TM 1-1H-34A-2

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

MAINTENANCE INSTRUCTIONS

USAF MODEL H-34A HELICOPTER (SIKORSKY)

This manual replaces AF TO 1H-34A-2, 18 May 1956
for use within the Department of the Army

DEPARTMENT OF THE ARMY • SEPTEMBER 1956

DEPARTMENT OF THE ARMY
WASHINGTON 25, D. C., *7 September 1956*

TM-1-1H-34A-2 is published for the use of all concerned.

By Order of *Wilber M. Brucker*, Secretary of the Army:

MAXWELL D. TAYLOR,
General, United States Army,
Chief of Staff.

Official:
JOHN A. KLEIN,
Major General, United States Army,
The Adjutant General.

Distribution:
Active Army:

CNGB (2)
Tec Svc, DA (1) except COFT (5)
Tec Svc Bd (2)
Hq CONARC (2)
Army AA Comd (2)
OS Maj Comd (5)
OS Base Comd (2)
Log Comd (2)
MDW (1)
Armies (5)
Corps (2)
Div (2)
Ft & Cp (2)
USMA (1)
Gen & Br Svc Sch (3) except Trans Sch (25)
Army Avn Sch (25)
Gen Depots (2) except Atlanta Gen Depot (none)
Trans Sec, Gen Depots (10)
Trans Depots (10)
Trans Terminal Comd (1)
Army Terminals (1)
Trans Fld Maint Shops (3)
Div Engr (1)
Engr Dist (1)
Mil Dist (1)
MAAG (1)
Units organized under following TOE's:
5-15C (2)
5-35R (2)
5-215R (2)
5-225C (2)
5-346R (2)
5-348R (2)
6-101C (2)
6-115R (2)
6-201C (2)
6-301C (2)
6-575C (2)
7-2R (2)
7-11R (2)
7-31C (2)
11-7C (2)
11-16C (2)
11-57C (2)
11-95R (2)
11-99R (2)
11-557C (2)
17-2C (2)
17-22R (2)
17-45C (2)
20-301R (2)
52-2C (2)
55-56R (2)
55-57C (2)
55-456R (2)
55-457R (2)
55-458R (2)
57-2C (2)

NG: State AG (6); units—same as Active Army except allowance is one copy to each unit.
USAR: None.
For explanation of abbreviations used, see SR 320-50-1.

LIST OF REVISED PAGES ISSUED

INSERT LATEST REVISED PAGES. DESTROY SUPERSEDED PAGES.

NOTE: The portion of the text affected by the current revision is indicated by a vertical line in the outer margin of the page.

* The asterisk indicates pages revised, added or deleted by the current revision.

ADDITIONAL COPIES OF THIS PUBLICATION MAY BE OBTAINED BY REQUISITIONING THROUGH NORMAL PUBLICATIONS SUPPLY CHANNELS.

TABLE OF CONTENTS

Paragraph		Page
	SECTION I	
	GENERAL INFORMATION	
1—1	General Information	1
1—3	Principal Dimensions	2
1—5	Stations and Water Lines	5
1—7	Access and Inspection Provisions	5
1—9	Identification and Modification Markings	5
1—11	Ground Handling	5
1—28	Servicing	14
1—30	Lubrication Requirements	18
1—32	Table of Specifications	23
1—34	Special Tools	25
	SECTION II	
	AIRFRAME GROUP	
2—1	Fuselage	36
2—3	Fuselage (Forward Section)	36
2—84	Tail Cone (Fuselage Aft Section)	51
2—94	Pylon (Foldable Tail Section)	53
2—107	Maintenance of Fuselage Surfaces	57
2—132	Furnishings and Equipment	63
2—134	Personnel Accommodations	64
2—169	Furnishings	70
2—178	Emergency Equipment	74
2—185	Miscellaneous Equipment	75
2—222	Landing Gear	78
2—225	Main Landing Gear Assembly	78
2—261	Tail Landing Gear Assembly	88
2—296	Main Rotor	97
2—298	Main Rotor Blades	97
2—305	Tracking	98
2—306	Main Rotor Head Assembly	99
2—359	Tail Rotor Assembly	108
2—375	Flight Controls	113
2—377	Cyclic Control System	113
2—388	Collective Pitch Control System	122
2—493	Tail Rotor Control System	139
2—516	Stabilizer	147
2—521	Rigging of Flight Controls	148
	SECTION III	
	HYDRAULIC, PNEUMATIC SYSTEMS	
3—1	Hydraulic Systems	159
3—13	Pneumatic System	159
	SECTION IV	
	UTILITY SYSTEMS	
4—1	Heating and Ventilating System	161
4—68	Windshield Wiper System	171
4—73	Fire Detector System	172
4—79	Fire Extinguisher	175
4—81	Cargo Sling	175
	SECTION V	
	POWER PLANT AND RELATED SYSTEMS	
5—1	Power Plant System	180
5—71	Fuel System	217
5—208	Lubrication System	258

TABLE OF CONTENTS (Cont)

Paragraph		Page
5—231	Ignition System	264
5—250	Starter System	267
5—266	Engine Cooling System	269
5—276	Carburetor Air Induction System	272
5—286	Engine Exhaust Collector	276
5—291	Engine Instruments	277
5—312	Transmission System	279
5—314	Hydro-Mechanical Clutch System	279
5—333	Main Drive Shaft Assembly	287
5—340	Main Gear Box and Rotor Quick Change Unit	288
5—348	Main Gear Box Assembly	297
5—375	Forward and Aft Transmission Installation	305
5—377	Main Gear Box Oil Cooler and Blower	306
5—387	Rotor Brake System	309
5—407	Tail Rotor Drive Shaft	314
5—436	Pylon Transmission Installation	322
5—438	Tail Rotor Drive Shaft Disconnect Coupling	322
5—448	Disconnect Shaft Assembly	326
5—453	Intermediate Gear Box	327
5—463	Pylon Drive Shaft	329
5—472	Tail Rotor Gear Box Assembly	330

SECTION VI

INSTRUMENTS

6—1	Instruments	336
6—7	Flight Instruments	336
6—55	Engine Instruments	348
6—92	Transmission System Instruments	354
6—108	Hydraulic System Instruments	356
6—118	Pitot-Static System	358

SECTION VII

ELECTRICAL SYSTEM

7—1	Electrical Power	362
7—5	DC Power Supply System	362
7—52	DC Power Distribution System	369
7—104	AC Power Supply System	379
7—115	AC Power Distribution System	380
7—139	Lighting Provisions	383
7—141	Exterior Lights	383
7—171	Interior Lights	385
7—188	Inspection Lights	387
7—199	Miscellaneous Equipment	387
7—206	Electrical Load Analysis Charts	388

SECTION VIII

RADIO AND RADAR

8—1	Radio and Radar	393
8—11	VHF Command Set (A.R.C. Type 12)	395
8—21	LF Range Receiver Installation (A.R.C. Type 12)	397
8—30	Intercommunication	400

SECTION IX

ARMAMENT AND PHOTOGRAPHIC

Not Applicable 401

SECTION X

WIRING DATA

10—1	Introduction	403
10—3	Wire Identification Code	403
10—6	Aluminum Wire and Terminals	404
10—8	Electrical Symbols Charts	405
10—10	Equipment List	405
10—12	Index of Wiring Diagrams	411

INTRODUCTION

This handbook contains all essential information required for such service and maintenance as can be accomplished by personnel of the operating units on the complete airframe and on the engines, accessories, instruments, and other installations and equipment of the model H-34A helicopter USAF Serial Nos 53-4475 through 53-4554.

Each section of the handbook provides maintenance information on the systems, components, and groups of equipment to which it applies. In each section, all applicable phases of the particular system, component, or item of equipment are discussed before proceeding to the next item.

A general Table of Contents for the entire handbook precedes section I and lists all section and main paragraph headings with paragraph numbers and initial page numbers. A Table of Contents is also provided at the beginning of each section. The section Table of Contents lists the section's main and secondary paragraph headings with the paragraph number and the initial page number.

Section I includes general information on handling and servicing the helicopter. Sections II through IX cover maintenance instructions on all systems, components, and groups of equipment of the helicopter. Section X includes wiring diagrams and associated data necessary for electrical and radio technicians.

An alphabetical index is located at the end of the book.

Refer to the Illustrated Parts Breakdown for all part numbers.

Figure 1—1. Model H-34A Helicopter

SECTION I

GENERAL INFORMATION

TABLE OF CONTENTS

Paragraph		Page
1—1.	**GENERAL INFORMATION**	1
1—3.	**PRINCIPAL DIMENSIONS**	2
1—5.	**STATIONS AND WATER LINES**	5
1—7.	**ACCESS AND INSPECTION PROVISIONS**	5
1—9.	IDENTIFICATION AND MODIFICATION MARKINGS	5
1—11.	**GROUND HANDLING**	5
1—12.	HOISTING HELICOPTER	5
1—13.	HOISTING PYLON	5
1—14.	JACKING	7
1—15.	LEVELING	8
1—17.	LEVELING HELICOPTER	8
1—18.	LEVELING MAIN ROTOR HEAD ASSEMBLY	9
1—19.	FOLDING MAIN ROTOR BLADES	10
1—20.	UNFOLDING MAIN ROTOR BLADES	10
1—21.	FOLDING PYLON	11
1—22.	UNFOLDING PYLON	11
1—23.	MOORING (BLADES FOLDED)	11
1—24.	MOORING (BLADES IN FLIGHT POSITION)	11
1—25.	PARKING	13
1—26.	TOWING	14
1—28.	**SERVICING**	14
1—30.	**LUBRICATION REQUIREMENTS**	18
1—32.	**TABLE OF SPECIFICATIONS**	23
1—34.	**SPECIAL TOOLS**	25

1—1. GENERAL INFORMATION.

1—2. DESCRIPTION. *(See figure 1—1.)* The model H-34A helicopter is a single engine, single main rotor, and vertical anti-torque tail rotor type helicopter manufactured by Sikorsky Aircraft Division, United Aircraft Corporation, Bridgeport, Connecticut. The helicopter is powered by a Wright model R-1820-84 radial, air-cooled engine. The three sections of the fuselage, the forward, the tail cone and the pylon, are of magnesium alloy and aluminum alloy semi-monocoque construction. The forward section contains the following from front to rear: engine compartment, clutch compartment, oil cell compartment, cockpit, transmission compartment, cabin, fuel tank compartment, electronics compartment and heater compartment. (See figure 2—1.) Fuel is carried in 11 cells beneath the cabin floor. The cockpit contains a pilot's seat on the right and an observer's seat on the left. The cabin accommodates 12 passengers or eight litters. The tail cone section supports the pylon and contains a catwalk to provide access to the tail rotor drive shaft. The pylon supports the tail rotor and stabilizer and is hinged to the tail cone. The pylon can be folded forward along the left side of the tail cone. (See figure 1—10.) The main rotor blades can be folded back along the tail cone. (See figure 1—9.) Flight controls consists of a cyclic control stick, a main rotor pitch control and tail rotor control pedals. A dual set of flight controls is installed at the observer's position. Direction of flight and lift are provided by the main rotor; directional stability and control of the heading of the helicopter are provided by the tail rotor. The engine is adapted to be installed facing aft and inclined upward. The transmission system, which includes a hydro-mechanical clutch, transmits power from the engine to the rotors. Flight and engine instruments are located on the instrument panel in front of the pilot. The nonretractable landing gear includes two main wheels and a single tail wheel. A conventional 28-volt dc system furnishes the electrical power for the helicopter; inverters supply ac current where required. Radio equipment provides air-to-air and air-to-ground communication and navigational information.

1–3. PRINCIPAL DIMENSIONS.

1–4. DESCRIPTION. See figure 1–2 and refer to table I for the principal dimensions of the helicopter.

TABLE I

TABLE OF PRINCIPAL DIMENSIONS

GENERAL	
Main Rotor Disc Diameter	56 ft
Tail Rotor Disc Diameter	9 ft 4 in
Design Gross Weight	11867 lb
WIDTH (over-all)	
Maximum (with rotors stationary)	56 ft
Minimum (with rotors stationary)	40 ft 1.05 in
Minimum (with blades folded)	13 ft
LENGTH (over-all)	
Maximum (both rotors at extreme positions)	65 ft 9.32 in
Minimum (both rotors at minimum positions)	56 ft 8.17 in
Minimum (blades and pylon folded)	37 ft
Minimum (main rotor at minimum position; tail rotor at extreme positions)	57 ft 11.76 in
Minimum (main rotor at extreme position; tail rotor at minimum position)	64 ft 5.73 in
HEIGHT	
Maximum (tail rotor at high position)	15 ft 10 in
Minimum (tail rotor at low position)	14 ft 10 in
Minimum (tail rotor removed)	14 ft 3.45 in
MAIN ROTOR BLADES	
Number of blades	4
Airfoil section (curve identification)	NACA 0012
Chord at root	16.4 in
Chord at tip	16.4 in

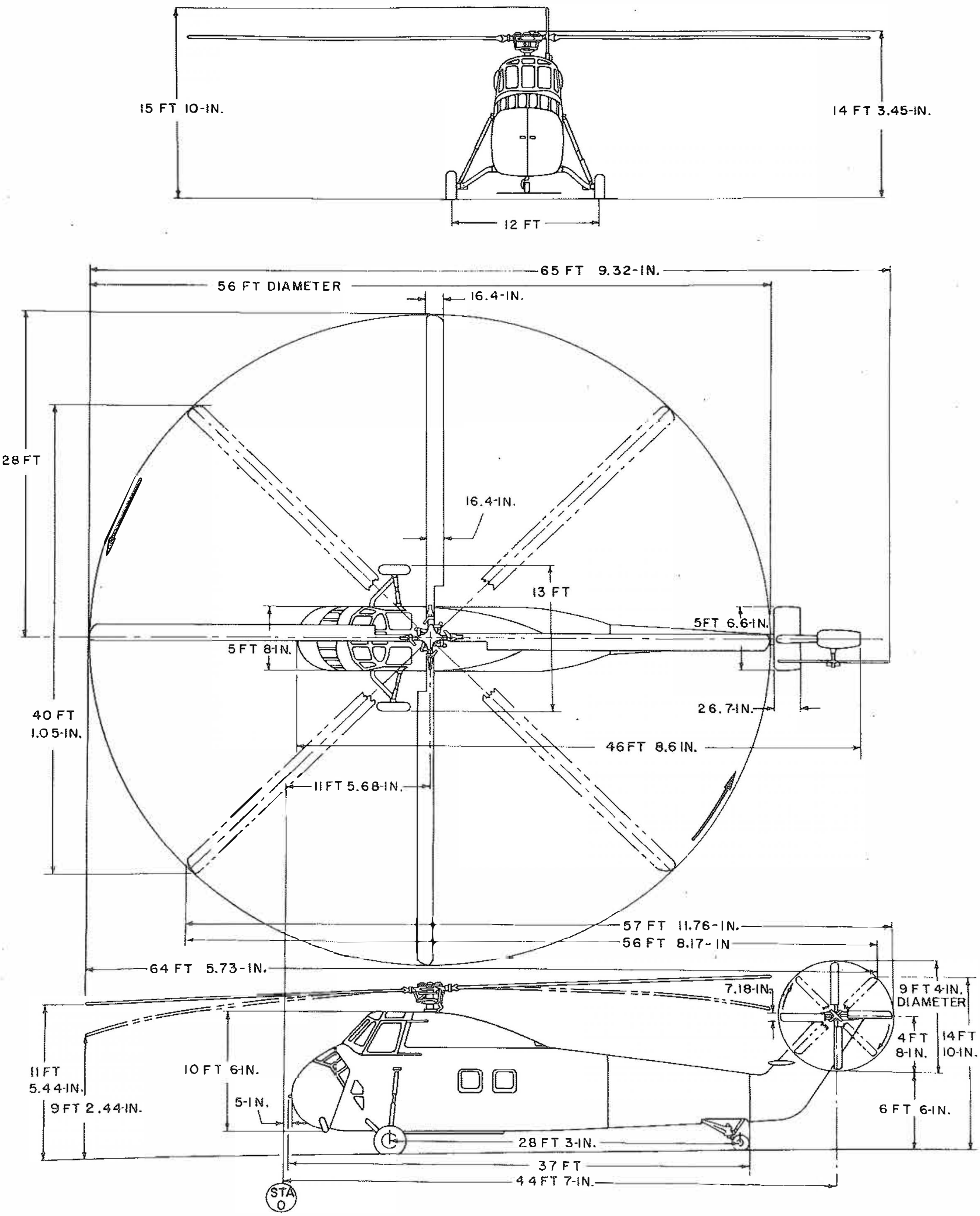


Figure 1—2. Three-View Dimensions

TABLE I (Cont)	
MAIN ROTOR BLADES (Cont)	
Blade radius	28 ft
Total blade area (four blades)	140 sq ft
Area per blade	35 sq ft
Area of rotation (rotor disc area)	2460 sq ft
Rotor solidity (total blade area divided by disc area)	0.0568
Ground clearance (static)	9 ft 2. 44in
Ground clearance (turning) maximum	11 ft 5.44 in
TAIL ROTOR BLADES	
Number of blades	4
Airfoil section	NACA 001 2
Chord at root	7.18 in
Chord at tip	7.18 in
Blade radius	4 ft 8 in
Total blade area (four blades)	1372 sq in
Area per blade	343 sq in
Area of rotation (rotor disc area)	9847 sq in
Rotor solidity (total blade area divided by disc area)	0. 1393
Ground clearance (static)	6 ft 6 in
Ground clearance (turning)	6 ft 6 in
STABILIZER	
Number	1
Length	5 ft 6.6 in
Area	12.38 sq ft
Airfoil	NACA 0009
FUSELAGE (without main and tail rotor blades)	
Width (with landing gear)	13 ft
Width (without landing gear)	5 ft 8 in
Height (without landing gear)	10 ft 6 in
Length	46 ft 8. 6in
Door dimensions (cargo)	4 ft 5.5 in x 4 ft
Height of door level above ground	2 ft 10. 5 in
Total cubic feet of storage space available	457 cu ft (approx)

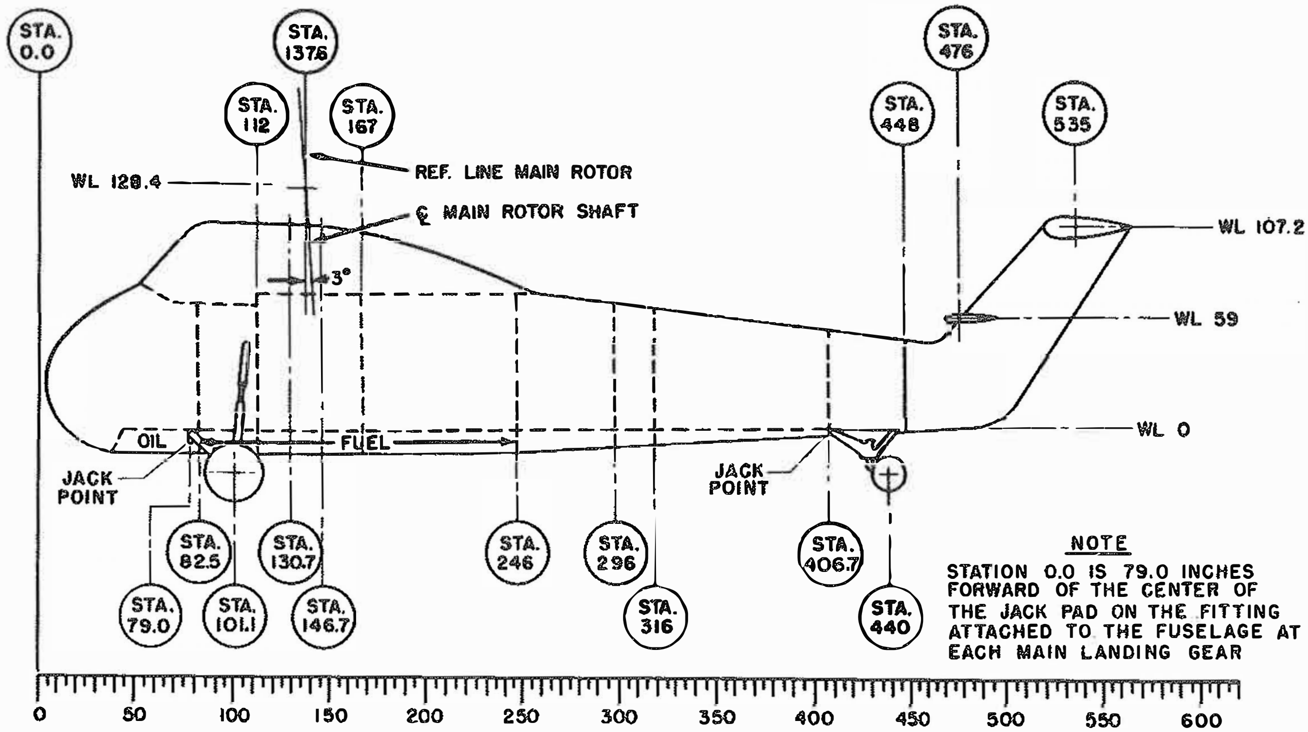


Figure 1–3. Stations Diagram

1–5. STATIONS AND WATER LINES.

1–6. DESCRIPTION. For reference purposes the length of the helicopter is divided into stations and the height is divided into water lines. If the station and water line of a particular part are known, its location on the helicopter can readily be determined by referring to figure 1–3.

Note

Readily accessible points from which measurements may be taken to determine station locations are: the cabin forward bulkhead (station 82.5); the jack pad (station 79) on the main landing gear fitting on the bottom structure and the jack pad (station 406.7) on the tail landing gear fitting on the bottom of the tail cone. (See figure 1–3.)

1–7. ACCESS AND INSPECTION PROVISIONS.

1–8. DESCRIPTION. All access and inspection provisions on the helicopter are illustrated in figure 1–4.

1–9. IDENTIFICATION AND MODIFICATION MARKINGS.

1–10. DESCRIPTION. An identification and modification plate is installed on each of the following helicopter components: engine mount, main rotor head, fuselage, pylon, tail cone and stabilizer. The plate identifies each component by model number, drawing or part number, contract number and serial number. Each plate is riveted to its respective component on the left side of the helicopter at the following locations: on the outboard side of the engine mount, on the lower plate of the main rotor head, on the fuselage where the fuselage and tail cone are joined, on the tail cone and pylon adjacent to each other on each side of the hinge opening, and on the top of the stabilizer.

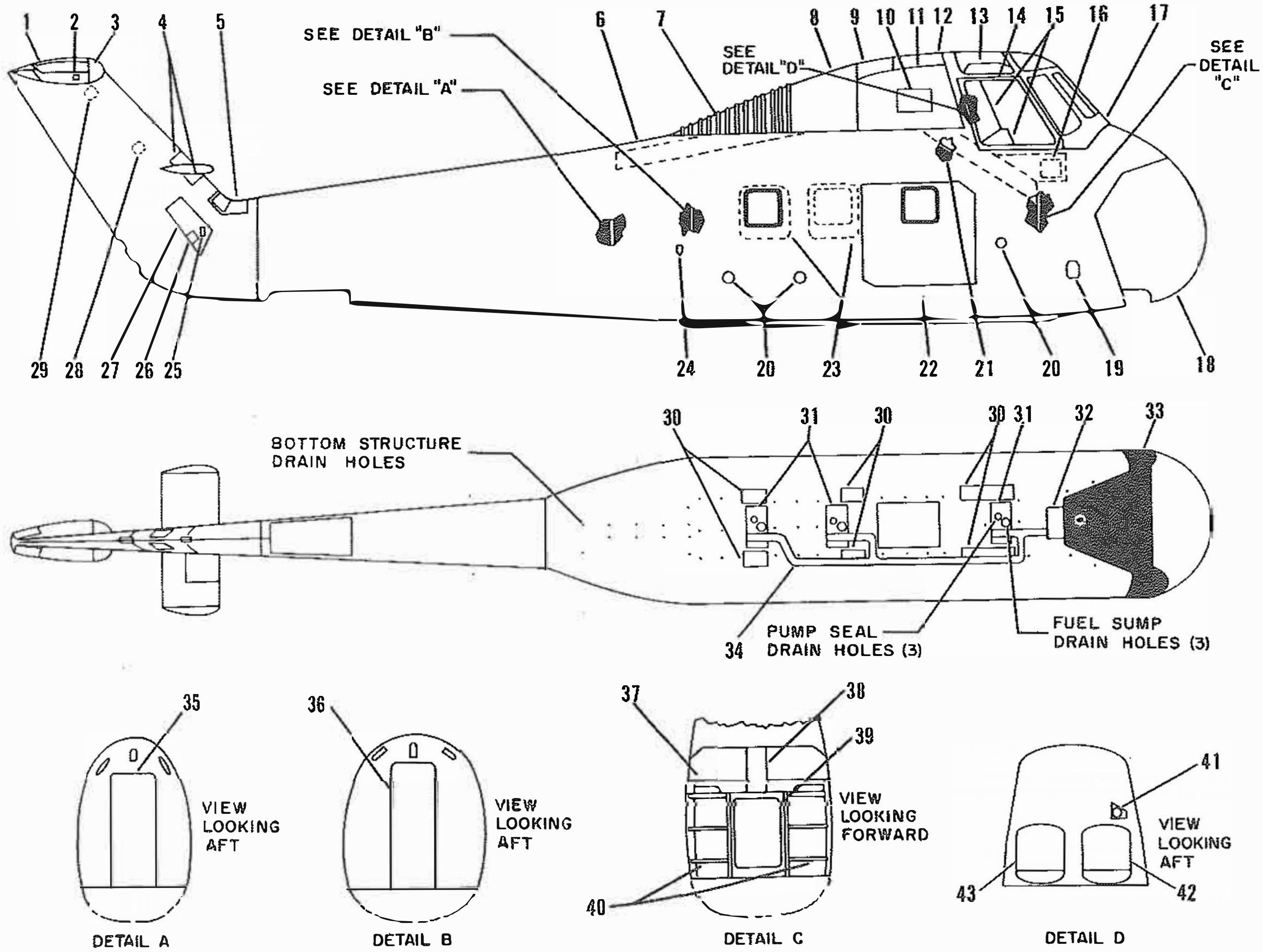
1–11. GROUND HANDLING.

1–12. HOISTING HELICOPTER. *(See figure 1–5.)* Hoist the helicopter at the four eyebolts on the top of the upper plate of the main rotor hub assembly. Connect the hoisting sling assembly, Sikorsky part No. S1670-10151, to the eyebolts by means of the quick release pins. Use guide lines on the mooring fittings on the fuselage to guide the helicopter during hoisting operations.

1–13. HOISTING PYLON. *(See figure 1–6.)* The tail rotor pylon can be supported during removal or installation by using the pylon hoisting sling, Sikorsky part No. S1670-10449, as follows:

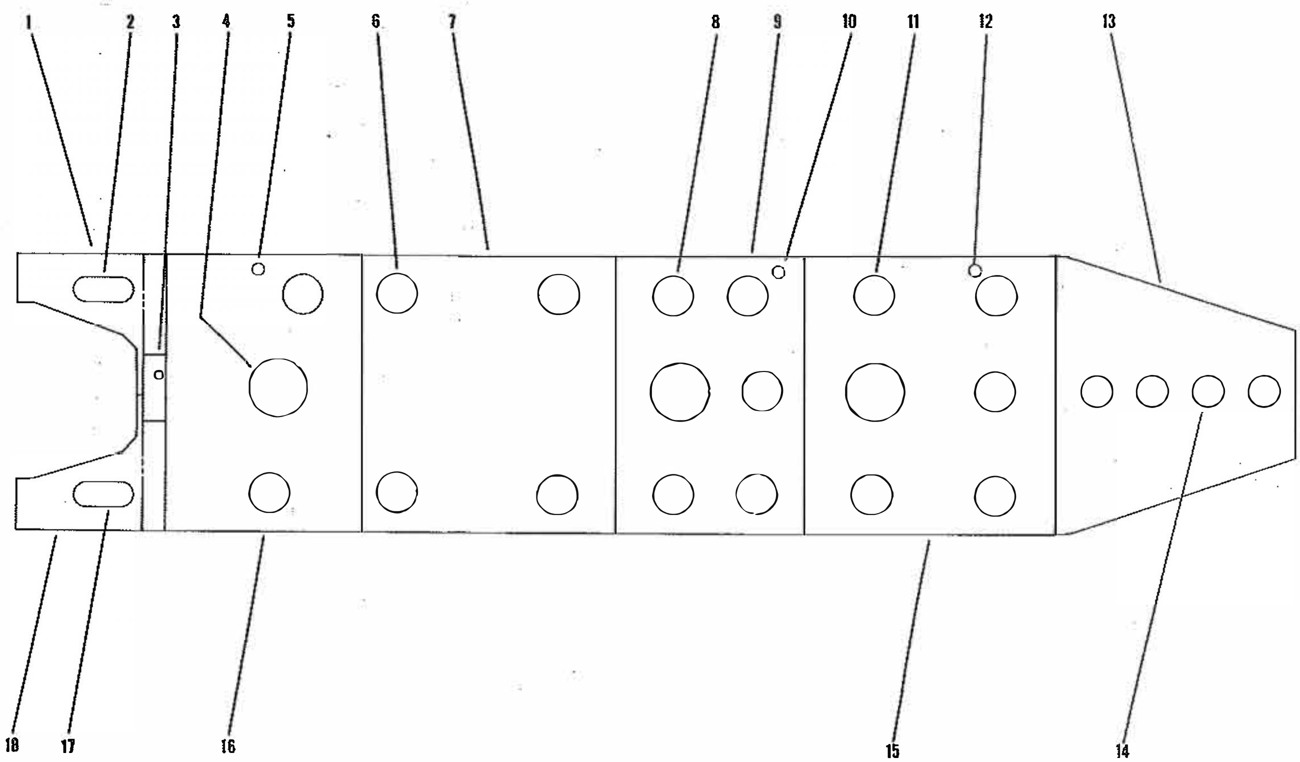
CAUTION

The two handles on the leading edge of the pylon must never be used to support or hoist the pylon.



1. Top Fairing Grill
2. Tail Rotor Gear Box Oil Level Window
3. Tail Rotor Gear Box Fairing Cover
4. Stabilizer Fairings
5. Disconnect Shaft and Air Intake Fairing
6. Tail Rotor Drive Shaft Covers
7. Louvered Fairing
8. Skin Assemblies
9. Fairing
10. Service Platform Door
11. Service Platforms
12. Main Gear Box Screen
13. Overhead Control Panel
14. Sliding Windows
15. Auxiliary Servo and Mixer Covers
16. Radio Circuit Breaker and Fuse Panel Door
17. Cockpit Canopy
18. Nose Doors
19. Oil Filler Door
20. Fuel Tank Filler Caps
21. Main Drive Shaft Tunnel Extension Cover
22. Cargo Door
23. Emergency Hatches
24. External Power Receptacle
25. Intermediate Gear Box Oil Level Window
26. Drain Plug Door
27. Intermediate Gear Box Panel
28. Support Bearing Panel
29. Upper Rubber Coupling Panel
30. Fuel Lines Plates
31. Fuel Sump and Cell Fitting Covers
32. Fuel Selector Valve and Strainer Panel
33. Engine Air Cooling and Oil Cell Opening
34. Emergency Fuel Lines Fairing
35. Tail Cone Opening
36. Electronics Compartment Opening
37. Cockpit Opening
38. Torque Shaft Cover in Main Drive Shaft Tunnel
39. Clutch Access (Carburetor Induction Heat) Door
40. Cockpit Ladders
41. Servo Reservoir Inspection Window
42. Observer's Seat
43. Pilot's Seat

Figure 1—4. Access and Inspection Provisions (Sheet 1 of 2)



1. Right Engine and Clutch Compartment Floor
2. Right Oil Cell Cover
3. Fuel Selector Valve and Strainer Door
4. Forward Fuel Cell Access Covers (Forward Tank)
5. Forward Fuel Tank Filler
6. Aft Fuel Cell Access Covers (Forward Tank)
7. Aft Cabin Floor Panel (Forward Tank)
8. Center Tank Fuel Cell Access Covers
9. Center Cabin Floor Panel
10. Center Fuel Tank Filler
11. Aft Tank Fuel Cell Access Covers
12. Aft Fuel Tank Filler
13. Electronics Compartment Floor
14. Electronics Compartment Floor Access Covers
15. Aft Cabin Floor Panel
16. Forward Cabin Floor Panel (Forward Tank)
17. Left Oil Cell Cover
18. Left Engine and Clutch Compartment Floor

Figure 1—4. Access and Inspection Provisions (Sheet 2 of 2)

a. Wrap the straps around the pylon with the lower strap through the hand hole below the screen on the trailing edge of the pylon. Lock the clips.

b. Attach a hoist to the ring.

c. Check to see that the straps are positioned over the red stripes on either side of the pylon.

d. Support the weight of the pylon with the hoist while removing or installing the attaching parts of the pylon. (Refer to paragraphs 2—98 and 2—99.)

1—14. JACKING.
(See figure 1—7.)

a. To jack the entire helicopter, use the jack pads on the two main landing gear fittings and the jack pad on the fitting on the bottom of the tail cone.

Note

The main landing gear fitting jack pads have a ground clearance of 20.25 inches when the tires are fully deflated; the jack lift required for a two-inch wheel clearance is 19.5 inches. The jack pad on the fitting under the tail cone has a ground clearance of 17.94; the jack lift required for a two-inch wheel clearance is 18.22.

b. To remove a main wheel, chock the tail wheel and the other main wheel and place the jack under the jack pad near the tie-down ring on the main landing gear leg.

Note

The ground clearance of the jack pad is 9.25 inches; the jack lift required for a two-inch wheel clearance is 9.5 inches.

c. To remove a main landing gear assembly, chock the tail wheel and the other main wheel and place the jack under the jack pad on the main landing gear fitting on the bottom structure.

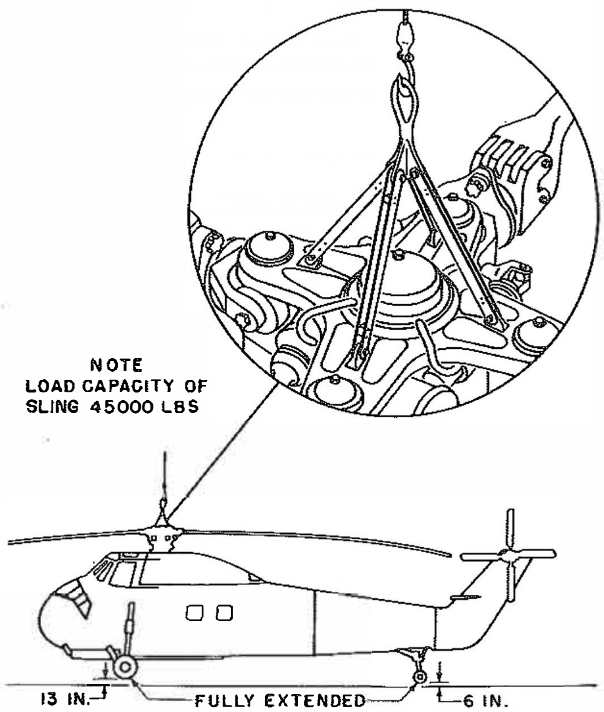


Figure 1–5. Hoisting Helicopter

Note

The jack pad ground clearance is 20.25 inches when the tires are fully deflated; the jack lift required for a two-inch wheel clearance is 19.5 inches.

d. To remove the tail wheel, chock each main wheel and place the jack under the jack pad on the tail landing gear yoke.

