated too far forward on V-brace. (c) Clevis screwed in too far making rod too short.	(a) Raise linkage on V-brace. (b) Rotate clamp aft. (c) Lengthen rod by screwing clevis out.
3 Door dimensions are correct but doors are too tight in "up" position.	(a) Linkage improperly adjusted.	(a) Raise linkage on V-brace and screw clevis in slightly. (b) Rotate clamp aft and Lengthen rod.
4 Door dimensions are correct but doors are too loose in "up" position.	(a) Linkage improperly adjusted.	(a) Lower clamp on V-brace or rotate clamp forward and shorten actuator rod.
5 Door dimensions are less than specified dimensions and doors are properly rigged.	(a) Linkage improperly adjusted.	(a) Rotate clamp forward and lengthen rod slightly.
6 Door dimensions are greater than specified and doors are properly rigged.	(a) Linkage improperly adjusted.	(a) Rotate clamp aft slightly and shorten rod slightly.

Table 2-5 Trouble Shooting, Main Landing-Gear Door Rigging

NOTE

A combination of any two or all of the methods for adjusting the door linkages (see note preceding step 5) may be necessary to maintain the correct door dimension in "down" position, and to obtain proper rig and tension of the doors in "up" position. To obtain correct rigging of the doors, see Trouble Shooting Table 2-5.

(8) Run gears up slowly, checking carefully to be sure the doors clear the tire and landing-gear fork. Maintain 1/4-inch minimum clearance between the door and tire, door and landing-gear fork, and door and wheel axle.

WARNING

Accumulative tolerances in the landing-gear door linkage and the landing-gear door swivel will allow approximately 1/4 to 3/8-inch "play" in the landing-gear door. When checking the 1/4-inch clearance, push the door toward the wheel and remove the "play". Maintain the 1/4-inch dimension with the "play" removed.

(9) Adjust linkage to close doors snugly and cause a bow of approximately 1/16 to 3/32-inch of the nacelle.

(10) Check the doors for alignment. A small amount of forming with a rawhide mallet may be necessary to align the edges of the

doors. Take care not to strike too hard and break the spot welds loose or distort the doors.

(11) Run gears down, tighten and key all bolts. Tighten and lock jam nut on the door rod linkage.

NOTE

The clevis head bolt attaching the rod end clevis to the door swivel should be tightened only finger tight.

(12) Repeat steps (4) through (11) for opposite gear.

(13) Remove aircraft from jacks.

MAIN WHEELS

3 The halves of the split wheels are held together by twelve bolts and nuts. Each half is balanced independently of the other, and for maintenance purposes may be replaced separately. The section of the wheel next to the brake assembly has an extended flange equipped with a hardened steel gear ring to accommodate the gear teeth in the brake disc. (Figure 2-57).

(a) Removal - Remove main wheel as follows:

(1) Place jacks under the aircraft on the side from which the wheel is to be removed.

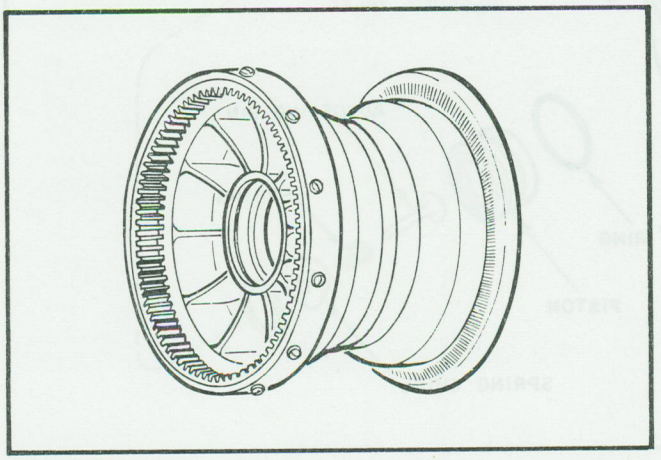


Figure 2-57 Wheel Assembly

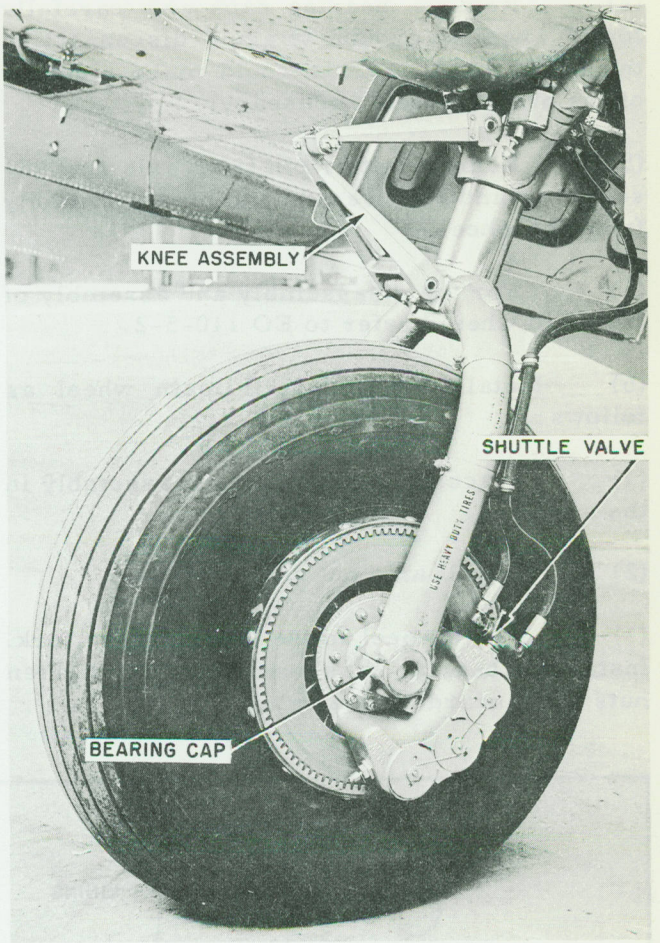


Figure 2-58 Landing Gear Assembly

(2) To enable rapid identification of the bearing caps on shock absorber assemblies, paint the caps and forks on the outer surfaces as follows:

a. On the Port Assembly, paint the outboard side red and the inboard side blue.

b. On the Starboard Assembly, paint the inboard side yellow and the outboard side green.

WARNING

The bearing caps securing the axle to the strut fork are not interchangeable or reversible. They must be installed exactly as they were removed.

(3) Remove safety wire and nuts holding bearing caps in place. (Figure 2-58).

(4) Remove bearing caps and carefully lower wheel to ground to avoid disconnecting the brake lines. (This would make bleeding of the brake system necessary).

(5) Remove cotter pin from axle nut, unscrew nut and remove axle and brake assembly from the wheel.

(6) For the disassembly and assembly of the main wheel, refer to EO 110-5-2.

(b) Installation - Install main wheel as follows:

(1) Place the axle and brake assembly in the wheel.

(2) Install axle nut and clevis pin.

(3) Place wheel in the landing-gear fork. Install the bearing caps over studs and tighten nuts to standard torque value.

WHEEL BRAKE ASSEMBLY

4 The single disc, gear-type brake assembly (Figure 2-59) consists of two main parts; the housing assembly, attached to the axle, and the disc, driven by the wheel. The housing assembly contains three pressure cylinders, each equipped with a piston assembly and movable circular lining segments. As the brake pedals are depressed, the hydraulic fluid pressurizes the cylinders simultaneously, causing the pistons in the cylinders to press the linings against the disc. The disc is forced laterally against stationery lining segments on the opposite side of the housing, causing braking action on the disc. The floating brake disc utilizes gear-type teeth milled around the outer edge of the disc. Matching teeth on the extended flange of the wheel assembly intermesh with those on the brake disc. The gear-type teeth provide a more positive linkage between the floating brake disc and the wheel assembly. The brake cylinder pistons incor-

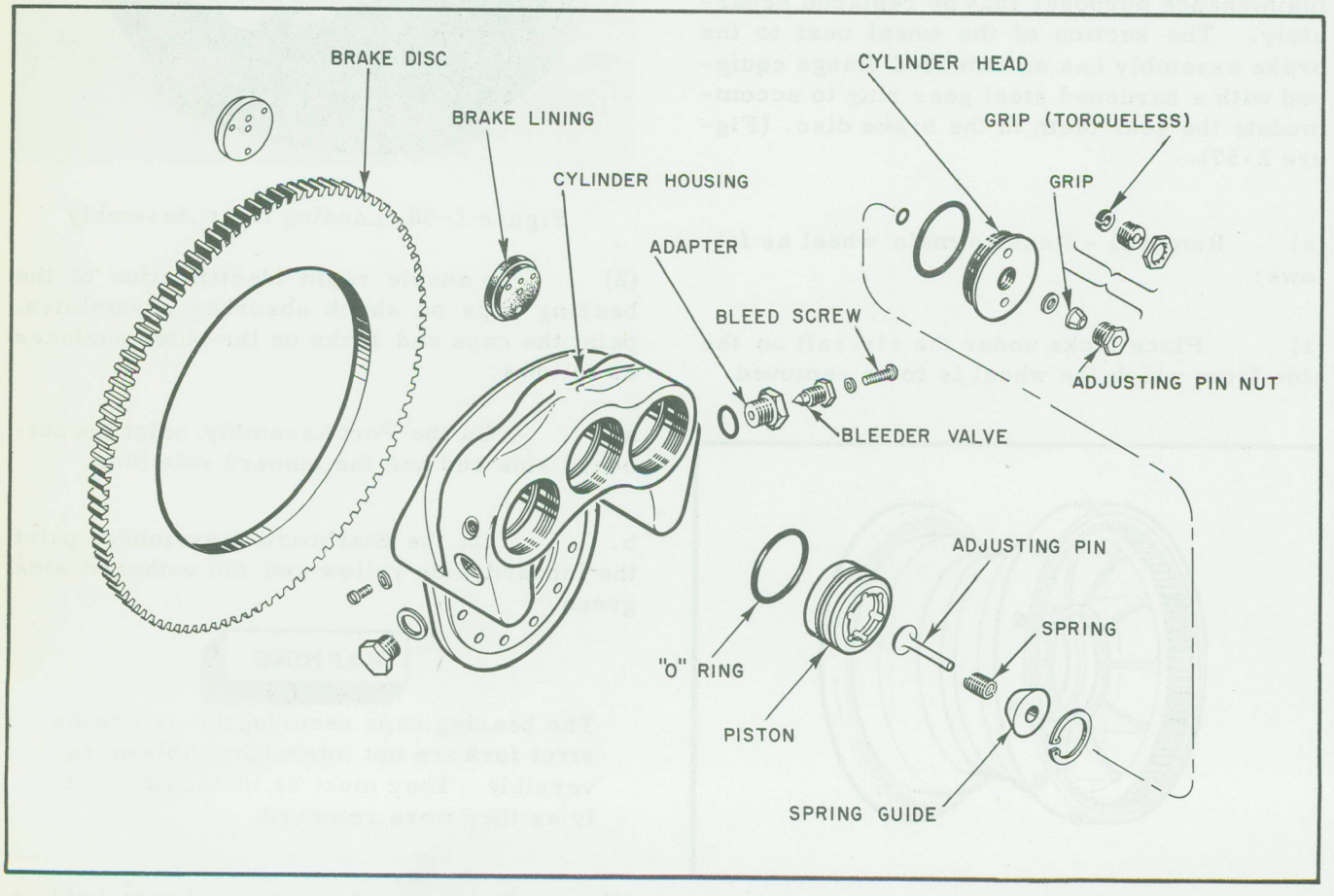


Figure 2-59 Brake Assembly

TROUBLE	PROBABLE CAUSE	CORRECTION
1 Spongy brakes.	(a) Air in brake system.	(a) Bleed system.
2 Dragging brakes.	(a) Foreign particles in system. (b) Adjusting-pin packing nut loose. (c) Disc warped or dished. (d) Master-cylinder piston cup not clearing compensating port.	(a) Clean system and all parts with cleaning fluid, Spec. 3-GP-8a. (b) Reset tension to 300 in.-lbs (c) Replace disc. (d) Adjust brake linkage to ensure the piston cup clearing the compensating port.
3 Brakes hard momentarily but lose pressure.	(a) Fluid leaking past seals in master cylinder. (b) Seals leaking in shuttle valve. (c) Leak elsewhere in system.	(a) Replace seals. (b) Replace seals. (c) Check system; tighten all fittings.
4 Brakes will not hold.	(a) Lack of fluid in system. (b) Brake segments worn thin.	(a) Bleed brakes and fill tank. (b) Replace segments.
5 Parking brake will not hold.	(a) Lever not adjusted properly. (b) Pressure leaking past seals.	(a) Adjust push-pull rod for maximum travel. (b) Replace seals.

Table 2-6 Trouble Shooting, Brake System

porate a threaded cap which screws into the brake cylinder. For Trouble Shooting, Brake System, see Table 2-6.

(a) Removal - To remove the wheel brake assembly (gear type) proceed as follows:-

(1) Support the aircraft on jacks.

NOTE

Do not disconnect the brake lines at the shuttle valve if only the brake lining segment is to be replaced. The system should be drained when disassembly of the brake unit is to be accomplished.

(2) Disconnect the brake lines at the shuttle valve and drain the brake system.

(3) Remove the wheel assembly from the landing-gear fork as outlined in Paragraph 3(a).

(4) Remove the floating steel disc by holding the lining segments apart and pulling the disc free.

(b) Disassembly - To disassemble the wheel brake assembly (gear type) proceed as follows:-

(1) Remove the wheel brake assembly as outlined in Paragraph 4(a).

(2) Remove the brake mounting bolts and slide brake from aircraft axle.

(3) Slide discs from brake housing and remove linings from pistons and housings.

(4) For brakes whose adjusting nut requires torquing:

a. Unscrew the adjusting nuts.

b. Unscrew the cylinder head and remove grip, washer, cylinder head, O-ring seal and adjusting pin O-ring seal.

c. Push piston from housing.

(5) For brakes with a non-torquing type grip:

a. Unscrew and remove cylinder head and piston assembly from brake housing.

b. Unscrew lock nut and bushing.

c. Place cylinder head and piston assembly in an arbor press and press adjusting pin through grip.

CAUTION

Support the cylinder head, allowing sufficient space for the adjusting pin to be pressed through the grip. A 3/16-inch diameter smooth pin should be used to press against the adjusting pin. Care should be taken not to damage the adjusting pin or grip.

(6) Remove grip, cylinder head O-ring seal and adjusting pin O-ring seal from cylinder head.

(7) Remove piston O-ring seal from piston.

(8) Use Truarc pliers and remove lockring. This will release the piston guide, return spring and adjusting pin from piston.

(9) Remove bleeder screw, washer, bleeder valve, bleeder adapter and gasket from housing.

(10) Unscrew inlet bushing and remove gasket.

(11) Complete disassembly by removing bleeder screws and washers from brake housing.

(c) Servicing - Glazed brake linings, if worn only slightly, are considered serviceable. Excessively worn linings are indicated when the adjusting pin recedes into the adjusting pin packing nut 1/4-inch or more. Measuring the adjusting pin should be considered only as a means of estimating wear. Measuring the pin gives the total linings and the disc, and does not take into consideration the possibility of unequal lining wear. The following method is recommended for determining lining wear accurately. Replace the anvil (fixed) lining when the distance between the brake housing and the brake disc reaches .438-inches with the brakes applied (Figure 2-60). The piston (movable) lining is visible and should be replaced when 1/16-inch of useable lining remains. Always replace complete set of linings in brake. Never mix new and used linings.

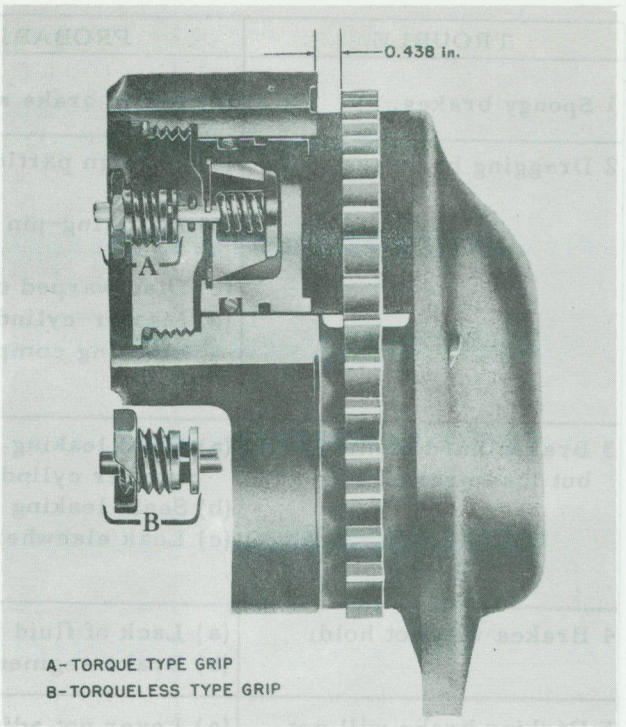


Figure 2-60 Brake Lining Wear Limit

NOTE

The steel disc used with the brake is not chrome plated. When placed into service it will first turn bluish in colour and will eventually turn to a straw colour. After turning to a straw colour the disc has less tendency to rust and will give better service. This discoloration will not affect the braking operation.

(d) Assembly - Assemble the wheel brake assembly (gear type) as follows:-

(1) Place adjusting pin, return spring and

(3) Pull actuator mechanism aft until it clears and then remove it through the inspection opening.

CAUTION

As actuator is moved aft, the rudder tab control drive will drop free. This is a small part and easily lost.

(b) Servicing - Check actuator mechanism for back lash. Tighten thrust collar. If this does not remove play, the screw mechanism must be replaced. Check for wear in pivot setscrew.

(c) Installation - Install the rudder tab actuator in the rudder as follows:

(1) Slip actuator mechanism into inspection opening in the rudder, clevis end first. Move it aft until it clears the rib and then up into position.

CAUTION

When the actuator mechanism is moved up into position, be sure to insert the drive between the actuator and the universal joint in the bearing.

(2) Install nuts or setscrew and tighten. Safety.

(3) Connect actuator arm to horn and safety.

90-DEGREE DRIVE AND CHAIN (HORIZONTAL STABILIZER)

13 The removal and installation of the 90-degree drive and chain installed in the horizontal stabilizer is as follows:

(a) Removal - Remove the 90-degree drive and chain as follows:

(1) Through the rudder tab inspection cover on the horizontal stabilizer, disconnect the flexible drive shaft from the 90-degree drive.

(2) Remove the mounting bolts holding the 90-degree drive to the stabilizer spar and remove the drive and chain.

(3) Remove chain guard from 90-degree drive and remove chain from sprocket.

(b) Servicing - Check sprocket for excessive wear. Check the 90-degree drive assembly for excessive play. Replace if necessary.

(c) Installation - Install the 90-degree drive and chain in the horizontal stabilizer as follows:

(1) Install chain on sprocket of the 90-degree drive assembly and install guard.

(2) Install the 90-degree drive assembly on the stabilizer spar and safety.

(3) Connect flexible drive shaft and cables.

RUDDER TAB CABLE

14 Removal and installation of the rudder tab cable is covered in the following paragraphs.

(a) Removal - To remove rudder tab cable, proceed as follows:

(1) Disconnect the cables at the turnbuckles on the overhead between Bulkheads 11 and 12.

NOTE

If a new cable is to be installed, use the procedure given in Paragraph 14(c).

(2) If necessary, remove pulleys located on the overhead on Bulkheads 5, 10 and 13.

(b) Servicing - Service rudder tab cables as follows:

(1) Frayed cables are considered unserviceable if there are more than six broken strands in any one inch of cable.

(2) Cables which are rusted or corroded are not considered serviceable.

(3) Cables not considered serviceable

cannot be repaired.

(c) Installation - To install rudder tab cables, proceed as follows:

(1) If a new cable is needed, it should be installed as the old cable is removed.

(2) Cut the clevis off one end of the old cable.

(3) Connect the cut end of the old cable and the end of the new cable which does not have a fitting. Make sure the connecting joint is no larger than the cable; otherwise difficulty will be encountered when the new cable is drawn into the fairleads.

(4) Remove the old cable and draw the new cable into position at the same time.

(d) Adjustment of Rudder Tab - To adjust and rig rudder tab proceed as follows:

(1) Rig rudder tab cables to the tension set in Table 2-1.

(2) Turn the tab either right or left until it hits the stop.

(3) Disconnect the actuator from the tab horn.

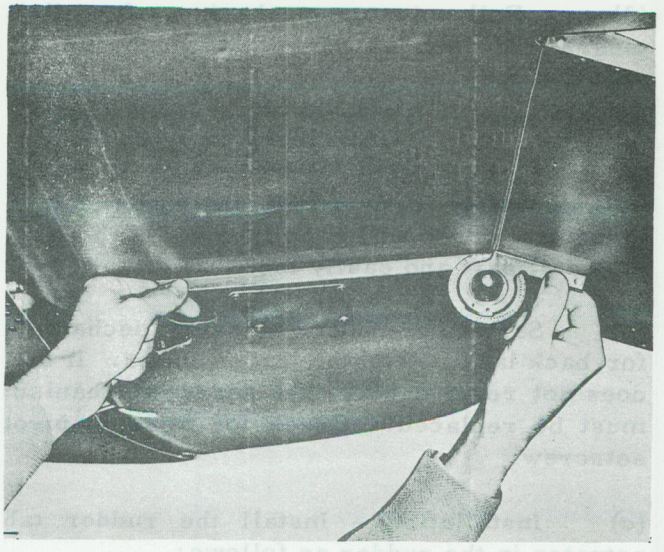


Figure 2-48 Rudder Tab Travel Check

(4) Using a protractor (Figure 2-48) set the tab to the figure shown in Table 2-2.

(5) Adjust the actuator rod so it will connect to the tab horn in this position.

(6) Check the tab for full travel each way.

(7) Safety all connections.

CONTROL CABLE	TENSION	TOLERANCE
Rudder Cables		
1. Forward of Reduction Pulleys	Determined by #2	
2. Aft of Reduction Pulleys	30	± 10 lbs.
3. Rudder Front Balance Cable	60	± 10 lbs.
4. Rudder Rear Balance Cable	30	± 10 lbs.
Elevator Cables		
5. Elevator Cable Upper	120	± 10 lbs.
6. Elevator Cable Lower	120	± 10 lbs.
Aileron Cables		
7. Control Column	35	± 5 lbs.
8. Outer Wing Panel	50	± 10 lbs.
9. Centre Section Wing	50	± 10 lbs.
All Tab Cables	10	± 2 lbs.
At temperatures + 15°F and below	14 PSI	± 2 PSI

Table 2-1 Cable Tension Chart

SURFACE	DEGREES	INCHES	MEASURING POINTS
AILERON Hex Head Bellcrank Stop Eccentric Bellcrank Stop One Hex Head and one Eccentric Bellcrank Stop	 45° ± 2° up 20° ± 2° down 38-1/2° ± 1° up 21° ± 1° down 37-1/2° to 47° up 18° to 24° down	 10-1/2" + 7/16" up 4-1/4" ± 7/16" down 9" ± 1/4" up 5" ± 1/4" down	From centre line of trailing edge of the aileron at the inboard end to the centre line of the trailing edge of the flap in the "neutral" position.
AILERON ADJUSTABLE TAB	22° ± 1° up 19° ± 1° down	1-7/16" ± 1/16" up 1-1/4" ± 1/16" down	From centre line of the tab at inboard end to centre line of aileron at trailing edge.
AILERON FIXED TAB			May be bent at trailing edge of aileron as required to provide proper rigging of the aircraft, but not to exceed 20° up or down
ELEVATOR	35° ± 1° up 25° ± 1° down	12-3/4" ± 3/8" up	Midway between inboard and outboard ends at the neutral setting at the trailing edge centre line.
ELEVATOR TAB	18° ± 1° up 13° ± 1° down	1-1/4" ± 1/16" up 7/8" ± 1/16" down	From the centre line of the trailing edge of the tab to the centre line of the trailing edge of the elevator.
RUDDER	25° ± 2° right 25° ± 2° left	8-1/4" ± 9/16" right 8-1/4" ± 9/16" left	From the rudder trailing edge.
RUDDER TAB	28° + 3° - 0° right 29° + 3° - 0° left	3-1/4" + 1/2" - 0" right 3-3/8" + 1/2" - 0" left	From the top of tab trailing edge centre line to trailing edge centre line of rudder.

Table 2-2 Surface Control Movements

SURFACE	DEGREES	INCHES	MEASURING POINTS
AILERON Hex Head Bellcrank Stop Eccentric Bellcrank Stop One Hex Head and one Eccentric Bellcrank Stop	 45° ± 2° up 20° ± 2° down 38-1/2° ± 1° up 21° ± 1° down 37-1/2° to 47° up 18° to 24° down	 10-1/2" + 1/16" up 4-1/4" ± 1/16" down 9" ± 1/4" up 5" ± 1/4" down	From centre line of trailing edge of the aileron at the inboard end to the centre line of the trailing edge of the flap in the "neutral" position.
AILERON ADJUSTABLE TAB	22° ± 1° up 19° ± 1° down	1-7/16" ± 1/16" up 1-1/4" ± 1/16" down	From centre line of the tab at inboard end to centre line of aileron at trailing edge.
AILERON FIXED TAB			May be bent at trailing edge of aileron as required to provide proper rigging of the aircraft, but not to exceed 20° up or down
ELEVATOR	35° ± 1° up 25° ± 1° down	12-3/4" ± 3/8" up	Midway between inboard and outboard ends at the neutral setting at the trailing edge centre line.
ELEVATOR TAB	18° ± 1° up 13° ± 1° down	1-1/4" ± 1/16" up 7/8" ± 1/16" down	From the centre line of the trailing edge of the tab to the centre line of the trailing edge of the elevator.
RUDDER	25° ± 2° right 25° ± 2° left	8-1/4" ± 9/16" right 8-1/4" ± 9/16" left	From the rudder trailing edge.
RUDDER TAB	28° + 3° - 0° right 29° + 3° - 0° left	3-1/4" + 1/2" - 0" right 3-3/8" + 1/2" - 0" left	From the top of tab trailing edge centre line to trailing edge centre line of rudder.

Table 2-2 Surface Control Movements

spring guide into piston. Press spring into piston and secure with retaining ring.

(2) Install piston O-ring seal on piston.

(3) Lubricate cylinder walls of housing and contacting surfaces of piston assembly with hydraulic fluid, specification 3-GP-26a.

(4) Lubricate cylinder head seal groove with hydraulic fluid, specification 3-GP-26a. Install cylinder head O-ring seal and adjusting pin O-ring seal.

(5) For brakes whose adjusting nut requires torquing:

a. Install piston in housing.

b. Place cylinder over adjusting pin and screw into housing. Torque to 75 foot-pounds.

c. Place washer on adjusting pin.

d. Dip grip in clean hydraulic fluid and install large end on adjusting pin first. Screw adjusting unit into position but do not tighten.

e. Push piston toward cylinder head as far as it will go. Draw up adjusting nut to 25 foot-pounds torque (Figure 2-61). Back off and re-torque several times to ensure proper seating of parts.

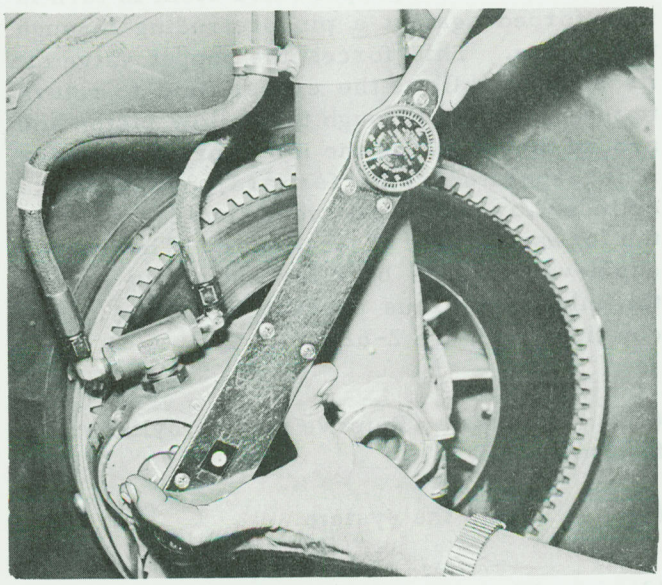


Figure 2-61 Brake Packing Nut Adjustment

f. Install linings into recesses of pistons and housing. Place disc between linings.

(6) For brakes with non-torquing type grip:

a. Place washer and grip in cylinder head. Screw threaded bushing into position but do not tighten.

b. Insert the end of the adjusting pin of the assembled piston through the O-ring seal, washer and align with hole in grip which is installed in cylinder head.

CAUTION

The end of adjusting pin must be free of nicks or burrs to prevent damage to grips or seals.

c. Place assembly in arbor press and press assembly together, forcing the adjusting pin through the grip and threaded bushing.

CAUTION

Space must be provided in the arbor for the end of the adjusting pin to be pressed through the bushing without being damaged.

d. Insert piston and cylinder head assembly into brake housing. Screw cylinder head into housing and torque to 75 foot-pounds.

e. Screw threaded bushing into cylinder head tightly. Back off 1/8 turn, hold and screw lock-nut on the bushing against cylinder head. Tighten lock-nut 1/3 turn to lock.

f. Install linings in recesses of pistons and housing. Place a flat bar between linings and force pistons toward the cylinder heads as far as possible.

CAUTION

Care should be taken to avoid damaging linings during this operation.

(7) Install disc between linings.

(8) Install gasket on bleeder adapter and screw into housing.

(9) Install bleeder valves, washer and screw in bleeder bushing.

(10) Install gasket on inlet bushing into housing.

(11) To complete assembly, place washer on screw and screw into housing.

(12) To test brakes after assembly, connect hydraulic test line and, with disc in proper position, apply 800 psi hydraulic pressure. This will properly set the automatic adjustment mechanism. With pressure applied, check for hydraulic leaks. Release hydraulic pressure and check to see that disc is free.

(13) Intermesh the teeth of the brake disc with the teeth in the extended flange of the wheel.

(14) Tighten the bearing retaining nut until the axle will no longer turn. Back off until the axle turns freely.

(15) Safety the axle nut.

(16) Install wheel on landing gear fork. Install the axle bearing caps. Install retaining nuts, tighten and safety.

CAUTION

The axle bearing caps are not interchangeable and must be installed in the position from which they were removed. Refer to Paragraph 3(a)(2).

(17) Connect brake lines and bleed brakes as outlined in paragraph 9.

(18) Remove aircraft from jacks.

(e) Adjustment - The single disc wheel brake assembly (gear type) is self-compensating and requires no lining clearance adjustment. An increased column of fluid between the cylinder head and the piston compensates for lining wear during the life of the brake lining. Brake pedals require no adjustment and remain constant regardless of the lining wear. Brake pedal setting can be changed at the attaching brake rod clevis.

MASTER CYLINDERS

5 Two types of master cylinders may be encountered both bearing the Part No. 694-187800; later types have a rectangular outlet plug at the forward end of the cylinder, whereas the earlier ones have the outlet located on the underside. The cylinders are of the compensating barrel type designed to maintain constant and correct volume of fluid in the system. Small amounts of fluid lost through leakage are automatically replaced. The piston and cylinder, actuated by the mechanical linkage, pressurizes the fluid in the chamber of the wheel brake cylinders. The seals in the master cylinders ensure positive fluid pressure and prevent leakage. The main spring in each master cylinder provides for the return of the piston and the toe brake assembly. The cylinders actuate in the toggle action linkage, below the pilot's compartment floor boards, and receive a direct supply of hydraulic fluid from a reservoir tank, located on the rear of No. 3 bulkhead. The master brake cylinder incorporates a rubber cup and poppet valve. The force of the back pressure of the fluid, as the brakes are applied, seats the poppet valve. This prevents a flow of fluid from the system to the reservoir. Upon releasing pressure from the toe pedal, the springs force the piston to the rear. The poppet valve stem in turn is then forced against a pin protruding through the sleeve. This forces the poppet valve off its seat and allows the excess fluid to return to the reservoir through the hollow piston and around the sleeve to the inlet port. A spacer is incorporated in the forward portion of the cylinder to prevent the rubber cup from hitting the forward end of the cylinder. The rubber cup never extends back far enough to engage the inlet port, thus preventing galling of the cup lips. (Figure 2-62).

(a) Removal - Remove master cylinder as follows:

(1) Drain the system.

(2) Disconnect hydraulic lines from cylinder.

(3) Disconnect the cylinder from the forward and rear toggle linkage.

(b) Disassembly - Disassemble master cylinder as follows:

(1) Remove cylinder as outlined in Paragraph 5(a).

(2) Remove the rubber dust boot.

(3) Remove the lock pin from the forward end of the coupling. Unscrew the coupling from the cylinder rod. This will allow the spring on the rear of the cylinder to come off.

(4) Remove the retainer lock ring.

(5) Pull out on the master cylinder rod. This will pull out the cap, sleeve and piston. Pull the cap off the rear end of the rod.

(6) Remove O-rings and cup. It is recommended that the cup be replaced each time the master cylinder is disassembled.

(c) Servicing - After the master brake cylinder has been disassembled:

(1) Check the O-rings; if they are worn or hard, replace them.

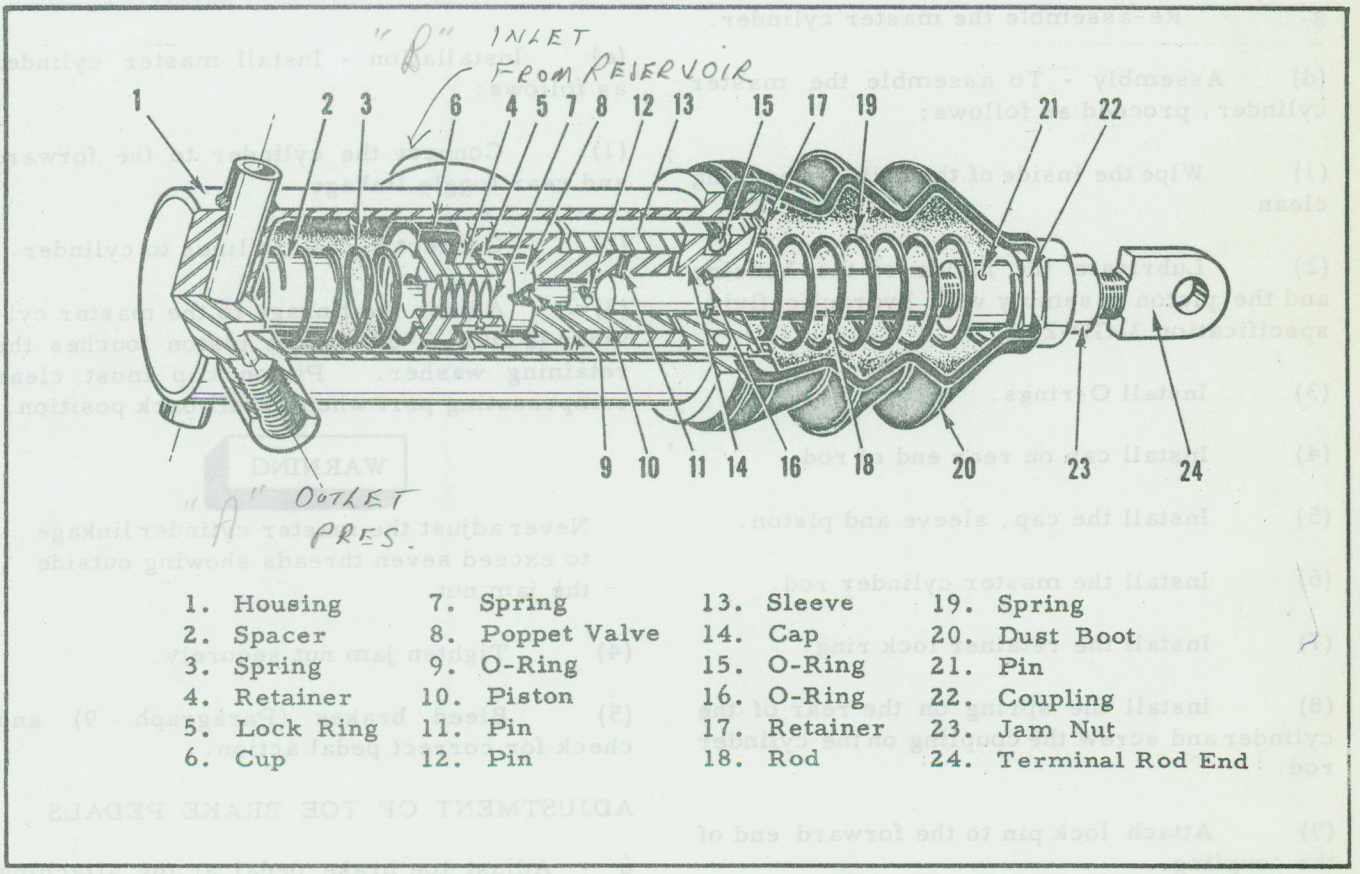
(2) If the cylinder shows signs of leakage, replace it.

(3) Check the brake cylinder walls for scoring. If the walls are badly damaged, replace the master cylinder.

(4) Check the rubber cup for wear and flexibility. It is recommended that the cup be replaced each time the master cylinder is disassembled.

(5) To replace the cup proceed as follows:

a. Install a screw in the forward end of the retainer, located just forward of the cup.



1. Housing	7. Spring	13. Sleeve	19. Spring
2. Spacer	8. Poppet Valve	14. Cap	20. Dust Boot
3. Spring	9. O-Ring	15. O-Ring	21. Pin
4. Retainer	10. Piston	16. O-Ring	22. Coupling
5. Lock Ring	11. Pin	17. Retainer	23. Jam Nut
6. Cup	12. Pin	18. Rod	24. Terminal Rod End

Figure 2-62 Master Cylinder

NOTE

Do not insert the screw into the retainer over 1/4-inch.

b. Place the screw head in a vise and attach the coupling and terminal rod end to the master cylinder rod.

c. Place a steel rod through the hole in the rod end and exert enough pressure to pull the piston loose from the retainer.

d. Wash and clean the cylinder and parts with cleaning fluid Spec. 3-GP-8a. Replace all damaged parts. If the O-ring installed in the poppet valve is damaged, the poppet valve must be replaced.

e. Inspect the inside area of the housing for damage. If damaged, replace housing.

f. Before assembling the master cylinder, lubricate the O-rings and cylinder barrel with hydraulic fluid.

g. Re-assemble the master cylinder.

(d) Assembly - To assemble the master cylinder, proceed as follows:

(1) Wipe the inside of the cylinder housing clean.

(2) Lubricate the inside of the housing and the piston assembly with hydraulic fluid, specification 3-GP-26a.

(3) Install O-rings.

(4) Install cap on rear end of rod.

(5) Install the cap, sleeve and piston.

(6) Install the master cylinder rod.

(7) Install the retainer lock ring.

(8) Install the spring on the rear of the cylinder and screw the coupling on the cylinder rod.

(9) Attach lock pin to the forward end of the coupling.

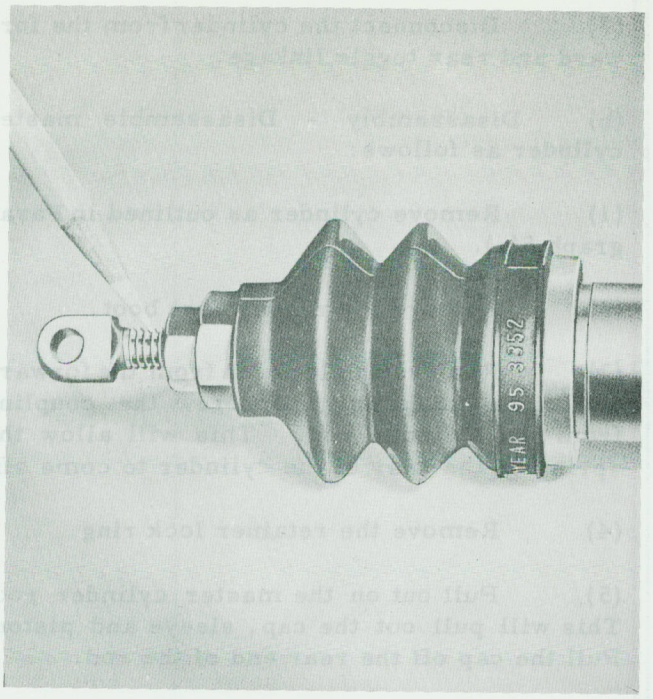


Figure 2-63 Cylinder Clevis Nut Adjustment

(10) Install rubber dust boot.

(e) Installation - Install master cylinder as follows:

(1) Connect the cylinder to the forward and rear toggle linkage.

(2) Connect hydraulic lines to cylinder.

(3) Adjust the linkage to the master cylinder (Figure 2-63) so the piston touches the retaining washer. Piston cup must clear compensating port when in full back position.

WARNING

Never adjust the master cylinder linkage to exceed seven threads showing outside the jam nut.

(4) Tighten jam nut securely.

(5) Bleed brakes (Paragraph 9) and check for correct pedal action.

ADJUSTMENT OF TOE BRAKE PEDALS

6 Adjust toe brake pedal at the attaching

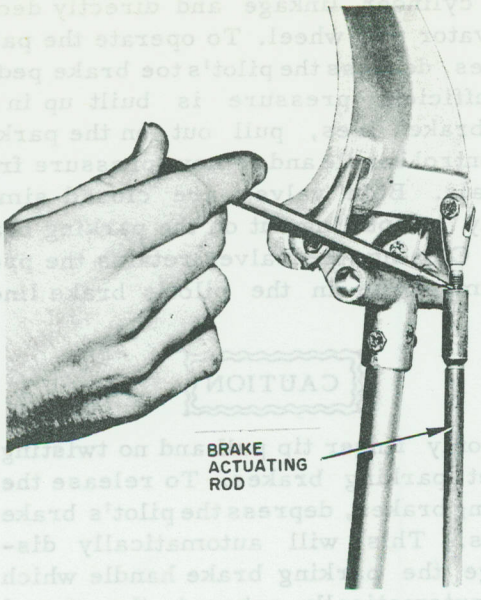


Figure 2-64 Brake Pedal Adjustment

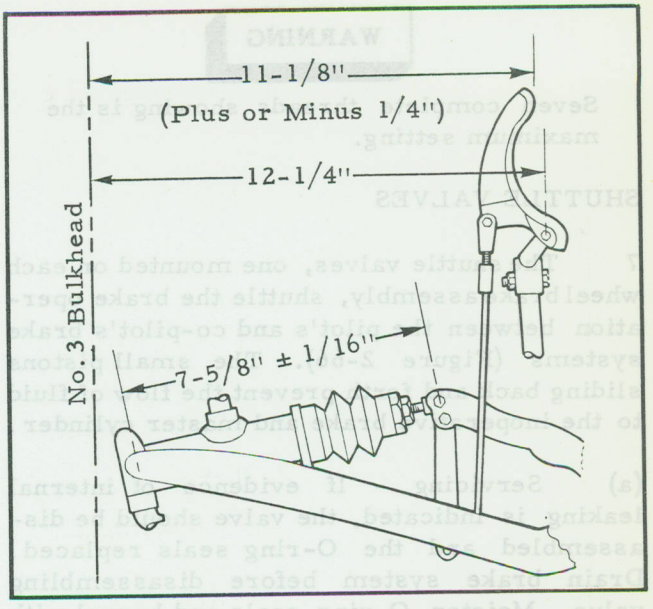


Figure 2-65A Brake Pedal Position Co-Pilot's

point of the brake pedal adjusting rod and the toe brake pedal, Figure 2-64. The measurements from No. 3 Bulkhead to the aft upper face of the toe pedals should be; pilot's - 10-3/8 inches, co-pilot's - 11-1/8 inches, with brakes off and the rudder pedals in the neutral position. The neutral rudder positions for the pilot and co-pilot are 11-1/2 inches and 12-1/4 inches respectively, plus or minus 1/4 inch. Refer to Figures 2-65 and 2-65A. The pedals require equal operating pressure and should be free of all sponginess. The pedal travel necessary to get full braking pressure in the lines may be adjusted at the master cylinder and brake pedal linkage. The master cylinder length is to be adjusted to 7-5/8" from the centre of its mounting hole to the centre of the hole in the cylinder terminal attached to the brake linkage Figure 2-65. To adjust, loosen the lock nut on the piston rod terminal. Screw rod in, to increase the pedal travel; screw rod out, to decrease pedal travel. The normal setting is five to seven threads shown on the rod.

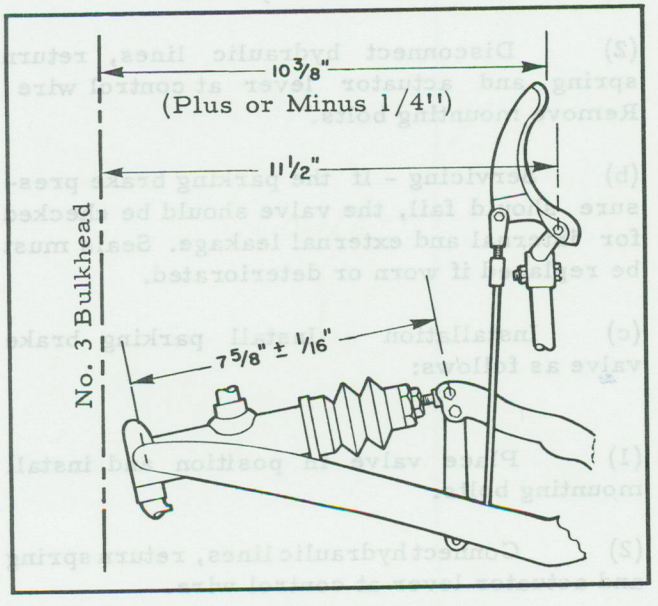


Figure 2-65 Brake Pedal Position Pilots

Figure 2-66 Shuttle Valve Mounted on Brakes

WARNING

Seven complete threads showing is the maximum setting.

SHUTTLE VALVES

7 The shuttle valves, one mounted on each wheel brake assembly, shuttle the brake operation between the pilot's and co-pilot's brake systems (Figure 2-66). The small pistons sliding back and forth prevent the flow of fluid to the inoperative brake and master cylinder.

(a) Servicing - If evidence of internal leaking is indicated, the valve should be disassembled and the O-ring seals replaced. Drain brake system before disassembling valve. Moisten O-ring seals and barrel with hydraulic fluid, Specification 3-GP-26a, before re-assembly. Bleed brakes after installing valve (see Paragraph 9).

PARKING BRAKES

8 The Expeditor is equipped with parking brakes which work in conjunction with the pilot's toe brakes. The parking brake assembly consists of the parking brake control assembly, two parking brake valves and two pressure hoses that connect the pilot's master cylinders to the parking brake valves (Figure 2-67). The two lever type valves are located in the belly, just to the right of the pilot's master cylinder linkage and directly decide the elevator pull wheel. To operate the parking brakes, depress the pilot's toe brake pedals until sufficient pressure is built up in the pilot's brake lines, pull out on the parking brake control handle and remove pressure from the pedals. Both valves are closed simultaneously by pulling out on the parking brake handle. Closing the valves retains the pressure pumped up in the pilot's brake lines.

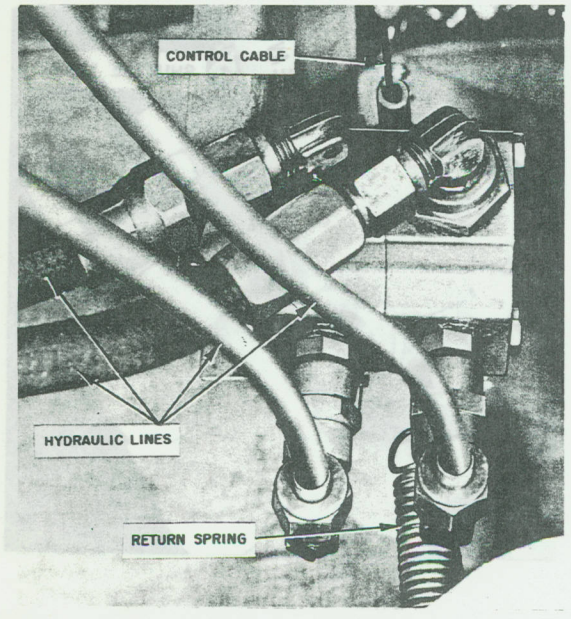


Figure 2-67 Parking Brake Valves

CAUTION

Use only finger tip pull and no twisting to set parking brakes. To release the parking brakes, depress the pilot's brake pedals. This will automatically disengage the parking brake handle which will automatically return to the normal "OFF" position. Do not push in on the parking handle to release the parking brake.

NOTE

The parking brakes cannot be applied by using the co-pilot's brake pedals.

(a) Removal - To remove parking brake valve, refer to Figure 2-67 and proceed as follows:

(1) Drain the brake system.

(2) Disconnect hydraulic lines, return spring and actuator lever at control wire. Remove mounting bolts.

(b) Servicing - If the parking brake pressure should fail, the valve should be checked for internal and external leakage. Seals must be replaced if worn or deteriorated.

(c) Installation - Install parking brake valve as follows:

(1) Place valve in position and install mounting bolts.

(2) Connect hydraulic lines, return spring and actuator lever at control wire.

(3) Bleed the brake system, Paragraph 9.

(4) Adjust parking brake control arm.

(d) Parking Brake Arm Adjustment - When a parking brake valve has been replaced, it is of great importance that full travel of the parking valve be maintained. The adjustment of the parking brake valve arm travel is accomplished by loosening the phenolic block bolts and repositioning the outer housing of the parking brake control in the phenolic block. Clearance between the end of the outer housing

and parking brake valve arm is 1/8", plus or minus 1/16". In the event that the inner control wire of the parking brake control becomes broken, it is recommended that the entire parking brake control be replaced. When a new parking control assembly is to be installed, cut the inner control wire of the new control assembly to the proper length as follows:

(1) Make certain the parking brake control handle is all the way in. This may be accomplished by pushing in on the handle or pulling on the protruding end of the inner wire.

(2) Cut the protruding end of the wire at a point measured 2-3/4" from the third coil of the outer housing to the end of the wire.

(3) Bend 1/16" of the protruding inner wire at a 90 degree angle. This 1/16" leg hooks into a small hole in the parking brake valve arm assembly as an additional safety measure.

(4) Adjustment of the parking brake valve for correct travel is accomplished as outlined previously.

(5) All sharp bends or kinks should be avoided in the routing and installation of the control to ensure smooth operation.

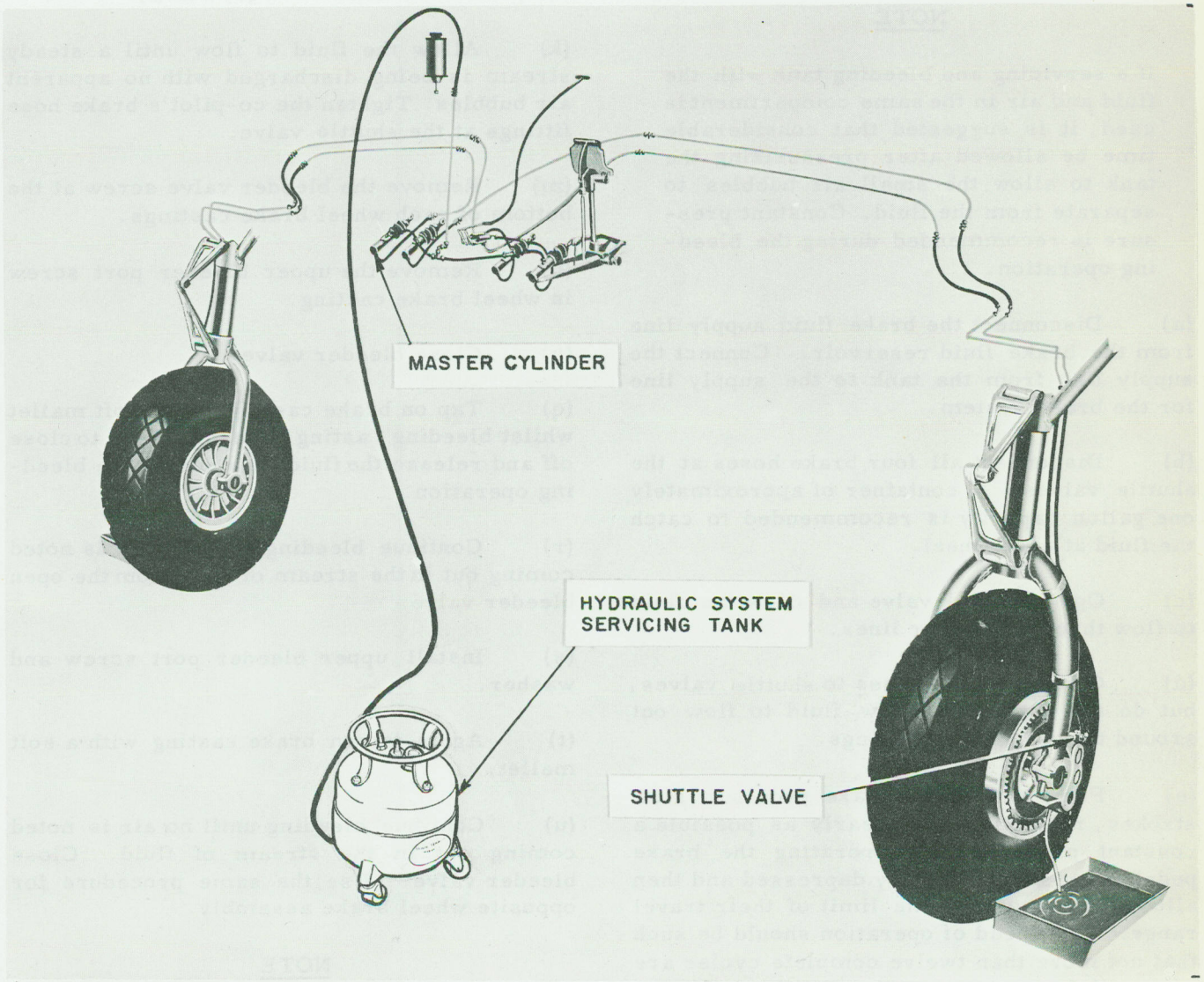


Figure 2-68 Brake Bleeding

BRAKE BLEEDING

9 The following equipment and procedure is recommended for use whenever it becomes necessary to bleed the brake system. The equipment consists of a servicing and bleeding tank operating at a maximum pressure of 400 psi. The tank is fitted with delivery and return lines and adapters. The delivery hose is approximately eighteen feet long. A flat drain pan of about one gallon capacity should be positioned at each brake casting. Fill the servicing and bleeding tank with hydraulic fluid, Specification 3-GP-26a, charge the tank with air, and set the pressure regulator at 55 to 65 psi. Refer to Figure 2-68 and proceed as follows:

NOTE

If a servicing and bleeding tank with the fluid and air in the same compartment is used, it is suggested that considerable time be allowed after pressurizing the tank to allow the small air bubbles to separate from the fluid. Constant pressure is recommended during the bleeding operation.

(a) Disconnect the brake fluid supply line from the brake fluid reservoir. Connect the supply line from the tank to the supply line for the brake system.

(b) Disconnect all four brake hoses at the shuttle valves. A container of approximately one gallon capacity is recommended to catch the fluid at each wheel.

(c) Open the tank valve and allow the fluid to flow through the four lines.

(d) Connect brake hoses to shuttle valves, but do not tighten. Allow fluid to flow out around two brake hose fittings.

(e) Pump the pilot's brake pedals in slow strokes, maintaining as nearly as possible a constant pressure. In operating the brake pedal, they should be fully depressed and then allowed to return to the limit of their travel range. The speed of operation should be such that not more than twelve complete cycles are accomplished per minute. Wiggle the brake hoses at the shuttle valve fittings during the pumping operation.

(f) Allow the fluid to flow until a steady stream is being discharged with no apparent air bubbles. Then tighten the pilot's brake hose fittings at each shuttle valve.

(g) Set the parking brake.

(h) Depress the co-pilot's brake pedals and at the same time loosen the fitting on the pilot's brake hose at the shuttle valve just enough to allow the shuttle valve to move over and close off the pilot's brake supply lines. Tighten the fittings.

(j) Pump the co-pilot's brake pedals using the procedure outlined in (e) and (f).

(k) Allow the fluid to flow until a steady stream is being discharged with no apparent air bubbles. Tighten the co-pilot's brake hose fittings at the shuttle valve.

(m) Remove the bleeder valve screw at the bottom of each wheel brake castings.

(n) Remove the upper bleeder port screw in wheel brake casting.

(p) Close bleeder valve.

(q) Tap on brake casting with a soft mallet whilst bleeding casting. Use the thumb to close off and release the fluid flow during the bleeding operation.

(r) Continue bleeding until no air is noted coming out in the stream of fluid from the open bleeder valve.

(s) Install upper bleeder port screw and washer.

(t) Again tap on brake casting with a soft mallet.

(u) Continue bleeding until no air is noted coming out in the stream of fluid. Close bleeder valve. Use the same procedure for opposite wheel brake assembly.

NOTE

After completing the bleeding procedure

for one wheel brake assembly, prior to starting on the opposite wheel, check the fluid in the servicing and bleeding tank. If fluid appears low, turn off air supply, and release air from tank. DO NOT TAKE OFF SERVICING TANK FILLER CAP UNTIL ALL AIR HAS BEEN RELEASED. Fill servicing tank with clean fluid and continue with bleeding operations.

(v) Close off fluid supply line from servicing tank.

(w) Disconnect servicing tank supply line from brake system supply line and connect brake system supply line to fluid reservoir.

(x) Put approximately one inch of fluid in reservoir.

(y) Release parking brake and allow two systems to set twenty or thirty minutes before trying the brakes. This is to allow any air to escape that may have entered the system while connecting the supply line to the reservoir.

(z) Fill the reservoir to the recommended level and test brakes for operation and firmness.

(aa) Set the parking brakes and check for possible leaks.

MAIN LANDING GEAR SHOCK ABSORBER

10 This paragraph contains instructions for the removal, servicing and installation of the main landing-gear shock absorber.

(a) Removal - Remove main landing-gear assembly as follows:

(1) Support aircraft on jacks.

WARNING

When hoisting or jacking the aircraft, always place a minimum ballast of 200 pounds on the horizontal stabilizer to prevent aircraft from nosing over. A felt or canvas pad should be used to protect the horizontal stabilizer and the ballast should be placed over the front spar near the fuselage.

(2) Drain brake system and disconnect flexible lines at inboard truss fittings and fitting on V-brace assembly.

(3) Remove lower drag-leg attaching bolt, releasing drag leg from cylinder assembly.

(4) Disconnect hydraulic lines and remove landing-gear safety-switch assembly and wiring from shock absorber and V-brace assembly.

(5) Remove landing-gear door actuator rods from brackets on V-brace assembly.

(6) Remove screws and plate covering landing-gear hinge bolts at inboard and outboard sides of nacelle.

(7) Remove retaining bolt securing the hinge bolt, inside the nacelle.

(8) Remove nuts from hinge bolts and remove hinge bolts.

(9) Remove gear from nacelle.

CAUTION

Support gear prior to hinge bolt removal. Severe damage to nacelle may occur if gear is allowed to fall.

(10) For the disassembly and assembly of the main landing-gear shock absorber refer to EO 15-50AA-2.

(b) Installation - Install main landing-gear assembly as follows:

(1) Place landing-gear in position and install hinge bolts. Install nuts on hinge bolts and tighten, aligning holes for hinge bolt retaining bolt in V-brace. Do not over-tighten or gear will bind.

(2) Install the outboard hinge bolt retaining bolt and nut and tighten. Nut should not be installed on inboard bolt until hydraulic lines are in place.

(3) Install lower drag-leg attaching bolt, securing drag leg to cylinder assembly.

(4) Attach landing-gear door actuator rods to brackets on V-brace.

(5) Attach safety-switch, wiring and clamps (left strut) and landing-gear latch control switch (right strut).

(6) Install wheel and brake assembly. Insert inboard hinge retaining bolt with the head on top and secure brake line clamps under the retaining bolt nut.

(7) Inflate strut, with weight of aircraft on the gear, until 2-1/2 inches of piston are exposed.

(c) Maintenance - The exposed reciprocating parts of shock struts are prone to pick up dirt, dust, and grit if an adhesive agent such as oil or preservative compound remains on the surfaces of such parts. Actuation of parts in this condition will cause scoring and galling of the piston rods, damage to packings, and subsequent leakage and failure. It is necessary, therefore, that the surfaces of such parts be cleaned when actuated. Experience has revealed that a thin film of oil is beneficial to prevent twisting and failure of the packing due to insufficient lubrication. Before and after each flight, the following precautions shall be complied with: The exposed part of the piston must be thoroughly cleaned of all foreign matter: This will help prevent cutting of seals with resulting leaks and failures. The exposed piston then shall be wiped off with a soft rag moistened in hydraulic fluid, Specification 3-GP-26a.

LANDING-GEAR OLEO DRAG LEG

11 The oleo drag leg consists of a piston, lower housing and coil spring, with appropriate seals and packings.

(a) Removal - Remove oleo drag leg as follows:

(1) Place the aircraft on jacks and retract the landing gear 2 or 3 inches (to relieve load on drag leg).

(2) Remove upper and lower attaching bolts and unit will drop free.

(b) Disassembly - To disassemble oleo drag leg proceed as follows:

WARNING

Release all air before attempting to disassemble unit.

(1) Release air in unit.

(2) Remove housing drain plug and drain hydraulic fluid from the unit.

(3) Remove the air valve and grease fitting from the upper end of the piston.

(4) Place the drag leg in a press or suitable holding fixture and compress the coiled spring.

(5) Remove the upper snap ring, spacer tube retainer, and spacer tube.

(6) Release pressure on unit, remove spring and two spring retainer collars.

(7) Remove scraper lock ring, scraper ring, and wiper ring.

(8) Unscrew the piston stop nut (with Beech spanner 734-188005) and remove the piston from the housing.

(9) Remove the lower "O" ring and two packing back up rings (the other "O" rings and packing rings were removed with the piston and piston stop nut).

NOTE

After the unit has been disassembled; and it is not to be reassembled immediately, the polished surfaces of the unit must be coated with a rust preventative (Specification 3-GP-701), to prevent rust or corrosion. The rust preventative must be removed prior to reassembly.

(10) Inspect bushings and replace if worn loose, or if the holes are elongated. Clean all parts with cleaning fluid Spec. 3-GP-8a and blow dry with compressed air. Replace all O-ring seals and packing rings.

CAUTION

Be careful not to cut, scratch or nick O-rings when installing over sharp threads.

(c) Assembly - Assemble oleo drag leg as follows:

(1) Lubricate inside of housing with hydraulic fluid (Specification 3-GP-26a) and install "O" ring and two packing rings in lower end of housing.

(2) Lubricate piston with fluid and install in housing.

(3) Lubricate piston stop nut with fluid and install packing and "O" rings in proper recesses on nut.

(4) Install stop nut on piston and screw into housing.

(5) Install wiper ring, scraper ring, and scraper lock ring.

(6) Install spring and spring retainer collars.

(7) Compress spring, install spacer tube, spacer tube retainer, and snap ring.

(8) Install bushings, upper and lower grease fittings, air valve fitting, service oleo and install housing drain plug and gasket.

(d) Servicing - After assembly, service oleo drag leg as follows:

(1) Remove air valve and with strut held at an angle of 30 degrees, which is approximately the position it is installed on the aircraft, fill with hydraulic fluid Specification 3-GP-26a.

(2) Install the air valve, tighten and apply 50 pounds of air pressure to strut.

(3) Lay strut in a horizontal position with the lower drain plug up. Loosen lower drain plug and allow entrapped air to escape. Tighten plug as soon as air is released.

(4) Place strut in position as described above, remove air valve and refill strut.

NOTE

An oil control tube is provided in the piston assembly to preclude possibility of overfilling strut if fluid is added with strut held in the proper position.

(5) Install air valve, tighten and add 50 pounds of air pressure. This air pressure is used to avoid an air lock in the top of the strut and is not required to extend the strut, which is spring actuated.

NOTE

Instructions above are for filling empty struts. If small amount of fluid is required to replace service loss, the strut may be refilled on the aircraft. Remove the air valve and fill to top of filler opening with hydraulic fluid. Reinstall air valve, tighten and apply 50 pounds air pressure.

(e) Installation - Install oleo drag leg as follows:

(1) Place drag leg in position and install upper and lower attaching bolts.

(2) Remove jacks from aircraft.

LANDING-GEAR MOTOR

12 The landing-gear motor is located in the centre section underneath the pilot's floorboards. It drives the landing-gear mechanism through a worm-gear drive enclosed in a gearbox. On one side of the gearbox is located a sprocket, which connects by chain to the hand crank in the pilot's compartment and a small sprocket which drives the tail-wheel retracting mechanism. On the other side of the gearbox is a clutch which disengages the motor and gearbox from the other parts of the system. (Figure 2-69). For trouble shooting, Landing Gear, see Part 7, Table 7-5.

(a) Removal - Remove landing-gear motor as follows:

(1) Disconnect all electrical leads.

(2) Remove support clamp from the forward end of the motor.

(3) Remove four bolts attaching motor to reduction gear housing.

(4) Pull motor forward until worm on the motor shaft is clear of the housing. It may be necessary to use the manual gear operation crank to back the worm and motor out of the gear housing.

(b) Servicing - Brushes should be replaced when they are worn to a minimum length of 7/16-inch. A tension of two pounds should be required to lift the brush from the commutator. If tension required is less than two pounds, replace spring. Clean the commutator with a suitable cleaning solvent and polish with fine sandpaper. If commutator is extremely rough or pitted, replace motor. During inspection of brushes, the brush holder must be lifted straight up and down. Brushes must be properly seated first, the screw tightened securely and a check carried out for sparking. Excessive sparking and burning will shorten the brush life considerably.

NOTE

For repairs other than exterior cleaning, replacement of brushes and springs, or cleaning of commutator, the motor should be tagged unserviceable and returned to stores.

(c) Installation - To install landing-gear motor proceed as follows:

CAUTION

Carry out dimensional check on landing gear motor before installation. Ensure spacer Part 824-188896 and worm gear Part 824-188904 are assembled on motor before measurements are taken. The maximum length of shaft from mounting flange to end of threaded part of shaft to be 4.530". Ensure all landing gear motors have spacer Part 824-188896 installed on motors before installation. This prevents end play on the armature shaft. Shims may be added between motor mounting face and gear box to ensure the required shaft extension.

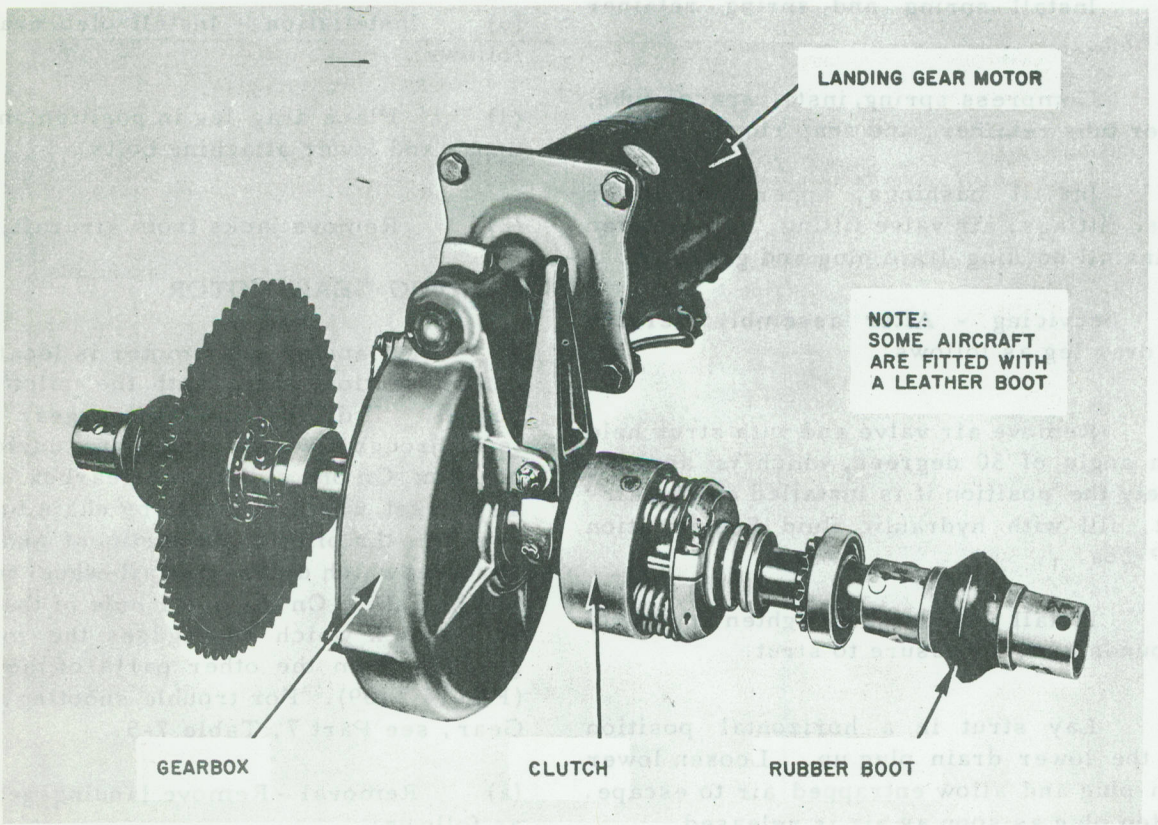


Figure 2-69 Landing Gear Motor and Gear Box

(1) Install motor in position on gearbox making sure gears are properly meshed.

(2) Install four bolts mounting motor to gear housing.

(3) Install support clamp at forward end of motor.

(4) Connect electrical leads.

(d) Adjustments - Procedure for checking up and down dynamic braking action is described in Paragraph 19, Part 7.

LANDING-GEAR MOTOR GEARBOX

13 The motor gearbox is a cast magnesium shell which houses the motor worm gear and the torque-shaft drive gear.

(a) Removal - Remove landing-gear motor gearbox as follows:

(1) Place the aircraft on jacks so all the wheels are off the floor.

(2) Remove the motor and worm gear as described in paragraph 12(a) of this section.

(3) With the landing-gear slide full against the down stop, scribe aligning marks on the landing-gear cross shaft collar and cross shafts.

(4) Remove the four taper pins that attach the collar to the torque shaft.

(5) Slide the collar outboard letting the short end of the shaft fall free.

(6) Remove the two attaching bolts on the universal joint and remove short shaft.

NOTE

Mark the shafts separately for positive identification and ease in assembling.

(7) Remove the clutch-release cable and housing from the bracket on the gear housing.

(8) Disassemble the repair link in the emergency hand crank chain and lay it aside.

(9) Remove the tail-wheel retract chain.

(10) Remove the motor bracket at the forward end of the motor. Disconnect the electrical wiring.

(11) Remove the two shaft bearing block halves and work the gearbox and shaft assembly free of the fuselage.

(b) Servicing - If the gearbox and shaft assembly needs repair it must be removed, tagged unserviceable and returned to stores. **The oil level in the box should be checked every 150 hours and maintained with universal gear lubricant, Specification MIL-L-6086B.** Every 600 hours, to flush the gear box:

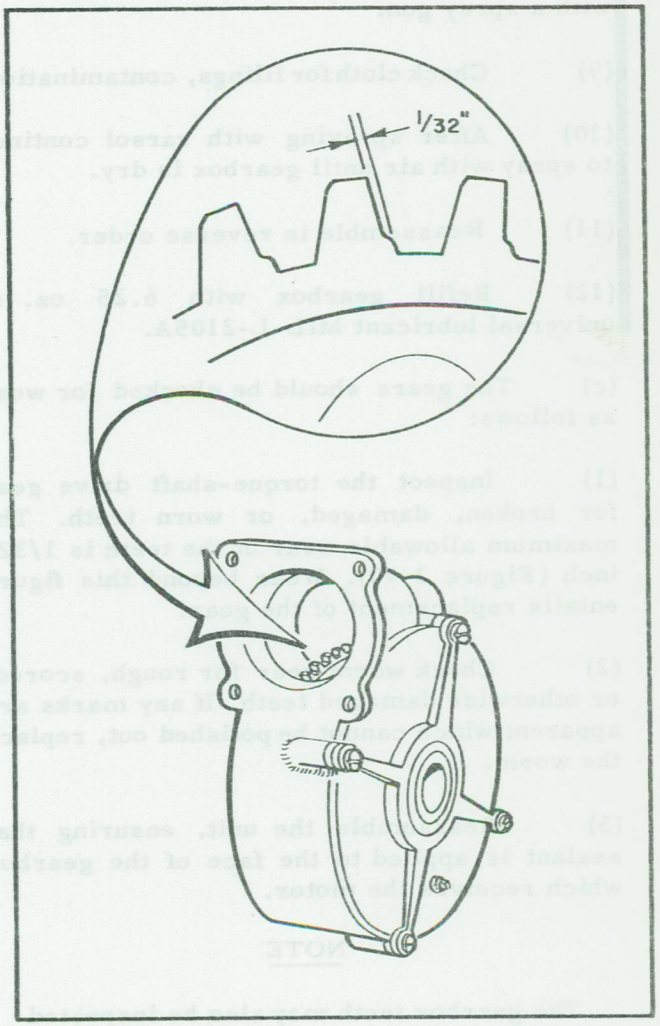


Figure 2-70 Torque Shaft Drive Gear Check

(1) Drain gearbox oil.

(2) Remove landing gear meter as per EO 05-45B-2.

(3) Disconnect clutch release cable assembly.

(4) Disconnect and remove housing clutch release cable.

(5) Tilt gearbox forward and down.

(6) Insert rubber hose into gearbox, through meter mount opening, and down to bottom of gearbox.

(7) Hold clean rag (cheesecloth) over motor mount opening, around rubber hose.

(8) Spray varsol through the rubber hose with a spray gun.

(9) Check cloth for filings, contamination.

(10) After spraying with varsol continue to spray with air until gearbox is dry.

(11) Reassemble in reverse order.

(12) Refill gearbox with 6.25 oz. of universal lubricant MIL-L-2105A.

(c) The gears should be checked for wear as follows:

(1) Inspect the torque-shaft drive gear for broken, damaged, or worn teeth. The maximum allowable wear on the teeth is 1/32-inch (Figure 2-70). Wear beyond this figure entails replacement of the gear.

(2) Check worm gear for rough, scored, or otherwise damaged teeth. If any marks are apparent which cannot be polished out, replace the worm.

(3) Reassemble the unit, ensuring that sealant is applied to the face of the gearbox which receives the motor.

NOTE

The gearbox teeth may also be inspected for wear whilst installed in the aircraft, providing the motor and worm are removed, with the use of a go-no-go gauge NSN 5220-21-844-6012. The inspection may be accomplished as follows:

Remove the clutch release cable and housing from the bracket on the gear housing.

Rotate the gearbox forward sufficiently to see the landing gear motor wheel (Part 404-188959, EO 05-45B-4, Part 2, Figure 29, Item 21 refers).

Check the worm gear at various intervals, by inserting the go-no-go gauge through the worm gear opening, and place the no-go end between the gear teeth. With the aid of light check to ensure the no-go tooth does not settle to its full depth of the gear teeth. Also ensure the underside of the go-no-go gauge shaft rests or comes in contact with top of gear teeth.

Should wear be beyond limits (i.e. 1/32-inch) remove unit for further examination and/or replacement.

(d) Installation - Install landing gear motor gearbox as follows:

(1) Insert the gearbox and the shaft assembly and attach the shaft bearing block halves.

(2) Reassemble the tail-wheel retract chain and adjust tension.

(3) Reassemble the emergency hand crank chain on the sprocket.

(4) Attach the previously-marked short cross shaft to the universal with the two attaching bolts.

(5) Place the short shaft in line with the collar and slip the collar inboard, lining up the proper holes that were previously marked. Install four tapered pins and safety.

(6) Attach the bracket on the forward end of the motor.

(7) Install the clutch-release cable and housing and adjust properly.

(8) Check alignment of previous scribe marks, making sure the landing-gear chain in the nacelle has not moved.

(9) Check the retract system for proper rigging. Landing-gear slides must synchronize.

CAUTION

Operate gear manually to check slide synchronization. Be sure tail gear slide is synchronized with main gear.

LANDING-GEAR CLUTCH ADJUSTMENT

14 This paragraph contains instructions for the clutch cable length adjustment, the overload clutch adjustment and the overload clutch testing.

(a) Clutch Cable Length Adjustment - To adjust the clutch cable length, hold the clutch pedal in the extreme aft position. Pull the top of the clutch arm outboard, fully engaging the clutch. Place the bolt on the cable giving 1/16 ± 1/32-inch clearance from the clutch arm (Figure 2-71). Tighten the bolt securely. Actuate the clutch pedal several times to check the bolt for slippage and sufficient throw.

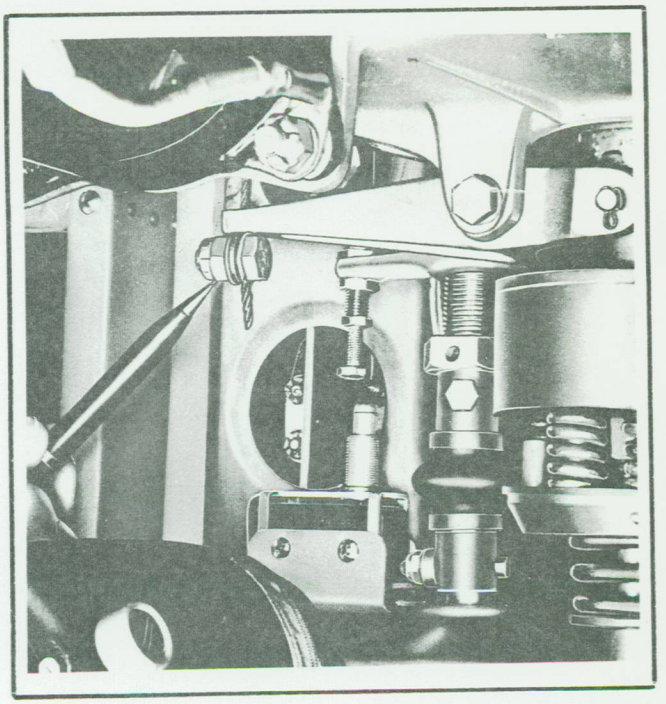


Figure 2-71 Clutch Cable Length Adjustment

(b) Overload Clutch Adjustment - Remove the wrap lock clamp and friction tape holding the clutch dust cover in place and remove the cover. Loosen the lock screw on the tension

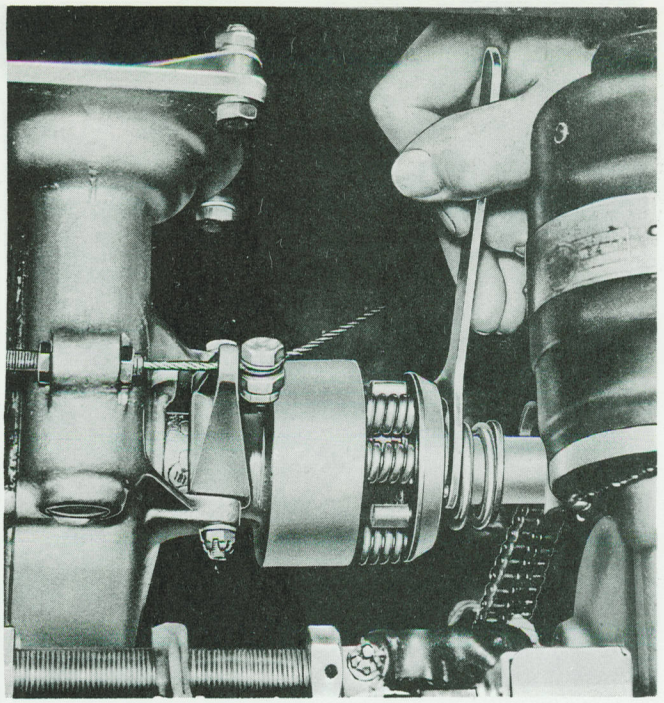


Figure 2-72 Overload Clutch Adjustment

nut (Figure 2-72).