Note

The jack pad ground clearance is 10.1 inches when the tire is fully deflated; the jack lift required for a two-inch wheel clearance is 6.2 inches.

e. To remove the tail landing gear assembly, chock each main wheel and place the jack under the jack pad on the landing gear fitting under the tail cone.

Note

The jack pad ground clearance is 17.94 inches when the tire is fully deflated; the jack lift required for a two-inch wheel clearance is 18.22 inches.

1–15. LEVELING.

1–16. DESCRIPTION. Two leveling procedures are used on the helicopter. One procedure is used when leveling the entire helicopter. The second procedure is used when leveling the main rotor head assembly. When the helicopter is level, the axis of the main rotor head assembly is three degrees forward of the perpendicular. The rotor head assembly must be level when rigging the main rotor flight controls and the removal and installation of the main rotor head assembly is facilitated if the axis of the hub is perpendicular.

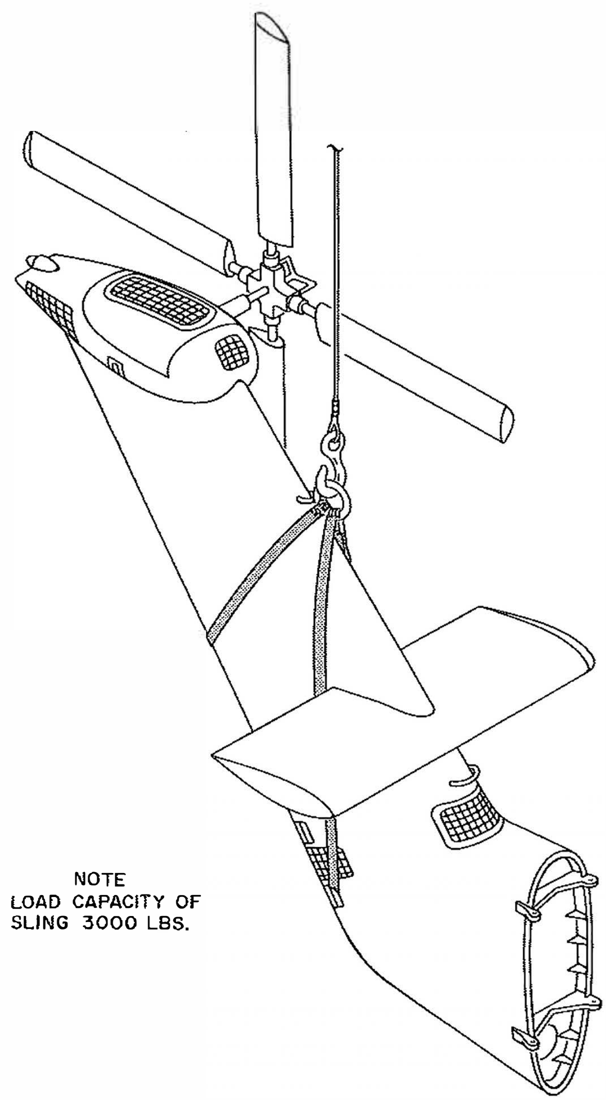
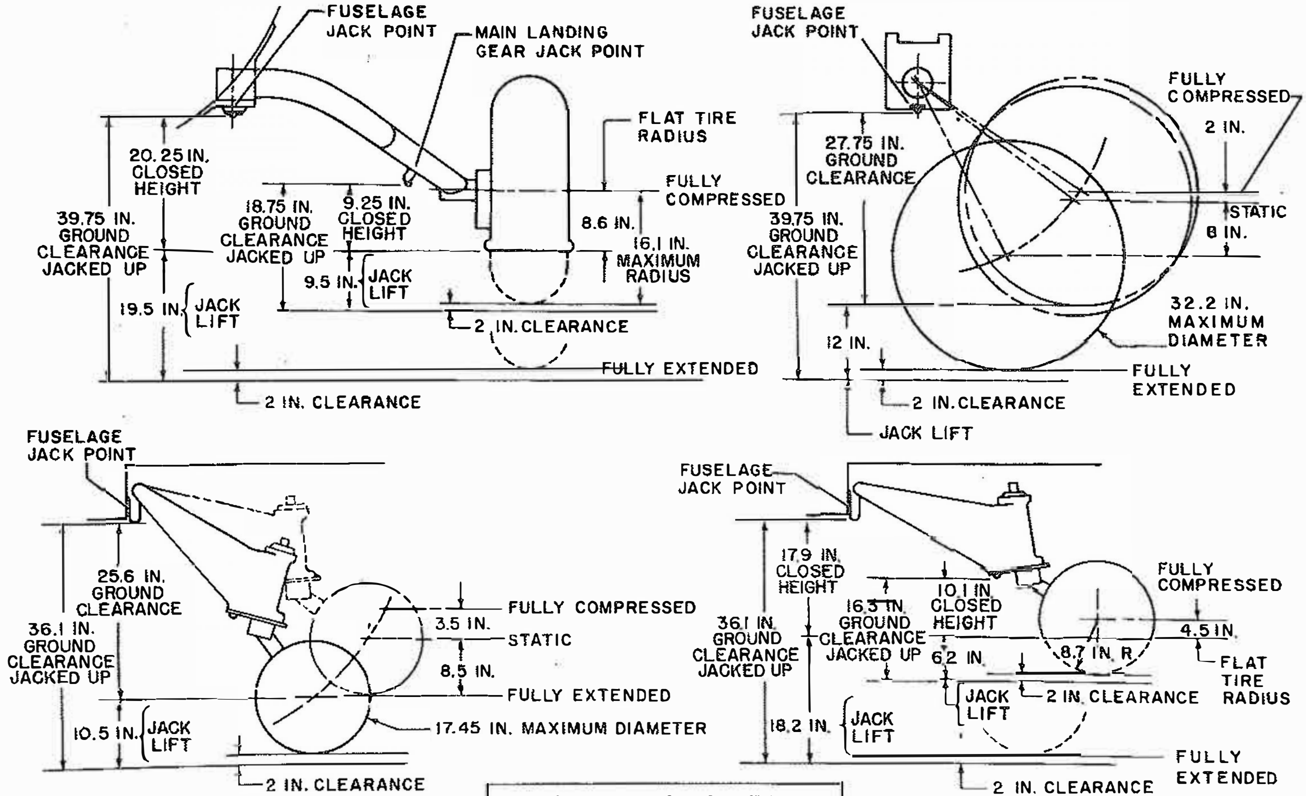


Figure 1–6. Hoisting Pylon

1–17. LEVELING HELICOPTER.
(See figure 1–8.)

a. Jack the helicopter at the jack pads on the two main landing gear fittings and at the jack pad on the fitting on the bottom of the tail cone. (See figure 1–7.)

b. Hang a plumb line from the leveling slot provided on the top frame of the cargo door to the leveling plate installed on the bottom of the door frame.



JACK LOADING CAPACITY	
MAIN LANDING GEAR JACK	10,000 LBS
TAIL LANDING GEAR JACK	3,000 LBS

Figure 1—7. Jacking Helicopter

c. Adjust the height of the jacks as required to precisely line up the plumb bob at the "O" point of the scribed markings on the leveling plate.

Note

If jacks are not available, level the helicopter by increasing or decreasing the air pressure in the landing gear shock struts.

1—18. LEVELING MAIN ROTOR HEAD ASSEMBLY.

a. Jack the helicopter at the jack pads on the two main landing gear fittings and at the jack pad on the fitting on the tail cone. (See figure 1—7.)

b. Align two opposite sleeve-spindle assemblies of the main rotor head assembly with the longitudinal axis of the helicopter.

c. Use a level on the upper plate of the main rotor head assembly and adjust the height of the jacks as required to level the main rotor head assembly transversely and longitudinally.

Note

If jacks are not available, level the main rotor head assembly by increasing or decreasing the air pressure in the landing gear shock struts.

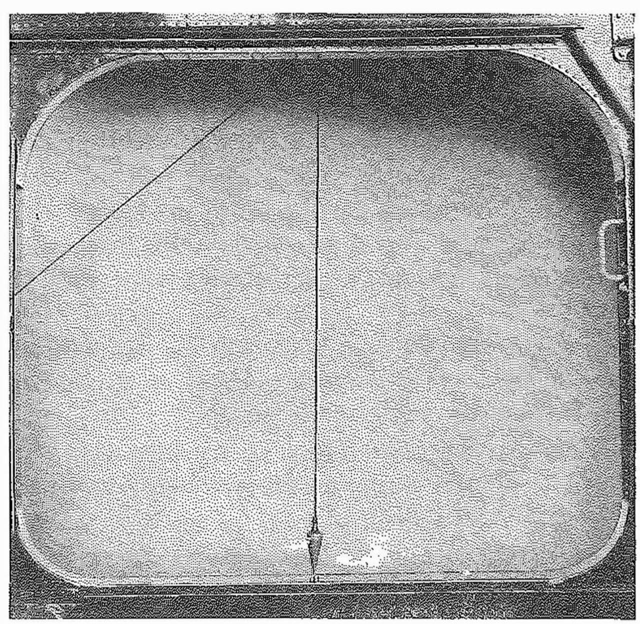


Figure 1—8. Leveling Helicopter

Figure 1—9. Main Rotor Blades Folded

1—19. FOLDING MAIN ROTOR BLADES.
(See figure 1—9.)

Note

When it is desired to fold the pylon together with the main rotor blades, the pylon should be folded first. (Refer to paragraph 1—21.)

a. Install the blade stowage assembly, Sikorsky part No. S1670-10521-2, on the tail cone at the locating bracket. Line up the yellow triangle on the hinge of the stowage assembly with the red triangle on the locating bracket.

b. Adjust the saddle assembly for snugness when attaching the latch to the fitting on each side of the tail cone. The pockets of the stowage assembly should now be in position to hold the blades.

c. Place the collective pitch control in the low pitch position and the cyclic control stick in neutral.

d. Turn the main rotor to position the blades at approximately a 45-degree angle with the longitudinal axis of the helicopter. Lock the main rotor with the rotor brake.

e. Support the aft right blade. Cut the lock wire and unscrew the knob of the lock assembly on the horn to permit the sleeve and blade to turn.

f. Remove the upper taper pin (paragraph 2—300, steps b. and c.) to permit the blade to hinge downward.

g. Fold the blade to the side of the tail cone and secure the blade, with the leading edge down, in the upper pocket of the stowage assembly.

h. Fold the forward, right blade as in steps e. through g. and secure the blade in the lower pocket of the stowage assembly.

i. Support the aft, left blade. Cut the lock wire and unscrew the knob of the lock assembly on the horn to permit the sleeve and blade to turn. Disconnect the bonding jumper.

j. Install the blade rotator, Sikorsky part No. S1670-10051, on the inboard end of the blade and secure it with the wing nuts. Rotate the blade 180 degrees and remove the rotator.

k. Remove the taper pin (paragraph 2—300, steps b. and c.) which is now at the top to permit the blade to hinge downward. Fold the blade to the side to the tail cone and secure the blade, with the leading edge down, in the upper pocket of the stowage assembly.

l. Fold the forward, left blade as in steps i. through k. and secure the blade in the lower pocket of the stowage valve.

CAUTION

The blade stowage assembly pockets are to be used for blade support only.

m. Install the blade stowage pocket, Sikorsky part No. S1670-10513-2 on the aft left blade and secure the straps to the handle on the pylon below the stabilizer.

1—20. UNFOLDING MAIN ROTOR BLADES.
(See figure 1—9.)

a. Release the forward left blade from the lower pocket, hinge the blade forward to the installed position and install the top taper pin. (Refer to paragraph 2—304, steps b. and c.)

b. Install the blade rotator, Sikorsky part No. S1670-10051, on the inboard end of the blade and secure it with the wing nut. Rotate the blade 180 degrees until the sleeve is in normal position and remove the rotator.

c. Lock the sleeve in position by turning the knob of the lock assembly on the horn. Lockwire the knob. Connect the bonding jumper.

d. Remove the blade stowage pocket from the aft, left blade and release the blade from the upper pocket of the stowage assembly. Unfold the blade as in steps a. through c.

e. Release the forward, right blade from the lower pocket.

f. Hinge the blade forward to the installed position and install the upper taper pin. (Refer to paragraph 2—304, steps b. and c.)

g. Rotate the blade until the sleeve is in normal position using the blade rotator, Sikorsky part No. S1670-10051, as outlined in step b. Lock the sleeve in position by turning the knob of the lock assembly on the horn. Lockwire the knob. Connect the bonding jumper.

h. Release the aft, right blade from the upper pocket and unfold the blade as in steps f. and g.

i. Remove the blade stowage assembly from the tail cone.

1—21. FOLDING PYLON.
(See figure 1—10.)

a. Position the tail rotor blades so they will clear the pylon when folded.

b. Release the handle of the wrench assembly from the spring-loaded latch on the right side of the tail cone. Unlock the pylon lockpins by placing the ratchet pin on the wrench in the down position and actuating the wrench from aft to forward. The red warning flag will be released automatically.

CAUTION

Do not let the pylon swing out of control during the folding operation.

Note

Opening the pylon releases a spring-loaded coupling which engages a brake plate to prevent the tail rotor blades from windmilling.

c. Swing the pylon around to the left side of the tail cone. Secure the pylon by pressing the rod on the tail cone into the wedjit fitting on the pylon.

1—22. UNFOLDING PYLON.
(See figure 1—10.)

a. Release the rod assembly on the tail cone from the wedjit fitting on the pylon.

CAUTION

Do not let the pylon swing out of control during the unfolding operation.

b. Swing the pylon around to the normal position. Engage the lockpin by placing the ratchet pin on the wrench in the up position and actuating the wrench from forward to aft until the red warning flag disappears. Secure the wrench handle in the spring-loaded latch.

Note

The coupling will be automatically disengaged from the brake plate when the pylon is in flight position.

1—23. MOORING (BLADES FOLDED).
(See figure 1—11.)

a. Head the helicopter into the wind.

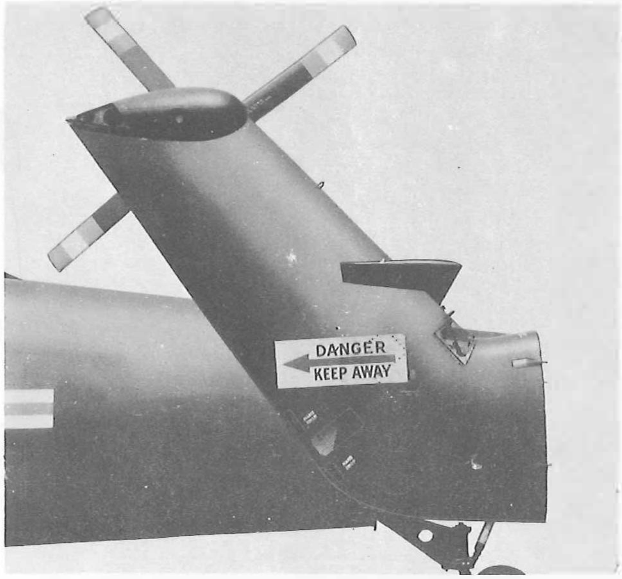


Figure 1—10. Pylon Folded

b. Fold the pylon. (Refer to paragraph 1—21.) Fold the main rotor blades. (Refer to paragraph 1—19.)

c. Secure mooring lines to the tie-down rings on the helicopter. Chock all wheels.

Note

Protective covers are provided to be installed as required. (Refer to paragraph 2—175.)

1—24. MOORING (BLADES IN FLIGHT POSITION).
(See figure 1—12.)

CAUTION

The following mooring procedure is to be used only in high winds. Continued daily use will result in bending of blade trailing edge tabs.

a. Install protective covers as required. (Refer to paragraph 2—175.)

b. Place the collective pitch control in the low pitch position and the cyclic control stick in neutral. Set the parking brake.

c. Turn the main rotor to position the blades at approximately 45 degrees with the longitudinal axis of the helicopter. Lock the main rotor with the rotor brake.

d. Secure mooring lines from the mooring rings on the helicopter to the fixed moorings on the field. (See figure 1—11.) Place wheel chocks forward and aft of each main landing gear wheel.

e. Install a tip sock assembly, Sikorsky part No. S1670-10506, over the tip of each blade by inserting the

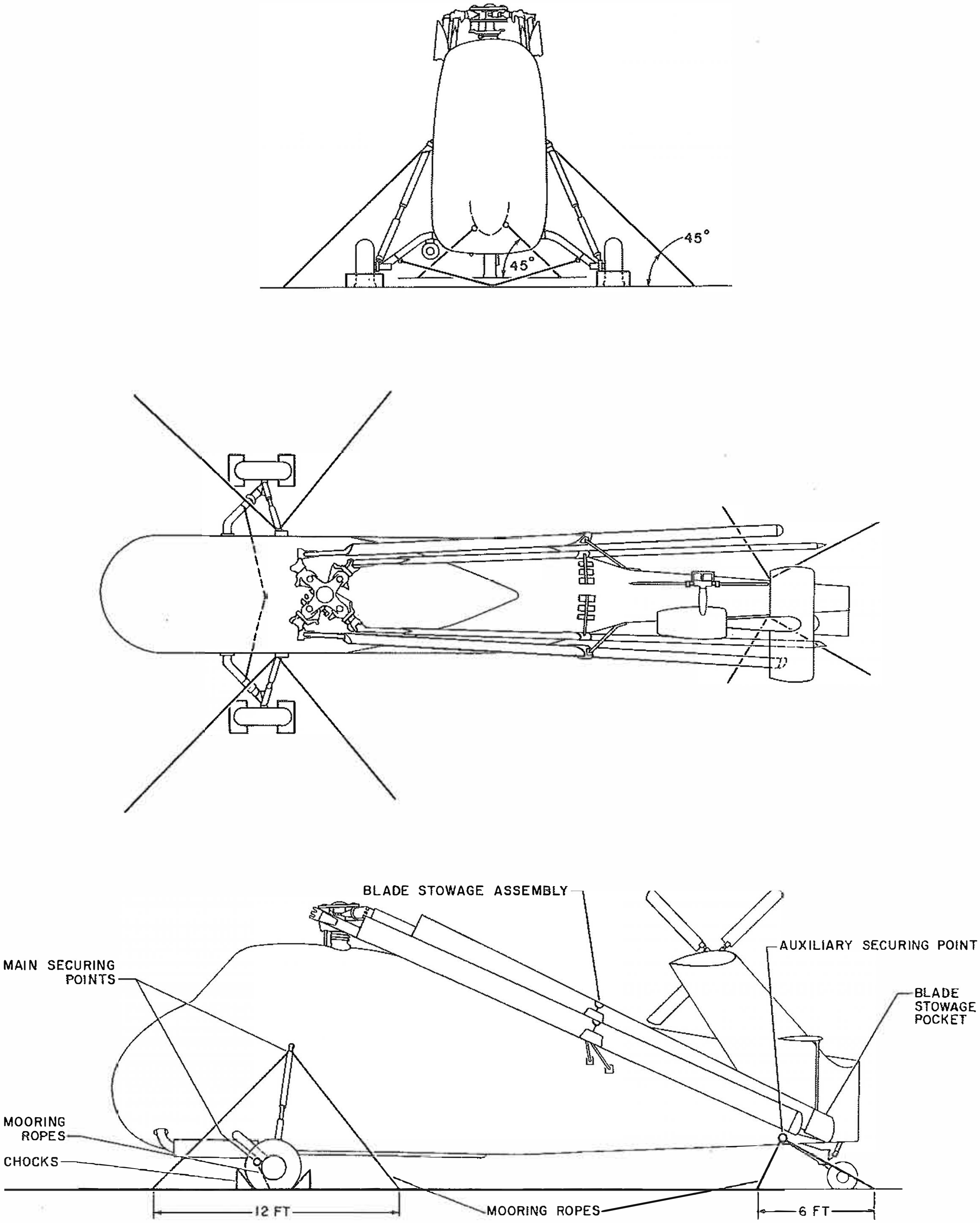


Figure 1—11. Mooring Helicopter (Blades Folded)

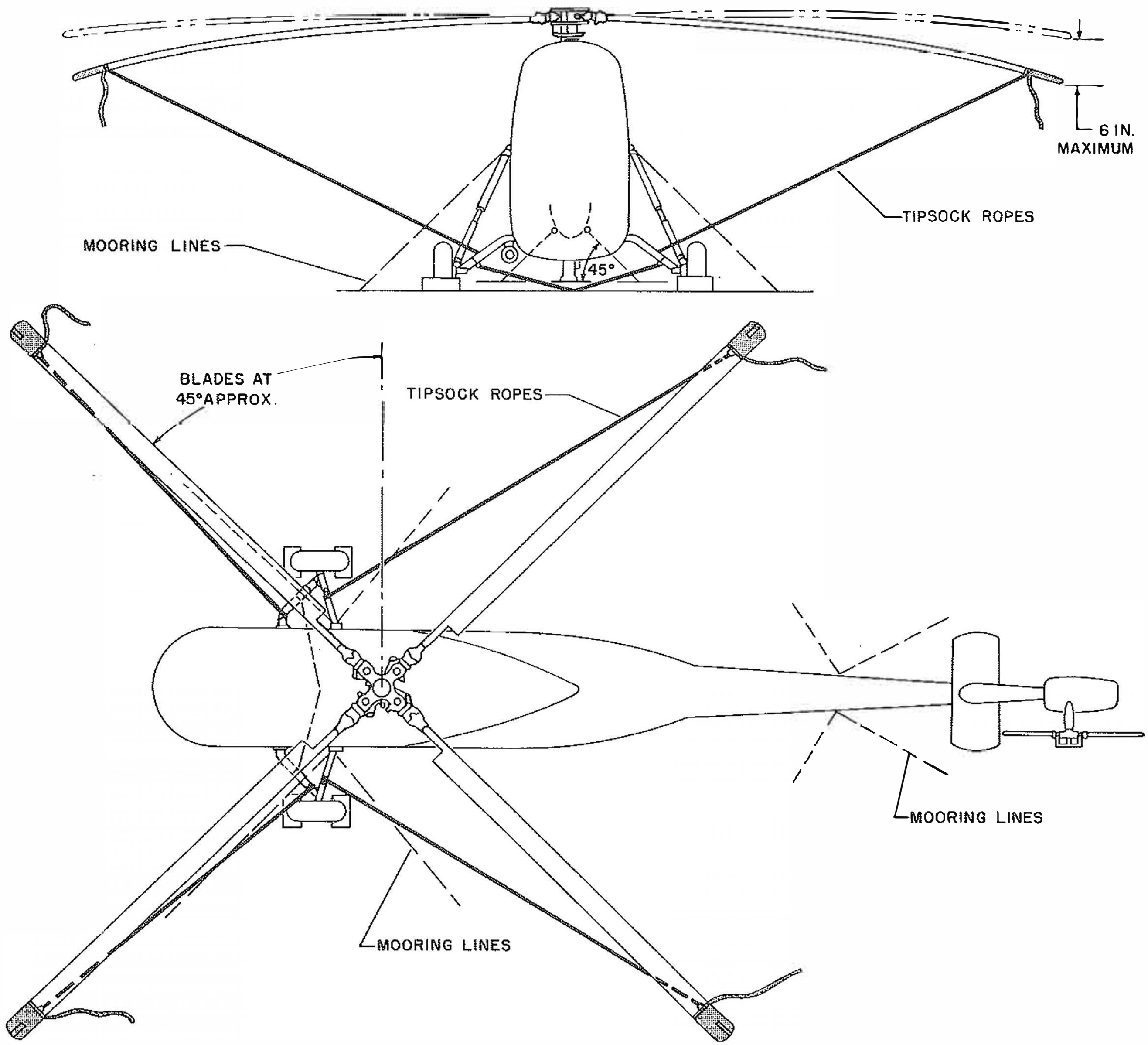


Figure 1—12. Mooring Helicopter (Blades in Flight Position)

end of the wire spreader portion of the sock into the socket of the assist pole.

f. Secure the free ends of each rope to the nearest landing gear strut with a suitable knot in such a manner that there is no slack in the rope. The maximum allowable deflection of the blades from a static position is six inches.

CAUTION

Excessive tightening of the ropes will result in bending of the blades.

g. To remove the tip sock assembly, release the ropes and remove the socks with the aid of the ropes.

1—25. PARKING. Move the tail wheel landing gear to the trailing position. Pull out the "TAIL WHEEL LOCK" handle, which is located below the instrument panel, to lock the tail wheel in this position. Set the main wheel parking brakes by depressing both toe brake pedals and pulling out the handle marked "PARKING BRAKE" which is located to the left of the pilot's tail rotor pedal adjustment knob.

Note

Depress both toe brake pedals, or the right pedal only, to release the parking brakes. Release the "TAIL WHEEL LOCK" handle to unlock the tail wheel.

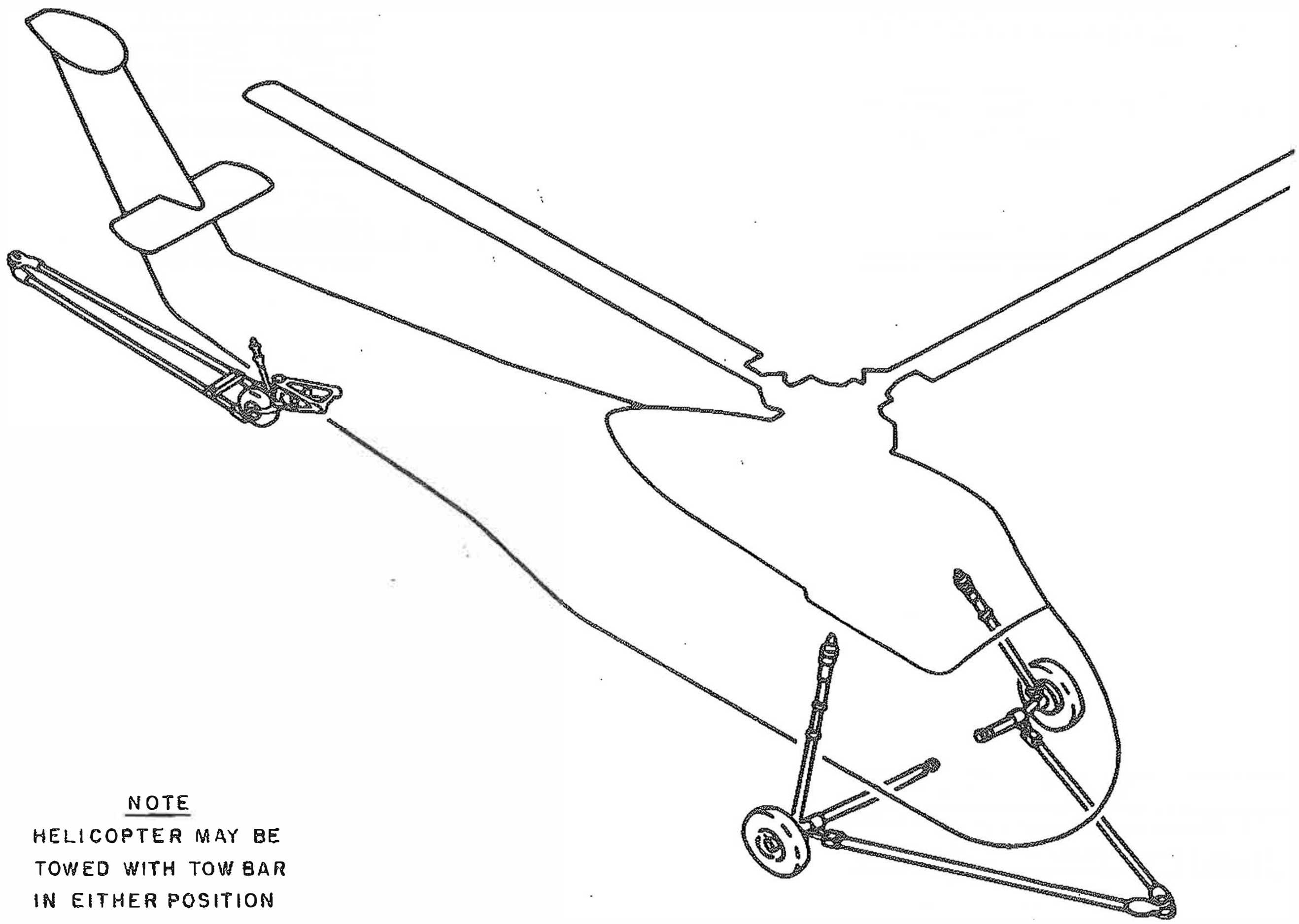


Figure 1—13. Towing Helicopter

1—26. TOWING.
(See figure 1—13.)

1—27. DESCRIPTION. To tow the helicopter forward, attach a standard Navy tow bar, R89-B-104300 (NAF601364), to the tie-down ring on each main landing gear leg. To tow the helicopter backward, insert the pin of the tow bar through the hole in the tail landing gear axle.

CAUTION

Do not tow the helicopter with the tail wheel lock engaged or with the parking brakes on.

1—28. SERVICING.

1—29. DESCRIPTION. Refer to table II and see figure 1—15 for servicing instructions for the helicopter. See figure 1—14 for servicing points.

TABLE II
SERVICING

REPLENISH WITH	*TOTAL CAPACITY*	*SPECIAL INSTRUCTIONS*
	FUEL SYSTEM	
Fuel	Forward 104 US (86.6 Imperial) gal, 393.6 liters 5.0 US (4.2 Imperial) gal, 18.9 liters unusable	Ground the helicopter and truck in accordance with applicable directives. Plug hose nozzle ground line into grounding jack above fuel filler.

TABLE II (Cont)

REPLENISH WITH	TOTAL CAPACITY	SPECIAL INSTRUCTIONS
Fuel (cont) **CAUTION** Alcohol will not be added to aviation fuels for use in aircraft, regardless of the type of fuel cells or tanks installed.	Center 67 US (55.8 Imperial) gal, 253.6 liters 1.0 US (0.8 Imperial) gal, 3.8 liters unusable Aft 88 US (73.3 Imperial) gal, 333.1 liters 1.0 US (0.8 Imperial) gal, 3.7 liters unusable	
	ENGINE OIL SYSTEM	
Engine Oil **WARNING** Do not overfill. Overfilling reduces necessary foaming space.	10.5 US (8.7 Imperial) gal, 39.7 liters 5.0 US (4.2 Imperial) gal, 18.9 liters expansion space	A stick-type level gage is located under the oil tank filler cap. Fill to mark on gage. Allow time for oil to find its level in both tanks. Recheck oil level and refill as necessary.
	MAIN GEAR BOX	
Heavy Duty Oil	20 US (16.65 Imperial) quarts, 18.92 liters (including oil cooler) 12 US (9.99 Imperial) quarts, 11.35 liters (not including oil cooler)	Hinge down left service platform. Fill to the full mark on sight level gage on lower left side of gear box. **Note** Before servicing the gear box, allow a minimum of ½-hour after gear box operation.
	INTERMEDIATE GEAR BOX	
Heavy Duty Oil	2.0 US (1.66 Imperial) pints (approx), 0.95 liters	Fill to the full mark on sight level gage on right side of gear box.
	TAIL ROTOR GEAR BOX	
Heavy Duty Oil	3 US (2.50 Imperial) quarts (approx), 2.84 liters	Fill to the full mark on sight level gage. With pylon folded, use dip stick on top of gear box to determine oil level.
	MAIN ROTOR DAMPERS	
Hydraulic Oil	6 US (4.99 Imperial) pints (approx), 2.84 liters	Fill to the full mark on fluid tank.

TABLE II (Cont)

REPLENISH WITH	TOTAL CAPACITY	SPECIAL INSTRUCTIONS
	PRIMARY SERVO SYSTEM HYDRAULIC OIL RESERVOIR	
Hydraulic Oil	0.45 US (0.37 Imperial) gal, 1.70 liters (reservoir) 0.40 US (0.33 Imperial) gal, 1.51 liters (refill)	Hinge down left service platform. Fill reservoir to full mark on sight level gage.
	AUXILIARY SERVO SYSTEM HYDAULIC OIL RESERVOIR	
Hydraulic Oil	0.45 US (0.37 Imperial) gal, 1.70 liters (reservoir) 0.40 US (0.33 Imperial) gal, 1.51 liters (refill)	Remove clutch access door. Remove cover and fill reservoir to full mark on sight level gage.
	WHEEL BRAKE SYSTEM MASTER CYLINDERS	
Hydraulic Oil	8 US oz (approx)	Fill master cylinders at filler plug on each cylinder. Bleed the system in accordance with instructions in paragraph 2—260.
	MAN LANDING GEAR SHOCK STRUTS	
Hydraulic Oil		For servicing instructions, see name plate on strut and refer to paragraph 2—240.
Air		For servicing instructions, see name plate on strut and refer to paragraph 2—228.
	TAIL LANDING GEAR SHOCK STRUT	
Hydraulic Oil		For servicing instructions, see name plate on strut and refer to paragraph 2—276.
Air		For servicing instructions, see name plate on strut and refer to paragraph 2—264.
	BATTERY	
Water		Fill battery 3/8-inch over protectors.
	TIRES	
Air		Inflate until tires are on their rolling radius line according to Tire Pressure Chart (figure 1—15).
	MAIN ROTOR BRAKE MASTER CYLINDER	
Hydraulic Oil		Fill cylinder to full mark on sight level gage.
	MAIN ROTOR BRAKE SYSTEM HYDRAULIC ACCUMULATOR	
Air		Hinge down right service platform. Charge accumulator with 250 psi at air valve.