NOTE

It may be necessary to spread the tension nut before it can be turned. Care must be exercised to avoid damage to the nut and the threads.

(1) Using Beech Spanner Wrench 180131, tighten to increase the tension or loosen to decrease the tension. Tighten the lock screw on the tension nut and safety. Replace the dust cover with friction tape and coat with shellac. Install wrap lock over tape.

(c) Overload Clutch Testing - Testing of the overload clutch is accomplished with a spring scale connected to the hand crank. The test is made in the following manner:

(1) Place the aircraft on jacks so that all wheels are clear of the floor.

(2) Disengage clutch and raise gear approximately halfway with hand crank.

(3) Re-engage the clutch.

(4) Set the hand crank handle forward with the teeth engaged, and hook a large spring scale to the handle at an angle of 90° to the floor.

(5) Pull up steadily on the scale until the clutch slips, which should be at a reading of 130 ± 10 pounds. If the clutch does not slip within the allowable scale reading, an adjustment should be made.

RETRACTING CHAIN (NACELLE)

15 This paragraph contains instructions for the removal, installation and adjustment of the landing-gear retracting chain.

(a) Removal - Remove the retracting chain as follows:

(1) Support aircraft on jacks.

WARNING

When hoisting or jacking the aircraft, always place a minimum ballast of 200 pounds on the horizontal stabilizer to prevent aircraft from nosing over. A felt or canvas pad should be used to protect the horizontal stabilizer and the ballast should be placed over the front spar near the fuselage.

(2) Retract landing-gear two or three inches from the lower stop. Mark position of slide on the slide tube to aid in synchronizing landing gear when chain is re-installed.

(3) Disconnect torque shaft at universal joint in the belly.

(4) Relieve tension on the chain by loosening lug bolts securing it to the slide.

(5) Disconnect both ends of the chain from the slide by removing safety clips and driving the pins from the repair links.

(6) Pull chain from the upper and lower sprockets.

(b) Installation - Install retracting chain as follows:

(1) Route chain over the upper and lower sprockets.

(2) Connect chain to the lug bolts at the slide and then safety it.

(3) Locate slide at position marked on removal of the chain and reconnect torque shaft.

(c) Adjustment - Adjust retracting chain as follows:

(1) Support aircraft on jacks so landing-gear wheels clear the floor.

(2) Using emergency hand crank, retract

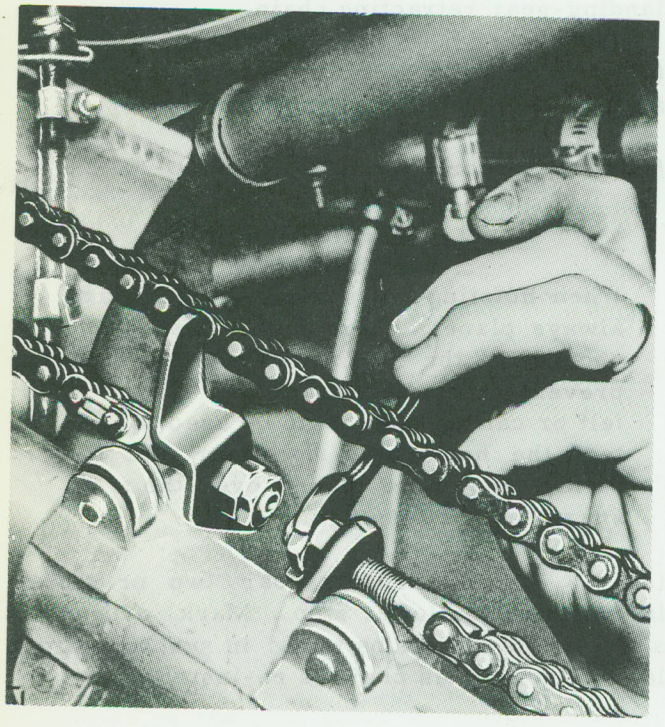


Figure 2-73 Landing Gear Chain Adjustment

landing-gear until slides in nacelles are about 1/8-inch from the lower stop.

(3) If this distance is not the same on both landing-gears, tighten lower chain adjusting bolt in the slide that is farther away from the stop (this will move slide down), or tighten upper chain adjusting bolt on the slide that is closest to the stop (this will move the slide up). See Figure 2-73.

NOTE

The chain adjustment will cover approx-

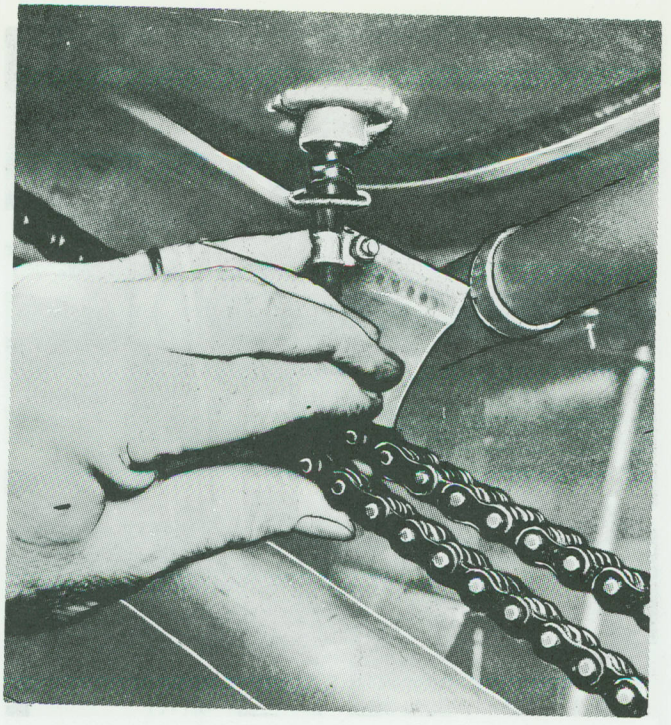


Figure 2-74 Chain Tension Check

imately 1/4-inch difference of the slide assemblies. If the difference in the position of the slides is greater than 1/4-inch the slides cannot be synchronized by adjusting the chain and the chain will have to be relocated on lower sprocket.

(4) The tension on the retract chains should be about 40 pounds. To set tension, tighten or loosen both adjusting bolts on chain by the same amount. Adjust chain so it does not slap slide tube during operation. This tension can be approximated by grasping retract chain at about the centre and squeezing with thumb and forefinger (Figure 2-74). If chain can just be squeezed together, tension is satisfactory.

(5) Recheck slide measurements for synchronization.

NOTE

The retract chains should be checked at regular intervals for possible wear. Check the measurement of thirty-six links from centre to centre on the link pins (Figure 2-75). The measurement should be 18 to 18-1/8-inches. If over

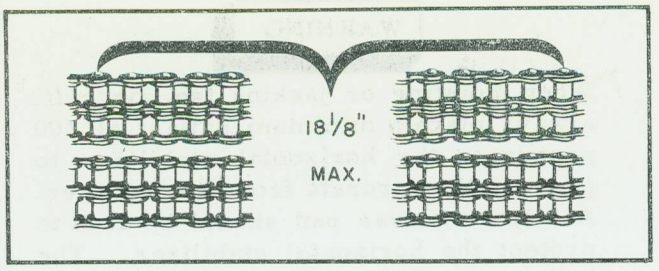


Figure 2-75 Landing-Gear Chain Length Check

18-1/8-inches, the chain should be replaced.

NOTE

Retract chains should be kept free of dirt, rust and corrosion at all times. Cleaning should be accomplished only with an approved solvent and under no circumstances should rust or corrosion be removed with an acid cleaner. Acid cleaners may embrittle and crack the highly heat-treated links. If a retract chain is excessively rusted or corroded to the extent of endangering safe operation, it should be replaced. The only recommended lubricant for retract chains is powdered graphite. A good method of application is to mix powdered graphite with a quick-evaporating solvent and apply to the retract chain with a brush.

SLIDE TUBES

16 The slide tubes are constructed from chrome molybdenum, round, seamless steel tubing which, prior to installation, are cadmium plated on the outer surface to resist rust and corrosion. They are securely attached at each end to the truss assembly and are adequately reinforced to absorb normal stresses induced by landing and take-off. The exterior surface is smooth to permit the slide assembly to travel the entire length of the tube with the least possible drag. There are three slide tubes; one for each of the main gears and one for the tail gear.

CAUTION

Where it is known or suspected that the geometric lock has been broken while the weight of the aircraft rested on the undercarriage, the slide tubes are to be thoroughly inspected for bending. Tubes showing any evidence of bending whatsoever are to be replaced.

(a) Removal (without using engine hoist) To remove slide tubes proceed as follows:

(1) Remove engine cowling, right-hand section of the exhaust collector ring, and heater muff from the left engine. (Remove cowling, left-hand section of the exhaust collector ring, and heater muff from the right engine).

(2) Remove generator and cover plates on inner cowl and firewall.

(3) Raise the aircraft on jacks until wheels are clear of floor. (See Part 1, Section 3).

(4) Loosen nuts on the front eye bolt of the retract chain to relieve all tension from the upper bracket.

(5) Remove bolt at lower end of slide tube and bolt from upper bracket.

(6) Rotate the tube with a strap wrench and pull out forward. If a strap wrench is not available, install a 1-1/2-inch hose clamp around the tube just above the slide assembly and secure firmly. Disengage clutch and retract gear with handcrank until tube clears lower sockets.

(b) Installation (without using engine hoist) - To install slide tubes proceed as follows:

(1) Insert new slide tube into place through the upper bracket maintaining a sufficient amount of the slide tube in the upper bracket to obtain a minimum distance of 9/16-inch from the centre of the finished hole for the upper slide tube retaining bolt and the upper end of the slide tube.

(2) Mark slide tube to match holes in slide tube sockets with 3/8-inch transfer punch as shown in Figure 2-76.

(3) Remove slide tube and drill tube with a 23/64-inch drill at points marked with the

Figure 2-76 Slide Tube Marking

transfer punch.

(4) Line-ream these holes to .375 inch ± .0005 inch.

(5) Remove all burrs and reinstall slide tube.

(6) Reinstall bolts in slide tube.

(7) Replace generator and cover plates, heater muff, exhaust collector ring, and cowling.

(8) Synchronize slides and adjust chain tension (refer to Paragraphs 15 through 17, Part 2, Section 6).

(9) Check tail-wheel synchronization.

(c) Removal (using engine hoist) - If a suitable engine hoist is available it is possible to save time by changing slide tubes in the following manner:

(1) Raise aircraft on jacks until wheels are off the floor.

WARNING

When hoisting or jacking the aircraft, always place a minimum ballast of 200 pounds on the horizontal stabilizer to prevent the aircraft from nosing over. A felt or canvas pad should be used to protect the horizontal stabilizer. The ballast should be placed over the front spar near the fuselage.

(2) Place the fuel selector valve and oil shut-off valve in the "OFF" position.

(3) Remove engine cowling and firewall cover plate.

(4) Disconnect exhaust pipe from rear hanger and remove heater valve from intensifier tube.

(5) Remove firewall section assembly (fairing covering exhaust pipe at front of nacelle).

(6) Loosen nuts on the front eye-bolt of the retract chain to relieve all tension from the upper bracket.

(7) Remove upper and lower slide tube bolts.

(8) Disconnect the oil intake and return, propeller feathering, oil vent, fuel primer, oil pressure and manifold pressure hose (to indicators) and anti-icer hose. Plug all connections to prevent loss of fluids and entrance of foreign matter into lines.

(9) Disconnect clamps holding the magneto leads to the engine mount assembly, also propeller governor controls.

(10) Attach sling to hoisting eyes on engine crankcase. Attach a hoist of at least 1500 pounds capacity.

(11) Gradually tighten the hoist to support the weight of the engine. Make certain hoisting lug connections are secure and separator bar prevents cables from damaging induction pipes.

(12) Remove nuts from bolts attaching the

two upper engine mount bushings to the centre section truss.

(13) Remove bolts fastening bonding strips at two upper engine mount bushings.

(14) Loosen nut on lower mount bolts.

(15) Remove two upper bolts from engine mounts.

(16) Carefully tilt engine down and forward until slide tube may be removed through access hole in the firewall. If engine is lowered cautiously, no damage to nacelle or tail pipe will result.

(17) Rotate slide tube with a strap wrench and pull out forward.

(18) Rotate slide tube with a strap wrench and work out through access hole in firewall. If a strap wrench is not available, secure a hose clamp on the tube above the slide and drive it out with a lead hammer or heavy rawhide mallet. If slide tube is bent, sawing it in two may simplify removal and avoid damage to centre section truss.

(d) Installation (using engine hoist) - To install slide tubes with the aid of engine hoist, proceed as follows:

(1) Insert new slide tube into place through upper bracket maintaining a sufficient amount of the slide tube in the upper bracket to obtain a minimum distance of 9/16-inch from the centre of the finished hole for the upper slide tube retaining bolt and the upper end of the slide tube.

(2) Mark the slide tube to match the holes in the slide tube sockets with a 3/8-inch transfer punch as shown in Figure 2-76.

(3) Remove the slide tube and drill the tube with a 23/64-inch drill bit at points marked with the transfer punch.

(4) Line-ream these holes to .375-inch $\pm$ .0005-inch.

(5) Remove all burrs and reinstall slide tube.

(6) Reinstall upper and lower slide tube bolts.

(7) Raise engine into position and reinstall mounting bolts, bond strips, plumbing, tail pipe hanger, tail pipe heater valve, firewall section, propeller governor plumbing and cowling. Remove sling from hoisting eye on engine crankcase.

(8) Synchronize slides and adjust chain tension (refer to Paragraphs 15 through 17, Part 2, Section 6).

(9) Check tail wheel synchronization.

(10) Place fuel selector and oil shut-off valves in "ON" position.

(11) Run engine to check plumbing connections.

LANDING-GEAR SLIDE ASSEMBLY

17 The landing-gear slide assembly consists of a steel forging machined to accommodate six steel rollers. The rollers are evenly spaced to give a smooth-sliding operation. Machined on the forging are two fittings for the retract-chain attachment. The forging is lined with a bronze bushing to assure free action on the slide tube.

(a) Removal - Remove landing-gear slide assembly as follows:

(1) Support aircraft on jacks.

WARNING

When hoisting or jacking the aircraft, always place a minimum ballast of 200 pounds on the horizontal stabilizer to prevent aircraft from nosing over. A felt or canvas pad should be used to protect the horizontal stabilizer and the ballast should be placed over the front spar near the fuselage.

(2) Remove retract chains (refer to Paragraph 15, Part 2, Section 6).

(3) Remove slide tube (refer to Paragraphs 16(a) or 16(c), Part 2, Section 6). It is

not necessary to completely remove the slide tube. Rotate slide tube forward just enough to let slide assembly drop off.

(b) Servicing - The landing-gear slide assemblies should be kept clean at all times. If bronze bushing is excessively worn or scored, replace slide assembly. Replacement of oleo drag leg is recommended if attaching bolt holes are elongated or worn.

(c) Installation - Install landing-gear slide assembly as follows:

(1) Place slide in position on slide tube.

(2) Install slide tube (refer to Paragraphs 16(b) or 16(d), Part 2, Section 6).

(3) Install and adjust retract chains (refer to Paragraph 15, Part 2, Section 6).

LANDING-GEAR TORQUE SHAFT

18 This paragraph contains instructions for the removal, servicing and installation of the landing-gear torque shaft.

(a) Removal - Remove the landing-gear torque shaft as follows:

(1) Support aircraft on jacks.

WARNING

When hoisting or jacking the aircraft, always place a minimum ballast of 200 pounds on the horizontal stabilizer to prevent aircraft from nosing over. A felt or canvas pad should be used to protect the horizontal stabilizer and the ballast should be placed over the front spar near the fuselage.

(2) Retract landing-gear slides two or three inches from the lower stop. Mark the position of the slides on the slide tube to aid in synchronizing the landing-gear when the torque shaft is installed.

(3) Remove the taper pins from the short cross shaft in the belly. Mark the shafts before removal so they may be re-installed in same position.

(4) Slip the torque shaft inboard to disengage it from the sprocket in the nacelle.

CAUTION

Do not lose keys on sprocket shaft.

(5) Remove torque shaft by slipping it outboard through the outer wing panel, until it is in a position to be removed through the landing-gear wheel well.

(b) Servicing - If torque shaft becomes bent or warped, remove and replace the entire torque shaft assembly.

(c) Installation - Install landing-gear torque shaft as follows:

(1) Install torque shaft in position through the wing stub and centre section and install the outboard end universal on the sprocket.

WARNING

Be sure keys are installed on sprocket.

(2) Install the short cross shafts on the torque shaft in the belly.

(3) Check the slides in the nacelle to see that they are in position according to the marks made previously on the slide tube.

(4) Install and key the taper pins through the inboard end of the short cross shaft.

(5) Using a 3/16-inch drill, and using the holes in the outboard ends of the cross shaft as a guide, drill in the torque shaft. Care must be maintained to drill straight through the shaft, or the hole will not clean out when reamed and the shafts will have to be replaced again.

(6) Using a Browne & Sharpe No. 1 Tapered Reamer, ream the holes and install taper pins.

(7) Check the landing-gear slides for synchronization. (See Paragraph 15(c), Part 2, Section 6).

(8) Check retract system for rigging, and remove aircraft from jacks.

TAIL WHEEL

19 The tail wheel is supported on the axle by two tapered roller bearings.

(a) Removal - Remove tail wheel as follows:

WARNING

When hoisting or jacking the aircraft, always place a minimum ballast of 200 pounds on the horizontal stabilizer to prevent aircraft from nosing over. A felt or canvas pad should be used to protect the horizontal stabilizer and the ballast should be placed over the front spar near the fuselage.

(1) Jack aircraft at tail jack point.

(2) Remove cotter keys from axle nuts, remove nuts.

(3) Remove axle and tail wheel.

(4) For disassembly and assembly of tail wheel refer to EO 110-5-2.

(b) Installation - Install tail wheel as follows:

(1) Place tail wheel in fork.

(2) Install axle, nuts and cotter pins.

(3) Remove jack.

TAIL-GEAR TRUSS ASSEMBLY

20 The tail-gear truss assembly is a welded steel tube structure. It supports the swivel fork and wheel assembly. At its forward end it is hinged to the fuselage and it is supported on the aft end by an air-oil shock absorber (Figure 2-55).

(a) Removal - To remove tail gear truss assembly proceed as follows:

(1) Jack aircraft at tail jack point.

(2) Remove tail wheel, see Paragraph 19(a).

(3) Remove tail-wheel lock cable.

(4) Remove hinge bolt at forward attachment.

(5) Remove bolt attaching shock absorber to tail-gear assembly at lower end of shock absorber.

(6) Lower gear away from fuselage.

(b) Installation - Install tail gear truss assembly as follows:

(1) Place truss in position on the aircraft.

(2) Install hinge bolts at forward attachment and safety.

NOTE

If side play is apparent between the tail wheel pivot forgings, insert washers AN960-816 or -816L on one side, or both sides, at the pivot forgings. This is to secure alignment of the tail strut with the slide tube. Side play up to 1/16-inch is acceptable.

(3) Install bolt attaching shock absorber to tail gear assembly at lower end of shock absorber and safety.

CAUTION

Ensure strut is installed with the air charging valve facing FORWARD.

(4) Attach tail wheel lock assembly and safety.

(5) Remove jack and check strut inflation.

TAIL SHOCK ABSORBER

21 This paragraph contains instructions for the removal and installation of the tail shock absorber.

(a) Removal - Remove tail shock absorber

as follows:

(1) Jack aircraft at tail jack point.

NOTE

When jacking the aircraft, always place a minimum ballast of 200 pounds on the horizontal stabilizer.

(2) Remove upper and lower attaching bolts and remove shock absorber from aircraft.

(3) For disassembly and assembly of the tail shock absorber refer to EO 15-50AC-2.

(b) Installation - Install tail shock absorber as follows:

(1) Place shock absorber in position on the aircraft.

(2) Install upper and lower attaching bolts and safety.

CAUTION

Ensure strut is installed with the lower grease nipple facing AFT and air charging valve facing FORWARD.

(3) Remove jack and inflate strut, with weight of aircraft on gear, so that 3 inches of piston are showing.

TAIL-WHEEL LOCK AND LOCK CONTROLS

22 The tail-wheel lock consists of a spring loaded plunger, which locks the tail wheel in a straight position parallel to the lateral axis of the aircraft. The lock control is located on the pedestal and overcomes the spring tension through a cable linkage to unlock the tail wheel. For trouble shooting, Tail Wheel Lock, see Table 2-7.

(a) Removal - Remove tail wheel lock controls as follows:

(1) Remove centre aisle floorboards.

(2) Disconnect the 1/16-inch cable from the stainless steel wire between Bulkheads 5 and 6.

(3) Remove screws from housing mounting bracket at truss assembly, centre and rear of belly compartment.

(4) Remove screws attaching control handle to pedestal and remove all clamps on the housing in the belly.

(5) Pull housing forward into belly compartment and remove bushing and nut which secures the mounting bracket to the housing.

NOTE

Measure the distance the housing extends aft through the bushing as an aid to installing a new housing in the correct position.

(6) Remove housing by pulling it up and out through the pilot's compartment.

(7) Remove spring assembly from cable, between Bulkheads 5 and 6.

(8) Remove pulleys at Bulkheads 7 and 10.

(9) Disconnect cable from locking pin at the tail wheel truss assembly and remove cable.

NOTE

Remove cable carefully to prevent damage to the phenolic fairleads through which the cable is routed.

(b) Servicing - Minor repairs will consist of replacing rusted or corroded cables and replacing the spring assembly if it becomes weak. If the housing in the belly is bent or kinked to such an extent that it restricts the operation of the control, it should be replaced. Replace pulleys which are frozen or sticky in operation.

(c) Installation - Install tail wheel lock controls as follows:

(1) Insert cable in opening of phenolic fairlead at Bulkhead 14 and pull forward into correct position.

TROUBLE	PROBABLE CAUSE	CORRECTION
1 Tail wheel will not lock.	(a) Metal fatique in spring.	(a) Replace spring.
	(b) Lever distorted and out of alignment.	(b) Repair or replace lever.
	(c) Tail wheel lock pin damaged.	(c) Replace lock pin.
2 Tail wheel will not unlock.	(a) Sheared pin in tail wheel lock pin.	(a) Replace lock pin.
	(b) Lever distorted and out of alignment.	(b) Repair or replace lever.
	(c) Tail wheel lock pin damaged.	(c) Replace lock pin.
3 Pedestal control handle will not lock.	(a) Lock control assembly wire kinked or broken.	(a) Replace lock control assembly.
4 Pedestal control handle will not unlock.	(a) Lock control assembly wire kinked or broken.	(a) Replace lock control assembly.

Table 2-7 Trouble Shooting, Tail Wheel Lock and Control

(2) Install clevis fitting on cable to locking pin of tail wheel truss assembly. Insert bolt, tighten nut snugly and key.

(3) Install pulleys at Bulkheads 7 and 10.

(4) Insert new control and housing assembly through opening in pedestal and pull into position through belly. Install screws and secure control handle to pedestal.

(5) Install bushing, mounting bracket and nut, in that order, in correct position on the housing. (See note following step (a)(5), Paragraph 22.

(6) Route housing aft under truss and install mounting bracket to truss assembly.

(7) Connect stainless steel control wire to spring assembly, and the cable to the opposite end of the spring assembly.

(8) Install all attaching clamps.

(9) Rig cable and safety turnbuckle. Check system for smooth operation and for correct locking action of the tail wheel swivel.

(10) Install centre aisle floorboards.

(d) Adjustments - The tail-wheel lock cable should have enough tension to keep it from dragging on bulkheads and should be kept clean for free and easy movement. The cable should be short enough to withdraw the locking pin completely, but long enough to permit the pin to seat firmly. Cable length may be adjusted with the turnbuckle under the centre aisle floorboards.

TAIL-WHEEL RETRACTING SYSTEM

23 Cables from a chain and sprocket drive on the main landing-gear torque unit are attached to the tail-wheel slide assembly. The shock absorber links the slide and the tail-wheel truss. As the slide is moved along the slide tube, the shock absorber lowers or retracts the tail gear.

(a) Removal of Tail Wheel Retract Cables - Remove the retract cables as follows:

(1) Release tension and disconnect the tail wheel retract cables in the rear fuselage compartment.

(2) Remove centre aisle floorboards.

(3) Remove pulleys at Bulkheads 10 and 7. Remove idler sprockets under centre section truss at Bulkhead 5 in the belly.

(4) Remove guard over sprocket on torque shaft in the belly.

(5) Mark with paint, or other suitable method, a link of the chain and its matching tooth of the sprocket.

(6) Pull chain out through the belly.

(7) Remove the pulleys over which the retract cables are routed at the forward end of the tail wheel slide tube.

(8) Remove large pulley on the aft side of Bulkhead 14 and disconnect the cable from the slide assembly.

(9) Remove cable by pulling it out through the tail wheel well.

(b) Servicing the Tail Wheel Retract Cables - If a cable has more than six broken strands in any one inch it must be replaced. Rusted or corroded chains must be replaced. Replace pulleys which are frozen or sticky in operation. Check the bushings in the idler sprockets for rust or corrosion, and lubricate as required. Check the idler sprockets for excessive wear. Worn sprockets must be replaced.

(c) Installation of Tail Wheel Retract Cables - Install the tail wheel retract cables as follows:

(1) Install the chain and cable assembly over the sprocket on the torque shaft in the belly and route aft through the fuselage.

(2) If the old chain is to be re-installed, by means of the previously marked chain link, position the marked link over the matching marked tooth of the sprocket. If a new chain is installed, place the corresponding link of the new chain over the marked tooth of the sprocket.

(3) Install pulleys at Bulkheads 7 and 10. Install idler sprockets at Bulkhead 5.

(4) Pull new cable into position and install large pulley at the aft end of the tail wheel slide tube.

(5) Attach cable to slide assembly.

CAUTION

The tail wheel retract cable is attached to the slide assembly with an aluminum-alloy shear bolt. NEVER replace the aluminum-alloy shear bolt with a steel bolt.

(6) Make sure the cables are in their correct positions and install the pulleys at the forward end of the tail wheel slide tube.

(7) Connect the tail wheel retract cables in the rear fuselage tail compartment and adjust to their approximate operating tension.

(8) Operate gears MANUALLY and check all slides for synchronization with each other. All slides must synchronize.

(9) Run gears electrically and set lower limit switch.

(10) Rig retract cables to correct tension and safety cable turnbuckles.

(d) Rigging of Tail Wheel Retract Cables - Rig the retract cables as follows:

(1) Support aircraft on jacks.

(2) Station a man in the pilot's compartment, a man in the rear fuselage tail compartment, and a man outside the aircraft. The man in the pilot's compartment will operate the landing-gear manually and electrically, the man in the rear fuselage will adjust the retract cables to proper tension, and the man outside will see that the wheel wells are clear of obstructions each time the gear is operated, and check the tail wheel slide for synchronization with the main gear slides and correct travel.

(3) Operate the landing gear system manually and position the main gear slides against

the lower stop. Adjust the turnbuckles on the tail wheel retract cables until the cables have approximately 50 pounds tension on each. Make sure the tail wheel slide is against the lower (aft) stop.

(4) Operate gears electrically and check the lower limit switch for correct setting (see Paragraph 15(a), Part 7).

CAUTION

Use extreme care when operating the system electrically. Added inertia in the landing-gear system, caused by electrical operation, may cause the landing-gear slides to contact the lower stops too hard and damage the retract system. An approximate setting may be obtained on the lower limit switch by manual operation however it should not be relied upon as a final correct setting to limit the travel of the gear when under electrical operation. It is recommended that the lower limit switch be adjusted initially to such a position where it will be reasonably certain that the slides will not contact the lower stops with undue force when the system is operated electrically. Continue electrical operation and adjustments by trial and error method until correct setting is obtained.

(5) Using a tensiometer to check cable tension, adjust retract cables to 70 plus or minus 5 pounds on the top retract cable and 50 plus or minus 5 pounds on the bottom cable.

NOTE

If the above tensions cannot be obtained, with the tail wheel slide against the lower stop, with three threads or less showing at the ends of the retract cable turnbuckles, the chain must be relocated on the idler sprocket in the belly. After chain is relocated on sprocket, operate gear MANUALLY to check synchronization of the tail wheel slide with the main gear slides.

(6) Run the gear to fully retracted position, then lower against the lower stop electrically. The man in the tail compartment will listen carefully to assure the tail wheel slide contacts the lower (aft) stop with a slight impact (barely audible) and the man outside will make a check through the tail wheel opening to be sure the slide is contacting the lower (aft) stop.

(7) Check cable tension and lower limit switch setting. Make minor adjustments in cable tension and lower switch setting if necessary. Safety the turnbuckles.

(8) Remove aircraft from jacks.

WARNING

The tail wheel retract cable is attached to the tail wheel slide with an aluminum alloy shear bolt. NEVER replace this aluminum-alloy shear bolt with a steel bolt.

TAIL WHEEL SLIDE AND SLIDE TUBE

24 This paragraph contains instructions for the removal and installation of the tail wheel slide and slide tube.

(a) Removal - Remove slide and slide tube as follows:

(1) Remove shear bolt attaching retract cables to slide.

(2) Remove shock strut assembly.

(3) Remove front and rear bolts attaching slide tube to aircraft structure.

(4) Using a strap wrench, work the slide tube ahead through the forward mounting.

(5) Slide will slip off the aft end of the tube.

(b) Installation - Install tail wheel slide and slide tube as follows:

(1) Install slide on the aft end of the tube.

(2) Using a strap wrench, work the slide tube through the forward mounting.

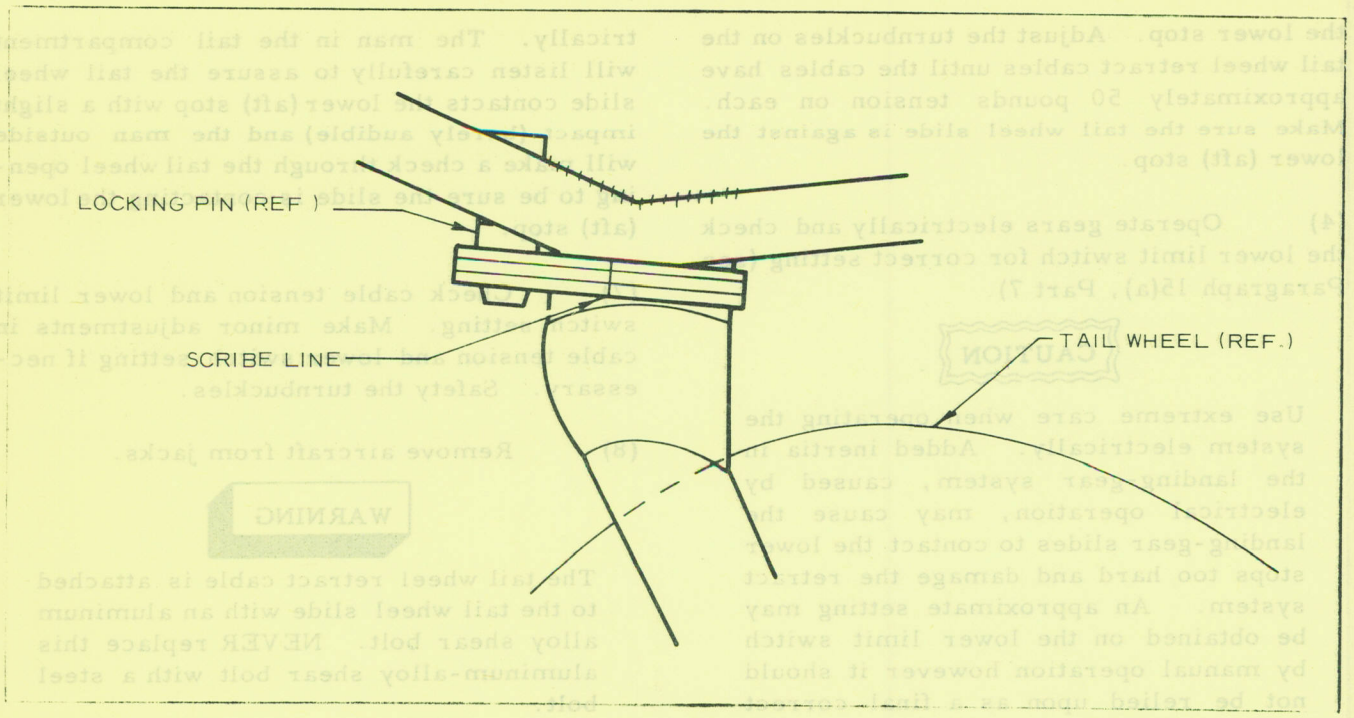


Figure 2-77

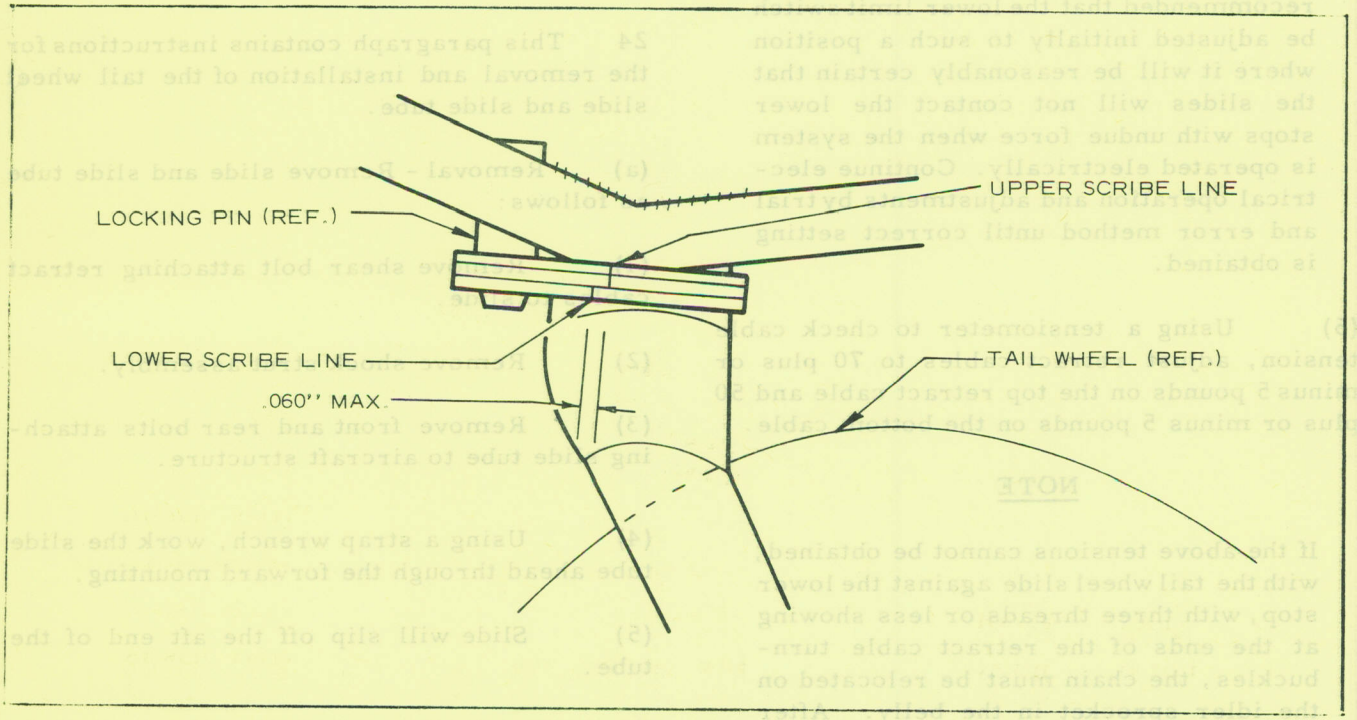


Figure 2-78

(3) Attach slide tube to aircraft structure with front and rear attaching bolts.

(4) Install shock strut assembly.

(5) Attach retract cables to slide with shear bolt.

TOLERANCES - TAIL WHEEL LOCK

25 In instances where the tail wheel is suspected of having too much swivel movement when in the locked position, it is to be checked using the following procedure:-

(a) Jack up the tail of the aircraft so that the tail wheel is free of the ground.

(b) Lock the tail wheel and ensure that the locking pin engages.

(c) Hold the tail wheel at one end of its swivel travel and scribe a pencil line as shown in Figure 2-77.

(d) Move the tail wheel to the other end of its swivel travel and measure the distance between the upper and lower scribe marks. Maximum allowable distance is 0.060". Figure 2-78 refers.

NOTE

For cases that are found beyond 0.060" tolerance, one of the following procedures is to be used to effect repairs:

The locking pin is to be replaced, or

The fork assembly is to be removed and returned to overhaul contractor to effect repairs in accordance with EO 05-45B-3 Part 5, Page 63, paragraph 12.

PART 3

HYDRAULIC AND PNEUMATIC SYSTEMS

NOT APPLICABLE

PART 4
UTILITY SYSTEMS
SECTION 1
HEATING AND VENTILATING SYSTEM

HEATING SYSTEM

GENERAL DESCRIPTION

1 The heating system is designed to operate efficiently through a wide temperature range. Heat for the cabin and pilot's compartment is derived from intensifier tubes inserted in the exhaust stack on each engine. Fresh air flows through an intake port into the intensifier tube where it is heated. A two-outlet control valve is located at the discharge end of each intensifier tube. They are actuated by the cabin heat controls on the control pedestal. The control valves route the heated air into the cabin and pilot's compartment, or overboard, depending on the position of the cabin heat controls. Individual temperature controls are installed at the pilot's and copilot's air ports. Heated air for windshield defrosting is routed through extensions of the conductor tubes under the pilot's compartment floorboards. A duct running from the left cabin heat inlet up the sidewall and forward on the overhead to the astrodome, routes the heated air for astrodome defrosting. An "ON" - "OFF" control is mounted in the cabin heat inlet. (See Figure 4-1). For Trouble Shooting, Heating System, see Table 4-1.

INTENSIFIER TUBES

2 Intensifier tubes of corrosion-resistant steel are located in the exhaust stack of each engine. They connect at their forward ends to an air inlet located in the engine baffles. The

TROUBLE	PROBABLE CAUSE	CORRECTION
1 Exhaust fumes in cabin and pilot's compartment.	(a) Cracked or broken intensifier tube - right-hand or left-hand.	(a) Replace. Note: Make no welding repairs on intensifier tube.
	(b) Exhaust gas shield missing.	(b) Install gas shield.
2 Heat-control valve sticking.	(a) Valve casting broken or bent.	(a) Replace.
	(b) Frozen due to exhaust corrosion.	(b) Remove valve. Clean with solvent and polish parts with fine emery cloth.
	(c) Richland-type control bent or clamps too tight.	(c) Loosen clamps and check control. Replace control if it is badly bent or kinked. Slight bends or kinks may be straightened by hand. Note: Lubricate with powdered graphite only. (Specification DTD-77).

Table 4-1 Trouble Shooting, Heating System

intensifier tubes are dimpled to provide greater heat transfer.

(a) Removal - Remove intensifier tubes as follows:

(1) Remove exhaust tail-pipe shroud.

(2) Remove bolts attaching the intensifier tube to the air-intake tube and the exhaust collector ring.

(3) Slide intensifier tube aft and remove exhaust gas shield.

(4) Remove tail-pipe support bolt and the bolt attaching the tail pipe to the exhaust collector ring.

(5) Pull tail pipe to the rear and outboard from the collector ring.

(6) Remove intensifier tube from tail pipe by pulling it out the forward end.

(b) Installation - Install intensifier tubes as follows:

(1) Insert intensifier tube in exhaust tail pipe and place tail pipe in position. To allow for expansion clearance ensure a minimum of 9/32 of an inch exists between the end of the intensifier tube extrusion of the tail pipe and the heater control box.

(2) On earlier models, where no deflector is installed, this clearance is to be a minimum of 3/16 of an inch.

(3) If, upon installation using the existing mounting holes, the clearance is less than specified, the intensifier tube is to be reworked as follows:

a. Remove the front intensifier tube securing bolt.

b. The intensifier tube is to be moved aft until the specified clearance is obtained.

c. The intensifier tube mounting hole is to be re-drilled and the old holes filled with weld if required.

(4) Install bolt attaching tail pipe to the

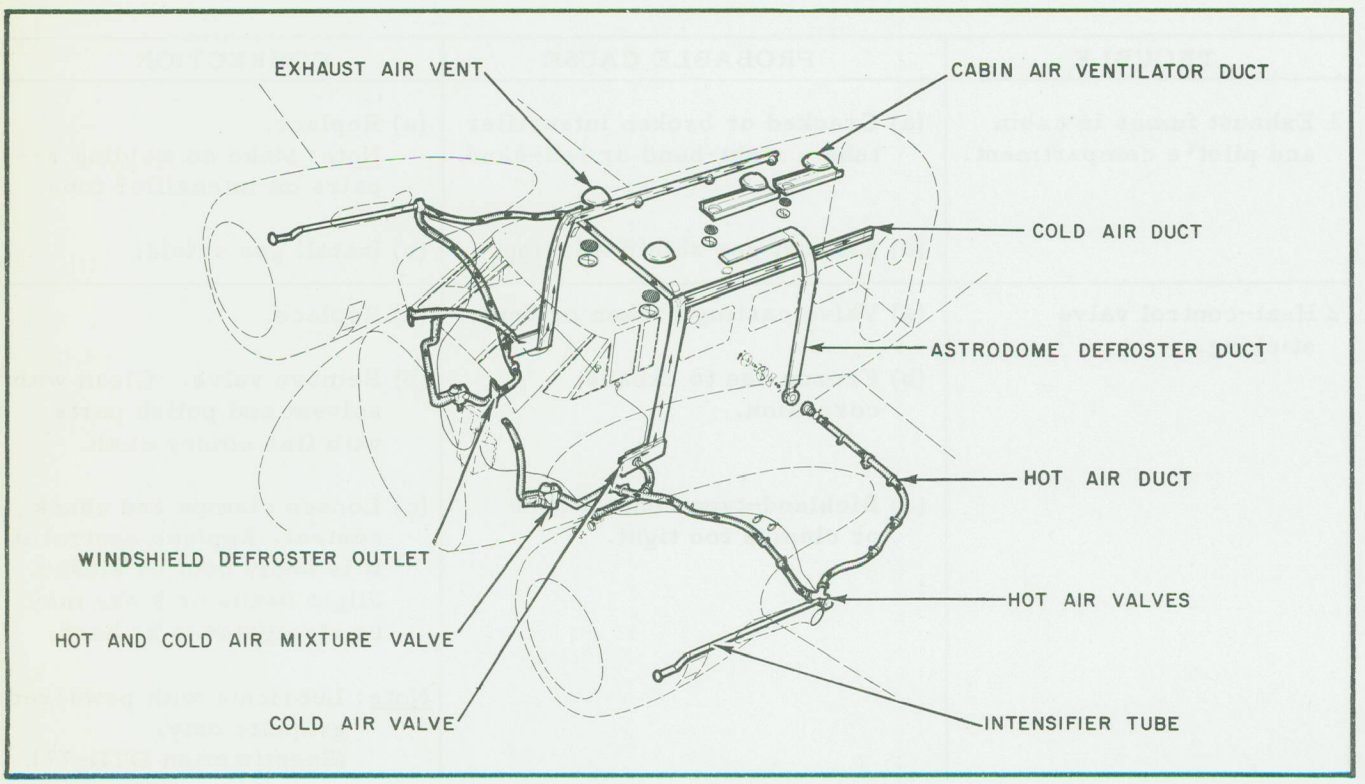


Figure 4-1 Heating and Ventilating System

exhaust collector ring. Safety.

(5) Install exhaust tail-pipe hanger bolt and safety.

(6) Install the exhaust gas shield on the forward end of the intensifier tube, then push intensifier tube forward into air-intake tube. Install two retainer bolts and safety.

WARNING

Make sure exhaust gas shield is in place.

(7) Install heater valve.

(8) Install tail-pipe shroud.

HOT AIR CONTROL VALVES

3 The hot air control valves are attached to the aft end of each intensifier tube. The valve consists of an inlet, two outlets and a by-pass opening to discharge the hot air when heat is not required (Figure 4-2). Controls for the hot air valves are located on the lower part of the pilot's control pedestal.

(a) Removal - To remove hot air valves proceed as follows:

(1) Remove valve cap.

(2) Remove nuts attaching heater diaphragm to control shaft and remove diaphragm.

(3) Remove bolt attaching valve to intensifier tube.

(4) Remove hose clamps attaching conductor tubes to valve.

(5) Remove nut holding control housing to valve casting and pull valve away from aircraft.

(b) Servicing - If hot air valves are damaged, replace the entire valve assembly.

(c) Installation - To install hot air valves proceed as follows:

(1) Place valve in position and install bolts to intensifier tube.

(2) Install control wire and lock housing in place with control-housing retaining nut.

(3) Attach conductor tubes and tighten hose clamps.

(4) Insert diaphragm and tighten retaining nut on control-wire shaft.

(5) Check for full travel of control.

(6) Install valve cap with three screws and safety.

(d) Adjustment - Unscrew control housing nut from valve casting. If the valve does not provide the full-hot position, turn control housing nut up the housing and screw nut back into valve. If valve does not shut off hot air, turn nut down on control housing a few turns and reinstall in valve. Safety the nut.

NOTE

Adjust control so there will be 1/4 inch spring back of the control handle when released, to ensure positive closing of the valve.

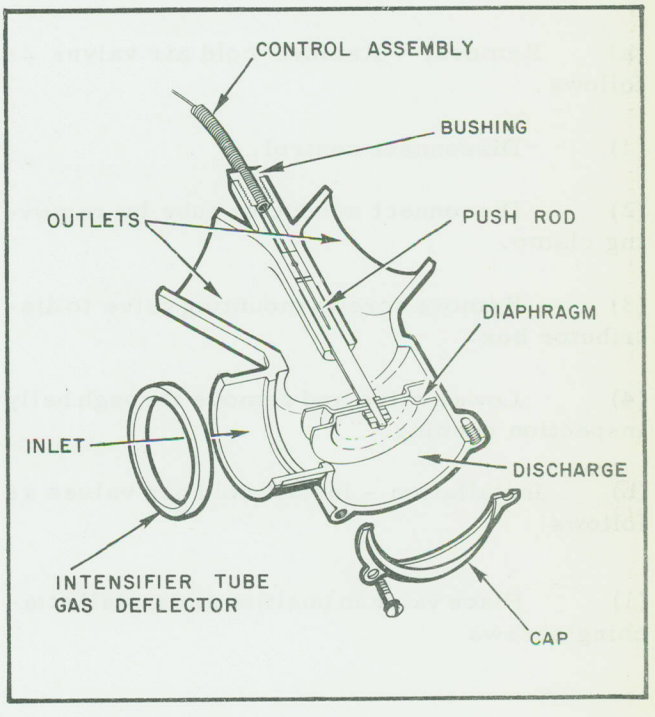


Figure 4-2 Hot Air Control Valve

VENTILATING SYSTEM

GENERAL DESCRIPTION

4 Cold air inlets are provided at four places, one in the leading edge of each centre section wing, and one each on the lower outboard side of the fuselage under the pilot's and copilot's floorboards. Air entering the centre section wing inlets is routed through conductor tubes of neoprene and glass fiber construction to a distributor box on each side of the fuselage. A valve in each distributor box regulates the amount of cold air that flows from the boxes into the cabin air ducts. Individually controlled outlets installed in the cabin air duct above each seat are regulated by the passengers for their comfort. The fuselage inlets route the air through short conductor tubes to the pilot's and copilot's individual air ports. (See Figure 4-1).

COLD AIR CONTROL VALVES

5 Diaphragm type valves are installed in each distributor box to control the flow of cold air. They are operated by controls mounted on Bulkhead 5, behind the pilot's and copilot's seats.

(a) Removal - Remove cold air valves as follows:

(1) Disconnect control.

(2) Disconnect conductor tube by removing clamp.

(3) Remove screws mounting valve to distributor box.

(4) Lower valve and remove through belly inspection opening.

(b) Installation - Install cold air valves as follows:

(1) Place valve in position and install attaching screws.

(2) Connect conductor tube and tighten clamp.

(3) Attach handwheel to valve shaft.

COLD AIR DUCTS

6 Outside air is distributed in the cabin from ducts extending fore and aft along the curved corner formed by the overhead and sidewalls. Constructed of formed aluminum sheet these horizontal ducts connect with vertical ducts at distributor boxes just aft of bulkhead 5.

CABIN AIR EXHAUST

7 The cabin air exhaust system consists of two formed aluminum-sheet ducts riveted to the cabin ceiling. On the lower side of each duct is an adjustable opening for the exhaust air to pass out of the cabin. On the upper side of each duct is an opening in the outside skin. Low pressure behind the discharge covers pulls air out of the cabin (Figure 4-3).

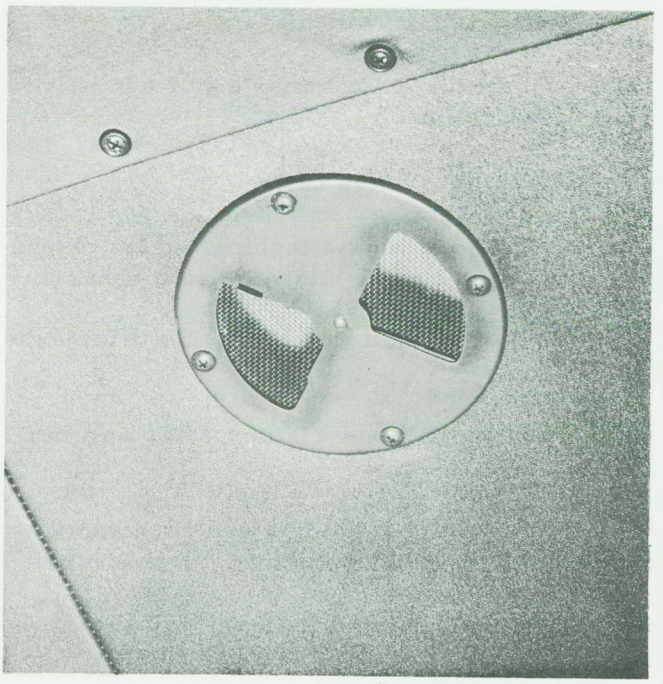


Figure 4-3 Cabin Exhaust Vent

PART 4

SECTION 2

DE-ICING AND ANTI-ICING SYSTEMS

DE-ICING SYSTEM

GENERAL DESCRIPTION

1 De-icer boots are mounted on the leading edges of wings and horizontal stabilizer. The boots are inflated by air pressure from the exhaust side of the engine-driven vacuum pumps. Air lines run from the pumps to oil separators located in each engine accessory compartment. From the oil separator in each engine section, lines run to a three-way valve. From the three-way valve the air is routed through the de-icing system oil separator to the distributor. When the de-icing system is used, the vacuum pump exhaust is discharged directly into the system; when not in use, it is directed overboard by a vent line. The three-way valve directing the vacuum-pump discharge is operated by a push-pull control (see Figure 4-4). Boots are inflated in four stages once every 40 seconds by rotation of a distributor valve. All de-icer boots are inflated and deflated once each revolution. A pressure relief valve is incorporated in the oil separator in the left nacelle. For Trouble Shooting, De-Icing System, see Table 4-2.

CAUTION

A defective vacuum pump should be replaced with the same type and model since the de-icer boots require pumps of high capacity.

DE-ICER BOOTS

2 This paragraph contains instructions for the removal, servicing and installation of the de-icer boots.

(a) Removal - Remove de-icer boots as follows:

(1) Remove attaching screws and fairing strips.

(2) Remove de-icer boots, pulling tubes through holes in wings only far enough to disconnect.

(b) Servicing - For minor repairs and parts replacement refer to EO 05-1-2AA.

(c) Installation - Install de-icer boots as follows:

TROUBLE	PROBABLE CAUSE	CORRECTION
1 System inoperative.	(a) Push-pull control loose or broken. (b) Vacuum Pumps inoperative. (c) Open circuit in control valve motor	(a) Check for broken or loose control, check for full throw of valve. (b) Check de icer pressure. (c) Check circuit.
2 Partial or slight operation of one or more boots.	(a) Lines may be clogged. (b) System pressure may be low.	(a) Check lines for stoppage and see that the lines are not kinked or bent. (b) Observe gage and adjust relief valve if necessary.

Table 4-2 Trouble Shooting, De-icer System

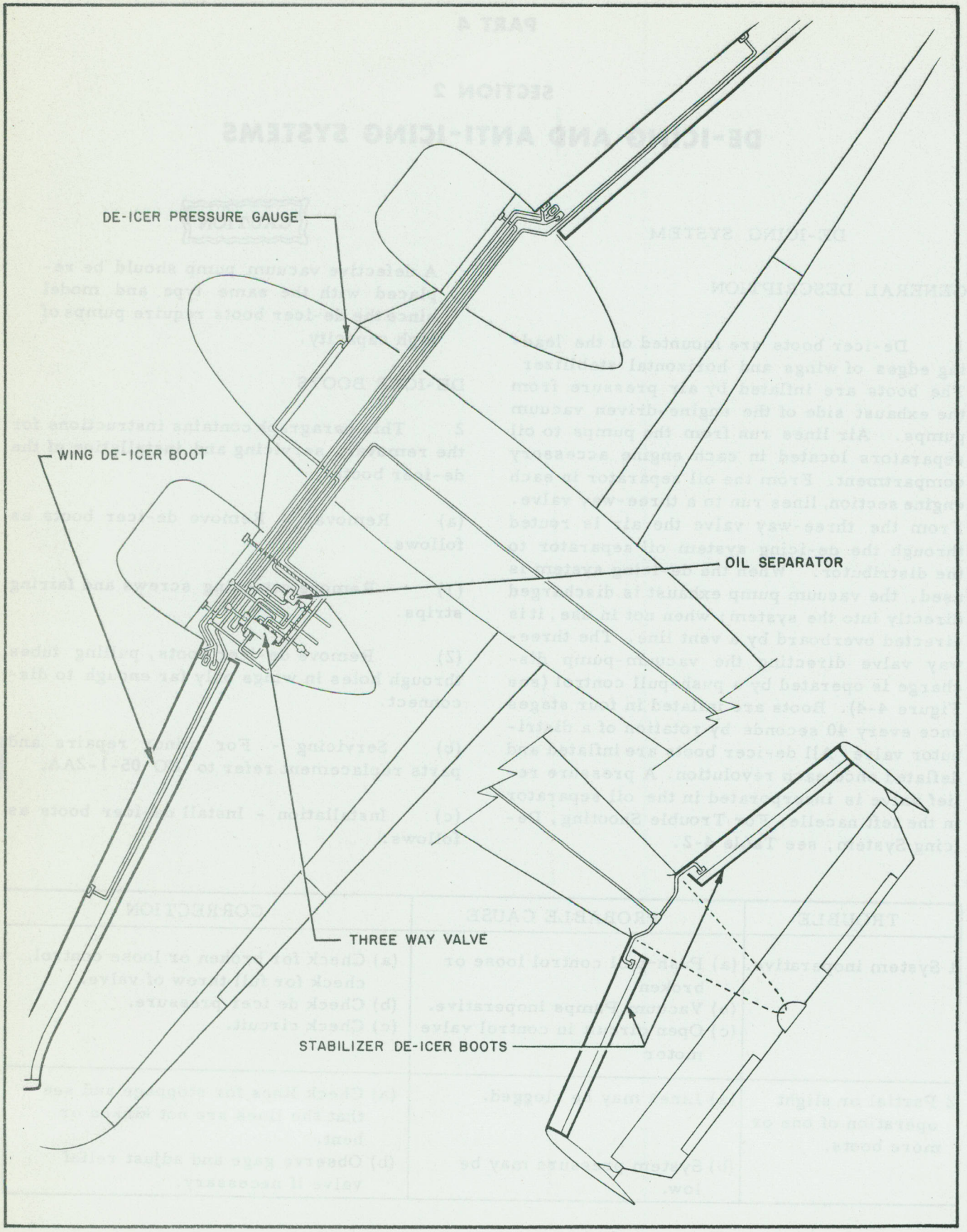


Figure 4-4 De-Icing System

(1) Apply a liberal amount of talcum powder on the inside surface of the boot and on the skin to which the boots are being attached.

NOTE

Before installing de-icer boots, inspect all applicable wing boot connector hose for deterioration. Do not install de-icer boots over painted or corroded surfaces.

(2) Attach lower edge of boot to under surface of the wing or stabilizer with fairing strip and machine screws.

(3) Pull de-icer boot over leading edge and apply special pins in every other hole (small end of pin goes into rivnut).

(4) Install fairing strips over pins in position on the de-icer boot.

(5) Install attaching machine screws in open holes, then remove pins one at a time and replace with screws.

(6) Tighten screws and attach lines.

(d) Testing - When testing the de-icing system, check all connections for leaks and check boots for tears and leaks. With engine running, set operating pressure at 7-1/2 psi. Note the inflation cycle of boots to see if all are operating properly. The de-icer boots inflate and deflate once every 40 seconds. The maximum permissible pressure drop for new de-icer boots is 2-1/2 psi, in 60 seconds. If a drop of more than 2-1/2 psi occurs when old de-icer boots are fitted, each boot must be checked for leaks. If no leaks are apparent a 5 psi drop is permissible.

CAUTION

Do not exceed ten pounds pressure at any time in the de-icer boots.

DISTRIBUTOR VALVE

3 The de-icer distributor valve is a six-port motor-driven rotary valve. (See Figure 4-6).

(a) Removal - Remove distributor valve as follows:

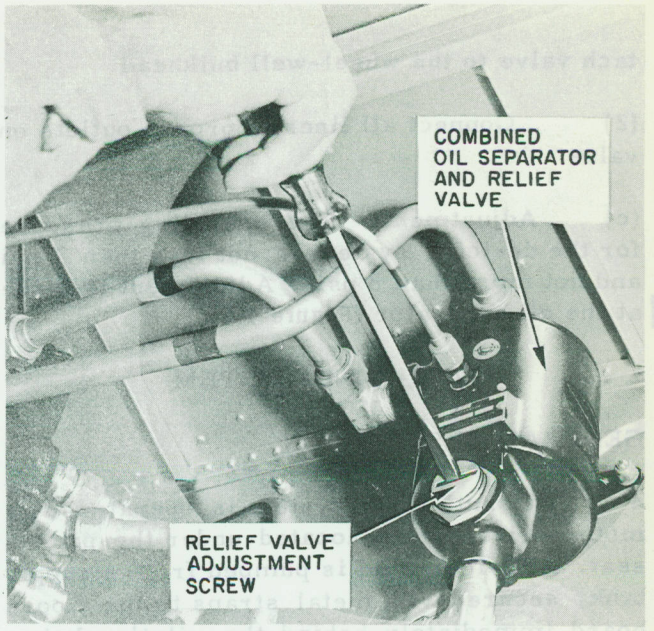


Figure 4-5 (Issue 1) Relief Valve Adjustment

(1) Disconnect all lines at the valve.

(2) Remove three bolts which attach the valve to the wheel-well bulkhead.

(b) Installation - To install distributor valve proceed as follows:

(1) Replace three mounting bolts and at-

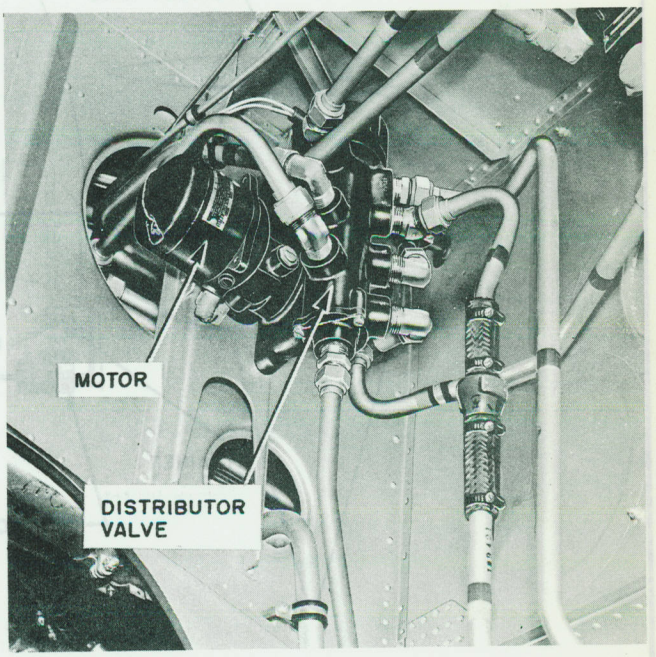


Figure 4-6 (Issue 1) De-icing System Distributor Valve

tach valve to the wheel-well bulkhead.

(2) Connect all lines to proper outlets on valve

(c) Adjustment - The operating pressure for the de-icing system is not less than 7 psi and not more than 8 psi. Adjustment is made at the oil separator (**Figure 4-5**).

ANTI-ICING SYSTEM

GENERAL DESCRIPTION

4 The anti-icing system is operated by a motor driven pump located under the pilot's seat. Anti-icer fluid is pumped from a supply tank, secured with metal straps to the floorboard immediately behind the pilot's chair, into lines extending under the floorboards and through centre section and nacelles to each propeller hub (Figure 4-7). A slinger ring at each hub distributes fluid as the propeller rotates. Speed of the pump motor is controlled by a rheostat switch on the right subpanel (Figure 4-8). For Trouble Shooting, Anti-Icing System, see Table 4-3.

ANTI-ICER TANK

5 The anti-icer supply tank is a 2.5 Imperial (3 US) gallon metal tank located beneath the pilot's seat just in front of Bulkhead 5.

(a) Removal - Remove anti-icer tank as follows:

(1) Drain anti-icer fluid from the system by removing plug on the underside of the fuselage directly below the tank (Figure 4-9).

(2) Working through belly access opening, disconnect the supply line at the fitting immediately below the tank. Remove nuts and spacers from the forward ends of the tank straps.

(3) Remove pilot's seat. (It is possible, although difficult, to remove anti-icer tank without removing seat).

(4) Disconnect vent line at the fitting on

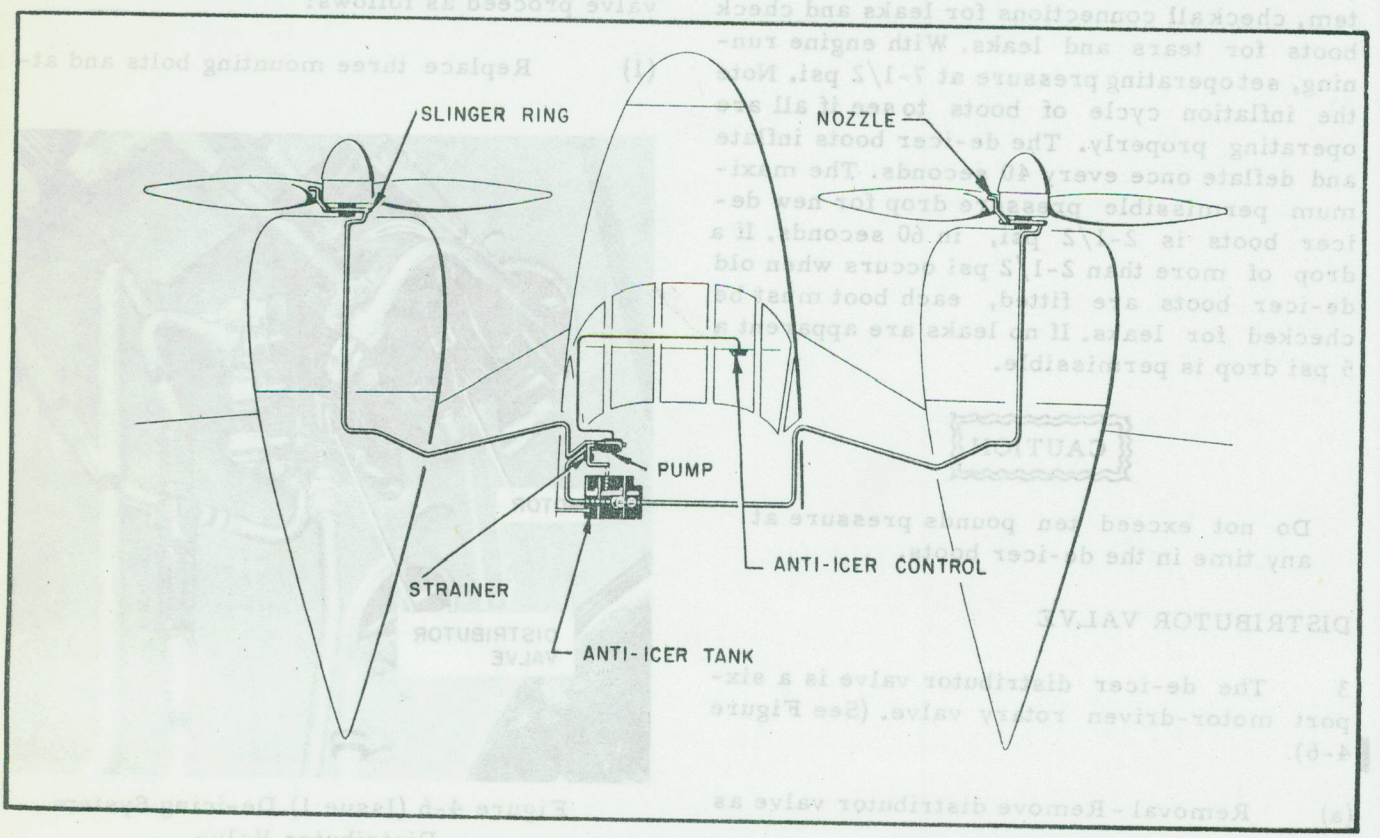


Figure 4-7 Anti-Icing System

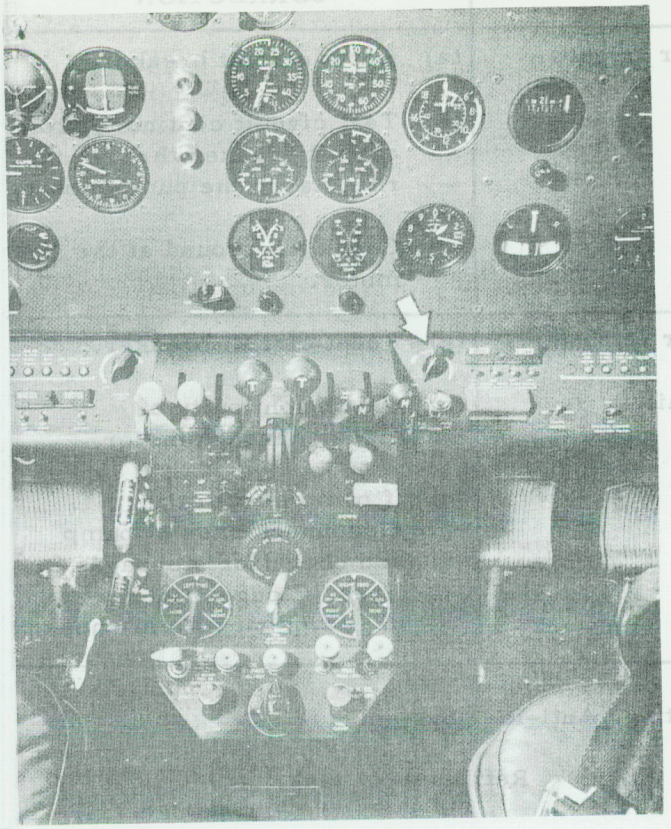


Figure 4-8 Anti-Icing Rheostat Switch

top of the tank.

(5) Pull tank straps clear and remove tank.

(b) Installation - Install anti-icer tank as follows:

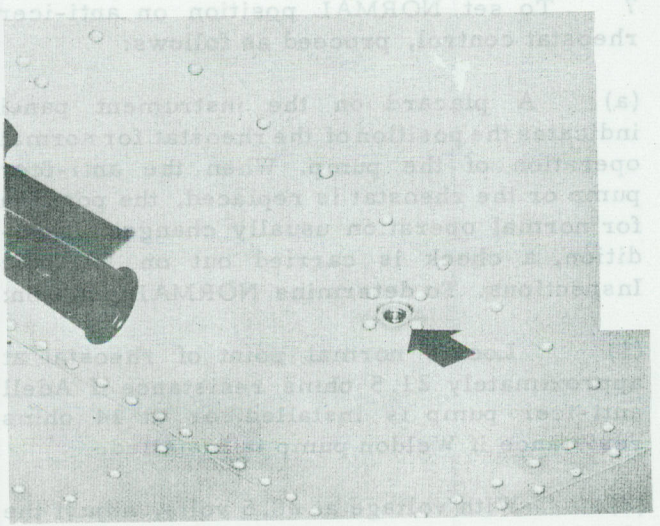


Figure 4-9 Anti-Icing Tank Drain

(1) Place tank in position under the pilot's seat and secure the tank straps. Make sure padding is in place around tank.

(2) Connect vent line at top of the tank.

(3) Install pilot's seat.

(4) Working through belly access opening connect supply line at the fitting below the tank.

(5) Install drain plug and fill tank.

ANTI-ICER PUMP ASSEMBLY

6 The anti-icer pump assembly is located next to the tank underneath the pilot's seat (Figure 4-10). It pumps fluid from the supply tank to each propeller-hub slinger ring, which distributes the fluid as the propeller rotates. Speed of the pump motor is controlled by a switch rheostat located on the right subpanel.

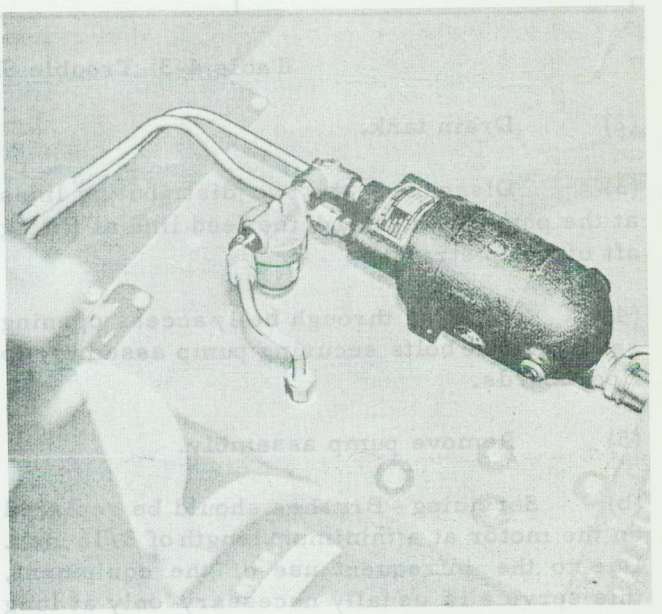


Figure 4-10 Anti-Icing Pump Assembly

(a) Removal - Remove anti-icer pump as follows:

(1) Disconnect electrical leads at the connector plug on the motor.

TROUBLE	PROBABLE CAUSE	CORRECTION
1 Motor inoperative.	(a) Circuit breaker tripped.	(a) Reset circuit breaker.
	(b) Open circuit.	(b) Test circuit continuity from circuit breaker through the rheostat to the pump motor.
	(c) Poor ground.	(c) Check the ground at the motor.
2 No fluid being delivered.	(a) Circuit breaker tripped.	(a) Reset circuit breaker.
	(b) Defective circuit.	(b) Check continuity of circuit through motor.
	(c) Lines clogged.	(c) If pump is operating, disconnect lines at pump and check for stoppages in lines. Clogged lines may be blown out with air hose.

Table 4-3 Trouble Shooting, Anti-Icer System

(2) Drain tank.

(3) Disconnect the two distributing lines at the pump fittings and the feed line at fitting aft of pump strainer.

(4) Working through belly access opening remove three bolts securing pump assembly to floorboards.

(5) Remove pump assembly.

(b) Servicing - Brushes should be replaced on the motor at a minimum length of 5/16 inch. Due to the infrequent use of the equipment, this service is usually necessary only at long intervals.

(c) Installation - Install anti-icer pump as follows:

(1) Place pump in position under pilot's chair.

(2) Working through belly access opening, install three mounting bolts in pump and tighten.

(3) Connect two distributing lines and feed line.

(4) Connect electrical connector plug to motor.

(5) Refill supply tank.

CAUTION

Ensure that the de-icing line and the priming line are not crossed at the port engine inner cowl.

SETTING "NORMAL" POSITION ON ANTI-ICER RHEOSTAT CONTROL

7 To set NORMAL position on anti-icer rheostat control, proceed as follows:

(a) A placard on the instrument panel indicates the position of the rheostat for normal operation of the pump. When the anti-icer pump or the rheostat is replaced, the position for normal operation usually changes. In addition, a check is carried out on Periodic Inspections. To determine NORMAL position:

(1) Locate normal point of rheostat at approximately 21.5 ohms resistance if Adell anti-icer pump is installed, or at 14 ohms resistance if Weldon pump is installed.

(2) With voltage at 28.5 volts, adjust the check valves to obtain normal flow of 3 to 3.6 Imp. quarts/propeller/hour. Four men are

required. Both sides are to be adjusted together, because adjustment of one side affects the flow on the other. To decrease the flow, turn the valve counterclockwise. Use a stop watch and two 1/2 pint (10 oz.) graduated containers, and check for 5 - 6 oz. of fluid at each propeller in 2-1/2 minutes. Both check valves must be continually tapped lightly to simulate engine vibration and keep the valves free for 2-1/2 minutes.

ADVANCE REVISION

Serial #2 dated 24 Apr 59
(Sheet 1 of 2)

The sheets of this Advance Revision are to be inserted in the EO as follows:-

Sheet 1 facing page 4-10
Sheet 2 facing page 4-10

SETTING "NORMAL" POSITION ON ANTI-ICER RHEOSTAT CONTROL

7 To set "Normal" position on anti-icer rheostat control, proceed as follows:-

(a) A placard on the instrument panel indicates the position of the rheostat for normal operation of the pump. When the anti-icer pump or the rheostat is replaced, the position for normal operation usually changes. In addition, a check is carried out every 200 hours on Periodic Inspections. To determine "normal" position:-

(1) Locate normal point of rheostat at approximately 21.5 ohms resistance if Adell anti-icer pump is installed, or at 14 ohms resistance if Weldon pump is installed.

(2) With voltage at 28.5 volts, adjust the check valves to obtain normal flow of 3 to 3.6 Imp. quarts/propeller/hour. Four men are required. Both sides are to be adjusted together, because adjustment of one side affects the flow on the other. To decrease the flow turn the valve counter-clockwise. Use a stop watch and two 1/2 pint (10 oz.) graduated containers, and check for 5 - 6 oz. of fluid at each propeller in 2-1/2 minutes. Both check valves must be continually tapped lightly to simulate engine vibration and keep the valves free for the 2-1/2 minutes.

(3) If one or both check valves are at the minimum setting and the flow is still excessive, adjust so that the flow from both sides is equal, then move the "normal" point of the rheostat clockwise to reduce the flow.

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(4) Check for maximum flow of 4-1/2 or more Imp. quarts/propeller/hour.

(5) If maximum flow cannot be obtained, move normal point of rheostat further clockwise, and repeat (2) and (4).

(6) Affix a suitable placard to indicate the "normal" position.

(7) Air Test. Operate the system on "normal" for 20 mins. and check that the flow is 2 to 2.4 Imp. quarts, i.e., 6 to 7.2 Imp. quarts/hour from both propellers. When measuring the fluid, care must be taken not to fill the tank into the neck since the fluid will syphon out through the tank vent and affect the measurement.

(3) If one or both check valves are at the minimum setting and the flow is still excessive, adjust so that the flow from both sides is equal, then move the NORMAL point of the rheostat clockwise to reduce the flow.

(4) Check for maximum flow of 4-1/2 or more Imp. quarts/propeller/hour.

(5) If maximum flow cannot be obtained, move normal point of rheostat further clockwise, and repeat (2) and (4).

(6) Affix a suitable placard to indicate the NORMAL position.

(7) Air Test. Operate the system on NORMAL for 20 minutes, and check that the flow is 2 to 2.4 Imp. quarts, i.e., 6 to 7.2 Imp. quarts/hour from both propellers. When measuring the fluid, care must be taken not to fill the tank into the neck since the fluid will syphon out through the tank vent and affect the measurement.

PART 4

SECTION 3

FIRE EXTINGUISHER AND DETECTION SYSTEM

FIRE EXTINGUISHER SYSTEM

GENERAL DESCRIPTION

1 The fire extinguisher system consists of the engine fire extinguisher and the hand fire extinguisher.

(a) Engine Fire Extinguisher - The engine fire extinguisher equipment is installed to discharge CO_2 into each engine accessory compartment (Figure 4-12). It consists of a supply cylinder and valve assembly, a control panel and necessary lines.

(b) Hand Fire Extinguishers - The aircraft is equipped with a CO2 hand fire extinguisher and a water glycol type hand fire extinguisher.

ENGINE FIRE EXTINGUISHER

2 The engine fire extinguisher system supply cylinder and valve assembly are located forward of the co-pilot's rudder pedals. A control panel, consisting of an engine selector valve and a release handle, is located at the base of the pilot's control pedestal. A line runs from the supply cylinder to the engine selector valve and from the valve to each engine compartment. A line extends from the cylinder to a safety plug outlet on the lower side of the fuselage below the cylinder. The release handle on the control pedestal is connected by a flexible cable to a valve on the cylinder (Figure 4-11).

(a) Removal - Remove engine fire extinguisher as follows:

CAUTION

Extreme care should be taken in removing the release cable from a full bottle to prevent accidental discharge.

(1) Remove valve cover. With safety wire, tie the lever to which the release cable is attached. Use several turns of wire, so there is no danger of releasing the lever when the cable is being disconnected.

(2) Disconnect tubing and release cable, loosen clamp holding bottle in well and lift bottle out.

(b) Servicing - Service to the engine fire extinguisher system, other than replacement of empty bottles, should not be attempted.

(c) Installation - Install the engine fire extinguisher as follows:

(1) Place bottle in well.

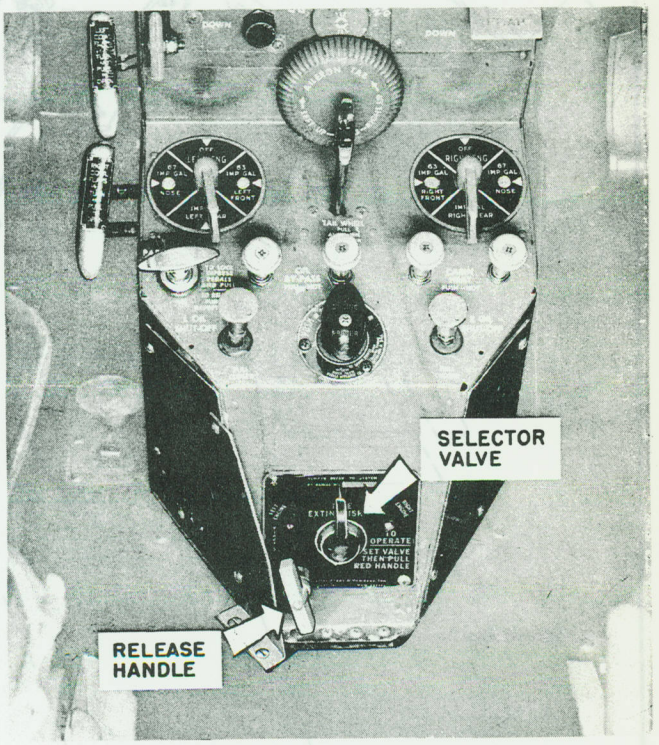


Figure 4-11 Selector Valve and Release Handle

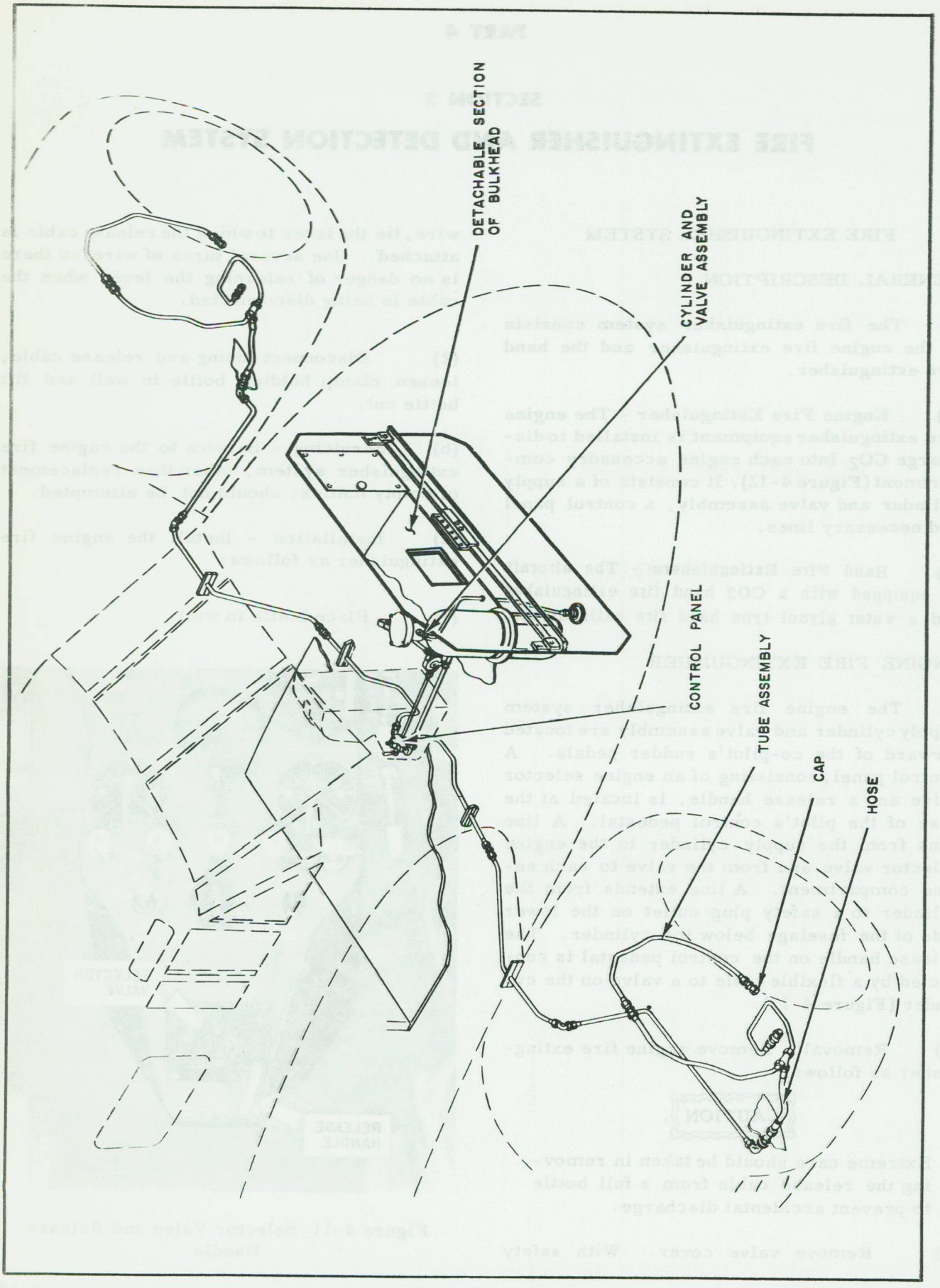


Figure 4-12 Engine Fire Extinguisher System

(2) Attach tubing and release cable to valve. Remove wire around release lever. Replace valve cover.

(3) Replace bolt in clamp holding bottle to floor and tighten.

HAND EXTINGUISHER

3 The aircraft is equipped with two hand fire extinguishers, (see Figure 4-13 and 4-13A) a CO_2 type extinguisher is stowed on the rear face of the main spare bulkhead. A water glycol charged extinguisher is mounted on the forward face of the rear cabin bulkhead.

NOTE

The water glycol charged extinguisher is for use on "A" class fires only.

FIRE DETECTION SYSTEM

GENERAL DESCRIPTION

4 The fire detection system in the Expeditor 3 consists of detector thermocouples in each nacelle located on the engine firewall and in the wheel well. A shock-mounted relay panel is situated on the floorboards, forward of the pilot's control pedestal. Two warning lights are mounted on the main instrument panel and a test-switch is fitted on the pilot's subpanel.

TROUBLE SHOOTING

5 Turn the battery switch ON. Allow 15 or 20 seconds to elapse, then turn the test switch ON. If the unit is functioning correctly the fire detector lights will come on. If they do not, check the system as follows:

(a) Reset the fire detector circuit breaker.

(b) Check the lamps in the fire detector lights.

(c) Check all electrical wire and conduit connections.

(d) Replace relay panel with another which is known to be operative.

(e) Check thermocouples (refer to paragraph 6(c).

(f) If, after performing these checks, the unit is still inoperative, remove it, tag unserviceable and return to stores.

DETECTOR THERMOCOUPLE

6 The fire sensing units - 12 per engine - are located throughout the engine accessory compartment and wheel well. They are positioned to cover all potential fire zones. The thermocouple wires are mounted in heat-resistant insulators and surrounded by a stainless steel cage. The cage is provided with openings to permit heat to reach the exposed hot junction with minimum interference.

(a) Removal - Remove thermocouple as follows:

(1) Remove thermocouple lead-in wires, and mark for correct replacement.

(2) Remove mounting screws and remove thermocouple.

(b) Installation - Install thermocouple as

Figure 4-13 Hand Fire Extinguisher

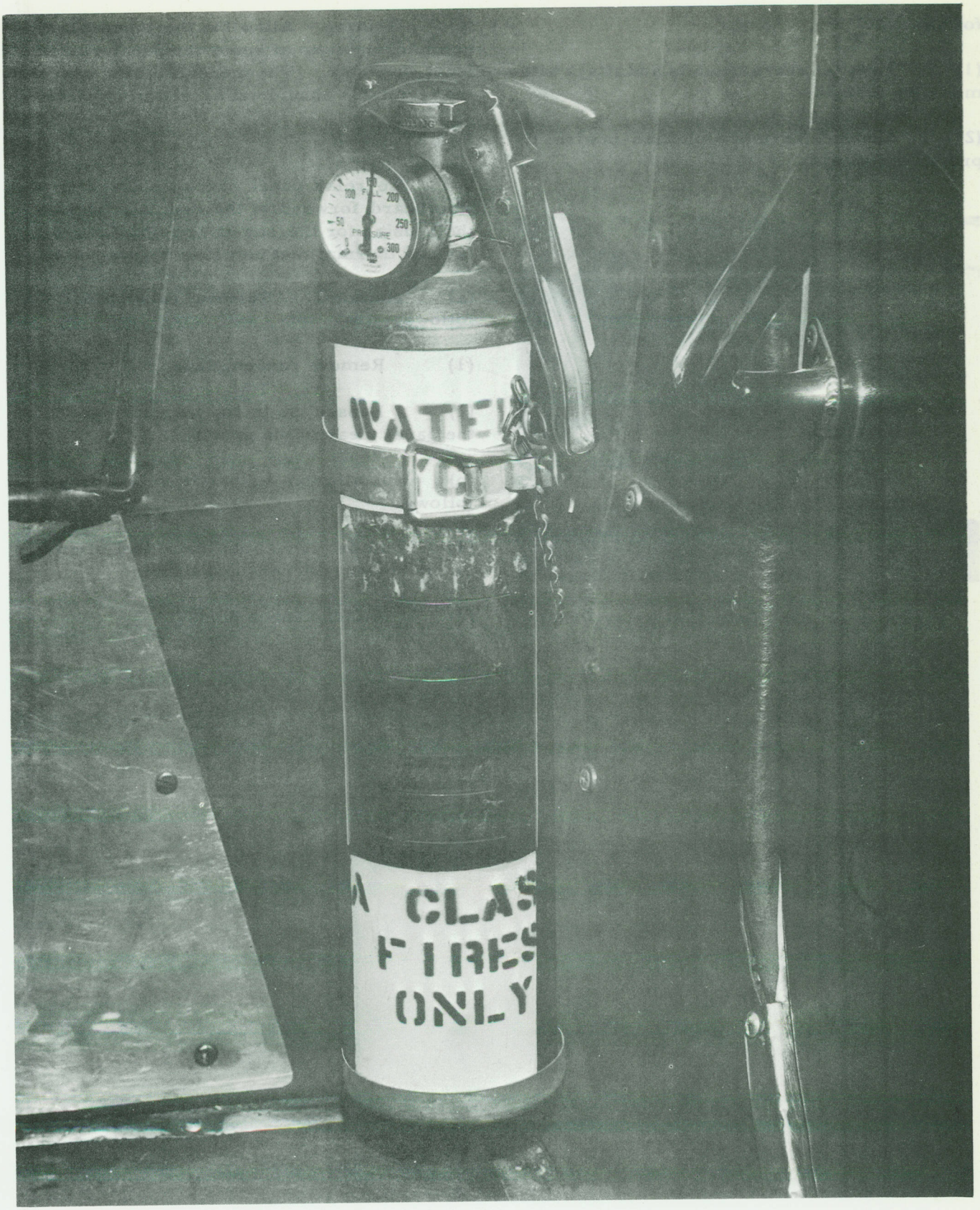


Figure 4-13A

follows:

(1) Position thermocouple and attach with mounting screws.

(2) Connect thermocouple lead-in wires to proper terminals.

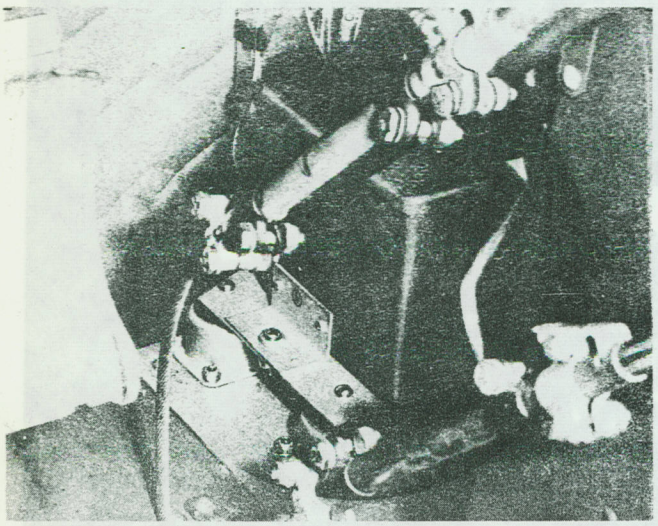


Figure 4-14 Fire Detection Relay Panel

(c) Testing - Allow the thermocouple detector to stabilize at room temperature for at least one hour. The measured resistance of the terminals should not exceed 0.09 ohms.

RELAY PANEL

7 The relay panel shock mounted on the floorboard forward of the control pedestal is the housing for the sensitive relay, slave relay and thermal test unit (see Figure 4-14).

(a) Removal - Remove relay panel as follows:

(1) Remove cannon plugs.

(2) Loosen the thumb fasteners and slide the panel clear of the mount.

(b) Installation - Install relay panel as follows:

(1) Slide panel into rack and align the thumb screw fasteners and tighten.

(2) Attach cannon plugs.

PART 4

SECTION 4

WINDSHIELD WIPER SYSTEM

GENERAL DESCRIPTION

1 The windshield wiper mechanism is installed inside the nose baggage compartment on the overhead between Bulkheads 2 and 3. An electric motor is coupled to a converter by a flexible shaft. The converter changes the rotary motion of the electric motor to an oscillating motion. Extending outboard from the converter are two flexible cables encased in rigid housings. The ends of these cables are attached to the actuating shafts. The actuating shafts are provided with splined ends so the position of the wiper blades in relation to the windshield may be altered. An aligning rod is also provided so the proper position of the wiper blade can be maintained (Figure 4-15). For Trouble Shooting, Windshield Wiper, see Table 4-4.

WINDSHIELD WIPER MOTOR

2 The windshield wiper motor is a two-speed, 24 volt, 1/6 hp motor, controlled from the pilot's compartment.

(a) Removal - Remove windshield wiper motor as follows:

(1) Gain access to the motor through the nose baggage compartment.

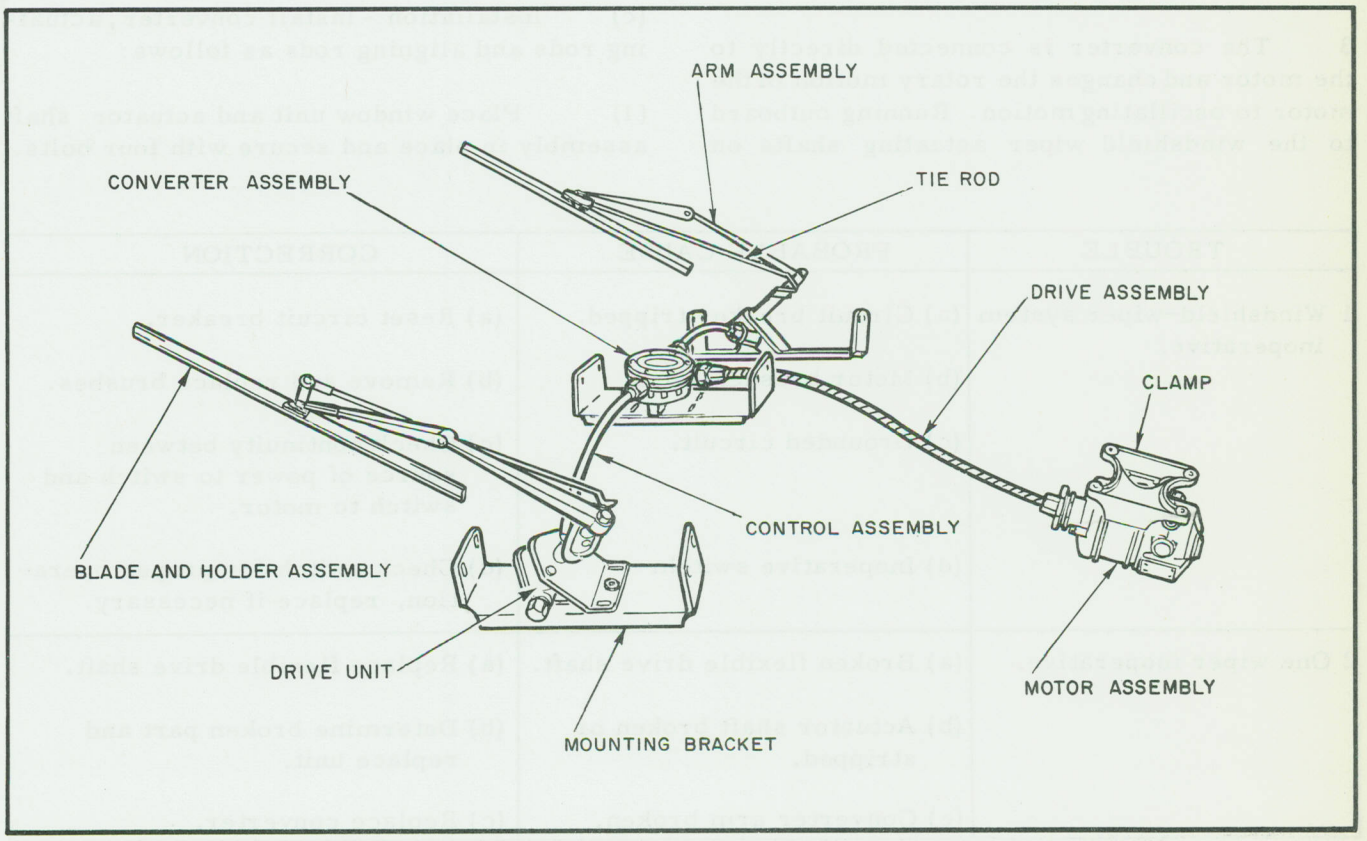


Figure 4-15 Windshield Wiper System

(2) Remove flexible drive to motor.

(3) Remove electrical connections.

(4) Remove four mounting bolts and remove motor.

(b) Servicing - The minimum brush length is 3/8-inch. Brushes should be replaced when worn to this measurement. The commutator should be kept clean.

(c) Installation - Install windshield wiper motor as follows:

(1) Insert motor in proper place and install the four mounting bolts.

(2) Install electrical connections.

(3) Install flexible drive shaft.

(4) Test motor for operation.

CONVERTER, ACTUATING RODS AND ALIGNING RODS

3 The converter is connected directly to the motor and changes the rotary motion of the motor to oscillating motion. Running outboard to the windshield wiper actuating shafts on either side are flexible shafts encased in rigid housings. These shafts in turn attach to the wiper arms and blades. Aligning rods are provided to align the blade to the windshield (Figure 4-15).

(a) Removal - Remove converter, actuating rods and aligning rods as follows:

(1) Remove actuator shafts from converter.

(2) Remove two bolts attaching converter to bracket and pull away unit.

(3) Remove nut from blade arm and remove arm and windshield wiper.

(4) Remove four bolts from window unit and pull away.

(b) Servicing - Replace the windshield wiper blades by removing safety wire and pulling clevis pin. Converter repairs are limited to replacement of the unit.

(c) Installation - Install converter, actuating rods and aligning rods as follows:

(1) Place window unit and actuator shaft assembly in place and secure with four bolts.

TROUBLE	PROBABLE CAUSE	CORRECTION
1 Windshield-wiper system inoperative.	(a) Circuit breaker tripped.	(a) Reset circuit breaker.
	(b) Motor brushes worn.	(b) Remove and replace brushes.
	(c) Grounded circuit.	(c) Check continuity between source of power to switch and switch to motor.
	(d) Inoperative switch.	(d) Check switch for proper operation, replace if necessary.
2 One wiper inoperative.	(a) Broken flexible drive shaft.	(a) Replace flexible drive shaft.
	(b) Actuator shaft broken or stripped.	(b) Determine broken part and replace unit.
	(c) Converter arm broken.	(c) Replace converter.

Table 4-4 Trouble Shooting, Windshield Wiper System

(2) Attach wiper arm and blade assembly.

(3) Install converter and attach actuator arms in converter.

(4) Attach converter to bracket and safety attaching bolts.

CAUTION

Do not operate wiper units when blades are installed unless a stream of water is played over the glass. Never operate the wiper system on dry glass; to do so will strip the flexible shaft.

(5) Test assembly for operation.

(d) Adjustments - In the event that one or both of the wiper blades strike the sides of the windshield, adjustment at the actuating shaft is necessary. Remove the nut holding the wiper arm to the actuator shaft. Slip the wiper arm off the actuator shaft and move one or more serrations away from the point where it was striking. Remove the cotter pin from the clevis pin of the aligning rod and lengthen or shorten the aligning rod to bring the blade in a position parallel to the inboard windshield frame. Reinstall the aligning rod and safety with a cotter pin. Test the wiper assembly. Repeat the above operation if necessary until the blade clears both the side windshield frames. Check operation at both high and low speeds.

WINDSCREEN FROST SHIELDS

4 To supplement the existing windscreen defrosting system, frost shields are available to units in areas where sub-zero winter temperatures are prevalent.

(a) Installation - The frost shields are to be installed as follows:

(1) Shields and windscreen must be dry and warm. Installation is not to be carried out in a hangar where the air is damp from washing aircraft or other similar operations.

(2) Thoroughly clean windscreen and windows with a good quality cleaner. Polish glass surface with a soft dry cloth, ensuring area cleaned is left perfectly dry.

(3) Remove the tape from the frost shield gasket. Install shield at desired position, at the same time exerting a slight pressure around the entire rubber gasket surface to ensure contact at all points. Support in this position for a few seconds to obtain a proper seal.

(4) An application of clear cellulose enamel, or lacquer, along the outer edges after installation is an added preventative against fogging or seepage of condensation under the gasket.

PART 5
POWER PLANT AND RELATED SYSTEMS

SECTION 1
POWER PLANT

GENERAL INFORMATION

DESCRIPTION

1 The power plants used on the Expeditor 3 series aircraft are conventional radial engines; however, there are systems and structures related to the power plant which are required to adapt it for these aircraft. Subjects covered in this part are: removal, repair, installation and adjustment of engine, engine cowlings, cowl flaps and controls, propeller and controls, and engine attaching parts. Detailed instructions beyond ordinary maintenance and repair of the engines and accessories are not included. Reference should be made to specific manuals for such information.

(a) Propeller - The propellers are full feathering Hamilton Standard Hydromatic Model 22D30-201. The blade design number is 6533A-21S. The propeller diameter is 99 inches and the blade angle at the 42-inch station is from 12 degrees in the fine pitch position to 84 degrees in the full-feathered position. Both the inverted cam and the standard cam are in use in 22D30 domes. The inverted cam will be found in all 200 series propellers, the standard cam in all others. With the inverted cam, the centrifugal twisting moment of the blade, and the engine oil pressure, directed to the inboard side of the propeller piston, decreases the blade angle. Oil under governor pump pressure directed to the outboard side of the piston increases the blade angle. With the standard cam the centrifugal twisting moment of the blade, and engine oil pressure, directed to the outboard side of the propeller piston, decreases the blade angle. Oil under governor pump pressure directed to the inboard side of the piston increases the blade angle. Feathering pumps located in each engine nacelle provide oil under pressure for feathering and unfeathering. The governor setting is controlled by the pilot to maintain the desired rpm.

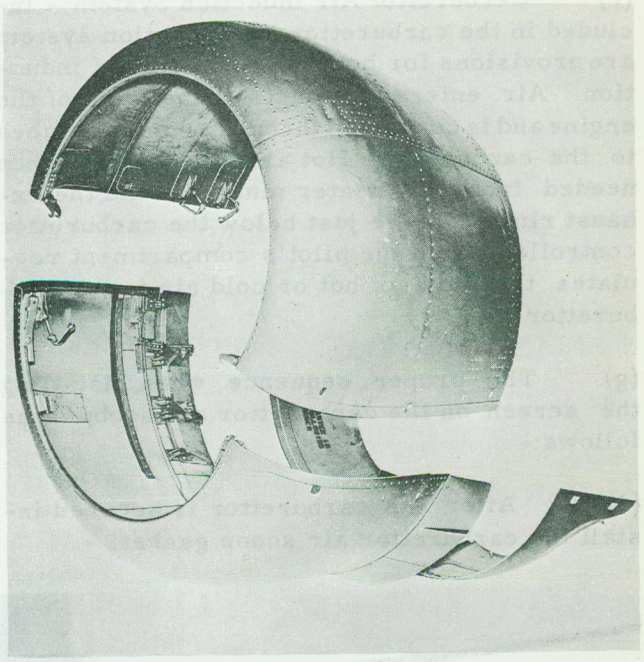


Figure 5-1 Engine Cowl

(b) Engine Cowling - The engine ring cowling is constructed in two sections connected by adjustable strap cowling fasteners. The upper section of the cowling extends to the firewall, covering the engine accessory compartment. The lower section covers only the engine and is fitted with flaps for engine temperature control (Figure 5-1).

(c) Engine Cowl Flaps - Three separate, overlapping cowl flaps are fitted to the trailing edges of the lower section of the ring cowl on each side of the engine. They are hinged at the forward edge and interconnected so they operate as a unit (Figure 5-1). The pilot can close or open the cowl flaps to control the engine temperature with the cowl flap controls on the side of the control pedestal.

(d) Exhaust Collector Ring - The exhaust collector ring on each engine is composed of

five segments of corrosion-resistant welded steel tubing. On the outboard side of each ring is a Y-section through which exhaust gases pass into the tail pipe (Figure 5-9).

(e) Carburettor - The carburettors used on Expeditor 3 series aircraft are the Stromberg Model NAR9B-19.

(f) Carburettor Air Induction System - Included in the carburettor air induction system are provisions for both hot and cold air induction. Air enters the ducts at the front of the engine and is conducted through aluminum tubes to the carburettor. Hot air is furnished when needed from the heater muffs around the exhaust ring. A valve just below the carburettor controlled from the pilot's compartment regulates the flow of hot or cold air to the carburettor.

(g) The proper sequence when installing the screen on the carburettor air scoop is as follows:-

(1) After the carburettor is secured install the carburettor air scoop gasket.

(2) Install the carburettor shield assembly and secure to the inner cowling assembly.

(3) Install the carburettor air scoop screen.

(4) Install gasket between screen and carburettor air scoop body.

NOTE

This gasket separates the lead surface side of the screen from making contact with the carburettor air scoop body.

(5) Install the scoop assembly.

NOTE

The carburettor air scoops are not manufactured to a close tolerance fit. Incorrect alignment will cause distortion, metal fatigue and premature support bracket failure. Insure correct align-

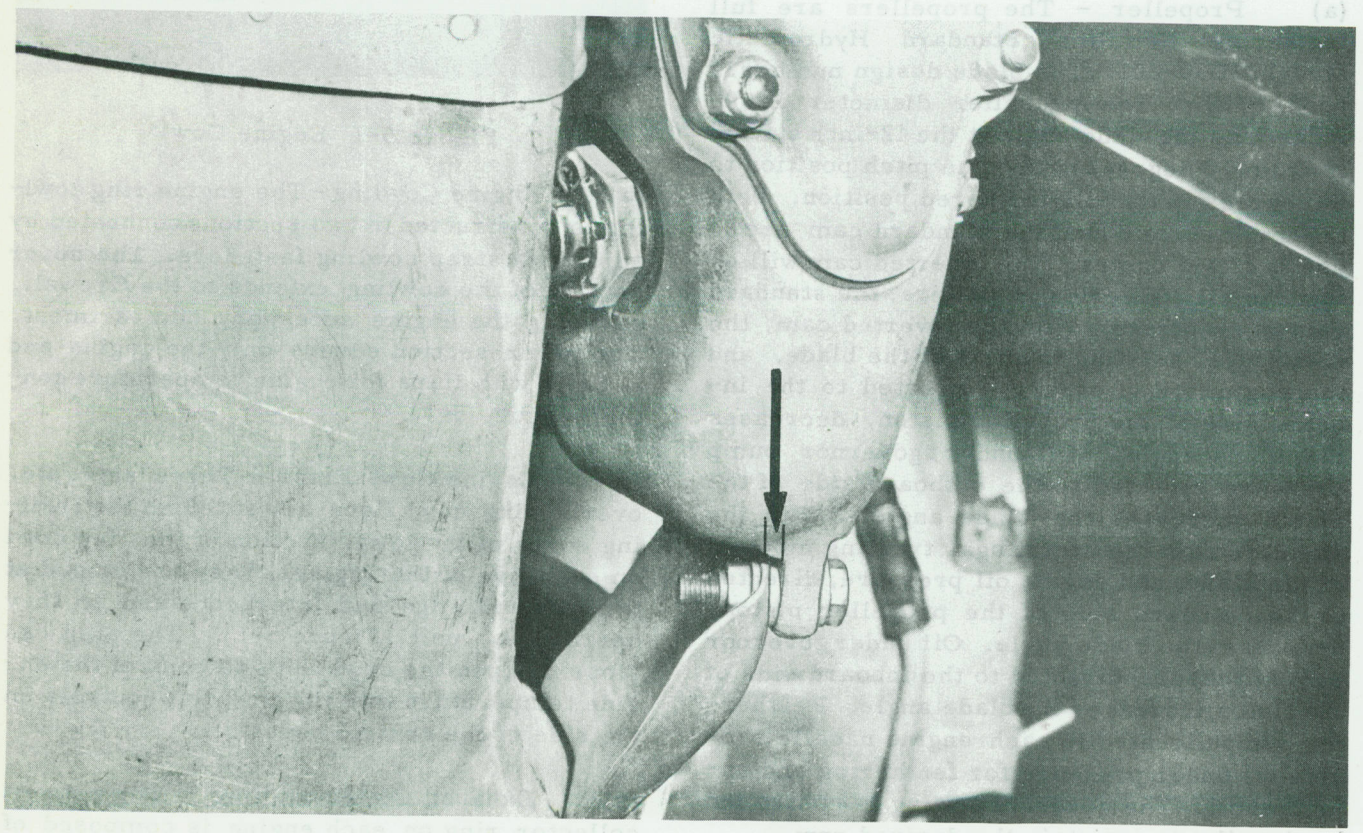


Figure 5-1A Air Scoop Brackets

ment between the cylinder lugs and the carburettor air scoop support brackets Part 414-189095-7 and 414-189095-5 before bolting into position. Rectification if required, may be accomplished by one or more of the following methods.

Rework and file support bracket as required.

Elongate bracket holes.

Insert spacers as required between the cylinder lugs and the support bracket. Refer to Figure 5-1A.

PROPELLER SYSTEM

PROPELLER

2 This paragraph contains instructions for the removal, servicing and installation of the propeller assembly.

(a) Removal - Remove the propeller as follows:

(1) Turn battery master switches "ON" and depress feathering switches to feather propeller.

(2) Remove cotter pin locking the propeller dome nut.

(3) Loosen dome retaining nut and remove the dome. The dome must be moved straight out until it clears the distributor valve assembly.

NOTE

A container should be held in readiness to catch the oil from the hub and dome when the dome is removed.

(4) Remove the propeller retaining nut lockwire.

(5) Remove the distributor valve.

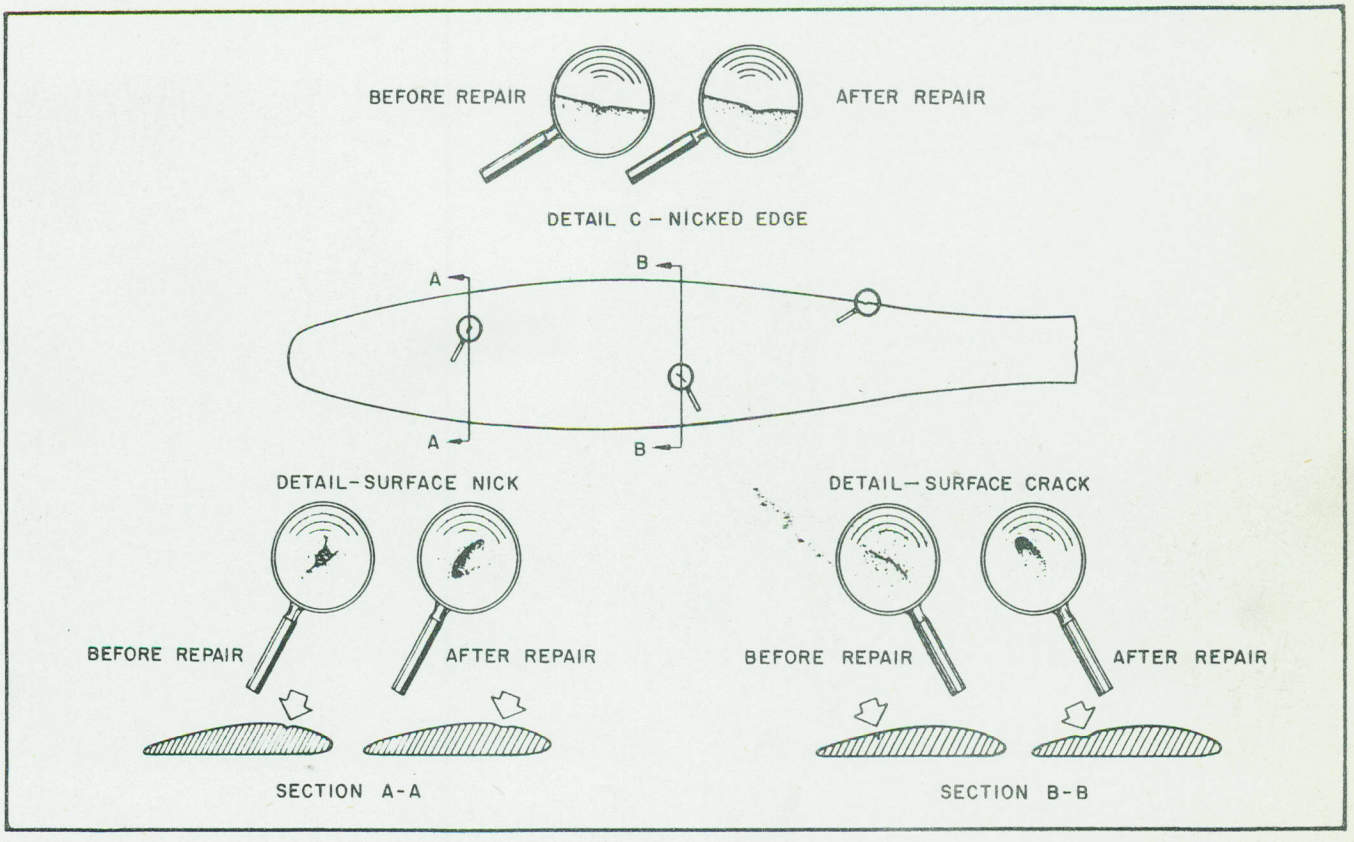


Figure 5-2 Propeller Repair

(6) Loosen the propeller retaining nut and remove the propeller.

(b) Servicing - Leakage ordinarily is the result of bad seals, or improperly mated or improperly torqued sections. Repair of these difficulties will require, in most instances, partial disassembly of the propeller and should be attempted only by authorized personnel. Small nicks or scratches may be removed from propeller blades. A curved "riffle" file is recommended for removing the sharp base of nicks or scratches. Fine emery cloth should be used for polishing and the surface should be etched and examined with a magnifying glass after the defect is removed (Figure 5-2).

WARNING

Only small nicks or scratches should be reworked locally. Other repairs must be made by a designated overhaul unit.

(c) Installation - Install propeller as follows:-

(1) Inspect the propeller shaft, threads and splines for corrosion, nicks, burrs or other damage. Carefully remove minor damage with a fine stone or crocus cloth. Wash parts clean with non-aromatic gasoline and allow to dry thoroughly. Apply light coat of engine oil (Specification 3-GP-100b). (RCAF Ref. No. 34A/17).

(2) Place rear cone against the thrust nut on engine shaft.

CAUTION

Make sure that the propeller is supported properly and installation is carefully made to prevent damage to the threads on the propeller shaft.

(3) Lift the propeller into position and install it on the engine shaft. The blank spline in the propeller must be in line with the wide spline on the engine propeller shaft.

(4) Install the propeller retaining nut on the shaft and tighten, using the installation wrench in conjunction with propeller torquing kit (DMS19550-A1). Refer to EO 15-30-2 for correct torque and EO 15-30AB-2C for complete propeller installation procedure.

(5) Install distributor valve and oil transfer plate gasket in crankshaft. Tighten the distributor valve into the crankshaft using a bar one foot long and torque to 100 to 120 foot-pounds. Align the locking hole in the distributor valve with the locking hole and slot in the crankshaft and propeller retaining nut.

CAUTION

Under no conditions should the valve be backed off even slightly to obtain hole and slot alignment. If this alignment cannot be obtained without exceeding the maximum torque specified, remove the distributor valve and reinstall it using a new gasket or reduce the thickness of the first gasket by lapping it slightly.

(6) Install propeller retaining nut and distributor valve lock ring.

(7) Install propeller dome as outlined in Paragraph 3(b).

DOME

3 Domes may be encountered on 22D30 propellers with either a Toroid O-ring type seal or a chevron-type seal.

(a) Removal - Remove the propeller dome as outlined in Paragraphs 2(a) (1), (2) and (3).

(b) Installation - The installation procedure for domes with either type seal is the same. It is necessary to follow the procedure listed below to ensure the dome is bottoming against the barrel shelf so that the seal will not wrinkle and subject the dome to leakage and possible failure. After the high and low pitch stop rings have been installed, install the dome in the following manner:-

(1) Install the required number of preload shims over the fixed cam locating dowels in the dome assembly.

NOTE

The thickness of shims required is etched on the dome barrel shelf.

(2) Set the dome assembly in the high pitch position.

(3) Place the propeller blades in the same high pitch position by lining up the correct angle stamped on the blade butt with the index line on the inner periphery of the dome-barrel shelf. Be certain that all blades are at the same angle as the dome.

CAUTION

When installing the dome assembly on the hub assembly, it is absolutely essential that the cam gear in the dome meshes properly with the blade gear segments. When the dome assembly and the blade assemblies are set at the same high pitch angle, the mating teeth will mesh properly. Make certain that the high pitch angle set in both the dome and the hub assemblies is identical.

NOTE

The initial installation is made without the dome barrel seal in place to determine the proper position of the retaining nut when fully tightened.

(4) Lift the dome assembly into position and install it so the fixed cam locating dowels fit into their respective holes in the hub assembly. Make certain that the arrow etched on the base of the fixed cam coincides at installation with the arrow stamped on the dome-barrel shelf of the outboard barrel half.

(5) Turn the dome in a counterclockwise direction until the fixed cam locating dowels enter the dowel holes in the dome barrel shelf of the outboard barrel half.

(6) Start the dome retaining nut into the hub assembly by hand, turning the dome retaining nut, and then attach the proper wrench and wrench bar. Tighten the dome retaining nut using a torque sufficient to seat the dome on the barrel shelf (approximately 250 foot-pounds). Do not exceed 750 foot-pounds.

(7) Mark the position of the dome retaining nut with respect to the barrel. Then remove the dome.

NOTE

With the dome assembly properly seated in the barrel, the front face of the dome retaining nut will be approximately flush with the front edge of the outboard barrel half. Tightening of the dome retaining nut, in addition to fastening the dome unit to the hub, serves to apply the preloading force to the gears, and to compress the dome-barrel seal. Failure to tighten the dome unit securely in the hub will result in elongation or failure of the dome shell retaining screws, and oil leakage around the dome retaining nut.

(8) Install the proper dome-barrel oil seal.

(9) Reinstall the dome assembly and apply sufficient torque to the dome retaining nut to bring it at least to the position previously marked, and to obtain alignment of the dome retaining nut cotter pin hole with one of the slots in the outboard barrel half dome retaining nut threads. Once the dome retaining nut has been started into the hub, do not back it out, the dome-barrel seal may catch between the threads when dome retaining nut is re-tightened, after it has been partially backed out.

(10) Cotter key the dome retaining nut to the outboard barrel half dome retaining nut threads.

(11) Check the high pitch blade angle either by the index line on the blades and the graduations on the barrel blade bore (if the propeller has this feature), or by a bubble protractor at the reference station, and then using suitable blade turning levers, shift the propeller blades into the full low position and check the low blade angle. These angles should be the same as the high and low pitch settings of the stop rings, and this check will ensure that the correct relationship between the blade gear segments and the cam gear has been obtained.

(12) Check all external cotter pins.

(13) If, after installing the dome according to the procedure outlined above, leaks are encountered around the dome, proceed as follows:-

a. Remove the dome.

b. Install a shim or shims as required to the outboard side of the seal to stop leakage.

c. Re-install the dome and recheck for leakage.

CAUTION

It is recommended that the sump plug and screen be removed and the engine oil caught in a container when feathering or unfeathering the propellers on the ground; engines not running.

PROPELLER GOVERNOR

4 The governor controls propeller pitch by regulating the flow of oil to the outboard side of the propeller piston to increase pitch, engine oil directed to the inboard side of the propeller piston plus centrifugal twisting moment of the rotating blades control decrease pitch.

(a) Removal - Remove propeller governor as follows:

(1) Mark position of the control cable pulley at the governor and remove pulley and cable from the governor.

(2) Disconnect oil lines at the governor.

(3) Remove nuts from the mounting studs holding the governor to the engine accessory case.

(4) Remove governor unit from engine.

(b) Installation - Install propeller governor as follows:

(1) Safety wire the plugs fitted in the unused outlets of the governor base.

(2) Put gasket and governor in place.

(3) Install mounting bolts and nuts.

(4) Connect oil lines to the governor.

(5) Install control cable and pulley on the governor in position determined by marks put on control cable pulley when removed (paragraph 4(a)(1)).

(c) Adjustment of Propeller Governor - The aircraft must be flight tested to see if constant speed is attained on both engines at 2300 rpm. If the engine speed is too high, turn the adjusting screw on the propeller governor clockwise to decrease the rpm. Each complete turn will change the speed approximately 25 rpm. Adjust the governor stop screw until a constant speed of 2300 rpm is attained. Safety the screw (Figure 5-3).

FEATHERING PUMP

5 An electric feathering pump is provided in each nacelle to furnish oil under pressure for propeller feathering. A line, branching from the main engine oil supply, passes to the feathering pump which in turn feeds high pressure oil to the distributing adaptor. The pressure actuates a valve that closes the oil line from the governor. At the same time this allows high pressure oil to pass through the propeller. The pressure acts on the governor oil side of the pitch varying piston and changes the pitch through 'fully course' to the 'feathered' position. As soon as the oil pressure has completed this selection, it actuates a differential cut-out switch fitted to the distributing valve, and the feathering motor is automatically shut off. When the feathering button is

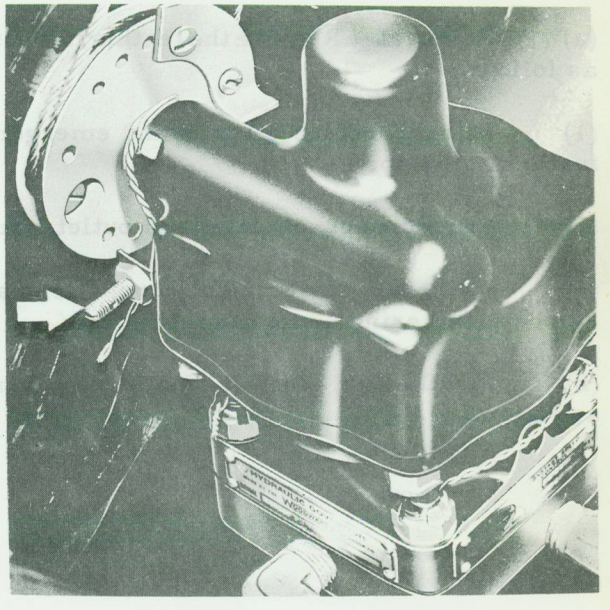


Figure 5-3 Propeller Governor Adjustment

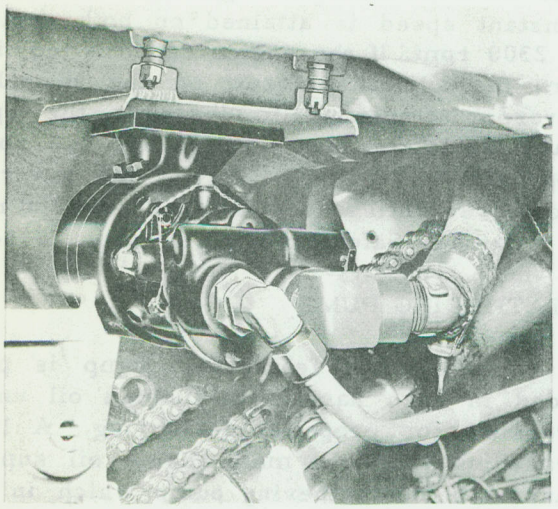


Figure 5-4 Propeller Feathering Pump

selected for a second time, the feathering action is repeated. The propeller dome sleeve moves backwards and directs the high pressure oil to the engine oil side of the piston, thereby unfeathering the blades. The feathering motor is cut out by releasing the feathering button when the blades reach the "coarse" pitch position and the governor takes over control through the "coarse-fine" range. (Figure 5-4).

(a) Removal - Remove the feathering pump as follows:-

(1) Drain engine oil tank and emergency feathering pump.

(2) Disconnect oil inlet and outlet lines.

(3) Disconnect electrical connections and remove feathering pump from brackets.

(b) Installation - Install feathering pump as follows:-

NOTE

Remove all paint and corrosion from the mounting lugs to ensure good electrical contact.

(1) Install feathering pump on brackets.

NOTE

Ensure new pumps are assembled for LH or RH installations as required. To change the assembly from RH to LH or vice versa; remove pump from motor rotate 180° and re-assemble using a new gasket AN4045. Relocate drain plug to lowest point in the unit.

(2) Connect the oil inlet and outlet lines to the pump.

(3) Connect electrical leads to the pump.

(4) Fill the engine oil tank to the full mark on the oil dip stick.

ENGINE COWLING

RING COWL

6 This paragraph contains instructions for the removal, servicing, installation and adjustment of the engine ring cowl.

(a) Removal - Remove ring cowl as follows:-

(1) Disconnect cowl flap controls at the actuating horn.

(2) Remove wrapper sheets.

(3) Release Dzus fasteners connecting the front edges of the upper and lower ring cowlings and disconnect bonding wires.

(4) Release strap fastener on each side of the cowling.

(5) Drop lower section of cowling until it clears the engine.

(6) Loosen clamps on heating system air scoop hose at the intensifier tube inlet. Remove hose from intensifier tube inlet. Retain clamps. Lift upper section of cowling clear of engine.

CAUTION

When lifting the upper section, care must be exercised to prevent damage to the propeller blades.

(b) Servicing - If small cracks develop in the ring cowling, they may be stop-drilled with a No. 40 (.093") drill. Drill a hole at each end of the crack. The phenolic liners in the cowling lug receptacles should be inspected. If wear is evident, replace them. To prevent deterioration of the rubber inner cowl seals, due to excessive heat from the upper portion of the exhaust collector ring, attach a strip of asbestos tape, of suitable width and length, to adequately cover the area of possible deterioration, with heavy duty staples of bifurcated rivets.

(c) Installation - The engine cowling should be fitted so that installation is possible with out the use of special tools. Install the cowling as follows:

(1) Install upper section of the cowling and center it on the supporting lugs.

(2) Install the wrapper sheets.

(3) Install the lower section of the cowlings and secure the strap fasteners on each side.

(4) Secure the Dzus fasteners on the front edges of the upper and lower ring cowling and connect bonding wires.

(5) Connect the cowl flap control to actuating horn.

(6) Place retained clamp on end of heating system air scoop hose. Slip end of hose on intensifier tube inlet and tighten clamp.

(d) Adjustment - Adjust the engine cowling as follows:

(1) The mating surfaces of the front cowl fastener assemblies should be filed, as required, to permit the fastener lever arm to be operated by hand to the locked position. Filing is necessary only where the mating surfaces contact so tightly that it is impossible to move the fastener lever arm, to the locked position, by hand with a moderate amount of effort.

(2) The turnbuckles on the S-36 cowl fastener assemblies should be adjusted to a maximum tightness; sufficient to cause the extrusion channel formers, along the mating surfaces of the upper cowl half, to rest against the extrusion channel formers, along the mating surface of the lower cowl half. Further tightening will only throw excessive strain on the cowl fasteners and the cowling skin in the area of the cowl fastener attaching points.

(3) The turnbuckles on the cowl fasteners, which attach the wrapper sheets, should be adjusted to a maximum tightness; sufficient to cause the extrusion channel reinforcements, on the upper ends of the wrapper sheets, to rest against the extrusion channel formers, on the upper half of the cowling. This adjustment should be made with the wrapper sheet support assemblies, on the former ring, positioned so that they do not contact the wrapper sheet. After making this adjustment, the wrapper sheet support assemblies should be adjusted so that they exert moderate pressure on the wrapper sheet and cause the trailing edge of the cowling to rest firmly upon the former ring. They should not be tightened to such an extent as to deform the wrapper sheet, or throw excessive strain on the cowling.

WRAPPER SHEETS

7 The engine wrapper sheets are in two sections fastened with Dzus and strap fasteners. They cover the lower section of the accessary compartment.

(a) Removal - Remove wrapper sheets as follows:

(1) Release the strap fasteners connecting wrapper sheets to the upper section of the ring cowling.

(2) Release the strap fasteners connecting wrapper sheets.

(3) Release Dzus fasteners at the lower ends of both sections of the wrapper sheets.

(4) Wrapper sheets will drop free of engine.

(b) Servicing - If small cracks develop in the wrapper sheets, they may be stop-drilled with a No. 40 (.098") drill. Drill a hole at each end of the crack.

(c) Installation - Install wrapper sheets as follows:

(1) Place the wrapper sheets on the engine and secure the Dzus fasteners.

NOTE

The wrapper-sheet fasteners are numbered on the inside to indicate the order in which they should be fastened. This sequence should be used when installing wrapper sheets.

(2) Secure the strap fasteners connecting wrapper sheets to the upper section of the ring cowling.

(d) Adjustments - Adjustment of the wrapper sheets may be made by changing length of the turnbuckles on the strap fasteners. Strap fasteners are located on the aft section of the

upper ring cowling. Padded brackets on the former ring are also adjustable to give added support to the wrapper sheets.

ENGINE COWL FLAPS

8 This paragraph contains instructions for the removal, servicing, installation and adjustment of the engine cowl flaps.

(a) Removal - Remove cowl flaps as follows:

(1) Disconnect actuating rod from arm on cowl flaps.

(2) Remove lower section of engine cowling.

(3) Remove cowl flap hinge bolts and bushings.

(4) Remove cowl flaps from lower engine cowling.

(b) Servicing - If the cowl flaps show excessive wear at the hinge point, new bushings should be installed. Replace leather caps at the corners of the cowl flaps when they become worn.

(c) Installation - Install cowl flaps as follows:-

(1) Install cowl flaps on lower ring cowling.

(2) Install lower section of ring cowling on aircraft.

(3) Connect actuating rod to centre arm on cowl flaps.

(4) Adjust cowl flaps.

(d) Adjustment - Adjust the cowl flap as follows:-

(1) Adjust the cowl flap control handle in pilot's compartment to have 1/4-inch springback from the closed position. This will assure complete closing and eliminate excessive vibration of the cowl flaps in flight.

(b) When the control in the pilot's compartment is in the closed position, the cowl flaps on each side of the engine should be closed. If adjustment is necessary, it may be made by changing the length of the main actuating rod attached to the centre flap of each unit.

(c) In addition to synchronizing the units on each side of the engine, the individual flaps in each unit must be synchronized with each other. The main control arm is attached to the centre flap of each unit, which in turn, is connected by rods to the other two flaps. The end flaps should be adjusted so they move freely without binding at the joints and yet form a smooth contour when closed.

POWER PLANT

ENGINE

9 The engines used on Expeditor 3 series aircraft are 450 hp Pratt and Whitney Wasp Jr, Model R985-AN-14B. They are nine-cylinder, radial, air-cooled engines with a direct drive from engine to propeller. (Figure 5-7).

(a) Removal - Remove engine as follows:-

(1) Remove the wrapper sheets.

(2) Remove the engine ring cowling.

(3) Drain oil system at Y-drain valve, located on the aft side of the firewall (Figure 5-30). If it is desired to retain oil in the tank during engine change, pull oil shut-off valve control to "CLOSED" position. 3T models are not fitted with an oil shut-off valve.

NOTE

Clean off any oil spilled on tires. Oil will cause deterioration of the rubber.

(4) Remove the propeller and governor and cap the crankshaft (Paragraph 2(a) and 4(a).

(5) Drain fuel from lines and strainer. Drain valve is located on fuel strainer on the forward side of the firewall.

(6) Disconnect all engine piping and hoses

at the firewall, and loosen rear clamp on the oil-outlet hose.

(7) Disconnect all engine electrical wiring at connaon plugs on the firewall.

(8) Disconnect the engine control rods (throttle, carburettor heat and mixture control) at the engine.

(9) Release the spring tension on governor control at the firewall and remove cable from the governor pulley.

(10) Disconnect the cabin heat valve from the intensifier tube at the rear of the exhaust stack and remove the detachable tail-pipe fairing.

(11) Disconnect fire extinguisher line at the forward end of the flexible hose.

CAUTION

To prevent damage to the hose when disconnecting the fire-extinguisher line, hold the fitting on the forward end of flexible hose solidly and unscrew fitting on the end of the CO_2 diffuser tube assembly.

(12) Attach hoist sling to eyes provided on

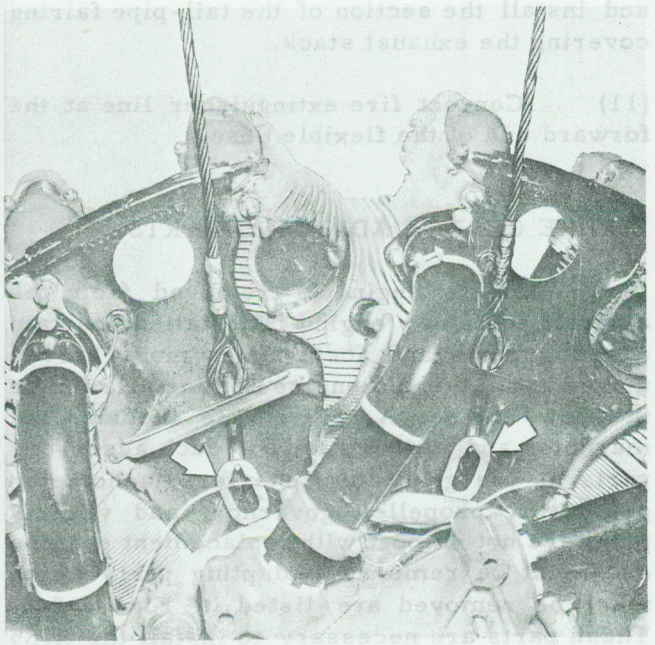


Figure 5-5 Engine Hoisting Eye Bolts

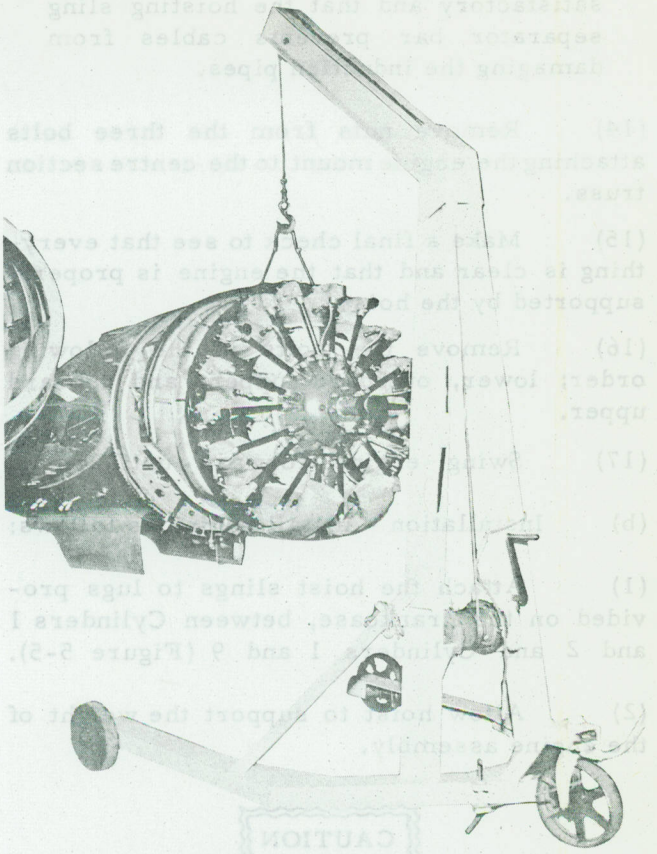


Figure 5-6 Hoisting Engine

engine crankcase. Eyes are located between cylinders 1 and 2 and between cylinders 1 and 9 (Figure 5-5).

WARNING

A suitable hoist capable of supporting the entire engine assembly (approximately 1500 pounds capacity) must be attached to the hoisting eyes before removing engine assembly. Two men are required to remove the assembly: one to remove the bolts and guide the engine, the other to operate the hoist (Figure 5-6).

(13) Allow hoist to support the weight of the assembly.

CAUTION

Check hoisting sling to make certain the

connections to the hoisting lugs are satisfactory and that the hoisting sling separator bar prevents cables from damaging the induction pipes.

(14) Remove nuts from the three bolts attaching the engine mount to the centre section truss.

(15) Make a final check to see that everything is clear and that the engine is properly supported by the hoist.

(16) Remove the bolts in the following order; lower, outboard upper, and inboard upper.

(17) Swing engine forward until clear.

(b) Installation - Install engine as follows:

(1) Attach the hoist slings to lugs provided on the crankcase, between Cylinders 1 and 2 and Cylinders 1 and 9 (Figure 5-5).

(2) Allow hoist to support the weight of the engine assembly.

CAUTION

Check hoisting sling to make certain that the connections to the hoisting lugs are satisfactory and that the separator bar on the sling prevents the cables from damaging the induction pipes. Two men are required to install the engine assembly, one to guide the engine, the other to operate the hoist.

(3) Make a thorough inspection of the engine and firewall. Check to see that all caps are removed from the plumbing and plumbing is free of all foreign matter, that accessories are all on and properly installed, and that all bolts are properly keyed or safetied.

(4) Move engine assembly back to the firewall and install the bolts in the shock mount supports in the following order; upper inboard, upper outboard, and lower.

CAUTION

When bringing the engine back to the firewall, make sure the engine controls are routed in their respective positions and the oil outlet hose is slipped into place on the firewall fitting.

(5) Install nuts, washers and bonding lugs on mounting bolts and safety.

(6) Connect all engine piping and hoses at the firewall.

CAUTION

Ensure that the priming line and the de-icing line are not crossed at the port engine inner cowl and that the priming line and the manifold pressure line are not crossed at the starboard engine firewall.

(7) Connect all engine electrical wiring.

(8) Connect engine control rods (throttle, carburettor air heat and mixture controls).

(9) Re-install propeller governor cable. Adjust the propeller governor (see Paragraphs 4(b) and 4(c), this Section.

(10) Connect cabin heat valve to the intensifier tube at the rear of the exhaust stack and install the section of the tail-pipe fairing covering the exhaust stack.

(11) Connect fire extinguisher line at the forward end of the flexible hose.

ENGINE CHANGE ADAPTING PARTS

10 When an engine is removed from the aircraft and a new engine is installed, certain adapting parts and accessories must be removed from the old engine for installation on the new engine. A new engine includes the magnetos and carburettor but such accessory parts as the generator, starter, tachometer generator, propeller governor, and vacuum pump are not shipped with replacement engines and must be removed. Adapting parts which must be removed are listed in Figure 5-8. These parts are necessary to install the R985 Pratt and Whitney engine on this particular aircraft (Figure 5-8).

EXHAUST COLLECTOR RING

11 The collector ring is connected to the cylinder exhaust ports by short adapters. Stainless steel heater muffs around the collector ring furnish heated air for the carburettor (Figure 5-9).

(a) Removal - Remove exhaust collector ring as follows:

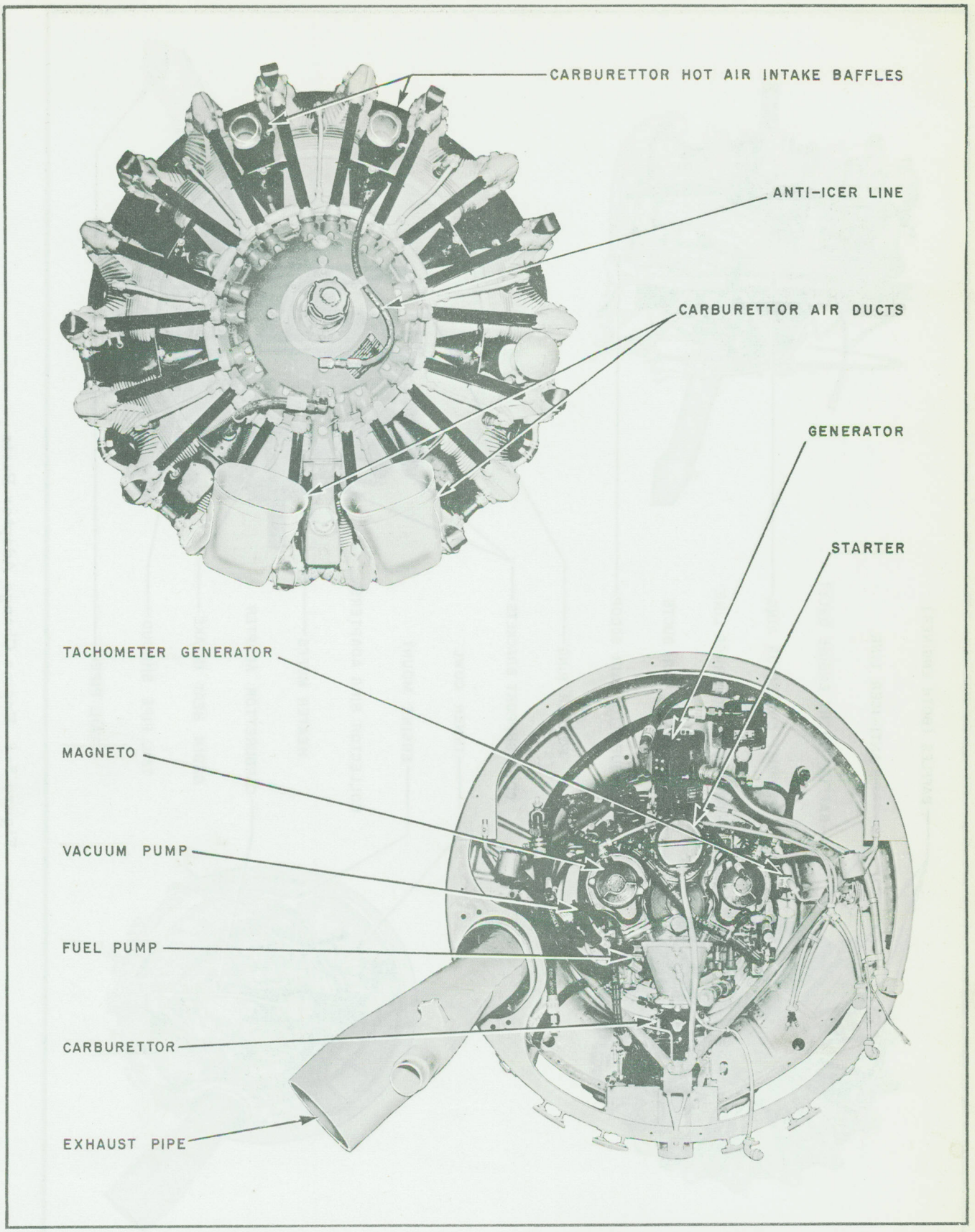


Figure 5-7 Front and Rear View of Power Plant

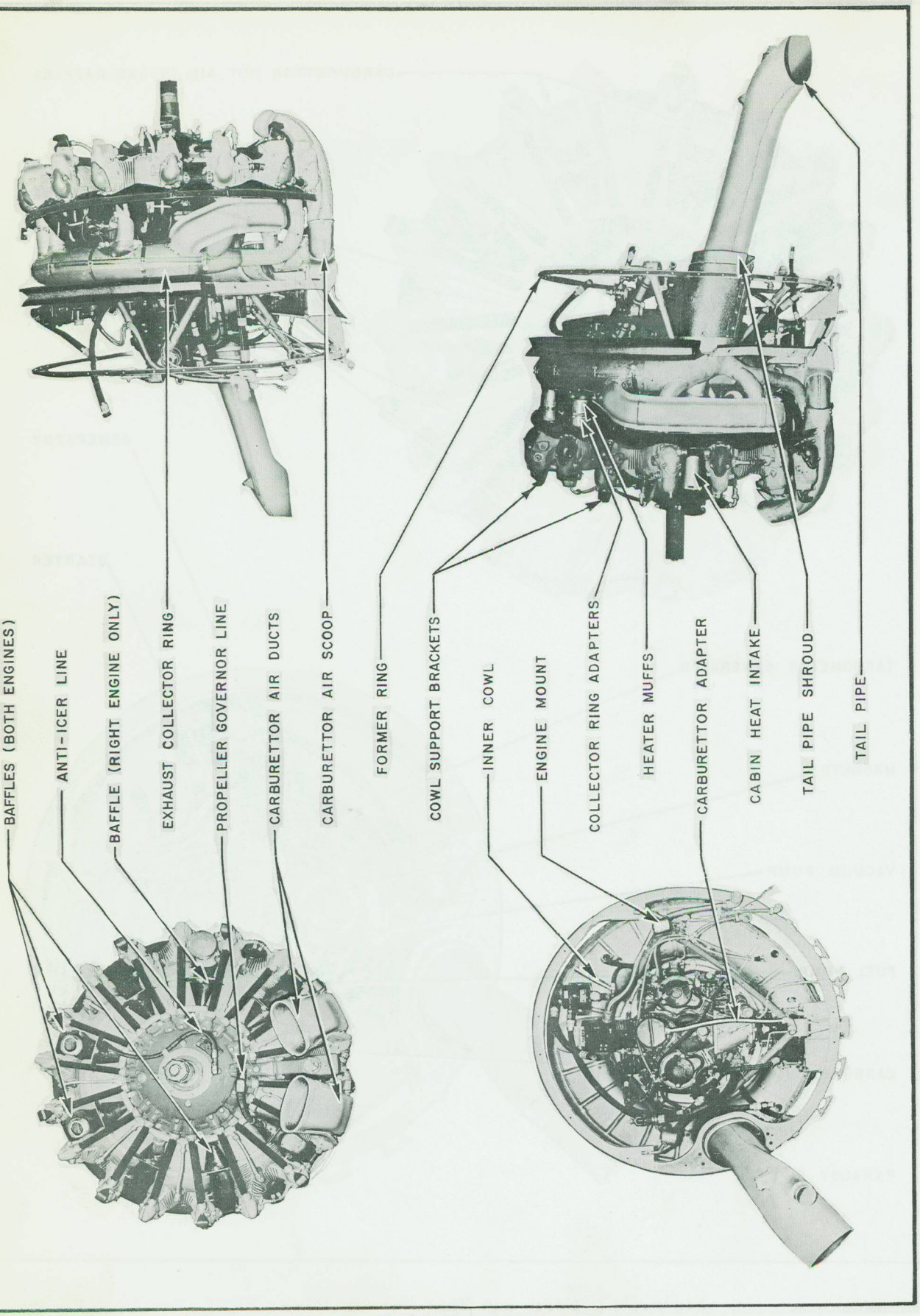


Figure 5-8 Engine Change Adapter Parts

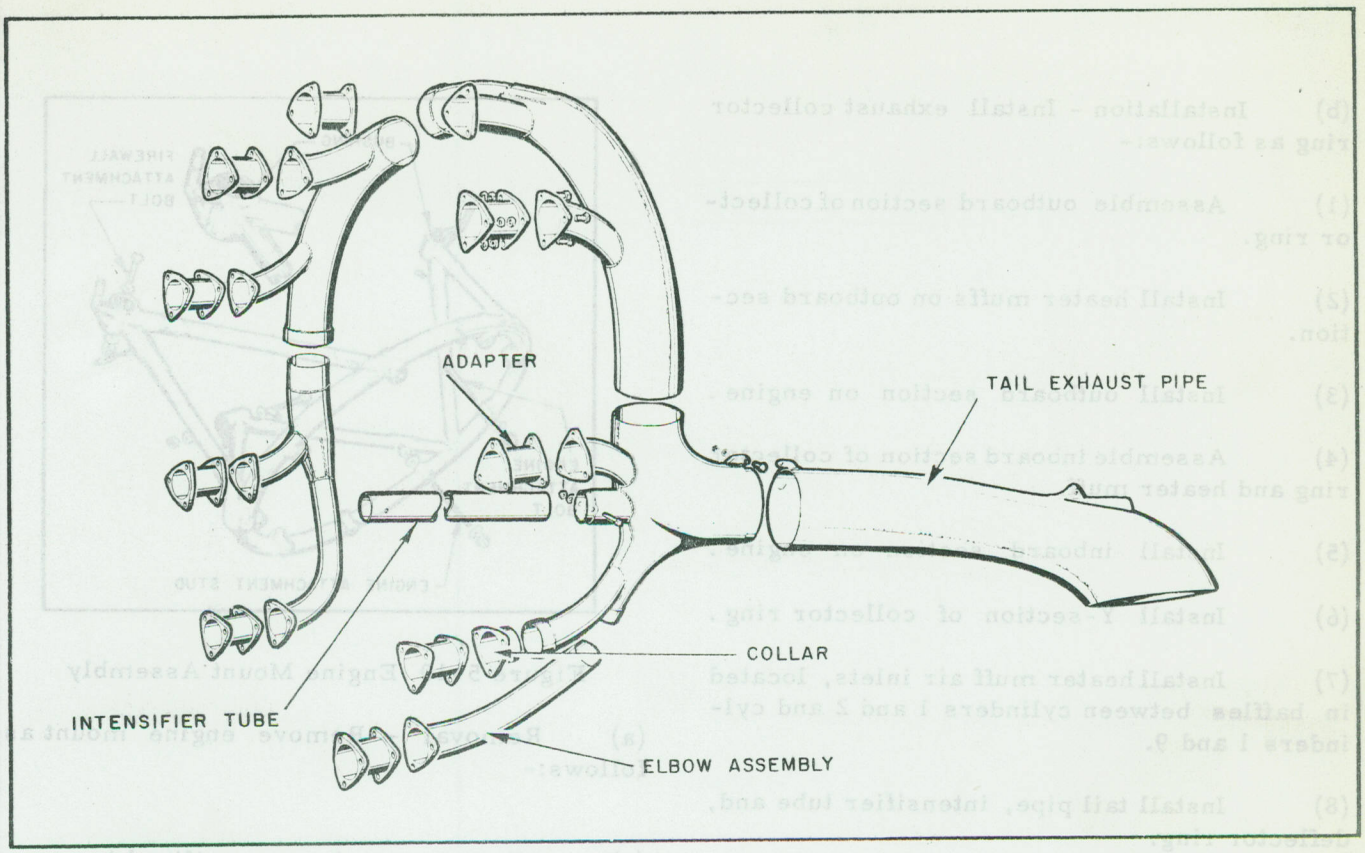


Figure 5-9 Engine Exhaust Collector Ring

(1) Remove engine wrapper sheets and cowlings.

(2) Remove tail pipe fairing.

(3) Remove cabin heat valve.

(4) Remove bolt between collector ring "Y" and tail pipe.

(5) Remove bolt attaching tail pipe to bracket on centre section truss.

(6) Pull tail pipe and intensifier tube aft until they are clear of Y-section.

NOTE

The gas shield installed at the forward end of the intensifier tube, between the fresh air inlet and the Y-section, will fall free when tail pipe and intensifier tube are pulled aft.

(7) Remove Y-section.

(8) Remove fresh air inlets located on engine baffles between cylinders 1 and 2 and cylinders 1 and 9. Remove air ducts to carburettor.

(9) Remove bolts holding inboard section of collector ring to adapters.

(10) Slip inboard section of collector ring away from engine.

(11) Repeat the procedure for the outboard section.

(12) Adapters may be removed after the collector ring sections have been removed.

CAUTION

To prevent seizing, ensure that the bolts securing the collector ring to the adaptors are reworked by extending the thread to the complete lenght of the bolt shank.

(b) Installation - Install exhaust collector ring as follows:-

(1) Assemble outboard section of collector ring.

(2) Install heater muffs on outboard section.

(3) Install outboard section on engine.

(4) Assemble inboard section of collector ring and heater muff.

(5) Install inboard section on engine.

(6) Install Y-section of collector ring.

(7) Install heater muff air inlets, located in baffles between cylinders 1 and 2 and cylinders 1 and 9.

(8) Install tail pipe, intensifier tube and, deflector ring.

(9) Install intensifier tube air intake and gas shield.

(10) Install tail pipe fairing.

(11) Install engine cowling and wrapper sheets.

CAUTION

Ensure alignment of exhaust collector ring segments to adaptors before bolting. Forcing alignment by bolting will result in eventual failure of the adaptors.

ENGINE MOUNT

12 The engine mount is a welded assembly of steel tubing. It is a single rigid structure attached to the centre section truss by three shock mounts (Figure 5-10).

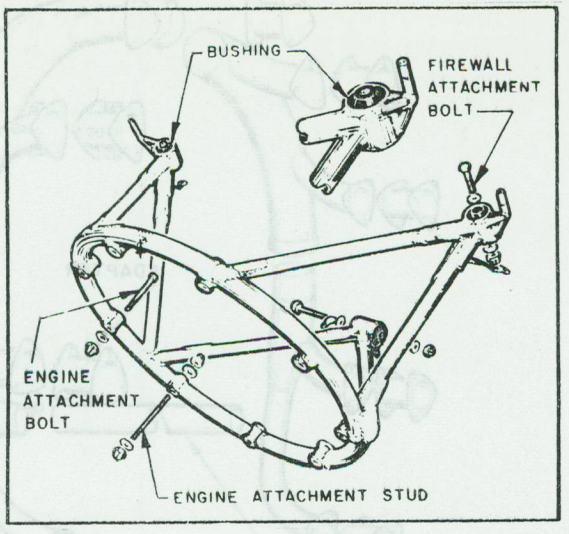


Figure 5-10 Engine Mount Assembly

(a) Removal - Remove engine mount as follows:-

(1) Remove engine as outlined in paragraph 9(a), this section.

(2) Remove two bolts from the lower former ring mounting bracket.

(3) Remove tail pipe.

(4) Remove carburettor cold air ducts.

(5) Remove carburettor hot air inlets.

(6) Remove carburettor air scoop by removing four nuts from studs on the bottom of the carburettor. Carburettor air scoop drain plate must be removed to reach the two front nuts.

(7) Disconnect throttle mixture control and all fuel lines from carburettor.

(8) Remove carburettor.

(9) Remove clamps holding all flex conduits to the engine mount.

(10) Remove generator.

(11) Remove vacuum pump discharge line.

(12) Disconnect and remove oil separator.

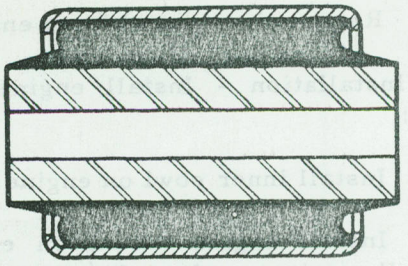
(13) Remove vacuum pump.

(14) Remove tachometer generator.

(15) Disconnect piping and remove propeller governor.

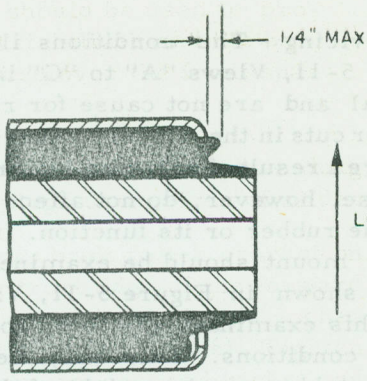
(16) Remove phenolic clamp holding primer and manifold lines to engine mount.

(17) Remove cotter pins and nuts from nine bolts holding engine mount ring to blower sec-



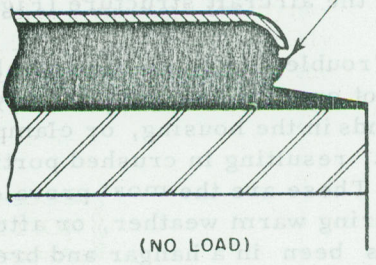
NORMAL MOUNT
(NO LOAD)

A



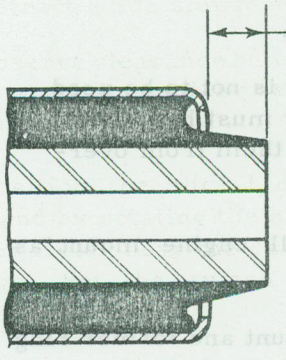
(LOADED)

B

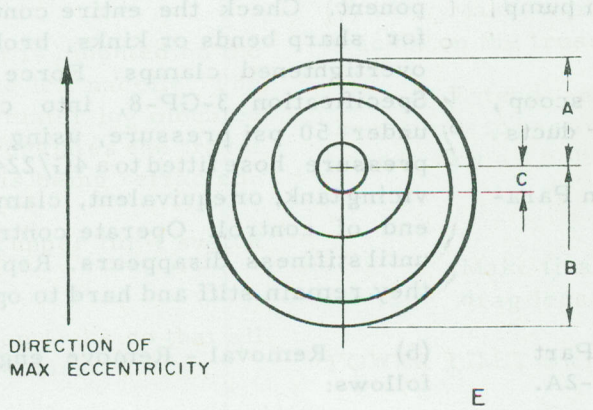


(NO LOAD)

C



D



E

NOTE:
B-A = .090 +.000 MAX
OR C = .045 +.000 MAX.
THESE ARE MAX. LIMITS
BUT IN ACTUAL CASES
THE DIMENSIONS MAY
BE CONSIDERABLY LESS.

Figure 5-11 Engine Mount Support Bushing

tion of engine crankcase. Pull mount aft from engine.

(b) Servicing - The conditions illustrated in Figure 5-11, Views "A" to "C" inclusive, are normal and are not cause for rejection. The nicks or cuts in the rubber, caused by outer shell, are a result of extreme loading conditions. These, however, do not affect the main body of the rubber or its function. In case of doubt, the mount should be examined for the conditions shown in Figure 5-11, Views "D" and "E". This examination is to be done under "no load" conditions. This may be accomplished by taking up the weight of the engine with a crane and making the measurement prescribed. If a mount exceeds any of the above, it must be replaced by a new part. In addition, the allowable separation of the rubber in the mounts shall be 3/32" deep and/or 1" along the circumference. These are maximum limits.

NOTE

Zinc Chromate primer is not to be used on the bushings. They must be masked as required to protect them from overspray during painting.