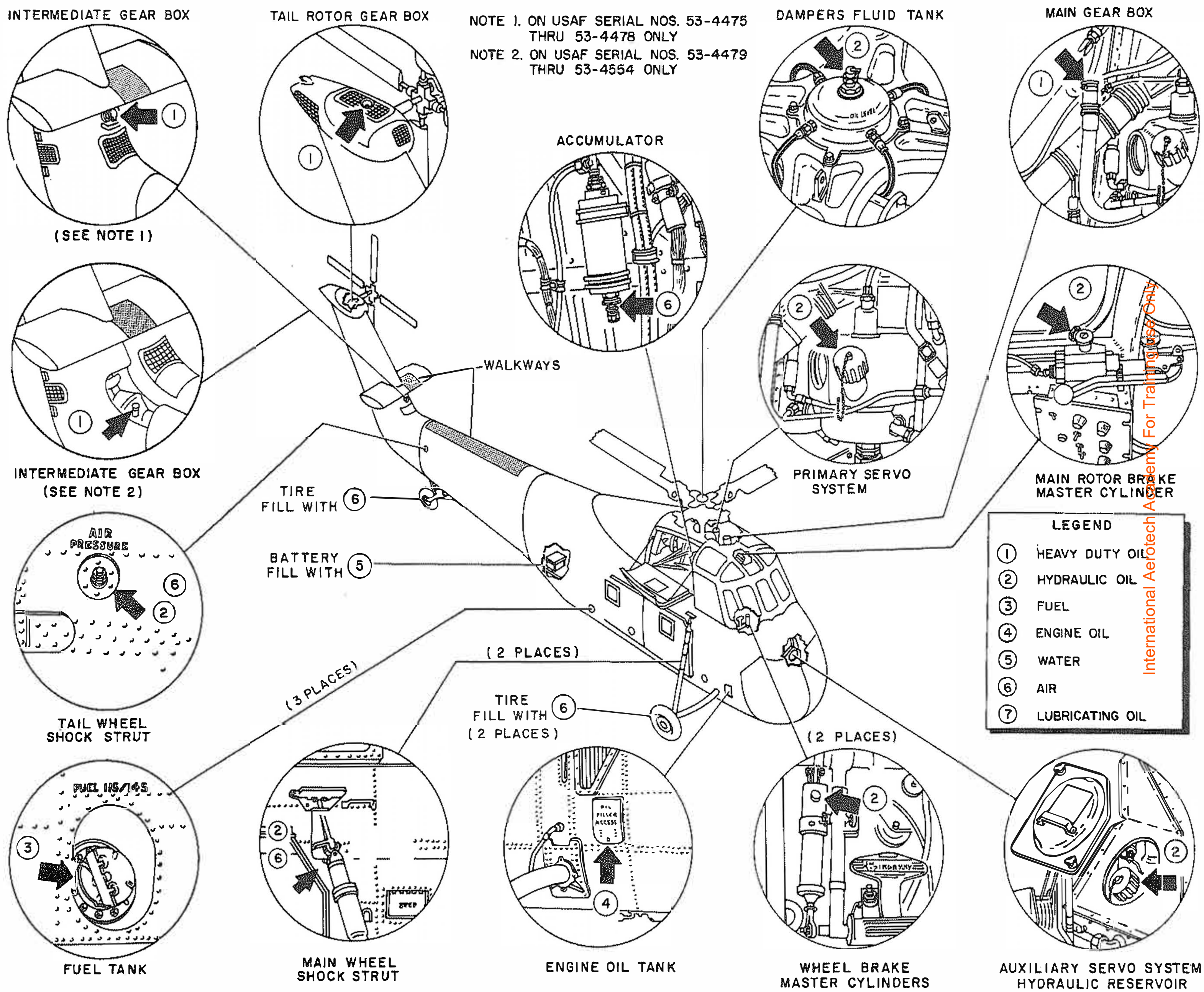


Figure 1—14. Servicing Diagram

TABLE II (Cont)

REPLENISH WITH	TOTAL CAPACITY	SPECIAL INSTRUCTIONS
	PEDAL DAMPER	
Air		Operate both servo systems at 1500 psi. Turn the auxiliary servo system off and charge the pedal damper with 1500 psi at both air valves. Turn both systems on. Turn the primary servo system off and check the operation of the tail rotor servo unit and damper.

1—30. LUBRICATION REQUIREMENTS.

1—31. DESCRIPTION. See figure 1—16 for the lubrication requirements of the helicopter.

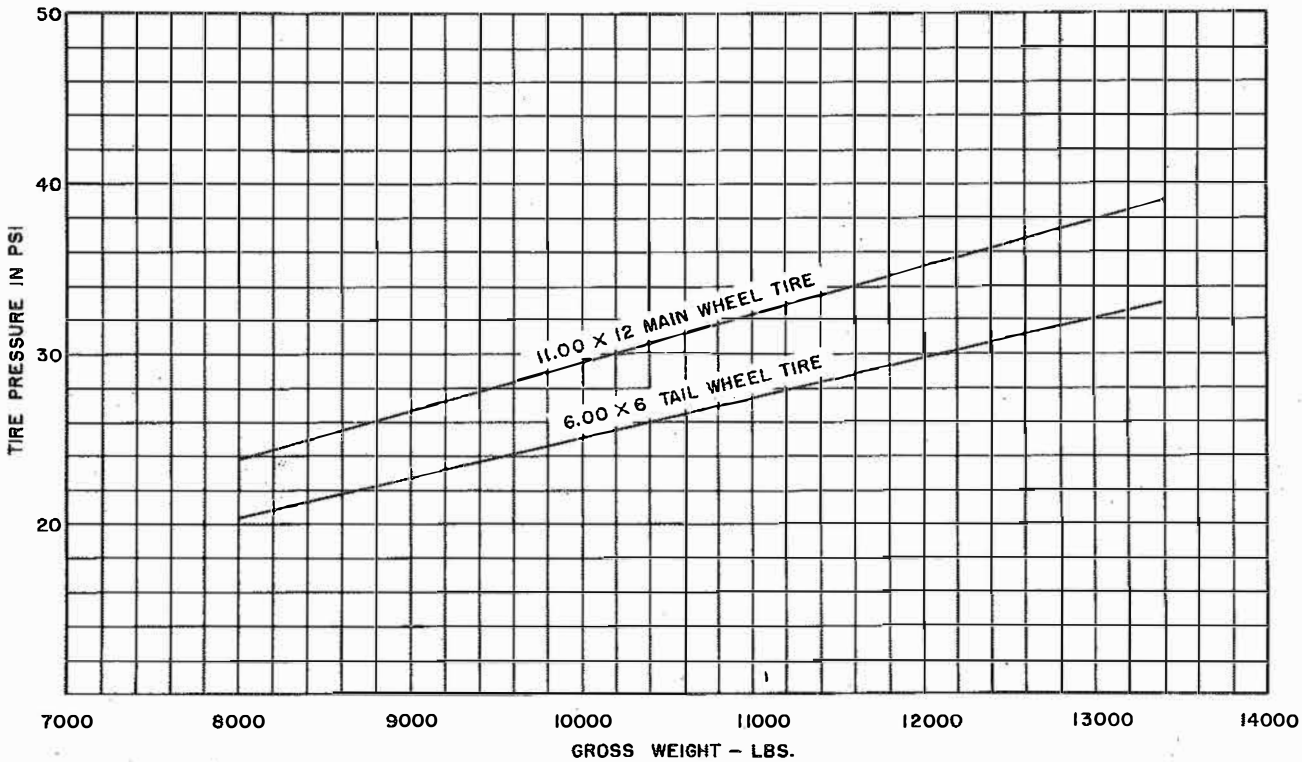


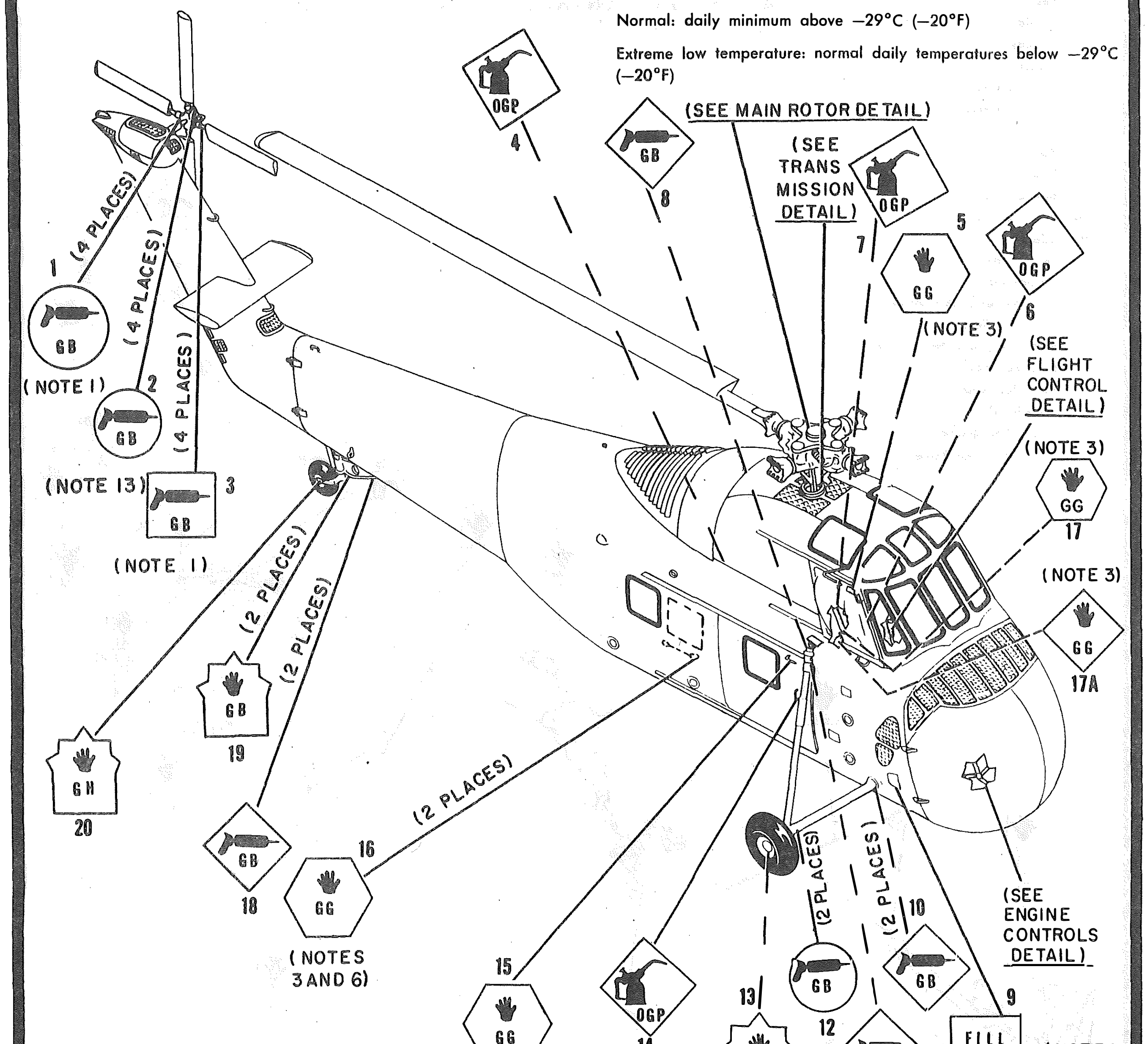
Figure 1—15. Tire Pressure Chart (Tire Pressure vs. Gross Take-Off Weight)

NOTE: Lubricate bearings at both ends of rods.

The seasonal ground temperatures on which this chart is based are as follows:

Normal: daily minimum above −29°C (−20°F)

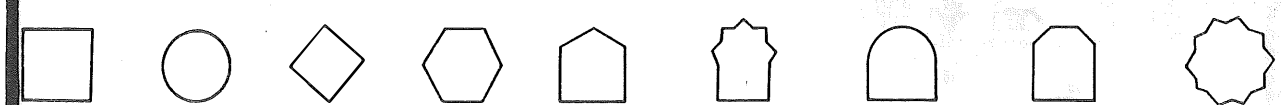
Extreme low temperature: normal daily temperatures below −29°C (−20°F)



Lubrication points indicated with dotted lines must be lubricated on both sides of helicopter.

LUBRICATION GUIDE

FREQUENCY SYMBOLS



PARTS NOMENCLATURE KEY

1. Tail Rotor Hub
2. Tail Rotor Link Rods
3. Tail Rotor Spindle
4. Service Platform Hinge
5. Sliding Window Emergency Release
6. Sliding Window Latch
7. Cockpit Seat
8. Upper Strut Fitting
9. Engine Oil Cell
10. Inboard and Outboard Leg Fittings
11. Upper Strut Universal
12. Lower Strut Universal
13. Main Wheel Bearings
14. Cargo Door Latch
15. Cargo Door Emergency Release
16. Emergency Hatch Release
17. Harness Reel Cable (All Seats)
17A. Cockpit Seat Support Fittings
18. Yoke Bushings
19. Fork Bearings
20. Tail Wheel Bearings

APPLICATION SYMBOLS

OIL CAN	ZERK OR ALEMITE GUN	HAND

TABLE OF LUBRICANTS

Ident. Letter	Specification	Type of Lubricant
GH	MIL-L-3545	Grease; High Temperature
GB	MIL-L-7711	Grease (General Purpose)
GLT	MIL-G-3278	Grease; Aircraft and Instruments (For Low and High Temperature)
OGP	MIL-L-7870	OIL (General Purpose, Low Temperature)
OEA	MIL-L-6082	Grade 1100 Oil; Engine
CPH	MIL-C-16173	Corrosion Preventive, Solvent, Cut Back, Cold-Application, Type I
GG	MIL-G-7187	Grease; Graphite
GO	MIL-L-2105	Grades 75 & 80, Lubricant, Gear, Universal (See Note 17)
OHA	MIL-O-5606	Oil; Hydraulic, Petroleum Base
OE	MIL-O-2104	Grade 30, Oil, Internal-Combustion Engine, Heavy Duty

SPECIAL SERVICE NOTES

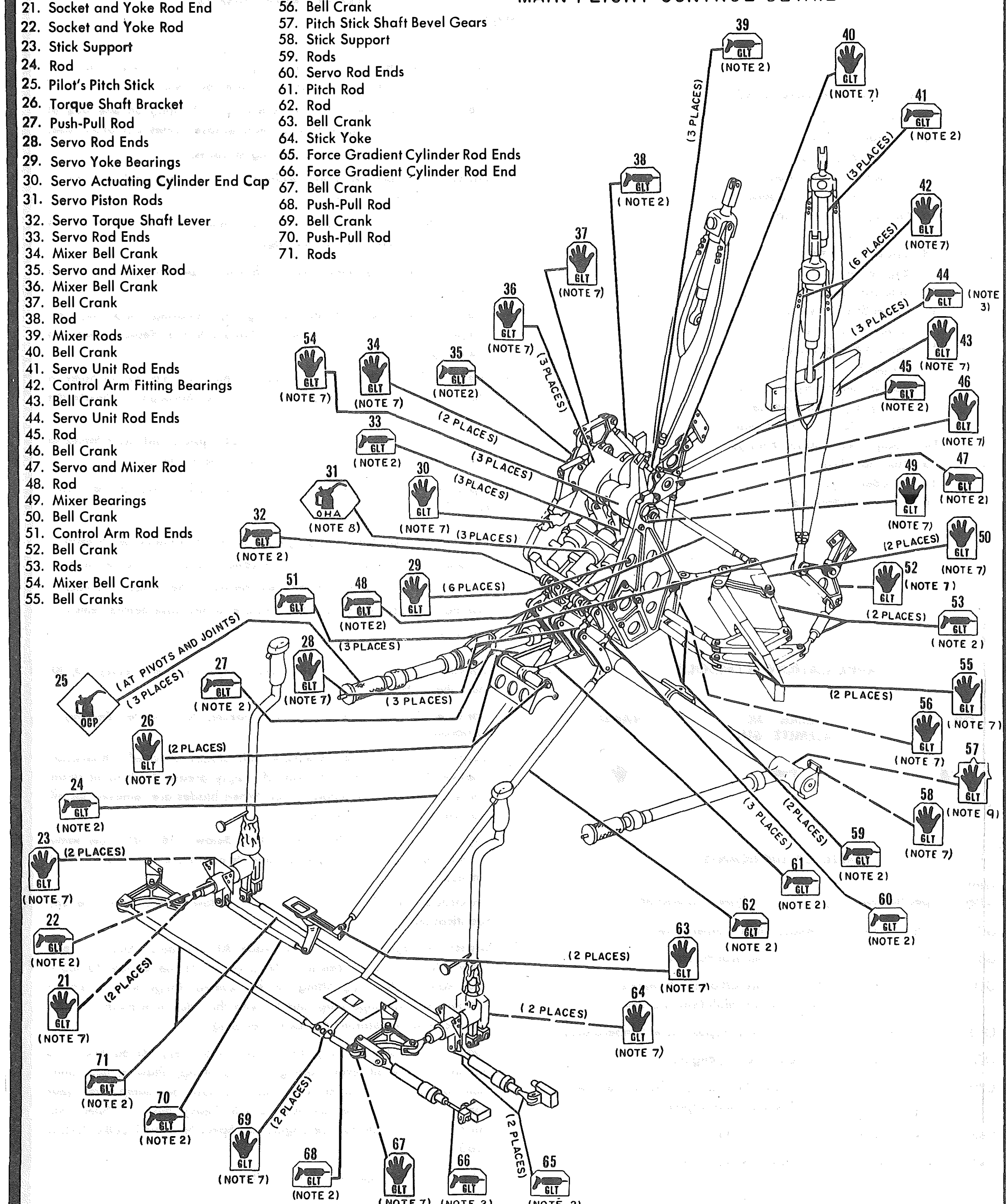
NOTE NO.

1. Bearings must be purged by applying grease gun to fitting until clean grease comes out past seal or from relief passages.
2. Lubricate shielded bearings by putting special fitting on one side of bearing and applying gun until clean grease comes out other side.
3. Apply grease sparingly to contacting surfaces.
4. Inspect and replenish daily; drain and refill every 100/120 hours. Fill to "Full" mark.
5. Use Grade 1100. Using oil dilution system, dilute lubricant as necessary for cold weather starting.
6. Operate emergency release to see that it is operating properly, then regrease.
7. Lubricate fully sealed Fafnir bearings by removing snap ring and composition seal from one side and hand packing. Replace seal and snap ring.
8. Apply oil by means of a squirt can to the small lubricating holes in the actuating cylinder. Supply enough oil to thoroughly saturate the felt wicking.
9. To apply grease to gears remove the stick support and shaft fitting to expose gears. Apply grease sparingly to the set of gears.
10. Inspect and replenish daily, if necessary. Fill oil in reservoir to "Full" mark.
11. To avoid forcing vertical hinge grease seals out of the hinge recesses by pressure of grease during lubrication, insert a "horse shoe" shaped shim of 0.015 inch thickness between the hinge and each spindle shoulder. Allow time for pressure to decrease before removing shim.
12. Lubricate daily for first 25/30 hours of operation and every 25/30 hours thereafter.
13. Lubricate at flush type fittings with nozzle, N-2, Shafer Bearing Corporation.
14. Lubricate Sleeve Spindle Assembly with blades attached. Otherwise, pressure of grease will force cap off. Apply grease slowly until clean grease comes out past inboard seal. When blades are removed install cap restrainer, S1670-10408.
15. Use Grade 30 down to −18°C (0°F). Below −18° (0°F) use same oil but apply auxiliary heat to raise temperature to −18°C (0°F) minimum.
16. Use Grade 30 down to −18°C (0°F). Below −18°C (0°F) use oil, Specification No. MIL-L-7808.
17. Inspect and replenish daily with Grade 80 lubricant; drain and refill every 100/200 hours. Below −32°C (−25°F) use Grade 75 lubricant. Rotate filler plug fitting on the splined flange to one o'clock position. Remove pipe plug and fill with the filler hole maintained at the one o'clock position. Replace filler plug.
18. Inspect and replenish daily; drain and refill every 50/60 hours. To obtain accurate oil level reading prior to filling, allow ½ hour minimum for entrapped oil to drain free into gear box sump after gear box operation. As alternate lubricant to heavy duty oil, Spec. No. MIL-O-2104, Grade 30, use engine oil, Spec. No. MIL-L-6082, Grade 1065.
19. Hand pack bearings only ⅓ to ½ full.

Figure 1–16. Lubrication Chart (Sheet 1 of 4)

MAIN FLIGHT CONTROL DETAIL

21. Socket and Yoke Rod End
22. Socket and Yoke Rod
23. Stick Support
24. Rod
25. Pilot's Pitch Stick
26. Torque Shaft Bracket
27. Push-Pull Rod
28. Servo Rod Ends
29. Servo Yoke Bearings
30. Servo Actuating Cylinder End Cap
31. Servo Piston Rods
32. Servo Torque Shaft Lever
33. Servo Rod Ends
34. Mixer Bell Crank
35. Servo and Mixer Rod
36. Mixer Bell Crank
37. Bell Crank
38. Rod
39. Mixer Rods
40. Bell Crank
41. Servo Unit Rod Ends
42. Control Arm Fitting Bearings
43. Bell Crank
44. Servo Unit Rod Ends
45. Rod
46. Bell Crank
47. Servo and Mixer Rod
48. Rod
49. Mixer Bearings
50. Bell Crank
51. Control Arm Rod Ends
52. Bell Crank
53. Rods
54. Mixer Bell Crank
55. Bell Cranks
56. Bell Crank
57. Pitch Stick Shaft Bevel Gears
58. Stick Support
59. Rods
60. Servo Rod Ends
61. Pitch Rod
62. Rod
63. Bell Crank
64. Stick Yoke
65. Force Gradient Cylinder Rod Ends
66. Force Gradient Cylinder Rod End
67. Bell Crank
68. Push-Pull Rod
69. Bell Crank
70. Push-Pull Rod
71. Rods

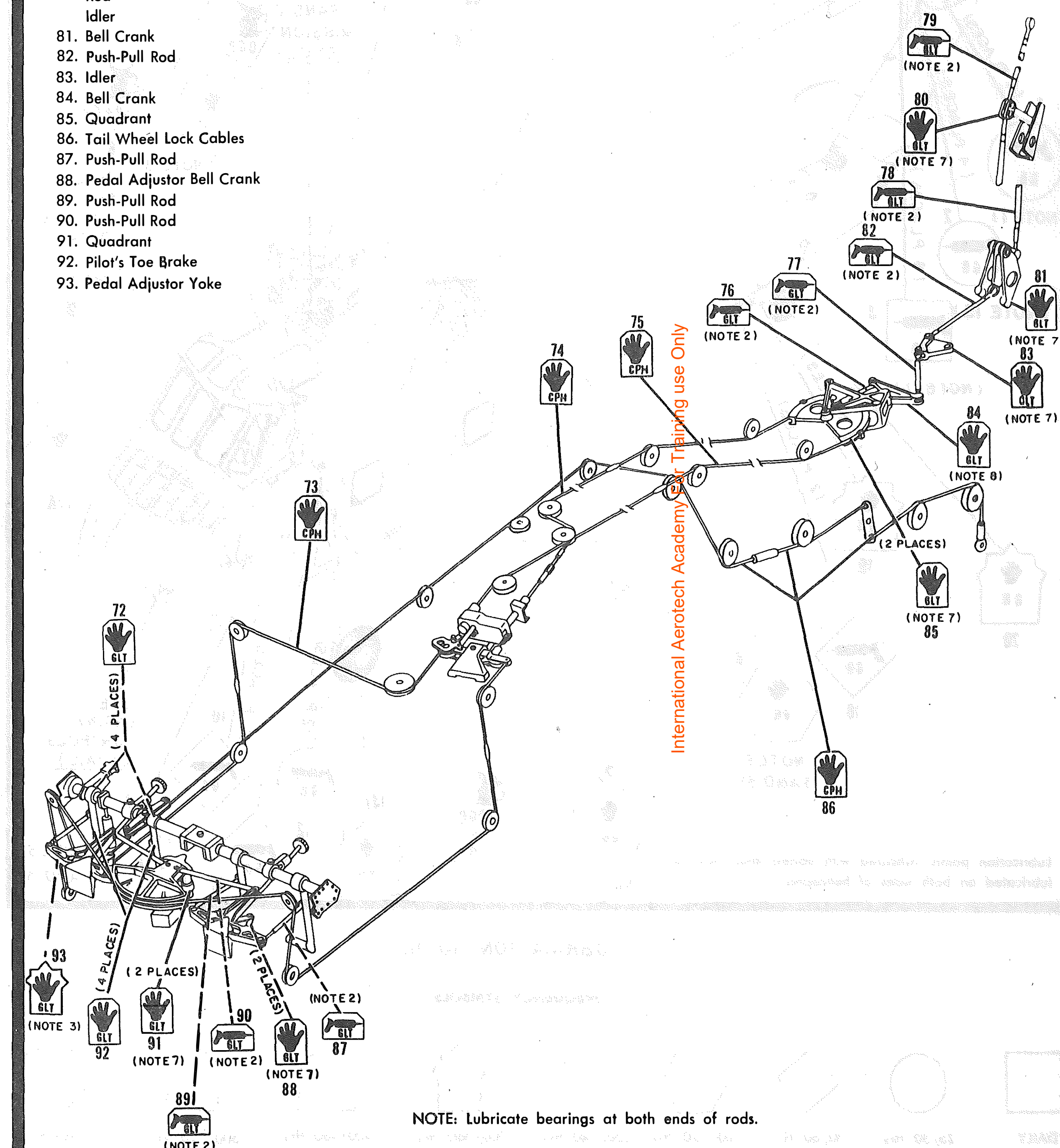


Lubrication points indicated with dotted lines must be lubricated on both sides of helicopter.

NOTE: Lubricate bearings at both ends of rods.

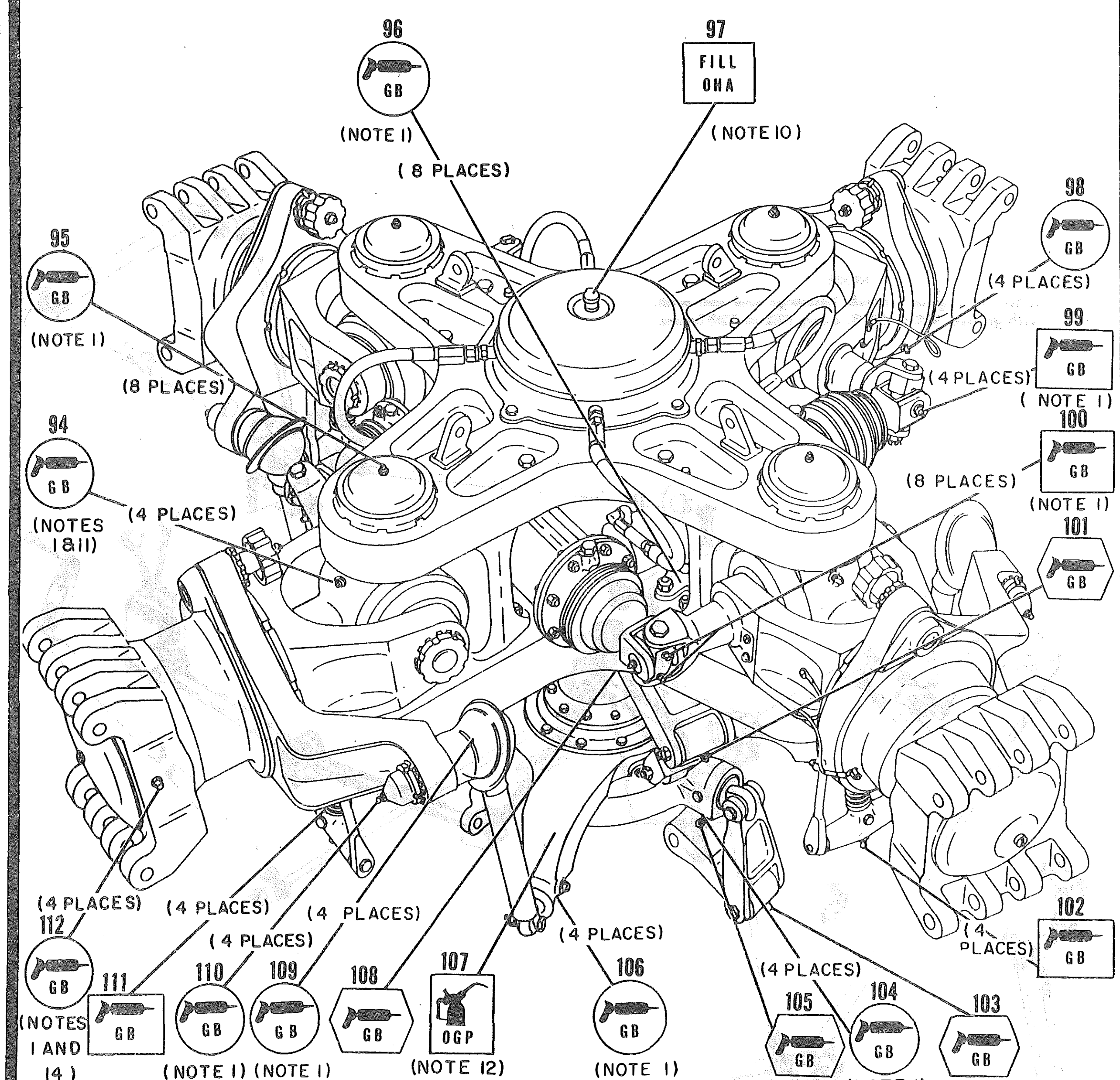
TAIL FLIGHT CONTROL DETAIL

72. Pedals
73. Cable
74. Cables
75. Cables
76. Push-Pull Rod
77. Push-Pull Rod
78. Rod
Rod
Idler
81. Bell Crank
82. Push-Pull Rod
83. Idler
84. Bell Crank
85. Quadrant
86. Tail Wheel Lock Cables
87. Push-Pull Rod
88. Pedal Adjustor Bell Crank
89. Push-Pull Rod
90. Push-Pull Rod
91. Quadrant
92. Pilot's Toe Brake
93. Pedal Adjustor Yoke

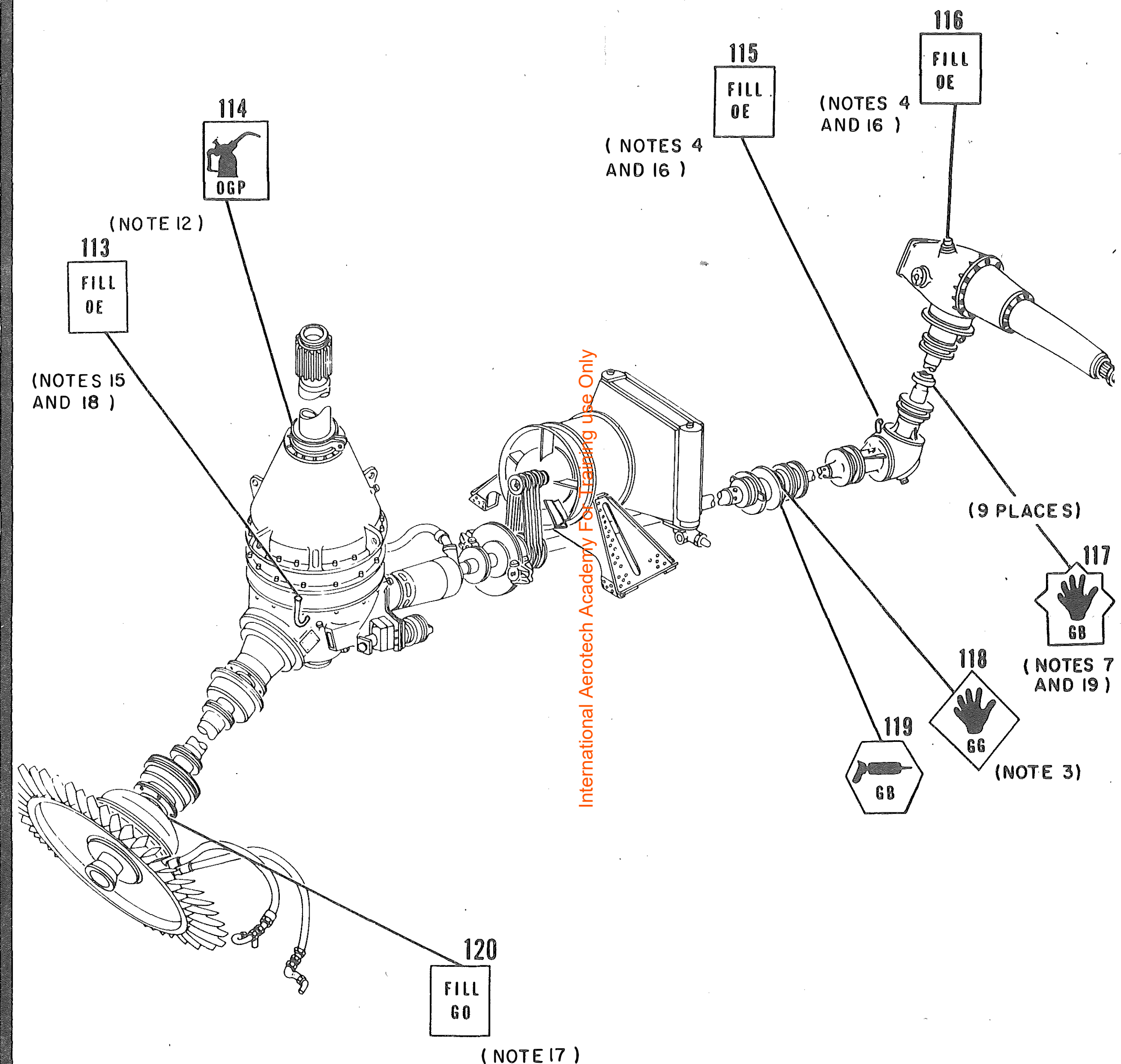


NOTE: Lubricate bearings at both ends of rods.

Figure 1–16. Lubrication Chart (Sheet 2 of 4)



94. Vertical Hinge
95. Hub Plate Bearings
96. Damper Bracket
97. Damper
98. Horn
99. Damper Pin
100. Damper Trunnion
101. Rotating Scissors Link
102. Anti-Flapping Restrainer
103. Stationary Scissors Link
104. Stationary Star Trunnion Bearing
105. Stationary Scissors Link
106. Rotating Star Trunnion Bearing
107. Rotating Star
108. Rotating Scissors Bracket
109. Horn Trunnion Yoke
110. Horn Bearing
111. Anti-Flapping Restrainer Hinge Fitting
112. Sleeve



113. Main Gear Box
114. Top Seal
115. Intermediate Gear Box
116. Tail Rotor Gear Box
117. Pylon and Tail Rotor Drive Shaft Bearings
118. Disconnect Coupling Ratchet Teeth
119. Disconnect Coupling
120. Hydro-Mechanical Clutch

Figure 1–16. Lubrication Chart (Sheet 3 of 4)

ENGINE
CONTROLS
DETAIL

NOTE

Lubricate engine controls bearings and rod ends with grease, MIL-G-3278, every [illegible] to 720 hours.