(c) Installation - Install engine mount as follows:

(1) Install engine mount and former ring on the blower case. Insert nine bolts from the rear and tighten to between 420 and 480 inch pounds torque.

(2) Re-install the generator, tachometer generator, propeller governor, vacuum pump, and associated plumbing and clamps.

(3) Re-install carburettor, air scoop, carburettor hot air inlet and cold air ducts.

(4) Re-install engine as outlined in Paragraph 9(b), this Section.

NOTE

Ensure proper installation. Refer Part 5, Sec. 1, para. (g)(5) page 5-2 and 5-2A.

ENGINE INNER COWL

13 The engine inner cowl seals the engine accessory compartment from the engine.

(a) Removal - Remove engine cowl as follows:

(1) Remove engine and engine mount (paragraphs 9(a) and 12(a), this Section).

(2) Remove inner cowl from engine.

(b) Installation - Install engine cowl as follows:

(1) Install inner cowl on engine.

(2) Install engine mount on engine and re-install engine on aircraft (paragraph 12(c) and 9(b), this Section).

ENGINE CONTROLS

14 The engine controls operate in spiral-wound spring steel conduits. End fittings are swaged on and cannot be removed. The conduit is protected by rubber tubing at points of contact with the aircraft structure (Figure 5-12).

(a) Trouble Shooting - If controls are stiff or do not operate smoothly, it may be due to sharp bends in the housing, or clamps that are too tight, resulting in crushed portions of the housing. These are the most prevalent causes found during warm weather, or after the aircraft has been in a hangar and brought up to room temperature. During cold weather operation, the same cause is congealed lubricant and foreign matter within the housing. Disconnect control at lower end and operate from cockpit to ensure stiffness is in control and not in component. Check the entire control installation for sharp bends or kinks, broken housing, or overtightened clamps. Force cleaner fluid, Specification 3-GP-8, into control housing under 50 psi pressure, using a length of high pressure hose fitted to a 4G/224 hydraulic servicing tank, or equivalent, clamped over lower end of control. Operate control continuously until stiffness disappears. Replace controls if they remain stiff and hard to operate.

(b) Removal - Remove engine controls as follows:

(1) Remove bolt attaching the control to the control lever inside the pedestal.

(2) Loosen control support blocks or

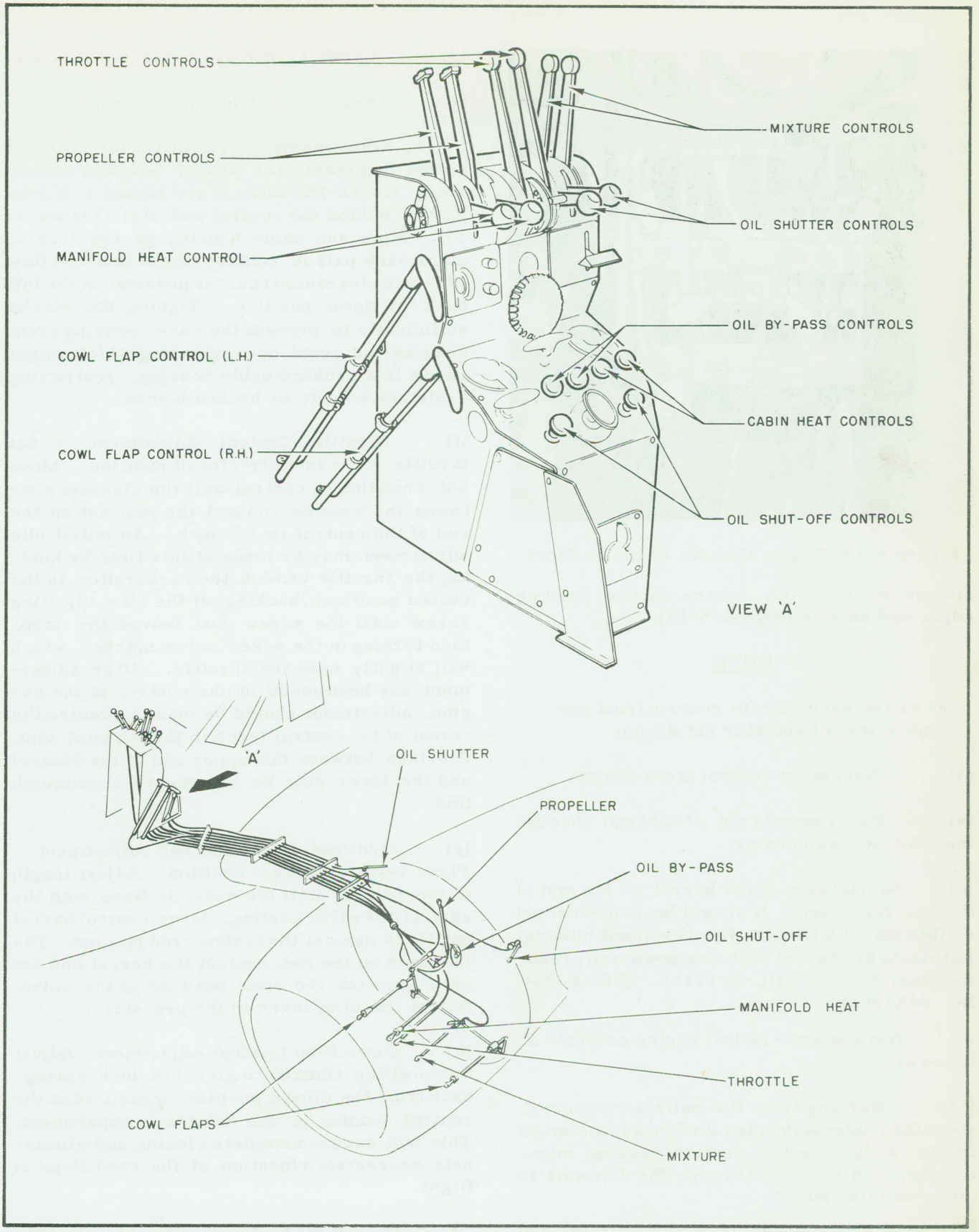


Figure 5-12 Propeller and Engine Controls

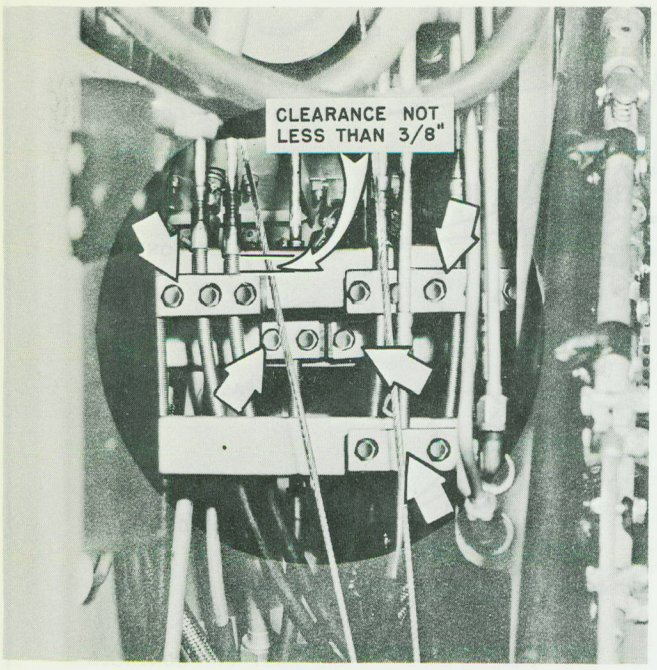


Figure 5-13 Engine Control Phenolic Block

clamps in the belly, centre section leading edge, and nacelle (Figure 5-13).

NOTE

It will be necessary to remove front section of the oil radiator air scoop.

(3) Disconnect control from engine.

(4) Pull controls out of aircraft through the belly access opening.

(c) Servicing - If the barrel on the end of the control is bent, it should be hand-formed so the control will move freely without binding. Lubricate the barrel with dry powdered graphite (Specification MIL-G-6711). (RCAF Ref. No. 34A/208).

(d) Installation - Install engine controls as follows:-

(1) Working from the belly access door, route the controls through the blocks or clamps in the belly, centre section leading edge, nacelle, and forward through the firewall to the connecting points.

(2) Connect controls at the pedestal and safety.

(3) Connect controls at engine and safety.

(4) Replace oil radiator air scoop.

(e) Adjustments - To align the control levers and obtain the proper pedestal clearance, loosen the bolts in the phenolic blocks located behind the control pedestal (Figure 5-13). Move the cable housing as required to align each pair of control levers and to allow 1/4-inch clearance from the pedestal in the full back or down position. Tighten the blocks sufficiently to prevent the cable housing from slipping but avoid overtightening which might result in a crushed cable housing, restricting cable movement, or broken blocks.

(f) Throttle Control Adjustment - Set throttle valve in fully-closed position. Move outer housing of control until the clearance between the housing end and the jam nut on the end of the control is 1/8 inch. An initial idle adjustment may be made at this time by holding the throttle arm on the carburettor in the closed position, backing off the idle adjusting screw until the screw just leaves the stop, then turning in the screw seven notches, which will slightly open the throttle. After adjustment has been made on the control at the engine, adjustment should be made to centre the travel of the control lever in the pedestal slot. Clevises between the upper end of the control and the lever may be adjusted to accomplish this.

(g) Manifold Heat Control Adjustment - Place valve in full hot position. Adjust length of the control until the valve is flush with the edge of the valve casting. Move control barrel until it is against the control-rod jam nut. The jam nuts on the rod, contact the barrel and act as a stop for the open position of the valve. Adjust travel of lever in the pedestal.

(h) Cowl-Flap Control Adjustment - Adjust the cowlflap control to give 1/4-inch springback from the closed position, measured at the control handle in the pilot's compartment. This will assure complete closing and eliminnate excessive vibration of the cowl flaps in flight.

(j) Oil Cooler Shutter Control Adjustment - Adjust shutter control as follows:-

(1) Remove front section of oil radiator air duct.

NOTE

Remove three screws inside air duct in order to remove front section.

(2) Loosen clamp on control cable housing. Clamp is located in the centre section wing and may be reached through air duct hole.

(3) Move control so that butterfly valve in the air duct is against the closed-position stop.

(4) Adjust the cable housing in the clamp so the barrel of the control is approximately 1/4 inch from the jam nut on the plunger.

(5) Temporarily tighten the clamp and move the control lever until the butterfly valve hits the stop in the open position. If full operation of the valve is attained, the clamp may be tightened. If the butterfly does not hit the stop in each position, the housing position must be adjusted.

(6) Tighten cable housing clamp and replace front section of air duct.

(k) Propeller Governor Control Adjustment - Adjust governor control as follows:-

(1) Loosen cable retaining screw on the pulley.

(2) Hold the centre of the control rod end 3 1/4 inches plus or minus 1/16 inch from the firewall and tighten the cable retaining clamp on the drive pulley (the top pulley on the firewall bracket, Figure 5-14).

(3) Adjust the control so it will have 3 1/4 inches plus or minus 1/16 inch travel between the barrel and the rod end.

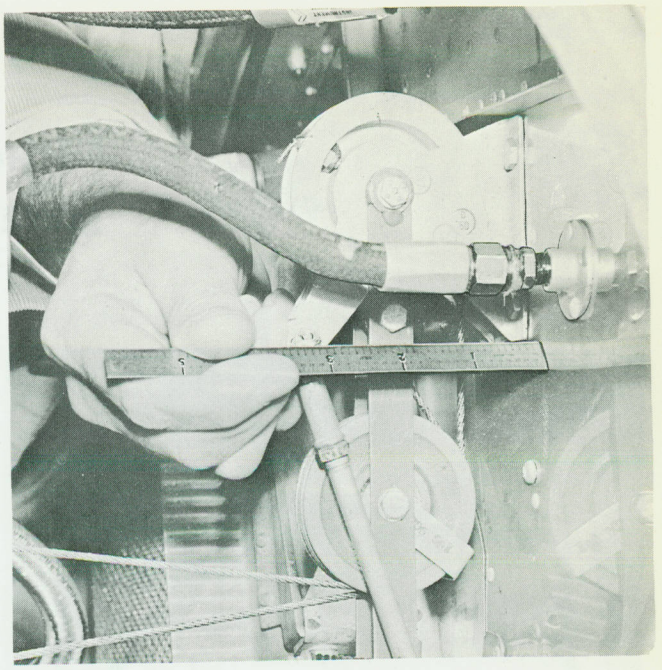


Figure 5-14 Propeller Govenor Control Setting

(4) Holding the control rod end at the extremity of its travel, rotate the pulley on the propeller governor until it strikes the external stop and tighten the cable retaining screw on the propeller-governor pulley.

(5) The aircraft must be flight tested to see if constant speed is attained on both engines at 2300 rpm. If the engine speed is too low, turn the adjusting screw on the propeller governor counterclockwise to increase the rpm (Figure 5-3). Turn the screw clockwise to decrease the rpm. Each complete turn will change the speed approximately 25 rpm. Adjust the governor stop screw until a constant speed of 2300 rpm is obtained. Safety the screw.

(6) The engine reference rpm, should be checked and re-established in accordance with EO 10A-1-1N.

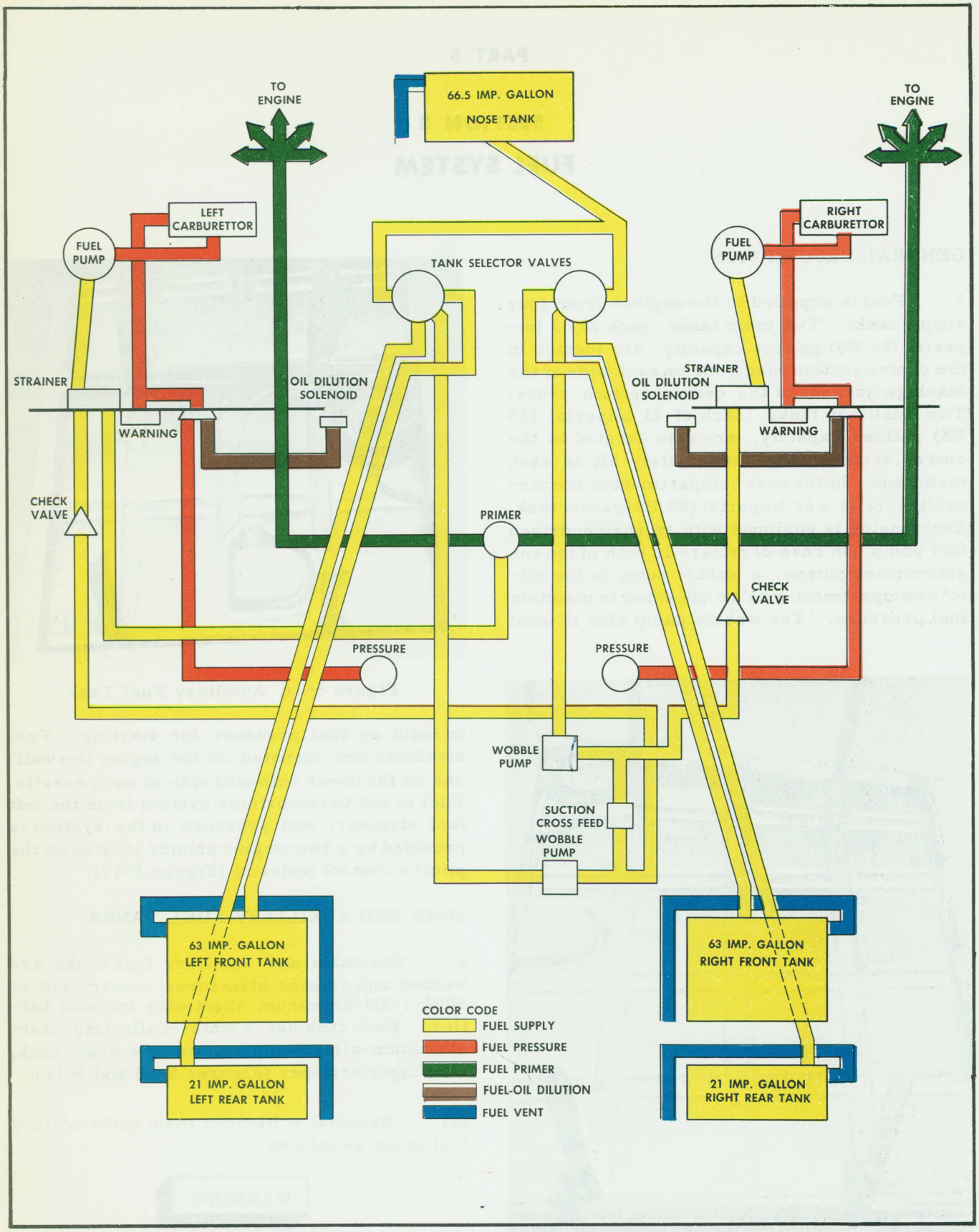


Figure 5-17 Fuel System Schematic

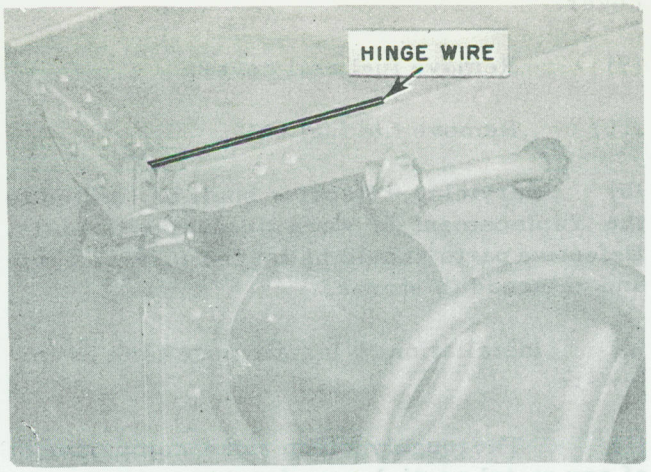


Figure 5-18 Main Tank Cover Hinge Wire

and ignition switches are in "OFF" position. The aircraft should be completely grounded.

(1) Drain fuel from tanks.

(2) Disconnect the fuel line from the tank. The fuel line connection to the auxiliary tank is accessible through the door located in the lower centre section skin, just below the tank. The main tank fuel line is accessible through the battery well.

(3) Remove all screws in the tank cover.

(4) Remove screws holding filler-neck scupper to tank well cover.

(5) Working from inside the nacelle, remove the hinge wire from the hinge on front edge of the main tank cover (Figure 5-18).

(6) Remove vent lines from the tanks.

(7) Disconnect the bonding cable and liquidometer wiring.

(8) Disconnect the tank retaining straps at the turnbuckles and lift the tank from the tank well.

(b) Servicing - Replace defective tank straps and finger strainers. Replace or reglue tank protective strips. If repairs to the tank proper are needed, tag as unserviceable and return to stores.

NOTE

Chromate cartridges, if installed, need not be replaced as they are no longer required.

(c) Installation - Install main and auxiliary fuel tanks as follows:-

(1) Inspect the wooden spacers and felt pads to be sure that they are in good condition and will protect the fuel tank from metal-to-metal contact.

(2) Clean the tank well thoroughly.

(3) Lower the tank into the tank well carefully to avoid damage to the wooden spacers and felt pads.

(4) Tighten tank retaining straps securely making sure the tank is properly seated and the protective felt strips are in place.

(5) Connect the vent line and the fuel line to tank.

(6) Connect the bonding cable to the tank.

(7) Connect the liquidometer wiring to

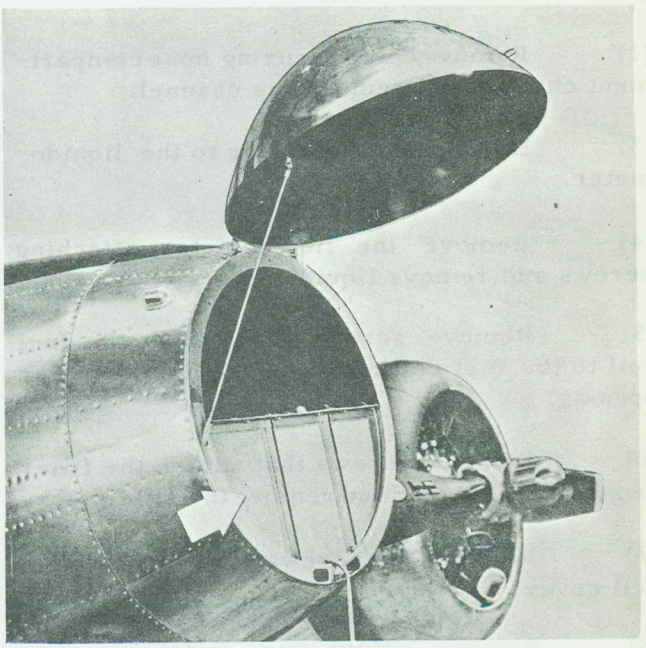


Figure 5-19 Nose Fuel Tank

the liquidometer unit in the fuel tank.

WARNING

The liquidometer unit must be checked for correct calibration.

(8) Install the fuel tank cover.

(9) Dip screw threads in rubber cement before installing. Screws are to be fully tightened, then backed off one quarter turn.

NOSE TANK

3 The nose auxiliary tank is a bladder type cell of rubber incorporating a drain cock and strainer (Figure 5-19).

(a) Removal - Remove nose tank as follows:-

WARNING

Before removing any part of the fuel system, make sure that all master battery and ignition switches are in "OFF" position. The aircraft should be completely grounded.

(1) Drain fuel cell.

(2) Remove bolts securing nose compartment channel and remove the channel.

(3) Disconnect the wiring to the liquidometer.

(4) Remove the liquidometer attaching screws and remove liquidometer.

(5) Remove screws that attach the fuel cell to the fuel cell cover at the liquidometer opening.

(6) Remove screws that attach the filler neck to the fuel cell and remove the filler neck.

(7) Remove the screws securing the fuel cell cover.

(8) Remove safety wire retaining pins that hold the top of the fuel cell to the fuel cell cover.

(9) Remove fuel cell cover.

(10) Remove the fuel cell.

(b) Servicing - Repairs shall be limited to the replacement of worn or damaged parts. Defective parts should be tagged unserviceable and returned to stores.

(c) Installation - Install nose tank as follows:-

(1) Thoroughly clean nose compartment of any metal particles or foreign matter.

(2) Place fuel cell in nose compartment.

(3) Attach safety wire to each of the retaining loops on top of the fuel cell.

(4) Install fuel cell cover. Thread the safety wires on the loops through the proper openings in the fuel cell.

(5) Install the retaining pins in the loops and wrap with safety wire to hold them in position.

(6) Install the fuel cell cover retaining screws.

(7) Install the filler neck and gasket.

(8) Install screws around liquidometer opening.

(9) Install liquidometer and safety wire the screws.

(10) Connect the liquidometer electrical leads.

WARNING

Liquidometer unit must be checked for correct calibration.

(11) Install the nose section channel.

(12) To prevent fuel fumes from entering the nose and pilot's compartment, cover each of the seam joints, screw and rivet heads with

AN-C-121 aircraft fabric applied with EC870 cement.

(d) Adjustment - The only adjustment on the fuel tank is the turnbuckles of the tank retaining straps and the liquidometer unit adjustment (Paragraphs 10(c) through 10(f) for details of liquidometer adjustment).

FUEL LINES

4 Fuel lines are seamless aluminum tubing. The lines are preformed and are supported in phenolite blocks, clamps, and bulkhead fittings to protect the lines from vibration and chafing.

(a) Removal - Remove fuel lines as follows:-

WARNING

All fuel lines and fittings should be capped to eliminate the possibility of any foreign material accumulating in them.

(1) To remove the fuel lines remove the piping supports and clamps and disconnect the lines at the fittings.

(b) Servicing - All fuel lines should be inspected for evidence of damage, especially at the points of contact with piping supports and clamps. If damaged, they must be replaced.

(c) Installation - Install fuel lines as follows:-

(1) Remove the caps from the lines and fittings. Check for cracks and foreign material in the tubing.

(2) Install lines, check for proper positioning in phenolite support blocks, and tighten connections.

(3) Check fuel system for leaks as follows:-

a. Plug fuel line connections at the firewall and the fuel tank vent lines.

b. Using a special plug containing an air valve and an air pressure gauge, plug the tank filler neck openings.

c. Apply approximately two pounds of air pressure to each tank. A leak in the system will be indicated by a drop in pressure on one or both of the gauges attached to the tanks.

d. By use of a soap suds solution leaks may be detected.

FUEL TANK SELECTORS

5 The two fuel selector valves are operated, through connection rods, from the pilot's compartment by handles mounted on the pedestal.

(a) Removal - Remove fuel selector valve as follows:-

(1) Drain fuel system.

(2) Remove belly inspection door.

(3) Disconnect and plug fuel lines from valve.

(4) Remove the two cotter pins at the bottom end of the selector rod.

(5) Remove the four bolts that attach the selector valve and remove valve.

(b) Servicing - Refer to EO 15-15CAB-2.

(c) Installation - Install fuel tank selector valve as follows:-

(1) Place selector valve in position on the aircraft and attach with four bolts.

(2) Secure selector rod to valve with cotter pins.

(3) Connect fuel lines to valve.

(4) Install belly inspection door.

(5) Re-fuel aircraft and carry out flow check.

FUEL SUCTION CROSS FEED SELECTOR

6 The cross feed selector valve is operated from the pilot's compartment. The

selector handle is located under the co-pilot's seat.

(a) Removal - Remove cross feed selector valve as follows:-

(1) Drain fuel system.

(2) Remove pin that connects rod to selector handle, under the co-pilot's seat.

(3) Remove the belly inspection door.

(4) Disconnect and plug fuel lines from valve.

(5) Remove the two bolts that attach the cross feed selector valve and remove valve.

(b) Installation - Install cross feed selector valve as follows:-

(1) Place the valve in position on the aircraft and attach with two bolts.

(2) Connect fuel lines to valve.

(3) Install belly inspection door.

(4) Install pin that connects rod to selector handle, under co-pilot's seat.

(5) Re-fuel aircraft and carry out flow check.

FUEL PUMPS

7 Each engine is equipped with a Type AN-4100-1 fuel pump which has a capacity of 200 gallons per hour. These pumps are located on the left-hand side of the engine accessory case.

(a) Removal - Remove fuel pump as follows:-

(1) Place fuel tank selector valve in "OFF" position.

(2) Drain fuel lines at strainer.

(3) Disconnect fuel lines from pump.

(4) Detach pump and adapter from engine.

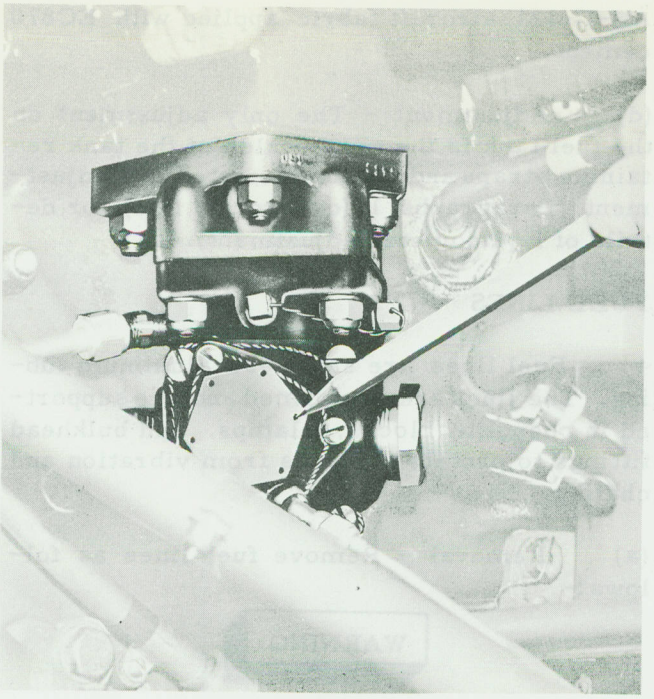


Figure 5-20 Fuel Pump Adjustment

(b) Installation - Install fuel pump as follows:-

(1) Install pump gasket on engine accessory pad.

(2) Locate pump on accessory pad so that intake of pump is in position to be connected to the intake line.

(3) Tighten nuts evenly and safety.

(4) Connect fuel lines to pump.

(c) Adjustments - The pressure relief valve on the fuel pump must be adjusted so the fuel pressure (with the engine turning 1800 rpm) will be 3 1/2 to 4 psi as indicated on the fuel pressure gauge. To adjust the pressure relief valve remove cap over adjusting screw, loosen the lock nut, and turn the adjusting screw clockwise to increase pressure or counterclockwise to decrease the pressure. Replace cap (Figure 5-20).

WOBBLE PUMPS

8 The two wobble pumps (Figure 5-21) are hand-operated emergency and starting fuel

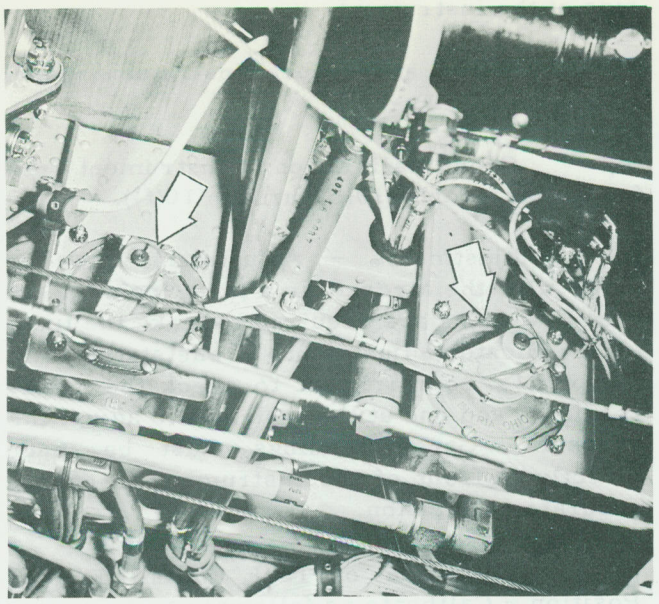


Figure 5-21 Wobble Pump

pumps mounted just beneath the floorboards. They have a combined capacity of 320 gallons per hour at 120 strokes per minute and are equipped with an adjustable relief valve to control the operating pressure. The operating handle for the pumps is located between the pilot's and copilot's seats.

(a) Removal - Remove wobble pump as follows:-

(1) Place tank selector valve in "OFF" position.

(2) Drain fuel lines at strainers.

(3) Disconnect fuel lines at the pump.

(4) Disconnect linkage between handle and pump.

(5) Remove screws mounting pump to floorboard bracket.

(b) Servicing - If fuel is leaking around the packing nut on the actuating shaft, tighten nut. If this fails to stop the leak, new packing must be installed.

(c) Installation - Install wobble pump as follows:-

(1) Mount pump to the floor bracket and safety the mounting screws.

(2) Connect actuating linkage.

(3) Connect the fuel lines.

(d) Adjustment - Adjust wobble pump as follows:-

(1) Place tank selector valve in "ON" position.

(2) Operate wobble pump and build up pressure in the system.

(3) Pressure relief valve should open at a pressure between six and ten pounds as indicated on the fuel pressure gauge.

(4) To adjust valve to the proper pressure remove cap, loosen the lock nut, and turn adjusting screw clockwise to increase pressure or counterclockwise to decrease pressure (Figure 5-22).

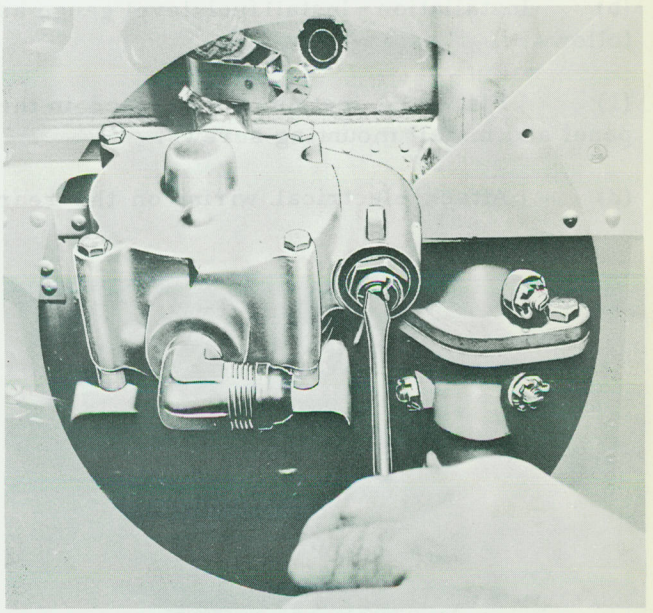


Figure 5-22 Wobble Pump Relief Valve

FUEL-LEVEL INDICATING SYSTEM

9 The fuel-level indicating system is designed to give an accurate inventory of available fuel supply in the aircraft. Each tank is

equipped with a liquidometer unit that registers the fuel level. The six-position selector switch is arranged so that readings may be obtained for the available fuel supply in any one tank, the tank unit registers the amount of fuel in that tank on the fuel-level gauge.

FUEL-LEVEL GAUGE

10 The fuel-level gauge is an electrically operated instrument which is connected to each fuel tank through a selector switch. The fuel-level gauge and selector switch are located on the main floating instrument panel (Figure 5-23).

(a) Removal - Remove fuel-level gauge as follows:-

(1) Fold down instrument panel (Paragraph 2, Part 6).

(2) Disconnect electrical wiring on the rear side of the instrument.

(3) Remove four mounting screws, lift gauge out.

(b) Installation - Install fuel-level gauge as follows:-

(1) Place the instrument in place in the panel and install mounting screws.

(2) Attach electrical wiring on the rear side of the instrument.

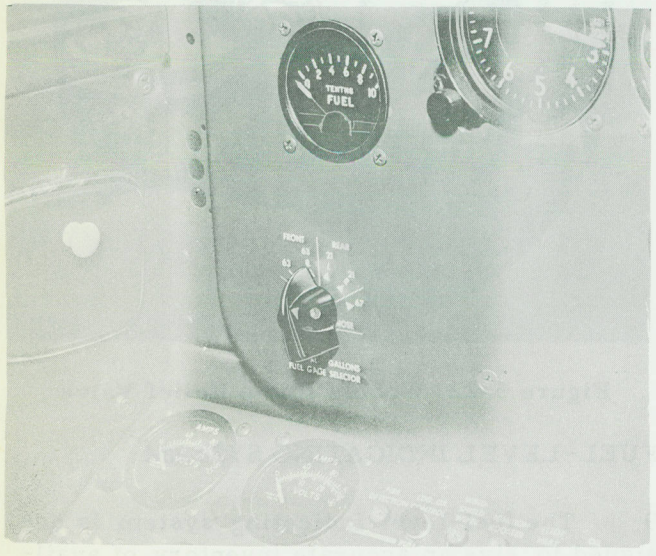


Figure 5-23 Fuel Level Gauge Selector

(3) Raise and secure instrument panel (Paragraph 2, Part 6).

(4) Check calibration of instrument (refer to Paragraphs 10(c) through 10(f)).

(c) Adjustments - Adjustments may be made with the aircraft in a three-point position. Two men are required to make the fuel-level indicator adjustments - one stationed in the pilot's compartment to check the gauge readings, and one at the tank unit to adjust the rheostat. Gauge readings must be made directly in front of the instrument to ensure accurate calibration.

(d) Calibration of Tank Units "Empty" Position - Calibrate as follows:-

(1) Turn selector switch to the desired tank.

(2) Drain tank and let tank unit float rest on the bottom of the tank.

(3) Turn "empty" adjustment, Screw A, on the tank unit rheostat (Figure 5-24) until the indicator in the cockpit reads "O".

(e) "Full" Calibration of the Main and Nose-Tank Units - Calibrate as follows:-

(1) Raise the tank-unit float until it rests lightly against the top of the tank. (The float can be reached through the tank filler neck).

(2) Turn the "full" adjustment, Screw B, (Figure 5-24) until the fuel-level gauge pointer rests above the "10" mark by a distance equal to the width of the mark. The pointer is not set directly on the "10" mark because of the difference encountered in raising the float by hand and the natural rise of the float in the tank.

(f) "Full" Calibration of Auxiliary Tank Units - Calibrate as follows:-

(1) Raise the float until its centreline is 1 1/2 inches from the top of the tank.

(2) Turn the "full" adjustment, Screw B (Figure 5-24) until the gauge pointer rests on

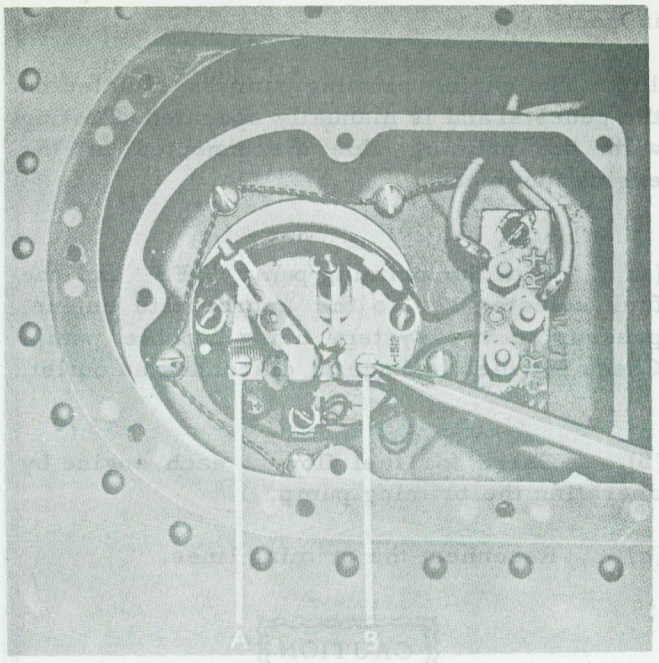


Figure 5-24 Liquidometer Adjustment

the "10" mark.

CAUTION

Test adjustments by placing the floats at the top and bottom positions two or three times and checking with the gauge reading. Never attempt to correct the gauge reading by bending either the sliding contact arm or the arm of the float.

NOTE

In the event that correct reading cannot be made by changine adjusting screws, the sliding contact arm can be rotated.

SELECTOR SWITCH

11 The selector switch is a six-position rotary switch. The switch barrel extends through the panel and is secured to the panel by a lock nut. The switch pointer rotates over a placard which is marked to show the tank positions and their capacities.

(a) Removal - Remove selector switch as follows :-

(1) Fold down instrument panel .(Paragraph 2, Part 6).

(2) Disconnect wiring leads on the rear side of switch.

(3) Back off setscrew securing handle to switch shaft and slip handle from shaft.

(4) Remove lock nut holding switch to instrument panel and pull switch clear of panel.

(b) Servicing - Only repairs that do not require disassembly of the switch should be attempted. Repairs should be limited to replacement of broken leads, repair of loose connections, or replacement of the defective switch.

(c) Installation - Install selector switch as follows :-

(1) Connect wiring leads to the rear side of the switch.

(2) Install switch in instrument panel and tighten the lock nut.

(3) Install switch handle and tighten setscrew.

CAUTION

Make sure that handle pointer and position of switch agree.

(4) Raise and secure instrument panel (Paragraph 2, Part 6).

LIQUIDOMETER TANK UNIT

12 The tank unit consists of a housing mounted to the fuel tank, to which is attached a float pivoting on one arm. Contained in the housing is a resistance strip with provision for adjustment and a movable contact arm connected by leverage to the float arm. A metal bellows attaches the lever to the housing and prevents leakage of fuel.

(a) Removal - Remove liquidometer as follows :-

(1) Remove inspection plate.

(2) Remove cover plate from tank unit and disconnect wiring.

(3) Remove screws holding unit to tank and carefully lift unit from tank.

(b) Installation - Install liquidometer as follows:

(1) Install gasket on tank flange. Apply tank sealing compound, Specification MIL-S-45180 Type 3 (RCAF Ref. 33G-45).

(2) Place tank unit assembly in position, check clearance and freedom of movement of float arm.

(3) Dip threads of mounting screws in the sealing compound, Specification MIL-S-45180 Type 3, and install tank unit on tank. Tighten screws securely and safely.

(4) Connect wiring to unit.

(5) Adjust calibration of unit (paragraphs 10(c) through 10(f).

(6) Install cover on unit and replace inspection plate.

13 The engine priming pump is situated on the pedestal and is manually operated. Testing with the priming line disconnected at the engine inner cowl:

(a) With the priming pump "OFF" and the fuel selector set to the appropriate engine, pressurize the system using wobble pump. Check for fuel leakage at disconnected outlet.

(b) Check for fuel flow at each engine by operating the priming pump.

(c) Reconnect the priming lines.

CAUTION

Ensure that the priming line is not crossed with the de-icing line at the port engine inner cowl.

PART 5

SECTION 3

OIL SYSTEM

GENERAL DESCRIPTION

1 Oil is supplied to each engine from a tank located in the top of each nacelle just aft of the firewall. The oil flows from the engine to an oil cooler and then to the supply tank. Oil returning from the engine may be by-passed around the oil cooler and to the supply tank through a by-pass valve controlled from the pilot's compartment. The oil temperature is regulated by a shutter in the air duct which controls the flow of cooling air through the oil cooler. Oil dilution is accomplished by a solenoid-operated valve mounted on the rear of the firewall, which injects gasoline into the oil inlet line to the engine (Figure 5-26). An oil shut off valve is provided on 3N, 3NM, 3NMT, 3NMT(s) and 3TM models so that the oil flow may be stopped at the firewall in emergencies, or for maintenance purposes.

CAUTION

Before starting engines check to see that oil shut off valve controls are "IN" and saftied using safety wire specification QQ-W-343, RCAF Sec./Ref. 30B/558.

(a) Oil Tank - The oil tank for each engine is located in the top of each nacelle just aft of the firewall. Each tank has a capacity of 6.6 Imperial (8 US) gallons. They are constructed of 5052-1/2H aluminum alloy sheets welded and riveted together. The tank is provided with internal baffles, a hopper, and a standpipe at the outlet fitting, to ensure an adequate supply of oil for propeller feathering. The oil tank filler cap incorporates a pressure relief valve to prevent the tank from bursting due to excessive pressure.

(b) Oil Cooler - The honeycomb type oil cooler is located on the front of the firewall. A duct circulates air through the oil cooler. The flow of air is controlled by a valve in the duct. Position of the valve may be adjusted with a control in the pilot's compartment (Figure 5-25).

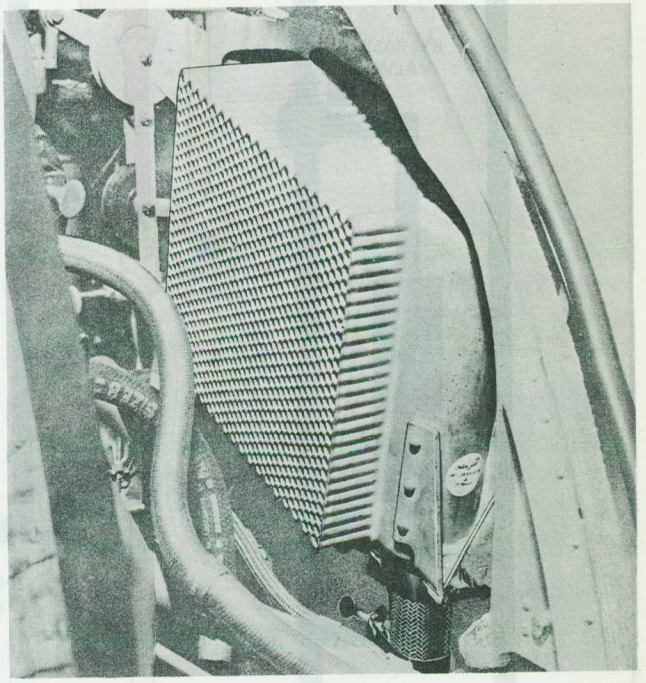


Figure 5-25 Oil Cooler

(c) Oil By-Pass Valve - The by-pass valve is installed in the oil return line to provide a means of returning oil to the supply tank without passing through the cooler. It may be manually operated from the pilot's compartment The valve is spring-loaded to open automatically at pressures not to exceed 25 to 45 psi to ensure oil circulation if the cooler becomes clogged (Figure 5-27).

(d) Oil "Y" Drain Valve - An oil "Y" drain valve is installed in the oil supply line to facilitate draining the oil system.

(e) Oil Pressure Gauge - Engine oil pressure is indicated on the multiple fuel pressure, oil temperature and oil pressure gauge. Under conditions of low temperature, the high viscosity of the oil causes sluggish operation of the gauge. Incorporated in the oil pressure line is a "tee" connector housing a spring-

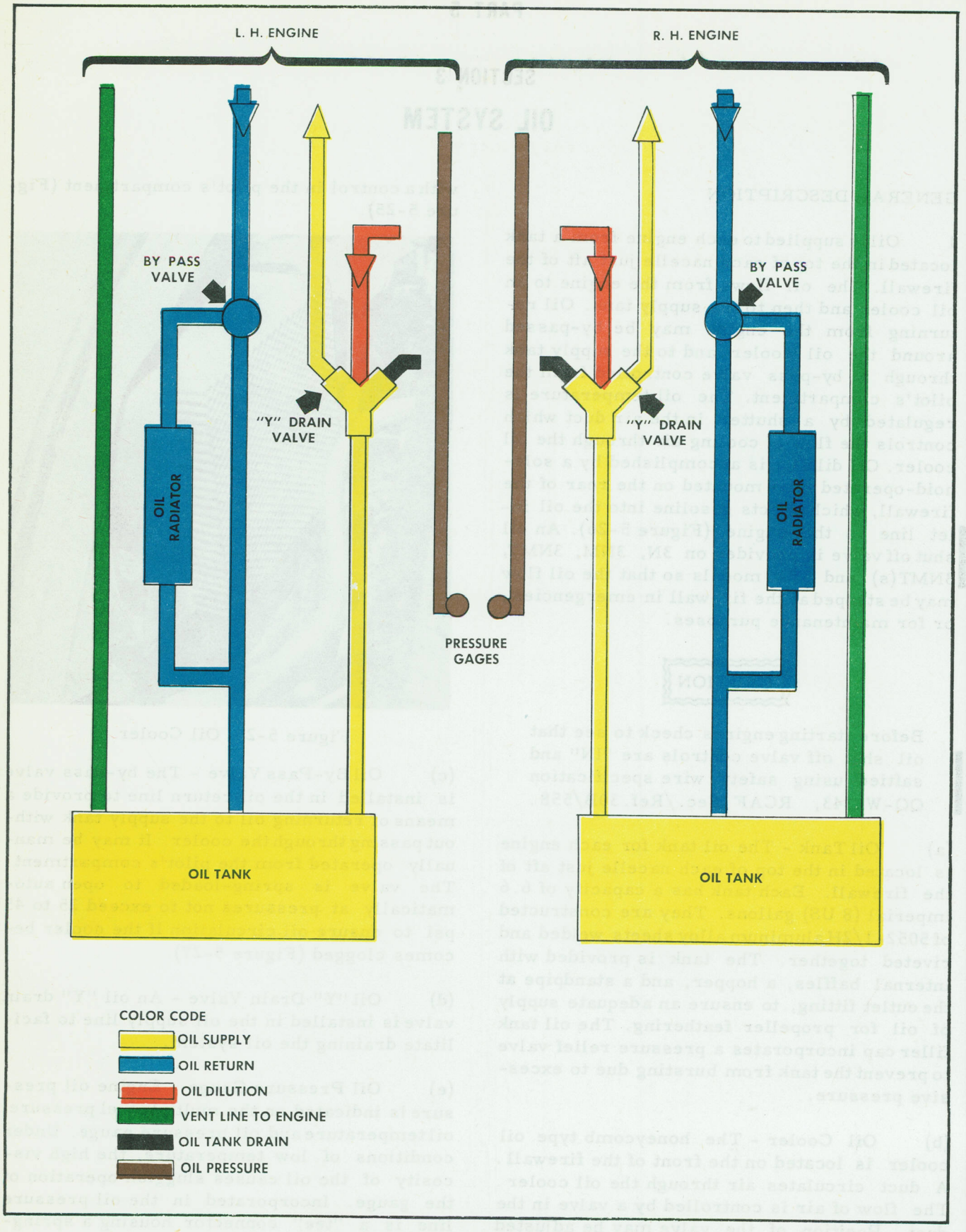


Figure 5-26 Oil System Schematic

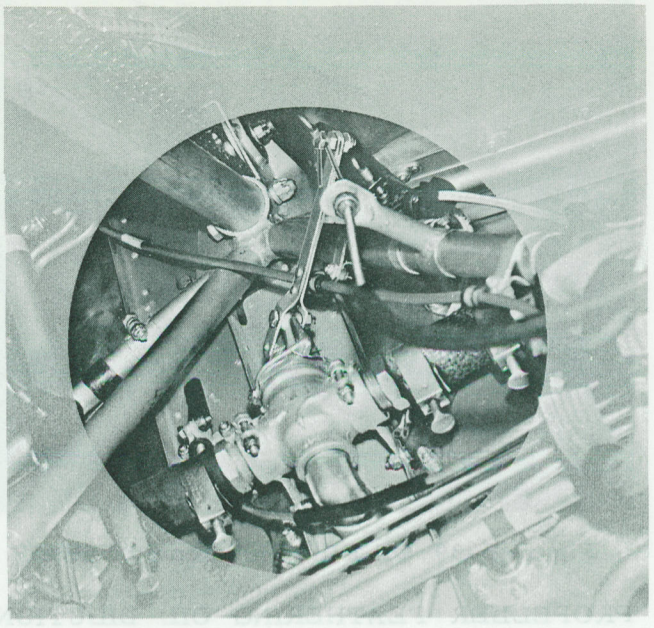


Figure 5-27 Oil By-Pass Valve

loaded valve and filler. To correct sluggish operation of the gauge, hydraulic oil is introduced by means of the "tee" filler and, in turn, engine oil and air are expelled from the line. A restrictor in the line prevents fluctuation of the needle.

OIL TANK

2 The oil tank for each engine is held in position by two padded steel straps. These straps are joined by turnbuckles which can be adjusted to protect tanks from vibration.

(a) Removal - Remove oil tank as follows :-

(1) Remove oil tank access cover.

(2) Drain oil from tank.

(3) Disconnect and plug all piping.

(4) Disconnect bonding links.

(5) Disconnect tank retaining straps at turnbuckles and lift tank free of nacelle.

(b) Servicing - Oil tanks must be removed and cleaned whenever an oil cooler or engine is changed due to internal failure. All sludge and oil should be removed and the tank interior throughly flushed. The sump fittings should be removed and cleaned thoroughly. Thoroughly inspect the tanks for damage, especially for evidence of contact with surrounding structures and for leaks. The tanks may be repaired by welding, using 5052-1/2H material and welding rod confirming to Federal Specification QQ-R-571, Type E. It is important to remove all traces of flux after making weld repairs. It should be washed inside and out with hot water immediately after welding. The tank should be immersed in a 5 per cent solution of nitric or sulphuric acid for one hour, then rinsed and flushed with clean water to remove all traces of acid.

(c) Installation - Install oil tank as follows :-

(1) Lower tank into well (Figure 5-28).

(2) Install tank retaining straps. Make sure padding is placed between straps and tank.

(3) Attach bonding links.

(4) Connect all piping.

CAUTION

Make sure all plugs and foreign objects are removed from piping.

(5) Fill tank and check for leaks.

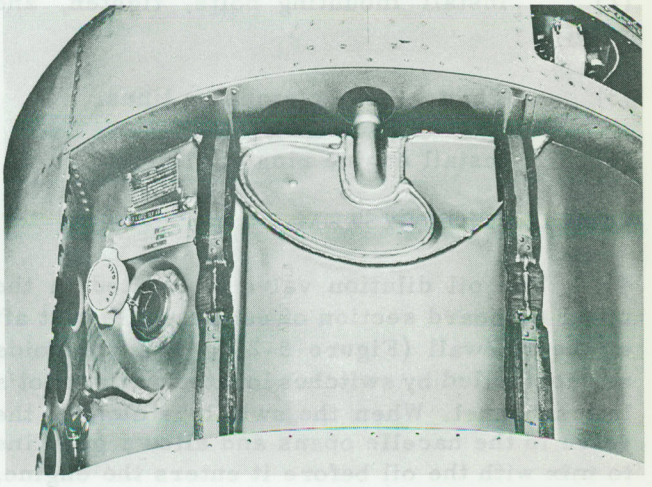


Figure 5-28 Oil Tank Installation

(6) Install access cover.

NOTE

To eliminate oil canning of the upper nacelle skin, the attaching screws of the oil tank cover are to be tightened and backed off 1/4 to 1/2 a turn.

OIL COOLER

3 The honeycomb type oil cooler is located on the front of the firewall.

(a) Removal - Remove oil cooler as follows:

(1) Remove engine ring cowling.

(2) Loosen hose clamps on inlet and outlet lines.

(3) Remove four mounting bolts securing cooler.

(4) Lift cooler up and forward until clear of firewall.

(b) Servicing - If oil cooler is clogged or damaged, it must be sent to a designated overhaul unit for repair.

(c) Installation - Install oil cooler as follows:

(1) Lower cooler into position, connecting piping as cooler is lowered.

(2) Install mounting bolts, tighten, and safety.

(3) Tighten hose clamps on lines.

(4) Install engine ring cowling.

OIL DILUTION SYSTEM

4 The oil dilution valve is located in the upper outboard section of each nacelle just aft of the firewall (Figure 5-29). The solenoids are controlled by switches located on the pilot's left subpanel. When the switch is closed, the valve in the nacelle opens and allows gasoline to mix with the oil before it enters the engine. The fuel enters the oil system at the oil "Y" drain.

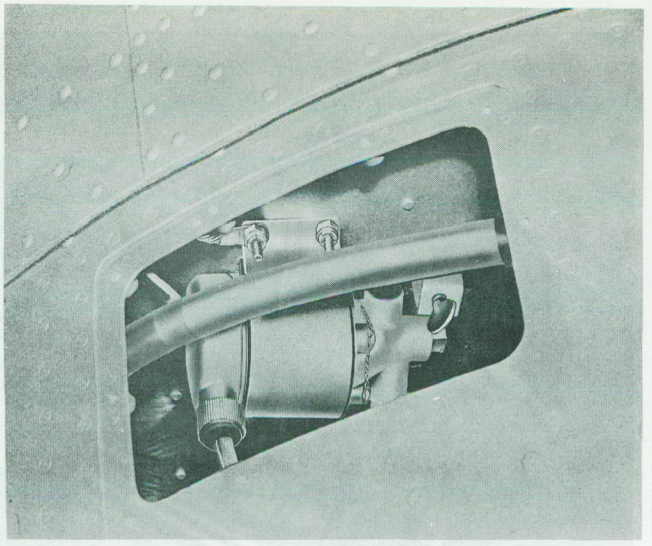


Figure 5-39 Oil Dilution Solenoid Valve

PROPELLER FEATHERING OIL DILUTION SYSTEM

5 A solenoid fitted behind each engine bulkhead allows fuel under pressure to enter the line between the oil tank and the propeller feathering pump, thereby diluting the oil used for feathering. The fuel for this purpose comes from the line connecting the wobble pump to the right hand engine strainer, and then goes to a Plessey Pump located in the right hand wheel well. This single pump sends the fuel to both engine feathering line solenoids. The oil dilution switch, mounted on top of the main instrument panel, has two positions, "WINTER" and "SUMMER". With the switch in the "WINTER" position the oil for feathering will be diluted automatically when the feathering button is depressed. When the switch is in the "SUMMER" position, feathering oil dilution does not occur.

5A To carry out a functional check of the Plessey pump and the relative solenoids the following procedure is to be followed:

(a) Disconnect power leads at the respective solenoids for the right and left motors propeller feathering.

(b) At the Plessey pump disconnect the flexible fuel pressure line leading to the right propeller feathering oil line. To the existing tee fitting attach, with a 6" flexible line and adaptors, an additional tee fitting. To this ad-

ditional tee, attach the flexible fuel pressure line that was disconnected from the existing tee. To the added tee, connect a low pressure gauge employing a 24" flex line. A de-icer gauge may be utilized.

NOTE

Flex lines are to be manufactured from unit sources.

(c) Select right engine fuel "ON".

(d) With the propeller feathering seasonal switch in "WINTER" position, master switch "ON", depress right propeller feathering button briefly, RELEASE SWITCH MANUALLY. Pressure indicated on the gauge will vary from 5 to 10 psi max. if the Plessey pump and solenoid being tested are serviceable. If no pressure is indicated pump is inoperative. If excessive pressure is indicated solenoid is inoperative.

(e) Repeat procedure to check left solenoid.

(f) Remove test equipment and reconnect flex line.

(g) Reconnect leads to motors propeller feathering.

(h) Check for leaks.

TROUBLE SHOOTING

6 To check oil dilution system, disconnect the line leading from the solenoid valve to the "Y" drain valve. Pressurize fuel system with wobble pump, and close the switch in pilot's compartment. If gasoline comes from the line, solenoid valve is operating properly. If gasoline does not appear from line circuit the

solenoid is inoperative. Check all electrical connections and circuit breaker. If circuit is not operating, either the plunger is sticking or solenoid is defective.

OIL BY-PASS VALVE

7 The oil by-pass valve is installed in the oil return line.

(a) Removal - Remove by-pass valve as follows:-

(1) Disconnect the oil by-pass control arm on the valve.

(2) Disconnect the oil lines at the valve.

(3) Remove the bolts securing the valve to the retaining clamps and remove the valve.

(b) Servicing - Inspect actuating arm and lever for excessive wear and replace if necessary. If valve leaks, packing should be replaced.

(c) Installation - Install oil by-pass valve as follows:-

(1) Place valve in position and secure with mounting bolts.

(2) Connect oil lines to the valve.

(3) Connect control to control arm.

OIL "Y" DRAIN VALVE

8 The oil "Y" drain valve is mounted on the aft side of the firewall and should be safetied in the closed position. The oil dilution line attaches to a fitting located at the top of the oil "Y" drain valve (Figure 5-30).

NOTE

Feathering reserve oil cannot be drained through the "Y" drain valve. To completely drain tank, disconnect feathering pump inlet line.

(a) Removal - Remove oil "Y" drain valve as follows:-

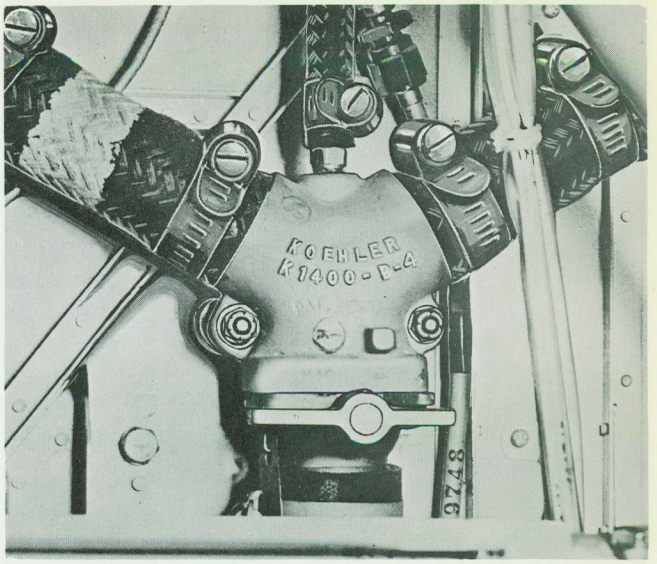


Figure 5-30 Oil "Y" Drain Valve

(1) Drain oil system.

(2) Disconnect all lines attached to "Y" drain valve.

(3) Remove attaching bolts and valve.

(b) Servicing - Leaks sometimes occur in the oil "Y" drain valve due to a collection of foreign particles on the neoprene seal, which prevents the valve from seating properly. Thorough cleaning of the seal may correct the conditon. If not, the seal must be replace.

(c) Installation - Install oil "Y" drain valve as follows:-

(1) Attach valve in place with mounting bolts and safety.

(2) Connect all lines.

OIL PRESSURE ADJUSTMENT

9 Adjust oil pressure as follows:-

(a) Remove wrapper sheets.

(b) On right-hand side of engine accessory housing (Figure 5-31) remove the cap from the oil pressure adjusting screw.

(c) Loosen lock nut on adjusting screw.

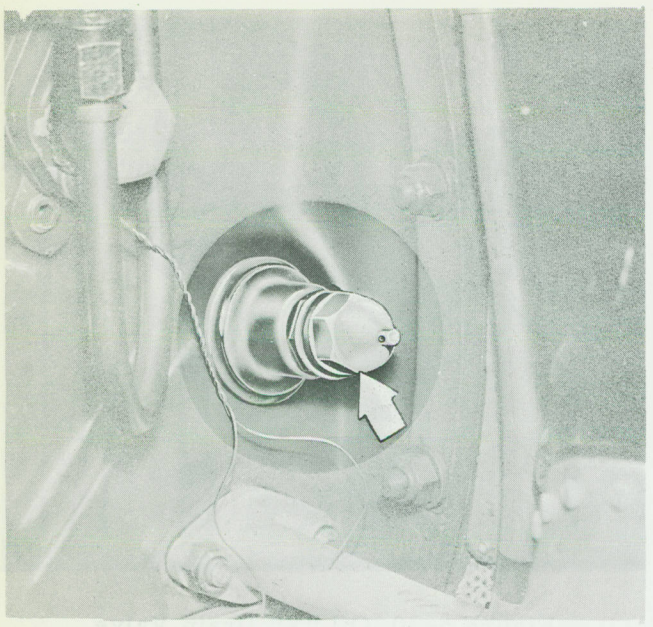


Figure 5-31 Oil Pressure Relief Valve

(d) With engine running and oil temperature in the normal operating range, turn adjusting screw clockwise to increase or counterclockwise to decrease until an oil pressure between 65 and 70 pounds is obtained at an engine rpm of 1800.

(e) Tighten lock nut, install cap, and safety.

(f) Install wrapper sheets.

PART 6

INSTRUMENTS

GENERAL DESCRIPTION

1 Instruments in the Expeditor 3 Series aircraft are conventional in design and operation. Instrument markings consist of fluorescent decalcomania placed on the instrument glasses. Deep orange radium, United States Radium Corporation colour R-410-Ab, and orange-red fluorescent paint, United States Radium Corporation colour R-410, are used on the instrument dial numerals and graduations.

(a) Main Flight Instrument Panel - The main floating panel (Figure 6-1) is shock-mounted for protection of the instruments. It contains all instruments with the exception of the standby compass, which is mounted on a bracket above the panel, and the two volt-ammeters located on the left subpanel (Figure 6-2).

(b) Gyro-Controlled Flight Instruments - The gyro-controlled flight instruments are divided into two groups, electrically driven for the pilot and vacuum driven for the copilot. In event of malfunction of the electrical or vacuum system, the alternate set of flight instruments will remain operative.

INSTRUMENT REMOVAL ACCESS

2 Maintenance and removal of the face-mounted instruments on the panel can be accomplished quickly from within the pilot's compartment (Figure 6-3). To gain access to the instruments proceed as follows:

(a) Remove screws which attach panel to the four bottom vibration absorbers.

(b) Hold panel in place and remove screws from the two top vibration absorbers.

(c) Tilt panel aft and down. (Panel is hinged along the bottom).

NOTE

Lower panel gently to prevent damaging instrument faces against the engine controls.

(d) Disconnect plumbing or wiring and remove the desired instrument.

(e) Installation of the instruments is the reverse of the removal procedure.

NOTE

Take care not to overtighten the bolts and screws which retain the instrument panel.

INSTRUMENT LIGHTING

3 The instrument panel is illuminated by multi-controlled instrument lighting plus an emergency lighting system. The multi-controlled instrument lighting consists of individual light assemblies. They are controlled by three rheostat switches spaced along the bottom of the main floating instrument panel. Their illumination causes the instrument markings to glow.

(a) Removal - Remove instrument ring type light assembly lamps as follows:

(1) Lower ring type light assembly hinged cover to expose the lamps. The emergency instrument lighting is provided by two ultra-violet lights, controlled integrally by rheostats one on each control column. Their radiation causes the instrument markings to glow. For Trouble Shooting of the instrument lights see Table 7-9.

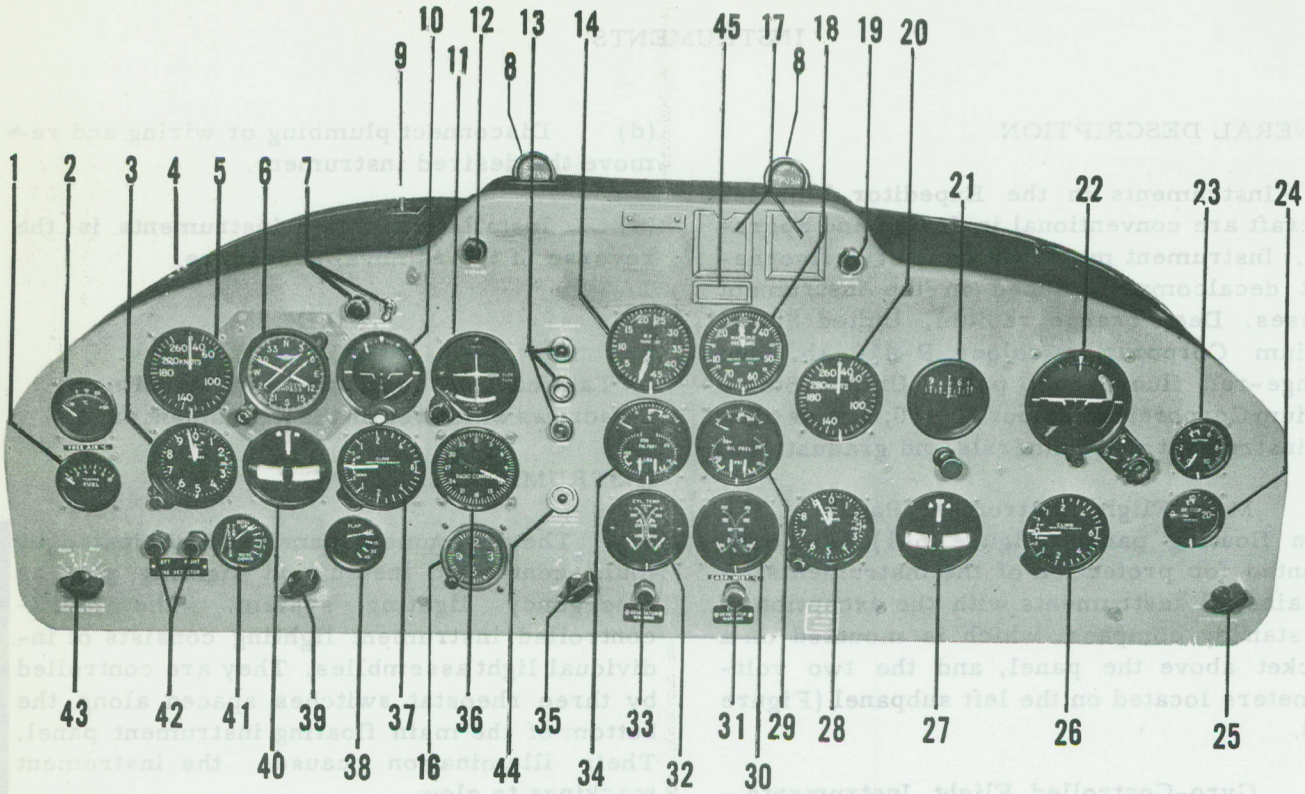
(b) Removal - Remove instrument lighting lamp as follows:

(1) Loosen two screws holding lamp housing.

(2) Twist housing disengaging two screws and lift housing off, exposing the lamp.

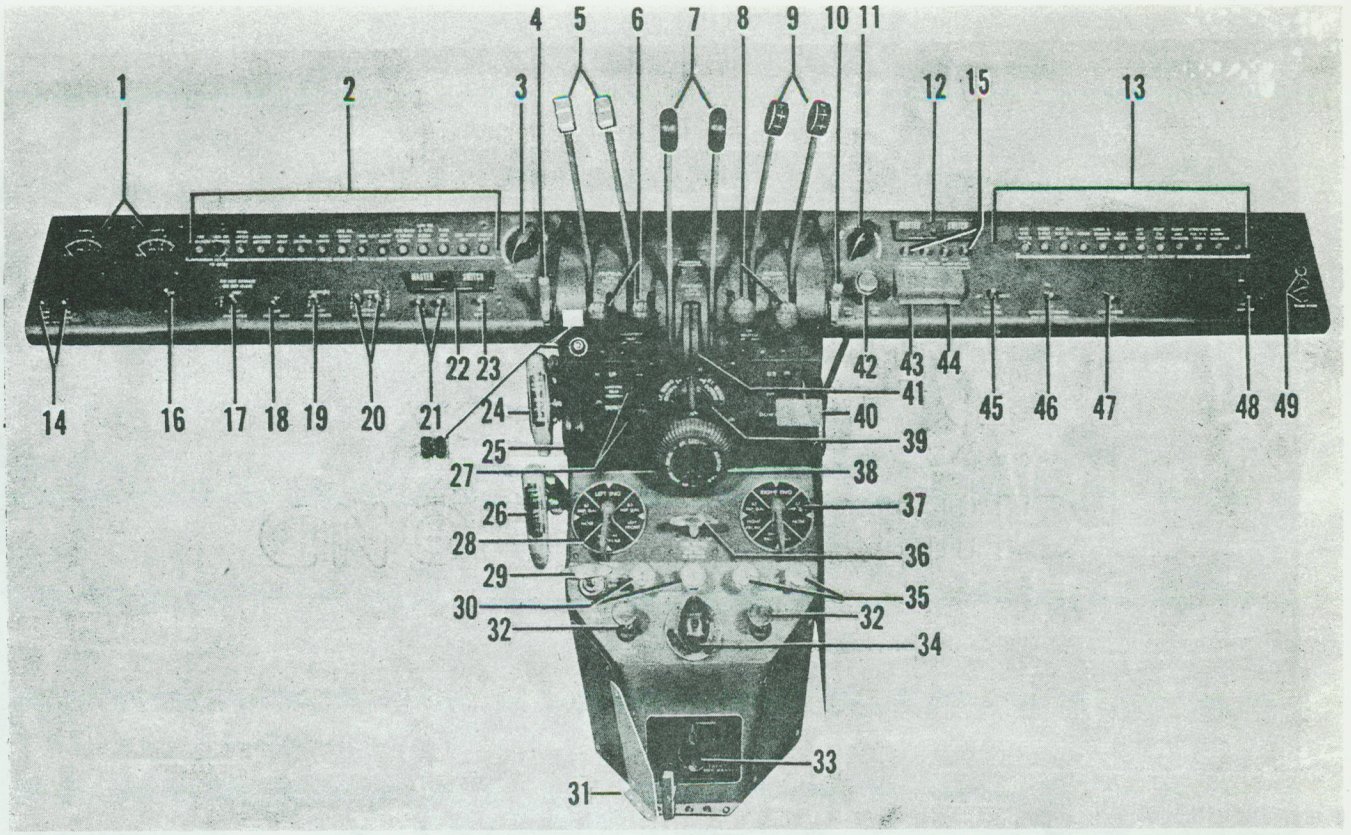
(3) Depress lamp and twist, releasing it from socket.

(c) Servicing - Maintenance to this unit is limited to replacement of lamp, repair of loose connections, aligning socket contacts, replacement of rheostat switch, or replacement of the light assembly.



1 Fuel Quantity Gauge
2 Outside Air Temperature
3 Altimeter
4 Summer/Winter Feathering Dilution Switch
5 Airspeed Indicator
6 Gyrosyn Compass
7 Gyro Horizon Erection Switch and Indicator Light
8 Propeller Feathering Buttons
9 Propeller Feathering Circuit Breaker
10 Gyro Horizon Indicator
11 ILS Indicator
12 Fuel Pressure Warning Light
13 Marker Beacon Lights
14 RPM Indicators (Tachometers)
15 (DELETED)
16 Clock
17 Compass Correction Card Holders
18 Manifold Pressure Gauge
19 Fuel Pressure Warning Light
20 Airspeed Indicator
21 Directional Gyro Indicator
22 Gyro Horizon Indicator
23 Suction Gauge
24 De-Icing Pressure Gauge
25 Instrument Light Rheostat Switch
26 Rate of Climb Indicator
27 Turn and Bank Indicator
28 Altimeter
29 Engine Gauge Unit
30 Carburettor Mixture Temperature Gauge
31 Generator Failure Warning Light
32 Cylinder Head Temperature Gauge
33 Generator Failure Warning Light
34 Engine Gauge Unit
35 Instrument Light Switch
36 Radio Compass Indicator
37 Rate of Climb Indicator
38 Flap Position Indicator
39 Instrument Light Switch
40 Turn and Bank Indicator
41 Elevator Tab Position Indicator
42 Fire Detection Warning Lights
43 Fuel Gauge Selector Switch
44 Horn Silencer Button
45 Ref. RPM Card Holder

Figure 6-1 (Issue 1) Floating Instrument Panel



1 Volt-Ammeters (LH & RH)
2 Circuit Breakers
3 UHF and TACAN Light Rheostat
4 Friction Lock
5 Propeller Controls
6 Manifold Heat Controls
7 Throttles
8 Oil Cooler Shutter Controls
9 Mixture Controls
10 Friction Lock
11 Anti-Icer Rheostat
12 Master Ignition Switch Throwbar
13 Circuit Breakers
14 Oil Dilution Switches
15 Master Ignition Switches
16 Fire Detection Warning Lights Test Switch
17 Windshield Wiper Switch
18 Pitot Heat Switch
19 Navigation Lights Switch
20 Landing Light Switches
21 Generator Switches
22 Master Switch Throwbar
23 Master Battery Switch
24 Cowl Flap Control (LH)
25 Landing Gear Position Switch
26 Cowl Flap Control (RH)
27 Landing Gear Position Lights
28 Fuel Selector Valve (Left Engine)
29 Parking Brake Control
30 Oil By-Pass Controls
31 Engine Fire Extinguisher Release Handle
32 Oil Shut-Off Valve Controls
33 Engine Fire Extinguisher Selector
34 Engine Primer
35 Cabin Heat Controls
36 Tail-Wheel Lock
37 Fuel Selector Valve (Right Engine)
38 Aileron Trim-Tab Control
39 Aileron Trim-Tab Position Indicator
40 Flap Position Switch
41 Friction Lock
42 De-Icer Control
43 Ignition Booster Switch (Under Hinged Cover)
44 Starter Switch (Under Hinged Cover)
45 Starter Selector Switch
46 Gyrosyn Compass Slaving Switch
47 Cabin Dome Light Switch
48 Inverter Switch
49 Spare Bulbs
50 Emergency Over-ride Switch and Decal

Figure 6-2 (Issue 2) Sub-panel and Control Pedestal

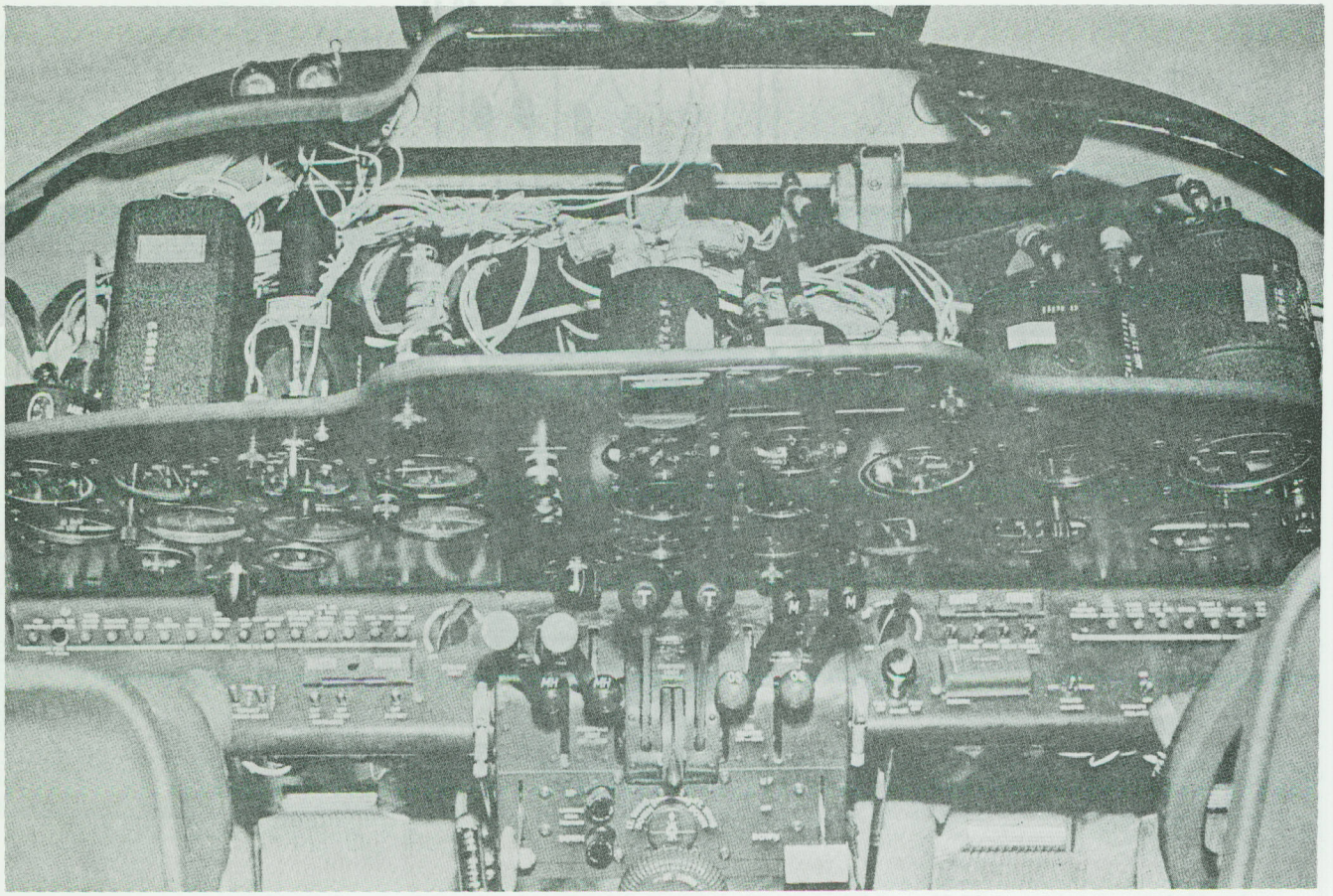


Figure 6-3 Instrument Removal Access

(d) Installation - Install instrument lighting lamp as follows:

(1) Place lamp in socket, depress and twist, engaging lugs on the base with slots in the socket.

NOTE

Lugs on the lamp base are offset so it may be installed in only one position.

(2) Install housing.

(3) Tighten the two screws holding the housing.

COMPASS LIGHT

4 The B21 standby compass is illuminated by a miniature 28V bulb controlled by the panel light rheostat on the upper radio console. Spare lamps are located on the right subpanel. The lamp may be replaced by removing it and the attached base from the case. Replace with a spare unit from the right subpanel.