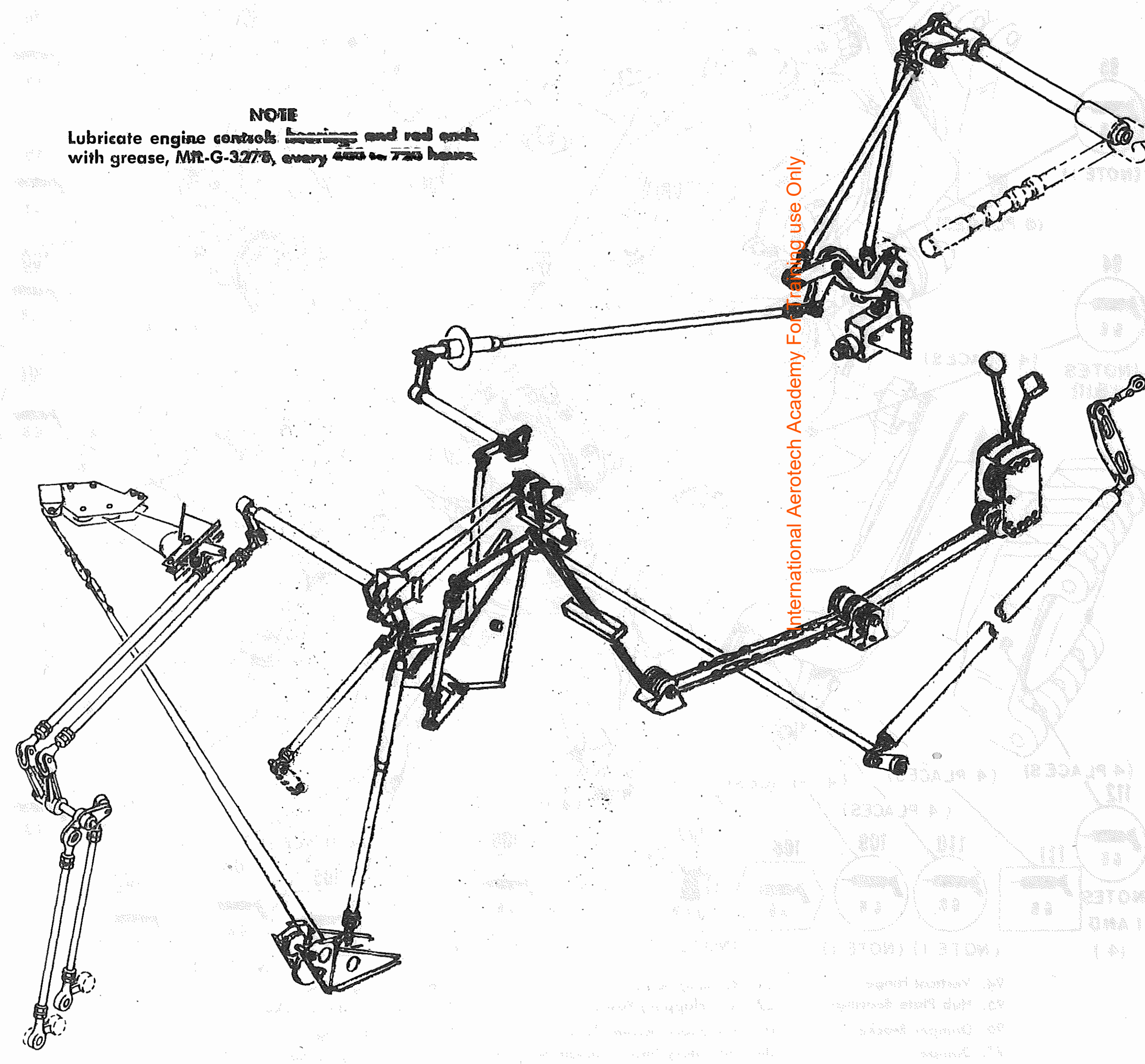


Figure 1–16. Lubrication Chart (Sheet 4 of 4)

1—32. TABLE OF SPECIFICATIONS.

1—33. DESCRIPTION. The Table of Specifications, table III, gives the government specification or manufacturer's number for fluids, lubricants and other materials required for maintenance of the helicopter. Materials in the table are referred to in the text by the index number.

TABLE III

SPECIFICATIONS

INDEX NO.	MANUFACTURER'S OR SPECIFICATION NO.	MATERIAL
1	MIL-F-5572 (Grade 100/130) Recommended (Grade 115/145) Alternate	Fuel; Aircraft Reciprocating Engine
2	MIL-L-6082 (Grade 1100)	Lubricating Oil; Aircraft Engine
3	Federal Specification P-S-661	Solvent; Dry Cleaning
4	MIL-C-11796	Petrolatum; Corrosion-Preventive, Hot Application
5	MIL-O-6083	Oil; Preservative, Hydraulic Equipment
6	MIL-O-5606	Oil; Hydraulic, Aircraft, Petroleum Base
7	MIL-C-6529	Compound; Corrosion-Preventive, Aircraft Engine
8	JAN-B-121	Barrier Materials; Greaseproof
9	JAN-P-127	Tape; Packaging and Packing for Overseas Shipment, Adhesive, Water Resistant
10	MIL-P-6889	Primer; Zinc-Chromate
11	MIL-L-7178	Lacquer; Cellulose Nitrate, Gloss Number 504 — Olive Drab Number 506 — Orange Yellow Number 509 — Insignia Red Number 511 — Insignia White Number 514 — Instrument Black
12	TT-T-266	Thinner; Lacquer
13	MIL-M-3171	Chrome Pickle Solution
14	MIL-C-5541	Alodine Treatment
15	SS-B-611	Borax (Sodium Borate)
16	O-S-576	Sodium Bicarbonate
17	TT-L-54	Lacquer; Spraying, Acid Resistant
18	EC-612	Sealer Compound; Minnesota Mining and Manufacturing Co., St. Paul, Minn.
19	VV-K-211	Kerosene
20	No. 3	Permatex; The Permatex Co., Inc., Sheepshead Bay, N.Y.
21	MIL-L-7711	Lubricating Grease (General Purpose Aircraft)

TABLE III (Cont)		
INDEX NO.	MANUFACTURER'S OR SPECIFICATION NO.	MATERIAL
22	TT-N-95	Naphtha; Petroleum, Aliphatic
23	MIL-C-5547	Compound; Polishing (For Acrylic Plastic)
24	MIL-G-7187	Grease; Lubricating, Graphite
25	MIL-C-5546	Compound; Engine Cleaning
26	MIL-C-5545	Compound; Corrosion-Preventive, Aircraft Engine
27	P.A.W.	Tape, 0.017 Thickness; E. I. Dupont de Nemours and Co.
28	EC-711 or MIL-C-5092, Type II	Cement; Minnesota Mining and Mfg. Co., St. Paul, Minn. Adhesive, Rubber (Synthetic and Reclaimed Rubber Base)
29	EC-847 or MIL-C-4003 or MIL-C-5092, Type II	Cement; Minnesota Mining and Mfg. Co., St. Paul, Minn. Cement, General Purpose (Synthetic Base) Adhesive, Rubber (Synthetic and Reclaimed Rubber Base)
30	No. 473	Vinyl Plastic Tape; Minnesota Mining and Mfg. Co., St. Paul, Minn.
31	EC-801 or MIL-C-7126, Type I	Sealer Compound; Minnesota Mining and Mfg. Co., St. Paul, Minn. Sealing Compounds, Synthetic Gloss
32	EC-807	Accelerator; Minnesota Mining and Mfg. Co., St. Paul, Minn.
33	TT-T-548	Toluol (For Use in Organic Coatings)
34	MIL-L-6082 (Grade 1065)	Lubricating Oil; Aircraft Engine (Transmission)
35	MIL-C-5044	Coatings; Aircraft Walkway, Non-Slip Brush and Spray
36	No. 3050	Permite; Heat Resistant Enamel (Similar to: MIL-E-7729 Enamel; Gloss, For Aircraft Use)
37	MIL-L-6805	Lacquer; Camouflage (Dull) Number 604 — Black Number 613 — Olive Drab Number 614 — Orange Yellow
38	MIL-G-3278	Grease; Aircraft and Instrument
39	TT-T-291	Thinner; Paint, Volatile Mineral Spirits
40	HH-T-101	Tape; Friction
41	TT-S-271	Shellac
42	Epon VI	Adhesive; Shell Chemical Co. (Similar to: MIL-A-5090 Adhesive, Aircraft Structural, Metal to Metal)

TABLE III (Cont)		
INDEX NO.	MANUFACTURER'S OR SPECIFICATION NO.	MATERIAL
43	JAN-A-669	Anti-Seize Compound; White Lead Base, General Purpose
44	MIL-T-5544	Thread Compound; Anti-Seize, Graphite Petrolatum
45	VV-P-236	Petrolatum
46	No. 101	Garlock Sealing Compound; The Garlock Packing Co., Palmyra, N.Y.
47	Federal Specification O-A-51	Acetone
48	No. 290	Tape; Fiberglas; Bauer and Black, Chicago, Ill.
49	No. 61	Oakite
50	MIL-L-3545	Lubricating Grease; High Temperature
51	MIL-T-6841	Tape; Adhesive, Rubber and Cork Composition
52	MIL-D-3464	Desiccant (Activated); in Bags, for Static Dehumidification and Packaging
53	AN-C-128	Compound; Insulating
54	MIL-L-6032	Lubricating Grease; Gasoline and Oil Resistant
55	No. 471	Vinyl Tape; Minnesota Mining and Mfg. Co., St. Paul, Minn.
56	MIL-S-6892	Remover; Paint
57	EC-750	Cement; Minnesota Mining and Mfg. Co., St. Paul, Minn.

1—34. SPECIAL TOOLS.

1—35. DESCRIPTION. The special tools required for service and maintenance of the helicopter are listed in table IV.

TABLE IV SPECIAL TOOLS			
PART NO.	NOMENCLATURE	FIGURE AND INDEX NO.	PROCURING SERVICE STOCK NO.
S1570-10117	Spanner Wrench — Transmission	1—17, 39	
S1570-10189	Arm Assembly	1—17, 16	
S1570-10190 (-1 and -2)	Drive Cylinder	1—17, 15	
S1570-10191	Flange Adapter	1—17, 14	
S1570-10338-6	Puller — Taper Pin — Main Rotor	1—17, 1	
S1570-10350	Bridge Assembly — Transmission System	1—17, 33	

TABLE IV (Cont)

PART NO.	NOMENCLATURE	FIGURE AND INDEX NO.	PROCURING SERVICE STOCK NO.
S1670-10013	Crutch Assembly	1–17, 17	
S1670-10051	Blade Rotator — Main Rotor Blade	1–17, 32	
S1670-10151	Hoisting Sling Assembly	1–17, 19	
S1670-10301	Arbor Assembly — Tail Rotor	1–17, 21	
S1670-10308	Wrench Assembly — Main Gear Box, Take-Off	1–17, 51	
S1670-10310	Wrench — Transmission System, Tail Rotor Hub	1–17, 7	
S1670-10338	Mounting Thimble — Main Transmission, Oil Seal, Accessories Section, Tachometer	1–17, 3	
S1670-10339	Mounting Thimble — Main Transmission, Oil Seal, Accessories Section, Vicker's Pump	1–17, 2	
S1670-10340	Mounting Thimble — Main Transmission, Oil Seal, Accessories Section, Generator	1–17, 4	
S1670-10341	Mounting Thimble — Main Transmission, Oil Seal, Accessories Section, Blower	1–17, 5	
S1670-10342	Mounting Thimble — Main Gear Box, Oil Seal, Main Shaft, Upper Housing	1–17, 9	
S1670-10343	Mounting Thimble — Main Transmission, Oil Seal, Lower Housing Splined Shaft	1–17, 8	
S1670-10364	Shaft Cap — Transmission System, Main Gear Box, Upper Housing	1–17, 10	
S1670-10374	Bearing Pusher — Transmission System	1–17, 41	
S1670-10383	Wrench — Hydro-Mechanical Clutch, Transmission System	1–17, 11	
S1670-10388	Eyebolt — Transmission System, Main Gear Box, Upper Housing	1–17, 6	
S1670-10396	Trackometer — Main Rotor Blade Tracking	1–17, 12	
S1670-10397-1	Sling Assembly — Power Plant Hoist	1–17, 30	
S1670-10399	Wrench Assembly — Main Rotor	1–17, 13	
S1670-10401	Anti-Torque Plate — Transmission System Disconnect, Tail Gear Box	1–17, 42	
S1670-10402	Sling Assembly — Main Rotor	1–17, 31	
S1670-10408	Cap Restrainer — Main Rotor	1–17, 27	
S1670-10409	Balancing Arbor Assembly — Hydro-Mechanical Clutch	1–17, 48	
S1670-10433	Wrench — Tail Rotor Hub	1–17, 38	
S1670-10437	Spanner Wrench — Tail Rotor Servo	1–17, 40	

TABLE IV (Cont)

PART NO.	NOMENCLATURE	FIGURE AND INDEX NO.	PROCURING SERVICE STOCK NO.
S1670-10441	Taper Pin Wrench — Tail Rotor Pitch Control	1—17, 49	
S1670-10442	Stand Assembly — Top Overhaul Engine (2 Required)	1—17, 34	
S1670-10447	Arm Assembly	1—17, 46	
S1670-10449	Sling — Pylon Hoisting	1—17, 28	
S1670-10458	Cap Restrainer — Main Rotor Head	1—17, 50	
S1670-10491-2	Cover Assembly — Air Exit Engine Compartment	2—15, 11	
S1670-10492-2	Cover Assembly — Pitot Tube	2—15, 2	
S1670-10493-2	Cover Assembly — Main Rotor Blade	2—15, 8	
S1670-10494-2	Cover Assembly — Main Rotor Head Assembly	2—15, 3	
S1670-10495-2	Cover Assembly — Tail Rotor Blade	2—15, 4	
S1670-10496-2	Cover Assembly — Main Gear Box Oil Cooler Air Exit Cover	2—15, 9	
S1670-10497-2	Cover Assembly — Windshield	2—15, 1	
S1670-10498-2	Cover Assembly — Main Transmission Screen	2—15, 10	
S1670-10499-2	Cover Assembly — Tail Rotor Gear Box	2—15, 6	
S1670-10500-2	Cover Assembly — Tail Rotor Assembly	2—15, 5	
S1670-10504-2	Cover Assembly — Nose Door Air Outlet	2—15, 12	
S1670-10506	Tip Sock Assembly — Blade Tie-Down	1—17, 36	
S1670-10510-2	Cover Assembly — Lower Pylon	2—15, 7	
S1670-10513-2	Blade Stowage Pocket	1—17, 35	
S1670-10521-2	Blade Stowage Assembly	1—17, 29	
S1670-10548	Blade Restrainer Assembly — Tail Rotor Control Rigging	1—17, 50	
80-521 (Bacharach Mfg. Co.)	Tool Kit Window Seal Insert	1—17, 24	
D-730 (Technical Development Company)	Tedeco Drain Attachment	1—17, 22	
HSP-ST5006 (Kell-Strom Tool Company)	Hydra-Pak Ram and Gage Assembly	1—17, 25	
KS-2069 (Rev. C or later) or KS-2187 (Kell-Strom Tool Company)	Ball Arm Sleeve	1—17, 26	

TABLE IV (Cont)

PART NO.	NOMENCLATURE	FIGURE AND INDEX NO.	PROCURING SERVICE STOCK NO.
KS-2172 (Alt: HSP-ST5003) (Kell-Strom Tool Company)	Housing	1—17, 20	
LAW-114 (Snap-On Tools Corp.)	Hex Wrench	1—17, 45	
LAW-118 (Snap-On Tools Corp.)	Hex Wrench	1—17, 44	
NAF601364	Tow Bar — Universal (R89-B-104300)	1—17, 23	
N-2 (Shafer Bearing Corp.)	Nozzle	1—17, 37	
630-3 (Owatonna Tool Co.)	Step Plate Adapter	1—17, 47	
952-D (Owatonna Tool Co.)	Bearing Pulling Attachment	1—17, 43	

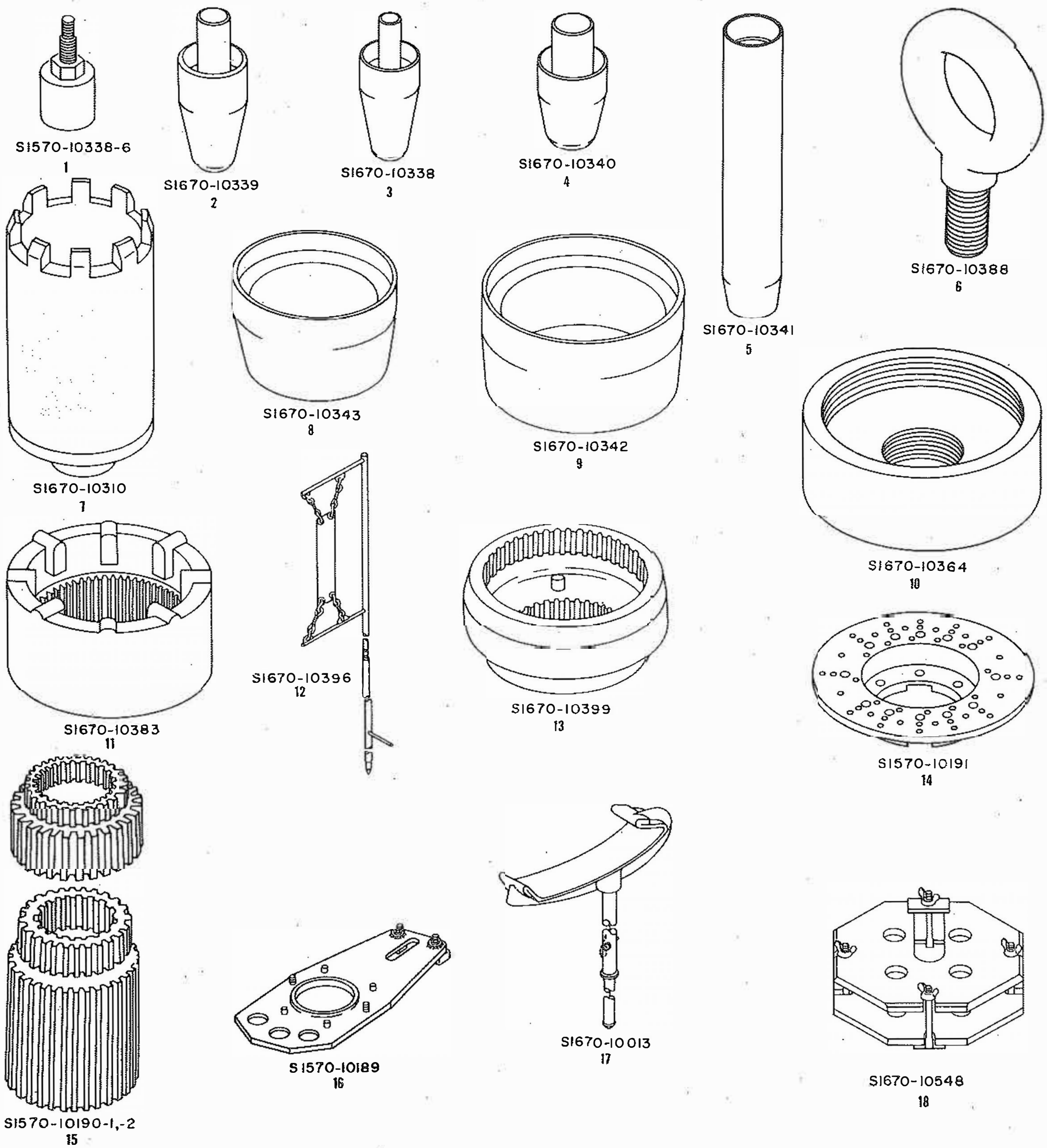


Figure 1–17. Special Tools (Sheet 1 of 3)

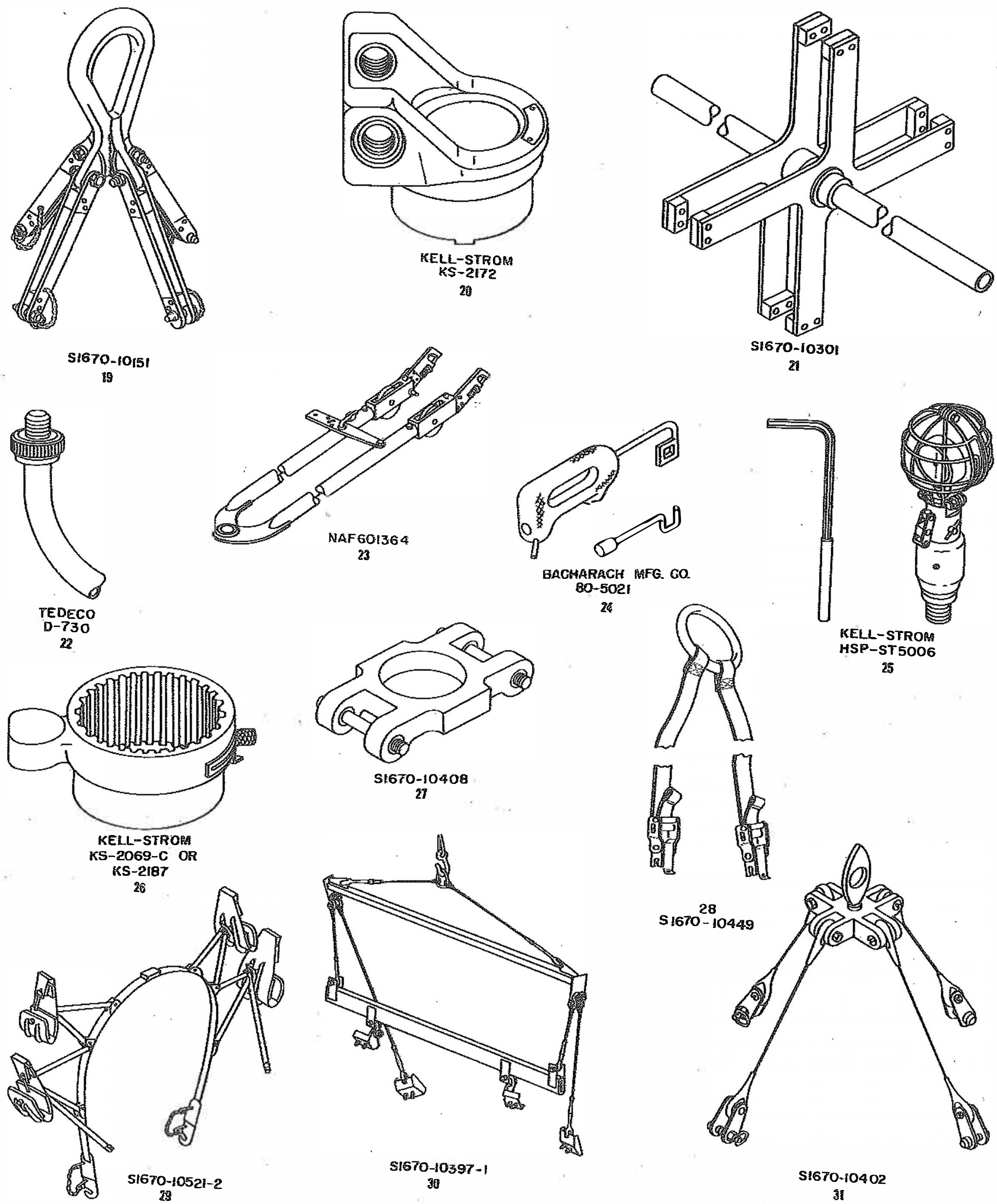


Figure 1—17. Special Tools (Sheet 2 of 3)

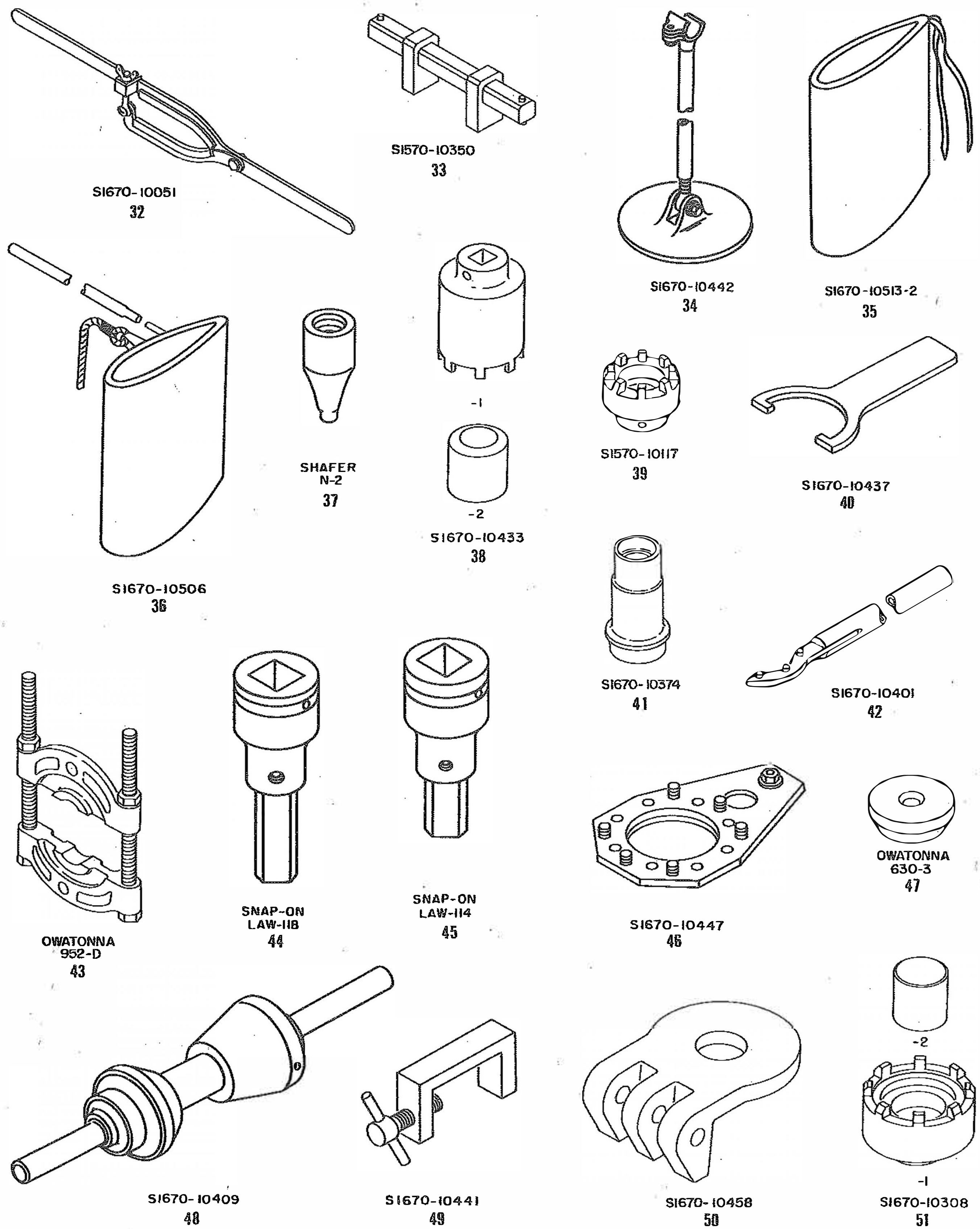


Figure 1—17. Special Tools (Sheet 3 of 3)

SECTION II

AIRFRAME GROUP

TABLE OF CONTENTS

Paragraph		Page
2–1.	**FUSELAGE**	**36**
2–3.	**FUSELAGE (FORWARD SECTION)**	**36**
2–5.	ENGINE COMPARTMENT	36
2–7.	NOSE DOORS	36
2–13.	CANTED BULKHEAD	38
2–14.	CLUTCH COMPARTMENT	38
2–16.	FIRE WALL	38
2–18.	CLUTCH ACCESS (CARBURETOR INDUCTION HEAT) DOOR	38
2–20.	COCKPIT	38
2–22.	TRANSMISSION COMPARTMENT	38
2–24.	CANOPY INSTALLATION	38
2–28.	SERVICE PLATFORMS	40
2–34.	COCKPIT CANOPY ASSEMBLY	41
2–36.	CRITERIA FOR LIMITS AND TOLERANCES OF CANOPY DEFECTS	41
2–39.	MAINTENANCE OF COCKPIT CANOPY TRANSPARENT PANELS	44
2–42.	COCKPIT SLIDING WINDOWS	46
2–46.	MAINTENANCE OF TRANSPARENT PANELS	46
2–49.	CABIN	47
2–51.	CARGO DOOR	47
2–57.	CABIN WINDOWS	48
2–62.	EMERGENCY ESCAPE HATCHES	49
2–66.	TAIL ROTOR DRIVE SHAFT COVER	49
2–68.	BOTTOM STRUCTURE	49
2–70.	BOTTOM STRUCTURE FLOORING AND CATWALK	49
2–74.	BOTTOM STRUCTURE PLATING	50
2–77.	BOTTOM STRUCTURE FAIRING	51
2–80.	ELECTRONICS COMPARTMENT	51
2–82.	HEATER COMPARTMENT	51
2–84.	**TAIL CONE (FUSELAGE AFT SECTION)**	**51**
2–86.	TAIL CONE	51
2–90.	PYLON FOLDING HINGE LOCK AND PIN SIGNAL FLAG	52
2–94.	**PYLON (FOLDABLE TAIL) SECTION**	**53**
2–96.	PYLON	55
2–100.	PYLON QUICK CHANGE UNIT	56
2–106.	STABILIZER	57
2–107.	**MAINTENANCE OF FUSELAGE SURFACES**	**57**
2–108.	MAINTENANCE OF METALLIC SURFACES	57
2–110.	CLEANING METALLIC SURFACES	57
2–111.	CORROSION	58

TABLE OF CONTENTS (Cont)

Paragraph		Page
2–113.	CORROSION ON MAGNESIUM ALLOYS	58
2–114.	CORROSION ON ALUMINUM ALLOYS	58
2–115.	DIFFERENTIATING BETWEEN ALUMINUM AND MAGNESIUM ALLOY	58
2–116.	INSPECTION OF EXTERNAL SURFACES FOR CORROSION	58
2–117.	INSPECTION OF INTERNAL SURFACES FOR CORROSION	58
2–118.	GENERAL PRECAUTIONS TO PREVENT CORROSION	58
2–119.	PREVENTION OF CORROSION BY BATTERY ACID	60
2–120.	INSULATION OF DISSIMILAR METALS AGAINST CORROSION	60
2–121.	USE OF SEALER COMPOUND TO PREVENT CORROSION	60
2–124.	SURFACE CORROSION TOUCH-UP TREATMENT – MAGNESIUM ALLOY	60
2–125.	SURFACE CORROSION TOUCH-UP TREATMENT–ALUMINUM ALLOY	61
2–126.	LIMITED ANTI-CORROSION MEASURES	61
2–127.	MAINTENANCE OF PLASTIC SURFACES	61
2–129.	CLEANING EXTERIOR PLASTIC SURFACES	62
2–130.	CLEANING INTERIOR PLASTIC SURFACES	62
2–131.	HOT CLIMATE PRECAUTIONS FOR PLASTIC SURFACES	62
2–132.	**FURNISHINGS AND EQUIPMENT**	**63**
2–134.	**PERSONNEL ACCOMMODATIONS**	**64**
2–136.	PILOT'S AND OBSERVER'S SEATS	64
2–141.	PILOT'S AND OBSERVER'S SEAT AND BACK CUSHIONS	64
2–143.	INERTIA REELS	64
2–147.	TROOP SEATS	65
2–149.	FOLDING AND ROLLING TROOP SEATS	65
2–150.	UNFOLDING AND UNROLLING TROOP SEATS	67
2–153.	PILOT'S AND OBSERVER'S SAFETY BELTS AND SHOULDER HARNESSES	69
2–157.	TROOP SEAT SAFETY BELTS	69
2–161.	CABIN DOOR AIR SAFETY HARNESS	69
2–163.	PERSONNEL BARRIER	69
2–165.	LITTERS	69
2–169.	**FURNISHINGS**	**70**
2–171.	CARGO SLING INSTALLATION	70
2–175.	PROTECTIVE COVERS	74
2–176.	SOUNDPROOFING	74
2–178.	**EMERGENCY EQUIPMENT**	**74**
2–180.	FIRST AID KITS	74
2–182.	FIRE EXTINGUISHER	74
2–183.	FIRE DETECTOR SYSTEM	75
2–184.	ALARM BELL	75
2–185.	**MISCELLANEOUS EQUIPMENT**	**75**
2–187.	RELIEF TUBE	75
2–192.	MAP CASE AND FLIGHT REPORT HOLDER	77
2–194.	DATA CASE	77
2–196.	PILOT'S CHECK LIST	77
2–198.	ASH TRAYS	77
2–200.	WINDSHIELD WIPER	77
2–201.	CARGO TIE-DOWN FITTINGS	77
2–205.	CARGO TIE-DOWN BELTS	77
2–207.	SKID RAIL INSTALLATION	77
2–209.	ANTI-GLARE CURTAIN	77

TABLE OF CONTENTS (Cont)

Paragraph		Page
2–211.	BLACK-OUT CURTAINS	78
2–213.	ASSIST HANDLES	78
2–215.	TINTED PANELS (BLIND FLYING)	78
2–217.	CANTEEN INSTALLATION	78
2–219.	HYDRAULIC RESCUE HOIST	78
2–221.	STOWAGE OF EQUIPMENT	78
2–222.	**LANDING GEAR**	**78**
2–225.	**MAIN LANDING GEAR ASSEMBLY**	**78**
2–228.	SERVICING THE SHOCK STRUT WITH AIR	79
2–230.	MAIN SHOCK STRUT ASSEMBLY	81
2–242.	LEG AND AXLE ASSEMBLY	84
2–249.	MAIN WHEEL ASSEMBLY	85
2–254.	WHEEL BRAKE SYSTEM	86
2–258.	TESTING BRAKE CYLINDER	88
2–261.	**TAIL LANDING GEAR ASSEMBLY**	**88**
2–264.	SERVICING THE STRUT ASSEMBLY WITH AIR	89
2–266.	TAIL WHEEL STRUT ASSEMBLY	89
2–278.	YOKE AND FORK ASSEMBLY	92
2–286.	TAIL WHEEL ASSEMBLY	95
2–291.	TAIL WHEEL LOCK CONTROL SYSTEM	95
2–296.	**MAIN ROTOR**	**97**
2–298.	**MAIN ROTOR BLADES**	**97**
2–305.	TRACKING	98
2–306.	**MAIN ROTOR HEAD ASSEMBLY**	**99**
2–315.	DAMPER	103
2–324.	ANTI-FLAPPING RESTRAINERS	106
2–330.	DROOP RESTRAINERS	106
2–334.	STATIONARY SCISSORS	106
2–338.	ROTATING SCISSORS	107
2–342.	FLUID TANK ASSEMBLY	107
2–348.	STAR ASSEMBLY	107
2–355.	CONTROL ROD ASSEMBLY	108
2–359.	**TAIL ROTOR ASSEMBLY**	**108**
2–371.	TAIL ROTOR BLADES	112
2–374.	BALANCING TAIL ROTOR ASSEMBLY	112
2–375.	**FLIGHT CONTROLS**	**113**
2–377.	**CYCLIC CONTROL SYSTEM**	**113**
2–381.	CYCLIC CONTROL STICK TRIM SYSTEM (FORCE GRADIENT INSTALLATION)	119
2–388.	**COLLECTIVE PITCH CONTROL SYSTEM**	**122**
2–392.	ADJUSTMENT OF COLLECTIVE OPEN LOOP SPRING CYLINDER	124
2–393.	MAIN ROTOR PRIMARY SERVO UNITS	124
2–400.	MAIN ROTOR AUXILIARY SERVO UNIT	126
2–408.	ACTUATING CYLINDER ASSEMBLY	127
2–415.	MAIN ROTOR SERVO UNIT HYDRAULIC SYSTEMS	130
2–417.	PRECAUTIONS FOR HYDRAULIC SYSTEM MAINTENANCE	130
2–418.	PRIMARY HYDRAULIC SYSTEM	130
2–420.	HYDRAULIC PUMP	130
2–424.	FILTER	132
2–429.	PRESSURE RELIEF VALVE	132
2–433.	THREE-WAY SOLENOID VALVE	132
2–437.	PRESSURE SWITCH	133
2–441.	RESTRICTOR AND SNUBBER	133
2–443.	PRESSURE TRANSMITTER	133
2–447.	SERVO SWITCH	133
2–449.	RESERVOIR	133

TABLE OF CONTENTS (Cont)

Paragraph		Page
2–453.	AUXILIARY HYDRAULIC SYSTEM	134
2–455.	HYDRAULIC PUMP	134
2–459.	FILTER	136
2–464.	PRESSURE RELIEF VALVE	136
2–468.	THREE-WAY SOLENOID VALVE	136
2–472.	PRESSURE SWITCH	137
2–476.	HYDRAULIC FUSE	137
2–480.	RESTRICTOR AND SNUBBER	137
2–482.	PRESSURE TRANSMITTER	137
2–486.	SERVO SWITCH	138
2–487.	RESERVOIR	138
2–492.	HYDRAULIC PRESSURE INDICATORS	139
2–493.	**TAIL ROTOR CONTROL SYSTEM**	**139**
2–497.	TAIL ROTOR PEDAL DAMPER	144
2–506.	TAIL ROTOR SERVO UNIT	145
2–515.	TAIL ROTOR SERVO UNIT HYDRAULIC SYSTEM	147
2–516.	**STABILIZER**	**147**
2–521.	**RIGGING OF FLIGHT CONTROLS**	**148**
2–523.	RIGGING MAIN ROTOR FLIGHT CONTROLS	149
2–524.	RIGGING TAIL ROTOR FLIGHT CONTROLS	153
2–525.	FLIGHT CHECK OF CONTROL RIGGING	155

2–1. FUSELAGE.

2–2. DESCRIPTION. *(See figure 2–1.)* The fuselage of the helicopter is divided into three main sections: the fuselage (forward section), the tail cone (fuselage aft section) and the pylon (foldable tail) section. All sections are of semi-monocoque construction. Magnesium and aluminum alloy are the chief structural metals, but titanium and stainless steel are used in some applications. Each section of the fuselage is detachable from the adjoining section.

2–3. FUSELAGE (FORWARD SECTION).

2–4. DESCRIPTION. *(See figure 2–1.)* The fuselage (forward section) consists of the supporting structure, framework and equipment for the cabin assembly. The cabin assembly is divided into the engine compartment, the clutch compartment, the cockpit, the transmission compartment, the cabin, the electronics compartment and the heater compartment. The cabin assembly bottom structure contains the oil cell and fuel tank compartments.

2–5. ENGINE COMPARTMENT.

2–6. DESCRIPTION. *(See figure 2–1.)* The engine compartment is located in the nose of the helicopter directly forward of the clutch compartment. The two compartments are separated by a canted bulkhead. Access to the engine, which is mounted on the forward end of the bottom structure, is provided by two clam-shell type doors. The bottom structure oil cell compartment extends forward into the engine compartment and is protected by the bottom structure bulkhead, beams, and a floor of titanium sheet.

2–7. NOSE DOORS.

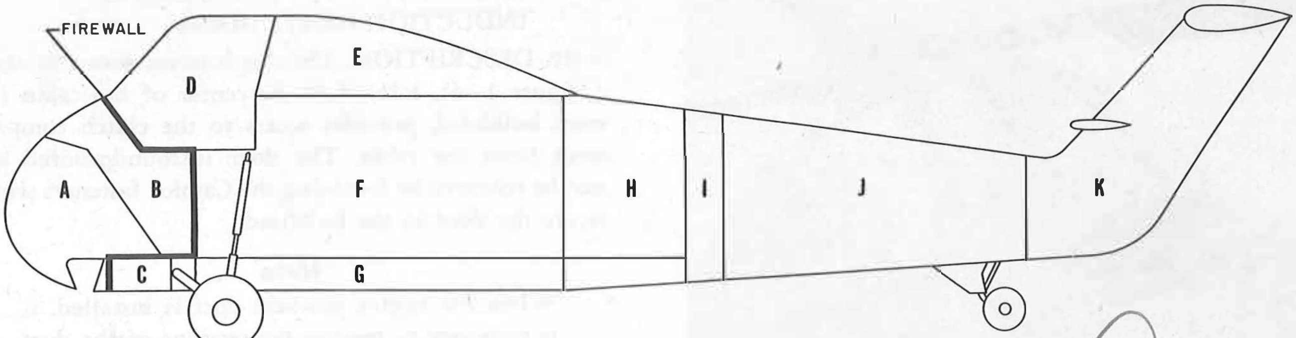
2–8. DESCRIPTION. *(See figure 2–2.)* Two large clam-shell type doors hinged to the cabin assembly forward frame provide access to the engine compartment and form the nose of the helicopter. A small screened section covers the forward air exhaust area at the bottom of each door. A handle is located on each door in the center of the nose, and an additional latch is installed on the left door. The doors are locked open by swinging them all the way back on their hinges, pulling the lock rods free of the pan spring clips recessed in the fuselage skin and working the lock rods into the wedjit fittings on the doors.

2–9. REMOVAL.

a. Disconnect the landing light wiring at the terminal block below the left door hinge located on the cabin assembly forward frame.

b. Disconnect the fire detector sensing elements at the socket receptacles inboard on the aft end of each door. Release the clamps which secure the elements on the nose doors aft of the socket receptacles.

c. Remove the washers, nuts and cotter pins that secure the bolts at the door hinges. Remove the doors.



A ENGINE COMPARTMENT
B CLUTCH COMPARTMENT
C OIL CELL COMPARTMENT
D COCKPIT
E TRANSMISSION COMPARTMENT
F CABIN
G FUEL TANK COMPARTMENT
H ELECTRONICS COMPARTMENT
I HEATER COMPARTMENT
J TAIL CONE
K PYLON

Figure 2–1. Interior Arrangement of Compartments

2–10. DISASSEMBLY.

a. Disconnect the landing light wiring from the light, and the ground from the left nose door. Free the terminal block cover, terminal block, and wiring from the nose door. Remove the screws which mount the landing light at the left nose door adapter plate. Remove the light. Remove the screws, washers and nuts and lift the adapter plate from the light panel.

b. Release the clamps to free the fire detector sensing elements from the nose doors. Remove the socket receptacles.

c. Remove the door half hinges from the channels by removing the screws, washers and nuts.

d. At the cowling latch and housing remove the bolts, washers and nuts which secure the parts to the channel hats on the nose doors. Remove the latch and housing from the doors.

e. Detach the handle latch upper springs from the latches and channel angles. Disconnect the lower springs from the lower rods and channels. Free the upper and lower latch rods, latches and links by removing the cotter pins, shear nuts, washers and clevis bolts, washers, shear nuts and cotter pins that secure the latch parts in position at the channel brackets, angles and handle bell cranks. Remove the spacers that locate the upper latches at the upper brackets. At the handle bell cranks remove the screws and self-lock nuts. Slide the bell cranks inboard off the handle shafts and the handles outboard from the doors.

2–11. ASSEMBLY.

a. Install the latch handles and inboard bell cranks at the nose door channels with the screws and self-lock nuts. Position and install the links and upper and lower latch rods with clevis bolts, washers, shear nuts and cotter pins at the channel brackets and latch bell cranks. Install the upper latches at the upper brackets with the spacers. Secure the spacers and latches with clevis bolts, washers, shear nuts and cotter pins. Attach the upper latch springs at the latches and channel angles and the lower springs at the lower rods and channels.

b. Install the cowling latch and housing at the channel hats with the bolts, washers and nuts.

c. Secure the door half hinges at the channels with the screws, washers and nuts.

d. Clamp the fire detector sensing elements to the nose doors. Install the socket receptacles.

e. Secure the adapter plate at the left nose door light panel with the screws, washers and nuts. Secure the landing light to the adapter plate with the screws. Clamp the wiring and install the terminal block and block cover on the nose door. Connect the wiring to the landing light and the ground to the left nose door.

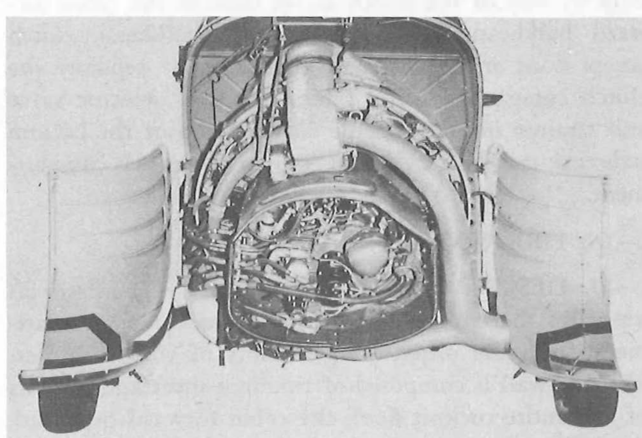


Figure 2–2. Nose Doors Open

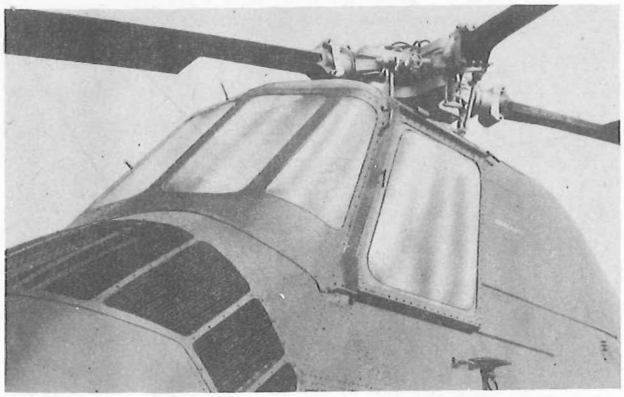


Figure 2—3. Cockpit Canopy

2—12. INSTALLATION.

a. Position the doors at the cabin assembly forward frame and secure the bolts at the door hinges with the washers, nuts and cotter pins.

b. Connect the fire detector sensing elements at the socket receptacles inboard on the aft end of each door. Clamp the elements to the doors aft of the socket receptacles.

c. Connect the landing light wiring at the terminal block below the left door hinge located on the cabin assembly forward frame.

2—13. CANTED BULKHEAD. *(See figure 2—1.)* The canted bulkhead, which separates the clutch compartment from the engine compartment, is a structural member of the cabin assembly. When the clutch and fan assembly is installed, the fan assembly is located in the bulkhead opening.

2—14. CLUTCH COMPARTMENT.

2—15. DESCRIPTION. *(See figure 2—1.)* The clutch compartment houses the clutch and fan assembly and is located aft of the engine compartment. When the power package is installed, the clutch compartment is accessible only by way of the clutch access door in the cabin forward bulkhead. The cabin forward bulkhead, clutch access door and sections of the fire wall separate the clutch compartment and cabin. The fuel selector valve and strainer installed in the forward end of the bottom structure may be serviced by way of the clutch compartment.

2—16. FIRE WALL.

2—17. DESCRIPTION. *(See figure 2—1.)* The fire wall separates the engine compartment and clutch compartment from the other compartments of the helicopter. The fire wall is composed of titanium sheet and consists of the entire cockpit floor, the cabin forward bulkhead, the clutch access door and the bottom structure forward floor and bulkheads.

2—18. CLUTCH ACCESS (CARBURETOR INDUCTION HEAT) DOOR.

2—19. DESCRIPTION. The clutch access door (39, sheet 1, figure 1—4), located in the center of the cabin forward bulkhead, provides access to the clutch compartment from the cabin. The door is soundproofed and may be removed by loosening the Camloc fasteners which secure the door to the bulkhead.

Note

When the engine pre-heat duct is installed, it is necessary to remove the sections of the duct from the flange on the outside and inside of the clutch access door before the door can be removed. A cap is provided to cover the flange opening when the duct is not installed.

2—20. COCKPIT.

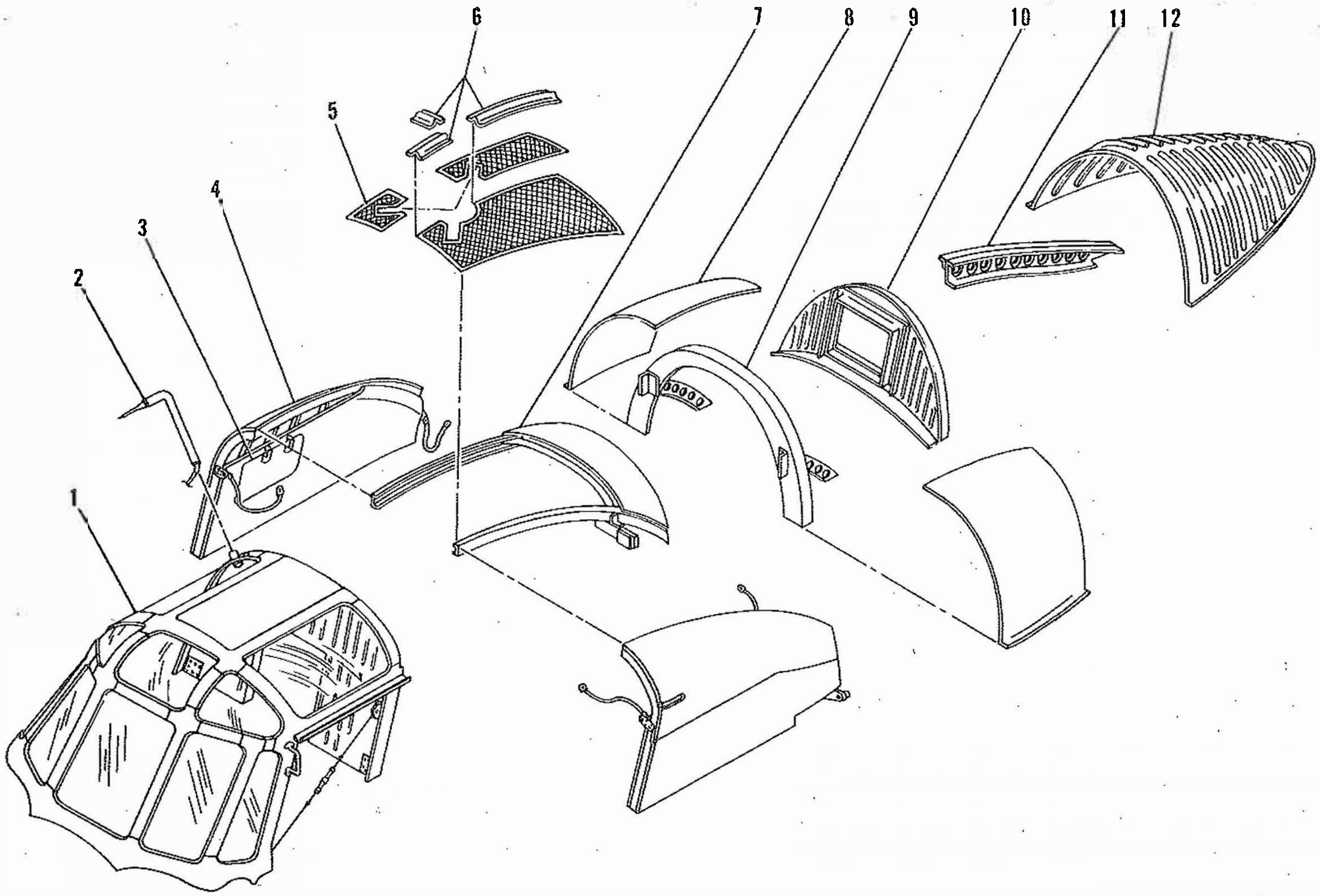
2—21. DESCRIPTION. *(See figure 2—1.)* The cockpit, located partially above and aft of the clutch compartment, is separated from the clutch compartment by the cockpit floor portion of the fire wall. The cockpit canopy canted bulkhead separates the cockpit from the transmission compartment. Access to the cockpit is gained through the sliding window on each side of the cockpit or by way of the cabin. Within the cockpit, covers located above the tunnel may be removed to allow servicing of the flight control components installed at the canopy canted bulkhead.

2—22. TRANSMISSION COMPARTMENT.

2—23. DESCRIPTION. *(See figure 2—1.)* The portion of the canopy installation (paragraph 2—24) aft of the cockpit houses the main gear box and hydraulic, electrical and flight control components. The main transmission deck separates the transmission compartment from the cabin. Hinged service platforms allow access to the transmission compartment from both sides of the canopy.

2—24. CANOPY INSTALLATION.

2—25. DESCRIPTION. *(See figure 2—4.)* The canopy installation encloses the cockpit and transmission compartment and can be removed by sections. The sections of the canopy include the cockpit canopy assembly (1, figure 2—4), a fairing (7) which supports a screen (5) located around the main gear box shaft and a service platform (4) at each side of the canopy aft of each sliding window. Immediately aft of the main gear box, a frame (9) supports the forward end of each skin (8) at each side of the canopy. The aft end of each skin is fastened to a bulkhead (10). A Fiberglas louvered fairing (12), through which air for the main gear box oil cooler is expelled, is supported by the fairing beam (11) and is secured to the bulkhead (10). Each service platform (4) is hinged to the cabin longeron and the transmission deck and functions as a protective panel for the



1. Cockpit Canopy Assembly
2. Pitot Tube
3. Service Platform Door
4. Service Platforms
5. Screens
6. Cap Strips
7. Fairing
8. Skins
9. Frame
10. Bulkhead
11. Fairing Beam
12. Louvered Fairing

Figure 2–4. Canopy Installation

main gear box when locked in the closed position. When unlocked, each platform hinges down from the canopy. Support cables position the platform at an advantageous level for servicing the canopy, main gear box or main rotor.

2–26. REMOVAL.

CAUTION

The fairing installation (7, figure 2–4) maintains the position of the canted bulkhead which forms the rear of the cockpit canopy (1). Removal of the fairing requires the installation of an auxiliary means of support for the canted bulkhead when either service platform (4) is hinged down to provide a working surface. Prior to removing the fairing (7), secure the canted bulkhead support cables, which are stowed in the cockpit, to the supports below each sliding window (figure 2–3) and to the canted bulkhead. Tighten the support cable turnbuckles.

a. Latch the cockpit sliding windows at the cockpit posts or remove them, as necessary (paragraph 2–44).

b. Loosen the Camloc fasteners, remove the securing screws and washers and lift each skin assembly (8, figure 2–4), located on each side of the canopy, from the frame and bulkhead assemblies (9 and 10).

c. Remove the louvered fairing installation (12) by removing the securing screws. Remove the screws securing the fairing beam (11) to the fuselage skin and to the bracket on the bulkhead assembly (10).

d. At the bulkhead assembly (10), remove all screws which position the main gear box oil cooler assembly at the bulkhead radiator support assembly. Remove the screws which secure the bulkhead assembly (10) to the fuselage skin and lift the bulkhead off the cabin.

e. Remove the screws attaching the screen assembly (5) to the canted bulkhead of the cockpit canopy (1) and to the fairing installation (7). Remove the screws and cap strips (6) which secure the screen sections to each other and lift the sections from the fairing installation.

f. Make sure the support cables are installed and tightened to support the canted bulkhead. Remove the screws, detach the aft end of the fairing installation (7) from the frame assembly (9), disconnect the forward end of each fairing beam from the canted bulkhead of the cockpit canopy (1) and remove the fairing installation.

g. Remove the service platforms (4). (Refer to paragraph 2—30.)

h. Detach the frame assembly (9, figure 2—4) and frame assembly brace from the transmission deck by removing the screws, washers and nuts. Remove the frame assembly from the deck.

i. Remove the cockpit canopy assembly (1). (Refer to paragraph 2—37.)

2—27. INSTALLATION.

a. Install the cockpit canopy assembly (1, figure 2—4). (Refer to paragraph 2—41.)

b. Position the frame assembly (9, figure 2—4) at the deck and secure the frame and frame brace to the deck with the screws, washers and nuts.

c. Install the service platforms (4). (Refer to paragraph 2—33.)

CAUTION

In preparation for servicing from the platform, install the support cables in the cockpit canopy (1, figure 2—4).

d. Install the fairing installation (7) by securing the forward end of each fairing beam to the canted bulkhead of the cockpit canopy (1) and the aft end of the fairing to the frame assembly (9) with screws.

e. Position and install the sections of the screen assembly (5) around the main rotor drive shaft with the cap strips (6) and screws. Secure the screen to the canted bulkhead of the cockpit canopy (1) and to the fairing installation (7). Stow the cockpit canopy support cables at the canted bulkhead.

f. Position the bulkhead assembly (10) on the cabin. Secure the bulkhead to the fuselage skin, and the bulkhead radiator support assembly to the main gear box oil cooler assembly with the screws.

g. Secure the louvered fairing beam assembly (11) to the bracket on the bulkhead (10) and to the fuselage skin with the screws. Position and secure the louvered fairing installation (12) at the beam (11) and fuselage skin with the screws.

h. Fasten each skin assembly (8) to each other and across the bulkhead and frame assemblies (10 and 9). Install the screws and washers securing the skins to the cabin.

i. Install the cockpit sliding windows, as necessary. (Refer to paragraph 2—48.)

2—28. SERVICE PLATFORMS.

2—29. DESCRIPTION. The service platforms (4, figure 2—4) are hinged to the cabin longeron and the transmission deck and function as protective panels for the transmission compartment. When unlocked, each service platform swings down and away from the canopy. Support cables position the platform at an advantageous level for servicing the canopy, main transmission, or main rotor. A service platform door (3) is installed in the right service platform to provide clearance for a rescue hoist when the service platform is hinged down.

2—30. REMOVAL.

a. At each side of the canopy, support the service platform (4, figure 2—4), and detach each cable assembly from the cockpit canopy canted bulkhead and the canopy frame assembly (9).

b. Close and lock the service platform against the canopy, slide the hinge pin forward out of the hinge and remove the clevis bolt at the hinge fitting extending out from the contour of the canopy skin.

c. Unlock the service platform and lift it off the canopy.

2—31. DISASSEMBLY.

a. Detach the support cables from the service platforms by removing the bolts, washers, nuts and cotter pins securing the cables to the platforms.

b. At each platform latch aft support, remove the bolt, washers, nut and cotter pin securing the arm to the support. Disconnect the spring from the tubing aft section and platform frame. Remove the pins, washers and cotter pins which attach the tubing sections to the arm and remove the tubing aft section arm, washer and spacer from each platform.

c. At each forward support, remove the bolt, washers and nut which secure the lever to the support. Remove the pins, washers and cotter pins attaching the lever to the handle lever assembly and the tubing forward section. Remove the tubing forward section, latch pin and lever from each platform.

d. Disconnect the spring from each handle lever assembly and from each support located above the handle attachment point. Remove the rollpins inboard and outboard of the platform skin contour. Slide the handle and tubing sections out from the platform and remove the lever assembly from the forward frame.

e. Remove the bolts, washers, nuts and springs which secure the service platform door (3, figure 2–4) to the right service platform. Remove the door.

Note

On helicopters bearing USAF Serial Nos 53-4503 and subsequent, a door stop on the transmission deck replaces the door springs. To replace the door stop, remove the bolts, washers and nuts which secure it to the deck.

2–32. ASSEMBLY.

a. Position the service platform door (3, figure 2–4) in the opening of the right service platform and secure it with the bolts, washers, nuts and springs.

Note

On helicopters bearing USAF Serial Nos 53-4503 and subsequent, a door stop on the transmission deck replaces the door springs. To install the door stop, position it on the deck and secure with nuts, washers and bolts.

b. Position each handle lever assembly at the platform forward frame with the inboard tubing section. Slide the outboard tubing section and handle in place and secure the handle and lever assembly to the tubing with the rollpins. Install the spring at the handle lever assembly and at the frame support above the handle.

c. Install each lever at the latch forward support with the bolt, washers and nut. Position and secure each tubing forward section and lockpin at the lever with the pin, washers and cotter pin. Connect the lever to the handle lever assembly with the pin, washers and cotter pin.

d. Secure the spacer, washer and arm at each latch aft support with the bolt, washers, nut and cotter pin. Connect the tubing sections at the arm with the pins, washers and cotter pins. Attach the spring to the tubing aft section and to the platform frame.

e. Secure the support cables at each platform with the bolts, washers, nuts and cotter pins.

2–33. INSTALLATION.

a. Position and lock each service platform (4, figure 2–4) against the canopy.

b. Install the clevis bolt at the hinge fitting extending out from the contour of the canopy skin and slide the hinge pin aft into the hinge at the bottom of the platform.

c. Support the service platform and unlock and swing the platform down. Install each cable assembly at the cockpit canopy canted bulkhead and the canopy frame assembly (9). Latch the service platform up into position.

2–34. COCKPIT CANOPY ASSEMBLY.

2–35. DESCRIPTION. The cockpit canopy assembly, which forms the cockpit enclosure, consists primarily of removable transparent panels mounted on the cockpit canopy skeleton and a canted bulkhead riveted to the skeleton. All the panels are plastic except the laminated glass windshield panel on the pilot's side of the canopy. The cockpit canopy assembly supports the pitot tube, the radio loop antenna and the cockpit sliding windows. The overhead control panel and canopy wiring are installed at the ceiling and canted bulkhead.

2–36. CRITERIA FOR LIMITS AND TOLERANCES OF CANOPY DEFECTS.

1. Definitions.

a. Nicks — Broken indentations or cavities having sharp edges.

b. Dents — Depressions or hollows left by blows or concentrated pressures.

c. Conchoidal Fracture — The cavity left by the loss of a chip in the form of a clam shell.

d. Scratches — Tears in the surface made by a pointed object.

e. Cracks — Narrow fractures extending deeper than scratches.

f. Crazing — A pattern or area of tiny fissures or splits.

g. Discoloration — Occurs as a brown to dark brown color.

h. Repairable Defects — Those capable of and approved for repair.

i. Permissible Defects — Those acceptable without repair or rework.

2. Nicks, Dents and Conchoidal Fractures.

a. CRITICAL VISION AREA.

(1) Repairable nicks, dents, etc.
None allowable

(2) Permissible nicks, dents, etc.
Length — 0.250 inch maximum
Width — 0.125 inch maximum
Depth — 10% of thickness up to 0.100 inch
Frequency — two per area

b. CRITICAL STRESS AREA.

(1) Repairable nicks, dents, etc.
Length — 0.250 inch maximum
Width — 0.100 inch maximum
Depth — 20% of thickness up to 0.100 inch
Frequency — two per square feet of area maximum

(2) Permissible nicks, dents, etc.
Length — 0.125 inch maximum
Width — 0.015 inch maximum
Depth — 10% of thickness up to 0.100 inch
Frequency — one per square foot of area maximum

c. NON-CRITICAL AREA.

(1) Repairable nicks, dents, etc.
Length — 0.250 inch maximum
Width — 0.100 inch maximum
Depth — 20% of thickness up to 0.100 inch
Frequency — two per square feet of area maximum

(2) Permissible nicks, dents, etc.
Length — 0.125 inch maximum
Width — 0.016 inch maximum
Depth — 10% of thickness up to 0.100 inch
Frequency — one per square foot of area maximum

3. Scratches.

a. CRITICAL VISION AREA.

(1) Repairable scratches
Length — five inch total per area maximum
Width — 0.02 inch maximum
Depth — 20% of thickness up to 0.100 inch
Frequency — See length above

Note

Repair shall be such as to cause no impairment in optical characteristics.

(2) Permissible scratches
Length — five inch maximum
Width — 0.02 inch maximum
Depth — 10% of thickness up to 0.100 inch
Frequency — One per area. Hairline scratches (depth of 0.001 inch or less) are acceptable in any amount and area so long as they do not cause vision blur or create undesirable glare.

Note

Waxing is required to minimize impairment of vision.

b. CRITICAL STRESS AREA.

(1) Repairable scratches
Length — 10 inch total per area maximum
Width — 0.02 inch maximum
Depth — 20% of thickness up to 0.100 inch
Frequency — See length above

(2) Permissible scratches
Length — 0.250 inch maximum
Width — 0.020 inch maximum
Depth — 10% of thickness up to 0.100 inch
Frequency — one per square foot of area maximum

c. NON-CRITICAL AREA.

(1) Repairable scratches
Length — 24 inch maximum
Width — 0.05 inch maximum
Depth — 20% of thickness up to 0.100 inch
Frequency — 20% of total area maximum

(2) Permissible scratches
Length — 24 inch maximum
Width — 0.02 inch maximum
Depth — 10% of thickness up to 0.100 inch
Frequency — Total length of scratches 3 times longest dimension of area maximum

4. Cracks.

a. CRITICAL VISION AREA.

(1) Repairable cracks
None allowable

(2) Permissible cracks
None allowable

b. CRITICAL STRESS AREA.

(1) Repairable cracks
None allowable

(2) Permissible cracks
None allowable

c. NON-CRITICAL AREA.

(1) Repairable cracks
Length — 12 inch maximum
Width — 0.05 inch maximum
Frequency — Repaired area equal 10% total area maximum

(2) Permissible cracks
Length — two inch maximum
Width — 0.02 inch maximum
Frequency — six of maximum lengths or 12 inch total per area maximum

Note

All cracks shall be stop-drilled. See Technical Order 1-1A-12.

5. Crazing.
   a. CRITICAL VISION AREA.
      (1) Repairable crazing
          None allowable
      (2) Permissible crazing
          None allowable
   b. CRITICAL STRESS AREA.
      (1) Repairable crazing
          None allowable
      (2) Permissible crazing
          None allowable
   c. NON-CRITICAL AREAS.
      (1) Repairable crazing
          Slight — no requirements
          Severe — 10% of area maximum
      (2) Permissible crazing
          Slight — 25% of area maximum
          Severe — 5% of area maximum
6. Discoloration.
   a. ALL AREAS.
      (1) Repairable discoloration
          None allowable — not repairable
      (2) Permissible discoloration
          May extend one inch from the entire edge area of the plastic enclosure unless otherwise noted

2—37. REMOVAL.

a. Remove the cockpit sliding windows. (Refer to paragraph 2—44.)

b. Remove the screen assembly (5, figure 2—4). (Refer to paragraph 2—26, step e.)

c. Remove the screws that secure the fairing installation to the aft side of the canted bulkhead.

CAUTION

Attach the canted bulkhead support cables to the support below each sliding window opening. Tighten the support cable turnbuckles.

d. Remove the service platforms. (Refer to paragraph 2—30.)

e. Remove the pilot's and observer's seats. (Refer to paragraph 2—138.)

f. Cut the lock wire and remove the bolt that holds the windshield wiper arm assembly to the shaft of the converter. Remove the arm assembly.

g. Remove the bolts, washers and nuts that secure the converter to the bracket on the canopy skeleton.

h. Slide the shaft out of the opening in the canopy. Swing the converter down behind the instrument panel and tape it to the helicopter structure.

i. Remove the pitot tube (2, figure 2—4). (Refer to paragraph 6—122, steps a. through c.) Disconnect the lower end of the pitot tubing from the union below the window opening. Remove the clamps that secure the tubing to the cockpit canopy and canted bulkhead. Remove the tubing.

j. Disconnect the standby compass light wiring from the terminal block at the instrument panel disconnect.

WARNING

Make sure the "BATT" and "GENERATOR" switches are off and that external power is disconnected.

k. Disconnect the wiring from the terminal block on the forward side of the canted bulkhead. Disconnect the wiring at the radio interphone junction box. Unclamp the wiring from the canted bulkhead. Unclamp and disconnect the R-11A loop antenna cable.

l. Remove the power supply cables from the overhead control panel. (Refer to paragraph 7—60, steps e. through i.)

m. Disconnect the plugs from the receptacles on the aft, right-hand side of the canted bulkhead.

n. Remove the clamp that secures the overhead control panel power supply cables and the wiring bundles to the canted bulkhead.

o. Pull the power supply cables and the small bundle of wiring through the canted bulkhead.

p. Disconnect the wires from the terminal blocks on the left- and right-hand sides of the canted bulkhead opening. Remove the clamps to free the wiring from the bulkhead. Disconnect the wiring at the main gear box inspection light switch.

q. Disconnect and plug the tubing from the rotor brake to the accumulator above the transmission deck forward and to the right of the main gear box. Remove the clamp that secures the tubing to the canted bulkhead.

r. Within the cockpit canopy (1, figure 2—4), remove the bolts and washers that secure the auxiliary servo and mixer, upper cover supporting panels to the canted bulkhead. Remove the cover from the servo and mixer assembly and from the lower cover.

s. Remove the screws and washers along the bottom edge of the cockpit canopy retainer fairing and at the brackets which support the retainer fairing across the cockpit forward skin.

t. On each side of the cockpit canopy forward of the sliding window opening, remove the screws, washers and gusset that secure the cockpit canopy to the cockpit.

u. Remove the screws that secure the canted bulkhead to the transmission fitting bulkhead.

v. Remove the screws, washers and nuts that secure the canted bulkhead to the transmission attaching fitting located at each forward corner of the transmission deck.

w. Detach and stow each support cable at the canted bulkhead.

x. Use a suitable sling and hoist the cockpit canopy up and off the helicopter.

CAUTION

Care must be exercised when removing the cockpit canopy from the transmission attaching fittings to prevent nicking or scratching the fittings.

Note

The components removed in steps y. through am. are not furnished with a new cockpit canopy and should be retained with the helicopter.

y. Remove the screws, washers and nuts that secure the two electrical receptacles to the forward, right-hand side of the canted bulkhead. Remove the overhead control panel with the receptacles and wiring attached. (Refer to paragraph 7—60, step j.)

z. Remove the R-11A loop antenna. (Refer to paragraph 8—26, step d.)

aa. Remove the rotor brake master cylinder. (Refer to paragraph 5—396.)

ab. Remove the accumulator. (Refer to paragraph 5—400, steps b. and c.)

ac. Remove the clamp and tubing between the accumulator and master cylinder.

ad. Disconnect the wiring at the back of the standby compass.

ae. Remove the standby compass. (Refer to paragraph 6—33, step e.)

af. Remove the free-air thermometer. (Refer to paragraph 6—53.)

ag. Remove the map case and flight report holder. (Refer to paragraph 2—193.)

ah. Remove the data case. (Refer to paragraph 2—195.)

ai. Remove the terminal block covers and the terminal blocks from the forward and aft sides of the canted bulkhead.

aj. Remove the nut that secures the main gear box inspection light switch to the name plate on the aft, left-hand side of the canted bulkhead. Remove the switch.

ak. Remove the screws, washers, gasket and nuts that secure the light assembly on top of the cockpit canopy. Remove the light assembly.

al. Remove the bolt, washers, spacers and nut that secure each support cable to the canted bulkhead. Remove the cables.

am. Remove the radio interphone junction box, headphones and hooks from the canted bulkhead by removing the screws, washers and nuts. Unclamp and remove the cord assembly on each side of the canted bulkhead.