(a) Servicing - Maintenance of the compass light system is limited to repair of loose connections, replacement of the lamp, or replacement of the rheostat switch.

INSTRUMENT VACUUM SYSTEM

GENERAL DESCRIPTION

5 The vacuum system for the co-pilot's gyro-controlled instruments comprises an engine-driven pump, a suction relief valve and an

air-oil separator in each engine accessory section; an air filter in the nose compartment, a vacuum control valve behind the instrument panel, a suction gauge on the panel, and the necessary tubing and hose. For Trouble Shooting, Vacuum System, see Table 6-1.

VACUUM PUMP

6 The AN6111-1 Type engine-driven vacuum pump is mounted at the left side of the engine, on the engine mounting pad.

(a) Removal - Remove vacuum pump as follows:

(1) Disconnect suction and discharge lines.

(2) Cut safety wire and remove nuts from the four mounting studs.

TROUBLE	PROBABLE CAUSE	CORRECTION
AIRSPEED INDICATOR		
1 Pointer fails to respond.	(a) Pressure line not properly connected.	(a) Make proper connections.
	(b) Pitot and static lines clogged.	(b) Disconnect lines from instruments and blow the lines clear.
2 Pointer indicates incorrectly.	(a) Leak in lines.	(a) Check and correct.
	(b) Leak in instrument.	(b) Check crystal seal. If leaking, replace instrument.
	(c) Defective indicator.	(c) Replace instrument.
RATE-OF-CLAMB INDICATOR		
1 Pointer not on zero.	(a) Aging diaphragm.	(a) Return pointer to zero. Tap instrument lightly while making adjustment.
2 Pointer fails to respond.	(a) Obstruction in static line.	(a) Disconnect all instruments operating on static pressure lines. Blow lines clear.
3 Pointer indicates incorrectly.	(a) Leak in static lines.	(a) Correct leak or replace instrument.
	(b) Leak in instrument case.	(b) Test for case leak. Replace instrument if necessary.
TURN-AND-BANK, DIRECTIONAL GYRO AND ARTIFICIAL HORIZON		
1 Instrument inaccurate or fluctuating.	(a) Leak in line or instrument.	(a) Repair leak. Replace instrument if leaking.
	(b) Damaged gyro.	(b) Replace instrument.
	(c) Vacuum supply fluctuating or not properly set.	(c) Check supply for constant and correct vacuum.

Table 6-1 Trouble Shooting, Instruments

TROUBLE	PROBABLE CAUSE	CORRECTION
ALTIMETER		
1 Instrument fails to operate.	(a) Static pressure lines are plugged.	(a) Disconnect all instruments operating on static pressure lines. Blow lines clear with clean, dry air.
2 Pointer oscillates.	(a) Irregular static pressures received in instrument case. (b) Leak in instrument case.	(a) Check static lines for restriction. (b) Replace
FUEL QUANTITY INDICATOR		
1 Low reading or no reading.	(a) Damaged pivots in indicator. (b) Poor connection at tank or indicator. (c) Defective transmitter. (d) Float arm stuck to bottom of tank. (e) Tank unit out of adjustment.	(a) Replace instrument. (b) Clean and tighten connections. (c) Replace. (d) Free float arm. (e) Adjust (Part 5, Section 2).
2 Pointer slams right or left.	(a) Leads short-circuited at receptacle pins. (b) Break in positive or negative lead.	(a) Solder leads and clear short circuit. (b) Repair lead.
POSITION INDICATOR (FLAP, ELEVATOR)		
1 Indicator does not respond.	(a) Open circuit. (b) Rheostat inoperative. (c) Indicator defective.	(a) Check continuity of circuit. Check circuit breaker. Reset. (b) Replace rheostat. (c) Replace.
VACUUM SYSTEM		
1 Suction gauge does not work.	(a) Clogged lines. (b) Shaft on vacuum pump broken.	(a) Clean lines. (b) Replace pump.
2 Vacuum operated instruments do not work.	(a) Clogged lines. (b) Oil separator defective.	(a) Clean lines. (b) Replace separator.

Table 6-1 Trouble Shooting, Instruments (continued)

(3) Pull pump out and off engine mounting pad.

(b) Servicing - If the unit is inoperative or malfunctioning, remove, tag as unserviceable and return to stores.

(c) Installation - Install vacuum pump as follows:

(1) Slide pump into position on the engine mounting pad, suction and discharge ports facing aft.

(2) Secure nuts on the four mounting studs.

(3) Safety wire the nuts.

(4) Connect suction and discharge lines to proper pump ports.

NOTE

Before installation of pump, be sure lubrication holes in pump flange are not covered by the flange gasket.

SUCTION RELIEF VALVE

7 The Expeditor 3 Series aircraft is equipped with AN6119-2 type suction relief valves

(a) Removal - Remove suction relief valve as follows:

(1) Free unit by disconnecting lines at the inlet and outlet elbows.

(b) Servicing - Clean the relief valve screen in solvent, specification 3-GP-8 or equivalent, and dry with compressed air.

(c) Installation - Install suction relief valve as follows:

(1) Hold relief valve in position.

(2) Connect lines to the inlet and outlet elbows.

(3) Adjust the relief valve.

NOTE

To adjust the suction relief valve, loosen locknut and turn adjusting screw counter clockwise to increase suction, or clockwise to decrease suction (set at 4.25 inches of mercury ± 0.25 at cruising speed).

OIL SEPARATOR

8 The Expeditor 3 series aircraft is equipped with two Eclipse type 558 oil separators.

(a) Removal - Remove oil separator as follows:

(1) Disconnect inlet, outlet, and oil return lines.

(2) Remove nuts from the two mounting bolts.

(3) Lift unit off inner cowl.

(b) Servicing - Disassemble and clean in solvent 3-GP-8 or equivalent, and dry thoroughly with compressed air.

(c) Installation - Install oil separator as follows:

(1) Place separator in position on mounting plate.

(2) Secure nuts on the two mounting bolts.

(3) Connect inlet, outlet and oil return lines.

CENTRALIZED AIR FILTER

9 The Expeditor 3 series aircraft is equipped with an AN5822-1 type air filter.

(a) Removal - Remove centralized air filter as follows:

(1) Disconnect instrument lines at manifold.

(2) Remove nuts from the two mounting bolts.

(3) Lift unit off mounting bracket.

(4) Remove filter bowl to clean or replace filter element.

(b) Servicing - Minor repairs will consist of cleaning the air filter inlet screen, or cleaning and replacing the filter element (every 50 hours). Use solvent 3-GP-8 or equivalent. Dry thoroughly with compressed air.

NOTE

To clean element, blow air through element in the direction opposite to normal flow. Care should be taken not to blow air into element at right angles, as this will tend to clog dust in element. Tilt air hose at approximately forty-five degrees.

(c) Installation - Install centralized air filter as follows:

(1) Place filter in position with intake port facing down, on mounting bracket.

(2) Secure nuts on the two mounting bolts.

(3) Connect instrument lines at the manifold.

NAVIGATION TRAINING INSTRUMENTS

AIR MILEAGE UNIT AND AIR POSITION INDICATOR

10 The Air Mileage Unit (AMU) and the Air Position Indicator (API) function together as a unit, designed to provide the navigator with an accurate and continuous air plot in terms of degrees and minutes of latitude and longitude. A gyrosyn compass repeater motor maintains the true course reading and counter mechanism of the API in accordance with the true heading of the aircraft. The AMU utilizes pitot and static air pressure and outside air temperature to determine the true airspeed and the air mileage flown. A flexible shaft, driven by the AMU motor and turning a predetermined number of revolutions per nautical mile, transmits the air mileage flown to the API, where it is resolved into latitude and longitude readings by the counter mechanism. The AMU and the API are set in operation by the "ON-OFF" switch on the API. If the unit is functioning correctly the indicator lamp should blink continuously. For accuracy, the local variation should set in with the variation setting control located on the master indicator. For Trouble Shooting, AMU and API, see Table 6-2.

AIR POSITION INDICATOR

11 This paragraph contains instructions for the removal, servicing, installation, maintenance and testing of the air position indicator.

(a) Removal - Remove air position indicator as follows:

(1) Disconnect flexible drive shaft at the bottom of the unit.

(2) If electrical wiring is clamped or stowed, remove clamps or other stowage to obtain as much slack as possible.

(3) Remove mounting bolts from unit, and remove unit.

NOTE

Support the unit while the mounting bolts are being removed. Two men will be required, one to support the unit while the other removes the mounting bolts.

(4) Remove the junction box cover.

(5) Disconnect electrical wiring.

NOTE

Mark the wiring before it is disconnected.

(b) Servicing - Minor repairs will consist of replacement of the API indicator lamp and the repair or replacement of electrical connections. If more extensive repairs are required, the unit should be removed, tagged unserviceable, and returned to stores.

(c) Installation - Install air position indicator as follows:

(1) Make the correct electrical connections.

(2) Install the junction box cover.

(3) Support the unit and install the mounting bolts.

(4) Connect the flexible drive shaft.

(5) Stow excess electrical wiring.

(d) Maintenance and Testing - The following information covers field maintenance instructions and functional test procedures for the Air Position Indicator Unit. Inspect and test the Air Position Indicator as follows:

(1) Inspect unit for security of mounting and electrical connectors.

(2) Inspect the flexible drive from the Air Mileage Unit to the API for kinks and security.

(3) Ensure that the five ampere fuse or circuit breaker is serviceable and that the supply voltage is correct.

(4) Ensure that the counter resetting knobs operate counters freely.

(5) Turn the "ON-OFF" switch to the "ON" position and after allowing 30 seconds for the tube filaments in the AMU to warm up, press the ground test switch and note that the lamp winks regularly and that the longitude and latitude counters move slowly.

(6) Synchronize API, repeater with compass indicator.

(7) Turn "ON-OFF" switch to the "OFF" position.

(8) The following inspections are to be carried out at all aircraft minor inspection periods.

a. Remove the Air Position Indicator and bench test as detailed in Part 3 of EO 20-35AB-2A.

b. Inspect installation wiring for damage and security of electrical connectors.

c. Re-install or replace, as applicable, the Air Position Indicator.

AIR MILEAGE UNIT

12 This paragraph contains information for the removal, servicing, installation, maintenance and testing of the air mileage unit.

(a) Removal - Remove air mileage unit as follows:

(1) Disconnect flexible drive shaft from the API.

(2) Remove hinge wires holding the forward navigators table at the inboard and outboard ends of the table, and remove the table.

(3) Disconnect flexible drive shaft from the AMU.

(4) Disconnect all electrical wiring from the AMU, also the pitot and static pressure lines.

(5) Loosen clamps on the air exhaust and

TROUBLE	PROBABLE CAUSE	REMEDY
1 API Lamp off, AMU motor on.	(a) Low voltage or a faulty tube.	(a) Check voltage for proper amount and tubes for correct functioning.
2 API Lamp off, AMU motor running at top speed.	(a) Bad leak in fan system or obstruction in fan pipe to diaphragm.	(a) Replace AMU.
3 API Lamp off, AMU motor off.	(a) No power. (b) Faulty main switch or push switch. (c) Broken lead in motor circuit. (d) Faulty brushes in motor.	(a) Check Power supply. (b) Check switches for correct functioning. (c) Repair lead in motor circuit if possible, or replace motor. (d) Install new brushes.
4 API Lamp off, AMU motor hunts.	(a) Lamp in API fused.	(a) Replace API Lamp.

Table 6-2 Trouble Shooting, AMU and API

inlet tubes, and slip the splice hoses back on the tubes.

(6) Remove the screws holding the unit to the shock mountings.

(7) Lift unit out.

(8) Remove mounting frame from the supports in the aircraft structure.

(9) Remove shock mountings from frame.

(b) Servicing - Minor repairs to the AMU will consist of replacement of the AMU motor brushes, the lubrication of the AMU motor, replacement of tubes and the repair of electrical wiring.

NOTE

Extensive repairs to the AMU and API should only be made by authorized maintenance personnel.

(c) Installation - Install air mileage unit as follows:

(1) Attach shock mountings to frame.

(2) Mount frame on supports provided in the aircraft structure.

(3) Slip splice hoses over exhaust and intake lines and slide well back on the lines. At the same time slip the hose clamps on but do not tighten.

(4) Position AMU in the mounting frame and align holes in mounting brackets with those in the shock mounts.

(5) Insert and tighten the screws in the shock mountings.

(6) Make hose connections on exhaust and intake lines and tighten the clamps securely.

(7) Connect the flex drive at the AMU, make all electrical connections and connect the pitot and static pressure lines.

(d) Maintenance and Testing - The following information covers field maintenance instructions and functional test procedure for the Air Mileage Unit.

(1) Inspect the unit for security of mounting, electrical connectors, and resiliency of shock mounts.

(2) Inspect the flexible drive from the AMU to the API for kinks and security.

(3) Inspect the pitot, static and cooling air pipelines and fittings for security and blockage and for deterioration of rubber tubing.

(4) Ensure that the 5 ampere fuse, or circuit breaker is serviceable and that the supply voltage is correct.

(5) Turn "ON-OFF" switch to the "ON" position and after allowing approximately 30 seconds for the tube filaments to warm up, press the ground test switch on the API and note that the lamp winks regularly and the longitude and latitude counters move slowly.

(6) Turn "ON-OFF" switch to the "OFF" position.

(7) The following inspections are to be carried out at all aircraft minor inspection periods:

a. Remove the Air Mileage Unit and bench test as outlined in EO 20-35AA-2A.

b. Inspect installation wiring for damage and security of electrical connectors.

c. Inspect pitot, static and cooling air pipelines and fittings for security and blockage and perform normal leakage tests.

d. Re-install or replace, as applicable, the Air Mileage Unit.

GYROSYN COMPASS SYSTEM

GENERAL DESCRIPTION

13 The gyrosyn compass indicates the true heading of the aircraft in relation to the earth's magnetic field. The compass is gyro stabilized, the gyro itself being controlled by a flux

valve which detects any change in direction as related to the earth's magnetic field. Placing the slaving switch on the right subpanel in the "OFF" position cuts the flux valve out of the circuit and allows the gyrosyn compass to act as a conventional directional gyro instrument. The gyrosyn compass system consists of the pilot's indicator with synchronizing control, (which is located on the main instrument panel) amplifier, servo amplifier, flux valve, inverter, repeater motor, master indicator and repeater indicator. For Trouble Shooting, Gyrosyn Compass, see Figure 6-3.

GYROSYN COMPASS INVERTER

14 The gyrosyn compass inverter is located under the pilot's floor boards. An inverter failure warning light mounted on the main instrument panel is controlled by a relay mounted under the floor boards near the undercarriage motor.

(a) Removal - Remove gyrosyn compass inverter as follows:

(1) Remove junction box cover.

(2) Disconnect wiring.

(3) Unscrew and remove four nuts on the mounting stud bolts.

(4) Remove unit.

(b) Servicing - Repair of this unit is limited to the replacement of commutator brushes and the repair or replacement of electrical wiring.

(c) Installation - Install gyrosyn compass inverter as follows:

(1) Position the unit on the mounting base.

(2) Tighten the nuts on the four studs.

(3) Connect electrical wiring.

(4) Install junction box cover.

FLUX VALVE

15 The flux valve is mounted in the outer right wing.

(a) Removal - Remove the flux valve as follows:

(1) Remove two screws in access door.

(2) Remove three screws through the mounting flange on the valve.

(3) Lift valve up and out.

(4) Remove valve cover plate.

(5) Disconnect wiring.

(b) Servicing - No repairs or adjustments will be made on the flux valve. If the unit is inoperative, remove, tag as unserviceable and return to stores.

(c) Installation - Install flux valve as follows:

(1) Connect wiring.

(2) Install valve cover plate.

(3) Place the valve in the mounting bracket provided in the structure.

(4) Install the three mounting screws.

(5) Install access door and secure two screws.

REPEATER INDICATOR

16 The repeater indicator is located at the rear navigator's position.

(a) Removal - Remove repeater indicator as follows:

(1) Remove screws in shock mountings and take floating panel off.

(2) Disconnect wiring connector plug at back of indicator unit.

(3) Remove four mounting screws through the panel into the instrument.

(4) Lift instrument out.

(b) Servicing - The repair or replacement of any part of the unit, will be done only by qualified personnel with proper laboratory equipment.

(c) Installation - Install repeater indicator as follows:

(1) Position unit in the floating panel.

(2) Install four mounting screws securing indicator to panel.

(3) Connect electrical plug at back of indicator unit.

(4) Position the floating panel and install the screws in the shock mountings.

(5) Tighten the screws securely.

MASTER INDICATOR

17 The master indicator is located at the forward navigator's position.

(a) Removal - Remove master indicator as follows:

(1) Disconnect all electrical wiring at the back of the unit.

(2) Remove four mounting screws.

(3) Remove instrument.

(b) Servicing - The repair or replacement of any part of the unit, will be done by only

TROUBLE	PROBABLE CAUSE	CORRECTION
1 Instrument does not start. CAUTION If gyro does not start within 20 seconds, turn off power and investigate. If single phase power is supplied to gyro, it will burn out.	(a) Failure of power supply. (b) Connections from instrument to power supply incorrect.	(a) Check power supply at gyrosyn compass indicator. The A-C voltage should read 26 plus or minus 1 volt and the frequency 400 plus or minus 40 cycles. (b) Check cables, plugs, and receptacles.
2 Annunciator shows dot or cross continuously after proper alignment procedure.	(a) Faulty circuit between gyrosyn compass indicator and flux valve.	(a) Check for open or short circuit. CAUTION Do not use a D-C ohmmeter across any coils of the flux valve.
3 Annunciator is sticky or sluggish.	(a) Improper shielding of the flux valve cable. (b) Defective gyrosyn compass indicator.	(a) The three signal leads should be shielded from excitation. (b) Replace indicator.
4 Deviation exceeds one degree during compensation check.	(a) Flux valve not properly compensated. (b) Faulty cable between compass indicator and flux valve.	(a) Compensate. (b) Check continuity. Repair or replace defective leads.
5 Repeater indicator lags gyrosyn indicator by more than 3 degrees.	(a) Open cable to synchro rotor. (b) Open synchro rotor. (c) Sticky bearings.	(a) Check cable leads for continuity. (b) Replace repeater. (c) Replace repeater.

Table 6-3 Trouble Shooting, Gyrosyn Compass

qualified personnel with proper laboratory equipment.

(c) Installation - Install master indicator as follows:

(1) Position the indicator in the supporting panel.

(2) Install four mounting screws.

(3) Connect electrical wiring plugs.

GYROSYN AMPLIFIER

18 The gyrosyn amplifier is located under the co-pilot's seat.

(a) Removal - Remove gyrosyn amplifier as follows:

(1) Disconnect wiring connector plug.

(2) Remove four screws through mounting flange on unit.

(3) Lift instrument out.

(b) Servicing - The repair or replacement of any part of this unit will be done only by qualified personnel.

(c) Installation - Install gyrosyn amplifier as follows:

(1) Position unit on the mounting frame.

(2) Install four mounting screws.

(3) Connect electrical wiring plug.

SERVO AMPLIFIER

19 The servo amplifier is located under the co-pilot's seat.

(a) Removal - Remove servo amplifier as follows:

(1) Disconnect wiring connections.

(2) Slide clips back, disengaging the unit from the studs on the mounting frame.

(3) Remove the amplifier.

(b) Servicing - The repair or replacement of any part of the unit will be done only by qualified personnel.

(c) Installation - Install servo amplifier as follows:

(1) Position unit on studs in the mounting frame.

(2) Engage sliding clips securing the unit to the mounting frame.

(3) Connect electrical wiring plug.

REPEATER MOTOR

20 The repeater motor is built into the API unit, and its removal constitutes a vital disassembly of the API unit. If it becomes necessary to remove or replace the repeater motor, the API unit must be removed, tagged as unserviceable, and returned to stores.

ADJUSTMENT OF THE GYROSYN COMPASS SYSTEM

21 In order for the gyrosyn compass system to function correctly, it must be synchronized so that the indicator readings and flux valve detections are the same. The synchronizing controls are located on the pilot's indicator, and when operated will simultaneously synchronize the pilot's indicator, the repeater motor in the API mechanism, the master indicator, and the rear navigator's repeater indicator. Synchronizing is generally accomplished before take-off; however, exceeding the limits of the gyro while in flight will necessitate resynchronizing the system. To synchronize the system proceed as follows:

(a) Turn battery master switch "ON" and allow gyro to start and get up speed.

(b) Place slaving switch in "ON" position.

(c) Observe annunciator window in upper right-hand corner of the pilot's indicator. A dot or cross appearing in the window will indicate which way synchronizing control is to be moved.

(d) Push synchronizing control in and rotate in a direction to correspond with image appearing in the annunciator window.

(e) On the ground, the system is synchronized when neither image appears in the window. In flight, however, the system is synchronized when the dot and cross appear alternately.

(f) Observe the master indicator and repeater indicator to see that they are synchronized also.

CAUTION

Do not engage synchronizing control for more than two minutes. A prolonged load on the precessing gyro can result in damage to the unit.

NOTE

In flight, when the images of the cross and dot appear alternately in the annunciator window, the unit is functioning properly. However, when either remains in the window for a prolonged period, the unit is out of synchronization.

LUBRICATION

22 Lubrication - The bearings and pivots of the indicators and repeater normally will require lubrication only when removed from the aircraft for complete overhaul. However, continuous operation in hot climates accelerates the evaporation of oil. Under such conditions, lubrication is required after 150 hours of operation. The amplifiers and the compensator require no lubricants.

NOTE

Lubrication requires the disassembly of the instruments and can be performed by qualified personnel only.

MAGNESYN COMPASS SYSTEM

23 Because of the shortage of Gyrosyn compass components, some Expeditor 3 aircraft are equipped with a Magnesyn compass system; the function and the components of the two systems are basically similar.

PITOT AND STATIC PRESSURE SYSTEM

24 The pitot and static pressure system is

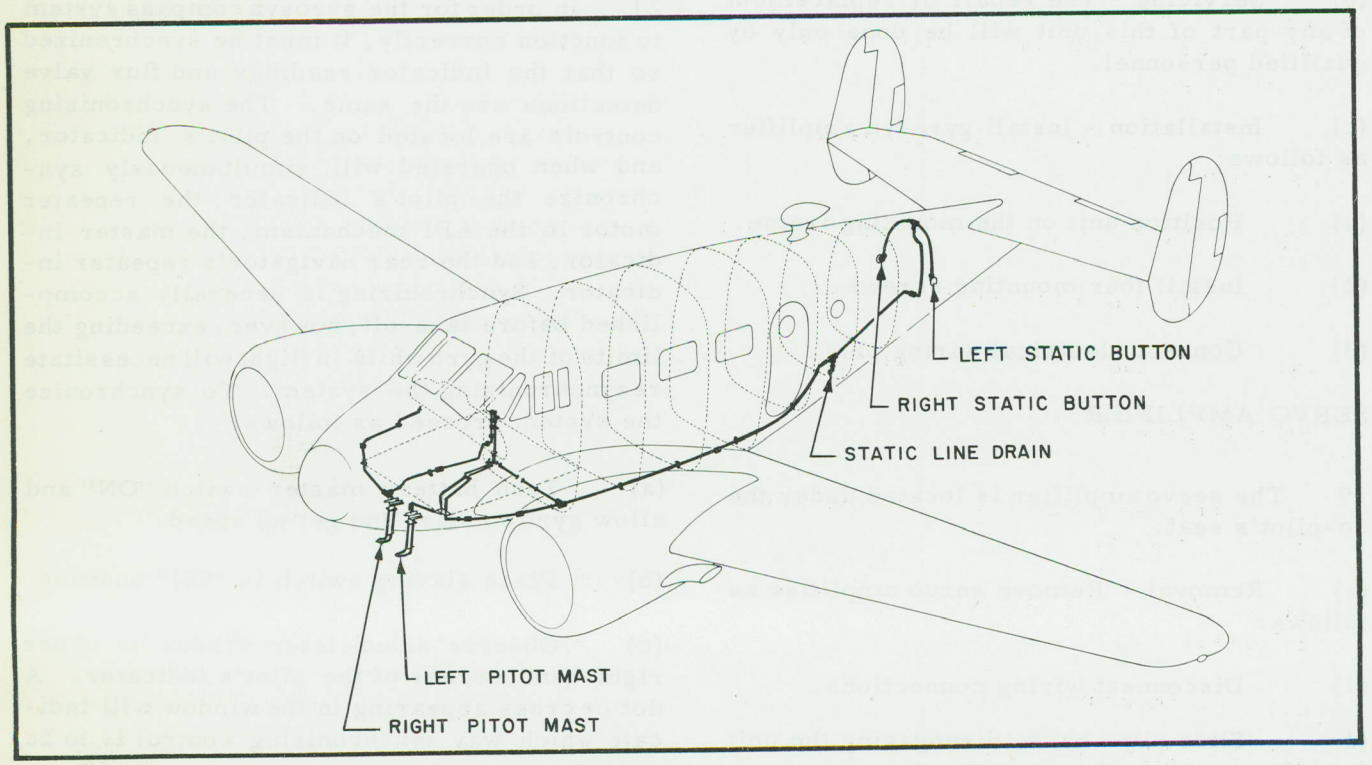


Figure 6-4 Pitot and Static Pressure System

TROUBLE	PROBABLE CAUSE	CORRECTION
1 Heating element inoperative.	(a) Bad switch. (b) Broken or grounded wire	(a) Replace switch. (b) Check circuit for continuity and replace if necessary.
2 Circuit breakers pop out	(a) Grounded wire.	(a) Replace wire or insulate.
3 Instruments do not read the same.	(a) Line clogged or loose. connection. (b) Defective instrument.	(a) Check all fittings for tightness. Disconnect lines from instruments and blow out foreign material from lines. (b) Replace instrument.
4 Instrument hand indicates incorrectly.	(a) Leak in line or loose connection. (b) Bad instrument diaphragm.	(a) Tighten connections. (b) Replace instrument.

Table 6-4 Trouble Shooting, Pitot and Static Pressure System

is designed primarily to furnish impact and static pressure for the airspeed instruments, and static pressure for the altimeter indicators (Figure 6-4). For Trouble Shooting, Pitot Static Pressure System, see Table 6-4.

(a) Impact Pressure - The impact pressure comes from two pitot masts, which are mounted side by side under the nose section of the aircraft at Bulkhead 3. The right-hand mast provides impact pressure for the copilot's and forward navigator's airspeed indicators. The left-hand pitot mast provides impact pressure for the pilot's airspeed indicator only. A heating element is built into both right and left-hand mast heads as a precaution against moisture freezing and obstructing the air passages. Elements are operated by a switch, mounted directly in front of the pilot on the left subpanel.

(b) Static Pressure - Static pressure for the pilot's, copilot's, and forward navigator's altimeters, as well as the rate of climb and other instruments, is provided by two static buttons (ports) which are riveted flush with the fuselage skin, one on each side of the fuselage between Bulkheads 12 and 13. By connecting these ports, a common line is made to provide static pressure to the various instruments.

(c) Testing - Test in accordance with EO 20-105BA-2.

NOTE

An aircraft with Air Mileage Units installed, if the pitot static system leaks beyond tolerance the AMU should be blocked off and the system re-checked.

DRIFTMETERS

25 This paragraph contains descriptive information on the B-5 Driftmeter and B-3 Driftmeter.

(a) B-5 Driftmeter - The B-5 Driftmeter is essentially a periscope mounted in the side of the fuselage. It incorporates a ruled reticle and a pantograph with which an image on the reticle may be transferred to a ruled indicator dial. With the driftmeter, the navigator can determine actual ground speed and the angle

between the heading of the aircraft and its actual course.

(b) Optical System, B-5 Driftmeter - The optical system consists of two mirrors, an objective lens, field lens, and eyepiece. Clips secure the outside mirror to the lower end of the periscope housing. Light reflected from the outside mirror passes through the objective lens at the upper end of the periscope housing and is reflected by the inside mirror through the field lens, reticle and eyepiece. The inside mirror is mounted on a plate below the base of the instrument. Directly above the in-

side mirror, attached to the base plate, are the field lens and reticle.

(1) The eyepiece is mounted in a tube centred over the reticle, the tube forming a part of the hinged frame housing the pantograph mechanism. A rubber eye protector is screwed onto the eyepiece tube.

(c) Pantograph, B-5 Driftmeter - The pantograph consists of a luminous-tipped pointer suspended above the reticle and so attached to one of the movable pantograph arms that it may be moved across the face of the reticle in any direction. Attached to the opposite arm of the pantograph is a pencil holder which may be moved across the ground glass which covers the indicator dial on the instrument base. The pointer and pencil holder are so interconnected that they remain in precise alignment and a pencil inserted in the holder will duplicate on the ground glass the track of the pointer across the reticle.

(1) The circular indicator dial is linked to the reticle by means of a parallel crank so their rotation is synchronized. An object on the ground may be aligned with one of the lines on the reticle by rotating the indicator dial and the deflection angle read in degrees from a scale on the base plate.

(2) A computer, consisting of a logarithmic scale dial marked for altitude, and a rotating seconds dial, is mounted beside the eyepiece on the mechanism frame. Given the altitude of the aircraft and the time in seconds for an object on the ground to pass between the time lines on the reticle, the computer will give the ground speed of the aircraft.

(d) Mounting, B-5 Driftmeter - Riveted to brackets under the base plate of the instrument are two channel-section rails. Each rail is fitted with a tension spring and detent to hold it in position on matching rails in the aircraft structure. Near the upper end of the periscope tube is a flange fitted with a sponge rubber gasket which seals the opening in the aircraft through which the periscope tube projects.

(e) B-3 Driftmeter - The B-3 driftmeter is a gyro-stabilized optical instrument to determine the drift azimuth of the aircraft relative to a fixed ground object. It is also used to obtain data from which ground speed and wind velocity may be computed. The driftmeter is mounted vertically on a fixed housing in the aircraft. It consists of a telescope tube with objective lens projecting beneath the fuselage, and an electrically-driven gyro in a housing at the upper end of the instrument. The telescope tube contains the optical system of lenses and prisms through which ground objects beneath the aircraft are viewed. The gyroscope maintains the grid ruled reticle of the instrument in a horizontal plane so that when the grid lines and the sighted object are viewed simultaneously, no error is introduced as a result of pitch and roll motions of the aircraft. The driftmeter, including gyro stabilized reticle and eyepiece, is free to rotate in its fixed housing to measure drift or azimuth, indicated on the respective scales on this housing. An additional scale may be used to measure line of sight angles from below the aircraft for ground speed computation data. The control handle for this scale is located opposite the gyroscope housing. This handle operates a pulley mechanism attached to a rotatable index prism in the extreme lower end of the tube.

TROUBLE	PROBABLE CAUSE	CORRECTION
1 Inadequate light on reticle.	(a) Socket assembly set too high or too low.	(a) Loosen set screw in step on upper gyro housing and adjust position of socket assembly until maximum light is obtained.
2 Shifting image.	(a) Loose screws at either end of outer sleeve.	(a) Tighten all screws on outer sleeve.
3 No light on reticle.	(a) Lamp fused.	(a) Replace lamp.

Table 6-5 Trouble Shooting, B-3 Driftmeter

(1) The B-3 Driftmeter receives its 110-volt, 400-cycle power from the BK-22 relay box. In order to operate the driftmeter gyro, the radio compass must be turned on.

CAUTION

All personnel should be warned not to grab the head of the instrument in passing. Damage to the gyro may result.

(2) For Trouble Shooting, B-3 Driftmeter, see Table 6-5.

B-5 DRIFTMETER

26 This paragraph contains instructions for the removal, servicing, installation and alignment of the B-5 Driftmeter.

(a) Removal - Remove B-5 Driftmeter as follows:

(1) Lift guide pins out of detents in channel rails and slide instrument out.

(b) Servicing - Minor repairs and parts replacement will be limited to cleaning the eyepiece, reticle and outside mirror surfaces, tightening screws, and replacing pencil in pencil tube. Wipe lenses and mirror gently with a soft, clean cloth dampened with clean water. See that the pencil has a good point. Make sure it does not raise the pantograph arm, causing it to bind in its slot. The pantograph arm, reticle bearing and connecting arm may be oiled as needed with a drop of instrument oil, Specification AN-0-11. Wipe off excess oil.

CAUTION

The optical glass from which the lenses and outside mirror are made is soft and easily scratched. Before they are wiped clean, any grit, filings, etc., must be removed with a soft brush or air jet. Avoid glass cleaners containing alcohol, since they may soften the shellac with which the mounting screws are cemented in place. The inside mirror is a single-surface mirror and cannot be cleaned.

(c) Installation - Install B-5 Driftmeter as follows:

(1) Depress the tension spring in the end of each channel rail with the fingers and slide the instrument on the rails in the aircraft structure. The guide pin in the centre of each rail will drop into a detent when the instrument is correctly positioned.

(d) Alignment - The Type B-5 Driftmeter should be aligned with the aircraft on the ground as follows:

(1) Place the aircraft in a normal flying position (level as in Figures 1-10 and 1-11).

(2) Stretch a cord on the ground parallel to the aircraft's longitudinal axis and so positioned that when viewed through the driftmeter eye lens, it will appear near the centre of the reticle.

(3) Move the indicator knob of the indicator dial to the right or left until the drift lines on the reticle are parallel to the stretched cord.

(4) The pointer on the indicator dial should read "0" on the drift scale. If it does not, loosen the screws on each end of the scale and slide scale to the right or left until the "0" is in line with the pointer.

(5) Tighten securely the screws holding the scale.

B-3 DRIFTMETER

27 This paragraph contains instructions for the removal, servicing, installation and alignment of the B-3 Driftmeter.

(a) Removal - Remove the Type B-3 Driftmeter as follows:

(1) Disconnect electrical wiring.

(2) Remove four screws holding the driftmeter to the shock mountings.

(3) Lift driftmeter out.

(b) Servicing - Maintenance of the driftmeter unit should consist of cleaning the lenses, (Paragraph 26(b), this Section) tightening screws and replacement of the 3-volt

lamp assembly. No part of the electrical or gyroscope systems is to be lubricated.

(c) Installation - Install the B-3 Driftmeter as follows:

(1) Place driftmeter in position on the aircraft and install the four screws that hold the driftmeter to the shock mountings.

(2) Connect electrical wiring.

(d) Alignment - The B-3 Driftmeter should be aligned as follows:

(1) Cage gyro.

(2) Position index pointer at "0" on the drift scale.

(3) Lay out a straight line on level ground.

(4) Place the aircraft in a level flight position (see Figures 1-10 and 1-11), so its longitudinal axis is parallel to the line.

(5) Stand about six feet to the rear of the aircraft and sight along the centre line to a distant object.

(6) Rotate unit until index is near "0" on the drift scale.

(7) By means of the line-of-sight control handle and the azimuth drive or tangent screw knob, sight through the unit upon the distant object and bring it into the centre of the reticle. If necessary, loosen the two screws holding the index pointer, and adjust the pointer until its reference point is exactly opposite the "0" degree point on the drift scale.

(8) Tighten the two screws which hold the index pointer, and secure the pointer in place.

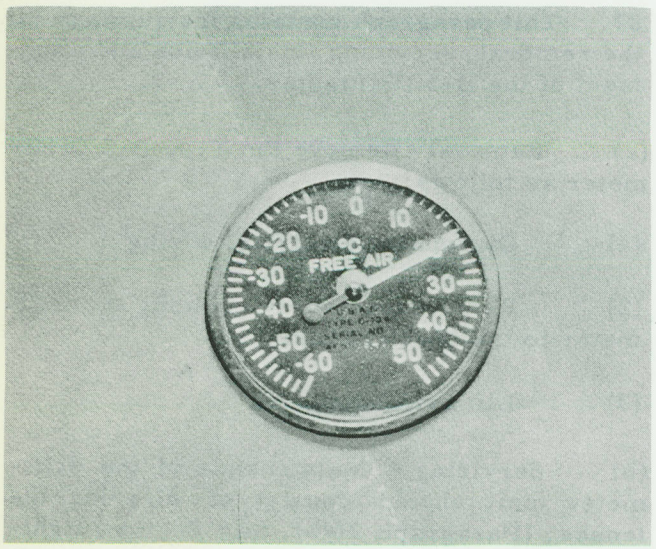


Figure 6-5 Outside Air Temperature Indicator

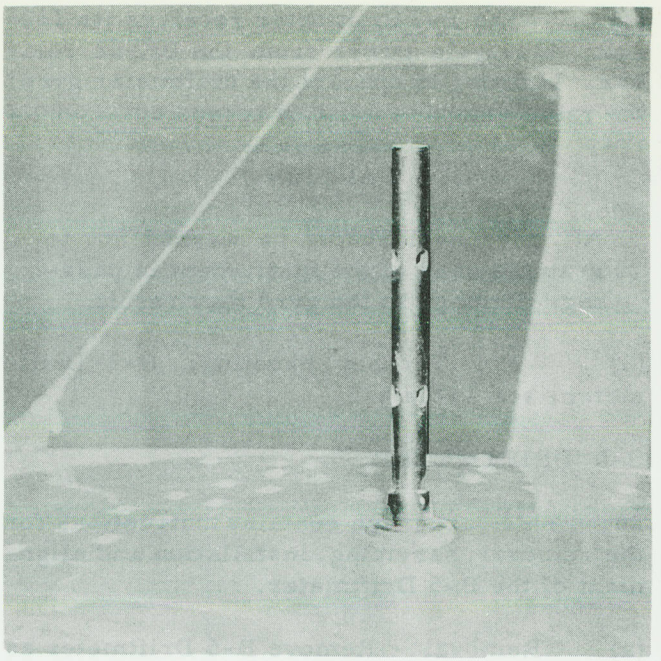


Figure 6-6 Outside Air Temperature Bulb

NOTE

It is advisable to set the driftmeter at 180 degrees on the drift scale before landing and take-off to prevent breakage of the driftmeter glass by stone.

DIRECT READING OUTSIDE AIR THERMOMETER

28 To assist the pilot in checking the critical range of carburettor icing, a free air temperature guage is fitted to the cockpit ceiling above the pilot's windshield, (Figure 6-5). The bulb of the thermometer passes through a rubber grommet in the skin of the aircraft, (Figure 6-6). A micarta spacer is fitted between the skin and the upholstery and houses the thermometer bulb.

ENGINE INSTRUMENTS

GENERAL DESCRIPTION

29 Engine indicating instruments consist of a dual tachometer indicator with two electric tachometer generators, a dual manifold pressure gauge, a dual cylinder head temperature indicator, a dual carburettor air temperature indicator, two engine gauge units and two fuel pressure warning lights. Refer to Figures 6-1 and 6-3. For Trouble Shooting, Engine Instruments, see Table 6-6.

(a) Dual Tachometer Indicator - The dual tachometer indicates the RPM of the two engine crankshafts. The instrument has a single dial and dual pointers, is graduated from 0 to 4500 RPM and is connected to the two tachometer generators by the respective cannon connections on the back of the instrument. Alternating current is transmitted from the generators to the indicator rotors, which revolve at a rate directly proportional to the engine speed.

(b) Tachometer Generators - The tachometer generators are mounted directly to the tachometer drive connections of the engine. The generators produce three-phase alternating current.

(c) Dual Manifold Pressure Gauge - The manifold pressure gauge consists of two sets of two connected metallic bellows, one evacuated and the other subjected to manifold pressure, that give indication of pressure in the intake manifolds of their respective engine under all operating conditions. The dual indicator, which has a single dial and dual pointers, is graduated from 10 to 75 inches of mercury (Hg).

(d) Dual Cylinder Head Temperature Indicator - The complete cylinder head temperature installation consists of a dual indicator, calibrated leads and two thermocouples. The indicator has a dual scale graduated from 0°C to 350°C (32°F to 662°F). The instrument is connected through the calibrated leads to a thermocouple gasket under the rear spark plug of #9 cylinder, on the right-hand engine, and of #2 cylinder, on the left-hand engine.

(1) The cylinder head temperature leads consists of iron-constantan leads from the gasket type thermocouples to connectors installed on the firewalls. From the connectors on the firewall, the leads are connected to their respective terminals on the back of the indicator.

(e) Dual Carburettor Air Temperature Indicator - The dual carburettor air temperature indicator is an electric resistance-type thermometer that is designed to operate in conjunction with resistance bulbs, located below the carburettors. The instrument, having a dual scale and graduated from minus 70°C to plus 150°C (minus 94°F to plus 302°F), is connected electrically to the respective resistance blub. Power for this instrument is supplied by the 24 volt d-c system.

(f) Engine Gauge Unit - The engine gauge unit for each engine is comprised of three instruments within one case; an oil temperature indicator with a scale range from minus 70°C to plus 150°C (minus 94°F to plug 302°F), a fuel pressure gauge with a range from 0 to 25 psi and an oil pressure gauge with a range from 0 to 200 psi. The oil temperature indicator operates on a ratiometer principle with a resistance bulb installed in the "Y" drain. Power for this instrument is supplied by the aircraft 24 volt d-c system. The two other instruments, fuel pressure and oil pressure, are conventional pressure type gauges.

(g) Fuel Pressure Warning Lights - The fuel pressure warning lights are controlled by warning signals which are located on the back of the firewall of each engine. The warning signals are sensitive fuel pressure gauges with electric contacts. The red warning lights come on when the pressure drops below 2.25 psi.

(h) When installing new fuel pressure switch Part 94-32215, ensure that air port plug has a hole drilled through (using #48 drill) bottom of plug meeting locking wire hole, thus allowing atmospheric pressure into switch.

GENERAL REMOVAL AND INSTALLATION, ENGINE INSTRUMENTS

30 The removal and installation of the following engine instruments is straight forward and, therefore, require no detailed information: Tachometer Indicator, Manifold Pressure Gauge, Carburettor Air Temperature Indicator, Engine Gauge Units and Fuel Pressure Warning Signals.

CYLINDER HEAD TEMPERATURE INDICATOR LEADS

31 This paragraph contains instructions for

the removal and installation of the cylinder head temperature indicator leads.

(a) Removal - To remove the cylinder head temperature indicator leads, proceed as follows:

(1) Remove the thermocouple gaskets by unscrewing the rear spark plugs of #9 cylinder, on right hand engine, and #2 cylinder, on left hand engine.

(2) Disconnect the thermocouple leads from the connectors on the firewall.

(3) Remove the lead assemblies.

(b) Installation - To install the cylinder head temperature indicator leads, proceed as follows:

(1) Connect the thermocouple lead to the connector assembly located on the firewall.

(2) Guide the lead up the tachometer generator lead, along the engine mount tube and through the fixed inner engine cowling.

(3) Connect the thermocouple gasket under the rear spark plug of #9 cylinder on the right-hand engine.

(4) Connect the thermocouple gasket under the rear spark plug of #2 cylinder on the left-hand engine.

(5) Connect the indicator leads to the connector assembly on the aft side of the firewall. Before connecting the lead to the indicator, check the pointer setting by comparing it with an accurate thermometer placed near the indicator. Allow the indicator time to acquire the same temperature as the surrounding air, then adjust the pointer, by means of the zero adjusting screw, to the temperature indicated by the thermometer.

(6) Complete the installation by connecting the leads to the indicator.

TROUBLE	PROBABLE CAUSE	CORRECTION
TACHOMETER INDICATOR		
1 No reading on indicator.	(a) Tachometer generator defective.	(a) Use voltmeter to check tachometer generator output. If defective, replace.
	(b) Defective indicator.	(b) Replace.
	(c) Open circuit.	(c) Check circuit continuity repair.
	(d) Defective tachometer drive mechanism.	(d) Remove tachometer generator and check drive mechanism on engine.
OIL TEMPERATURE AND CARBURETTOR AIR TEMPERATURE		
2 Full scale reading on the high scale.	(a) Open circuit in the resistance bulb.	(a) Replace bulb.
3 No reading.	(a) Broken power lead or poor connection in receptacle.	(a) Check continuity of wiring and receptacle connection.
MANIFOLD PRESSURE		
4 Incorrect reading on indicator.	(a) Moisture in line.	(a) Disconnect line at indicator and blow out.

Table 6-6 Trouble Shooting, Engine Instruments

TROUBLE	PROBABLE CAUSE	CORRECTION
MANIFOLD PRESSURE		
	(b) Line Leak.	(b) Tighten connections.
CYLINDER HEAD TEMPERATURE		
5 Incorrect reading on indicator.	(a) Break in lead. (b) Break in thermocouple (c) Poor connection at thermocouple connectors. (d) Reversed leads at the instrument.	(a) Replace lead. (b) Replace thermocouple. (c) Clean and tighten terminals. (d) Check connections.
FUEL AND OIL PRESSURE		
6 Sluggish or nil indication on gauge.	(a) Leaking, blocked or broken pressure line.	(a) Check line and tighten fittings or replace line.
FUEL PRESSURE WARNING SIGNAL		
7 Light not on below 2.25 psi.	(a) Light bulb burnt out. (b) Open circuit in wiring. (c) Contacts not making contact.	(a) Replace bulb. (b) Use voltmeter to check power or ohmeter to check continuity. (c) Check and adjust moveable contact.
8 Light on above 2.25 psi.	(a) Contacts stuck or not adjusted correctly.	(a) Check and re-adjust.

Table 6-6 Trouble Shooting, Engine Instruments (continued)

TROUBLE	PROBABLE CAUSE	CORRECTION
MANIFOLD PRESSURE		
	(b) Line Leak.	(b) Tighten connections.
CYLINDER HEAD TEMPERATURE		
5 Incorrect reading on indicator.	(a) Break in lead.	(a) Replace lead.
	(b) Break in thermocouple	(b) Replace thermocouple.
	(c) Poor connection at thermo-couple connectors.	(c) Clean and tighten terminals.
	(d) Reversed leads at the instru-ment.	(d) Check connections.
FUEL AND OIL PRESSURE		
6 Sluggish or nil indica-tion on gauge.	(a) Leaking, blocked or broken pressure line.	(a) Check line and tighten fittings or replace line.
FUEL PRESSURE WARNING SIGNAL		
7 Light not on below 2.25 psi.	(a) Light bulb burnt out.	(a) Replace bulb.
	(b) Open circuit in wiring.	(b) Use voltmeter to check power or ohmeter to check continuity.
	(c) Contacts not making contact.	(c) Check and adjust moveable contact.
8 Light on above 2.25 psi.	(a) Contacts stuck or not ad-justed correctly.	(a) Check and re-adjust.

Table 6-6 Trouble Shooting, Engine Instruments (continued)

PART 7

ELECTRICAL SYSTEM

GENERAL DESCRIPTION

1 A 28-volt d-c system provides energy for the electrically operated system and accessories of the aircraft. The primary source of energy is two 28-volt d-c generators, one on each engine. They power all electrical equipment and maintain the charge in the two 12-volt, series connected, batteries.

(a) Battery System - The battery system is made up of two AR-12-36 12-volt batteries, see Figure 7-1. The batteries are connected in series to furnish 24-volt current. Solenoid switches, controlled by a battery master switch on the pilot's left subpanel connect the batteries to the main electrical system. The master switch energizes the main distribution post in the belly of the aircraft, the bus bar in the subpanel, and the starter relays in the wheel well. For Trouble Shooting, Battery System, see Table 7-1.

(b) Starter System - One Jack and Heintz J-1 starting motor is installed on each engine. The armature terminal is grounded to the aircraft. The motor is controlled through a Type B-8A solenoid switch (starter relay) located on the inboard side of the wheel well just aft of the firewall. The solenoid switches are operated by a push button switch and a starter selector switch on right subpanel (Figure 7-2). For Trouble Shooting, Starter System, see Table 7-2.

(c) Generator System - A type 30E-16-1-A 100 ampere generator, geared to run at twice engine speed, is mounted on the top of each engine accessory casing. The harness is encased in "transflex" tubing and passes to a plug on the firewall. The negative lead from the generator is grounded to one starter mounting bolt, the remaining leads being connected to the generator controls in the control box. A control box for each generator

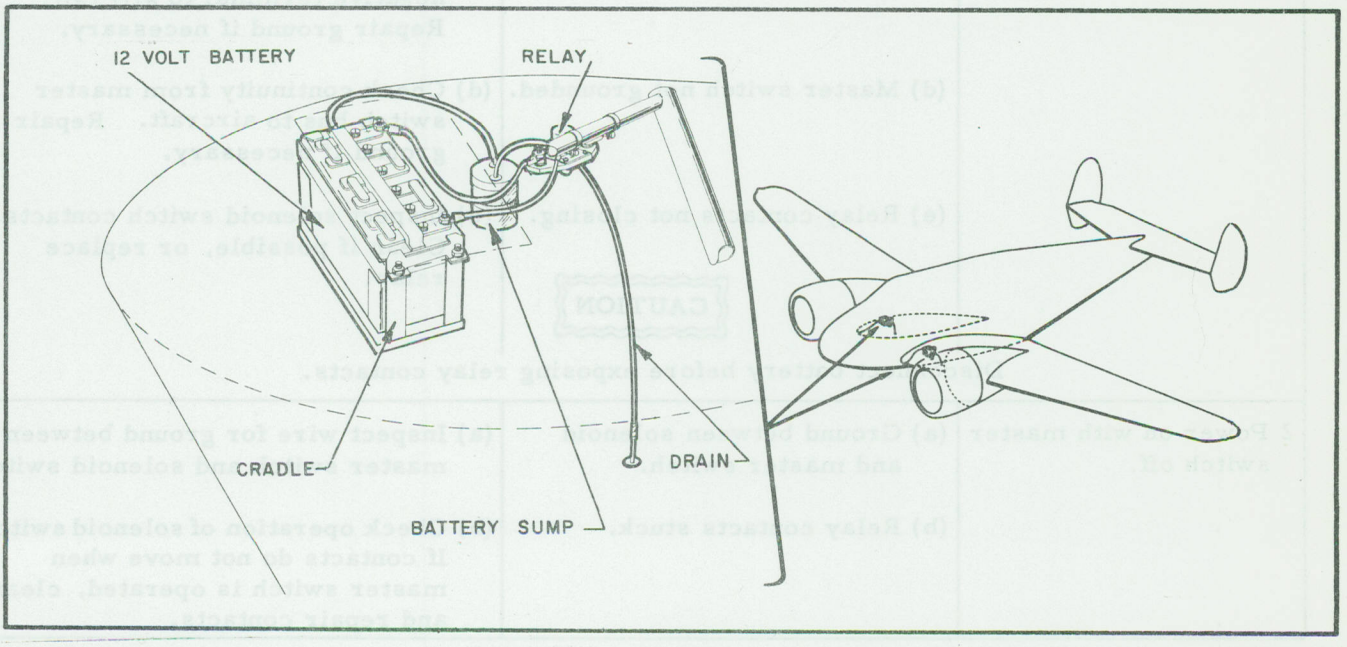


Figure 7-1 Battery Vent System

is mounted in the leading edge, forward of the battery installation in 3N, 3NM and 3TM aircraft, and on the main spar bulkhead in the 3T version. Each box contains a voltage regulator, reverse current relay and adjustable type resistor. In 3N, 3NM and 3TM aircraft, rheostats for adjustment of the voltage regulators are mounted within a box on the left rear face of the main spar bulkhead. Initial adjustment is made in the control box. Fine adjustment is carried out within the fuselage during flight. The generator master switches and voltammeters are located on the pilot's sub-panel.

(d) Landing Gear System - The landing gear electrical system consists of the landing gear position switch, upper limit switch, lower limit switch, position light switches, switch latch, safety switch, dynamic brake relay, warning horn switches and warning horn cut-out relay, undercarriage emergency override switch and relay.

(e) Lighting Systems - The lighting systems consist of interior lighting, exterior lighting, flasher unit and landing lights.

BATTERIES

2 The batteries are located in each wing between the fuselage and nacelle, just ahead of the main spar.

TROUBLE	PROBABLE CAUSE	CORRECTION
1 No power indicated with battery master switch on.	(a) Batteries dead.	(a) Check batteries; replace if discharged.
	(b) Open circuit between battery and master switch.	(b) Check, all terminals and connections for tightness. Check solenoid primary circuit; replace solenoid if defective. Check continuity from solenoid to master switch. If faulty, repair or replace wire.
	(c) Battery not grounded.	(c) Check continuity from battery negative terminal to aircraft. Repair ground if necessary.
	(d) Master switch not grounded.	(d) Check continuity from master switch bus to aircraft. Repair ground if necessary.
	(e) Relay contacts not closing.	(e) Inspect solenoid switch contacts. Clean if possible, or replace relay.
	CAUTION	
	Disconnect battery before exposing relay contacts.	
2 Power on with master switch off.	(a) Ground between solenoid and master switch.	(a) Inspect wire for ground between master switch and solenoid switch.
	(b) Relay contacts stuck.	(b) Check operation of solenoid switch. If contacts do not move when master switch is operated, clean and repair contacts.

Table 7-1 Trouble Shooting, Battery System

(a) Removal - Remove each battery as follows:-

(1) Make sure battery master switch on pilot's left subpanel is in "OFF" position. Remove battery access panel.

(2) Loosen and remove wing nuts holding battery on stand. Remove battery cover.

(3) Disconnect vent hose at battery.

(4) Disconnect battery terminals from battery and tape exposed terminals to prevent accidental short while removing battery.

(5) Lift battery from aircraft.

CAUTION

Neutralize any electrolyte spilled from battery with water solution of sodium bicarbonate.

(b) Installation - Install each battery as follows:-

(1) Make sure battery master switch on

TROUBLE	PROBABLE CAUSE	CORRECTION
1 Both starters inoperative.	(a) Circuit breaker tripped in starter switch circuit.	(a) Reset circuit breaker.
	(b) Battery master switch inoperative.	(b) Check cockpit lights. If inoperative, check switches and battery solenoids.
	(c) Low batteries.	(c) Test batteries. If low, replace or start with external power.
	(d) Open circuit.	(d) Check all connections and wiring in starter system.
2 One starter inoperative.	(a) Solenoid switch inoperative.	(a) Test operation of solenoid. If inoperative, test coninuity from starter terminal to solenoid terminal. Check terminal connections and ground at solenoid. If solenoid-energizing circuit is closed and solenoid switch does not operate, replace it.
	(b) Poor ground at motor.	(b) Test continuity from armature lead to ground. Repair if necessary.
	(c) Break in circuit between solenoid switch and motor.	(c) Test continuity. Repair if necessary.
	(d) Defective starting motor.	(d) Check brushes, springs and condition of commutator. Repair or replace as required.
3 Starter solenoid chatters when starter is turned on.	(a) Low batteries.	(a) Check batteries. Recharge if necessary.

Table 7-2 Trouble Shooting, Starter System

pilot's left subpanel is in "OFF" position.

(2) Tape exposed terminals to prevent accidental short during installation.

(3) Set battery in place, terminals toward engine.

(4) Connect vent hose to battery.

(5) Put battery cover in place and tighten down wing nuts, securing battery.

(6) Install terminals on battery, replace access panel.

(c) Testing - Place battery master switch in "ON" position. Test polarity of subpanel bus-bar with d-c voltmeter. (Negative lead of voltmeter to ground). A positive voltage indicates proper installation of battery.

STARTER

3 A Jack and Heintz J-1 starting motor is installed on each engine. The starter is operated by means of a switch mounted on pilot's console (Figure 7-2). For Trouble Shooting of the starter system, see Table 7-2.

(a) Removal - Remove each starter as follows:-

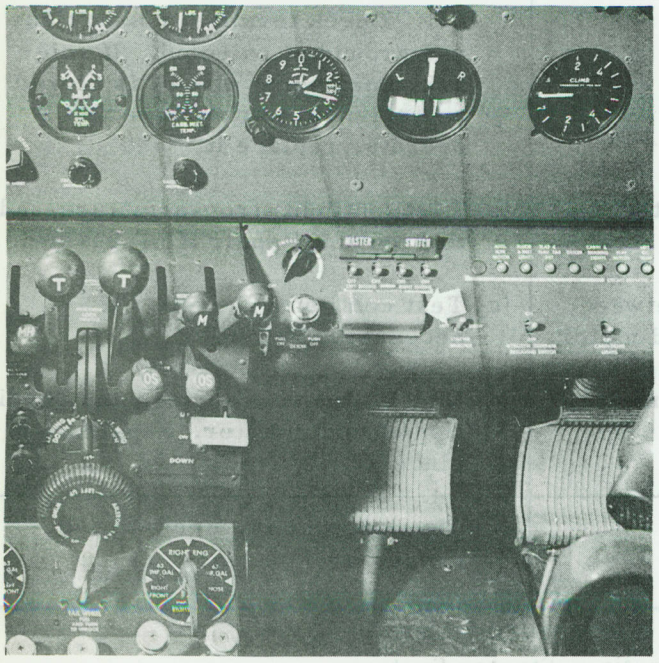


Figure 7-2 Engine Starter Switch

(1) Remove engine cowling.

(2) Disconnect wiring from starter.

(3) Remove mounting nuts holding the starter to the engine and lift starter back and out.

(b) Servicing - To ensure proper operation during periods between inspections, replace starter brushes which are worn to minimum permissible length of 11/32 inch. Replace starter brush spring if tension is less than 24 ounces or more than 28 ounces, measured when the spring leaves the top of a new brush. If the commutator is rough or dirty, smooth with No. 000 sandpaper. If it is badly scored, the starter must be replaced.

NOTE

Do not attempt repairs on starter in the field, other than external cleaning, replacement of brushes and springs, or cleaning the commutator.

(c) Installation - Install each starter as follows:-

(1) Slide starter forward against mounting pad. Rotate starter to position the positive electrical terminal at approximately 11 o'clock on the left hand engine and approximately 2 o'clock on the right hand engine. Install mounting bolts.

(2) Connect wiring to starter. Install terminal cover with conduit outlet between the four and eight o'clock positions.

(3) Fit engine cowl.

IGNITION SYSTEM

4 Each engine is equipped with a dual ignition system and dual magnetos. Individual "ON" "OFF" switches for the four magnetos are located on the right subpanel (Figure 7-3). The switches may be operated separately, or closed all at once by means of a hinged throw-bar. Components of the system are shielded to prevent radio interference.

TROUBLE SHOOTING

5 Trouble in the ignition circuit other than magnetos is usually found to be a grounded or broken switch wire. A continuity check will usually locate the trouble.

ADVANCE REVISION

Serial #4 dated 22 Jan 60
(Sheet 1 of 1)

(This Advance Revision replaces Advance Revision serial #3)

The sheet of this Advance Revision is to be inserted in the EO as follows:-

Sheet 1 facing page 7-4

The following sub-para. 3(c) is to be read in lieu of the existing sub-para. 3(c):-

(c) Installation - Install each starter as follows:-

(1) Slide starter forward against mounting pad. Rotate starter to position the positive electrical terminal at approximately 11 o'clock on the left hand engine and approximately 2 o'clock on the right hand engine. Install mounting bolts.

(2) Connect wiring to starter. Install terminal cover with conduit outlet between the four and eight o'clock positions.

(3) Fit engine cowl.

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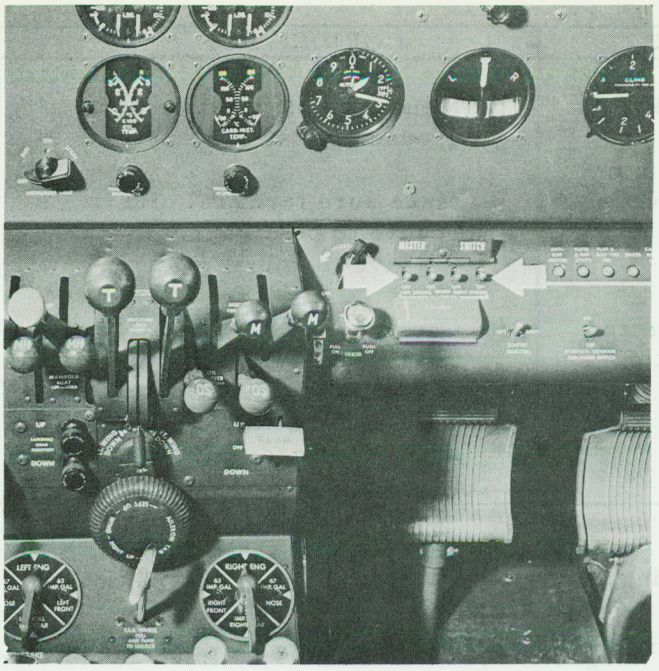


Figure 7-3 Ignition Switch

INDUCTION VIBRATOR

6 When starting, the engines do not turn over fast enough for the magnetos to produce a hot spark. For this reason an induction vibrator is included in the starting ignition circuit to energize the primary coil of the magneto and furnish a strong spark (Figure 7-4). Expeditor 3NM and 3TM aircraft, beginning with Serial CA-155 and after, except CA-281, are equipped with AN4181-1 induction vibrators. Expeditor 3 Series aircraft, Serials CA-176 through CA-261, except CA-195 through CA-200, the magneto harness assemblies were modified to allow Scintilla magnetos (SB9R) to be used in place of American Bosch magnetos (SB9RU-3). The magneto harness modification allows for the installation of an AN4181 type induction vibrator.

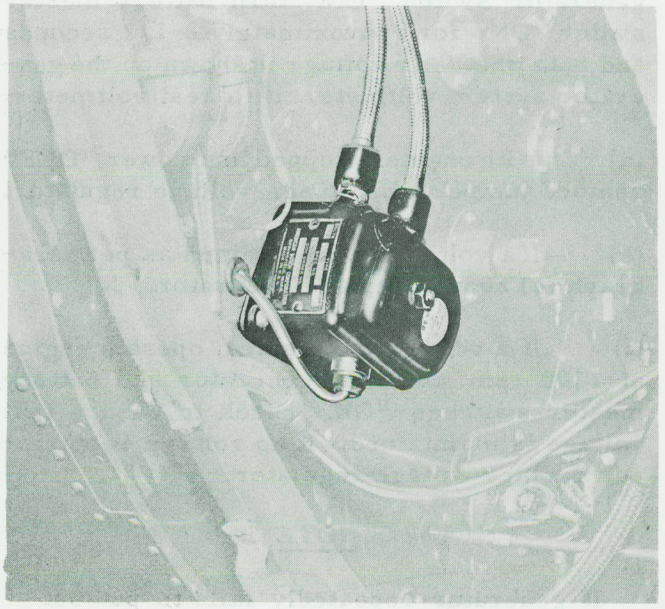


Figure 7-4 Induction Vibrator

(a) Trouble Shooting - A number of so-called vibrator troubles may be caused by faulty spark plugs, defective switch cable or switch, damaged or incorrect external wiring, or low battery. In Table 7-3 it is assumed that these items have been separately investigated, with faults having been traced directly to the induction vibrator.

(1) In addition to the probable causes listed on the trouble shooting chart, failure of the unit to function may be caused by internal open circuit, excessively worn or pitted vibrator points or improper relay point opening. Only the remedies listed in the trouble shooting chart should be attempted by maintenance personnel. If the remedies listed in the table do not correct the trouble, remove the unit, tag unserviceable, and return to stores.

CAUTION

Do not attempt to make any adjustments while the unit is installed on the aircraft.

(b) Removal - To remove the induction vibrator, disconnect the wiring plugs from the vibrator and remove the mounting screws which secure it to the firewall.

(c) Installation - To install the vibrator, secure it to firewall with its mounting screws and connect wiring plugs to their proper terminals.

GENERATOR FAILURE WARNING LIGHT SYSTEM

7 The purpose of the generator failure warning lights is to indicate failure of one or both generators, or to indicate if current is drawn from the batteries or from the generators.

TROUBLE	PROBABLE CAUSE	CORRECTION
1 Vibrator inoperative.	(a) Unit not grounded.	(a) Mounting bolt must be contacting grounding plate.
	(b) Loose or disconnected.	(b) Make sure terminal clip is secure to positive cable and positive terminal post.
	(c) Loose or disconnected "MAG." or "IGN. SW." terminals.	(c) Check to see that "MAG." and "IGN. SW." cables are secured to terminal nuts with springs. Tighten slotted nuts so a firm contact is made with the terminal within the unit.

Table 7-3 Trouble Shooting, Induction Vibrator

(a) The reverse current relay is designed to close the generator circuit when the output voltage is from 20 to 24 volts; provided this exceeds the bus bar voltage by .35 to .65 volts with the generator switch in the "ON" position. The relay automatically disconnects the generator from the bus system when a 16 to 25 ampere current is flowing from the batteries to the generator. The relay is mounted in a box under the pilot's compartment floor between the co-pilot's seat and the main spar. This relay is not adjustable on the aircraft.

(b) When the generator is connected to the system, the warning light is OFF.

(c) When the reverse current is disconnected, the relay is energized and the warning light comes ON.

(d) If one or both generators fail in flight, the light (or lights) will automatically come ON.

(e) The generator failure warning lights are located on the main instrument panel (see Figure 6-1).

(f) The generators normally cut in at approximately 900 RPM.

FLASHING GENERATOR FIELD

8 If a generator fails to build up voltage because of reversed polarity, loss of residual magnetism, or excessively filmed commutator, flash the field as follows:-

(a) With engines stopped and power "OFF" remove voltage regulator from generator circuit.

(b) Using a jumper of #18 gauge wire or larger, connect the battery terminal on the reverse current relay to the "A" terminal on the voltage regulator base.

(c) With engines operating at 1300 rpm and generator switch "ON" turn battery master switch "ON" for approximately 2-1/2 seconds and note whether a voltage is shown on the generator system voltmeter, or a test voltmeter.

(d) With engines stopped and power "OFF" remove jumper and replace voltage regulator.

(e) If a voltage is not obtained as per paragraph (c) above, replace generator.

(f) If a voltage is obtained, operate engine at 1300 rpm and with generator and battery master switches "ON" check to ensure that voltage is maintained. If no voltage is obtained, replace voltage regulator.

NOTE

If generator repeatedly fails to put out voltage on run-up, check generator to

see if the commutator is dirty or excessively coated with oil, etc. Clean commutator sufficiently to obtain continued operation. The commutator need not be cleaned to a bright surface. A slight lubrication film, identifiable as a bronze discoloration, is desirable for high generator load and high altitude operation.

WARNING

Do not flash generator field by closing reverse-current relay contacts. Serious damage to the relay, to the electrical system, and injury to the person closing the contacts may result from the heavy current drawn from the battery.

GENERATOR

9 A type 30E-16-1-A 100 ampere generator is mounted on the top of each engine accessory casing. For Trouble Shooting, Generator, (refer to Table 7-4).

(a) Removal - To remove the generator, proceed as follows:

(1) Loosen the hose clamp and disconnect the flexible ram air hose at the generator.

(2) Disconnect and tag the electrical leads to the generator terminals.

(3) Remove the four castellated nuts that secure the flange to the engine casing and remove the generator.

(b) Servicing - Repair of generators in the field should be limited to external cleaning, replacement of brushes and cleaning of commutator.

(1) Check the length of each brush. The minimum permissible length is 9/16 inch. Replace worn brushes before their minimum length is reached to ensure satisfactory operation of the generator until the next brush inspection. Replace any brush if the pigtail is damaged or broken. Re-solder loose terminals. Seating new brushes shall be carried out in accordance with EO 40-10BL-3, Repair and overhaul Instructions, Generator 30E-16-1-A.

(2) If the commutator is rough or dirty, smooth with No. 000 sandpaper. If roughness, scoring, or pitting is extreme, generator should be tagged as unserviceable and returned to stores.

CAUTION

Ensure that procedures detailed in EO 40-10BL-6A/1 have been complied with when replacing spline drive shaft.

(c) Installation - To install generator, proceed as follows:

(1) Check to see that gasket is in good condition and is properly located on engine mounting pad.

(2) Remove brush cover and visually inspect commutator and brushes.

(3) Turn armature and check for free rotation.

(4) Replace the brush cover.

(5) Refit the generator and secure with four nuts. Wirelock the nuts.

(6) Reconnect the leads to the generator terminals.

(7) Fit the flexible hose to the generator air inlet. Tighten the hose clamp.

(8) Replace the engine cowling.

ADJUSTMENT OF GENERATOR CIRCUITRY

10 Regulate the voltage as follows:

NOTE

Paragraph 10(a) refers to the Expeditor 3T aircraft only, in which the generator control boxes are located within the aircraft cabin.

(a) To regulate the voltage on the Expeditor 3T aircraft, proceed as follows:

(1) Adjust both generator voltage control rheostats to their mid-travel positions.

(2) Connect a precision voltmeter between the "GEN" terminal of the reverse current relay and the aircraft structure.

(3) Adjust the semi-fixed resistor in the

TROUBLE	PROBABLE CAUSE	CORRECTION
1 Zero or low voltage indicated.	(a) Loose connector or open circuit.	(a) Check connections at generator, firewall, control box, voltmeter and voltmeter selector switch. Check continuity of circuits.
	(b) Open or shorted field circuit in generator, defective armature.	(b) Test resistance of field. Resistance should be 3 Ohms. Check field circuit connections. Replace generator if defective.
	(c) Brushes binding in holders, weak brush springs	(c) Clean brushes and holders with a clean lint-free dry cloth; replace weak springs.
	(d) Brushes worn out.	(d) Replace brushes if worn to a length of 1/2 inch or less.
	(e) Dirty commutator.	(e) With generator running, polish commutator with No. 000 sandpaper.
	(f) Defective voltmeter.	(f) Replace voltmeter.
	(g) Loss of residual magnetism.	(g) Flash generator field.
	(h) Defective regulator.	(h) Replace regulator.
	(j) Generator not turning.	(j) Check generator shaft. Replace generator if necessary.
2 No generator output.	(a) Engine speed too low.	(a) Increase engine speed until voltage reaches 27 volts. Turn lights or other load on. Ammeter should show current flow.
	(b) Loose connection or open circuit.	(b) Check all terminals in system for tightness. Check continuity of circuits.
	(c) Defective generator control switch or reverse current relay.	(c) Test switches, replace if defective.
	(d) Brushes not contacting commutator.	(d) Check for worn or sticking brushes, rough or damaged commutator. Service or replace brushes and springs. Sand commutator or replace generator.
	(e) Defective voltage regulator.	(e) Replace regulator.
3 Low generator output.	(a) Voltage regulator out of adjustment.	(a) Set generator voltage at 28 volts.
	(b) High resistance connection.	(b) Tighten generator system connections.
	(c) Worn or sticking brushes.	(c) Check brush length, minimum length is 1/2 inch. Make sure brushes are free in holders.
	(d) Dirty commutator.	(d) Clean commutator with No. 000 sandpaper, use air jet to remove grit.
	(e) Defective generator.	(e) Replace generator if defective.
	(f) Generator voltages not equal.	(f) Adjust regulators to give equal voltage.

Table 7-4 Trouble Shooting, Generators

generator control box so that the slide tap is 1/3 the distance from the grounded end.

(4) Start the engines and run generators with a small load, for a period of 15 to 30 minutes to warm up the voltage regulators.

(5) With the engine speed at 1800 rpm and with right generator "ON" and left generator "OFF", adjust the voltage regulator rheostat knob so that voltmeter reads 28 volts. Turning the knob to the right will increase the voltage and to the left will decrease it.

(6) Repeat steps for left generator with the right generator "OFF".

NOTE

Bus voltage should never be allowed to exceed 28 volts with both generators on.

(7) With both engines running at 1800 rpm and with both generators "ON", turn on a normal cruising electrical load (about 20 amperes) and make a fine adjustment of voltage regulator rheostats so that the two ammeter readings do not differ more than 10 amperes. To make the fine adjustment, turn the rheostat for the generator having the higher load in the direction which decreases the load on that generator. Turn the rheostat for the generator with the lower load in the direction which increases the load on that generator. Rheostats to be adjusted in turn, one notch at a time until required adjustment is reached.

(8) With both generators "ON" and with both engines running at 1800 rpm, turn on maximum electrical load (including landing lights temporarily) and adjust the slide tap on the generator paralleling resistors so that there is no more than 10 amperes difference in the two ammeter readings. To make a generator take more load, move the resistor tap toward the ground end of the resistor. To make a generator take less load, move the tap away from the ground end.

(9) During the test flight, following the ground adjustment, ammeters will be observed for unequal generator load division. Repeat adjustment procedure if necessary.

NOTE

Use a precision portable voltmeter with a 0-30 volt range, accurate with 0.5% to make voltage tests. The voltmeter on the instrument panel should not be used as a test instrument. It is only an indicator for generator operation.

NOTE

Paragraph 10(b) refers to the Expeditor 3N, 3NM and 3TM only, in which the generator control boxes are inaccessible during engine run.

(b) To regulate the voltage on the Expeditor 3N, 3NM and 3TM aircraft, proceed as follows:-

(1) Plug the test voltmeter into the voltmeter jacks in the voltage regulator rheostat box.

(2) Adjust the semi-fixed resistors in the generator control box so that the slide tap is 1/3 the distance from the grounded end. This setting should be matched on both resistors to as high a degree of accuracy as possible.

(3) Start the engines and run generators with a small load, for a period of 15 to 30 minutes to warm up the voltage regulators.

(4) With the engine speed at 1800 rpm and with the right generator "ON" and the left generator "OFF", adjust the voltage regulator control rheostat (located in cabin) so that the voltmeter reads 28 volts.

(5) Repeat the steps for the left generator, with the right generator "OFF".

NOTE

Bus voltage should never be allowed to exceed 28 volts with both generators on.

(6) With both generators "ON" and with both engines at 1800 rpm, turn on maximum electrical load (including landing lights temporarily). If there is more than 10 amperes difference between the two ammeter readings, restore balance by adjusting the voltage reg-

ulator control rheostats to bring the high generator down and the low generator up in equal steps.

(7) Gradually decrease the load and check that the ammeter readings do not differ by more than 10 amperes throughout the entire load range. When all possible load has been switched "OFF", take voltage readings on the test meter of each generator with the opposite generator switched "OFF". These voltages should not differ by more than 0.5 volts.

(8) If any of the limits in the preceeding paragraph are exceeded, repeat the adjustments in paragraphs (4) to (6) inclusive. The slide tap of the equalizer resistor of the generator which shared the greater portion of the load is to be moved one notch away from the grounded end. The other generator resistor slide tap is to be moved one notch toward the grounded end.

(9) Repeat these adjustments until specified limits are maintained.

REGULATOR ADJUSTMENT

11 With both engines running at the same rpm, equalize the generator outputs by adjusting one of the voltage control rheostats until the outputs as indicated on the instrument panel ammeters are equal. A difference of five amperes between the outputs of the generators is permissible.

REVERSE CURRENT RELAY

12 This relay (AN3025-1) prevents reverse current, in excess of 25 amperes, from flowing from the battery or bus to the generator. The differential voltage type of relay accomplishes this by automatically connecting the generator, which it controls, to the battery or electrical bus system when the generator builds up a voltage greater than that of the bus. Likewise, it automatically disconnects the generator from the battery or bus when the generator voltage drops to a value lower than that system. The relay will operate when the generator voltage is from 20-24 volts, provided this voltage exceeds the bus voltage by .35 to .65 volt, and the generator switch is in the "ON" position. The relay automatically disconnects the generator from the bus when from 16 to 25 amperes of reverse current is flowing from the battery to the generator.

(a) Testing for Operation - Turn "ON" battery switch, start engine and check relays for proper operation by slowly accelerating engine and noting that the ammeter indicates a charging current; retard engine slowly and note that ammeter pointer goes to negative side of scale, then abruptly returns to "O".

NOTE

Since this is a delicate device, the cover should not be removed except for overhaul and adjusting by authorized personnel. Therefore, if the relay is inoperative or malfunctioning it should be removed, tagged as unserviceable and returned to stores.

LANDING GEAR POSITION SWITCH

13 The landing gear position switch accompanied by an undercarriage emergency override switch and a red (UP) light and a green (DOWN) light, is located on the pilot's control pedestal, see Figure 7-5. This switch is

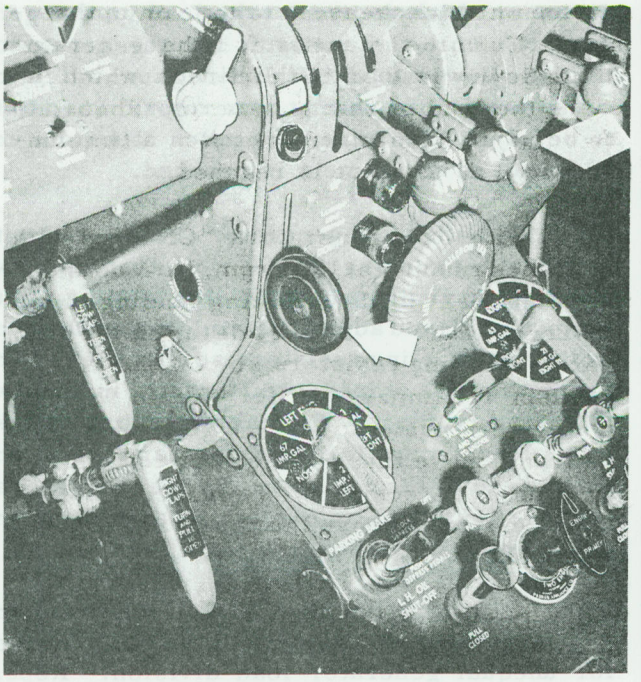


Figure 7-5 (Issue 1) Landing Gear Position Switch

TROUBLE	PROBABLE CAUSE	CORRECTION
1 Landing gear will not retract or lower.	(a) Circuit breaker out.	(a) Check circuit breaker in energizing circuit and circuit breaker in motor circuit.
	(b) Open circuit due to loose or broken wire.	(b) (1) Test continuity from sub-panel circuit breaker to centre terminal. (2) Test continuity from main power terminal in the belly of the aircraft to the solenoid switch bus bar (Terminal 3 on dynamic-brake).
	(c) Improper or loose ground.	(c) Test motor ground lead.
2 Landing gear will lower but not retract.	(a) Open circuit between position switch and dynamic-brake relay.	(a) Test continuity from lower terminal of position switch through landing gear safety switch and up limit switch to the energizing wire terminal of the up solenoid switch (Terminal C-1 on the dynamic-brake relay).
	(b) Up solenoid switch inoperative.	(b) Check operation of up solenoid switch (located in the dynamic-brake relay).
	(c) Open circuit between dynamic-brake relay and up winding in motor.	(c) Test continuity from up solenoid power terminal to Terminal 1 of dynamic-brake relay.
3 Landing gear will retract but not lower.	(a) Open circuit.	(a) Test continuity from up terminal of the position switch through the down limit switch to the energizing wire terminal of the down solenoid (Terminal C-2 on the dynamic-brake relay).
	(b) Down solenoid inoperative.	(b) Check down solenoid.
4 Circuit breaker tripping in energizing circuit.	(a) Ground in circuit.	(a) Test for ground between circuit breaker and centre post at position switch. (b) Test for ground between position switch and solenoid switch on side of energizing circuit that is releasing the circuit breaker. (c) Test for ground between circuit breaker and terminal X1 of under-carriage emergency over-ride relay.
5 Circuit breaker tripping in motor circuit.	(a) Ground in circuit.	(a) Test for ground between main power terminal and solenoid switch bus bar (Terminal 3 on dynamic-brake relay). Test for ground in motor leads. (Leads disconnected from motor).
	(b) Mechanical defect in gear causing overload.	(b) Check landing-gear system for defect causing overload on motor. Check solenoid switch.