2—38. DISASSEMBLY.

a. Remove the nuts, washers, spacers and bolts that secure the handles to the cockpit canopy posts forward of the sliding window emergency release handles.

b. Free the transparent panel window retainers located in the cockpit canopy ceiling from the canted bulkhead and longerons by removing the screws, washers and nuts.

c. Remove the retainer fairing from across the front and bottom of the cockpit canopy.

d. Unfasten the retainers from any other section of the skeleton by removing the Nylok screws and washers. Remove the retainers, rubber edgings and transparent panels from the skeleton.

2—39. MAINTENANCE OF COCKPIT CANOPY TRANSPARENT PANELS. Care must be exercised in cleaning and protecting acrylic plastic to avoid the destruction of its optical qualities. Transparent plastic panels should be maintained only in the manner outlined in paragraphs 2—127 through 2—131.

2—40. ASSEMBLY.

a. Fix each rubber edging and transparent panel into each retainer by installing the screws and washers in the retainer holes.

b. In preparation for installation, position the retainers and retainer fairing against the skeleton and note the gaps which occur between the retainers.

c. Directly under each gap and outboard of the skeleton install two-inch wide tape (index 27, paragraph 1—32) so that one inch of tape extends outboard in opposite directions from the gap. Trim the tape to avoid interference with the transparent panels.

CAUTION

Do not use the surface of the helicopter to back up the tape while cutting.

d. Weatherproof all retainer gaps with sealer compound (index 18, paragraph 1—32). Seal around joints and between the retainers and the retainer fairing with cement (index 57, paragraph 1—32).

e. Secure the retainers to the canted bulkhead and longerons with the screws, washers and nuts. Secure the retainers and the retainer fairing to the canopy skeleton with the washers and Nylok screws.

f. Install the handle at the canopy posts forward of the sliding window emergency release handles with the bolts, washers, spacers and nuts.

Note

Install the washers under each bolt and nut.

2—41. INSTALLATION.

Note

Before hoisting the cockpit canopy assembly onto the helicopter, install the components outlined in steps a. through o. If the components were not removed, install the cockpit canopy assembly as outlined in steps p. through aj.

a. Secure each support cable to the canted bulkhead with the bolt, washers, spacers and nut.

b. Position the light assembly and gasket on top of the cockpit canopy and secure it with the screws, washers and nuts. Install the radio interphone junction box, headphones and hooks on the canted bulkhead with the screws, washers and nuts. Position and clamp the cord assemblies on the canted bulkhead.

c. Position the main gear box inspection light switch on the name plate on the aft, left-hand side of the canted bulkhead. Secure the switch with the nut.

d. Install the terminal blocks on the forward and aft sides of the canted bulkhead.

e. Install the data case. (Refer to paragraph 2—195.)

f. Install the map case and flight report holder. (Refer to paragraph 2—193.)

g. Install the free-air thermometer. (Refer to paragraph 6—54.)

h. Install the standby compass. (Refer to paragraph 6—34, step a.)

i. Connect the wiring at the back of the standby compass.

j. Install the accumulator. (Refer to paragraph 5—401, steps b., c. and d.)

k. Install the rotor brake master cylinder. (Refer to paragraph 5—397.)

l. Install the tubing between the accumulator and the master cylinder. Secure the tubing with the clamp.

m. Install the R-11A loop antenna. (Refer to paragraph 8—27, step d.)

n. Install the overhead control panel with the receptacles and wiring attached. (Refer to paragraph 7—61, step b.)

o. Secure the two electrical receptacles to the forward, right-hand side of the canted bulkhead with the screws, washers and nuts.

p. Using a suitable sling and hoist, position the cockpit canopy assembly on the helicopter.

CAUTION

Care must be exercised when positioning the canted bulkhead at the transmission attaching fittings to prevent nicking or scratching the fittings.

q. Secure the canted bulkhead to the transmission attaching fittings with the screws, washers and nuts at each corner of the transmission deck.

r. Secure the canted bulkhead to the transmission fitting bulkhead with the screws.

s. Install the screws, washers and gusset that secure the cockpit canopy to the cockpit on each side of the helicopter forward of the sliding window openings.

t. Install the screws and washers along the bottom edge of the cockpit canopy retainer fairing and at the brackets which support the retainer fairing across the cockpit forward skin.

u. Within the cockpit canopy (1, figure 2—4), secure the auxiliary servo and mixer, upper cover supporting panels to the canted bulkhead with the bolts and washers. Install the cover on the servo and mixer assembly and on the lower cover.

v. Remove the plug and connect to the accumulator the tubing that extends from the rotor brake. Secure and clamp the tubing to the canted bulkhead. Bleed the rotor brake system. (Refer to paragraph 5—392.)

w. Connect the wiring to the terminal blocks on the aft side of the canted bulkhead. Install the terminal block covers. Clamp the wiring to the bulkhead. Connect the wiring to the main gear box inspection light switch.

x. Push the power supply cables and the small bundle of wiring through the canted bulkhead openings and connect the cables to the overhead control panel. (Refer to paragraph 7—61, steps c. through f.)

y. Install the clamp that positions the power supply cables and wiring bundles that go into the overhead control panel.

z. Connect the plugs to the receptacles on the aft, right-hand side of the canted bulkhead.

aa. Connect the wiring to the terminal block on the forward side of the canted bulkhead. Install the terminal block cover. Connect the wiring at the radio interphone junction box. Clamp the wiring to the canted bulkhead. Clamp and connect the R-11A loop antenna cable.

ab. Connect the standby compass light wiring to the terminal block at the instrument panel disconnect.

ac. Install the pitot tube (2, figure 2—4). (Refer to paragraph 6—123, steps d. through f.) Connect the lower end of the pitot tubing to the union below the window opening. Install the clamps that secure the tubing to the cockpit canopy and canted bulkhead.

ad. Slide the converter shaft through the opening in the canopy and secure the converter to the bracket with the bolts, washers and nuts.

ae. Bolt the arm assembly to the converter shaft. Lockwire the bolt.

af. Install the pilot's and observer's seats. (Refer to paragraph 2—139.)

ag. Install the service platforms. (Refer to paragraph 2—34.)

CAUTION

In preparation for servicing from the platform, secure the support cables below each sliding window opening.

ah. Secure the fairing installation to the canted bulkhead with the screws.

ai. Install the screen assembly. (Refer to paragraph 2—28, step e.)

aj. Install the cockpit sliding windows. (Refer to paragraph 2—48.)

2—42. COCKPIT SLIDING WINDOWS.

2—43. DESCRIPTION. *(See figure 2—4.)* A sliding plastic window is installed on each side of the cockpit canopy. Each window may be jettisoned, regardless of the window's position in the track assembly, by operating the emergency release handle located at the forward end of the cockpit canopy longeron above the window opening. The handle may be operated from inside or outside the helicopter. The sliding window transparent panels may be removed for repair or replacement.

2—44. REMOVAL.

a. Unlatch the sliding window at the forward cockpit canopy post.

b. Release the sliding window from the cockpit canopy by pulling the inside release handle aft or the outside release handle forward. Support the sliding window and, while holding either release handle in an unlocked position, drop the window down far enough to free the pins from the longeron assembly above the upper track. Make sure the window retainer is free from the bottom track.

c. Push or pull the window out from the cockpit canopy.

2—45. DISASSEMBLY.

a. Remove the pin, washer and cotter pin that secures the terminal at the lower end of the cable assembly to the lever of the latch installation.

b. Release the pin-spring that positions the pin in the lock housing at the upper corner of the window and remove the pin collar and pin-spring. Remove the screws and washers that secure the lock housing to the sliding window frame.

c. Remove the screw, spacer and washers that secure the cam to the frame.

d. Remove the pin and cable assembly from the cam by removing the pins, washers and cotter pins.

e. Remove the pin, washer and nut adjacent to the latch installation.

f. Release the pin-spring that positions the shaft in the bushing of the latch assembly and remove the latch assembly. Remove the handle and shaft with the spacer, washers and lever.

g. Back out the screws which attach the striker to the cockpit canopy post at the sliding window opening. Detach the striker tension spring from the post to remove the striker and spring.

h. Detach the retainers and center track from the window frame assembly by removing all washer head screws, washers and nuts from the frame tubing. Work the retainers, center track rubber edging and transparent panel free from the frame.

i. Slide the center track out from the intermediate channel, work the ball spacers and synchronizer ball free from the intermediate channel and slide the intermediate channel from the outer channel. The remaining ball spacers will work free from the outer channel.

2—46. MAINTENANCE OF TRANSPARENT PANELS. Care must be exercised in cleaning and protecting acrylic plastic to avoid the destruction of its optical qualities. Transparent plastic panels should be maintained only in the manner outlined in paragraphs 2—127 through 2—131.

2—47. ASSEMBLY.

a. Apply grease (index 38, paragraph 1—32) sparingly by hand to all contacting surfaces of the sliding window track channels, track ball spacers and center track. Position the ball spacers in the outer channel. Slide the intermediate channel into the outer channel. Install the synchronizing ball and the remaining ball spacers and slide the center track between the two center ball spacers.

b. Position and secure the transparent panel, rubber edging, center track and retainers on the window frame assembly with the washer head screws, washers and nuts.

c. Position the striker at the elongated holes in the cockpit canopy post and secure with the screws. Attach the tension spring to the striker and post.

Note

When installing a new cockpit canopy skeleton assembly, drill a No. 40 (0.098 inch diameter) hole in which to locate the lower end of the striker tension spring at the skeleton post.

d. With the spacer, washers and lever located on the shaft, position the shaft in the bushing of the latch assembly and install the pin-spring.

e. Install the pin, washer and nut adjacent to the latch installation.

f. Secure the lock housing to the frame with the screws and washers and install the collar, pin and pin-spring in the housing.

g. Secure the cam to the frame with the screw, spacer and washers.

h. Secure the pin and cable assembly to the cam with the pins, washers and cotter pins.

i. Secure the terminal at the lower end of the cable assembly to the lever on the latch installation with the pin, washer and cotter pin.

Note

When installing a new sliding window retainer and/or frame, drill a No. 50 (0.070 inch diameter) hole through the inboard sections of the retainer and/or frame as required to locate the outboard end of the shaft spring. To complete the installation of a new latch assembly, drill a $\frac{1}{8}$ (0.125) inch diameter hole through the handle and outboard shaft end to house the pin-spring. Install the pin-spring.

2–48. INSTALLATION.

a. With the sliding window release handle in an unlocked position, work the pins into position at the longeron assembly above the window opening and locate the sliding window against the cockpit canopy in order to engage the retainer at the bottom of each window in the track attached to the fuselage skin.

b. Push the inside handle forward or the outside handle aft to engage the rod weld assembly at the support weld assembly pins.

c. Latch the sliding window at the forward cockpit canopy post.

2–49. CABIN.

2–50. DESCRIPTION. *(See figure 2–1.)* The cabin is located aft of the clutch compartment and below the cockpit and the transmission compartment. The cabin is entered through the sliding cargo door (figure 2–5)

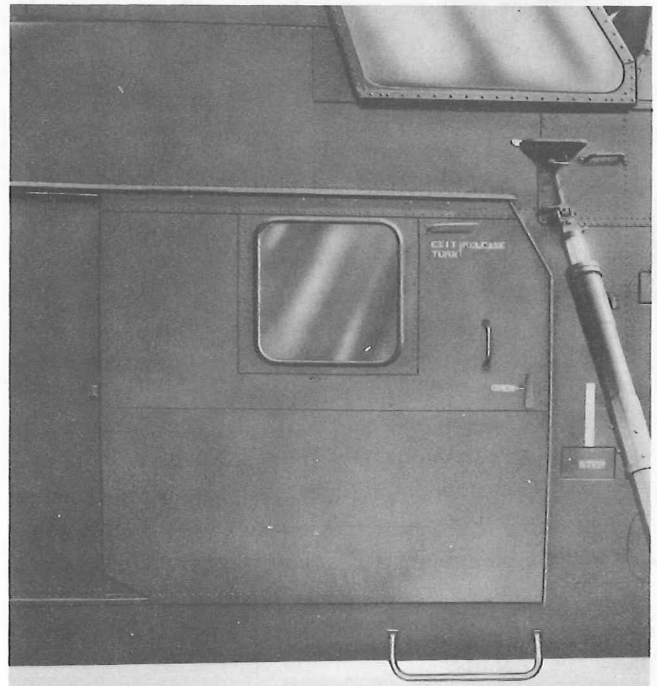


Figure 2–5. Cargo Door

installed on the forward right side of the cabin. Four windows are installed in the cabin, two in the emergency escape hatches (figure 2–6) on the left side of the helicopter, one in the cargo door and one in the side of the helicopter aft of the cargo door. The clutch access door is installed in the cabin forward bulkhead. Ladders are provided on either side of the clutch access door to facilitate entry to the cockpit from the cabin. An opening in the cabin rear bulkhead permits access to the electronics compartment.

2–51. CARGO DOOR.

2–52. DESCRIPTION. *(See figure 2–5.)* A sliding cargo door containing a single window is installed on the right side of the cabin. The door is held in the closed position by a hand-operated latch. The door can be jettisoned from the inside or outside the helicopter by pulling down on the emergency handle and either pulling or pushing the door out of position.

2–53. REMOVAL.

a. Unlatch the cargo door from the fuselage door frame.

b. Release the cargo door from the track assembly by pulling the inside or outside emergency handle down far enough to back the cargo door rod out of the door angles and the track support assemblies. Support the door, and while holding either handle in an unlocked position, drop the door free from the gutter above the track assembly. Make sure the channel at the bottom of the cargo door is free from the rail secured to the bottom structure.

c. Push or pull the cargo door out from the cabin.

2—54. DISASSEMBLY.

a. Inboard of the emergency release inside handle, remove the taper pin, washer and nut. Slide the outside handle out from the inside handle. Pull the inside handle down from the rod side plate and out from the clip spring mounted on the cargo door.

b. Outboard of the latch outside handle, remove the screws securing the handle at the pin and slide the handle off the pin. Pull the pin from the door and remove the inside handle from the door frame tubing. Remove the self-locking screw which attaches the latch spring to the frame forward tubing. Work the latch and spring down out of the door frame tubing. Remove the spring from the latch pin.

c. Remove the bolts, washers and nuts securing the cargo door bumper to the aft edge of the cargo door.

d. Remove the washer head screws which secure the channel to the bottom edge of the cargo door and remove the channel.

e. Remove the cargo door handle by removing the bolts, washers and nuts.

f. Remove the cargo door window. (Refer to paragraph 2—59.)

g. At the fuselage skin above the cargo door opening, slide the track inner races and ball cage out of the track housing, remove the machine screws, washers and nuts securing the track housing to the gutter angle and drop the track housing down from the gutter.

h. Remove the screws and nuts attaching the cargo door stop to the fuselage skin below the right rear cabin window. Remove the stop.

i. Remove the screws, washers and nuts attaching the strike plate to the fuselage skin at the center of the right edge of the cargo door opening. Remove the strike plate.

2—55. ASSEMBLY.

a. Install the strike plate on the fuselage skin at the center of the right edge of the cargo door opening with the screws, washers and nuts.

b. Position the cargo door stop on the fuselage skin below the right rear cabin windows and secure with the screws and nuts.

c. Apply grease (index 38, paragraph 1—32) sparingly to all contacting surfaces of the ball cage, inner races and housings of the track. Secure the housing to the gutter angle with the machine screws, washers and nuts and slide the inner races and ball cage into the housing.

d. Install the cargo door window. (Refer to paragraph 2—61.)

e. Install the cargo door handle and secure it with the bolts, washers and nuts.

f. Secure the channel along the bottom edge of the cargo door with the washer head screws.

g. Secure the cargo door bumper to the aft edge of the cargo door with the bolts, washers and nuts.

h. Install the self-locking screw at the door frame forward tubing. Attach the spring at the screw and at the latch pin. Work the latch up into the frame tubing and position the latch and inside handle at the latch attachment point with the pin. Secure the outside handle on the outboard end of the pin with the screws.

i. Position the emergency release inside handle at the rod side plate and clip spring. Slide the outside handle into the inside handle and secure the parts inboard of the cargo door with the taper pin, washer and nut.

Note

When installing new emergency release handles, drill and ream for the taper pin so that the small end of the tapered shank shall not extend more than 1/16-inch beyond the surface of the inside handle stub.

2—56. INSTALLATION.

a. With the cargo door release handle in an unlocked position, work the door angles into the track support assembly below the cargo door gutter and locate the cargo door against the cabin in order to engage the cargo door channel at the rail secured to the bottom structure.

b. Push the inside or outside emergency handle up to engage the rod at the door angles and track support assemblies.

c. Latch the cargo door at the door frame.

2—57. CABIN WINDOWS.

2—58. DESCRIPTION. Four plastic windows are installed in the cabin. The two windows located on the left side of the cabin are installed within the two emergency escape hatches (figure 2—6). One of the two windows located on the right side of the cabin is installed in the cargo door (figure 2—5); the other is fitted into the fuselage skin aft of the cargo door. The windows are secured by rubber seals and filler strips around each window.

2—59. REMOVAL. Remove each window as follows:

a. Using the stub end of the special tool, Bacharach part No. 80-5021, remove the filler strip around each window.

Note

To remove the filler strip from the right aft cabin window located in the fuselage skin, pull the strap assembly secured to the fuselage skin out from the seal. Pull the remainder of the filler away from the seal.

b. Remove the window and rubber window seal.

2–60. MAINTENANCE. Refer to paragraphs 2–127 through 2–131 for cleaning and protecting the cabin windows.

2–61. INSTALLATION.

a. Install the rubber window seal on the window frames using special tool, Bacharach part No. 80-5021.

b. Install the window in the seal.

c. Using special tool, Bacharach part No. 80-5021, insert the rubber filler strip in the seal around the window on the outside.

Note

At the right aft cabin window located in the fuselage skin, work the strap assembly into the seal while inserting the filler strip.

2–62. EMERGENCY ESCAPE HATCHES.

2–63. DESCRIPTION. *(See figure 2–6.)* Two emergency escape hatches are provided on the left side of the cabin. A window is installed in the center of each hatch. An emergency release handle is installed on the lower forward corner of each hatch on both the inside and outside of the helicopter. The hatch can be quickly jettisoned by pushing down on the outside handle and pulling the hatch out or pushing forward and up on the inside handle and then pushing the hatch out. Two assist handles are installed directly above each hatch on the outside of the helicopter to aid personnel in leaving the helicopter through the hatches.

2–64. REMOVAL. Push the emergency release handle down on the outside or push the inside handle forward and up and then pull or push the hatch out.

2–65. INSTALLATION. Work the emergency hatch into position, engage the lugs at the top of the hatch in the fuselage channel slots and pull the outside emergency handle up or the inside handle backward and down to its locked position.

2–66. TAIL ROTOR DRIVE SHAFT COVER.

2–67. DESCRIPTION. A cover (6, sheet 1, figure 1–4), which protects the tail rotor drive shaft, is located in the cabin and electronics compartment. The forward section of the cover is soundproofed and fastened to the aft transmission deck frame, the cabin ceiling and cabin rear bulkhead. The aft section is secured to the aft side of the cabin rear bulkhead and to the electronics compartment frames and aft bulkhead. A drain for the cover is installed just forward of the cabin rear bulkhead. After unfastening the soundproofing and disconnecting the hose from the drain tube at the forward cover section, either section of the cover may be removed by backing out the washer head screws which secure the section in the position.

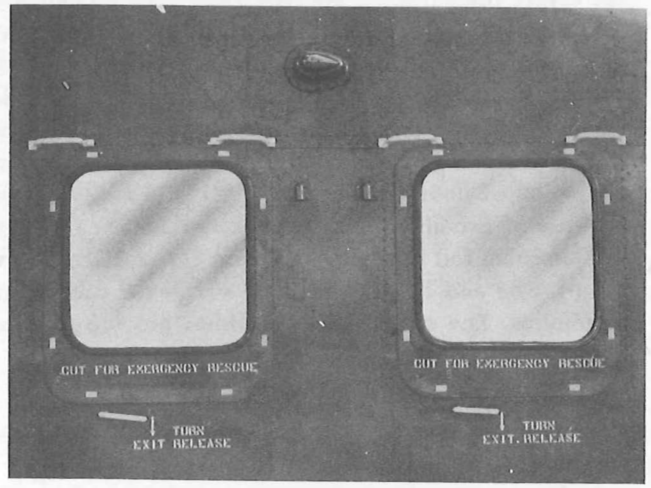


Figure 2–6. Emergency Escape Hatches

2–68. BOTTOM STRUCTURE.

2–69. DESCRIPTION. *(See figure 2–1.)* The bottom structure, which extends the entire length of the fuselage forward section, is the major supporting section of the cabin assembly. Flooring installed across the top of the bottom structure skeleton assembly covers the oil cell and fuel tank compartments. A bottom structure catwalk is provided in the heater compartment. The fuel selector valve and strainer are installed below the flooring between the oil cell and fuel tank compartments and a hatch is located between the aft fuel cells of the forward fuel tank. The bottom structure is lined with a removable skin which is secured in sections by screws to the bottom structure skeleton assembly. The skeleton assembly is covered externally by plating. The bottom structure fairing is attached to the plating.

2–70. BOTTOM STRUCTURE FLOORING AND CATWALK.

2–71. DESCRIPTION. *(See sheet 2, figure 1–4.)* The walking surface of the cabin assembly bottom structure consists of engine, clutch and electronics compartment flooring, cabin flooring and the heater compartment catwalk. Only the flooring in the cabin and the catwalk in the heater compartment are removable. The oil cell covers (2 and 17), the fuel selector valve and strainer door (3) and the electronics compartment access covers (14) provide access to the bottom structure from the engine, clutch and electronics compartments. The cabin and electronics compartment flooring and the catwalk are composed of floor assemblies (7, 9, 13, 15 and 16) constructed of two aluminum sheets with a honeycomb core of aluminum foil between the sheets. Circular access covers (4, 6, 8 and 11) are mounted on all the cabin floor assemblies. The cabin floor assemblies provide easy access to the fuel cells.

2–72. REMOVAL.

a. Remove the troop seats. (Refer to paragraph 2–151.)

b. Remove the skid rails, as necessary, from the cabin floor assemblies.

c. Remove the bolts, washers and nuts that secure the filler cap, gasket and elbow to the scupper at each fuel tank filler (5, 10 and 12, sheet 2, figure 1–4). Remove each filler cap and gasket.

d. Disconnect the vapor return line from the union in the forward tank filler elbow.

e. Cut the lock wire and remove the bolts and washers that secure each elbow to the floor assembly. Remove each elbow and gasket.

f. Remove the bolts and washers that secure the fuel cell access covers (4, 6, 8 and 11) to the floor assemblies. Remove the covers and gaskets. Remove the screws that secure each fuel cell cover support to the bottom surface of the floor assemblies.

g. Remove all bolts and washers that secure the floor assemblies to the keel beams, forward hatch frame, bulkheads and longerons. Lift the cabin floor assemblies off the bottom structure.

Note

When removing a floor assembly, check that the securing bolts of the tie-down fittings in the adjacent floor assembly are removed.

h. Remove the gasket and spacer from each fuel tank filler hole.

i. Remove the catwalk installation located in the heater compartment by removing the screws and washers that secure the catwalk to the bottom structure frame and bulkhead installation.

2–73. INSTALLATION.

a. Install the spacer and gasket at the fuel tank filler hole in each floor assembly with the spacer against the bottom surface of the floor assembly.

b. Position each cabin floor assembly and secure it to the bottom structure keel beams, forward hatch frame, bulkheads and longerons with the bolts and washers.

Note

Secure the tie-town ring fittings of each floor assembly to the adjacent floor assembly with the bolts.

c. Secure each fuel cell cover support to the bottom surface of a floor assembly with the screws. Secure each gasket and fuel cell access cover (4, 6, 8 and 11, sheet 2, figure 1–4) to the top surface of a floor assembly with the bolts and washers.

d. Position each fuel tank filler elbow on the gasket at the filler elbow and secure it with the bolts and washers. Lockwire the bolts.

e. Install a gasket between each filler elbow and scupper. Position a filler cap and gasket against the outer surface of each scupper. Secure the filler cap, gaskets and elbow to each scupper with the bolts, washers and nuts.

f. Connect the vapor return line to the union in the forward tank filler elbow.

g. Install any skid rails that were removed.

h. Install the troop seats. (Refer to paragraph 2–152.)

i. Position the catwalk in the aft portion of the heater compartment and secure it to the bottom structure frame and bulkhead with the screws and washers.

2–74. BOTTOM STRUCTURE PLATING.

2–75. DESCRIPTION. *(See figure 2–9.)* The bottom structure plating forms the exterior surface of the bottom structure of the helicopter. The plating is composed of magnesium and aluminum sheets riveted to the bottom structure skeleton. Removable panels, cover and plates are provided in the plating for access to certain components located within the bottom structure. All panels, covers and plates, except the hinged panel (32, sheet 1, figure 1–4), are secured to the plating with Dzus fasteners, provides access to the fuel selector valve and the fuel system strainer. The covers (31) provide access to the fuel cell sumps and attached fittings. The plates provide access to certain fuel lines. Drilled holes are provided in the plating to drain any water that might accumulate in the bottom structure. The removal of certain panels, covers and plates will necessitate the removal of the bottom structure fairing (paragraph 2–78).

2–76. MAINTENANCE. The bottom structure plating is located in an area that is highly susceptible to corrosion and, therefore, requires periodic washing and cleaning, immediate recognition and treatment of corrosion and immediate touch-up of surfaces from which the protective coating is missing. Refer to paragraphs 2–108 through 2–126 for instructions in preventive maintenance for the bottom structure plating.

2—77. BOTTOM STRUCTURE FAIRING.

2—78. DESCRIPTION. The bottom structure fairing (34, sheet 1, figure 1—4) protects the fuel lines and connections located beneath the cabin bottom structure. The fairing sections are secured to each other and to the bottom structure plating with screws and washers.

Note

On helicopters bearing USAF Serial Nos 53-4475 through 53-4489, the bottom structure fairing is made up of magnesium and aluminum panels. On USAF Serial Nos 53-4490 and subsequent, a Fiberglas fairing is installed.

2—79. MAINTENANCE. Wash the fairing with mild soap and clean fresh water. Rinse thoroughly and dry. Never use solvent or similar cleaning agents, particularly on the Fiberglas fairing.

2—80. ELECTRONICS COMPARTMENT.

2—81. DESCRIPTION. *(See figure 2—1.)* The electronics compartment is located just aft of the cabin. Shelves are provided in the compartment for mounting the electrical and radio equipment. Access to the compartment is gained through the opening in the cabin rear bulkhead. An opening is provided in the electronics compartment rear bulkhead which allows entry into the heater compartment and tail cone. The aft section of the tail rotor drive shaft cover encloses the portion of the drive shaft located in the electronics compartment. Heater duct sections and tail rotor flight control components are installed within the compartment.

2—82. HEATER COMPARTMENT.

2—83. DESCRIPTION. *(See figure 2—1.)* The heater compartment, which houses the cabin heater, is located just aft of the electronics compartment. Tail rotor flight control components are mounted within the compartment and a tail rotor drive shaft rubber coupling, which connects the third and fourth sections of the drive shaft, is located just aft of the electronics compartment rear bulkhead. The inside of the tail cone is accessible only from the heater compartment. The tail cone is secured to the cabin at the frame located on the aft end of the heater compartment.

2—84. TAIL CONE (FUSELAGE AFT SECTION).

2—85. DESCRIPTION. *(See figure 2—1.)* The tail cone (fuselage aft) section is the second of the three main sections that form the fuselage of the helicopter. The tail cone section is attached to the fuselage forward section and supports the pylon (foldable tail) section, the tail rotor flight and tail landing gear lock controls, the tail landing gear, the fourth section of the tail rotor drive shaft and the radio antenna.

2—86. TAIL CONE.

2—87. DESCRIPTION. *(See figure 2—1.)* The tail cone is bolted to the rear of the fuselage forward section at the mating forward section and tail cone frames at fuselage station 316. The tail cone supports the pylon (foldable tail) section and the tail landing gear. Access to the tail cone attachment bolts, tail rotor flight and tail landing gear lock controls, tail rotor drive shaft and pylon light wiring is gained through the electronics and heater compartments. A catwalk is installed within the tail cone to support maintenance personnel when servicing the tail cone section and equipment. The catwalk, composed of a honeycomb core of aluminum foil between two aluminum sheets, is secured with screws to the skeleton assembly frames. The pylon folding hinge lock, which secures the pylon to the tail cone at the upper and lower hinges, is located between the hinges on the right side of the tail cone. (See figure 2—7.)

2—88. REMOVAL.

a. Disconnect the fixed wire-type antenna at the mast. Roll up the wire and tape it to the cabin assembly.

b. Disconnect the tail rotor flight controls at the turnbuckles located in the forward portion of the tail cone.

c. Remove the pylon quick change unit. (Refer to paragraph 2—100.)

CAUTION

Extreme care must be exercised to avoid nicks, scratches or other damage to the tail cone and pylon hinge assemblies when removing the tail cone or pylon sections.

d. Remove the heater components located aft of the plenum duct assembly. (Refer to paragraphs 4—6, 4—11, 4—24 and 4—28.)

e. Disconnect and remove the fourth section of the tail rotor drive shaft. (Refer to paragraph 5—413, steps c. through h.)

f. Place padded cradles directly under bulkheads to support the fuselage forward section and the tail cone section individually.

CAUTION

To avoid crushing the skin, do not place supporting cradles between the bulkheads or frames. Use sponge-type rubber between the structure and the supporting cradles to avoid marring the skin.

g. Remove the tail landing gear. (Refer to paragraph 2—263.)

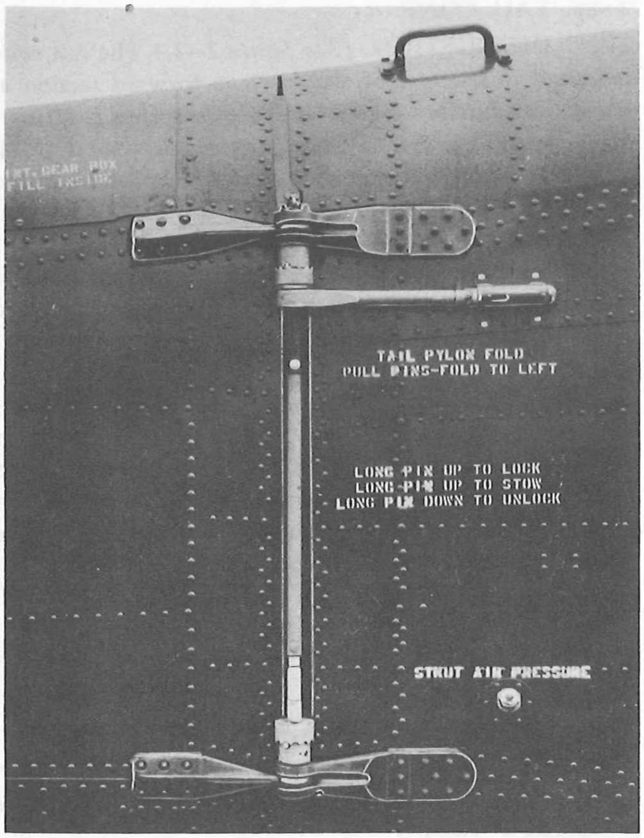


Figure 2–7. Pylon Folding Hinge Lock

h. Detach the tail cone from the fuselage forward section by removing the bolts, washers and nuts which secure the two sections together.

i. Remove the pylon folding hinge lock and pin signal flag. (Refer to paragraph 2–92.)

j. Remove the tail rotor flight control components located in the tail cone. (Refer to paragraph 2–495.)

2–89. INSTALLATION.

Note

In the event the sponge weather stripping loosens at the tail cone frame aft of the hinge bulkhead, apply rubber adhesive (index 28, paragraph 1–32) to refasten the stripping to the frame and intercostal angle and to the tail cone skin. Check and trim sponge ends to eliminate interference at the skin cut-outs.

a. Install the pylon folding hinge lock and pin signal flag. (Refer to paragraph 2–93.)

b. With the fuselage forward section and tail cone properly supported by padded cradles at the bulkheads and frames only, install the bolts, washers and nuts which secure the tail cone to the fuselage forward section.

CAUTION

To avoid crushing the skin, do not place supporting cradles between the bulkheads or frames. Use sponge-type rubber between the structure and the supporting cradles to avoid marring the skin.

c. Install the tail landing gear. (Refer to paragraph 2–265.)

d. Install the fourth section of the tail rotor drive shaft. (Refer to paragraph 5–426, steps a. through g.)

e. Install the heater components located aft of the plenum duct assembly. (Refer to paragraphs 4–8, 4–15, 4–25 and 4–30.)

f. Install the tail rotor flight controls in the tail cone. (Refer to paragraph 2–496.)

g. Install the pylon quick change unit. (Refer to paragraph 2–105.)

CAUTION

Extreme care must be exercised to avoid nicks, scratches or other damage to the tail cone and pylon hinge assemblies when installing the tail cone or pylon sections.

h. Connect the aft end of the wire antenna to the mast.

2–90. PYLON FOLDING HINGE LOCK AND PIN SIGNAL FLAG.

2–91. DESCRIPTION. *(See figure 2–7.)* The pylon folding hinge lock and pin signal flag are installed on the aft, right side of the tail cone between the upper and lower tail cone hinges. The hinge lock secures the pylon in the unfolded, or flight, position. The hinge lock consists primarily of a torque tube, two jack pin nuts, two collars, two receptacles, two jack screw pins, a ratchet wrench and a sleeve. A jack pin nut is fastened to each end of the torque tube. The torque tube and jack pin nuts are supported at each end by a collar. The collars are screwed onto receptacles that are bolted to the upper and lower tail cone hinges. A jack screw pin is threaded into each jack pin nut and extends into the hinge receptacle. The ratchet wrench is installed over the hexagonal shoulder of the upper jack pin nut and is held in place by the sleeve which is bolted to the torque tube. When the wrench is actuated, the torque tube and jack pin nuts turn, causing the jack screw pins to move through the receptacles and into the hinges, thus locking the pylon to the tail cone. When the upper jack screw pin is retracted from the hinge, the red pin signal flag, marked "PIN OUT," swings out from the fuselage as a warning that the pylon is not properly locked. As the pin is moved into the locked position, the flag retracts into the fuselage. A ratchet pin in the handle of the ratchet wrench determines the direction of the wrench action; the pin must be in the up position to extend and in the down position to retract. When not in use, the handle of the wrench is secured against the tail cone in a spring-loaded latch assembly.