Table 7-5 (Issue 1) Trouble Shooting, Landing-Gear

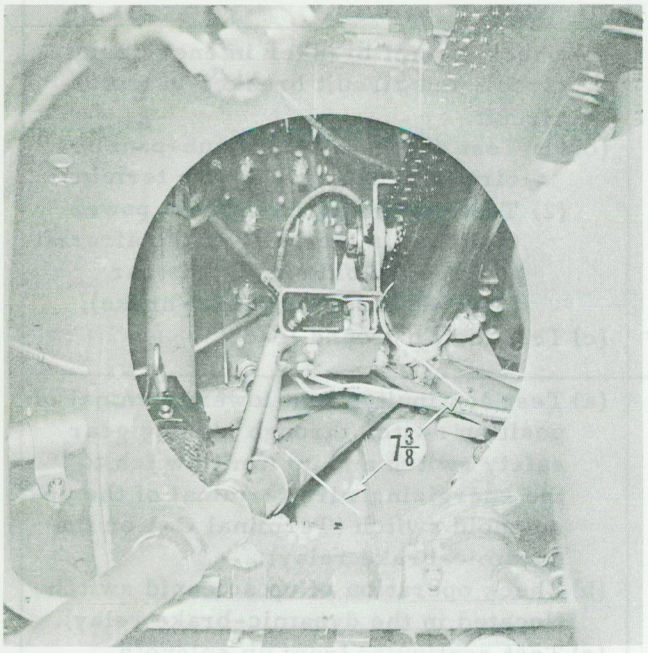


Figure 7-6 Upper Limit Switches

readily identified by a miniature wheel mounted on the switch handle. This switch when actuated, controls the landing gear motor operation, through the dynamic brake relay. Limit switches, safety switches, emergency over-ride switch, emergency over-ride relay and position light switches form the remainder of the circuit. For Trouble Shooting, Landing Gear, see Table 7-5.

CAUTION

Do not reverse undercarriage mid-cycle. Extensive damage to dynamic brake relay contacts can result.

WARNING

Inadvertent operation of the undercarriage emergency over-ride switch and simultaneous raising of landing gear selector handle will cause the aircraft undercarriage to retract if battery power is "ON" or external power is applied to aircraft whether or not the weight is on the gear.

(a) Undercarriage Emergency Over-ride Switch - The undercarriage emergency over-ride switch is located directly above the landing gear selector handle.

(b) Testing of undercarriage emergency over-ride operation as follows:

(1) Support aircraft on jacks so that all the wheels are clear of the floor.

WARNING

When hoisting or jacking the aircraft, always place a minimum ballast of 200 pounds on the horizontal stabilizer to prevent aircraft from nosing over. A felt or canvas pad should be used to protect the horizontal stabilizer, and the ballast should be placed over the front spar near the fuselage.

(2) Adjust actuating bolts on LH and RH scissors so they will not actuate the safety switches with shock struts fully extended.

(3) Apply external power source to aircraft.

(4) Depress undercarriage emergency over-ride switch simultaneously raising landing gear selector handle to "UP" position. Undercarriage will retract in normal manner to up limit position.

(5) Lower undercarriage and adjust safety switches actuating bolts in accordance with EO 05-45B-2, Part 7, paragraphs 17 and 18.

NOTE

Momentary depressing of undercarriage emergency over-ride switch will energize the latch solenoid and emergency over-ride relay. The relay will remain energized but have no effect on normal operation of undercarriage circuit. Relay will de-energize when undercarriage reaches its up limit or power is removed from aircraft.

UPPER LIMIT SWITCH

14 The upper limit switch is mounted on the truss tube near the top of the left nacelle. The switch is operated by the actuator lug

mounted on the slide assembly, and regulates the travel of the landing gear as it is being retracted.

(a) Adjustment - Adjust upper limit switch as follows:

(1) Support aircraft on jacks so that all the wheels are clear of the floor.

WARNING

When hoisting or jacking the aircraft, always place a minimum ballast of 200 pounds on the horizontal stabilizer to prevent aircraft from nosing over. A felt or canvas pad should be used to protect the horizontal stabilizer and the ballast should be placed over the front spar near the fuselage.

(2) Remove upper bolts from both drag legs and swing drag legs down, free of slide.

(3) Position upper limit switch bracket on truss member so the front edge of the forward mounting clamp on the bracket is 7-3/8 inches from the upper stop (see Figure 7-6). Tighten bolts just sufficiently to secure bracket, so that it will move when struck a firm blow with a rubber or rawhide mallet.

(4) Install actuator wedge on upper drag leg bolt and slip bolt into the slide. Do not install drag leg.

(5) Retract slide slowly with handcrank.

(6) Observe clearance between the actuator wedge and the switch bracket. Maintain 1/16 inch minimum clearance.

(7) Position the slide 1/8-inch from the upper stop and by rotating the bracket, set the switch lever roller near the centre of the actuator wedge. Set the switch so the actuator wedge trips it.

(8) Crank gear down and install drag leg. Retract gear electrically and check the position of the slide. Maintain the 1/8-inch gap between the slide and stop.

(9) Make minor adjustments by rotating bracket on the truss.

(10) Extend and retract the gear two or three times to be sure the 1/8-inch gap is maintained. Key all bolts.

NOTE

Make final check with both drag legs installed.

LOWER LIMIT SWITCH

15 The lower limit switch is located at the lower end of the left landing gear slide tube (Figure 7-7), and it regulates the travel of the landing gear as it is being extended. For Trouble Shooting, Limit Switches, see Table 7-5.

(a) Adjustment - Adjust undercarriage lower limit switch as follows:-

(1) Support aircraft on jacks so all wheels are clear.

(2) Retract the gear electrically to upper position and then lower electrically to the lower position. The slide should contact the stop firmly at the bottom of the slide tube, but not with a hard impact.

(3) If the slide hits the stop too hard, retract the gears two or three inches from the lower stop and relocate lower switch mounting bracket slightly forward. If the slide does not hit the stop firmly locate the switches aft. Retract gears electrically and check the upper limit switch setting again. Extend gears electrically and check lower switch setting. Continue until switches are set correctly.

CAUTION

Do not set the lower limit switch to impose an abnormal stress on the landing gear torque shafts and landing gear motor mechanism. To check the load make a mark across the clutch teeth and release the clutch. The resulting "spring-back" of the clutch engaging teeth should be no more than 1/2 the width of one tooth. If this is exceeded, relocate lower switch mounting bracket slightly forward.

(4) Tighten bolts securely holding switch and bracket.

LANDING GEAR POSITION LIGHT SWITCHES

16 The position light switches in right nacelle, control the red and green indicator lights on the pilot's control pedestal, which register the full "UP" or "DOWN" position of the landing gear. When the gear is down the green light is on. When the gear is up there is no light. As the gear is lowered the circuit is closed and the red light comes on and stays on until the down position is reached at which time the green light comes on. As the gear is raised the green light goes out and the red light comes on until the up position is reached and the circuit is opened at which time the red light goes out. At any time the gear is up and BOTH throttles are retarded, the red light will come on. For trouble shooting position light switches see Table 7-7.

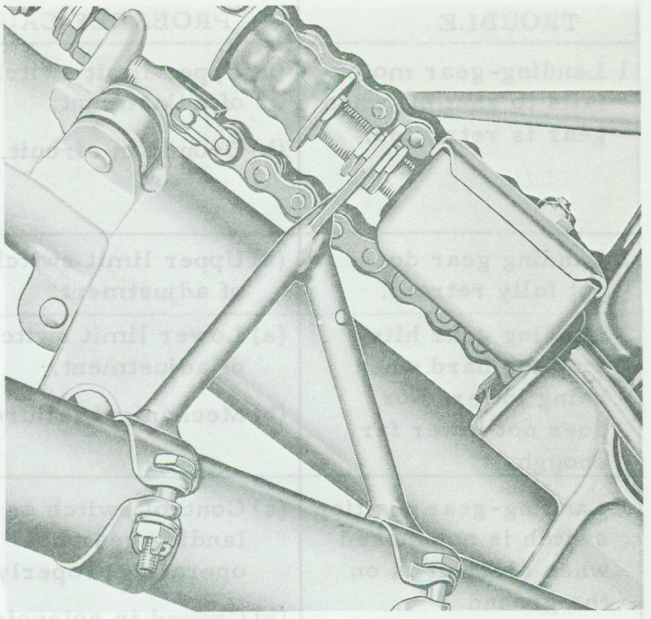


Figure 7-7 Lower Limit Switch

(a) Adjustment of Upper Switch - Adjust upper position light switch as follows:-

(1) Support the aircraft so all wheels are clear of the ground.

WARNING

When hoisting or jacking the aircraft, always place a minimum ballast of 200 pounds on horizontal stabilizer to prevent aircraft from nosing over. A felt or canvas pad should be used to protect the horizontal stabilizer and the ballast should be placed over the front spar near the fuselage.

(2) Retract slide manually until slide is approximately 5/16-inch from full "UP" position.

(3) Loosen switch bracket and set switch so red light just goes out. Maintain 1/16-inch minimum clearance between actuator wedge and switch bracket.

(4) Lower slide, attach both drag legs, then retract; check operation of red light on the pilot's control pedestal.

(5) Tighten switch bracket.

TROUBLE	PROBABLE CAUSE	CORRECTION
1 Landing-gear motor fails to shut off when gear is retracted.	(a) Upper limit switch out of adjustment. (b) Ground in circuit.	(a) Check adjustment of upper limit switch. (b) If switch is adjusted properly, then check for defective switch on ground in circuit.
2 Landing gear does not fully retract.	(a) Upper limit switch out of adjustment.	(a) Adjust upper limit switch.
3 Landing gear hits stop too hard when being lowered or does not lower far enough.	(a) Lower limit switch out of adjustment. (b) Mechanical failure.	(a) Adjust lower limit switches. (b) Check slide mechanism and landing-gear stops. Check for binding of gear.
4 Landing-gear position switch is not locked when aircraft is on the ground.	(a) Control switch on landing gear not operating properly. (b) Ground in solenoid actuating circuit. (c) Solenoid inoperative. (d) Defective undercarriage emergency over-ride switch.	(a) Check adjustment of switch and check for short or ground in switch. (b) Check circuit for ground. (c) Actuate switch on landing gear and check to see if solenoid latch is operating. (d) Check for ground from solenoid to switch and test switch.
5 Undercarriage emergency over-ride relay remains energized.	(a) Ground circuit.	(a) Test for ground from relay to emergency over-ride switch.

Table 7-6 (Issue 1) Trouble Shooting, Limit Switches

TROUBLE	PROBABLE CAUSE	CORRECTION
1 Both lights inoperative.	(a) Circuit breaker tripped. (b) Open circuit.	(a) Check circuit breaker. (b) Check continuity circuit breaker to lampholders.
2 One light inoperative.	(a) Defective light or holder. (b) Defective switch. (c) Open circuit.	(a) Check lamp and holder. (b) Check operation of switch. (c) Test continuity from circuit breaker to lampholder, lampholder to switch, and from switch to ground.
3 One light stays on.	(a) Defective switch. (b) Grounded circuit.	(a) Check operation of switch. (b) Test for ground between light and switch.
4 Circuit breaker tripping.	(a) Defective circuit.	(a) Test for ground between fuse and lights.

Table 7-7 Trouble Shooting, Position Light Switches

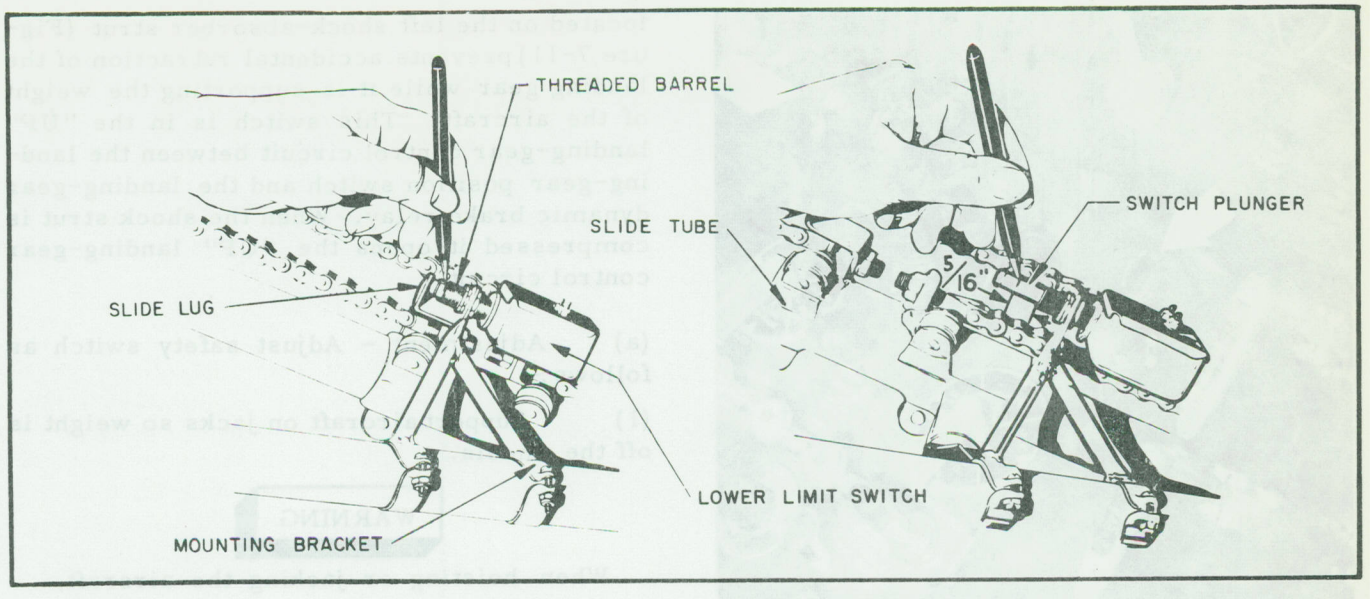


Figure 7-8 (Issue 1) Landing Gear Lower Position Light Switch Adjustment

(b) Adjustment of Lower Switch - Adjust lower position light switch as follows:-

(1) Support the aircraft so all the wheels are clear of the ground.

(2) Retract landing gear about half-way or until slide clears the switch.

(3) Make a mark on the switch plunger 5/16 inch from the threaded barrel (see Figure 7-8).

(4) Lower landing gear to the lower stop, adjust the switch against the slide so the mark placed on the switch just clears the end of the threaded barrel.

(5) Retract landing gear, then lower; check operation of green light on pilot's control pedestal.

(6) Tighten lock nuts holding the switch barrel.

LANDING-GEAR SWITCH LATCH

17 The solenoid operated switch latch in the control pedestal engages and locks the position switch in the "DOWN" position, preventing accidental retraction while the weight of the aircraft is on the gear (Figure 7-9). As the shock strut (right) extends it actuates the control switch opening the circuit to the solenoid, which in turn releases the latch. In emergencies the switch latch may be released manually through a hole in the left side of the control pedestal (Figure 7-10).

(a) Adjustment - Adjust landing gear switch as follows:-

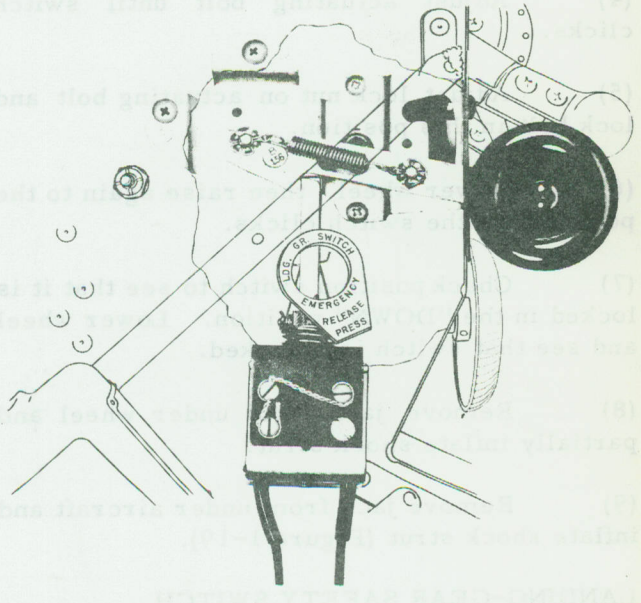


Figure 7-9 Landing Gear Switch Latch

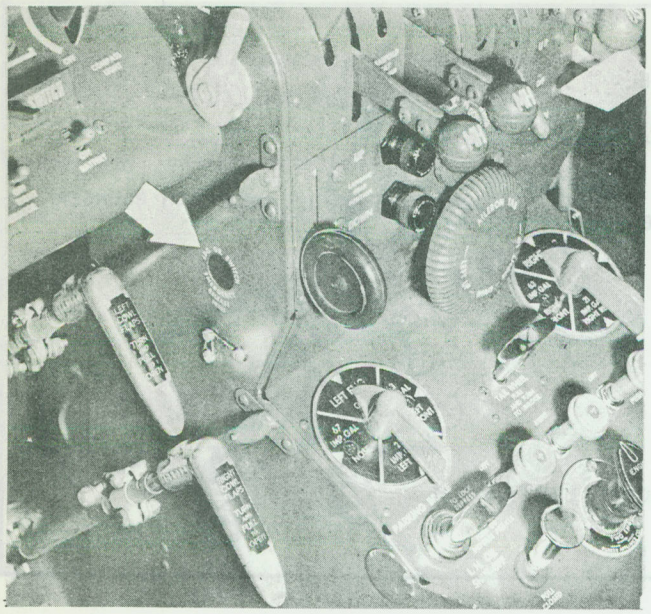


Figure 7-10 Landing Gear Switch Latch Emergency Release

(1) Support aircraft on jacks so the weight is off the landing gear.

(2) Release the air from the shock absorber.

(3) Place a small jack under the shock-absorber fork and raise wheel until shock absorber is compressed 1/2 inch (Figure 7-12).

(4) Adjust actuating bolt until switch clicks.

(5) Adjust lock nut on actuating bolt and lock bolt in this position.

(6) Lower wheel, then raise again to the point where the switch clicks.

(7) Check position switch to see that it is locked in the "DOWN" position. Lower wheel and see that switch is unlocked.

(8) Remove jack from under wheel and partially inflate shock strut.

(9) Remove jack from under aircraft and inflate shock strut (Figure 1-19).

LANDING-GEAR SAFETY SWITCH

18 The landing-gear safety switch, which is located on the left shock-absorber strut (Figure 7-11) prevents accidental retraction of the landing gear while it is supporting the weight of the aircraft. This switch is in the "UP" landing-gear control circuit between the landing-gear position switch and the landing-gear dynamic brake relay. When the shock strut is compressed it opens the "UP" landing-gear control circuit.

(a) Adjustment - Adjust safety switch as follows:-

(1) Support aircraft on jacks so weight is off the wheels.

WARNING

When hoisting or jacking the aircraft, always place a minimum ballast of 200 pounds on the horizontal stabilizer to prevent aircraft from nosing over. A felt or canvas pad should be used to protect the horizontal stabilizer and the ballast should be placed over the front spar near the fuselage.

(2) Release air from the shock absorber.

(3) Place a small jack under the shock-absorber fork and raise wheel until shock absorber is compressed 1/2 inch (Figure 7-12).

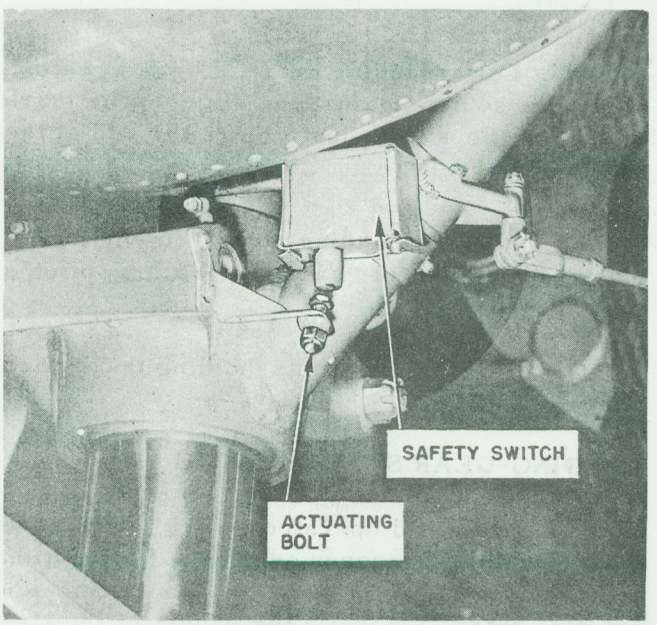


Figure 7-11 Landing-Gear Safety Switch

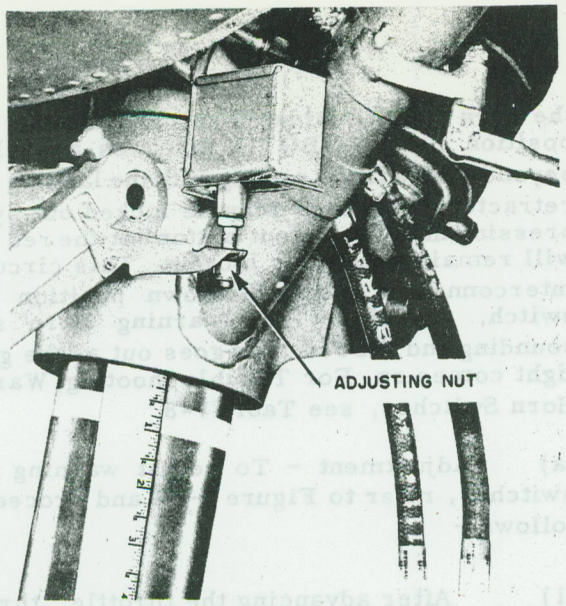


Figure 7-12 Switch Latch Control Adjustment

(4) Adjust actuating bolt until switch clicks.

(5) Raise wheel, then lower it carefully to the point where switch clicks again. Mark this location of shock strut and then release the jack from under the wheel. The distance from this mark with shock fully extended should be 1/2 inch.

DYNAMIC BRAKE RELAY

19 The dynamic brake relay located under the pilot's floorboards (Figure 7-13) is incorporated in the landing gear circuit between the position and limit switches and the motor. It prevents overtravel of the gear and coasting of the motor after the upper or lower gear limits have been reached. The up and down relay solenoids are controlled by the position switch on the control pedestal and the limit switches in the left nacelle. Either the position switch or the limit switches will energize and de-energize the solenoids. Contactors on the solenoid plungers complete the running circuit when the solenoid is energized, but remain normally closed in the braking circuit when the solenoid is de-energized. A rocker arm contact operated by arms on the solenoid plungers selects for braking the field opposite to the one last used for running. Counter voltage induced in motor armature as the motor is running returns to ground through the opposite field, the rocker arm contacts and the relay that was selected in the control circuit, thereby braking the armature. The two running windings of the motor are wound on the same field poles but counter wound for opposite polarity. This accounts for braking action when selected field collapses inducing the counter field which is waiting to be grounded through rocker arm contacts.

(a) Removal - Remove dynamic brake relay as follows:-

(1) Disconnect all electrical leads.

(2) Remove nuts from mounting bolts, remove relay.

(b) Servicing - Repairs on the relay should be limited to tightening connections, keeping contacts clean, or replacement of the entire relay.

NOTE

No attempt should be made to repair or adjust the relay, except by authorized personnel.

(c) Installation - Install dynamic brake relay as follows:-

(1) Place unit in position on mounting bolts, install nuts.

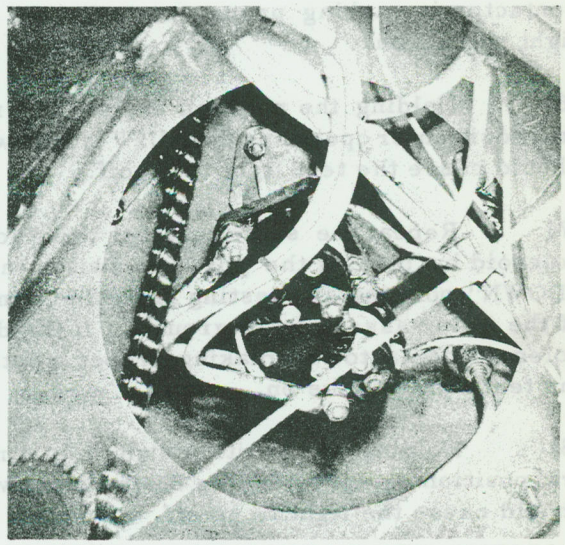


Figure 7-13 Dynamic Brake Relay

(2) Connect all electrical leads.

(d) Testing - Test dynamic brake relay as follows:-

NOTE

If after running the following tests the relay proves to be malfunctioning, it should be tagged unserviceable and returned to stores.

(1) Support aircraft on jacks so all wheels clear the floor.

(2) Disconnect leads at motor and turn on electrical system. (Tape these leads to prevent them from becoming grounded).

(3) Test (with a 24-volt test light) continuity from main power terminal in belly of aircraft to the No. 3 terminal on the dynamic brake relay.

(4) Manually set the landing gear so that both limit switches are clear of the slide assembly actuator and place the landing gear position switch in the "UP" position (for testing "UP" solenoid).

(5) Test from Terminal No. 1, of the relay assembly to ground; if the "UP" solenoid contactor is making proper contact, the test light will be on.

(6) Holding the position switch in a neutral position or operating the "UP" limit switch should cause the test light to go off.

(7) Repeat the same test for the "down" solenoid by placing the position switch in the "DOWN" position and testing from Terminal 2 of the relay assembly to ground. If the down solenoid contactor is making proper contact, the test light will be on.

(8) Holding the position switch in a neutral position or operating the down limit switch should cause the light to go off.

WARNING-HORN SWITCHES

20 The throttle warning-horn switches are located in the pilot's control pedestal in front of the throttle levers. Their function is to energize the warning horn circuit which sounds the horn and illuminates the red landing gear position light, if BOTH throttles are closed beyond a safe flight setting with the landing gear retracted. The horn may be locked out by depressing the horn cutout button but the red light will remain on during lockout. This circuit is interconnected with the down position light switch, therefore, the warning horn stops sounding and the red light goes out as the green light comes on. For Trouble Shooting, Warning Horn Switches, see Table 7-8.

(a) Adjustment - To adjust warning horn switches, refer to Figure 7-14 and proceed as follows:-

(1) After advancing the throttle, throttle back slowly to closed position. The flick of the switch should occur 3/4 inch before reaching closed position, measured at the control knob. The instrument panel may be used as a base for the ruler when checking the 3/4 inch movement at the control knob.

(2) Gaining access through the nose section to the throttle switches, loosen clamp holding switches at the adjustment screws.

(3) Move switches in contact with throttles until a click is heard, indicating that the switches have closed.

(4) Secure switches in this position.

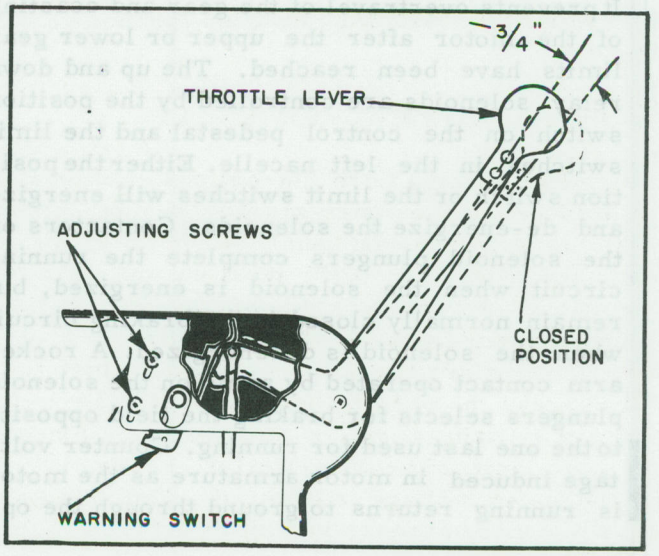


Figure 7-14 Warning-Horn Switch Adjustment

TROUBLE	PROBABLE CAUSE	CORRECTION
1 Warning horn inoperative.	(a) Silencer operating.	(a) (1) Advance throttle and then retard to check again. (2) Check the silencer relay for serviceability.
	(b) Circuit breaker tripped.	(b) Check circuit breaker in sub-panel.
	(c) Open or grounded circuit.	(c) (1) Check continuity to horn. (2) Check operation of throttle switches. (3) Check continuity from horn to nacelle switch. (4) Test from nacelle switch to ground.
	(d) Throttle switches	(d) Check throttle-switch adjustments and check for defective switches.
	(e) Throttle switches improperly adjusted.	(e) Reset throttle switches.
2 Circuit breaker tripping.	(a) Possible ground in circuit.	(a) Check for ground between circuit breaker and warning horn.

Table 7-8 Trouble Shooting, Warning Horn

(5) Aircraft should be flight tested to determine if switches function properly in flight.

WARNING--HORN CUT-OUT RELAY

21 The warning horn cut-out push button is located below the inner marker beacon light on the main instrument panel. When the undercarriage is in the "UP" position and either throttle is retarded, the warning horn will sound. Depressing the warning horn silencer button energizes the silencer relay, which in turn breaks the warning horn circuit. The relay will remain energized and, hence, silence the horn until either the throttles are advanced or the undercarriage is lowered. The landing gear circuitry appears in Figure 0-00.

(a) Removal - Remove warning horn cut-out relay as follows:-

(1) Disconnect and tag the leads to the relay.

(2) Remove the hardware attaching the relay to the forward bulkhead and remove the relay.

(b) Installation - Install warning horn cut-out relay as follows:-

(1) Place the relay in position and install the hardware that attaches the relay to the forward bulkhead.

(2) Connect the leads to the relay.

(3) The aircraft should be flight tested to determine whether the switches operate in flight.

TROUBLE	PROBABLE CAUSE	CORRECTION
1. No lights turn on.	(a) Circuit-breaker tripped.	(a) Reset and tighten.
	(b) Loose connection.	(b) Check and tighten all connections.
	(c) Battery dead.	(c) Check battery.
2. One light does not light.	(a) Faulty rheostat.	(a) Repair or replace rheostat.
	(b) Bulb burned out.	(b) Replace bulb.
	(c) Loose connection.	(c) Check and tighten connection.

Table 7-9 Trouble Shooting, Instrument Lights

LIGHTING SYSTEMS

INTERIOR LIGHTING

22 Interior lighting consists of pilot's compartment lights, instrument lights, cabin lights and pilot's extension light.

(a) Pilot's Compartment Lights - A red reading light is mounted in each upper forward corner of the compartment. Switches are mounted in the fixtures.

(b) Instrument Lights - Instrument panels are illuminated by multi-controlled instrument lighting plus an emergency lighting system. The multi-controlled instrument lighting consists of individual light assemblies. They are controlled by three rheostat switches spaced along the bottom of the main floating instrument panel. The emergency instrument lighting is provided by two ultra-violet lights, controlled integrally by rheostats, one on each control column. The compass is individually lighted by a lamp in the case, with the control switch on the upper radio console. For Trouble Shooting, Instrument Lights, see Table 7-9.

(c) Cabin Lights - The cabin lighting on Model 3N and 3NM consists of one light in the forward baggage compartment, two cabin dome lights, two navigator table lights; and one rear baggage light. The Model 3TM is similar but has three cabin dome lights and five individual reading spot lights instead of the two navigator table lights. For Trouble Shooting, Cabin Lights, see Table 7-10.

(d) Pilot's Extension Light - An extension light, with a long cord wound on a spring - loaded reel, is located on the forward side of the bulkhead aft of the co-pilot's seat. The "ON-OFF" switch is located in the end of the box housing the reel.

EXTERIOR LIGHTING

23 Exterior lighting consists of navigation lighting with flasher unit and landing lights.

(a) Navigation Lights - The aircraft is equipped with flashing navigation lights controlled by a switch on the Pilot's subpanel. The system consists of a red (left) and green (right) wing tip light, a red and white twin tail light installation, and an upper and lower white fuselage light. The wing tip lights have plexiglass reflectors attached to them, which make them visible from the cockpit. The control switch has three positions: "FLASHING" (up); "STEADY" (down) and "OFF" (centre). When the switch is in the "FLASHING" position, the red and green wing tip lights and the white tail light alternate with the red tail light and the upper and lower fuselage lights. When the switch is in the "STEADY" position, the red and green tip lights and white tail light burn continuously. If the flasher control unit fails, these three lights will remain on.

(b) Landing Lights - The landing lights are fully retractable and flush mounted, one on the underside of each outboard wing. They are

TROUBLE	PROBABLE CAUSE	CORRECTION
1 No lights go on.	(a) Batteries dead.	(a) Replace batteries or use external power.
	(b) Loose connection.	(b) Check and tighten electrical connections.
2 One circuit does not light.	(a) Circuit breaker tripped.	(a) Check for short circuit; reset breaker.
	(b) Loose connection.	(b) Check connections and continuity of circuit.
3 One bulb does not light.	(a) Bulb burned out.	(a) Replace bulb.
	(b) Fixture not grounded.	(b) Check for good bonding between fixture and structure. Tighten mounting screws.
	(c) Loose connection.	(c) Check all connections in circuit.
	(d) Defective fuxture or switch.	(d) Replace fixture or switch.

Table 7-10 Trouble Shooting, Cabin Lights

separately controlled by switches on the pilot's left sub-panel. Each light assembly consists of an extension - retraction motor, and switch contacts. A small solenoid brake provides braking action against the armature of the motor.

FLASHER UNIT

24 The flasher control unit is mounted on the bottom of the floorboard at the rear of the pilot's seat. The unit is accessible through the belly access doors.

(a) Removal - Remove flasher unit as follows:-

(1) Remove belly access door, disconnect electrical harness from unit, and remove the two nuts which connect the unit to the mounting bolts.

(b) Installation - Install flasher unit as follows:-

(1) Place unit in position under mounting bolts, install nuts, and connect electrical wiring harness.

NOTE

The flasher unit is a delicate mechanism. Therefore, should it prove defective, tag it as unserviceable and return it to stores.

LANDING LIGHTS

25 This paragraph contains information and instructions on the operation, removal, servicing installation and adjustment of the landing lights. For Trouble Shooting, Landing Lights, see Table 7-11.

(a) Operation of Landing Lights - Each light is controlled by a three-position toggle switch. The positions of the switch are placarded "EXTEND", "OFF", and "RETRACT".

(1) When the switch is placed in the "EXTEND" position, the circuit is completed to the landing-light motor, energizing and lifting the solenoid brake and causing the light to be extended. As the light travels through 12 to 14 degrees of arc, contact points complete the circuit to the lamp. At the end of the travel a limit switch opens the motor circuit and releases the braking solenoid to stop the motor.

(2) When the switch is placed in the "RETRACT" position, the circuit is completed to the opposite winding of the motor and the solenoid brake is energized and lifted. The lamp circuit is opened and light is retracted.

(b) Removal - Remove landing light as follows:-

(1) Remove screws attaching outer ring of light housing to lower side of wing.

(2) Lower light assembly and disconnect wires.

(c) Servicing - To replace landing-light

TROUBLE	PROBABLE CAUSE	CORRECTION
1 Light fails to extend or retract.	(a) Circuit breaker tripped (lamp does not light).	(a) Check for short circuit. Set breaker.
	(b) Loose connection or defective wire.	(b) Tighten connections and check continuity; replace or repair wire if necessary.
	(c) Defective ground.	(c) Check ground connections.
	(d) Defective switch or extension-retraction motor.	(d) Check continuity of circuits, replace any defective part.
	(e) Dirty, burned, or pitted contact points.	(e) Clean contact points.
2 Lamp fails to light.	(a) Circuit breaker tripped (light does not extend or retract).	(a) Check for short circuit. Reset circuit breaker.
	(b) Lamp burned out.	(b) Replace lamp.
	(c) Loose connection or defective wire.	(c) Tighten connections, check circuit continuity. Replace or repair wire if necessary.
	(d) Landing-light lamp switch defective.	(d) Check continuity through switch, replace if necessary.
3 Light does not extend proper angle.	(a) Contact point not properly adjusted.	(a) Adjust movable contact point so that when fully extended bottom rim of lamp is 11 1/2 inches from back edge of lamp recess in wing.
4 Light does not retract flush with wing.	(a) Stationary switch contact not properly aligned.	(a) Bend stationary switch contact arm slightly as necessary to make lamp stop flush with lower side of wing.

Table 7-11 Trouble Shooting, Landing Lights

bulb,extend light, remove bulb mounting ring, remove old bulb and install new one, reinstall mounting ring, and retract light.

NOTE

Contact points must be kept clean to ensure proper operation. Do not attempt repair other than cleaning contact points, replacing bulb, or adjusting extended and retracted positions. If other repairs are needed, remove part, tag as unserviceable and return to stores.

(d) Installation - Install landing light as follows:-

(1) Hold landing light assembly below the landing light well and connect electrical leads.

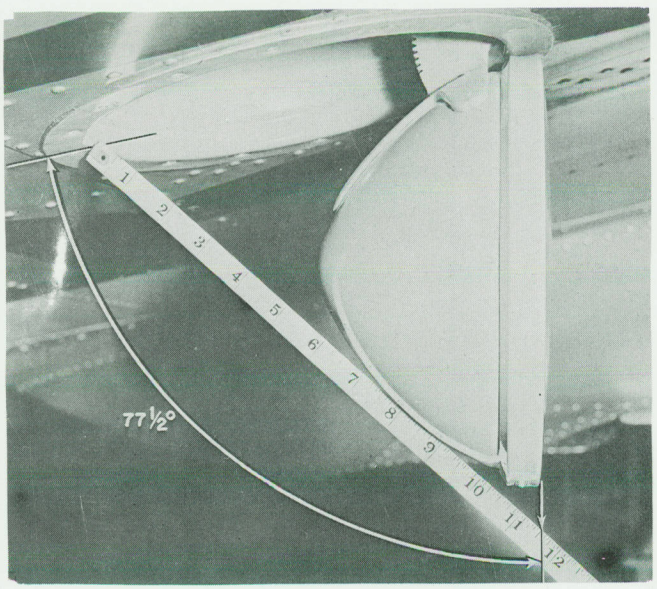


Figure 7-15 Landing Light Extension Measurement

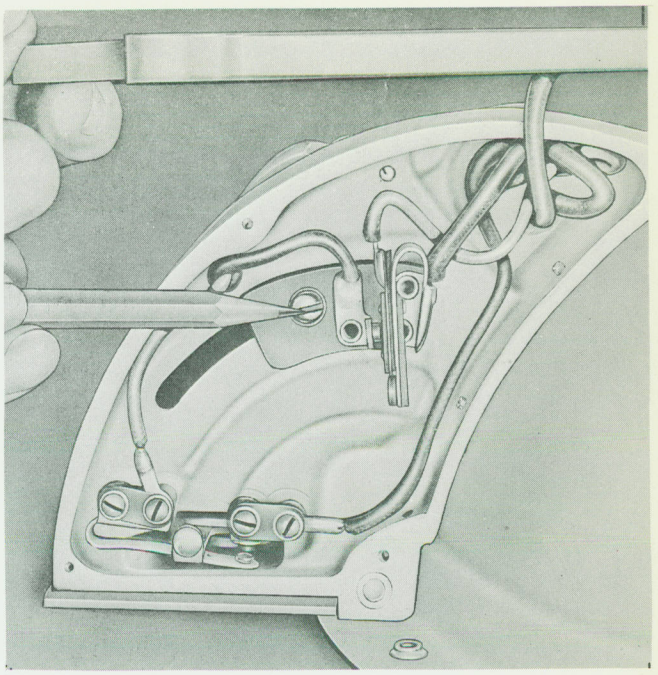


Figure 7-16 Landing Light Adjustment

(2) Place assembly in position and install screws.

(3) Operate light to test for proper installation and adjustment.

(e) Adjustment - To regulate the extended position of landing light, extend light and measure distance from lower aft edge of lens rim to aft edge of light well in ring. It should be 11 1/2-inches, equivalent to 77 1/2 degrees angular movement (Figure 7-15). If it is not, remove the switch contact housing cover and adjust the movable contact point (Figure 7-16). Reinstall cover, retract and extend light and remeasure distance. To regulate the retracted position of landing light, extend light and measure distance from lower aft edge of lens rim

PART 8

TELECOMMUNICATIONS

GENERAL DESCRIPTION

1 The communications equipment in the Expeditor 3-Series consists of a low-medium frequency range receiver, a marker beacon a localizer receiver, a glide path receiver and a radio compass for navigational purposes. For communications there are two high-frequency transmitters, two high-frequency receivers, and a ten-channel very high-frequency transceiver. An interphone system provides inter-communication among the crew members (Figure 8-1). In the Expeditor 3T an omni-receiver replaces the ILS localizer receiver and a "FROM - TO" indicator is installed on the instrument panel. Provision is made to monitor the marker beacon, range, and radio compass receiver (Figure 8-2).

(a) The various systems are described separately in the following paragraphs, together with servicing and trouble shooting procedures. Maintenance and repairs on internal circuits of this equipment should be attempted only by qualified personnel, using the proper apparatus. Much of this equipment is bench-tuned (pretuned) and calibrated. Tampering, in some instances even changing a tube, may change the alignment, and make the unit inoperative.

WARNING

Do not attempt repair or disassembly of this equipment without placing all power switches in the "OFF" position. Plate voltages run from 250 to 600. Repairs by authorized personnel only.

INTERPHONE SYSTEM

2 The interphone system consists of a dynamotor, an amplifier unit, and three cabin jackboxes. A combination speaker and headphone arrangement is provided for the pilot and copilot with controls on the overhead radio control panel. The interphone amplifier unit, and dynamotor, are located with the radio equipment in the aft section of the fuselage. For Trouble Shooting, Interphone, see Table 8-1.

JACKBOX

3 This paragraph contains instructions for the removal, servicing, installation and testing of the jackbox.

(a) Removal - Remove jackbox as follows:

(1) Remove two screws from jackbox cover.

(2) A slight pull will remove unit from base plug.

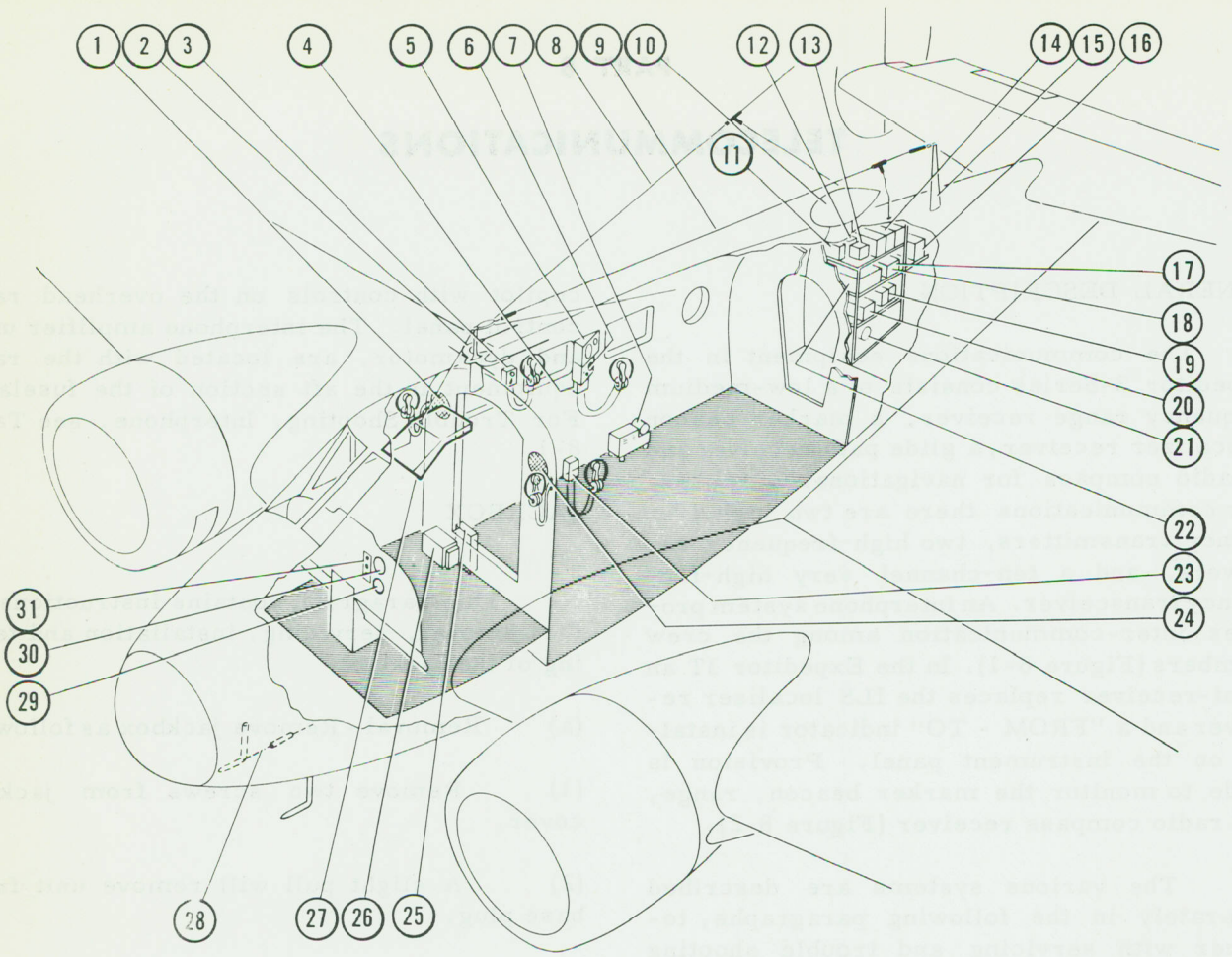
(b) Servicing - Wire connections are easily checked and resoldered if necessary. If the box requires complete rewiring, a good box may be used as a working pattern. Damaged units, or those requiring extensive repairs should be tagged unserviceable and returned to stores.

(c) Installation - Install jackbox as follows:

(1) Push unit into base plug.

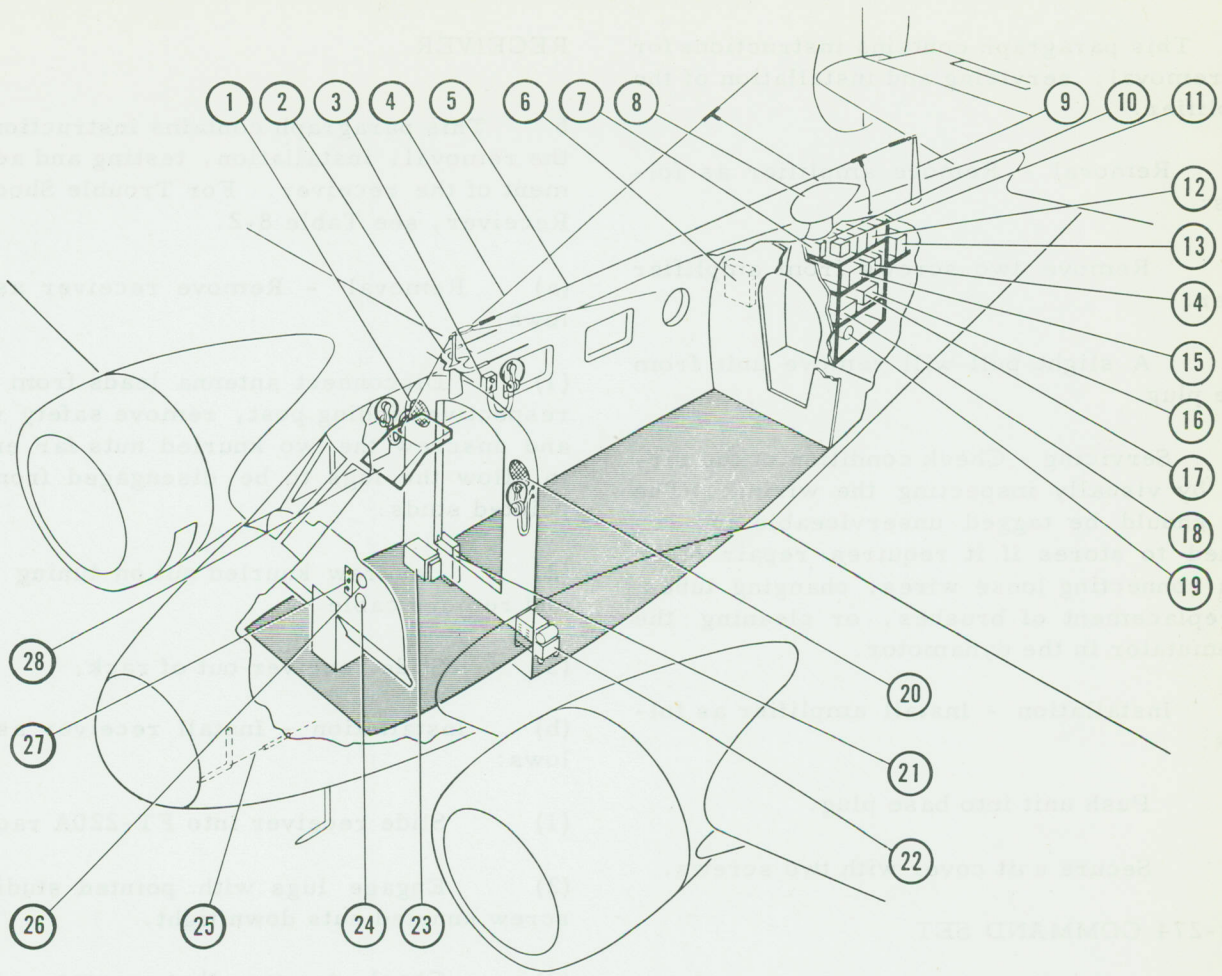
(2) Secure unit with two screws.

(d) Testing - Perform operative test on the system checking for volume and noise. Check operation of all jackboxes, and pilot's and co-pilot's headphones and speakers (using overhead interphone controls), for correct response on all sets. In case of excessive noise, distorted background, or low output, refer to Trouble Shooting Table 8-1.



1 Co-pilot's Speaker
2 Localizer and Glide Path Receivers Di-pole Antenna
3 First Navigator's Jack Box (3N, 3NM)
4 Second Navigator's Jack Box (3N, 3NM)
5 Radio Compass Indicator
6 Radio Compass Control Panel
7 Localizer Receiver BC 733
8 SCR 274 Antenna
9 Radio Compass Sense Antenna
10 Radio Compass Loop Antenna
11 No. 10 Bulkhead Junction Box
12 Interphone Amplifier
13 Antenna Relay
14 Receivers BC 453B, BC 454B, BC 455B Part of SCR 274 installation (Items 14, 17 and 19)
15 AF/ICA-67 VHF Antenna
16 Marker Receiver MN 53B
17 Modulator BC 456, Part of SCR 274 Installation (Items 14, 17 and 19)
18 Iso-Amplifier (Outboard of Modulator)
19 Transmitters BC 458A, and BC 696A or BC 457A. Part of SCR 274 Installation (Items 14, 17 and 19)
20 VHF Transceiver AF/ICA-67
21 Radio Compass Inverter
22 Radio Compass Receiver
23 Navigation Instructor's Jack Box
24 Pilot's Speaker
25 No. 5 Bulkhead Junction Box
26 Glide Path Receiver R89B
27 Master Radio Control Panel
28 Marker and Range Antenna
29 Radio Compass Indicator
30 Localizer and Cross Pointer Indicator
31 Marker Indicator Lights

Figure 8-1 Radio Equipment Location Diagram (3N, 3NM and 3TM)



1 Co-pilot's Speaker
2 Localizer and Glide Path Di-pole Antenna
3 Forward Cabin Junction Box
4 SCR 274 Antenna
5 Radio Compass Sense Antenna
6 No. 9 Bulkhead Junction Box
7 No. 10 Bulkhead Junction Box
8 Radio Compass Loop Antenna
9 AF/ICA-67 VHF Antenna
10 Interphone Amplifier
11 Antenna Relay
12 Receivers BC 453B, BC 454B, BC 455B Part of SCR-274 Installation (Items 12, 14 and 16)
13 Marker Receiver MN-53B
14 Transmitters, BC 458A and BC 696A or BC 457A. Part of SCR 274 Installation (Items 12, 14 and 16)
15 VHF Transceiver AF/ICA-67
16 Modulator BC 456. Part of SCR 274 Installation (Items 12, 14 and 16)
17 Iso-Amplifier (Outboard of Modulator)
18 Radio Compass Receiver
19 Radio Compass Inverter
20 Pilot's Speaker
21 No. 5 Bulkhead Junction Box
22 Localizer Receiver BC 733
23 Glide Path Receiver R89-B
24 Radio Compass Indicator
25 Marker and Range Antenna
26 Localizer and Glide Path Cross Pointer Indicator
27 Marker Indicator Lights
28 Master Radio Control Panel

Figure 8-2 Radio Equipment Location Diagram (3T)

AMPLIFIER

4 This paragraph contains instructions for the removal, servicing and installation of the amplifier.

(a) Removal - Remove amplifier as follows:

(1) Remove two screws from amplifier cover.

(2) A slight pull will remove unit from base plug.

(b) Servicing - Check condition of the circuit by visually inspecting the wiring. The unit should be tagged unserviceable and returned to stores if it requires repair other than connecting loose wires, changing tubes; or replacement of brushes, or cleaning the commutator in the dynamotor.

(c) Installation - Install amplifier as follows:

(1) Push unit into base plug.

(2) Secure unit cover with two screws.

SCR-274 COMMAND SET

5 Model SCR-274 aircraft radio equipment is a complete, multichannel, radio transmitting and receiving set; designed to transmit and receive voice, tone modulated, or continuous wave signals. The set consists of two transmitters, three receivers, a modulator, and an antenna relay, located in the aft fuselage section. A remote control box, and circuit breakers for protection of the system are installed in the overhead radio control panel (Figure 8-3). The set is calibrated as follows:

(a) BC-453B ("RANGE" receiver) 190-500 kc.

(b) BC-454B ("COMMAND" receiver) 3.0-6.0 mc.

(c) BC-455B ("COMMAND" receiver) 6.0-9.1 mc.

(d) BC-696A transmitter 3.0-4.0 mc.

(e) BC-458A transmitter 5.3-7.0 mc.

RECEIVER

6 This paragraph contains instructions for the removal, installation, testing and adjustment of the receiver. For Trouble Shooting, Receiver, see Table 8-2.

(a) Removal - Remove receiver as follows:

(1) Disconnect antenna leads from their respective binding post, remove safety wires and unscrew the two knurled nuts far enough to allow the lugs to be disengaged from the pointed studs.

(2) Unscrew knurled nut on tuning cable and remove cable.

(3) Slide receiver out of rack.

(b) Installation - Install receiver as follows:

(1) Slide receiver into FT-220A rack.

(2) Engage lugs with pointed studs and screw knurled nuts down tight.

(3) Check to see that remote-control tuning dial is set at the same frequency as the dial on front of receiver. Insert remote tuning cable and screw knurled nut down tight.

(4) Connect antenna lead to antenna binding post.

(c) Testing - An aural check on the operation of receiver should be made before each flight by listening to signals at maximum gain. Excepting lock-tuned receivers, tune each one through the entire band. All receivers except the one being tested should be turned off. If each receiver responds normally, no further test is necessary. If a receiver does not respond normally, check the following: switches are in the proper positions, headsets are connected to the proper jacks, plugs are securely attached, battery voltage is satisfactory, dynamotor is operating properly, and antenna circuit is properly aligned.

TROUBLE	PROBABLE CAUSE	CORRECTION
1 Jackbox inoperative.	(a) Jackbox not grounded properly.	(a) Remove jackbox cover and check ground below switch.
	(b) Open circuit.	(b) Check continuity between jackboxes or from forward junction box to jackbox.
	(c) Open circuit inside jackbox.	(c) Check all connections inside box. Repair or replace jackbox.
2 All jackboxes inoperative.	(a) Open circuit at amplifier.	(a) Check terminal connections at amplifier.
	(b) Open or shorted windings on input or output transformers.	(b) Check continuity and leads to ground. Replace amplifier if necessary.
	(c) Defective tube.	(c) Make visual check on tube elements, test on tube testing device or replace with tube known to be good.
3 Distorted background.	(a) Open capacitor in amplifier.	(a) Check leads of capacitor in amplifier, replace if necessary.
4 Low output.	(a) Open or shorted turns of transformer windings.	(a) See 2(b) above.
	(b) Defective tube.	(b) See 2(c) above.
5 Noisy.	(a) Defective capacitor.	(a) See 3 above.
	(b) Defective tube.	(b) See 2(c) above.

Table 8-1 Trouble Shooting, Interphone

TROUBLE	PROBABLE CAUSE	CORRECTION
1 Weak signals in headphones.	(a) Broken antenna lead-in.	(a) Repair lead-in.
2 No signals in headphones.	(a) Defective vacuum tube.	(a) Replace tube.

Table 8-2 Trouble Shooting, SCR-274 Receiver

TROUBLE	PROBABLE CAUSE	CORRECTION
1 Side tone in headset. No output to antenna.	(a) Antenna lead-in broken.	(a) Repair lead-in.
2 Output in antenna. No side-tone.	(a) Defective modulator.	(a) Replace defective tube in modulator or replace modulator.

Table 8-3 Trouble Shooting, SCR-274 Transmitter

(d) Adjustment - As a final receiver adjustment, trim the antenna circuit for maximum sensitivity. This operation should be performed near the high-frequency end of the dial where the adjustment is most critical. Tune to a point where there is only background noise and no signal and adjust the "align-input" control on the front of the receiver for maximum noise. Failure to make this adjustment properly may result in considerable loss of available receiver sensitivity.

TRANSMITTER

7 This paragraph contains instructions for the removal, servicing, installation and testing.

(a) Removal - Remove transmitter as follows:

(1) Disconnect antenna leads from their respective binding posts, remove safety wires and unscrew the two knurled nuts far enough to allow the lugs to be disengaged from the pointed studs.

(2) Slide transmitter out of rack.

(b) Servicing - Repairs should be limited to replacement of low-frequency tubes and dynamotor. If the set requires more extensive repair it should be tagged unserviceable and returned to stores.

(c) Installation - Install transmitter as follows:

(1) Slide transmitter into FT-226A rack.

(2) Engage lugs with pointed studs and screw knurled nuts down tight.

(3) Connect antenna lead to antenna binding post.

(d) Testing - A check on the operation of each transmitter may be made by watching the antenna current indication on the antenna relay unit and by listening to the side-tone. If transmitter does not respond normally, check switch positions, plug attachments, battery voltage, dynamotor operation, and antenna resonance. Establish two-way communication with another aircraft or a ground station, checking operation.

TRANSMITTER TUNING

8 Tune the transmitter as follows:

(a) Set frequency control dial to the desired transmitter frequency.

(b) Set antenna coupling control to about 2 on its scale.

(c) Throw the toggle switch on antenna relay unit to "LOCAL".

(d) Set transmitter control unit emmission switch to "VOICE". (For maximum power output on "CW", set this switch to "CW" and proceed).

(e) The transmitter control unit selector switch may be in any position when the test key on the transmitter rack is used for test purposes.

(f) After making sure that neither the microphone button nor the key is closed, set transmitter power switch to "ON".

(g) Allow 15 seconds for tubes to warm up.

(h) Press the test key on the rack directly below the transmitter being tested.

(j) Resonate the antenna circuit by adjusting the antenna inductance for maximum antenna current. This adjustment should be made with the antenna coupling switch at a lower setting than that which gives highest antenna current.

(k) Vary the antenna coupling switch until maximum current is indicated on the meter of the antenna relay unit.

(m) Observe the antenna current on "CW" and "TONE". Antenna current readings will vary widely with the antenna and the choice of frequency. For a short fore and aft antenna, the reading on "CW" probably will be greater than half-scale. On "VOICE" it will be considerably less than for "CW" and for "TONE" it will be between the values of "CW" and

"VOICE".

(n) Lock the three controls of each transmitter by rotating the lock knobs one-half turn clockwise to a stop, in which position the word "LOCK" on the knob will read right side up.

(p) Leave the toggle switch on the antenna relay unit on "LOCAL". The remote position is provided for a remote indication of antenna current in the pilot's or radioman's position. A remote indicating meter is not normally supplied as a part of this equipment.

(q) Mark in soft pencil the frequency to which each transmitter has been tuned in the appropriate blank space on the plate above the transmitter-selection switch. Record the transmitter tuning data accurately on the write-in plate on the front of each transmitter. This information applies to the transmitter as tuned in the particular aircraft.

COMMUNICATION INSTALLATION AIR AF/ ICA-67 (VHF) RCAF AF/UTA-68

9 The AF/UTA-68 transceiver unit provides two-way radio-telephone communication in the frequency range 115 to 152 mc. Transmission and reception are accomplished on any one of ten preset, crystal controlled, frequencies. The channel frequencies are common to both receiver and transmitter.

(a) The transceiver unit, mounted in the aft fuselage section, comprises six major assemblies plugged into a single chassis. The chassis, in turn, is housed in a protective cover and installed on shock mount AF/ASM-69, which is permanently attached to the aircraft structure. Forced ventilation is provided within the protective cover by a fan mounted on the dynamotor shaft.

(b) Operation of the unit is remotely controlled by a "VHF RECEIVER" and "FREQUENCY SELECTOR" switch on the overhead radio panel. The system is protected by a circuit breaker in the overhead radio panel.

NOTE

A few seconds are required for the channel change mechanism to switch channels, during which time both receiver and transmitter are inoperative.

(c) For Trouble Shooting, VHF Transceiver, see Table 8-4.

TRANSCEIVER UNIT

10 This paragraph contains instructions for the removal, servicing, installation, testing and preflight inspection and tuning and adjustment.

(a) Removal - Remove transceiver unit as follows:

(1) Loosen two wing nuts on the front of the mounting base.

TROUBLE	PROBABLE CAUSE	CORRECTION
RECEIVING: 1 Weak signals in headset.	(a) Broken antenna lead-in.	(a) Repair lead-in.
2 No signals in headset.	(a) Defective vacuum tube.	(a) Replace tube.
TRANSMITTING: 1 Sidetone in headset. No output to antenna.	(a) Broken antenna lead-in.	(a) Repair lead-in.
2 Output in antenna. No sidetone in headset.	(a) Defective modulator.	(a) Replace defective tube in modulator or replace modulator.

Table 8-4 Trouble Shooting, AF/UTA-68 Transceiver

(2) Pull unit forward disengaging the two positioning studs.

(3) Lift unit out, remove protective cover by releasing camlock fastener.

(b) Servicing - Repairs should be limited to routine inspection, testing and lubricating; replacement of tubes and major assemblies with pre-tested units; cleaning dynamotor commutator and replacement of dynamotor brushes. If the unit requires more extensive maintenance, it should be tagged unserviceable and returned to stores.

WARNING

Dynamotor fan is exposed when the unit is operated without the protective cover. Install fan guard and keep fingers and tools away from the vicinity of the fan.

(c) Installation - Install transceiver unit as follows:

(1) Replace protective cover and secure with camlock fastener.

(2) Slide unit into place engaging the two positioning studs.

(3) Tighten two wing nuts on the front of the mounting base.

(d) Testing and Preflight Inspection - Test and inspect transceiver as follows:

(1) Check the transceiver unit for proper insertion in the shock mount.

(2) Check the clamping nuts on the power cable, mic-tel cable and control cable at both ends and be sure they are tight.

(3) Remove the transceiver front panel cover and check the crystal units for proper frequencies and location in the proper sockets.

(4) Connect signal generator I-130 to the antenna jack on the transceiver, turn the unit on, and check the receiver output to the headset and the channel frequency on each channel in turn.

(5) Reconnect the antenna transmission line to the transceiver and check the couplings to be sure they are tight.

(6) Operate the transmitter on each channel in turn and check the output signal level and frequency with Field Strength Meter I-95.

(7) Modulate the transmitter and check the sidetone signal in the headset.

(8) Establish two-way communication with another aircraft, or a ground station, checking operation on each channel.

(e) Tuning and Adjustment - Tuning of the transceiver unit should not be attempted by maintenance personnel. If the unit is out of adjustment it should be tagged unserviceable and returned to stores.

AN/ARN-7 RADIO-COMPASS

11 The AN/ARN-7 radio compass is designed primarily for use as a navigational instrument. The unit consists of an R-5A/ARN-7 receiver located in the aft section of the fuselage, an I81A indicator on the pilot's instrument panel, a C4/ARN-7 control box in the overhead radio panel, an I82A indicator and C4/ARN-7 control box at the second navigator's station, an MG-149F inverter in the aft section of the fuselage, an LP-21 loop atop the fuselage, and the necessary interconnecting cables. Remote control of the receiver permits its operation from either the pilot's or second navigator's position. Signal may be received over a frequency range of 200 to 1750 kc.

(a) Characteristics of the radio compass make it possible to obtain the following:

(1) Automatic visual bearing indication of the source of radio signals received and simultaneous aural reception of the same signals on a nondirectional antenna.

(2) Aural reception of modulated rf signals with the nondirectional antenna.

(3) Aural and directional indication on the loop antenna. The control box provides switching for either "CW" or "VOICE" reception,

tuning audio control, rotation of loop, and selections of "OFF, "COMP", "ANT", or "LOOP" operations. A dehydrator unit is provided to prevent excessive moisture from entering the loop assembly.

TROUBLE SHOOTING

12 A satisfactory trouble shooting operation cannot be performed in the aircraft. However, if the equipment is found to be inoperative, make the following checks before removing the equipment from the aircraft:

(a) Check the fuse in the BK-22 relay box located behind the copilot's seat. See that Terminals 60 and 61 are properly connected for the system voltage of the aircraft.

(b) See that the a-c supply voltage and battery voltage are normal.

(c) See that Relays BK-22 and Re-8 on the rear of the BK-22 connector panel are operating satisfactorily. The Re-8 relay should operate when the "ON-OFF" switch is operated on the control box.

(d) Check all plugs and connections for tightness.

(e) See that Loop LP-21 is properly connected.

(f) Make sure that non-directional antenna and lead-in are not grounded or open.

(g) If, after running these checks and correcting where necessary, the set still does not operate, remove the R5A/ARN-7 receiver, tag unserviceable and return to stores.

R5A/ARN-7 RECEIVER

13 This paragraph contains instructions for the removal, servicing, installation and testing of the R5A/ARN-7 receiver.

(a) Removal - Remove receiver as follows:

(1) Disconnect large cannon plug, loop cannon plug, sense antenna lead, and grounding braids from front of receiver unit.

(2) Release wing fasteners.

(3) Lift front of chassis up and forward to disengage rear of chassis from mounting rack.

(b) Servicing - Do not attempt repairs other than replacement of audio or i-f vacuum tubes and the inverter. If the unit requires more extensive repair it should be tagged unserviceable and returned to stores.

(c) Installation - Install R5A/ARN-7 receiver as follows:

(1) Place receiver in proper position on mounting rack, making sure the flange at the rear of receiver is secured in rear of rack.

(2) Secure wing fasteners, making sure receiver is in place and securely fastened to the rack.

(3) Connect all plugs and ground braids.

(d) Testing - Test R5A/ARN-7 receiver as follows:

(1) Check "ANT" and "LOOP" operation on all four bands. Check compass operation and indicator response.

(2) Turn control switch to "COMP" and note whether or not magnetic compass is affected.

(3) Turn control to "LOOP" and tune several stations in to check sensitivity.

(4) Check audio control to see that it controls headset

(5) Check operation of loop "L-R" switch. Loop should rotate 10 degrees per second. Push switch in. Loop should operate 30 to 55 degrees per second.

(6) Switch to "COMP" and check accuracy of bearing to transmitters from "compass rose".

(7) Check dehydrator unit for excessive moisture. A dark blue color indicates the desired dry condition. A light blue or pink

color indicates excessive moisture and the dessicant crystals should be replaced. If no replacement is available, heat pink dessicant in a flat pan slowly until it is a dark blue color. Allow to cool before refilling.

ILS EQUIPMENT

14 The instrument landing system, by means of a cross pointer indicator on the instrument panel, provides the pilot with both lateral and vertical guidance to the runway selected for landing.

(a) The system consists of a glide path receiver R-89B located underneath the co-pilot's seat, a localizer receiver BC 733D located on the cabin floor at rear navigator's station, a di-pole antenna atop the fuselage, a control box BC-732 on the pilot's overhead radio panel, a cross pointer indicator ID-48 on the pilot's instrument panel, and the necessary interconnecting wires and cables. Test jacks are provided for monitoring both receivers.

(b) The R-89-B ultra high-frequency glide path receiver operates from 24 to 28 volt d-c current, on a frequency range of 332.6 to 335.0 mc. It controls the horizontal pointer of the indicator, showing the attitude of the aircraft in relation to the glide path beam. Operation of the unit and frequency selection are accomplished remotely at the control box BC-732 on the pilot's overhead radio panel (Figure 8-3).

(c) The BC-733-D super-heterodyne localizer receiver operates from power furnished by dynamotor DM-53-A on a frequency range of 108.3 to 110.3 mc. It controls the vertical pointer of the indicator showing the attitude of the aircraft in lining up with the runway. Operation of the unit and frequency selection are accomplished remotely at the control box BC-732 in the pilot's overhead radio panel. (Figure 8-3).

TROUBLE SHOOTING

15 Trouble shooting with the equipment installed in the aircraft is limited. However, before using detailed testing procedures or removing the equipment from the aircraft, check the following:

(a) Availability of power.

(b) Circuit breaker tripped.

(c) Condition of tubes.

(d) All electrical connections.

(e) Antennae and connections.

(f) If after checking these items the set is still inoperative, it should be tagged unserviceable and returned to stores.

NOTE

A signal will not be received unless the aircraft is reasonable close to the area covered by the beam. The flag alarms will show in the ID-48 indicator when no signal is being received.

ILS RECEIVERS

16 This paragraph contains instructions for the removal, servicing, installation and testing of the glide path and localizer receivers.

(a) Removal - Remove the glide path and localizer receiver as follows:

(1) Glide Path Receiver.

a. Disconnect cannon plugs.

b. Loosen thumb screw on front of mounting.

c. Pull unit forward disengaging flange from lip on mounting.

(2) Localizer Receiver.

a. Disconnect ground wire and cannon plugs.

b. Loosen thumb screw on front of mounting.

c. Pull unit forward disengaging flange from lip on mounting.

(b) Servicing - Do not attempt repairs other than repair of loose connections; re-

placement of tubes, cleaning dynamotor commutator, replacing dynamotor brushes, or replacement of crosspointer indicator. If the unit requires more extensive repairs it should be tagged unserviceable and returned to stores.

(c) Installation - Install the glide path and localizer receivers as follows:

(1) Glide Path Receiver.

a. Slide unit into place on mounting, being sure to engage flange in lip on mounting.

b. Secure thumb screw on front of mounting.

c. Reinstall cannon plugs and ground wire.

(2) Localizer Receiver.

a. Slide unit into place on mounting, being sure to engage flange in lip on mounting.

b. Secure thumb screw on front of mounting.

c. Reinstall cannon plugs and ground wire.

(d) Testing - Consult applicable directives for detailed testing procedures and operation of testing equipment.

MARKER BEACON RECEIVER MN-53B

17 The MN-53B super-heterodyne marker receiver is designed to give the pilot aural and visual identification when passing over an airways marker, or outer and inner markers in the instrument landing system.

(a) The system consists of a marker receiver MN-53B and dynamotor MP-37B located in the aft fuselage section, the receiving antenna, airways (white), outer (purple), inner (amber) indicator lamps located on the pilot's instrument panel, and an "OFF", "LOW", "HIGH" remote control switch located on the pilot's overhead radio panel (Figure 8-3). The receiver is entirely automatic and no tuning is required in flight; however, the control switch provides for "LOW" and "HIGH" receiver sensitivity.

TROUBLE SHOOTING

18 Trouble shooting with the equipment installed in the aircraft is limited. However, before using detailed testing procedures or removing the equipment from the aircraft, check the following:

(a) Availability of power.

(b) Circuit breaker tripped.

(c) Condition of tubes.

(d) All electrical connections.

(e) Defective indicator lamps.

(f) If, after checking these items the set is still inoperative, it should be tagged unserviceable and returned to stores.

MN-53B RECEIVER

19 The MN-53B receiver is located in the aft fuselage.

(a) Removal - Remove MN-53B receiver as follows:

(1) Disconnect antenna connection and cannon plug.

(2) Loosen the two knurled knobs, disengaging the two feet on the receiver.

(3) Pull receiver out of the mounting.

(4) Remove chassis from dust cover by releasing the fastener on back of cover.

(b) Servicing - Do not attempt repairs other than repair of loose connections; replacement of tubes, cleaning dynamotor commutator or replacing dynamotor brushes; replacement of indicator lights.

(c) Installation - Install MN-53B receiver as follows:

(1) Install chassis in dust cover, secure fastener on back of cover.

(2) Slide receiver into place on mounting,

being sure to engage the two positioning studs at back of mounting.

(3) Engage the two knurled knobs on feet of receiver and tighten them.

(4) Install antenna connection and cannon plug.

(d) Testing - Consult applicable directives for detailed testing procedures and operation of testing equipment.

NOTE

To ensure that the output of the marker beacon is not in excess of other equipment, adjust the adjustment screw inside No. 10 junction box to approximately 50% rotation. If this is not carried out, the noise level in the Pilot's or Co-pilot's earphones may become objectionable.

ISOLATION AMPLIFIER

20 The isolation amplifier incorporated in the radio equipment is designed to allow either the pilot or copilot to receive audio independently of each other. Audio switches for each radio circuit are provided on the overhead

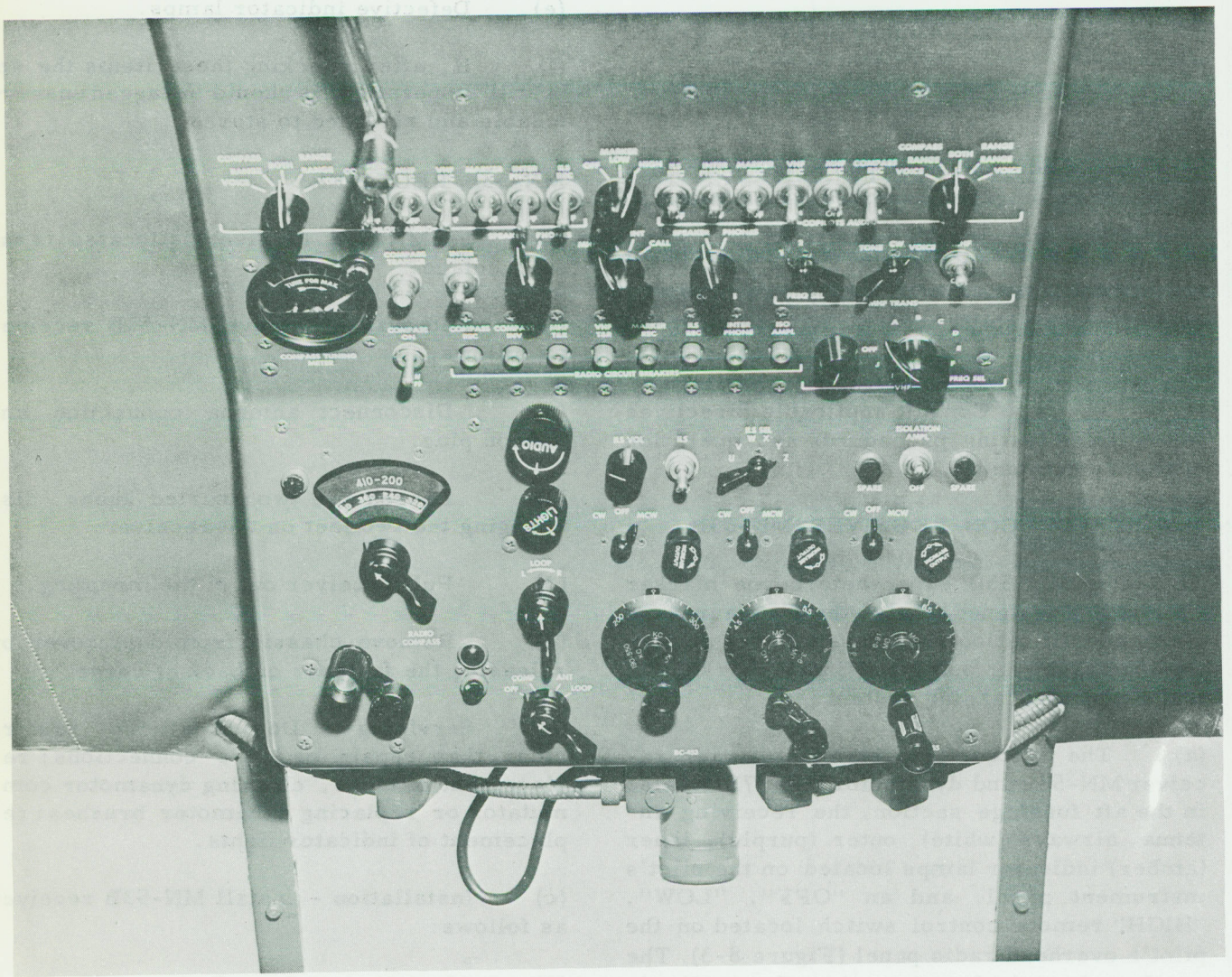


Figure 8-3 Overhead Radio Control Panel

radio panel, for both pilot and copilot. The audio received in their respective headphones or speakers is determined by the position of the audio switches. As an example it would be possible for the copilot to receive radio compass, marker, and command receiver audio, while the pilot is receiving and transmitting on VHF. The pilot and copilot will never receive audio from the same radio circuit unless their respective audio switches are both closed. The system consists of an isolation amplifier and dynamotor in the aft fuselage section; an "ISO - AMP" - "OFF" switch and a circuit breaker for protection of the system, on the overhead radio control panel (Figure 8-3).

TROUBLE SHOOTING

21 A satisfactory trouble shooting operation cannot be performed with the equipment installed in the aircraft. However, if the equipment is inoperative make the following checks before removing it from the aircraft:

(a) Check circuit breaker.

(b) Check availability of power at the dynamotor.

(c) See that all electrical and plug connections are secure.

(d) Check condition of tubes.

(e) If after running all these checks the unit is still inoperative remove amplifier, tag unserviceable and return to stores.

ISOLATION AMPLIFIER

22 This paragraph contains instructions for the removal, servicing, installation and testing of the isolation amplifier.

(a) Removal - Remove the amplifier as follows:

(1) Disconnect cannon plugs.

(2) Release four snap slides on mounting.

(3) Lift amplifier up off mounting.

(b) Servicing - Do not attempt repairs other than replacement of tubes in the amplifier, or replacement of brushes and cleaning commutator in the dynamotor. If the unit requires more extensive repairs it should be tagged unserviceable and returned to stores.

(c) Installation - Install the amplifier as follows:

(1) Place amplifier in position on mounting.

(2) Secure the four snap slides.

(3) Connect cannon plugs.