2–92. REMOVAL.

a. Fold the pylon. (Refer to paragraph 1–21.)

b. Actuate the ratchet wrench (8, figure 2–8) to lock the jack screw pins (4 and 17) tight in the locked position.

c. Remove the flathead pins and cotter pins (13 and 10) which secure the jack pin nuts (6 and 15) and sleeve (11) to the torque tube (12).

d. Remove the screws and lock washers (3 and 19) which secure the collars (7 and 14) at the upper and lower hinge receptacles (2 and 18). Unscrew the collars (7 and 14) from the receptacles (2 and 18).

e. Slide the torque tube (12), sleeve (11), wrench (8) and collar (7) down from the upper hinge (1). Unscrew and remove the jack pin nuts (6 and 15) from the jack screw pins (4 and 17).

f. Remove the hinge lock parts from position between the upper and lower hinges (1 and 20). Work the upper and lower jack screw pins out of the receptacles (2 and 18) and hinges (1 and 20).

g. Remove the receptacles (2 and 18) from the hinges (1 and 20) by removing the screws and washers (5 and 16).

h. Unhook the pin signal flag tension spring from the tail cone frame and from the pin on the flag. Remove the spring and the pin and washers from the flag.

i. Remove the rollpin that secures the flag at the upper hinge and remove the flag.

2–93. INSTALLATION.

a. Position and secure the pin signal flag at the upper hinge with the rollpin.

b. Install the pin in the hole provided in the lower portion of the flag and place a washer over the pin on each side of the flag. Hook the loop on the lower end of the tension spring through the hole in the pin. Hook the upper loop end of the spring into the hole in the tail cone frame.

Note

With the flag in the "PIN OUT" position, tension on the spring should be $1\frac{3}{4} \pm \frac{1}{8}$ pounds.

c. Install the pylon hinge lock receptacles (2 and 18, figure 2–8) on the upper and lower tail cone hinges (1 and 20) with the screws and lock washers (5 and 16).

d. Pack the receptacles (2 and 18) with grease (index 38, paragraph 1–32). Work the jack screw pins (4 and 17, figure 2–8) into the receptacles (2 and 18) and hinges (1 and 20).

e. Pack the jack pin nuts (6 and 15) with grease (index 38, paragraph 1–32). Assemble the collar (7, figure 2–8) and ratchet wrench (8) on the upper jack pin nut (6). Position the upper jack pin nut (6) in the torque tube (12) and slide the sleeve (11) up and over the torque tube (12) and jack pin nut (6).

f. Assemble the collar (14) and lower jack pin nut (15) at the bottom end of the torque tube (12).

g. Position the assembled parts between the tail cone hinges (1 and 20). Screw the jack pin nuts (6 and 15) onto the jack screw pins (4 and 17).

h. Screw the collars (7 and 14) onto the upper and lower hinge receptacles (2 and 18) until they are finger-tight and one of the scallops on the collar lines up with the hole in the side of each receptacle. Install the screws and lock washers (3 and 19) to secure the collars.

i. Secure the hinge lock parts to the torque tube (12) by installing the flathead pins and cotter pins (10 and 13). Actuate the ratchet wrench (8) to retract the jack screw pins (4 and 17).

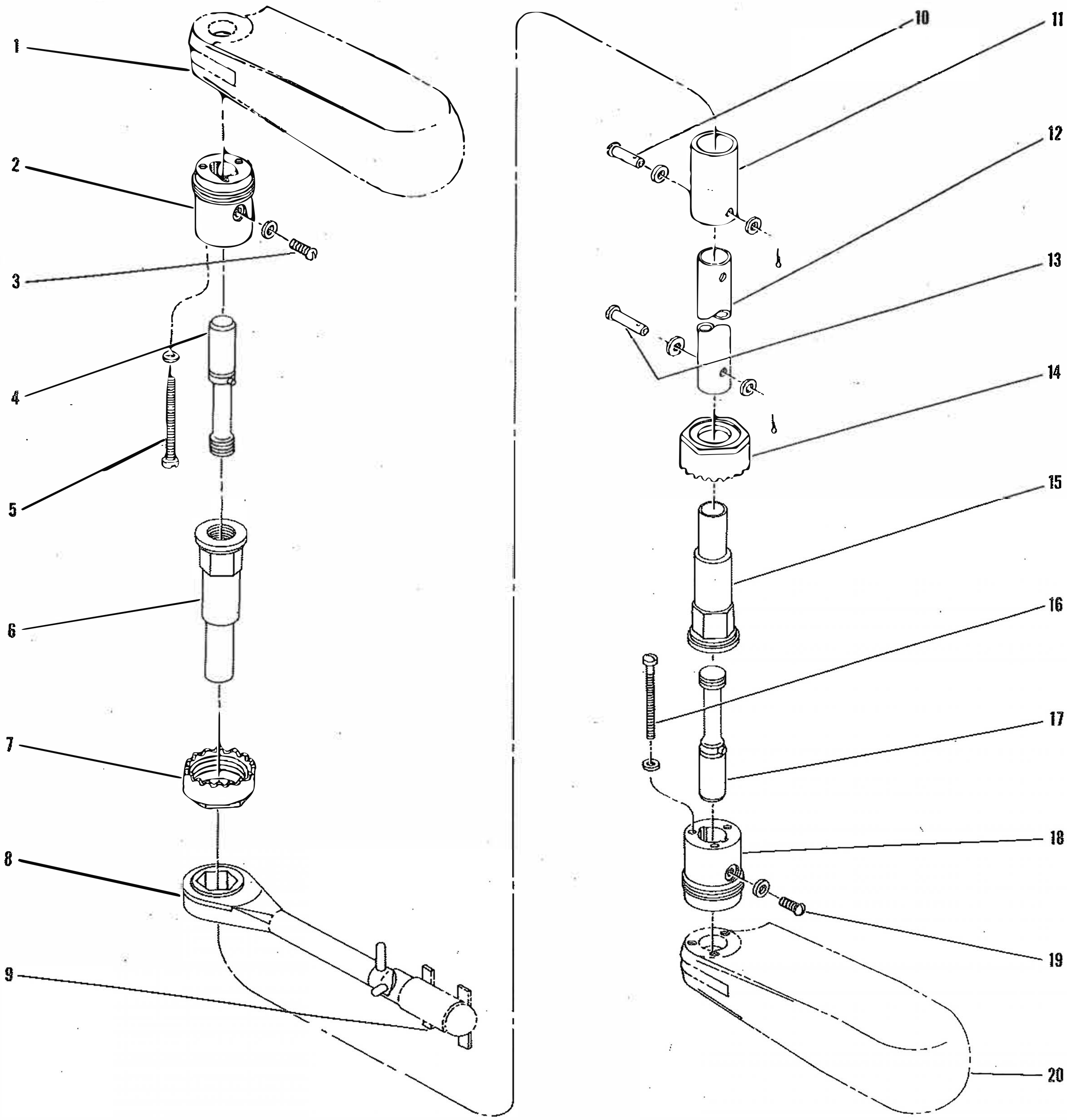
Note

If a new torque tube, jack pin nut, or sleeve is being installed, fully retract the jack screw pins (4 and 17) into the jack pin nuts (6 and 15). Check and adjust, if necessary, the jack pin nuts (6 and 15) to obtain a flush position against the receptacles (2 and 18). Drill a No. 12 (0.189 inch diameter) hole to accommodate the flathead pins.

j. Unfold the pylon. (Refer to paragraph 1–22.)

2–94. PYLON (FOLDABLE TAIL) SECTION.

2–95. DESCRIPTION. *(See figure 2–1.)* The pylon (foldable tail) section is the third of the three main sections that form the fuselage of the helicopter. The pylon section is supported by the tail cone (fuselage aft) section to which it is secured at station 448 by hinges and the pylon folding hinge lock. When the hinge lock is unlocked, the pylon can be folded forward along the left side of the tail cone (figure 1–10). The pylon section supports the stabilizer, the intermediate and tail rotor gear boxes with associated transmission equipment, the tail rotor assembly, the yellow position light and a portion of the tail rotor flight controls.



1. Upper Hinge
2. Receptacle
3. Screw, Lock Washer
4. Jack Screw Pin
5. Screw, Lock Washer
6. Jack Pin Nut
7. Collar
8. Wrench
9. Latch
10. Flathead Pin, Cotter Pin
11. Sleeve
12. Torque Tube
13. Flathead Pin, Cotter Pin
14. Collar
15. Jack Pin Nut
16. Screw, Lock Washer
17. Jack Screw Pin
18. Receptacle
19. Screw, Lock Washer
20. Lower Hinge

Figure 2–8. Pylon Folding Hinge Lock Disassembled

2—96. PYLON.

2—97. DESCRIPTION. *(See figure 2—1.)* The pylon supports the tail rotor assembly and associated transmission equipment and the stabilizer. The pylon is secured to the tail cone by hinges installed on the tail cone and pylon bulkheads and by the pylon folding hinge lock. The pylon hinge lock wrench (figure 2—7), located on the right side of the tail cone, releases pins from the adjacent hinges to unlock the pylon and allow it to be folded forward along the left side of the tail cone (figure 1—10). When in the folded position, the pylon can be secured by engaging the lock rod on the tail cone in the wedjit fitting on the pylon. (Refer to paragraph 1—21.) Hand holds are provided near the trailing edge of the pylon to assist in folding, unfolding and hoisting the pylon. The intermediate and tail rotor gear boxes are bolted to frames inside the pylon. The tail rotor disconnect coupling is bolted to the pylon hinge bulkhead. All items inside the pylon are accessible by means of removable panels and fairings. The lower fairing (5, sheet 1, figure 1—4), which is screened for ventilation, provides access to the disconnect coupling, disconnect shaft assembly and intermediate gear box. The upper and lower stabilizer fairings (4) provide access to the stabilizer turnbuckle assembly. The screened opening on each side of the pylon between the hand holds provides ventilation of the intermediate gear box. The large panel (27) on the right side of the pylon provides access to the intermediate gear box. The lower circular panel (28) on the left side of the pylon provides access to the tail rotor flight controls and the tail rotor drive shaft support bearing. The upper circular panel (29) provides access to the rubber coupling at the tail rotor gear box. A top fairing grill (1) and a tail rotor gear box fairing cover (3) are installed at the top of the pylon. The yellow position light is installed at the extreme aft end of the pylon.

2—98. REMOVAL.

CAUTION

Extreme care must be exercised to avoid nicks, scratches or other damage at the tail cone and pylon hinge assemblies when removing the pylon.

a. Remove the tail rotor and tail rotor gear box assemblies. (Refer to paragraph 5—476.)

Note

If a suitable padded cradle is available, the removal of the components outlined in steps a. through i. may be accomplished while the pylon is in the cradle.

b. Remove the pylon drive shaft. (Refer to paragraph 5—466, steps a., b. and d. through f.)

c. Remove the intermediate gear box and disconnect shaft assemblies from the pylon. (Refer to paragraph 5—457, but omit step d.)

d. Remove the tail rotor drive shaft disconnect coupling. (Refer to paragraph 5—440, step c.)

e. Remove the pylon tail rotor flight control system components. (Refer to paragraph 2—495, steps ab. through ae.)

f. Remove the screws and washers that secure the position light and support assembly to the top of the pylon. Disconnect the electrical wiring and remove the light and support assembly.

g. Disconnect the electrical wiring from the terminal block. Release the clamps that secure the conduit tube to the pylon structure and remove the conduit tube and light wiring.

h. Remove the screws, washers and nuts that secure the terminal block to the pylon structure. Remove the terminal block.

i. Replace all pylon access panels and fairings.

j. Support the pylon with the hoisting sling, Sikorsky part No. S1670-10449. (Refer to paragraph 1—13.)

CAUTION

The two handles on the leading edge of the pylon must never be used to support or hoist the pylon.

k. Remove the hinge bolts, washers, nuts and cotter pins from the left side of the upper and lower hinge assemblies.

Note

On helicopters bearing USAF Serial Nos 53-4512 and subsequent, pins are installed in place of the bolts and nuts in the upper and lower hinge assemblies.

l. Carefully swing the pylon clear of the tail cone and place in a padded cradle.

2—99. INSTALLATION.

Note

In the event the sponge weather stripping loosens from the pylon hinge fairing forward of the hinge bulkhead, apply rubber adhesive (index 29, paragraph 1—32) to refasten the stripping to the hinge fairing angle and pylon plating. Check and trim sponge ends to eliminate interference at the fairing cut-outs.

CAUTION

Extreme care must be exercised to avoid nicks, scratches or other damage at the tail cone and pylon hinge assemblies when installing the pylon.

a. Support the pylon with the hoisting sling, Sikorsky part No. S1670-10449. (Refer to paragraph 1—13.) Work the left side of the upper and lower hinge assemblies into the tail cone hinge assemblies. Install the hinge bolts, washers, nuts and cotter pins.

CAUTION

The two handles on the leading edge of the pylon must never be used to support or hoist the pylon.

Note

On helicopters bearing USAF Serial Nos 53-4512 and subsequent, pins are installed in place of the bolts and nuts in the upper and lower hinge assemblies.

Note

If a suitable padded cradle is available, the installation of the components outlined in steps b. through k. may be accomplished prior to step a. while the pylon is in the cradle.

b. Remove all pylon access panels and fairings.

c. Position and secure the position light wiring terminal block on the pylon structure with the screws, washers and nuts.

d. Install the clamps which secure the conduit tube and electrical wiring to the pylon structure and clamp the tube and wiring in place. Connect the wiring to the pylon terminal block.

e. Connect the electrical wiring to the light and support assembly and secure the light and support assembly to the top of the pylon with the screws and washers.

f. Install the pylon tail rotor flight control system components. (Refer to paragraph 2—496, steps a. through c.)

g. Install the tail rotor drive shaft disconnect coupling. (Refer to paragraph 5—447, steps a. and d.)

h. Install the intermediate gear box and disconnect shaft assemblies. (Refer to paragraph 5—462, but omit step c.)

i. Install the pylon drive shaft. (Refer to paragraph 5—470, steps c., d., g., h., and i.)

j. Install the tail rotor and tail rotor gear box assemblies. (Refer to paragraph 5—482.)

k. Service the intermediate and tail rotor gear boxes. (See figure 1—14.)

l. Rig the tail rotor flight controls. (Refer to paragraph 2—524.)

m. Replace all pylon access panels and fairings.

2—100. PYLON QUICK CHANGE UNIT.

2—101. DESCRIPTION. When an easy and fast replacement of the pylon section is desired, the completely built-up pylon may be removed and installed as a quick change unit. The quick change unit is made up of the pylon itself on which are installed the stabilizer, the tail rotor disconnect coupling and shaft, the intermediate and tail rotor gear boxes, the pylon drive shaft, the tail rotor assembly, flight control rods and the yellow position light and wiring.

2—102. REMOVAL.

CAUTION

Extreme care must be exercised to avoid nicking or scratching the tail cone and pylon hinge assemblies when removing the pylon quick change unit.

a. Fold the pylon. (Refer to paragraph 1—21.)

b. Disconnect the position light wiring from the terminal block on the forward side of the tail cone aft bulkhead. Disconnect the ground wire.

c. Disconnect the tail rotor flight control rod from the bell crank at the aft bulkhead of the tail cone.

d. Support the pylon with the hoisting sling, Sikorsky part No. S1670-10449. (Refer to paragraph 1—13.)

CAUTION

The two handles on the leading edge of the pylon must never be used to support or hoist the pylon.

e. Remove the hinge bolts, washers, nuts and cotter pins from the left side of the upper and lower hinge assemblies.

Note

On helicopters bearing USAF Serial Nos 53-4512 and subsequent, pins are installed in place of the bolts and nuts in the upper and lower hinge assemblies.

f. Carefully swing the pylon quick change unit clear of the tail cone and place in a padded cradle.

2—103. PREPARATION FOR SHIPMENT.

a. Remove the tail rotor blades and attaching parts.

(Refer to paragraph 2—364.) Pack the blades in the racks provided in the container.

b. Tie the attaching parts together, wrap in greaseproof barrier material (index 8, paragraph 1—32) and secure it with adhesive tape (index 9, paragraph 1—32). Place them in the container.

c. Remove the drain plugs and drain the intermediate and tail rotor gear boxes. Replace the plugs and fill the gear boxes with a mixture of 75 percent lubricating oil (index 34, paragraph 1—32) and 25 percent corrosion-preventive compound (index 7, paragraph 1—32). Actuate the tail rotor hub by hand to circulate the mixture throughout the gear boxes. Remove the plugs and drain the mixture from the gear boxes. Replace the plugs.

d. Coat all exposed exterior machined surfaces with corrosion-preventive compound (index 4, paragraph 1—32) and wrap with greaseproof barrier material (index 8, paragraph 1—32).

e. Position the pylon quick change unit in the container and secure it in place.

f. Fill the basket provided in the container with bags of activated desiccant (index 52, paragraph 1—32) and seal the container so it is airtight.

2—104. PLACING IN SERVICE AFTER SHIPMENT.

a. Remove the pylon quick change unit from the container and place it on a suitable stand or in a padded cradle.

CAUTION

The two handles on the leading edge of the pylon must never be used to support or hoist the pylon.

b. Remove the greaseproof barrier material from the exposed exterior machined surfaces and clean the corrosion-preventive compound from all surfaces with solvent (index 3, paragraph 1—32).

c. Flush the intermediate and tail rotor gear boxes with lubricating oil (index 34, paragraph 1—32). Service the gear boxes. (Refer to paragraph 1—28.)

d. Remove the greaseproof barrier material from the tail rotor blade attaching parts and clean the corrosion-preventive compound from all surfaces with solvent (index 3, paragraph 1—32).

e. Install the tail rotor blades on the tail rotor assembly. (Refer to paragraph 2—368.)

2—105. INSTALLATION.

CAUTION

Extreme care must be exercised to avoid damaging the tail cone and pylon hinge assemblies when installing the pylon quick change unit.

a. Remove the pylon quick change unit from the padded cradle using the hoisting sling, Sikorsky part No. S1670-10449. (Refer to paragraph 1—13.)

CAUTION

The two handles on the leading edge of the pylon must never be used to support or hoist the pylon.

b. Carefully swing the pylon into its folded position along the left side of the tail cone and work the left side of the upper and lower hinge assemblies into the tail cone hinges.

c. Install the hinge bolts, washers, nuts and cotter pins.

Note

On helicopters bearing USAF Serial Nos 53-4512 and subsequent, pins are installed in place of the bolts and nuts in the upper and lower hinge assemblies.

d. Connect the tail rotor flight control rod to the bell crank at the tail cone aft bulkhead.

e. Connect the position light wiring to the terminal block on the forward side of the tail cone aft bulkhead. Connect the ground wire.

f. Unfold and secure the pylon. (Refer to paragraph 1—22.)

g. Check the tail rotor flight control rigging. (Refer to paragraph 2—524.)

2—106. STABILIZER. For information on the stabilizer, refer to paragraph 2—516.

2—107. MAINTENANCE OF FUSELAGE SURFACES.

2—108. MAINTENANCE OF METALLIC SURFACES.

2—109. GENERAL. The maintenance of fuselage surfaces other than acrylic plastic requires a comprehensive program of preventive maintenance adapted to the specific operating conditions of the helicopter. Periodic washing and cleaning, inspection, recognition and treatment of corrosion and touch-up of surfaces which have lost their protective coatings will prevent extensive structural repairs and add to fuselage life. Diligent preventive maintenance keeps corrosion at a minimum. Thorough periodic inspection for corrosion is necessary to uncover any conditions of corrosion before it becomes extensive. The following paragraphs give in detail the recommended procedures for fuselage surface maintenance. The procedures should be incorporated into the maintenance program of operating units as dictated by experience gained under specific operating conditions.

2—110. CLEANING METALLIC SURFACES.

a. Using mild soap and water, wash the exterior surface of the fuselage when dirt accumulates. Rinse the area thoroughly with clean fresh water and dry with a clean cloth.

Note

Helicopters operating over salt water or in the proximity of salt water should be washed with fresh water after each day's flight to prevent corrosion.

b. Clean the interior surfaces of the fuselage with a cloth dampened in fresh water. Dry thoroughly with a clean cloth.

c. Stubborn oil or grease spots may be removed from the exterior or interior surfaces with a cloth dampened in solvent (index 3, paragraph 1—32). Wash and dry the area immediately to remove the solvent.

CAUTION

Never use a solvent or similar cleaning agents on Fiberglas fairings.

2—111. CORROSION.

2—112. CAUSES OF CORROSION. Corrosion of magnesium and aluminum alloys, the alloys used for the fuselage, may be caused by the salts in sea air or spray, by electrolytic corrosion caused by the contact of dissimilar metals, by engine exhaust gases, by battery acid and by relief tube spray.

2—113. CORROSION ON MAGNESIUM ALLOYS. Corrosion will not normally be present on painted, treated or protected magnesium surfaces. Corrosion will attack magnesium whenever bare magnesium becomes exposed to moisture or air. However, corrosion may attack magnesium even though it is painted, as moisture can permeate the paint. Corrosion is present if any of the following conditions are in evidence:

a. White powdered appearance.

b. Discoloration of chromate primer.

c. Blistering or cracking of the finish coating.

CAUTION

Bare magnesium alloys will corrode very rapidly when exposed to salt-laden air. Adequate protective finishes must be maintained on magnesium at all times.

2—114. CORROSION ON ALUMINUM ALLOYS. Corrosion will not usually be present on aluminum surfaces that have a protective finish. Corrosion will attack bare aluminum surface. However, corrosion may attack aluminum even though the surface is painted, as moisture will permeate the paint. Corrosion is present if any of the following conditions are in evidence:

a. Scaly or blistered appearance.

b. Dulling and pitting.

c. Whitish or reddish powdered deposits.

2—115. DIFFERENTIATING BETWEEN ALUMINUM AND MAGNESIUM ALLOY. In order to differentiate between aluminum and magnesium alloy, apply one drop of ordinary battery acid to the surface of the metal in question. The area on the magnesium will immediately show a foaming or boiling action with a black discoloration; no reaction to the acid will be shown on the aluminum.

CAUTION

Immediately after completing the magnesium and aluminum acid test, wash the tested area with water to prevent burns and continued acid action on the magnesium.

2—116. INSPECTION OF EXTERNAL SURFACES FOR CORROSION.

a. Inspect the finish for scratches, cracks, tears, punctures, peeling, fading, blistering or other damage, particularly around bolts, screws and other fasteners.

b. Inspect seams and joints for loose or missing sealer compound.

c. Inspect exposed skin edges for condition of corrosion-protective finish or sealer compound and for evidence of corrosion.

d. Inspect dissimilar metal contacts for evidence of corrosion. (See figure 2—9.)

e. Inspect areas that are exposed to exhaust gases or relief tube spray for evidence of corrosion.

2—117. INSPECTION OF INTERNAL SURFACES FOR CORROSION.

a. Inspect primed surfaces for scratches and other damage or wear.

b. Inspect magnesium alloy surfaces for condition of zinc-chromate primer.

c. Inspect the areas of dissimilar metal contacts for evidence of corrosion. (See figure 2—9.)

d. Inspect the area around bolts, screws and other fasteners for corrosion and condition of zinc-chromate primer.

e. Inspect hidden surfaces whenever removal of any equipment exposes the area.

f. Inspect the area around the battery for the condition of the acid-resistant lacquer.

2—118. GENERAL PRECAUTIONS TO PREVENT CORROSION.

a. Clean and inspect the helicopter regularly.

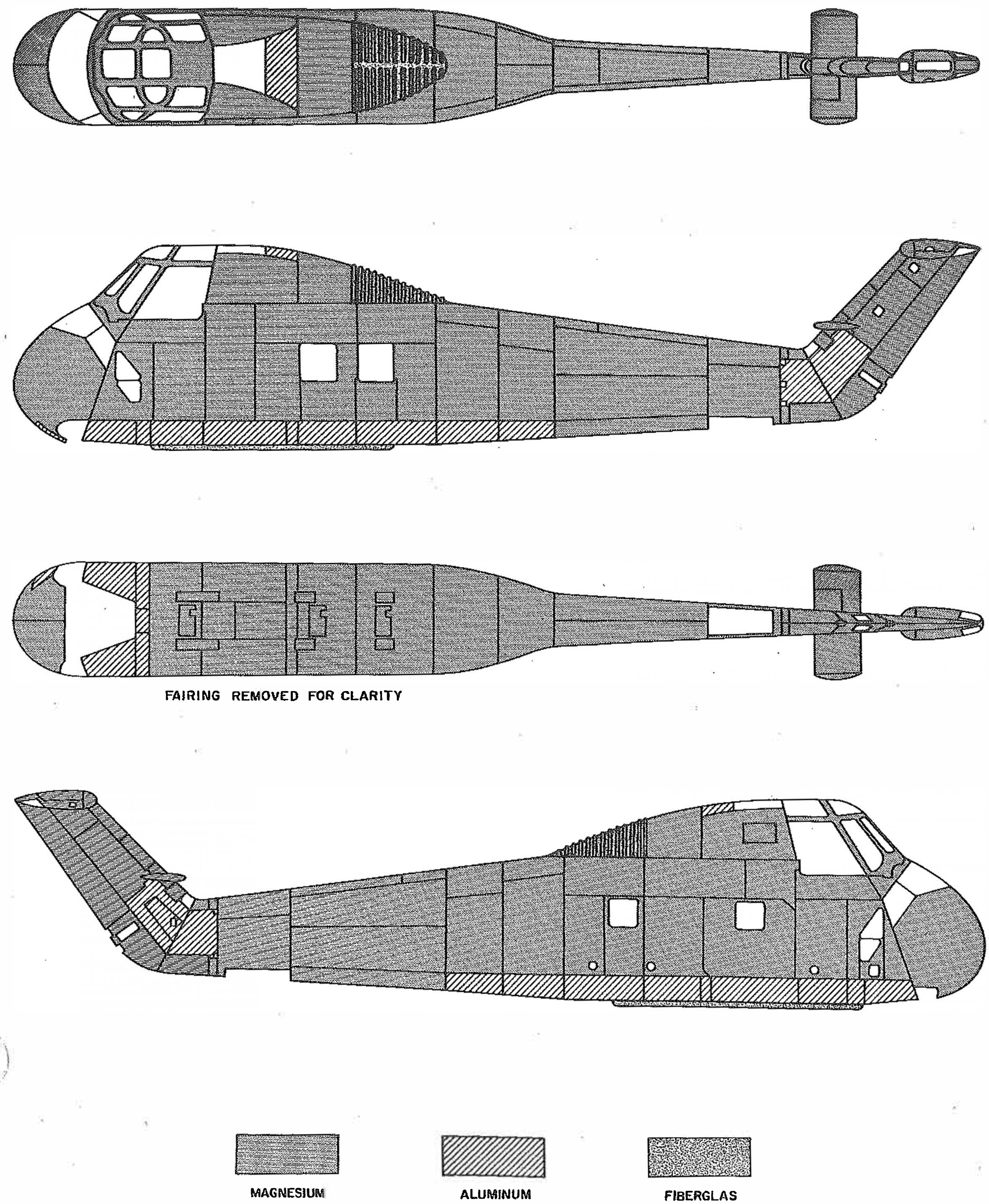


Figure 2—9. Skin Plating Diagram

b. Be sure all drain holes are kept open.

c. Remove all metal particles and foreign matter after repair in an area.

Note

Metal particles and other foreign matter may cause a dissimilar metals contact and thereby become a starting point for corrosion.

d. Never use steel wool, emery cloth or a wire brush to remove corrosion.

e. Always remove all welding flux from aluminum alloy as the flux is corrosive to aluminum. Scrub the flux away with hot water and a 10 percent sulfuric acid solution and then flush the area with clean fresh water.

2–119. PREVENTION OF CORROSION BY BATTERY ACID.

a. Neutralize spilled battery acid by using a solution of sodium bicarbonate (baking soda) (index 16, paragraph 1–32) or sodium borate (borax) (index 15, paragraph 1–32) and water. To prevent corrosion by the neutralizing agent, rinse the area after use with clean fresh water and dry thoroughly.

b. Paint all exposed surfaces within 12 inches of the battery with two coats of acid-resistant lacquer (index 17, paragraph 1–32).

2–120. INSULATION OF DISSIMILAR METALS AGAINST CORROSION. Prevent electrolytic corrosion between dissimilar metals by following the procedures outlined below.

a. Apply adhesive vinyl tape (index 30, paragraph 1–32) between any dissimilar metals. Extend the tape approximately 1/2-inch, but not less than 1/4-inch, beyond the joint edges. When the use of vinyl tape is impracticable, use 56S-F aluminum foil extending approximately 1/4-inch, but not less than 1/8-inch, beyond the joint edges.

CAUTION

Do not use any surface of the aircraft to back the tape for cutting purposes. Avoid scratching or marking structural materials.

b. Fill the joint areas which would retain water with a mixture composed of 100 parts by weight of sealer compound (index 31, paragraph 1–32) to 12 parts of accelerator (index 32, paragraph 1–32). (Refer to paragraphs 2–121 through 2–123.)

c. Coat contacting surfaces of magnesium to magnesium with Permatex (index 20, paragraph 1–32) in addition to zinc-chromate primer (index 10, paragraph 1–32).

d. Use 56S aluminum alloy washers under bolt heads and nuts which would otherwise contact magnesium. Paint the washers with zinc-chromate primer (index 10, paragraph 1–32).

Note

If 56S aluminum is not available, 52S or XC-56S alloy should be used for foil and washers.

e. Bevel the edges of magnesium sheets to minimize the edge effect of the finish lacquer at sharp corners.

2–121. USE OF SEALER COMPOUND TO PREVENT CORROSION.

2–122. DESCRIPTION. Sealer compound (index 31, paragraph 1–32) combined with accelerator (index 32, paragraph 1–32) is used to replace loose or missing sealer on exterior surfaces. The sealer fills seams and joints which might trap water, and prevents moisture from entering through exposed edges where vinyl tape does not extend. The sealer compound may be mixed to one of two consistencies depending upon the method of application desired. For the standard consistency for use with a putty knife or caulking gun, mix 100 parts by weight of sealer compound (index 31, paragraph 1–32) to 12 parts by weight of accelerator (index 32, paragraph 1–32). For brush coating consistency, add 40 parts by weight of Toluol (index 33, paragraph 1–32).

2–123. APPLICATION. Use sealer compound as follows:

Note

Be sure that seams and joints are clean and free from foreign matter.

a. Apply sealer with a brush, putty knife or similar tool.

CAUTION

Do not scratch the surface of the metal with the tool.

b. Force the sealer well down into the seams to eliminate any air pockets.

c. Brush or shape the sealer to give the joint or seam a smooth appearance.

2–124. SURFACE CORROSION TOUCH-UP TREATMENT — MAGNESIUM ALLOY.

CAUTION

Do not use steel wool, emery cloth or a wire brush on magnesium surfaces. Use a phenolic scraper or fiber brush to remove loose flakes of corrosion.

a. Wash the affected area with a solution of mild soap and fresh water. Rinse the area with clean water and wipe dry using a clean, soft, lintless cloth.

b. Use lacquer thinner (index 12, paragraph 1–32) on the damaged area to remove any grease and old paint.

c. Allow the thinner to evaporate.

d. Apply a chrome pickle solution (index 13, paragraph 1–32) and allow the solution to remain from one to two minutes.

CAUTION

Do not allow the chrome pickle solution to remain on the bare magnesium area more than two minutes as it will cause a chemical reaction and damage the magnesium.

e. Thoroughly wash the area where the solution was applied with a clean cloth soaked in clean fresh water.

f. After the area is dry, apply one coat of zinc-chromate primer (index 10, paragraph 1–32) to an exterior surface of the helicopter or two coats to an interior surface and allow the primer to dry for approximately 30 minutes.

g. On exterior surfaces, apply two coats of finish lacquer (indexes 11 and 37, paragraph 1–32) to match the original finish. If a corroded condition is corrected at the airframe step areas, on the inside of either nose door or at any transmission housing, refinish the step areas with walkway coating (index 35, paragraph 1–32) and coat the interior of the nose doors and the exterior of the transmission housing with heat resistant enamel (index 36, paragraph 1–32).

2–125. SURFACE CORROSION TOUCH-UP TREATMENT – ALUMINUM ALLOY.

CAUTION

Do not use steel wool, emery cloth or a wire brush cloth on aluminum surfaces. Use aluminum wool, a phenolic scraper or a fiber brush to remove loose flakes of corrosion.

a. Wash the affected area with a solution of mild soap and clean fresh water. Rinse the area with clean water and wipe dry with a clean, soft, lintless cloth.

b. Apply alodine (index 14, paragraph 1–32) liberally with a swab.

c. Allow the solution to remain on the surface for not less than three minutes and not more than five minutes.

Note

Avoid letting the alodine mixture dry on the surface. If it has dried, rewet the surface with alodine.

d. Rinse the alodized surface with clean water. After rinsing, wipe off excess moisture with a clean, lintless cloth. Air-blow any moisture from the joints or crevices and allow to dry completely in open air.

e. When the area is completely dry, apply two coats of zinc-chromate primer (index 10, paragraph 1–32), allowing approximately 30 minutes between each coat.

f. On an exterior surface of the helicopter, apply one coat of matching finish lacquer (indexes 11 and 37, paragraph 1–32). Wherever necessary, refinish the step areas of the airframe with walkway coating (index 35, paragraph 1–32).

2–126. LIMITED ANTI-CORROSION MEASURES. Use limited anti-corrosion measures outlined here only in cases where the proper materials or equipment are not available.

a. Examine the area in question for the extent of corrosion.

WARNING

If the area is corroded too far to withstand normal loads before the helicopter can reach a major overhaul base, structural repair will have to be performed on the area before the helicopter is cleared for flight.

b. Remove any loose paint and the powdery products of corrosion by scraping or brushing the area.

CAUTION

Use a sharp phenolic scraper or a heavy fiber brush to clean affected areas. Do not use steel wool, emery cloth, a wire brush or a sharp metal tool.

c. Wash off the areas with a mild soap and clean fresh water. Rinse thoroughly.

d. Dry the surface and paint it with two coats of zinc-chromate primer (index 10, paragraph 1–32).

e. Apply a finish coat of matching lacquer (indexes 11 and 37, paragraph 1–32), if available.

f. If none of the above protective coatings are available, apply a corrosion-preventive compound (index 4, paragraph 1–32) or apply any grease liberally to the affected areas.

2–127. MAINTENANCE OF PLASTIC SURFACES.