(d) Testing - Perform operative test with all other radio equipment in operation. Check unit to see that audio is isolated or received in the pilot's or copilot's headphones or speakers according to the position of the individual audio switches.

NOTE

Ensure that the isolation amplifier headset audio level is the same in the "ON" as well as in the "OFF" position. Remove both of the spare and panel bulbs. By means of a screwdriver, adjust the pilot's and co-pilot's headset level controls until the output is constant between isolation amplifier "ON" and "OFF". Adjust with isolation amplifier "ON". If this is not carried out the noise level in the pilot's or co-pilot's earphones may become objectionable.

GENERAL DESCRIPTION

1 CTel Project 63A1 was raised to install communication equipment in Expeditor 3TM aircraft Serials 1521, 1527, 1533 and 1566.

2 The various systems are described separately in the following paragraphs, together with servicing and trouble shooting procedures. Maintenance and repairs to internal circuits of this equipment should be attempted only by qualified personnel using the proper apparatus. Much of this equipment is bench-tuned and calibrated. Tampering, in some instances even changing a tube, may change the alignment and make the unit inoperative.

WARNING

Do not attempt repair or disassembly of this equipment without placing all switches in the OFF position. Plate voltages run from 250 to 600. Repairs are to be carried out by authorized personnel only.

INTERPHONE SYSTEM

3 The interphone system consists of a dynamotor and an amplifier unit. A headphone-mike arrangement is provided for the pilot and co-pilot with controls on the overhead radio control panel and the pilot's instrument panel. The interphone amplifier unit and dynamotor are located on the radio equipment rack in the aft section of the fuselage.

4 SERVICING - Check condition of the circuit by visually inspecting the wiring. The amplifier unit should be tagged unserviceable and returned to stores if it requires repair other than connecting loose wires, changing tubes, replacement of brushes or cleaning the commutator in the dynamotor. For detail maintenance instructions, refer to EO 35H-5RC36-2.

5 TROUBLE SHOOTING - For trouble shooting, interphone, refer to EO 35H-5RC36-2.

AN/ARC-552 UHF SYSTEM

6 Radio set AN/ARC-552, together with the control units, provides two-way amplitude modulation (AM) radio-telephone communication between aircraft and between aircraft and ground stations. The radio set is capable of transmitting and receiving on any one of 1750 frequency channels, spaced at 100 kc intervals in the band of 225.0 mc to 399.9 mc. In addition a guard channel, set to a predetermined frequency of 243.0 mc may be selected remotely. Controls are provided for manual selection of any one of the 1750 channels.

7 The RT-5011/ARC-552 transceiver and the F20-4 inverter mounted on the radio equipment rack in the aft fuselage, is controlled by a C-5064/ARC-552 control and two audio switch panels mounted on the overhead control panel, and two mike selection switches mounted on the instrument panel. The AR-256A/ARC antenna is mounted on top of the fuselage and an audio-matching transformer and a test jack is mounted on the radio junction box.

8 SERVICING OF TRANSCEIVER - Check condition of the circuit by visually inspecting the wiring. Do not attempt repairs other than replacement of tubes and connecting loose wires. If the unit requires more extensive repairs, it should be tagged unserviceable and returned to stores. For detail maintenance instructions, refer to EO 35AA-5ARC552-2.

9 TROUBLE SHOOTING - For system trouble shooting, refer to EO 35AA-5ARC552-2, Part 3.

BENDIX VHF SYSTEM

10 The Bendix VHF (single channel) system consists of a TA-21A transmitter, a RA-21A receiver and a power relay mounted on the radio equipment rack in the aft fuselage. Remote control is achieved by using a CNA-21CNX control unit and two mike selection switches mounted on the instrument panel and two audio switch panels mounted on the overhead radio control panel. The AN104B antenna mast is located atop the rear fuselage and an audio-matching transformer and a test jack is mounted on the radio junction box.

11 The TA-21A transmitter is designed to provide crystal-controlled operation on 360 channels spaced 50 kilocycles apart in the frequency range of 118.0 to 135.95 megacycles.

12 The RA-21A receiver is a triple-conversion, superheterodyne receiver operating in the frequency range from 108.0 to

135.95 megacycles, with 560 channels spaced 50 kc apart.

13 SERVICING - Check condition of the circuit by visually inspecting the wiring. Do not attempt repairs other than replacement of tubes and connecting of loose wires. If any unit requires more extensive repairs it should be tagged unserviceable and returned to stores. For detail maintenance instructions, refer to EO 35AD-5TA21A-2A and EO 35AB-5RA21A-2.

14 TROUBLE SHOOTING - For trouble shooting, transmitter and receiver, refer to EO 35AD-5TA21A-2A and EO 35AB-5RA21A-2 respectively.

BENDIX VOR/ILS SYSTEM

15 The VOR/ILS system, by means of the MN-72 and MN-97 indicators, provides the pilot with a complete navigational system and both lateral and vertical guidance to the runway selected for landing.

16 The system consists of a RA-21A receiver, a GSA-8A receiver, a NVA-21A navigation unit, a power relay and a transformer mounted on the radio equipment rack in the aft fuselage. The system is remotely controlled by a CNA-21CNX control unit located on the instrument panel and two audio switch panels on the overhead control panel. The MN-72 magnetic indicator and the MN-97 course indicator is located on the instrument panel and the AS-27/ARN-5 DI-POLE antenna is located atop the forward fuselage. A test jack is provided in the radio junction box for rapid testing purpose.

17 The NVA-21A navigation unit and the RA-21A receiver provides complete VOR/LOC course information. Some of the visual indications possible include:

(a) The bearing to a selected VOR (VHF) omnidirectional range station.

(b) The lateral deviation from a selected VOR station radial.

(c) The lateral deviation from a tone localizer (LOC) path to an airport runway.

18 The GSA-SA receiver is designed to receive glide slope transmission within the frequency range of 329.3 to 335.0 megacycles and to provide vertical guidance to a pilot during landing operations.

19 SERVICING - Check condition of the circuit by visually inspecting the wiring. Do not attempt repairs other than replacement of tubes and connecting of loose wires. If any unit requires more extensive repairs it should be tagged unserviceable and returned to stores. For detail maintenance instructions, refer to EO 35AC-10NVA21A-2, EO 35AB-5RA21A-2, EO 35AB-10GSA8A-2 and EO AD-5TA21A-2.

20 TROUBLE SHOOTING - For trouble shooting, NVA-21A navigation unit, RA-21A receiver and GSA-8A receiver, refer to EO 35AC-10NVA21A-2, EO 35AB-5RA21A-2 and EO 35AB-10GSA8A-2 respectively. For general reference see EO 35AD-5TA21A-2.

AN/ARN-6 RADIO COMPASS SYSTEM

21 The AN/ARN-6 radio compass is designed primarily for use to obtain the following information within the frequency range of 100 to 1750 kc.

(a) Automatic visual bearing indication of the source of radio signals received and simultaneous aural reception of the same signals on a non-directional antenna.

(b) Aural reception of modulated rf signals with the non-directional antenna.

(c) Aural and directional indication on the loop antenna.

22 The R101A/ARN-6 receiver is mounted on the radio equipment rack in the aft fuselage. Remote control is accomplished using a control head and two audio switch panels on the overhead control panel. The AS-313/ARN-6 loop and the centre long wire sense antenna is mounted atop the rear fuselage.

23 SERVICING - Do not attempt repairs other than replacement of audio and rf vacuum tubes or connection of loose wires. If the unit requires more extensive repairs it should be tagged unserviceable and returned to stores. For detail maintenance instructions, refer to EO 35AA-10ARN6-2.

24 TROUBLE SHOOTING - For system trouble shooting, refer to EO 35AA-10ARN6-2.

MN-53B MARKER BEACON RECEIVER

25 The MN-53B superheterodyne marker receiver is designed to give the pilot aural and visual identification when passing over an airways marker, or outer and inner markers in the instrument landing system.

26 The MN-53B marker receiver, located on the radio equipment rack in the aft fuselage, is remotely controlled by a control head and two audio switch panels on the overhead control panel. The airways (white), outer (purple) and inner (amber) indicator lamps are located on the pilot's instrument panel and the receiving antenna is mounted on the underside of the aircraft.

27 SERVICING - Do not attempt repairs other than repair of loose connections, replacement of tubes, cleaning dynamotor commutator or replacing dynamotor brushes and replacement of indicator lights. For detail maintenance instructions, refer to EO 35AA-10MN53B-2.

28 TROUBLE SHOOTING - Trouble shooting with the equipment installed in the aircraft is limited. However, before using detailed testing procedures or removing the equipment from the aircraft, check the following:

(a) Availability of power.

(b) Circuit breaker tripped.

(c) Condition of tubes.

(d) All electrical connections.

(e) Defective indicator lamps.

(f) If, after checking these items, the set is still inoperative, it should be tagged repairable and returned to stores.

ISOLATION AMPLIFIER

29 The isolation amplifier incorporated in the radio equipment is designed to allow either the pilot or co-pilot to receive audio independently of each other. Audio switches for each radio circuit are provided on the overhead control panel, for both pilot and co-pilot. The audio received in their respective headphones is determined by the position of the audio switches. As an example, it would be possible for the co-pilot to receive radio compass and marker audio while the pilot is receiving and transmitting on VHF. The pilot and co-pilot will never receive audio from the same radio circuit unless their respective audio switches are both closed. The OA-5002/ARR isolation amplifier, located on the radio equipment rack in the aft fuselage, is controlled by a control head mounted on the overhead control panel.

30 SERVICING - Do not attempt repairs other than replacement of tubes in the amplifier and repair of loose connections. If the unit requires more extensive repairs it should be tagged unserviceable and returned to stores. For detail maintenance instructions refer to EO 35H-20/OA5002-2

31 TROUBLE SHOOTING - A satisfactory trouble shooting operation cannot be performed with the equipment installed in the aircraft. However, if the equipment is inoperative, make the following checks before removing it from the aircraft.

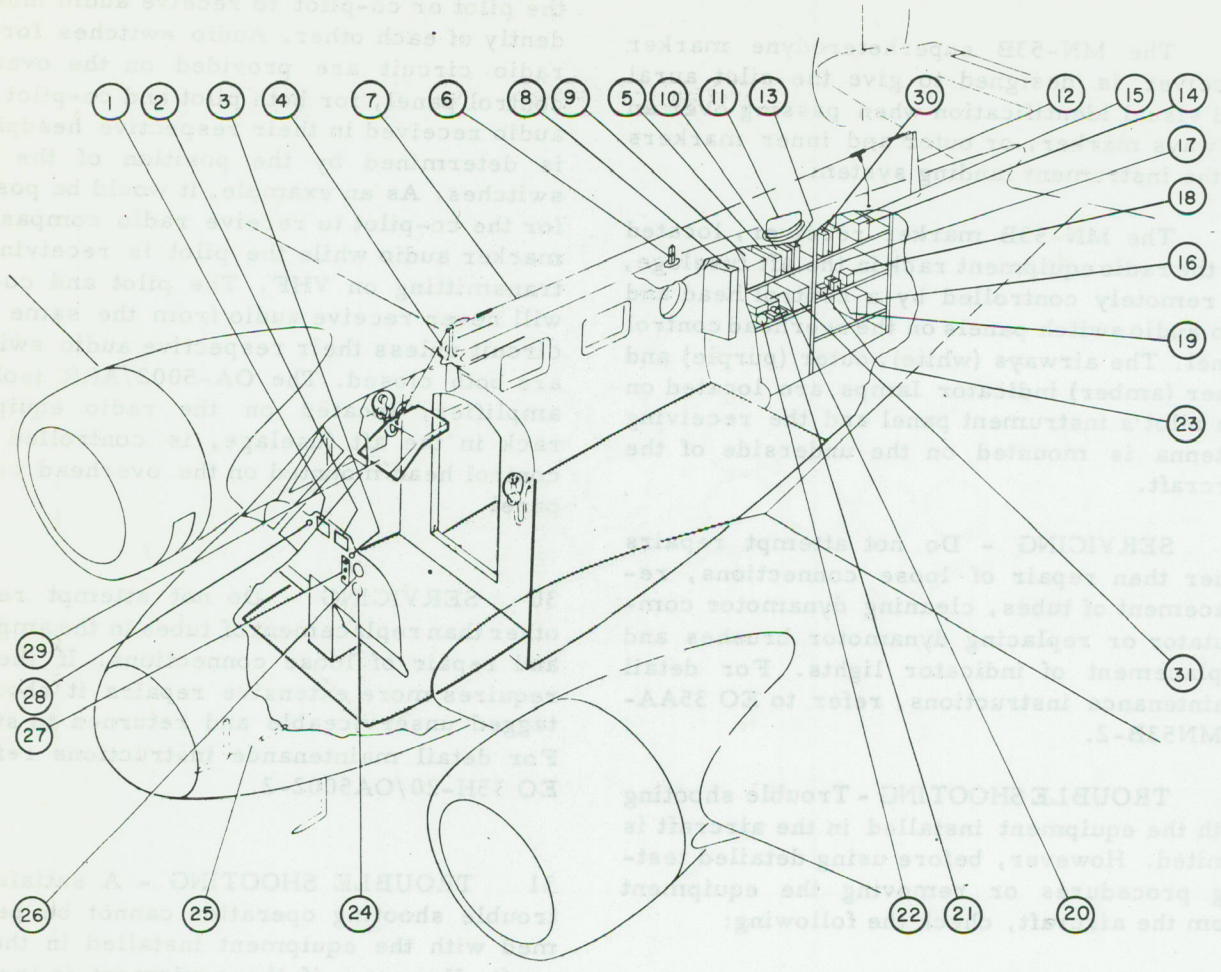
(a) Check circuit breaker.

(b) Check availability of power.

(c) See that all electrical and plug connections are secure.

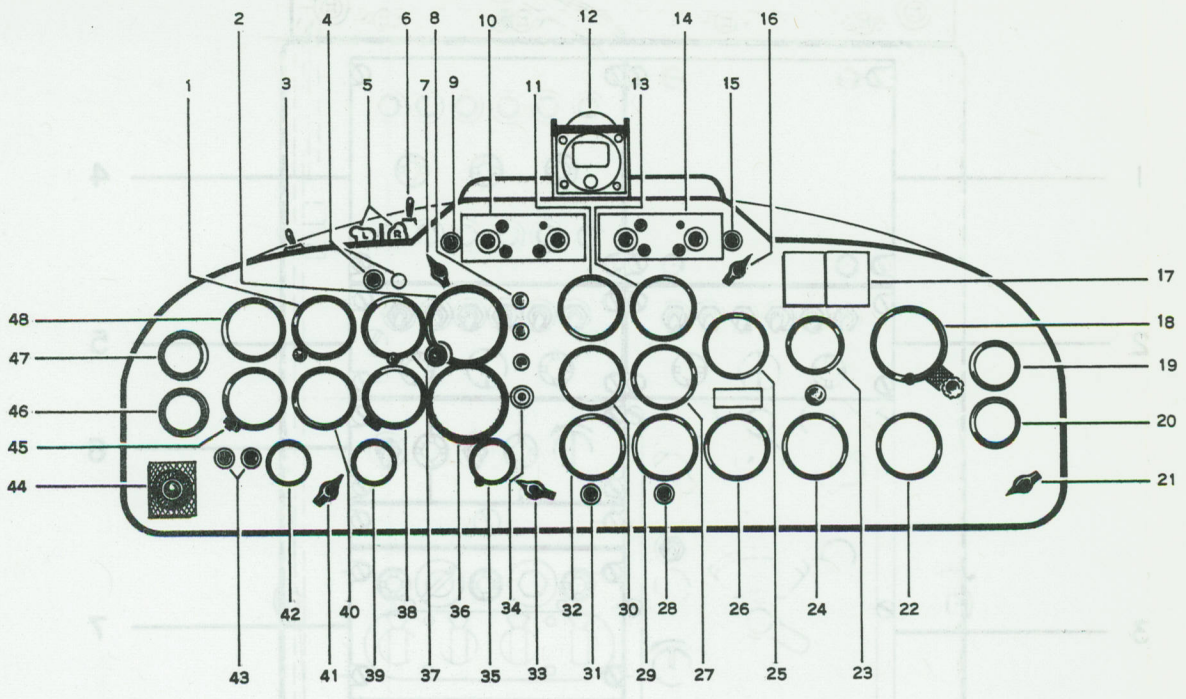
(d) Check condition of tubes.

(e) If after running all these checks the unit is still inoperative remove amplifier, tag repairable and return to stores.



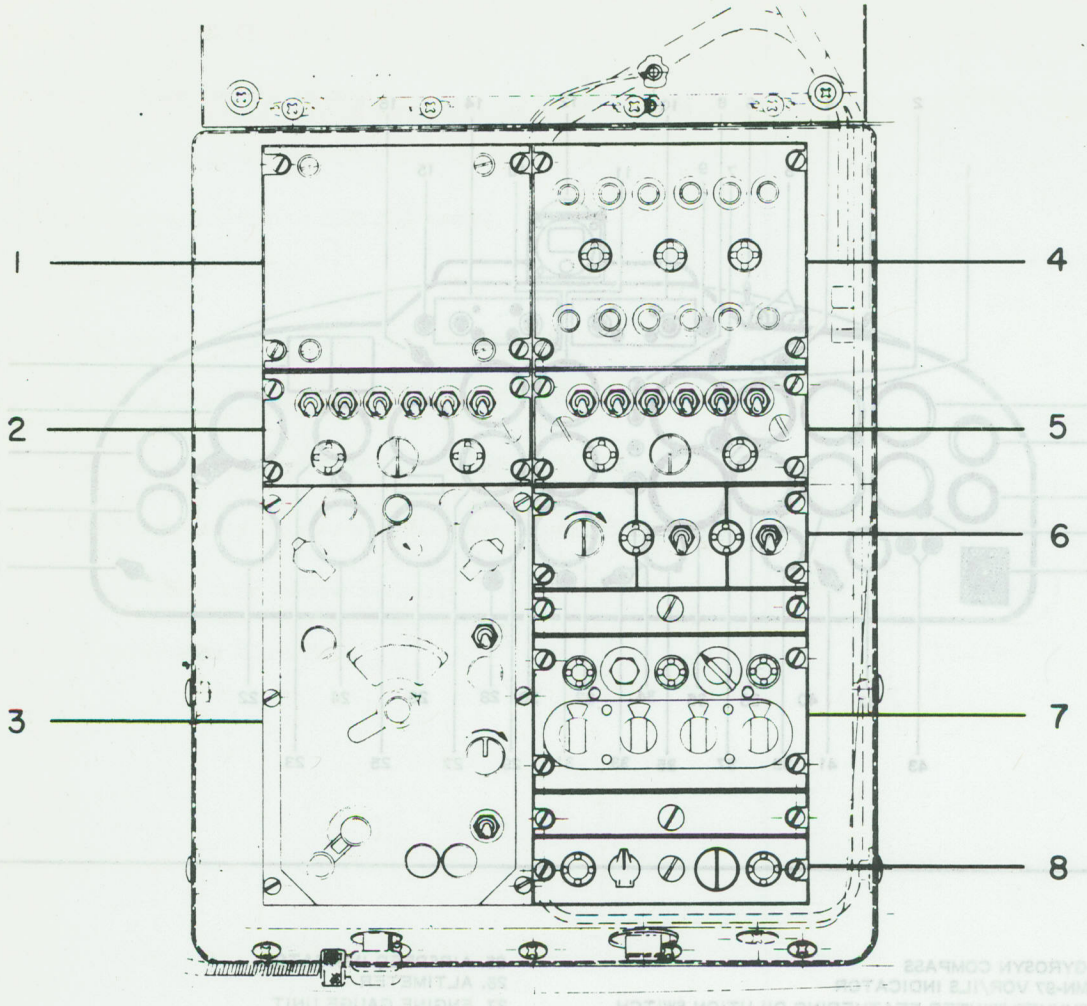
1 VOR /ILS CONTROL PANEL
2 BENDIX VHF CONTROL PANEL
3 PILOT'S MIC SWITCH
4 VOR/ILS DI-POLE ANTENNA
5 GSA-8A GLIDE SLOPE RECEIVER
6 AT-256/ARC ANTENNA MAST
7 RADIO COMPASS SENSE ANTENNA
8 RADIO JUNCTION BOX
9 RIOIA/ARN-6 RADIO COMPASS RECEIVER
10 RA-21A VOR/ILS RECEIVER
11 AS313/ARN-6 RADIO COMPASS LOOP
12 BENDIX VHF ANTENNA MAST
13 NVA-21A NAVIGATION UNIT
14 ISOLATION AMPLIFIER OA-5002/ARR
15 TA-21A VHF TRANSMITTER
16 MN53B MARKER BEACON RECEIVER
17 VOR/ILS POWER RELAY
18 UHF TRANSFORMER
19 VHF POWER RELAY
20 INTERPHONE AMPLIFIER BC-347
21 DYNAMOTOR PE-86
22 F-20-4 INVERTER
23 VOR/ILS TRANSFORMER
24 MN-72 VOR/ILS INDICATOR
25 MARKER ANTENNA
26 MN-97 VOR/ILS INDICATOR
27 MARKER INDICATOR LIGHTS
28 CO-PILOT'S MIC. SWITCH
29 PILOTS OVERHEAD RADIO CONTROL PANEL
30 RA-21A VHF RECEIVER
31 RT-5011/ARC-552 TRANSCEIVER

Figure 8-4 Radio Equipment Location Diagram (Bendix/ARC552 Configuration)



1. GYROSYN COMPASS
2. MN-97 VOR/ILS INDICATOR
3. SUMMER/WINTER FEATHERING DILUTION SWITCH
4. GYRO HORIZON ERECTION SWITCH AND INDICATOR LIGHT
5. PROPELLER FEATHERING BUTTONS
6. PROPELLER FEATHERING CIRCUIT BREAKER
7. PILOT'S MIKE SWITCH
8. MARKER BEACON LIGHTS
9. FUEL PRESSURE WARNING LIGHT
10. BENDIX VHF CONTROL PANEL
11. RPM INDICATOR (TACHOMETERS)
12. B-21 COMPASS
13. MANIFOLD PRESSURE GAUGE
14. VOR/ILS CONTROL PANEL
15. FUEL PRESSURE WARNING LIGHT
16. CO-PILOT'S MIKE SWITCH
17. COMPASS CORRECTION CARD HOLDERS
18. GYRO HORIZON INDICATOR
19. SUCTION GAUGE
20. DE-ICING PRESSURE GAUGE
21. INSTRUMENT LIGHT SWITCH
22. RATE OF CLIMB INDICATOR
23. DIRECTIONAL GYRO INDICATOR
24. TURN AND BANK INDICATOR
25. AIRSPEED INDICATOR
26. ALTIMETER
27. ENGINE GAUGE UNIT
28. GENERATOR FAILURE WARNING LIGHT
29. CARBURETTOR MIXTURE TEMPERATURE GAUGE
30. ENGINE GAUGE UNIT
31. GENERATOR FAILURE WARNING LIGHT
32. CYLINDER HEAD TEMPERATURE GAUGE
33. INSTRUMENT LIGHT SWITCH
34. HORN SILENCER BUTTON
35. CLOCK
36. MN-72 VOR/ILS INDICATOR
37. GYRO HORIZON INDICATOR
38. RATE OF CLIMB INDICATOR
39. FLAP POSITION INDICATOR
40. TURN AND BANK INDICATOR
41. INSTRUMENT LIGHT SWITCH
42. ELEVATOR TAB POSITION INDICATOR
43. FIRE DETECTION WARNING LIGHTS
44. FUEL GAUGE SELECTOR SWITCH
45. ALTIMETER
46. FUEL QUANTITY GAUGE
47. OUTSIDE AIR TEMPERATURE GAUGE
48. AIRSPEED INDICATOR

Figure 8-5 Floating Instrument Panel (Bendix/ARC552 Configuration)



1 MIKE RELAY PANEL
2 PILOTS AUDIO SWITCH PANEL
3 AN/ARN-6 RADIO COMPASS CONTROL
4 CIRCUIT BREAKER PANEL
5 CO-PILOTS AUDIO SWITCH PANEL
6 INTERCOM. - ISO. AMPL. CONTROL
7 AN/ARC-552 UHF CONTROL
8 MARKER CONTROL

Figure 8-6 Overhead Radio Control Panel (Bendix/ARC552 Configuration)

PART 9

ARMAMENT AND ARMAMENT SYSTEMS

NOT APPLICABLE

PART 10

PHOTOGRAPHIC

NOT APPLICABLE

PART 11

WIRING DATA

INTRODUCTION

1 The major portion of this part consists of wiring diagrams of all electrical circuits found in the Expeditor 3 Series aircraft. Included is a symbol chart showing all graphic symbols used in the diagrams along with a brief explanation and an equipment list of all items of equipment used and an explanation of their purpose and/or function.

2 The electrical equipment list and the radio equipment list give the name and applicable AN or other military part number where possible. When a piece of apparatus is not standard and has no military nomenclature, the identifying part number of the manufacturer is included. These numbers are not to be used for procurement purposes; the Parts Catalog should be consulted for procurement information.

3 Each piece of equipment has been assigned the index number identifying it on the manufacturer's blueprints, to eliminate as much confusion between manufacturer and customer as possible. In some instances two or more different items have the same index number on different diagrams. Also the same number may be used, but with different nomenclature. Hence the index list.

4 To find the nomenclature of a particular part shown on a wiring diagram, note the index number and figure number. Then after finding the index number in the first column of the equipment list, look for the number referred to the particular diagram (Figure number) being used, in the second column. Familiarization with this method will bring quick and positive identification of each item of equipment on any diagram.

5 An alphabetical index of the wiring diagrams is included in this part. The models to which each diagram is applicable are given.

6 A wiring diagram of each circuit is shown on a separate page except in instances where the simplicity and brevity of the circuit did not merit full page presentation. Wires are numbered exactly as they are found in the aircraft.

7 The schematic wiring diagrams are arranged with the components of the circuit as near to their true position, relative to each other, as possible. The circuits are arranged as they would be seen in a cutaway, top view of the aircraft.

8 Each figure includes an oblique view of the aircraft showing routing of conduit and location of apparatus used in the schematic diagrams.

9 Length and size of wires are given only when they are critical to the operation of the circuit.

WIRING DIFFERENCES

10 The basic differences in wiring configuration that will be met on various models of Expeditor 3 aircraft are as follows:-

(a) Electrical System - The wiring is basically the same on all aircraft, except to the generator control box installed in the 3T aircraft.

(b) Radio and Intercomm System - All systems function the same for all aircraft. The 3T aircraft is fitted with an additional radio junction box, which is installed on No. 9 Bulkhead. All other junction boxes are identical, except for the radio compass relay box (Item 89). The majority of 3N or 3NM and 3TM aircraft, have connectors (Items 84 and 85) fitted to the BK22 relay box, but on 3T and early 3N

aircraft these connectors are not used.

(c) Navigation System - The wiring to the navigation equipment is basically the same for all aircraft with the following exceptions:-

(1) Wiring configuration on 3N and 3NM aircraft is different due to additional equipment such as repeaters and associated duplicate navigational instruments.

(2) The C-2 gyrosyn compass junction box (Item 42) fitted in the 3T aircraft differs from those installed in other models of Expeditor 3 aircraft due to the non-requirement of repeaters and duplicate navigational instruments.

ALPHABETICAL LIST OF WIRING DIAGRAMS

CIRCUIT	FIGURE	PAGE
AF-UTA68 Transceiver Circuit	11-26	11-42
AN/ARC-552 UHF Circuit (Bendix/UHF Configuration)	11-34	11-57
Battery Ignition and Starter Circuit using VJR-24B5 Vibrator	11-2	11-17
Battery Ignition and Starter Circuit using AN4181-1 Vibrator	11-3	11-18
BC-733D Localizer and R-89B Glide Path Receiver Circuit	11-22	11-37
BC-733D Localizer and R-89B Glide Path Receiver Circuit	11-23	11-38
Bendix VHF Circuit (Bendix/UHF Configuration)	11-35	11-59
Bendix VOR/ILS Circuit (Bendix/UHF Configuration)	11-36	11-61
Electrical Symbols (2 Sheets)	11-1	11-15
Flap Circuit	11-4	11-19
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Fire Detection Circuits	11-17	11-32
Generator Circuit (3N, 3NM and 3TM)	11-8	11-23
Generator Circuit (3T)	11-9	11-24
Instrument Ringlight Circuit (EO 05-45B-6A/197)	11-15A	11-30A
Interior Lighting Circuit	11-12	11-27
Interphone Circuit	11-21	11-36
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Landing Gear Motor Position Lights and Warning Horn Circuit	11-10	11-25
Master Marker Beacon	11-20	11-35
Master Interphone and Telecom Circuit (Bendix/UHF Configuration)	11-39	11-67
MN-53B Marker Beacon Receiver Circuit (Bendix/UHF Configuration)	11-38	11-65
Navigation and Landing Lights	11-11	11-26
Navigational Equipment and Flight Instruments Circuits (3NM)	11-27	11-43
Navigational Equipment and Flight Instruments Circuits (3N)	11-28	11-45

CIRCUIT	FIGURE	PAGE
Navigational Equipment and Flight Instruments Circuits (3TM)	11-29	11-47
Navigational Equipment and Flight Instruments Circuits (3T)	11-30	11-49
Overhead Radio Control Panel	11-31	11-51
Oil Dilution and Pitot Heat Circuit	11-16	11-31
Oil Carburettor - Air and Free Air Temperature Indicator Circuits	11-18	11-33
Propeller Feathering Circuits (CA111 only)	11-6	11-21
Propeller Feathering Circuit	11-7	11-22
R-5A/ARN-7 Radio Compass (3N, 3NM and 3TM)	11-24	11-39
R-5A/ARN-7 Radio Compass (3T)	11-25	11-41
R101A/ARN-6 Radio Compass Circuit (Bendix/UHF Configuration)	11-37	11-63
Rudder Tab Position Indicator and Radio Panel Light Circuit	11-13	11-28
SCR-274 Command Set and Audio System	11-32	11-53
Turn and Bank Indicator Circuit	11-19	11-34

EQUIPMENT LIST, ELECTRICAL SYSTEM

INDEX NO.	FIGURE NO.	NAME	PART NO.
1	11-2, 11-3	Battery-12 volt, 36 ampere hour shielded storage	AR-12-36
2	11-11	Lamp - PAR-64 bulb, landing	AN3130-4560
3	11-11	Lamp - GG-10 bulb, cand. bayonet base wing position	AN3122-1524
4	11-11	Lamp-S-8 bulb, cand. bayonet base tail position	AN3124-307
5	11-12	Lamp - G-6 bulb, cabin, nose and rear baggage compartment	AN3131-303
6	11-10, 11-17 11-14, 11-5	Lamp - T-3 1/4 bulb, miniature bayonet base indicator light.	AN3-21-313
7	11-15	Lamp - T-1 1/4 bulb, special base instrument compass light	AN3126-323
8	11-18	Bulb - Electric resistance type, oil carb, air and free air temperature	AN5525-1
9	11-12	Switch - Cabin dome lights	AN3021-2
10	11-12	Lamp - G-6 bulb (extension light)	AN3137-304
11	11-2	Induction vibrator	VJR-24B5
11	11-3	Induction vibrator	AN4181-1
12	11-18	Circuit breaker - Right engine oil temperature	PSM-10
13	11-18	Circuit breaker - Left engine oil temperature	PSM-10
15	11-4	Circuit breaker - Flap motor	PSM-20
16	11-12	Circuit breaker - Instrument, dome reading lights	PSM-10
17	11-15	Circuit breaker - De-icer	PSM-10
18	11-14	Circuit breaker - Flap and elevator tab position indicator	PSM-10
19	11-15A	Circuit breaker - Instrument Lights	PSM-5
20	11-15	Circuit breaker - Anti-icer motor	PSM-10
21	11-19	Circuit breaker - Electric turn and bank indicator	PSM-5
22	11-11	Circuit breaker - Right landing light motor	PSM-10
23	11-11	Circuit breaker - Left landing light motor	PSM-10
24	11-18	Circuit breaker - Carburetor air temperature indicator	PSM-10
25	11-10 11-14	Circuit breaker - Landing-gear position light	PSM-10
26	11-5	Circuit breaker - Fuel level and pressure warning indicator lights	PSM-10
27	11-11	Circuit breaker - Right landing light lamp	PSM-30
28	11-11	Circuit breaker - Left landing light lamp	PSM-30
29	11-10	Circuit breaker - Landing-gear warning horn	PSM-10
30	11-11 11-13	Circuit breaker - Flasher position rudder tab and radio panel light	PSM-10
31	11-16, 11-6	Circuit breaker - Oil dilution	PSM-15
32	11-16	Circuit breaker - Pitot heat	PSM-20
33	11-2, 11-3	Circuit breaker - Induction vibrator	PSM-10
34		Circuit breaker - Windshield wiper motor	PSM-15
35	11-10	Circuit breaker - Landing-gear position control	D-6751-1-10
36	11-8	Circuit breaker - Generator	PLM-50
37	11-10	Circuit breaker - Landing-gear motor	PLM-50
38	11-16, 11-5, 11-7	Valve - Oil dilution solenoid	37D6210

EQUIPMENT LIST, ELECTRICAL SYSTEM

INDEX NO.	FIGURE NO.	NAME	PART NO.
39	11-5	Light Assembly - Fuel pressure warning indicator	AN3157-2
40	11-15	Compass - Magnetic	404-183722
41	11-11	Light assembly - Electrically retractable landing	AN3095-9
42	11-11	Light assembly - Wing position, wing tip L.H. (red)	AN3033-3
43	11-11	Light assembly - Wing position, wing tip R.H. (green)	AN3033-4
44	11-12	Light assembly - rear baggage compartment dome	804-180997
45	11-12	Light assembly - Cabin dome	404-180997
46	11-12	Light assembly - Nose baggage compartment dome	804-180997
47	11-10	Warning horn - Landing gear	B9606
48	11-2, 11-3	Magneto - Engine	SB9RN-4
49	11-10	Motor assembly - Landing-gear	84-188900
50	11-5	Gauge - Fuel	404-183723
51	11-16	Pitot heat tube	782-02
52	11-18	Plug - Carburetor air temperature firewall	AN3108-12S-3P
53	11-18	Receptacle - Carburetor air temperature, firewall	AN3100-12S-3S
54	11-8	Plug - Generator, firewall	AN3100-28-5S
55	11-8	Receptacle - Generator, firewall	AN3108B-28-5P
56	11-2, 11-3	Plug - Starter, firewall	AN3108-18-6P
57	11-2. 11-3	Receptacle - Starter, firewall	AN3100-18-6S
58	11-2, 11-3	Plug - Magneto, firewall	AN3108-18-22S
59	11-2, 11-3	Receptacle - Magneto, firewall	AN3100-18-22P
60	11-14	Rheostat - Flap position	G106337
61	11-14	Rheostat - Elevator tab position	404-186117
62	11-15	Rheostat - Anti-icer control	AN3155-50-30
63	11-3	Receptacle - External power source	42B3748
64	11-15	Light assembly - Ultra violet fluorescent, instrument	404-180541-2
65	11-15	Rheostat - Compass light	AN3155-25-25
66	11-15A	Rheostat - Instrument lighting	AN3155-50-75
67	11-14	Resistor - Flap and elevator tab position indicator 160 ohms	10EC/34493
68	11-5	Transmitter - Right front fuel tank	189630-2
69	11-5	Transmitter - Right rear fuel tank	189726-2
70	11-5	Transmitter - Left front fuel tank	189630-1
71	11-5	Transmitter - Left rear fuel tank	189726-1
72	11-8	Shunt - Ammeter	AN3200-300
73	11-7, 11-2. 11-3	Relay - Starter Type B-8A	32424
74	11-17	Switch - Fire detector test	AN3021-8
75		Plug - Windshield wiper motor	AN3106-18-5S
76	11-2, 11-3	Relay - Master battery Type B-4	94-32324
77	11-2, 11-3	Motor - Starter Type J-1	756-21
78	11-5	Switch - Fuel gauge selector	734-183826
79	11-10	Switch - Landing-gear upper position indicator light	AN3210-1
80	11-17	Light assembly - Fire detection indicator	AN3057-6
81	11-11	Flasher - Position light	450250-0-3
82	11-2, 11-3	Switch - Master battery	AN3027-2
83		Switch - Windshield wiper motor control	AN3021-1
84		Plug - Tachometer, firewall	AN3108-14S-1S
85		Receptacle - Tachometer, firewall	AN3100-14S-1P

EQUIPMENT LIST, ELECTRICAL SYSTEM

INDEX NO.	FIGURE NO.	NAME	PART NO.
86	11-2, 11-3	Switch - Master magneto	AN3021-2
87	11-11	Switch - Landing light	AN3021-1
88	11-10	Switch - Landing-gear warning horn	AN3210-1
89	11-8, 11-9	Box - Generator failure warning	21798
90	11-11	Switch - Pitot heat	AN3021-2
91	11-11	Switch - Flasher position rudder tab indicator and radio panel lights	AN3027-1
92	11-14	Indicator - Flap position	404-183799
93	11-10	Switch - Landing-gear lower limit	WZ-R31
94	11-10	Switch - Landing-gear position control	AN3023-3
95	11-4	Switch - Flap upper limit	AN3210-1
96	11-4	Switch - Flap position control	AN3022-1
97	11-2, 11-3	Box - External power source receptacle	180961
98		Generator - Tachometer	AN5531-2
99	11-5	Switch - Fuel pressure warning Type C-3	94-32215
100	11-14	Indicator - Elevator tab position	404-183797
101	11-5, 11-10		
	11-16, 11-17		
	11-18, 11-6		
	11-6	Box assembly - Nacelle junction L.H.	644-180520
102	11-5, 11-10		
	11-16, 11-17		
	11-18, 11-5		
	11-6	Box assembly - Nacelle junction R.H.	644-180520-1
103	11-18	Indicator - Dual carburetor air temperature	404-183719
104	11-2, 11-3	Switch - Starter	138143E
105	11-8	Box assembly - Generator equipment L.H.	404-180578
106	11-8	Box assembly - Generator equipment R.H.	404-180578
107	11-15	Switch - De-icer motor valve	94-189682
108	11-11, 11-12		
	11-14	Strip assembly - Terminal	NAS45-6-8
109	11-4	Strip assembly - Flap terminal	NAS18-5A
110	11-10	Pedestal assembly -	404-189055
111	11-10	Switch - Landing-gear upper limit	MS25008-1
112	11-4	Switch - Flap lower limit	AN3210-1
113	11-6	Switch - Oil dilution valves	AN3021-8
114	11-10	Switch - Landing-gear safety	BZ-RQ-41
115	11-5	Transmitter - Nose fuel	404-189715
116	11-5, 11-3		
	11-10, 11-11		
	11-13, 11-6	Subpanel assembly - Complete left hand	644-183817
117	11-4, 11-2		
	11-3, 11-27	Subpanel assembly - Complete right hand	644-183818
118		Indicator - Dual tachometer	644-183713
119			
120	11-18	Plug - Oil temperature and free air temperature bulb	AN3106-12S-3S
121	11-8	Ammeter	605A
122	11-8	Switch - Master generator	AN3021-2
123	11-12	Lamp assembly - Cockpit (aircraft extension)	804-180866 or B7825

EQUIPMENT LIST, ELECTRICAL SYSTEM

INDEX NO.	FIGURE NO.	NAME	PART NO.
124	11-19	Indicator - Electric turn-and-bank	644-183716
125	11-12	Light assembly - Cabin table Type A-11	94-32372
126	11-19	Plug - Electric turn-and-bank indicator	AN3106-10SL-3S
127	11-7, 11-6	Switch - Prop. feathering control	2CC184
128	11-12	Light assembly - Cockpit map reading	894-180805
129	11-7, 11-6	Plug - Prop. feathering switch, firewall	AN3108-12S-4S
130	11-7, 11-6	Receptacle - Prop. feathering switch, firewall	AN3100-12S-4P
131	11-7, 11-6	Relay - Prop. feathering motor Type B8A	54484
132		Motor - Windshield wiper	D12364
133	11-11	Light assembly - Tail position clean lens Type S-1	A-2064
134	11-12	Switch - Cockpit map reading light	10-SW-75
135	11-16	Bus bar - Oil dilution switches	108446
136	11-7, 11-6	Switch - Propeller feathering pressure	55526
137	11-11	Light assembly - Tail position red lens Type S-1	A2064
138	11-12	Strip - Copper terminal	804-183926
139	11-10	Light assembly - Landing-gear up position indicator (red)	VM400-2
140	11-10	Switch - Landing-gear lower position indicator light	AN3210-1
141	11-4	Motor - Flap	804-182626
142	11-2	Connector - Magneto "Y"	148-1-0250
143	11-11	Plug - Landing light	AN3106-18-5S
144	11-10	Light assembly - Landing-gear down position indicator (green)	VM400-3
145	11-11, 11-14	Strip assembly - Tail position lights and rudder tab terminals	NAS45-6-4
146	11-8	Plug - Generator	AN3106-22-12S
147		Plug - Tachometer generator	AN3108-14S-1S
148	11-18	Plug - Carburetor air temperature bulb	AN3108-12S-3S
149			
150	11-11	Plug - Outboard wing	GK-C8-21C-5/8B
151	11-11	Receptacle - Outboard wing	GK-C8-32SL
152	11-5	Plug - Fuel gauge	AN3106-14S-2S
154		Plug - Fuel tachometer indicator	AN3108-14S-1S
155	11-18	Plug - Dual carburetor air temperature indicator	AN3106-14S-5S
156		Plug - Compass light resistor (24 volt)	
157	11-8, 11-10 11-12, 11-15		
	11-13, 11-5	Splice - Disconnect	A-57
158	11-8, 11-15		
	11-16	Splice - Disconnect	B-57
159	11-15	Plug - Anti-icer pump	AN3108-12S-4S
160	11-12	Lamp - S-8 bulb, cabin table lights	AN3132-308
161	11-8, 11-9	Light assembly - Generator failure warning light	VM400-2
162	11-8	Generator Type M-3	404-189240
163	11-8	Relay - Generator reverse current	AN3025-1
164	11-8	Box - Voltage rheostat	111-71007
165	11-8	Regulator - Generator voltage Type P-1	94-32276
166	11-8, 11-2	Post assembly - Terminal distribution	814-180537
167	11-8	Generator - Anti-flash relay	Type B4A

EQUIPMENT LIST, ELECTRICAL SYSTEM

INDEX NO.	FIGURE NO.	NAME	PART NO.
168	11-8	Box assembly - Generator conduit junction	804-187360
169	11-10	Relay - Landing-gear dynamic brake	6046-H39A
170	11-4	Box assembly - Flap dynamic brake relay	814-180592
171	11-4	Relay - Flap dynamic brake	20023
172	11-13	Light assembly - Rudder tab indicator	209
173	11-11, 11-13	Strip assembly - Position light flasher terminal	NAS45-6-4
174	11-2	Switch - Booster and starter selector	AN3027-1
175	11-5	Plug - Fuel pressure warning switch	AN3106-12S-3S
176	11-8, 11-15	Capacitor	26F558G3
177	11-4, 11-7, 11-10, 11-12, 11-15, 11-5, 11-19, 11-18		
	11-2	Bus bar - Right subpanel circuit breaker	108446-12
178	11-12	Rheostat - Cabin table lights 25 ohms, 25 watt type 351 - HAMAR	0147
179	11-12	Bus bar - Cabin dome light switch	404-183886
180	11-2, 11-3	Switch - Induction vibrator booster	138143
181	11-7, 11-6	Motor - Propeller feathering	59664-1
182	11-18	Indicator - Oil temperature (engine gauge)	404-183715
183	11-18	Plug - Oil temperature and free air temperature indicator	AN3106-14S-2S
184	11-2	Bus bar - Magneto switches	108446-4
185	11-3, 11-5 11-11, 11-16 11-17, 11-18 11-13, 11-2		
	11-5, 11-6	Bus bar - Left subpanel circuit breakers	108446-11
186	11-8	Bus bar - Battery and generator switches	108446-2
187	11-11	Bus bar - Landing light switches	404-183887
188	11-11, 11-13	Bus bar - Rudder tab position indicator and flasher position light switches	404-183887
189		Bus bar - Pitot switch	404-183886
190	11-13	Lamp - Radio panel	AN3124-307
191	11-13	Rheostat - Radio panel lamp 25 watt 75 ohms 351 HAMAR	0150
192		Socket - Radio panel lamp	S. C. 2611
193	11-14	Antenna coupler (male and female)	1071
194	11-5, 11-10 11-16, 11-17		
	11-5, 11-6	Strip-assembly - Nacelle junction box terminal	NAS45-6-7
195	11-7	Circuit breaker - Propeller feathering control	AN3160-5L
196	11-11	Plug - Position light flasher	AN3106-14S-5S
197	11-5	Plug - Nose fuel tank transmitter	AN3108-14S-1S
198	11-10	Solenoid - Landing-gear position control switch latching	734-183872
199	11-12	Splice - Two-way	BB
200	11-15	Pump-Anti-icer	125-24D-4-1/8
201	11-12	Lamp - G-6 bulb - Cockpit map reading	AN3131-303
202	11-16	Pitot heat tube	782-02

EQUIPMENT LIST, ELECTRICAL SYSTEM

INDEX NO.	FIGURE NO.	NAME	PART NO.
203	11-7, 11-6	Plug - Propeller feathering switch	AN3108-12S-4S
204	11-8, 11-9	Relay - Generator failure warning light	1252
205	11-15	Light assembly - Ultra violet fluorescent instrument Type C8	B2930-A
206	11-17	Plug - Fire detector relay panel	AN3106-14S-5S
207	11-17	Plug - Fire detector relay panel	AN3106-14S-5S Pos. X
208	11-17	Relay panel - Fire detector Type - Model 117-52A	35884
209	11-18	Indicator - Free air temperature	644-183710
210	11-17	Circuit breaker - Fire detector	PSM-5
211	11-17	Thermocouple assembly - Fire detector, firewall	35534-3
212	11-17	Thermocouple assembly - Fire detector, wheel well	35534-3
213	11-9	Rheostat	0360-B
214	11-7	Switch - Feathering oil dilution	AN3022-2
215	11-7	Relay - Plessey pump	AN3320-1
216	11-7	Plug - Plessey pump	AN3108A-14S-2S
217	11-7	Receptacle - Plessey pump	AN3101A-14S-2P
218	11-7	Plessey Pump - Feathering oil dilution	Type FP3, Mk3
219	11-8	Rheostat - Generator - voltage box	AN3155-25-11
220	11-8, 11-9	Plug - Generator failure warning light box	AN3106-14S-5S
221	11-8, 11-9	Receptacle - Generator failure, warning light box	AN3102-14S-5P
222	11-9	Control Box - Generator	(4MBA-6634(LH) (4MBA-6634-1 RH)
223	11-10	Relay - Warning horn silencer	1265-NA
224	11-10	Push Button - Warning horn silencer	C100B9RSH
225	11-11	Light - Upper and lower navigation	AN3097-2
226	11-9	Bus Bar - 100 Amp Generator (3T)	111-71006
227	11-15	Resistor - Compass light 140 ohm	RW32G141
228	11-15A	Light assembly - Instrument lighting	A5299-24
229	11-15A	Light assembly - Instrument lighting	B4750
230	11-15A	Light assembly - Instrument lighting	B4785-1
231	11-15A	Light assembly - Instrument lighting	B4855
232	11-10	Diode	IN1096
233	11-10	Light assembly ground observer	A5056-2-308
234	11-25	Switch undercarriage emergency over-ride	MS25089-4C
235	11-25	Relay undercarriage emergency retract	MS24149-D1

EQUIPMENT LIST, RADIO AND INTERPHONE

INDEX NO.	FIGURE NO.	NAME	PART NO.
1	11-26	Plug Yellow (Control Panel)	NK-27-21C-5/8
2	11-21, 11-25		
	11-22, 11-26	Plug Green (Control Panel)	NK-27-21C-5/8
3	11-26	Plug Blue (Control Panel)	NK-27-21C-5/8
4	11-26	Plug White (Control Panel)	AN3106-24-11S
5	11-25, 11-21		
	11-22	Plug Red (Control Panel)	NK-27-21C-5/8
6	11-24	Filter	FL-30
7	11-24	Radio Compass Unit	R-5A/ARN-7
8	11-24	Plug (Radio Compass)	PL-122
9	11-24	Control Box	C-4/ARN-7
10	11-24	Mounting	FT-224-A
11	11-24	Loop	LP-21-LM
12	11-24	Plug (loop)	PL-112
13		Cord Assembly	CD-365
14	11-24	Relay	BK-22-K
15	11-24	Indicator	644-180817
16	11-24	Plug	PL-118
17	11-24	Indicator	I-82-A
18	11-24	Inverter	MG-149-F
19	11-24	Plug	AN3108-22-4S
20	11-25	Relay	SW-172-A
21	11-21	Jack Box (Instructor)	BC-1366-M
22	11-21	Jack Box (First Navigator)	BC-1366-M
23	11-24, 11-21	Jack Box (Second Navigator)	BC-1366-M
24	11-21	Interphone Amplifier	BC-347-C
25	11-21	Dynamotor	PE-86
26	11-32	Radio Receiver	BC-453-B
27	11-32	Radio Receiver	BC-454-B
28	11-32	Radio Receiver	BC-455-B
29	11-32	Rack	FT-220-A
30	11-32	Plug	PL-152-A
31	11-32	Plug	PL-147-A
32	11-32	Plug	PL-151-A
33	11-32	Modulator	BC-456-A
34	11-32	Plug	PL-148-A
35	11-32	Plug	PL-154-A
36	11-32	Plug	PL-153-A
37	11-32	Plug	PL-156-A
38	11-32	Transmitter	BC-458-A
39	11-32	Transmitter	BC-696-A
40	11-32	Rack	FT-226-A
41	11-32	Antenna Relay	BC-442-A
42	11-20, 11-30	Marker Receiver	MN-53A
43	11-20, 11-30	Plug	SK-C16-21C-5/8
44	11-20	Plug	A-13784-2
44	11-30	Plug	PL-259A
45	11-20, 11-30	Jewel Holder	A120196-1
46	11-20, 11-30	Jewel Holder	A120196-3

EQUIPMENT LIST, RADIO AND INTERPHONE

INDEX NO.	FIGURE NO.	NAME	PART NO.
47	11-20, 11-30	Jewel Holder	A120196-4
48	11-20, 11-30	Lamp-Bay, Base Bulb, 6.3-1/4 amp	A9320-4
49	11-26	Transceiver	AF/UTA-68
50	11-26	Plug	AN3106-20-27S
51	10-26	Plug	AN3108-16S-1S
52	11-26	Plug	AN3108-16-11S
53	11-26	Plug	UG-21B/U
54	11-26	Adapter	UG-27A/U
55	11-26	Plug	PL-259A
56	11-26	Antenna Mast	AN104-B
57	11-25, 11-23, 11-22	Glide Path Receiver	R89B/ARN-5A
58	11-25, 11-23, 11-22	Plug	AN3108-10SL-4S
59	11-25, 11-23, 11-22	Plug	AN3108-18-1S
60	11-25, 11-23 11-22	Plug	UG-102/U
61	11-25, 11-23, 11-22	Adapter	UG-104/U
62	11-25, 11-23, 11-22	Localizer Receiver	BC-733-D
63	11-25, 11-23 11-22	Plug	AN3108-20-27S
64	11-23	Fixed Composition Resistor	1000 ohms $\pm$ 10% 1/2 Watt
65		Relay	SW-172-A
66	11-25, 11-20 11-22, 11-24 11-21, 11-30,	Isolation Amplifier	644-180717
67	11-30, 11-23 11-22	Plug	AN3106A-20-11S
68	11-23, 11-22	Plug	AN3106A-20-27S
69	11-21	Disconnect Splice	A-57
70		Disconnect Splice	B-57
71	11-26, 11-22 11-25, 11-20 11-23, 11-30 11-21	Rear Radio Junction Box	644-180660
72	11-23, 11-22	ILS Junction Box	644-180678
73	11-23, 11-25 11-22	Antenna	AS-27A/ARN-5
74	11-25, 11-22	Indicator	644-180827
75	11-25, 11-23, 11-22	Plug	AN3106-18-1S
76	11-25, 11-22	Plug	AN3106-14S-7S
77		Fuse	AGS(3A)
78	11-24	Receptacle	AN3102-24-28P

EQUIPMENT LIST, RADIO AND INTERPHONE

INDEX NO.	FIGURE NO.	NAME	PART NO.
79	11-24	Plug	AN3106-24-28S
80			
81	11-24, 11-21	Receptacle	AN3102-18-1P
82	11-24, 11-21	Plug	AN3106-18-1S
83	11-23	Capacitor	A120160 1250MFD IVN
84	11-23, 11-20		
	11-24, 11-30	Plug	AN3106-22-14S
85	11-23, 11-20		
	11-24, 11-30	Receptacle	AN3102-22-14P
86	11-20, 11-30	Adapter	M359A
87	11-26	Overhead Control Panel	644-180680 BAN111-72009
88	11-26	Transformer	A4350
89	11-24	Box Assembly - Radio Compass Relay	644-180659(3N, 3NM and 3TM
90	11-20	Volume control (10, 000 ohms)	N-107
91	11-31	Pilot's and Copilot's Range Voice Switches	1426
92	11-31	Pilot's and Copilot's Audio Switch	828OK15
93	11-31	Marker Beacon Control Switch	3143J
94	11-31	Pilot's and Co-pilot's Speaker-Phone Selector	3142J
95	11-31	Mic-Selector Switch	47498-H3
96	11-31	MHF - Selector	7079
97	11-31	MHF - Tone-CW-Voice Switch	7104
98	11-31	MHF - On-Switch	1516
99	11-31	VHF - Volume Rheostat - 10, 000 ohms	BA33-010-1262
100	11-31	VHF - Selector	47428-H1
101	11-31	Compass Transfer DPST Switch	S17
102	11-31	Compass Tuning Meter	I-70-B
103	11-31	Compass Audio, Rheostat	L75003
104	11-31	Compass Band Switches and Shaft Assembly	AA109907
105	11-31	Compass Light Rheostat	A29842
106	11-31	Loop Control Switch	AC59710
107	11-31	Lamp	AN3136-323
108	11-31	Compass Selector Switch	C62539
109	11-31	Command, Audio Selector	6536
110	11-31	Command Audio Control	6488
111	11-31	I. L. S. Volume Control	ES0696917-1
112	11-31	I. L. S. On Switch	1516
113	11-31	I. L. S. Frequency Selector	ESO691190-1
114	11-31	Circuit Breaker	PSM5
115	11-31	Circuit Breaker	PSM10
116	11-31	Circuit Breaker	PSM20
117	11-31	Circuit Breaker	PSM35
118	11-31	Muting Relay	1604
119	11-31	Relay	12231
120	11-31	Relay	12231
121	11-25	Box Assembly - Radio Compass Relay	4MBA6521-2 (3T only)
122	11-32	Box Assembly - Radio Junction, No. 9 Bulkhead (3T only)	3MBA4803

EQUIPMENT LIST, RADIO AND INTERPHONE

INDEX NO.	FIGURE NO.	NAME	PART NO.
123	11-32	Pilot's and Co-pilot's Speaker	S10340
124	11-32	Pilot's and Co-pilot's Phone Jack	JK-34
125	11-32	Pilot's and Copilot's Mic-Jack	JK-33

EQUIPMENT LIST, NAVIGATION AND FLIGHT INSTRUMENTS

INDEX NO.	FIGURE NO.	NAME	PART NO.
1	11-27, 28, 29, 30	Instrument Inverter	AN3532-1
2	11-27, 28, 29, 30	Circuit Breaker	PSM-10
3	11-27, 28, 29, 30	Circuit Breaker	PSM-20
4	11-27, 28, 29, 30	Switch	AN3027-2
5	11-27, 28, 29	Switch	AN3021-2
6	11-27, 28, 29, 30	C2 Gyrosyn Compass Indicator	633-180829
7	11-27, 28, 29	Junction Box, Assembly	644-180545
8	11-27, 28, 29, 30	Plug Assembly	820756
9	11-27, 28, 29, 30	Warning Light	AN3157-2
10	11-27, 28, 29, 30	Resistor Assembly	800 ohms 25W 204 Acker
11	11-27, 28, 29, 30	C2 Gyrosyn Amplifier	653895
12	11-27, 28, 29, 30	Plug	AN3106-20-11S
13	11-27, 28, 29	Plug	AN3106-18-1S
14	11-27-28, 29, 30	Plug	AN3106-16S-1S
15	11-29	Plug	AN3100-16S-1P
16	11-27, 28, 29	Plug	SK7941-61(Pink)
17	11-27, 28, 29	Plug	SK7941-77(Gray)
18	11-27, 28, 29	Plug	SK7941-75(Lemon)
19	11-27, 28, 29	Plug	SK7941-85(Red)
20	11-27, 28, 29	Breeze Plug	E1002-13-1P
21	11-27, 28, 29, 30	Plug	AN3106-14S-5S
22	11-27, 28, 29	Circuit Breaker	PSM-5
23	11-27, 28, 29, 30	Jumper	AN749-2-5
24	11-27, 28, 29	Lamp	AN3121-313
25	11-27, 28, 29	Socket Type Plug	TYPE W217 10H/ 7636
26	11-27, 28, 29, 30	Socket Type Plug	TYPE W153 10H/ 8246
27	11-27, 28, 29, 30	Flux Valve	656520
28	11-27, 28, 29, 30	Power Control Unit	652832
29	11-27, 28, 29	Plug	TYPE W153 10H/ 8246
30	11-27, 28, 29, 30	Eletric Gyro Horizon Indicator Model H-5	644-180830
31	11-27, 28, 29	Servo Amplifier	674733
32	11-27, 28, 29	Air Mileage Unit	MK-1
33	11-27, 28, 29	Air Position Indicator	MK-1
34	11-27, 28, 29	Master Indicator	16203
35	11-27, 28, 29	Compass Repeater	Step-by-Step
36	11-27, 28, 29	Jumper	AN749-3-8
37	11-27, 29	Jumper	AN749-2-4
38	11-27, 28, 29	Driftmeter	TYPE B-3 Spec MIL D-7106
39	11-27, 28, 29	Splice - Electrical Disconnect	AN753-1
40	11-30	Junction Box Assembly	2MBA6560

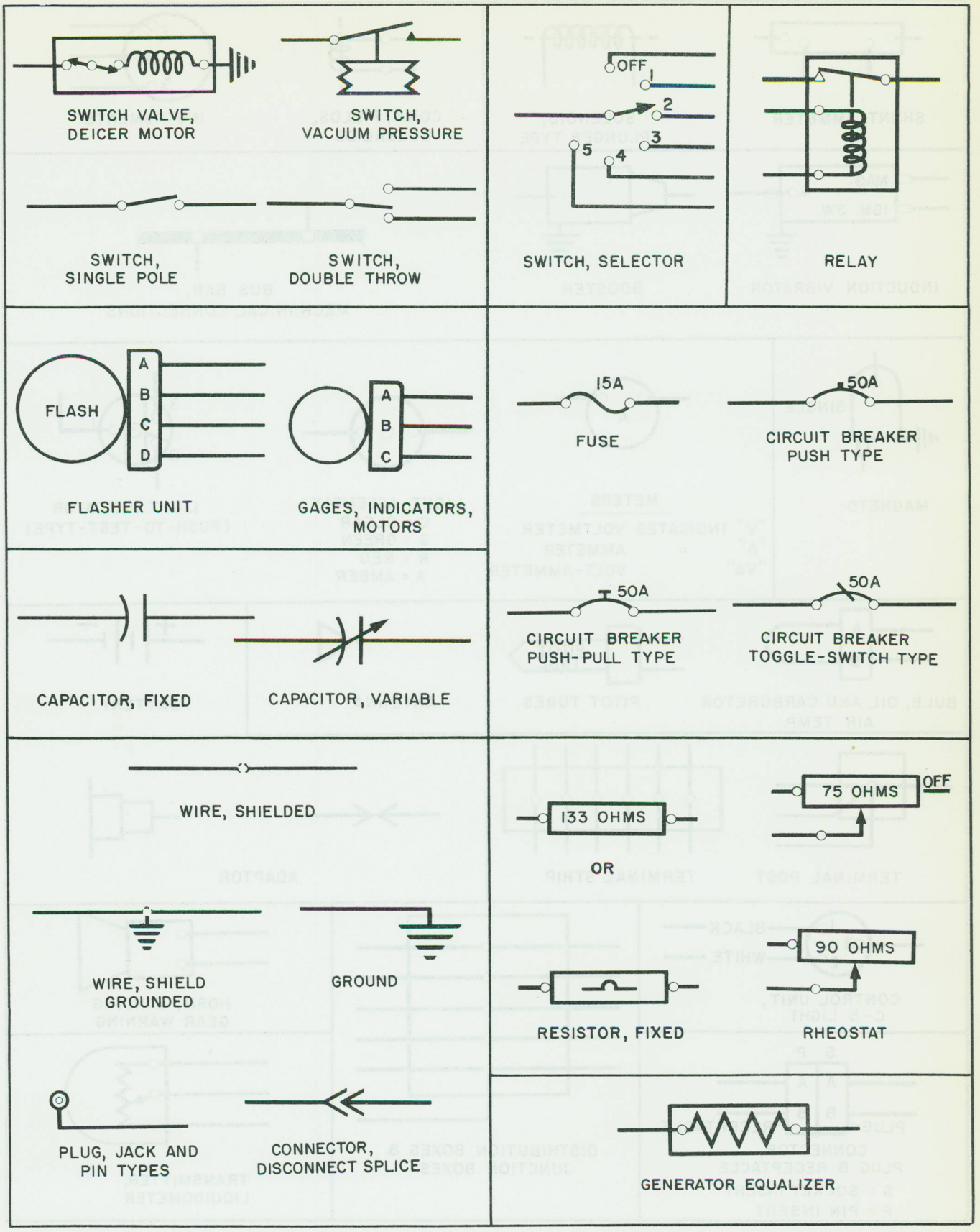


Figure 11-1 Electrical Symbols (Sheet 1 of 2)

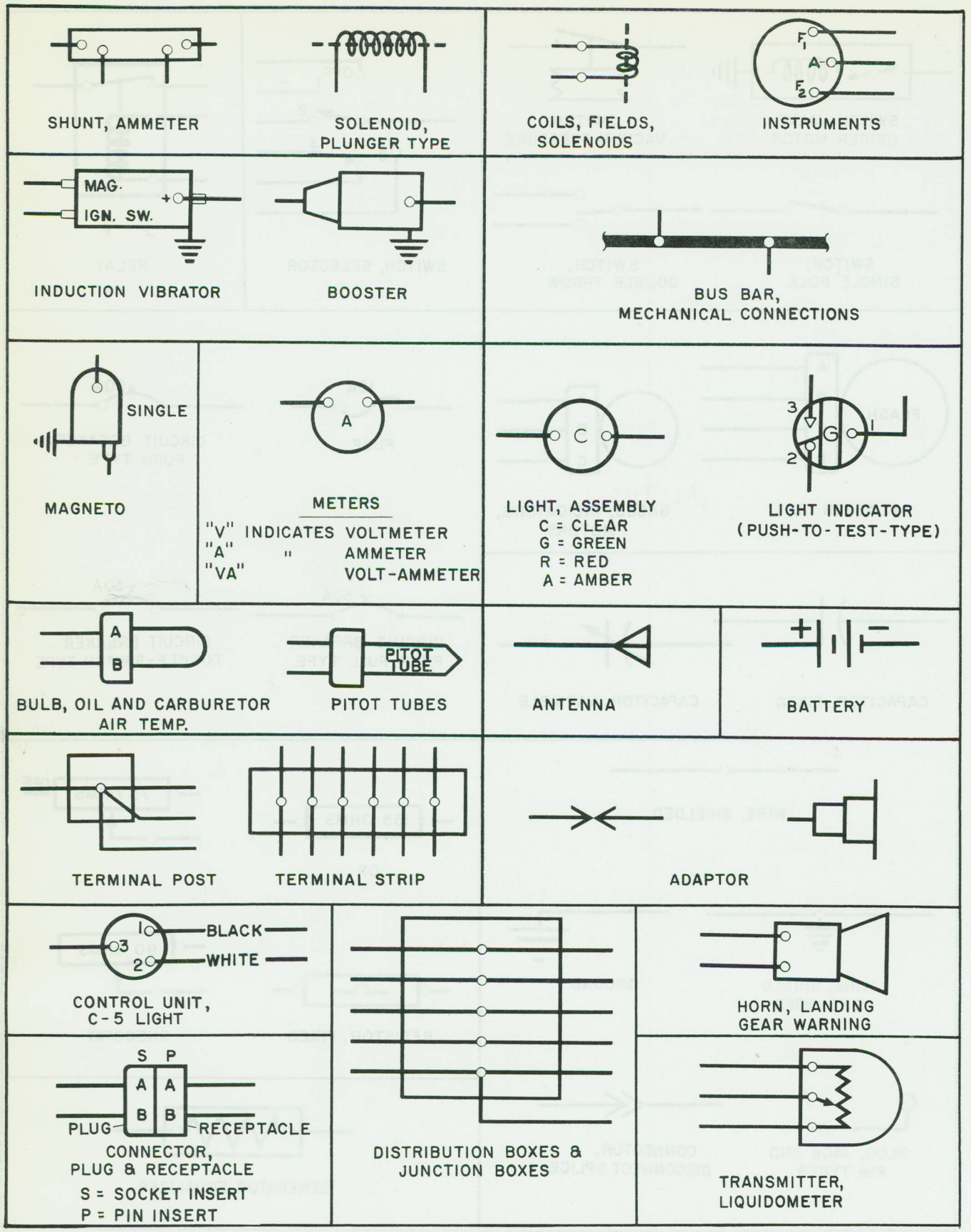


Figure 11-1 Electrical Symbols (Sheet 2 of 2)

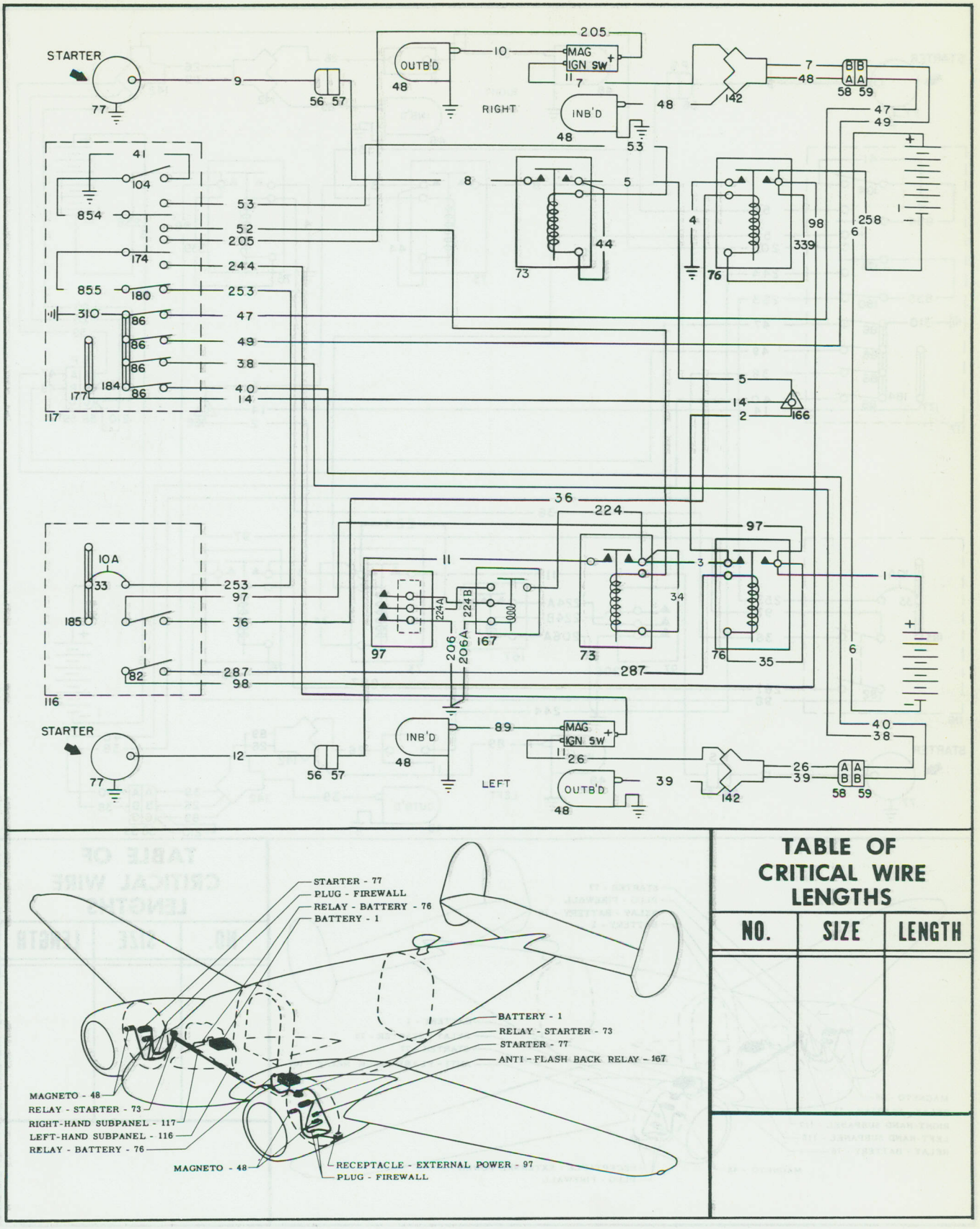


Figure 11-2 Battery Ignition and Starter Circuit using VJR-24B5 Vibrator

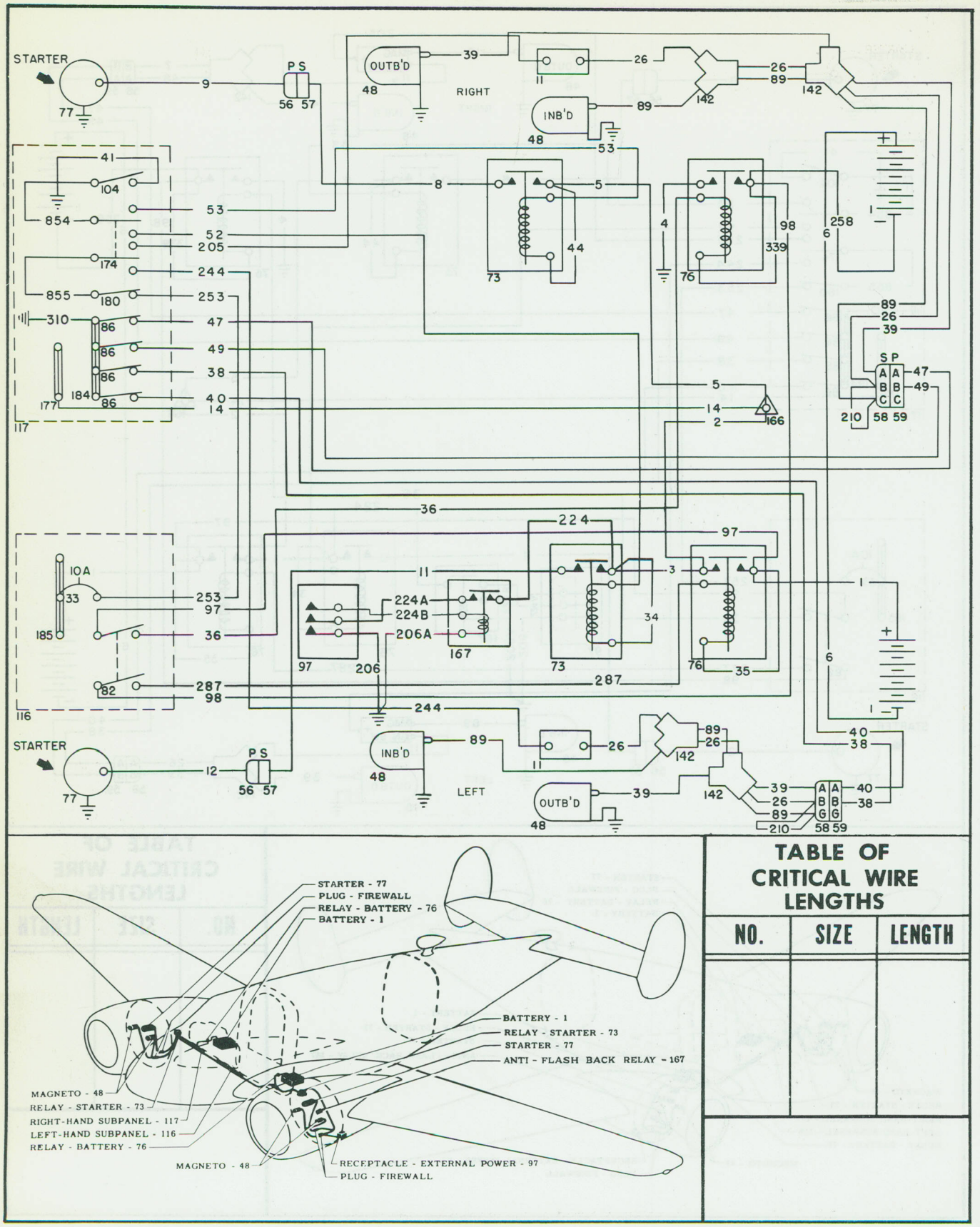


TABLE OF CRITICAL WIRE LENGTHS

NO.	SIZE	LENGTH

Figure 11-3 Battery Ignition and Starter Circuit using AN4181-1 Vibrator

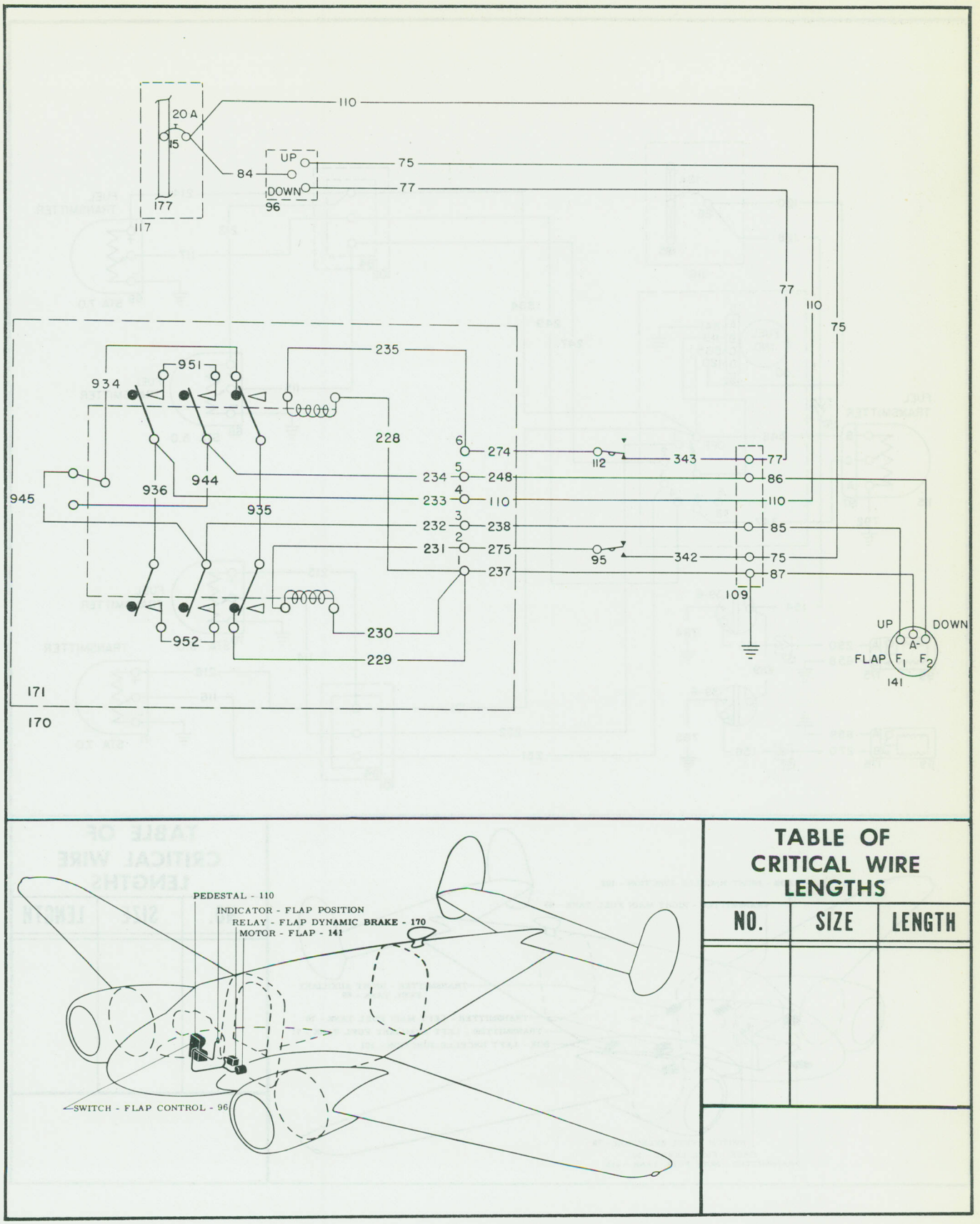


TABLE OF CRITICAL WIRE LENGTHS

NO.	SIZE	LENGTH

Figure 11-4 Flap Circuit

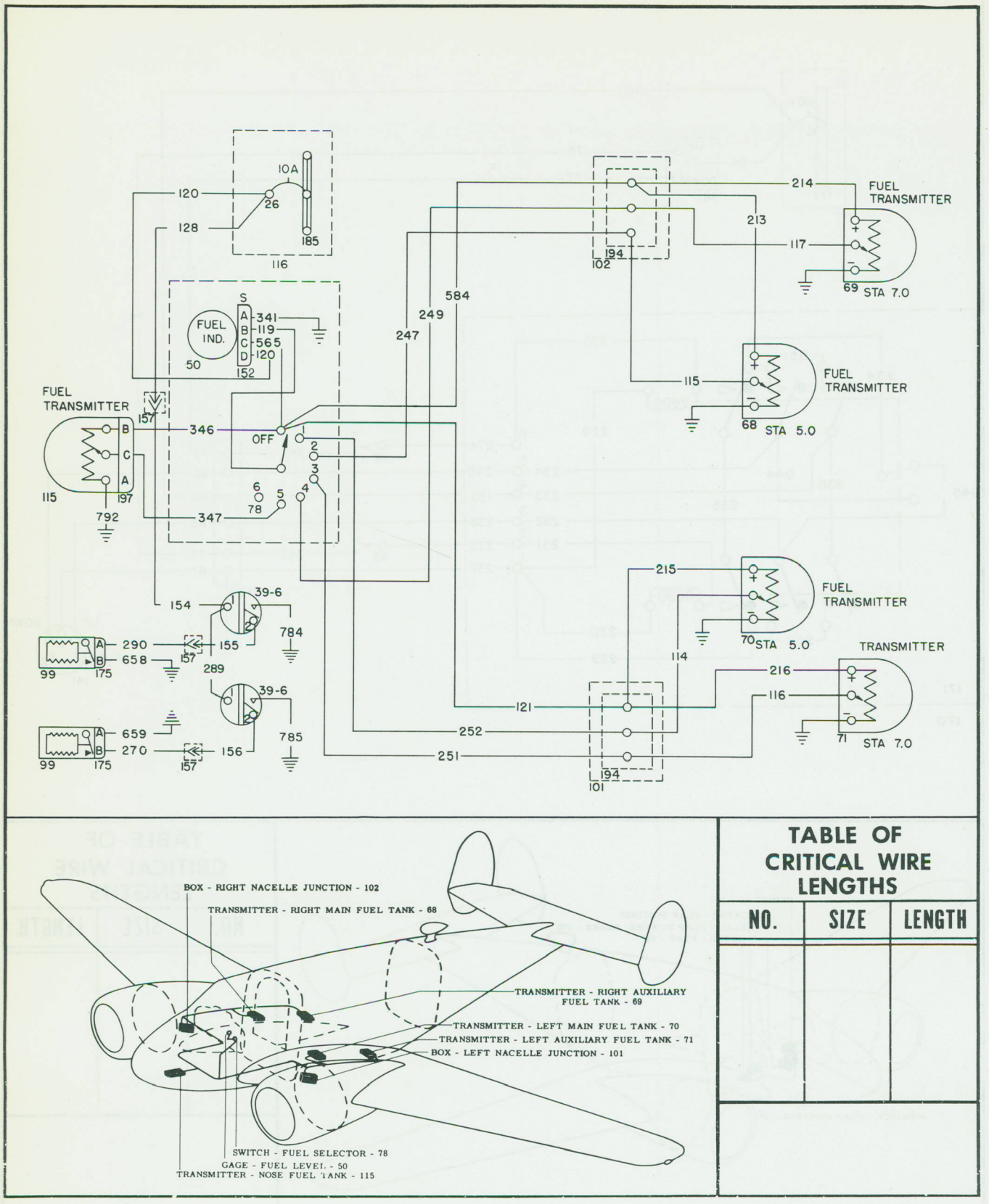


TABLE OF CRITICAL WIRE LENGTHS

NO.	SIZE	LENGTH

Figure 11-5 Fuel Pressure Transmitter and Indicator Circuit

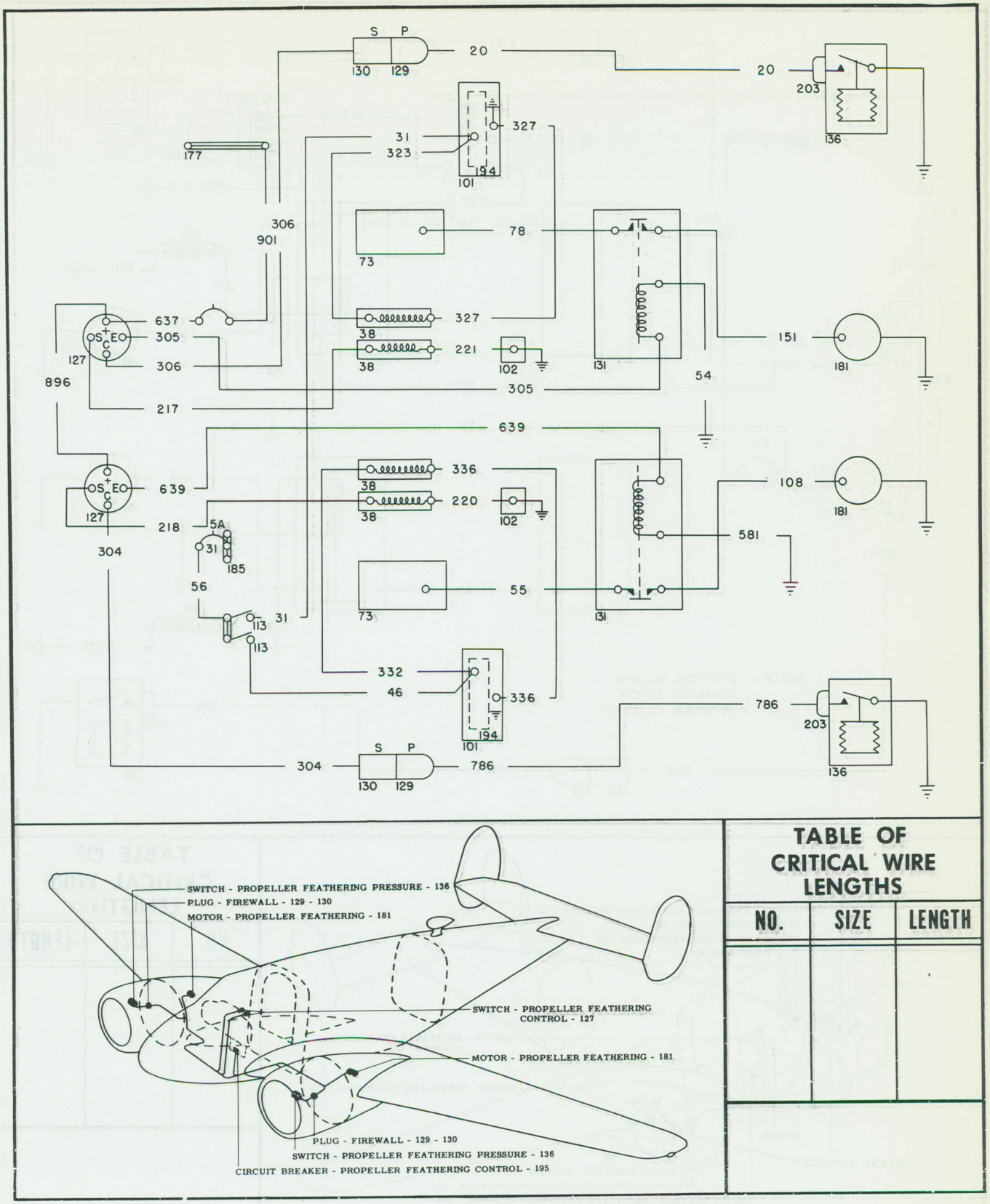


Figure 11-6 Propeller Feathering Circuits (CAIII only)

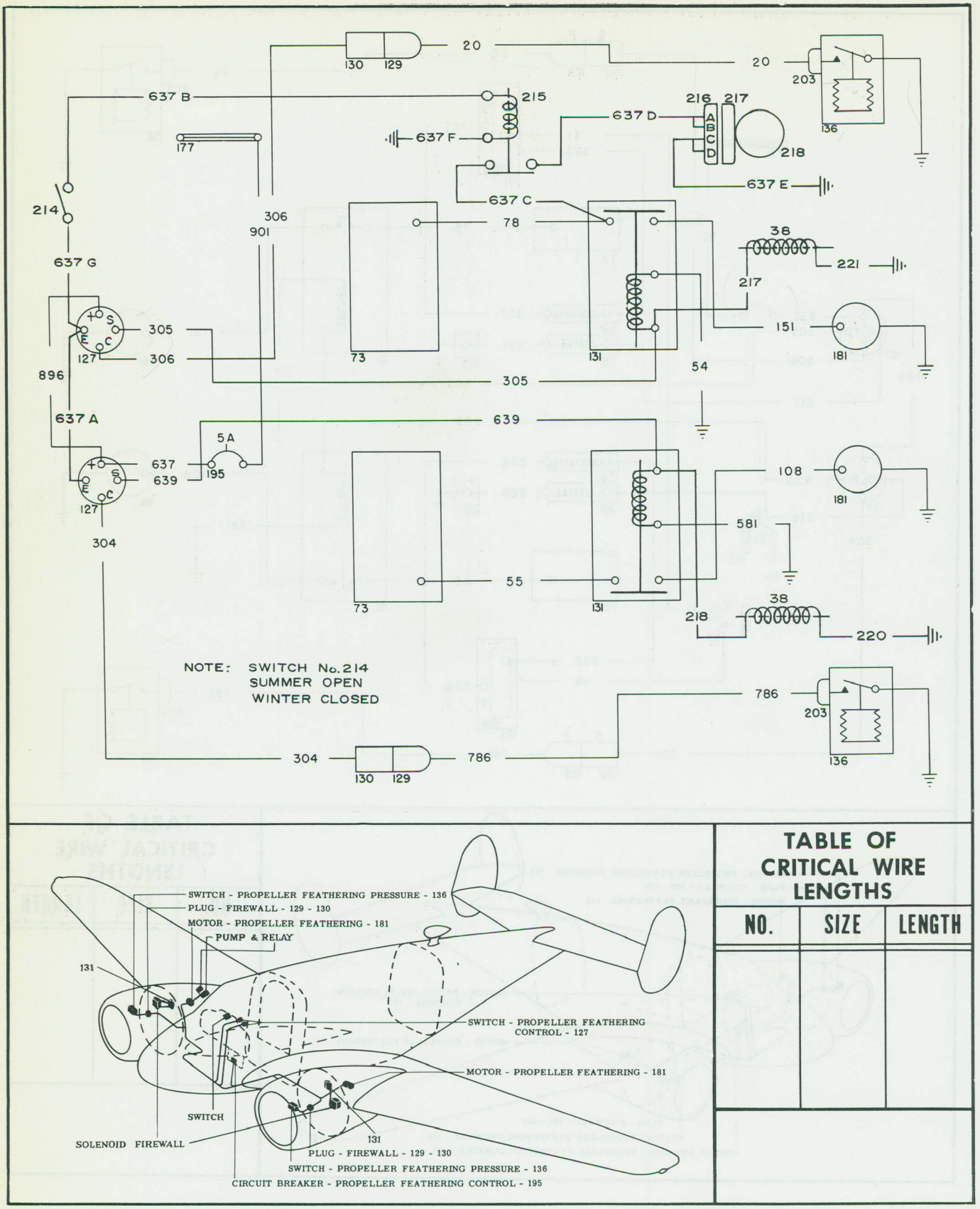


TABLE OF CRITICAL WIRE LENGTHS

NO.	SIZE	LENGTH

Figure 11-7 Propeller Feathering Circuit

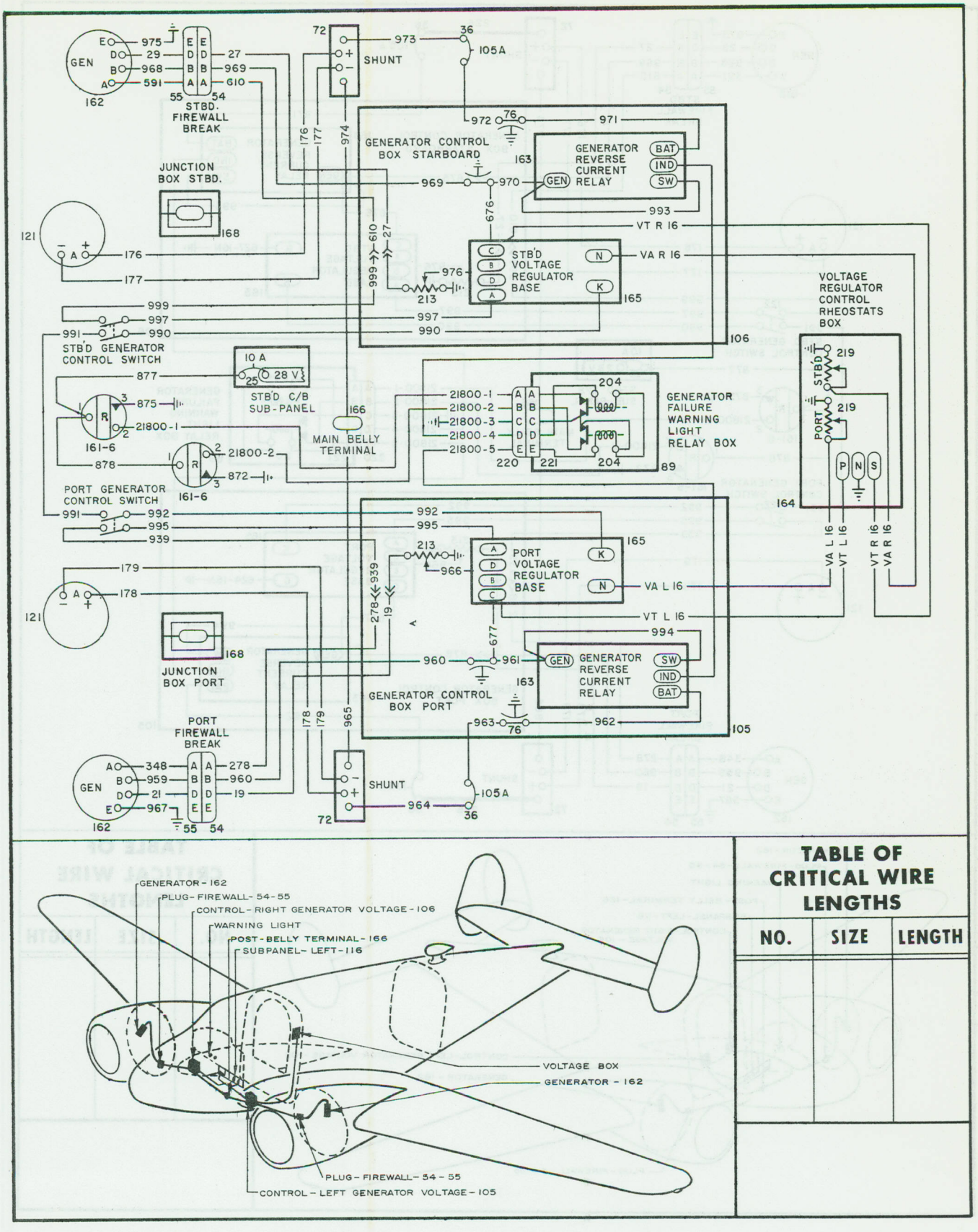


TABLE OF CRITICAL WIRE LENGTHS

NO.	SIZE	LENGTH

Figure 11-8 (Issue 1) Generator Circuit (3N, 3NM and 3TM)

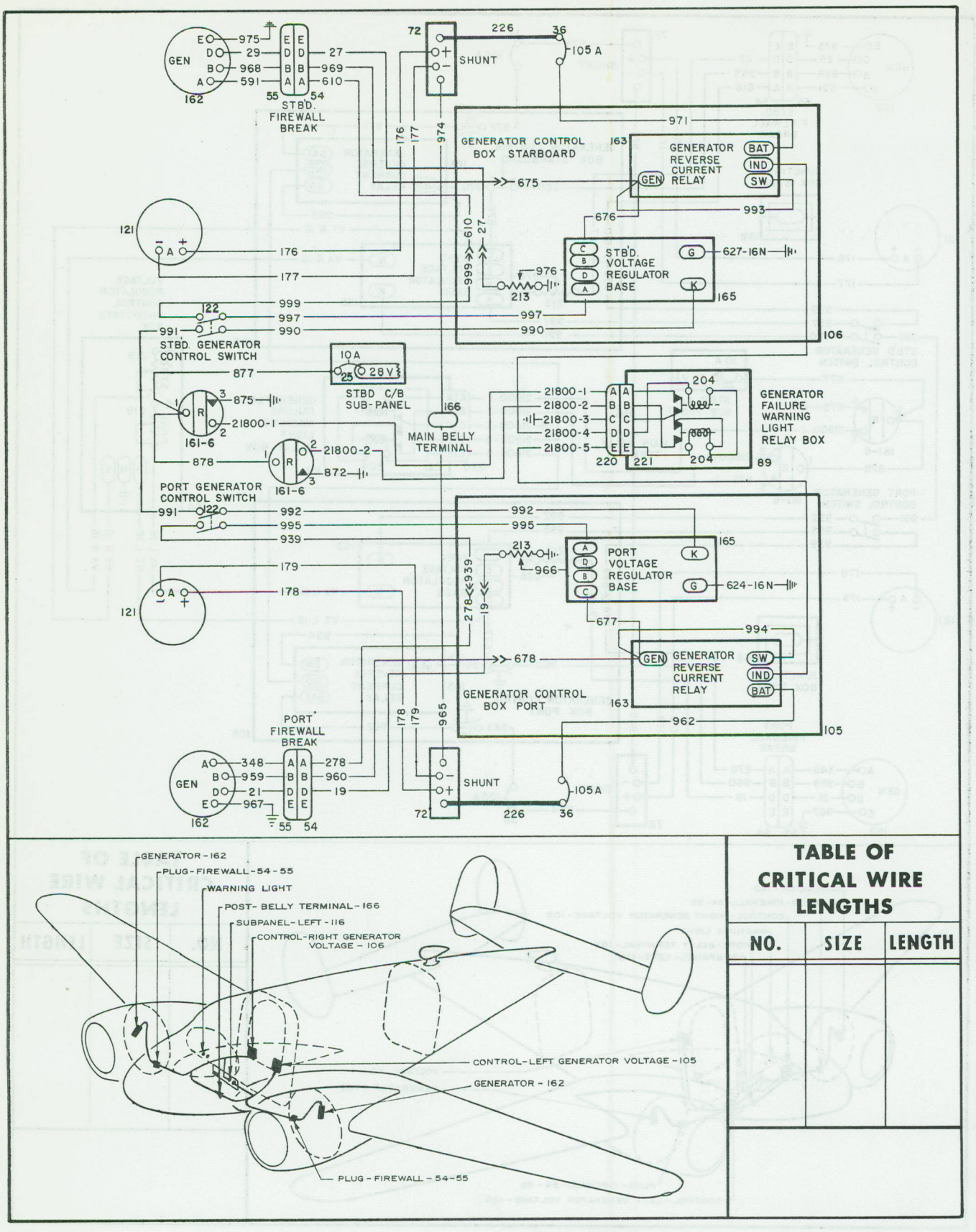


TABLE OF CRITICAL WIRE LENGTHS

NO.	SIZE	LENGTH

Figure 11-9 (Issue 1) Generator Circuit (3T)

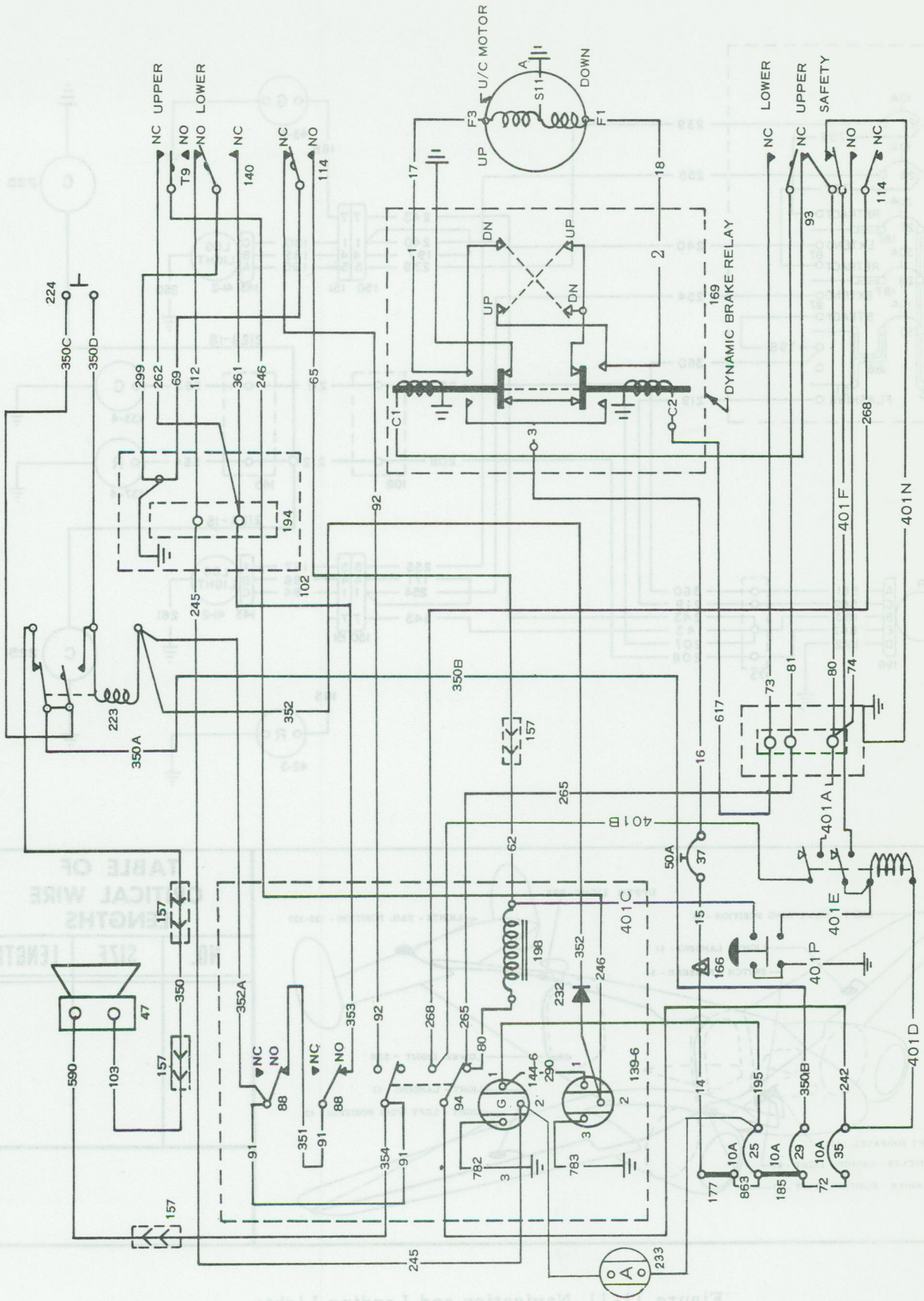


Figure 11-10 (Issue 4) Landing Gear Motor Position Lights and Warning Horn Circuit

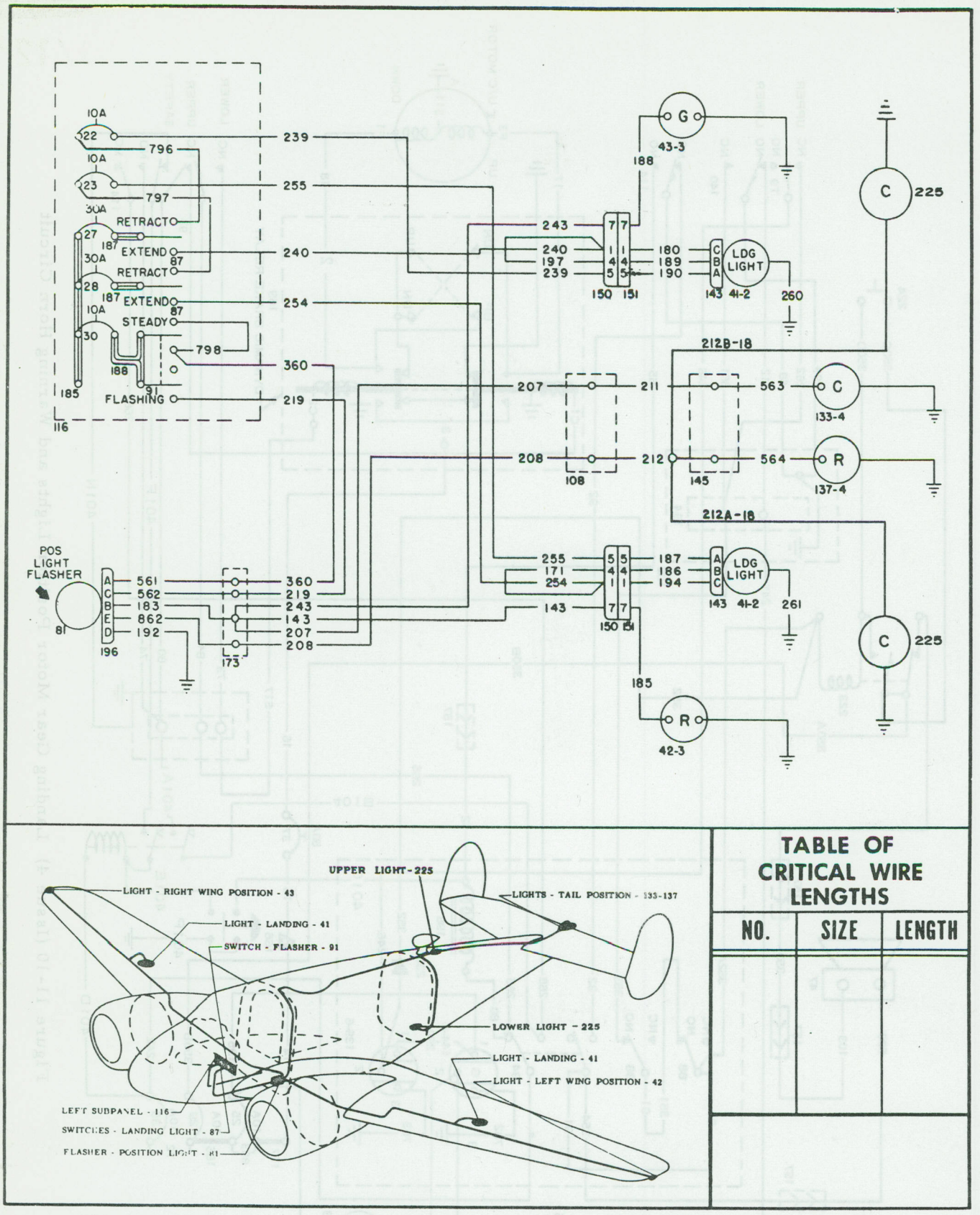


TABLE OF CRITICAL WIRE LENGTHS

NO.	SIZE	LENGTH

Figure 11-11 Navigation and Landing Lights

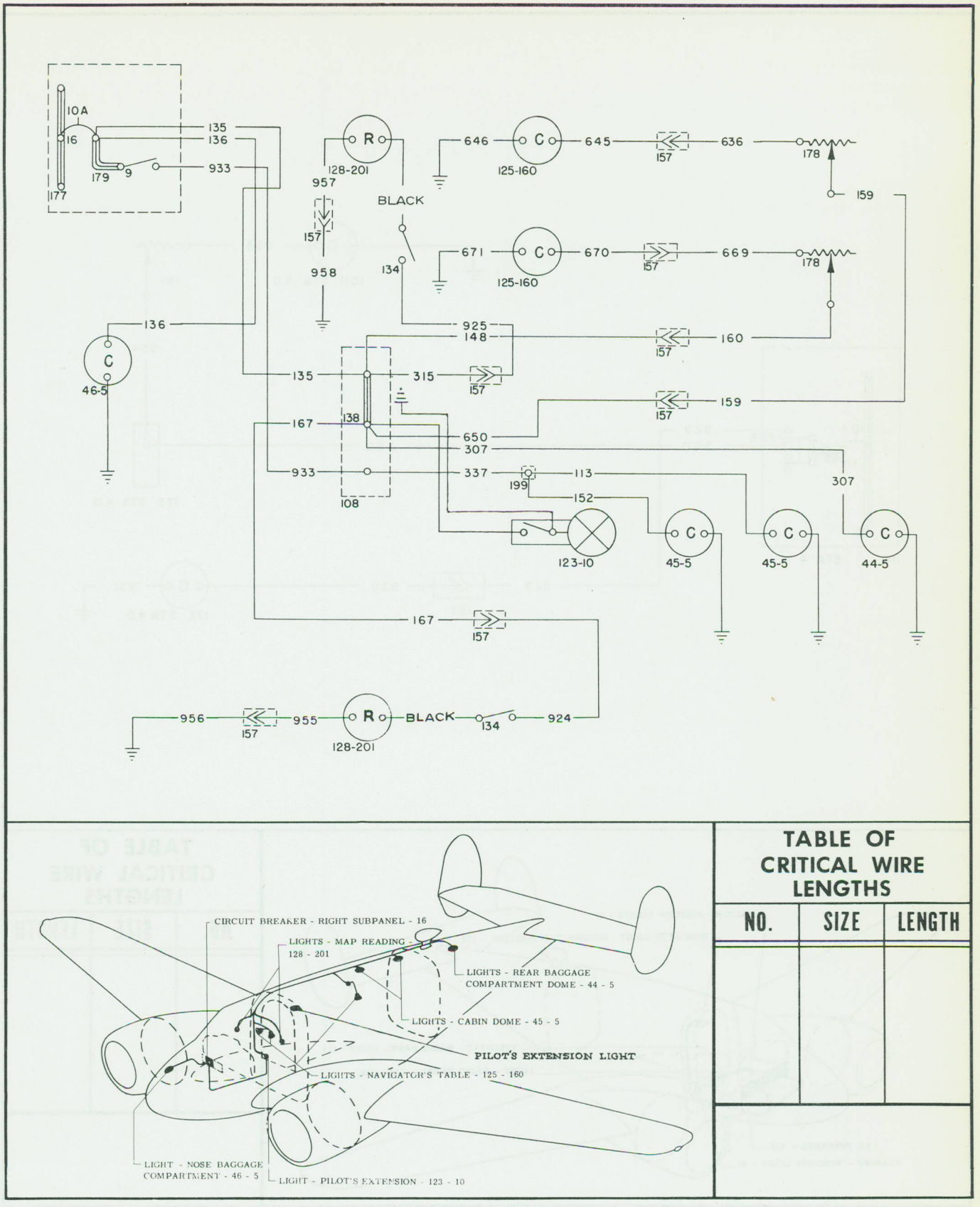


TABLE OF CRITICAL WIRE LENGTHS

NO.	SIZE	LENGTH

Figure 11-12 Interior Lighting Circuit

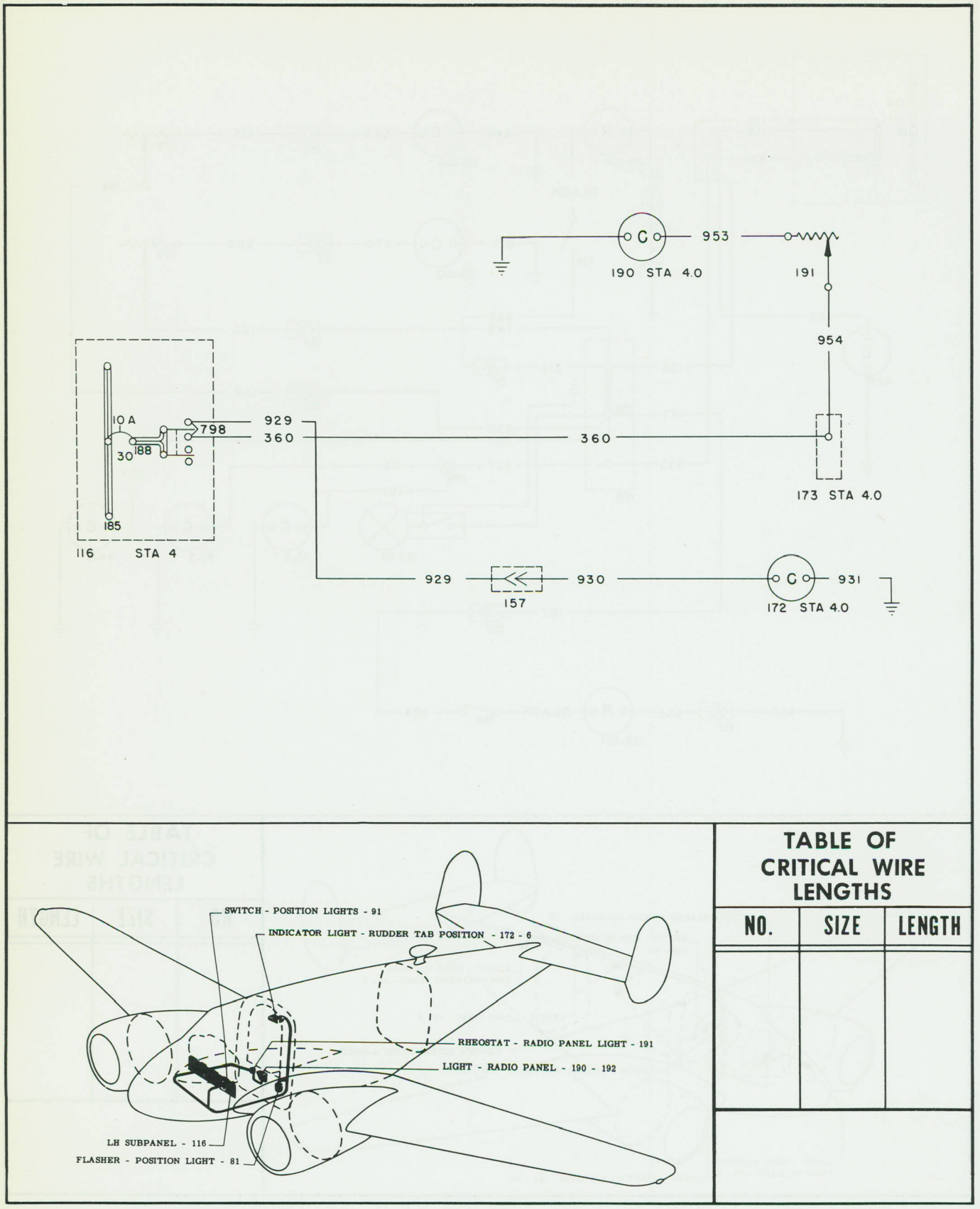


TABLE OF CRITICAL WIRE LENGTHS

NO.	SIZE	LENGTH

Figure 11-13 Rudder Tab Position Indicator and Radio Panel Light Circuit

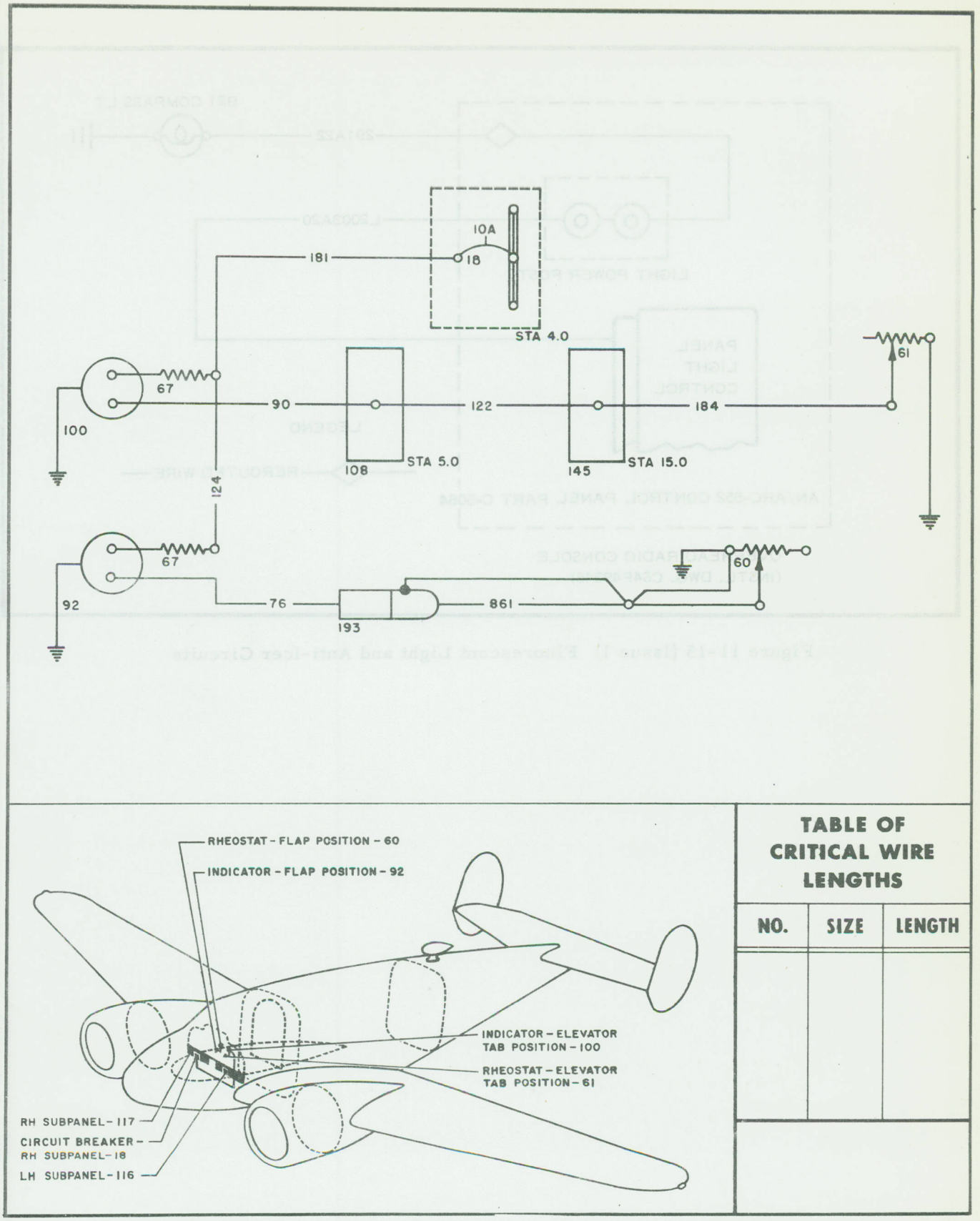


TABLE OF CRITICAL WIRE LENGTHS

NO.	SIZE	LENGTH

Figure 11-14 Flap, Elevator Tab Indicators

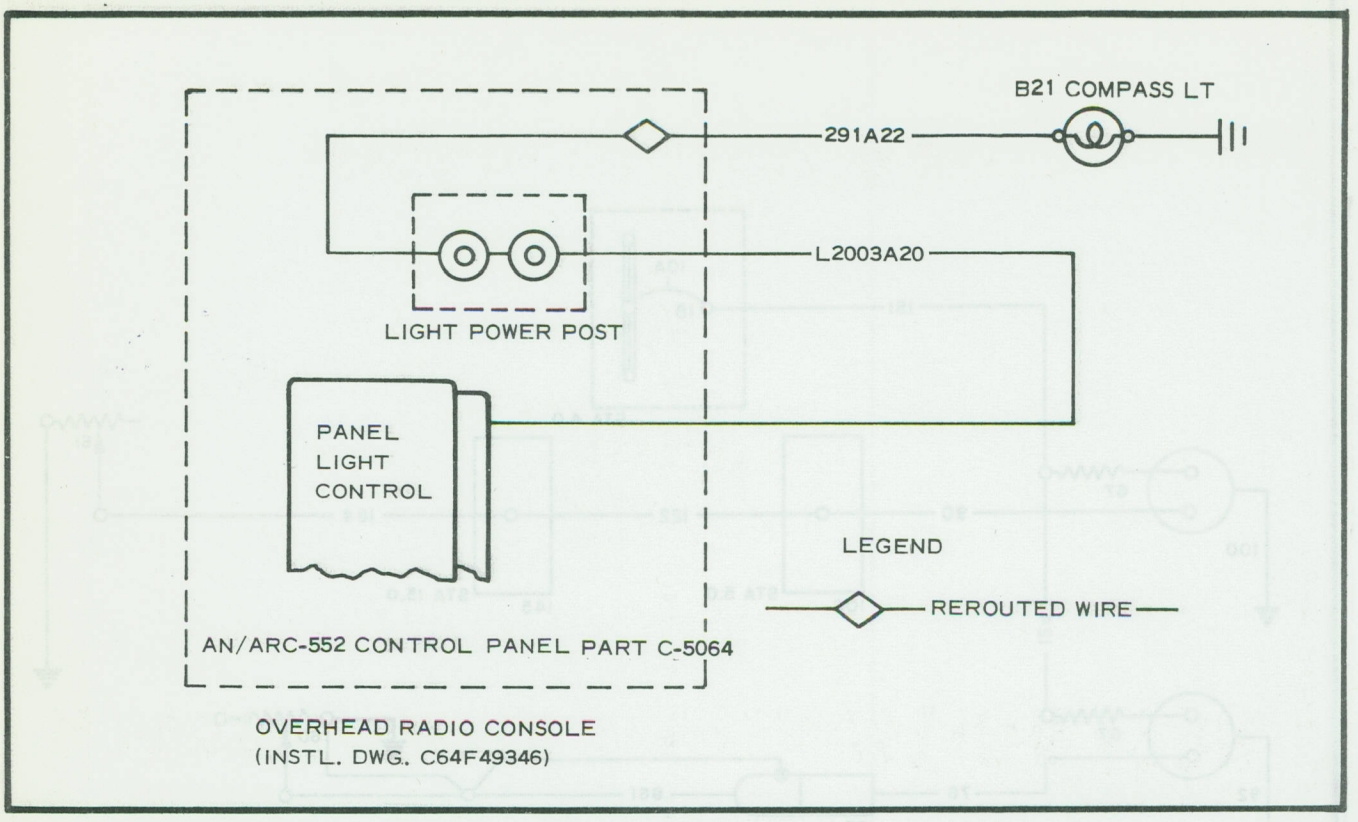


Figure 11-15 (Issue 1) Fluorescent Light and Anti-Icer Circuits

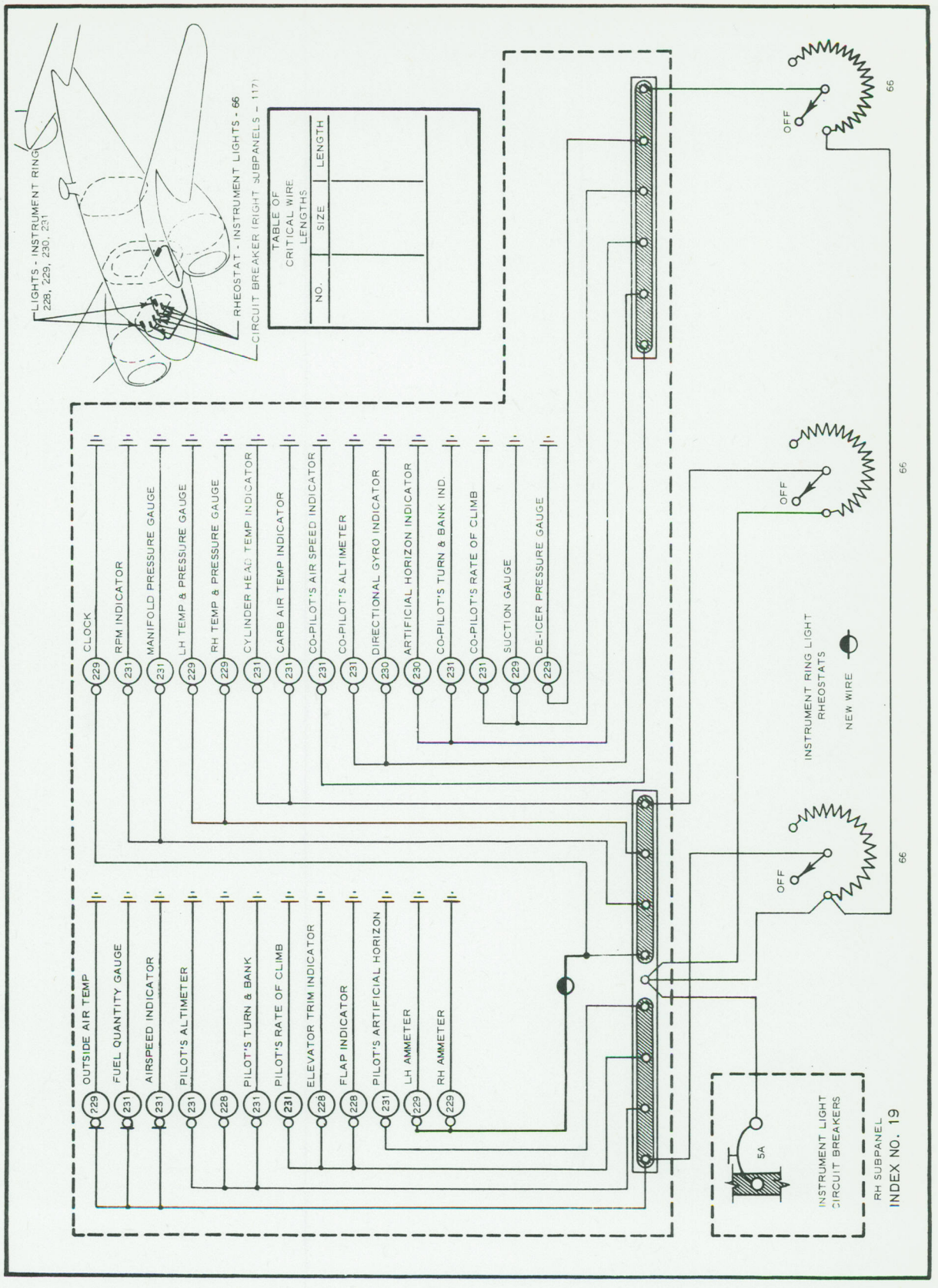
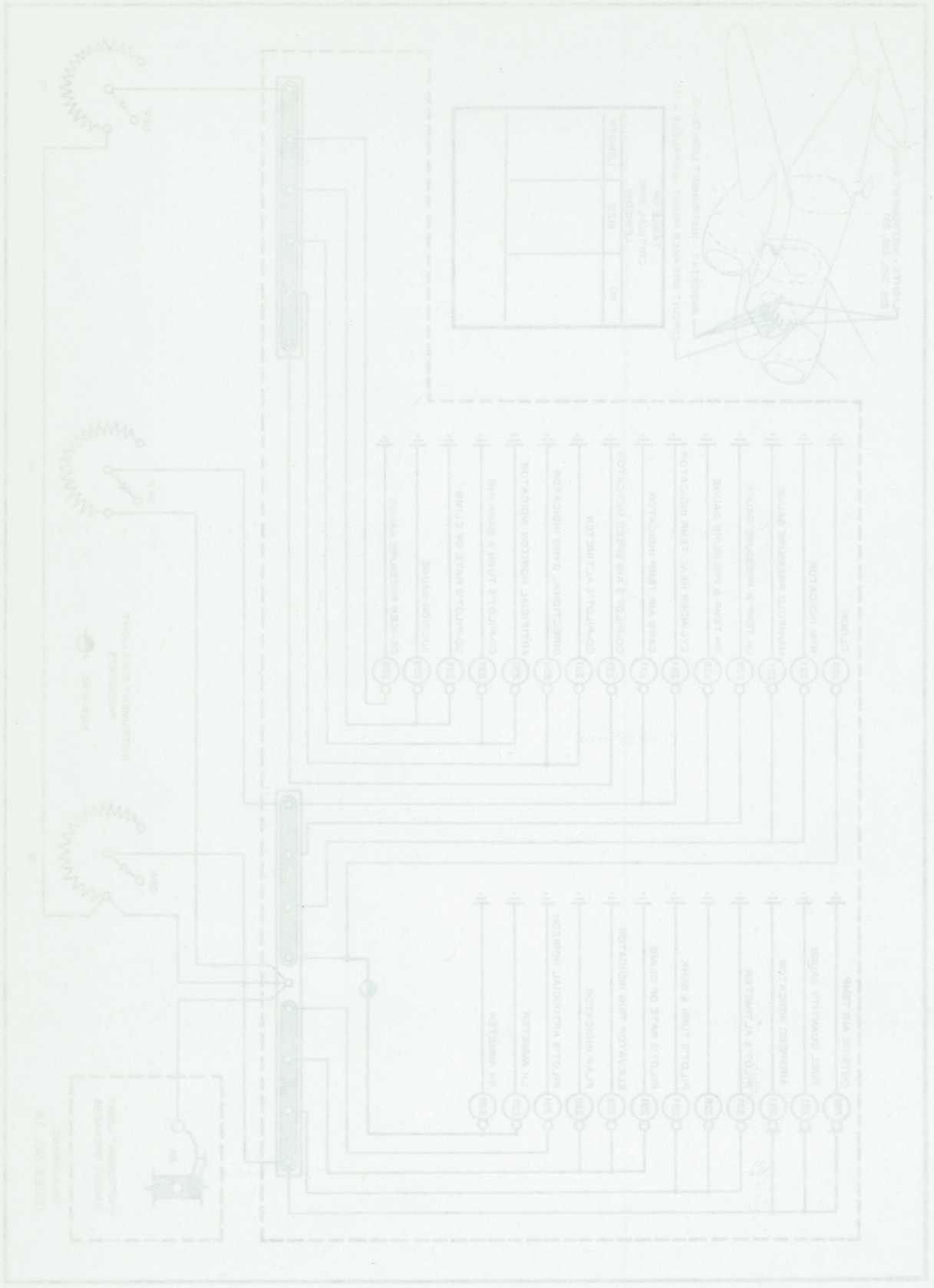


Figure 11-15A (Issue 5) Instrument Ringlight Circuit (EO 05-45B-6A/197)



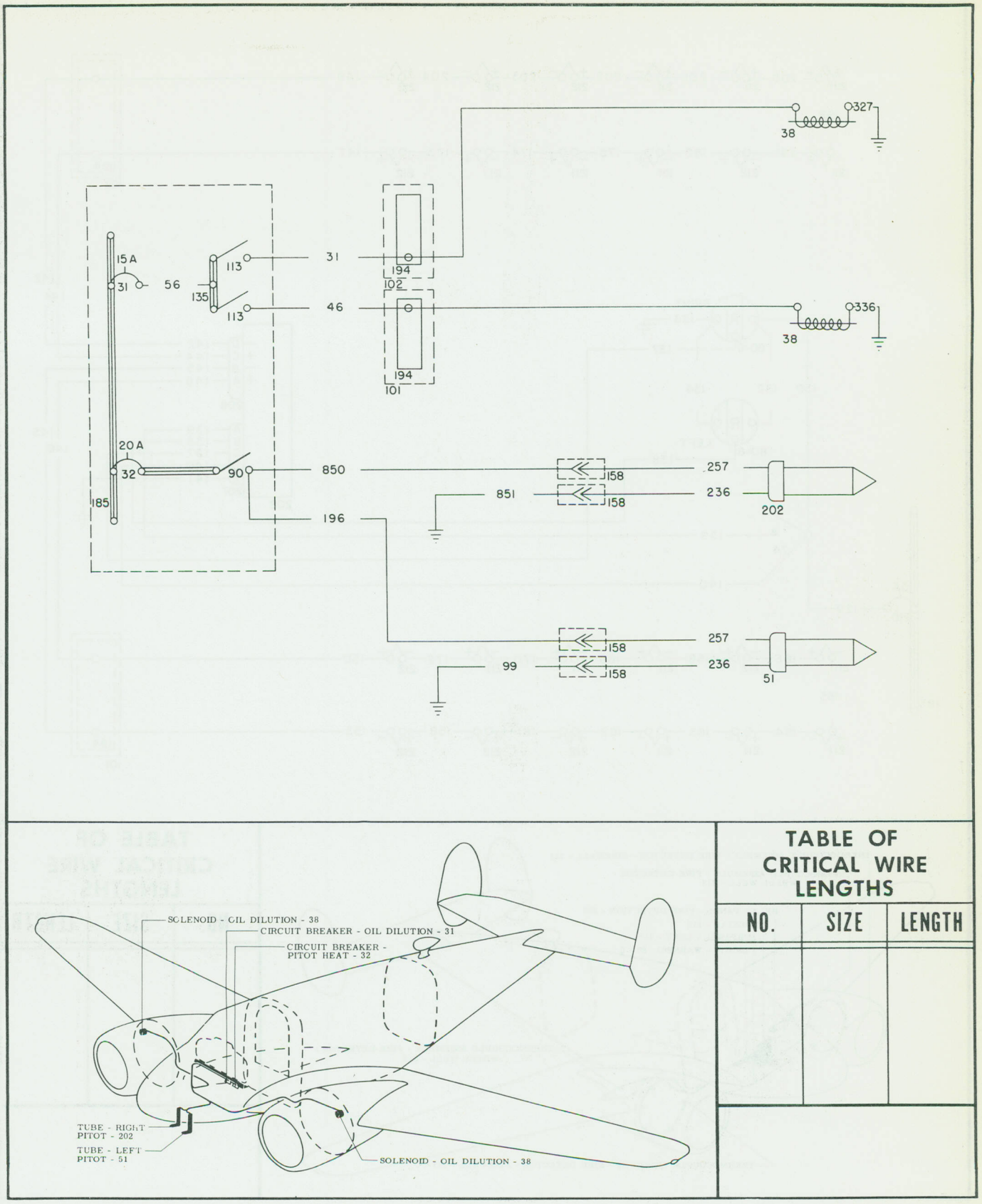
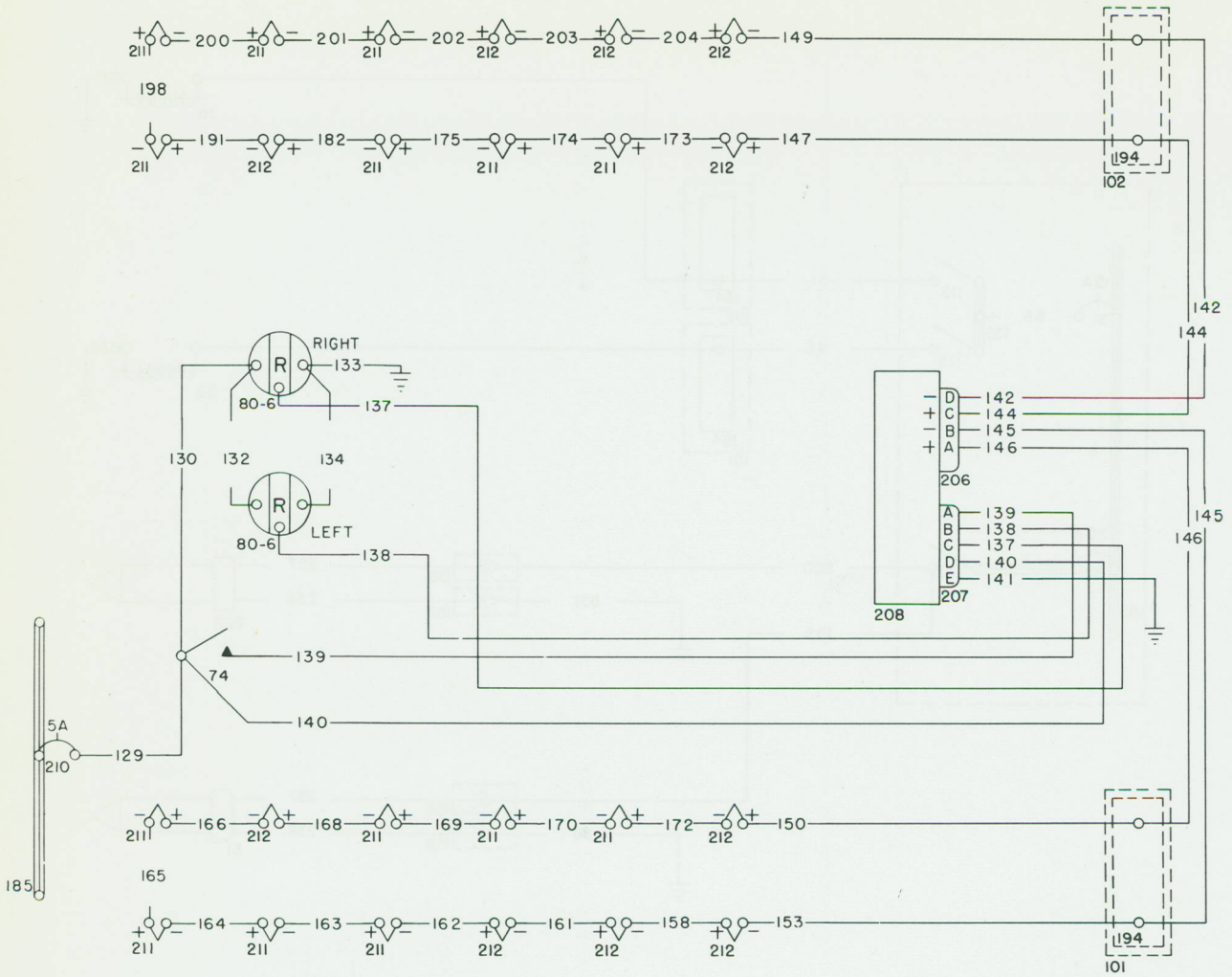


TABLE OF CRITICAL WIRE LENGTHS

NO.	SIZE	LENGTH

Figure 11-16 Oil Dilution and Pitot Heat Circuit



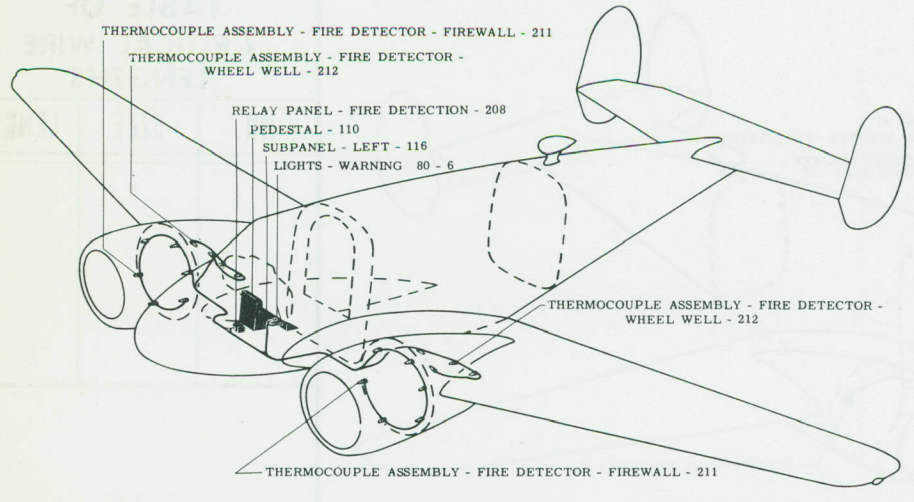


TABLE OF CRITICAL WIRE LENGTHS

NO.	SIZE	LENGTH

Figure 11-17 Fire Detection Circuits

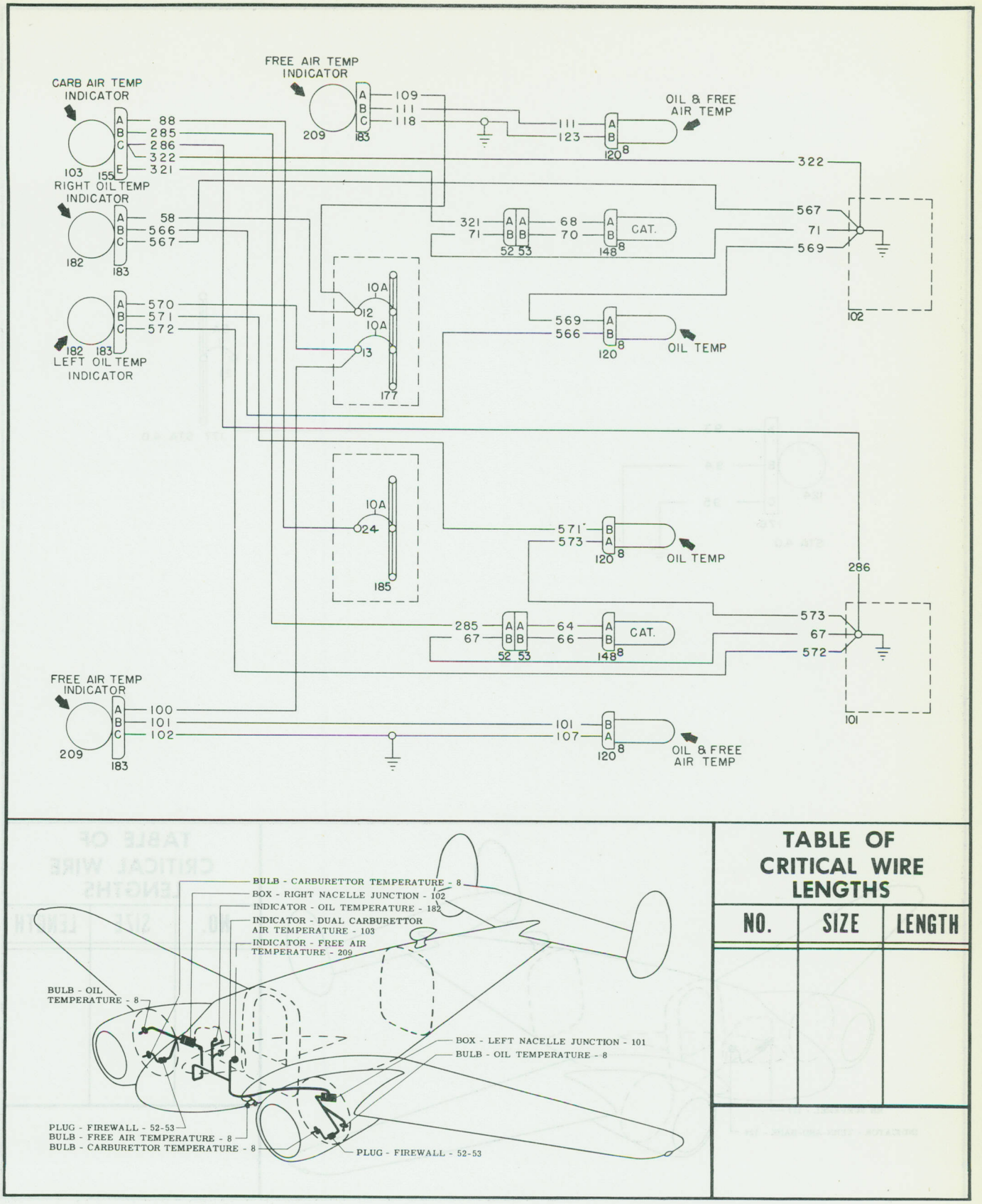


TABLE OF CRITICAL WIRE LENGTHS		
NO.	SIZE	LENGTH

Figure 11-18 Oil Carburettor - Air and Free Air Temperature Indicator Circuits

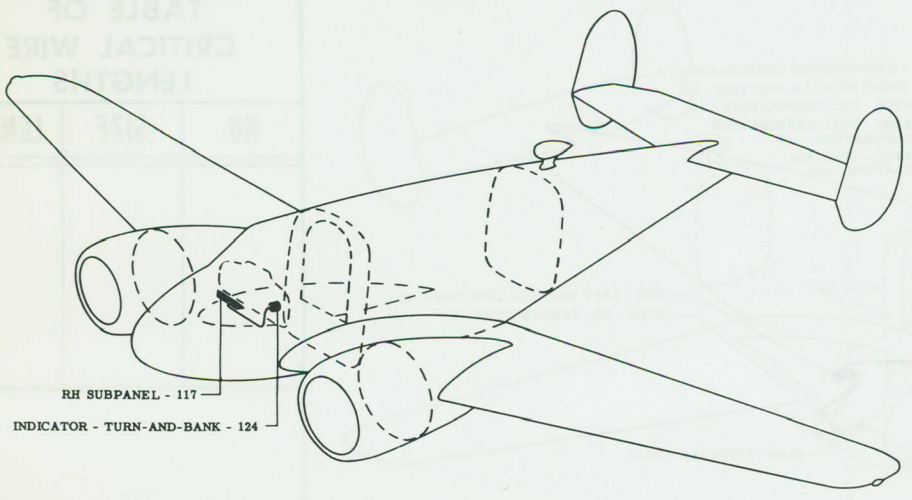


TABLE OF CRITICAL WIRE LENGTHS

NO.	SIZE	LENGTH

Figure 11-19 Turn and Bank Indicator Circuit

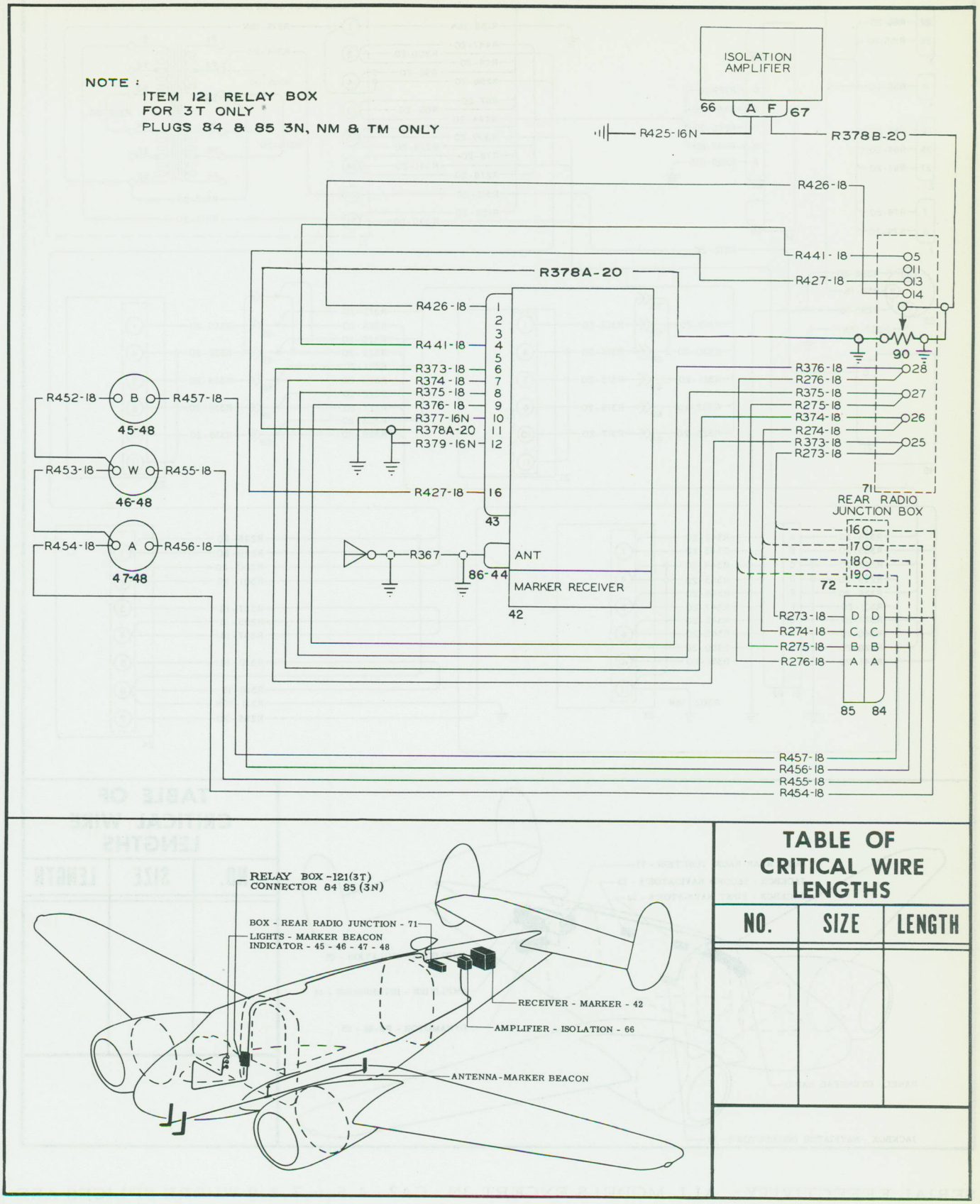


TABLE OF CRITICAL WIRE LENGTHS

NO.	SIZE	LENGTH

Figure 11-20 Master Marker Beacon

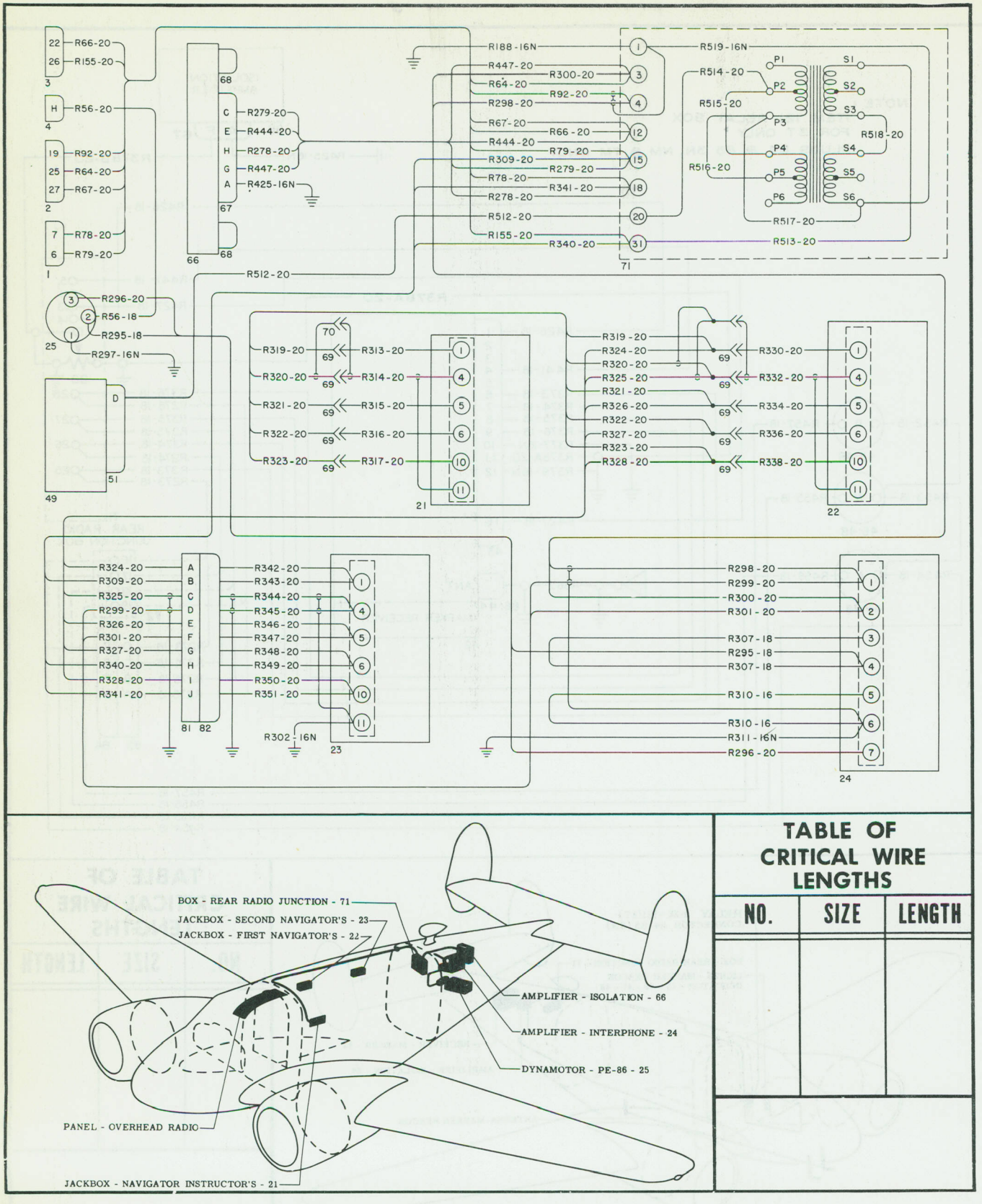


TABLE OF CRITICAL WIRE LENGTHS

NO.	SIZE	LENGTH

SERIAL EFFECTIVITY: ALL MODELS EXCEPT 3N, CA2, 4,5,6,7,8,9 WHERE SPLICES ARE USED IN PLACE OF PLUGS 81 & 82. JACK BOXES 21,23 & 24 ARE NOT INSTALLED IN 3T.

Figure 11-21 Interphone Circuit

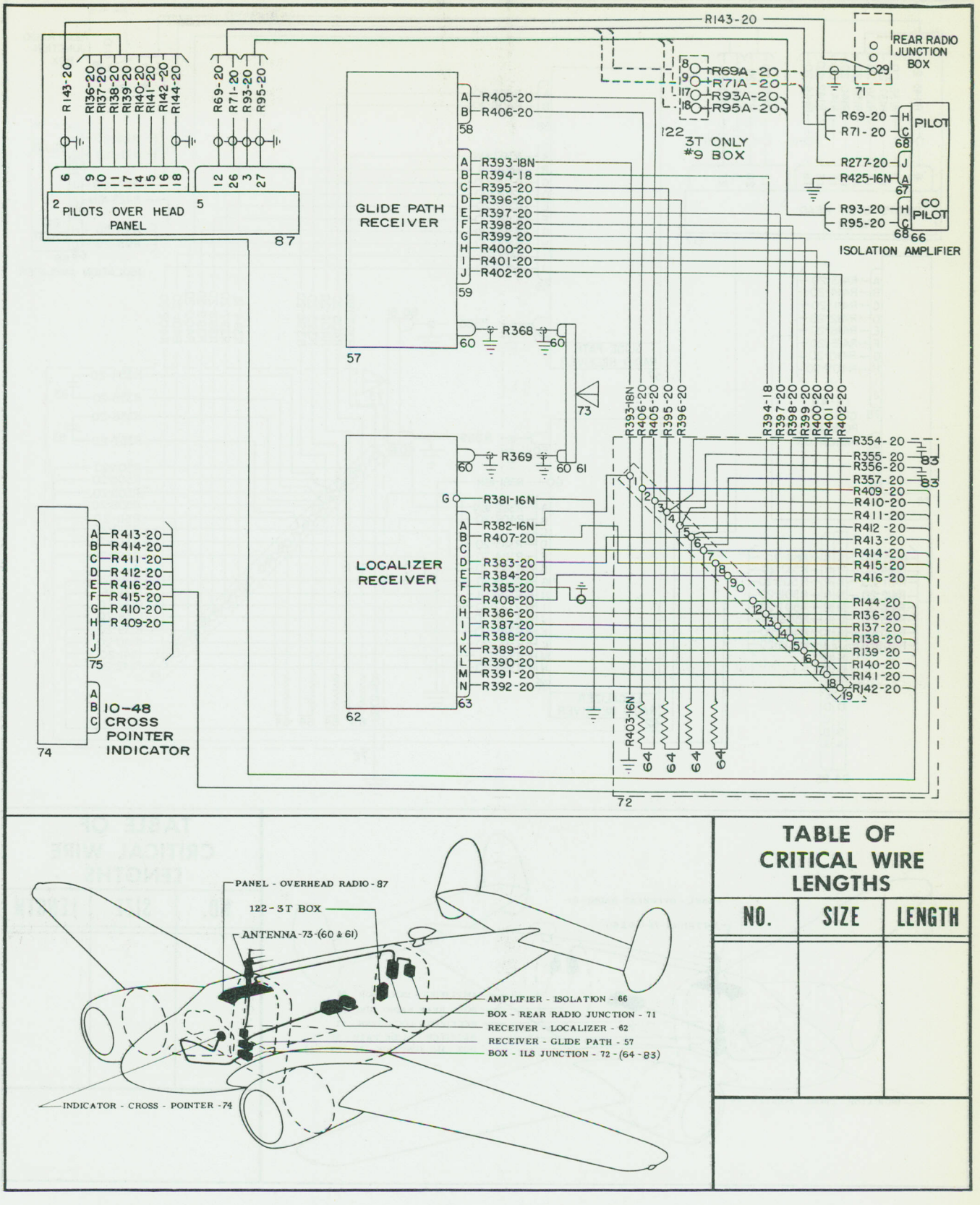


TABLE OF CRITICAL WIRE LENGTHS

NO.	SIZE	LENGTH

SERIAL EFFECTIVITY: 3N, CA, 2, 4, 5, 6, 7, 8, 9 and 3T

Figure 11-22 BC-733D Localizer and R-89B Glide Path Receiver Circuit

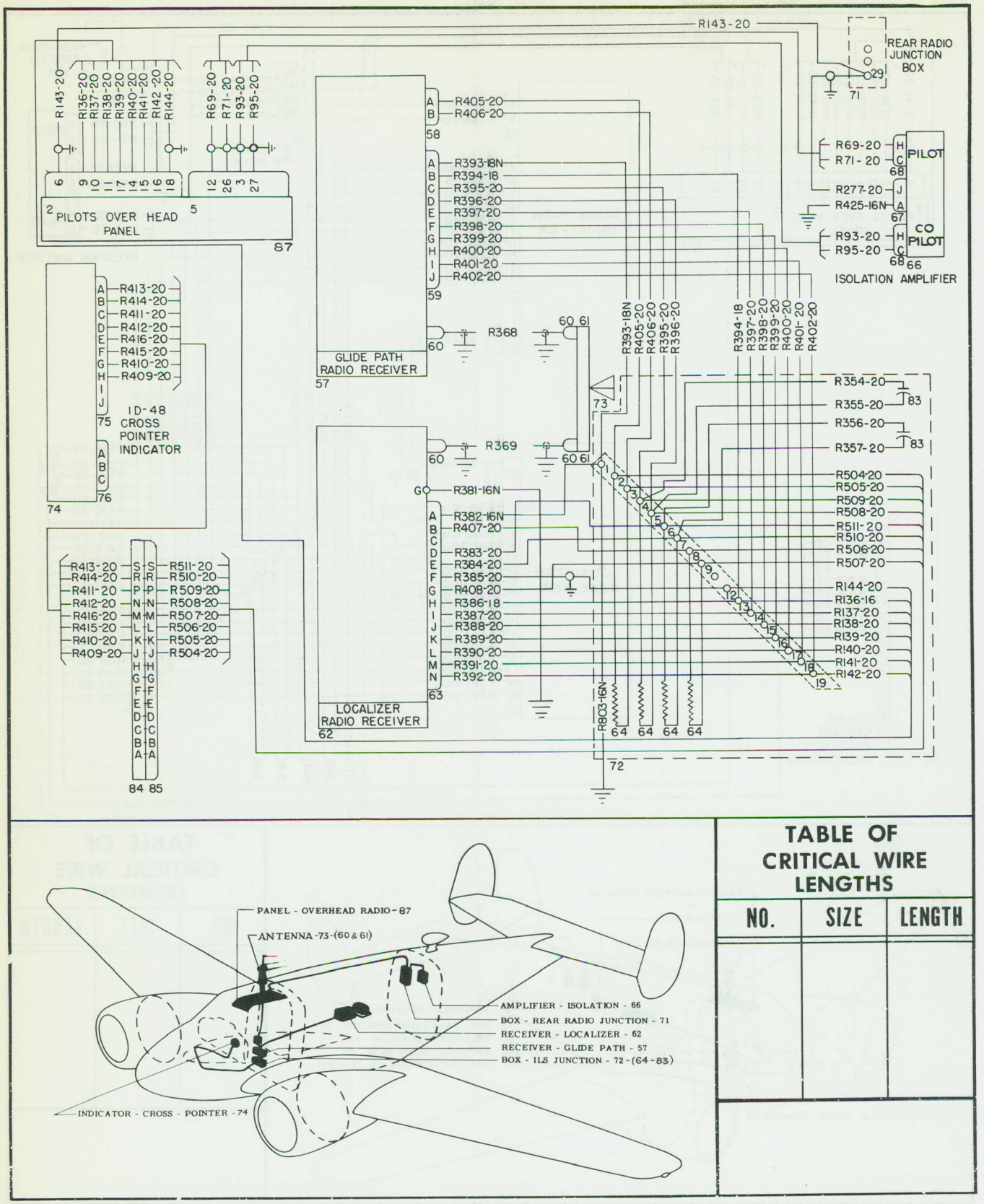


TABLE OF CRITICAL WIRE LENGTHS

NO.	SIZE	LENGTH

SERIAL EFFECTIVITY: All Models CA3, CA10 and after except 3T

Figure 11-23 BC-733D Localizer and R-89B Glide Path Receiver Circuit