2–128. GENERAL. Transparent acrylic plastic surfaces are free of the effects of corrosion, but the surfaces are highly susceptible to scratches, optical distortion and crazing. Plastic surfaces, therefore, require preventive maintenance. Great care must be exercised in cleaning and maintaining plastic to avoid the destruction of its optical qualities. Transparent plastic should be cleaned only in the manner outlined in paragraphs 2—129 and 2—130.

CAUTION

Do not use the following materials on acrylic plastics: acetone, alcohol, aromatic naphtha, benzene, tetrachloride, de-icing fluids, fire extinguisher fluids, gasoline, hexane, kerosene, lacquer thinners, window cleaning sprays or other solvents. If these materials are used on the transparent plastic they will soften the plastic and cause crazing.

2—129. CLEANING EXTERIOR PLASTIC SURFACES.

a. Flush with plenty of water to soften the dirt. Use the bare hands gently to feel and dislodge any dirt.

b. Wash with mild soap and water. Be sure the water is free of dirt or other abrasives. A soft cloth, sponge or chamois may be used in washing, but only as means of carrying soapy water to the plastic. Go over the surface with the bare hand, so any dirt can be quickly detected and removed by flushing before it scratches the plastic surface. Apply any approved plastic cleaner.

c. After the plastic is clean, rinse thoroughly with water and dry with a clean, damp chamois.

d. Oil and grease may be removed by rubbing lightly with a cloth wet with aliphatic naphtha (index 22, paragraph 1—32) and then washing with soapy water and rinsing with clear water.

CAUTION

Do not confuse aliphatic naphtha (index 22, paragraph 1—32) with the more common aromatic naphtha. Aromatic naphtha is definitely harmful to plastics and should never be used.

WARNING

Aliphatic naphtha is extremely inflammable and precaution should be observed when using it to avoid the possibility of fires and explosions.

e. Do not rub the acrylic plastic with a dry cloth since this is not only likely to cause scratches, but also builds up an electrostatic charge which attracts dust particles to the surface. If the surface becomes charged, patting or gently blotting with a clean damp chamois will remove this charge as well as the dust.

f. If there is no water available for cleaning purposes, use a soft cloth bunched loosely in the hand and dust the surface of the plastic lightly to remove dirt.

g. If, after removing dirt and grease by either of the methods described, no great amount of scratches are visible, the plastic should be coated with Simonize, or an equivalent wax. The wax fills in the minor scratches and helps prevent further scratching. The wax should be applied in a thin, even coat with a soft cloth and brought to a high polish by rubbing lightly with another clean, soft, dry cloth. Do not rub too long in one place.

h. If, after removing dirt and grease, the plastic surface is found marred by small scratches, apply a suitable polish (index 23, paragraph 1—32) by hand, using a soft, clean cloth as an applicator and another soft, clean cloth to remove the polish. Several applications may be necessary to restore suitable clarity to the scratched area. Then apply wax as described in step g.

CAUTION

Do not attempt to polish or wax any plastic panels until the surfaces have been thoroughly cleaned. The presence of dirt, grit and sand during the waxing or polishing operations may cause serious damage to the transparent paneling.

2—130. CLEANING INTERIOR PLASTIC SURFACES.

Note

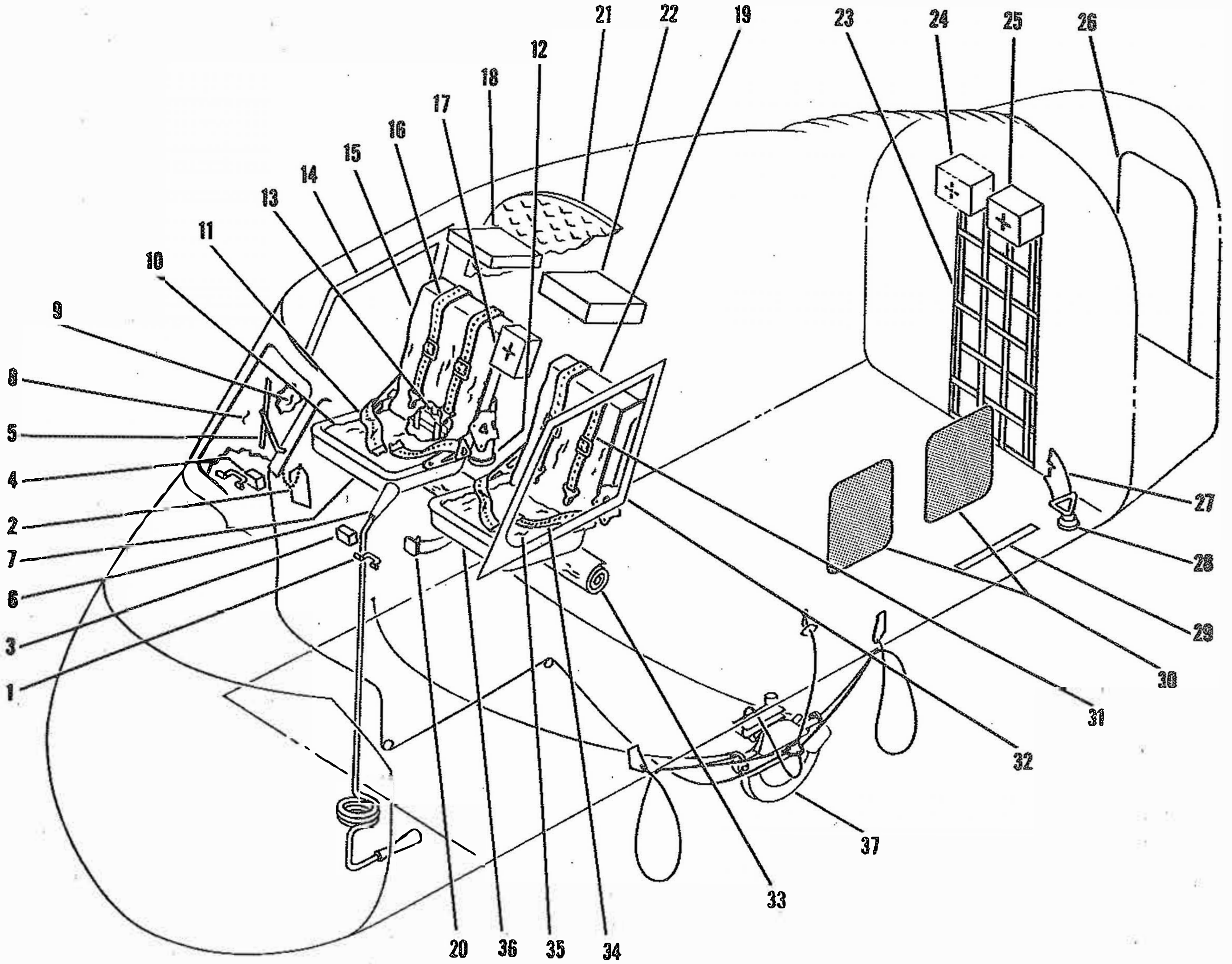
Use the external cleaning method whenever possible. Use the internal cleaning method only where water cannot be readily employed.

a. Dust the plastic surface lightly with a soft clean cloth. Do not wipe the surface with a dry cloth.

b. Wipe carefully with a soft, damp cloth or sponge. Keep the cloth or sponge free of grit by rinsing it frequently in clean water.

c. Apply wax as described in paragraph 2—129, step g.

2—131. HOT CLIMATE PRECAUTIONS FOR PLASTIC SURFACES. To prevent distortion of plastic panels in hot climates, it is recommended that doors and windows of the helicopter be opened slightly to permit free circulation of air through the cabin when the helicopter is parked under the direct rays of the sun. In general, sunlight has very little effect on acrylic plastics. Therefore, covers need not be used as a protective measure unless there is danger of sandstorms which will



1. Assist Handle
2. Pilot's Check List
3. Observer's Ash Tray
4. Pilot's Ash Tray
5. Windshield Wiper
6. Relief Tube
7. Pilot's Seat
8. Windshield
9. Tinted Panels (Blind Flying)
10. Pilot's Seat Cushion
11. Pilot's Safety Belt
12. Fire Extinguisher
13. Inertia Reel
14. Pilot's Sliding Window
15. Pilot's Back Cushion
16. Pilot's Shoulder Harness
17. First Aid Kit
18. Map Case and Flight Report Holder
19. Observer's Back Cushion
20. Air Safety Harness
21. Soundproofing
22. Data Case
23. Personnel Barrier
24. First Aid Kit Provisions
25. First Aid Kit
26. Seal
27. Cargo Tie-Down Belt
28. Cargo Tie-Down Fitting
29. Skid Rail
30. Black-Out Curtains
31. Observer's Shoulder Harness
32. Observer's Sliding Window
33. Anti-Glare Curtain (Rolled)
34. Observer's Safety Belt
35. Observer's Seat Cushion
36. Observer's Seat
37. Cargo Sling (Stowed)

Figure 2–10. Fuselage Equipment

cause abrasion of the plastic sheet or unless covers are required for camouflage purposes. In any case, covers should not be drawn tight over the enclosure since the pressure may distort the panels.

2–132. FURNISHINGS AND EQUIPMENT.

2–133. DESCRIPTION. *(See figure 2–10.)* Furnishings and equipment are provided on the helicopter for accommodation and safety of personnel, accommodation of cargo, protection of equipment, emergency warning, first aid, fire fighting, map and record stowage, black-out flying and training purposes. They are grouped under the following headings: personnel accommodations, furnishings, emergency equipment, and miscellaneous equipment.

2–134. PERSONNEL ACCOMMODATIONS.

2–135. DESCRIPTION. The following personnel accommodations and safety devices are provided: pilot's and observer's seats (7 and 36, figure 2–10), seat and back cushions (10, 15, 19 and 35), troop seats (figure 2–20), pilot's and observer's safety belts (11 and 34) and shoulder harnesses (16 and 31), inertia reels (13), troop safety belts (figure 2–11), personnel barrier (23, figure 2–10) and litters (figure 2–13).

2–136. PILOT'S AND OBSERVER'S SEATS.

2–137. DESCRIPTION. The pilot's and observer's seats (7 and 36, figure 2–10) are mounted on support fittings, or tracks, secured to the forward side of the transmission fitting bulkhead. Each seat can be folded up against the seat back to permit entry to the cockpit from the ladders installed on the cabin forward bulkhead. The seats are equipped with lap-type safety belts (11 and 34), cushions for the seats (10 and 35) and seat backs (15 and 19), shoulder harnesses (16 and 31) and bungee cords to aid in raising and lowering the seats. Each seat may be raised or lowered on the bulkhead support fittings by pulling up on the adjustment handle, located on the right side of the pilot's seat or the left side of the observer's seat, to disengage the seat lockpins from the support fittings. The action of a compression spring encircling each lockpin forces the pin into a new locking position when the handle is released.

2–138. REMOVAL.

Note

The instructions outlined in steps e. through g. may be accomplished before or after removal of the seats.

Note

The seat bucket may be removed separately, when removal of the entire seat assembly is unnecessary, by removing the bolts, washers and nuts from the fitting assembly on each side of the seat and sliding the seat bucket out from between the fittings.

a. Remove the inertia reel controls. (Refer to paragraph 2–145, steps a. and b.)

b. Unhook the bungee cords from each seat back support tube.

c. Hold up the seat back adjustment handle to free the lockpins from the support fitting. Slide each seat up and off the fittings.

d. Remove the inertia reels, controls and cables. (Refer to paragraph 2–145, steps h. through j.)

e. Remove the safety belts and shoulder harnesses. (Refer to paragraph 2–155.)

f. Unsnap and remove the seat and back cushions.

g. Remove the bolt, washer, spacer and nut that secures each bungee cord to the canted bulkhead. Remove each bungee cord.

2–139. INSTALLATION.

Note

Steps f. and g. may be performed before or after the seats are installed in the helicopter.

a. Install the inertia reels with the reel controls and attaching cables. (Refer to paragraph 2–146, steps a. and b.)

b. Secure the bungee cords to the canted bulkhead with the bolts, washers, spacers and nuts.

c. Position each seat at the canted bulkhead and hook the bungee cords to the seat back support tube.

d. Hold the seat back adjustment handle up in the unlocked position. At the seat back fitting, slide the seat down and onto the bulkhead support fittings. Lock the handle at a convenient seat height.

e. Install the reel controls. (Refer to paragraph 2–146, steps h., i. and j.)

f. Install and snap-fasten the seat and back cushions in place.

g. Install the safety bolts and shoulder harnesses. (Refer to paragraph 2–156.)

2–140. TESTING. With the seat in the full up position and the release handle actuated, a force of 180 to 185 pounds applied to the center of the seat should move the seat free of the full up position.

2–141. PILOT'S AND OBSERVER'S SEAT AND BACK CUSHIONS.

2–142. DESCRIPTION. Seat and back cushions (10, 15, 19 and 35, figure 2–10) are provided for both the pilot's and observer's seats in the cockpit. The seat and back cushions (10, 15, 19 and 35) are snap-fastened around the seat bucket tubing and to the seat backs.

2–143. INERTIA REELS.

2–144. DESCRIPTION. *(See 13, figure 2–10.)* Inertia reel assemblies are provided for the pilot's and observer's seats. Each assembly includes a reel, a reel control and a control cable. The control, located on the left side of each seat, actuates the reel on the back of the seat through the control cable. The reel cable attaches to the shoulder harness and locks automatically or manually at each ½-inch of extension. The control has two positions, manual and automatic. In the automatic, or aft, position the reel cable is free to extend and permit the occupant of the seat to lean forward. In emergencies, a force of 2 or 3 g's will automatically lock the reel and the reel will take up slack if the cable is extended. When the reel is locked in this manner, it remains locked until the control lever is placed in the manual lock, or forward, position and then returned to the aft position. The manual, or forward, control position, in which the occupant of the seat is prevented from being thrown forward, should be used only when a crash landing is anticipated. During normal flight the control should be in the automatic position.

2—145. REMOVAL.

a. Free the observer's inertia reel control from the bracket on the frame to the left of the seat by removing the screws. Tape the reel control to the seat.

b. Free the pilot's reel control from the fitting on the main drive shaft tunnel by removing the screws, washers and nuts. Remove the fitting from the tunnel by removing the bolts and washers. Remove the fitting. Tape the reel control and fitting to the seat.

c. Remove the pilot's and observer's seats. (Refer to paragraph 2—138, steps b. and c.)

d. Place the control handle in the automatic position.

e. Back off the nut at each end of the control cable until it is clear of the case on the control and the reel.

f. Lift the end of the cable from the socket of the shaft inside each case and remove the cable.

g. Remove the horseshoe washer from each groove of the control cable and slide each nut off the cable.

h. Disconnect the shoulder harness fitting from the link on the reel cable.

i. Remove the bolt, washers and nut that secure the link to the fitting on the end of the reel cable. Remove the link.

j. Remove the bolts, washers and nuts that secure the reel to the rear of each seat support. Remove the reel.

2—146. INSTALLATION.

a. Secure the reel to the rear of each seat support with the bolts, washers and nuts.

b. Secure the link to the fitting on the end of the reel cable with the bolt, washers and nut.

c. Connect the shoulder harness fitting to the link on the reel cable.

d. Place the control handle in the automatic position.

e. Slide each nut over the ends of the control cable and place the horseshoe washers in each groove of the control cable.

f. Place each end of the control cable in the socket of the inner shaft of the control case and the reel case.

Note

The ends of the cable must seat in the shaft in order to have the control cable function properly.

g. Slide each nut onto the thread of each case and tighten the nuts.

CAUTION

Do not tighten the control cable nuts with more than 30 inch-pounds of torque.

h. Install the pilot's and observer's seats. (Refer to paragraph 2—139, steps b. through d.)

i. Secure the pilot's reel control fitting to the main drive shaft tunnel with the bolts and washers.

j. Secure the pilot's reel control at the fitting with the screws, washers and nuts.

k. Secure the observer's reel control to the bracket on the cockpit frame with the screws.

2—147. TROOP SEATS.

2—148. DESCRIPTION. *(See figures 2—11 and 2—12.)* Nylon wall-type troop seats are installed in the cabin to accommodate twelve passengers. A three-passenger seat and a two-passenger seat are installed against the right cabin wall and two three-passenger seats and a single seat are installed against the left cabin wall. Hooks installed at the top of each seat back secure the seat back to a support tube mounted near the top of the cabin wall. Safety belts for each passenger are attached to eyebolt rings bolted to the rear tube of each seat. Straps are provided for securing the seats in a folded position against the cabin wall or the seats may be removed and rolled for more permanent stowage. The aft section of the divided two-passenger seat extends into the cargo door opening and may be folded forward over the forward section of the seat to provide clearance for use of the cargo door. The back of the aft three-passenger seat on the left wall covers the emergency escape hatches. This seat back may be quickly removed by pulling the upper tube inboard from the cabin wall which releases the tube from spring-loaded friction catches and permits the seat back to drop down and away from the escape hatch area.

2—149. FOLDING AND ROLLING TROOP SEATS. *(See figure 2—12.)*

a. Press in the ears on the lower end of the legs and release the legs from the tie-down fittings (18, figure 2—11) in the floor.

b. Fold each leg up parallel to the front tube of the seat.

c. Swing the seat up against the side of the helicopter and fasten the straps under the seat to the upper tube of the seat.

Note

For permanent stowage, roll the seats according to the following steps:

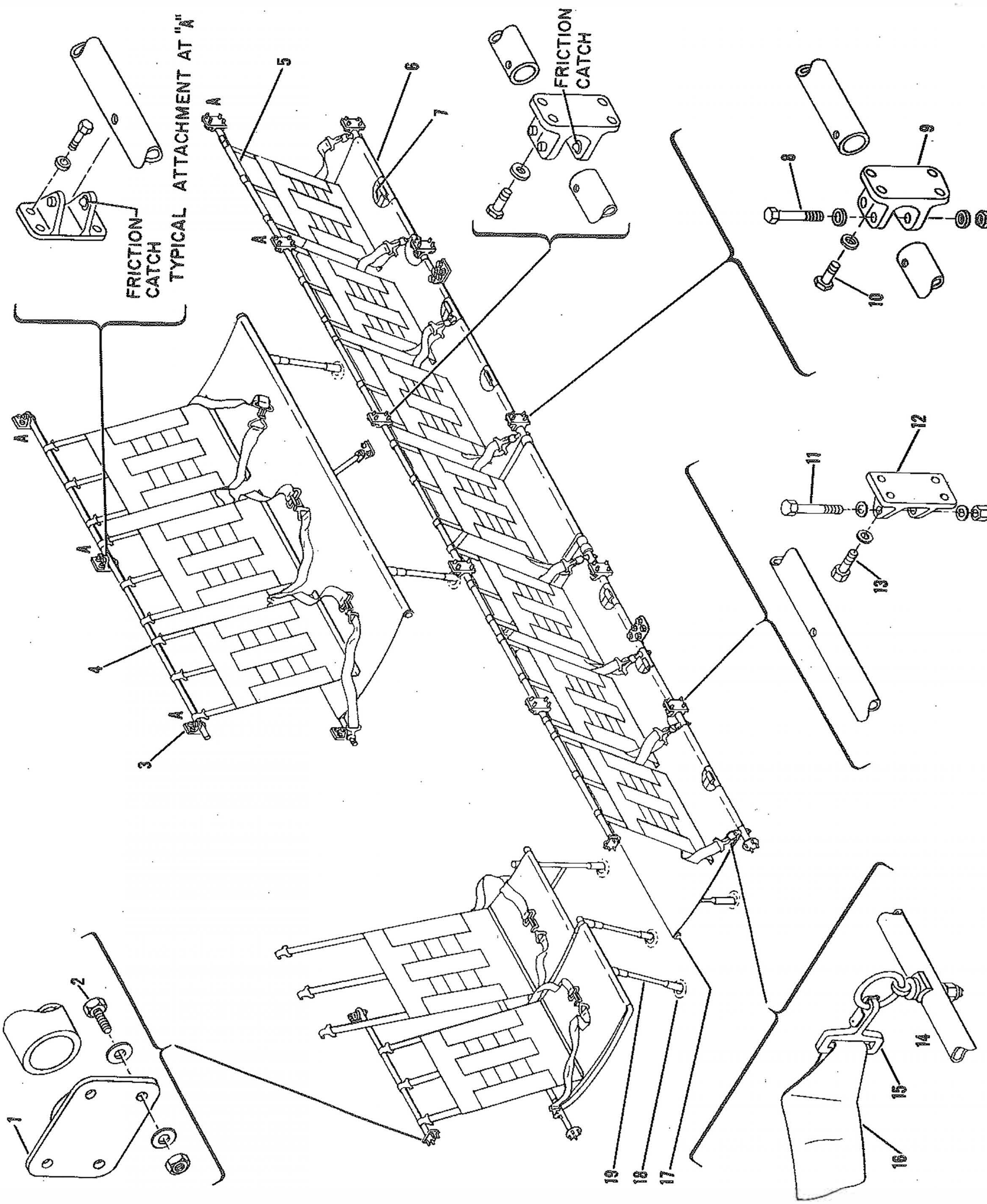


Figure 2-11. Troop Seats

Key to Figure 2—11

1. Support Fitting
2. Bolt, Washers
3. Support Fitting
4. Hook
5. Back Support Tube
6. Rear Seat Tube
7. Spreaders
8. Bolt, Washers, Nut
9. Support Fitting
10. Bolt, Washers
11. Bolt, Washers, Nut
12. Support Fitting
13. Bolt, Washers
14. Seat Rear Support Tube
15. Eyebolt
16. Safety Belt
17. Seat Front Support Tube
18. Tie-Down Fitting
19. Support Leg

d. Release the folding strap from the upper tube and free the spreaders from the rear tubes. Fold the spreaders parallel with the folded legs.

e. Unhook the webbed seat back from the upper tube.

f. Roll up the seat and back and secure the roll, with the stowage straps, to the rear tubes.

2—150. UNFOLDING AND UNROLLING TROOP SEATS.

a. Unfasten the straps from the rear tube of the seat and unroll the seat and back.

b. Unfold the spreaders and position them against the rear tube.

c. Unfold the legs and secure them in the tie-down fittings.

d. Secure the seat back hooks on the upper tube.

2—151. REMOVAL.

a. Press in the ears on the lower end of each support leg (19, figure 2—11) cuff and raise the legs from the tie-down fitings (18) on the cabin floor. Fold the legs (19) and spreaders (7) parallel to the seat front support tubes (17).

b. Unhook the safety belts (16) from the eyebolts (15) on the seat rear tubes (14) and remove the belts.

c. Remove the bolts, washers and nuts (8 and 11) which secure the seat rear tubes (6) to the fittings (9 and 12) along the cabin walls.

d. Release the back strap hooks (4) from the back support tubes (5) and remove the troop seats from the helicopter.

e. Remove the back support tube (5) from the fittings (3) on the cabin walls.

Note

At points where friction catches are installed as shown in figure 2—11, pull the back support tube out of the friction catches in the fittings and remove the support tubes.

f. Remove the bolts and washers that attach the back support tube fittings (3) to the cabin walls; remove the fittings.

Note

At this point, the litters may be installed by installing the required supports. The supports for the second highest litter poles pick up the same attaching holes as the troop seat back tube fittings. Removal of the other troop seat fittings is not necessary in order to change to the litter installation.

g. Remove the remaining bolts and washers (2, 10 and 13) which secure the support fittings (1, 3, 9 and 12) to the cabin walls and bulkheads; remove the fittings.

2—152. INSTALLATION.

a. Position the support fittings (1, 3, 9 and 12, figure 2—11) on the cabin walls and bulkheads and install the bolts and washers (2, 10 and 13).

b. Position the seat back tube (5) in the fittings (1 and 3) and install the bolts, washers and nuts.

Note

At points where friction catches are installed as shown in figure 2—11, press the back support tube into the friction catches in the fittings.

c. Slide the seat rear tubes (6) into the double thickness of material at the rear of the seat and position the

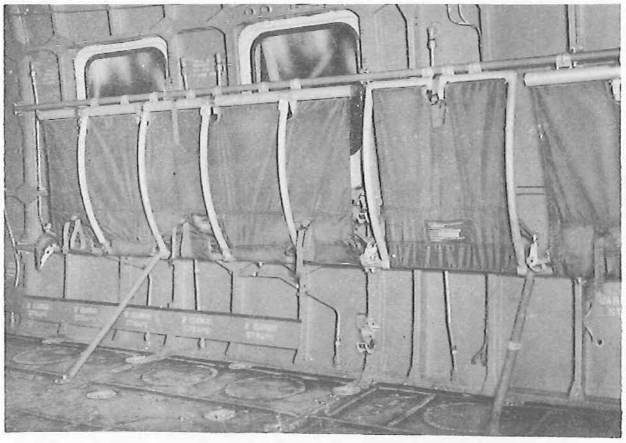


Figure 2—12. Troop Seats Folded

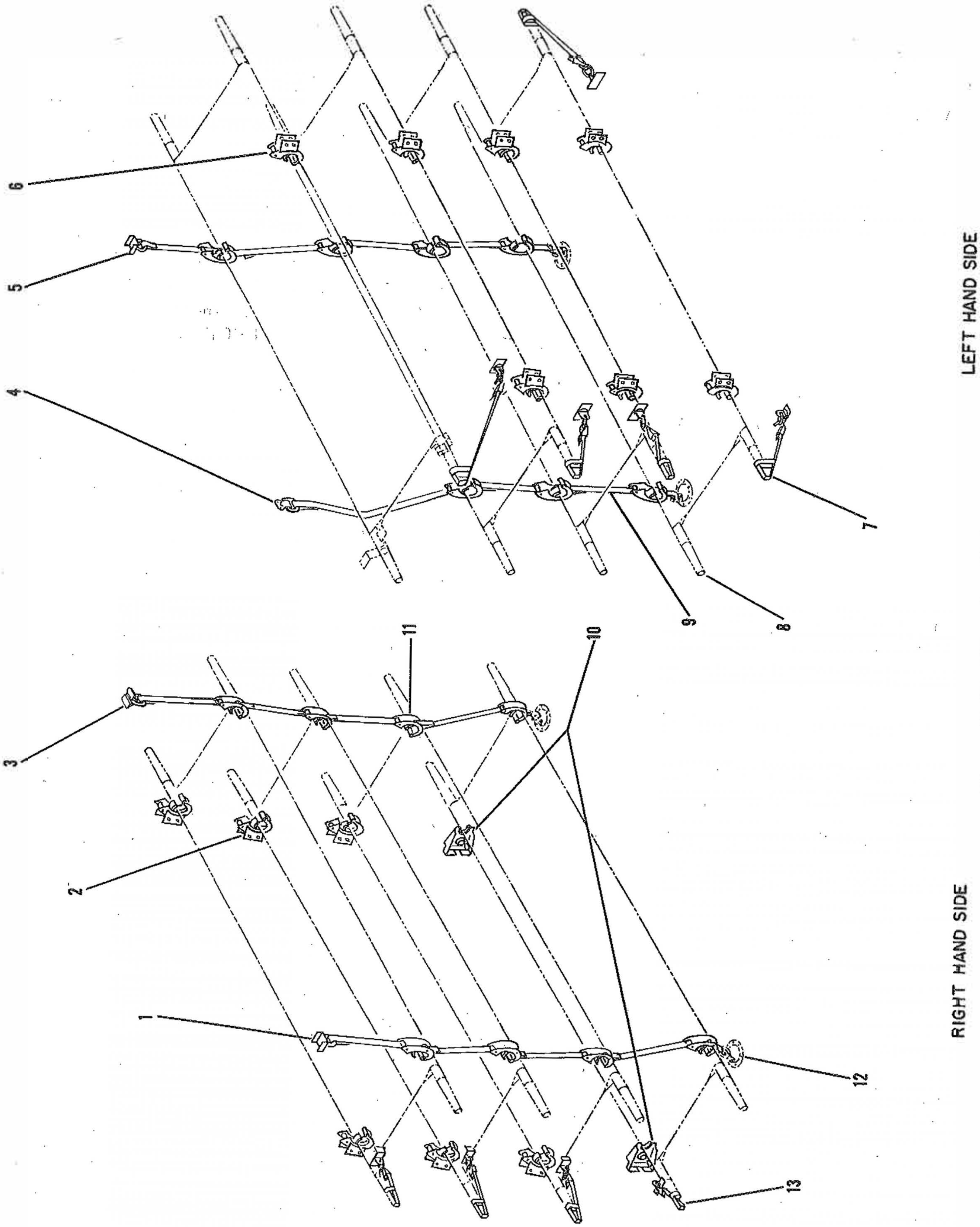


Figure 2—13. Litters Installation

Key to Figure 2—13

1. Fitting
2. Support
3. Eyebolt and Ring
4. Fitting
5. Fitting
6. Support
7. Retaining Cap
8. Litter Pole
9. Strap Assembly
10. Litter Stops
11. Support
12. Cargo Tie-Down Ring
13. Retaining Cap

tube in the support fittings (9 and 12); install the bolts, washers and nuts (8 and 11).

d. Unfold the spreaders (7) and position them on the seat rear tube (6); unfold the leg assemblies (19) and swing them down into a vertical position; secure the legs in the tie-down fittings (18) on the cabin floor.

e. Secure the back hooks (4) on the back support tube (5).

2—153. PILOT'S AND OBSERVER'S SAFETY BELTS AND SHOULDER HARNESSES.

2—154. DESCRIPTION. *(See figure 2—10.)* Lap-type safety belts (11 and 34) and shoulder harnesses (16 and 31) are installed on the pilot's and observer's seats in the cockpit. The safety belts are secured at the rear of the seat bottom pans and are adjustable in length. The shoulder harnesses are attached to the inertia reel behind each seat, extend forward and down over the backs of the seats, and are fastened to the safety belts. When not in use, the safety belts are stowed by hanging each loose end on the S-hooks at the upper end of the bungee cords.

2—155. REMOVAL.

a. Disconnect each shoulder harness from the inertia reel at the rear of the seat by removing the bolt, washers and nut attaching the harness fitting to the link on the cable. Remove the harness straps.

b. Remove the lap-type safety belts from the seat gussets.

Note

The safety belts are stowed when not in use by hanging each loose end on the S-hooks at the upper end of the bungee cords.

2—156. INSTALLATION.

a. Install the lap-type safety belts.

b. Connect each shoulder harness fitting to the reel link on the inertia reel cable on the back of each seat by installing the bolt, washers and nut.

2—157. TROOP SEAT SAFETY BELTS.

2—158. DESCRIPTION. Lap-type safety belts (16, figure 2—11) are provided on each troop seat. A hook on the end of each safety belt is snap-locked to an eyebolt ring secured to the troop seat rear tube.

2—159. REMOVAL. Unsnap the hook at the end of each safety belt and remove it from the seat rear tube.

2—160. INSTALLATION. Snap the hook at the end of a safety belt over the seat rear tube on each side of each of the twelve troop seats.

2—161. CABIN DOOR AIR SAFETY HARNESS.

2—162. DESCRIPTION. An air safety harness (20, figure 2—10) may be installed across the cabin door opening on the right side of the cabin. It is snap-hooked to eyebolts and rings mounted on the cabin wall structure at each side of the opening.

2—163. PERSONNEL BARRIER.

2—164. DESCRIPTION. A personnel barrier (23, figure 2—10) is installed in the opening in the cabin rear bulkhead to prevent personnel from entering the electronics compartment. The barrier consists primarily of a strap assembly suspended from a tube. The tube is secured at the top of the opening by an electrically operated solenoid mounted on the bulkhead. The strap assembly contains six horizontal and four vertical straps. A channel nut on each end of each horizontal strap slides in a channel secured to the bulkhead. The lower end of each outboard vertical strap is secured to the bulkhead. When not in use, the barrier is folded down against the floor. The barrier is placed in position by pulling it up to the top of the opening and engaging the plate on the tube with the solenoid. The plate is released from the solenoid by operating the "ELECT COMPT BARRIER — REL" switch located on the overhead control panel in the cockpit. To remove the barrier, remove the screw, washers and nut from the lower end of each outboard vertical strap, release the plate from the solenoid and work the channel nuts up and out of the channels.

2—165. LITTERS.

2—166. DESCRIPTION. *(See figure 2—13.)* Provisions are made for the installation of eight pole-type litters in the cabin, four against each cabin wall. These provisions consist primarily of supports mounted on the cabin walls, strap assemblies secured to fittings on the ceiling and floor and litter retaining caps which are attached to intercostal supports on the cabin walls. The inboard litter poles are supported and secured by the clamp supports on the strap assemblies. The outboard litter poles are secured in the supports mounted on the cabin walls. The forward end of the outboard litter poles fit into the litter retaining caps to prevent forward motion.

When not in use, the litter strap assemblies are stowed on the right side of the cabin at floor level.

2—167. REMOVAL.

a. Release the straps and remove the litter retaining caps (7 and 13, figure 2—13) from the forward end of the outboard litter poles (9) and the aft end of the lower outboard pole on the right side of the cabin.

b. Remove the litters by releasing the supports (2 and 6) on the cabin walls and the strap assemblies (9). The lower outboard pole of the right-hand bank of litters must be moved forward out of the retaining cap.

c. Open the slides and remove the straps (9) from the fittings (1, 3, 4 and 5) at the cabin ceiling.

d. Release the straps (9) from the cargo tie-down fittings (12) in the cabin floor.

e. Slide the cabin wall supports (2) which secure the second highest litter poles out of the channels and remove the bolts, washers and nuts that secure the channels to the walls.

Note

At this point, the troop seats may be installed by installing the required fittings. The upper support fittings for the troop seats pick up the same mounting holes as the litter supports that have been removed. Removal of the other litter fittings is not necessary in order to change to the troop seat installation.

f. Unbolt and remove the eyebolts and rings to which the retaining cap straps are attached and remove the caps and eyebolts.

g. Remove the bolts, washers and nuts that secure the stop assemblies (10) to the cabin walls and remove the stops.

h. Unbolt and remove the support fittings (1, 4 and 5) and eyebolts and rings (3) from the cabin ceiling.

i. Slide the remaining cabin wall supports (6) out of the channels and remove the screws, washers and nuts that secure the channels to the walls.

2—168. INSTALLATION.

a. Position the fittings (1, 4 and 5, figure 2—13) and eyebolts (3) on the cabin ceiling and install the bolts, washers and nuts.

b. Position the cabin wall support channels and install the screws, washers and nuts; slide the supports (2 and 6) into the channels.

c. Install the outboard strap assemblies (9), and fasten them to the ceiling fittings (1, 4 and 5) and eyebolt rings (3) and to the cargo tie-down rings (12) in the cabin floor.

d. Position the stop assemblies (10) on the cabin walls and install the bolts, washers and nuts.

Note

When installing the stop assemblies, make certain that the fillers are installed between the aft stop and the cabin wall.

e. Install the retaining cap, eyebolts and rings and tighten the washers and nuts.

f. Attach the retaining cap to the eyebolts.

g. Install the litter poles (8) in the supports (2, 6 and 11) and tighten the support fittings.

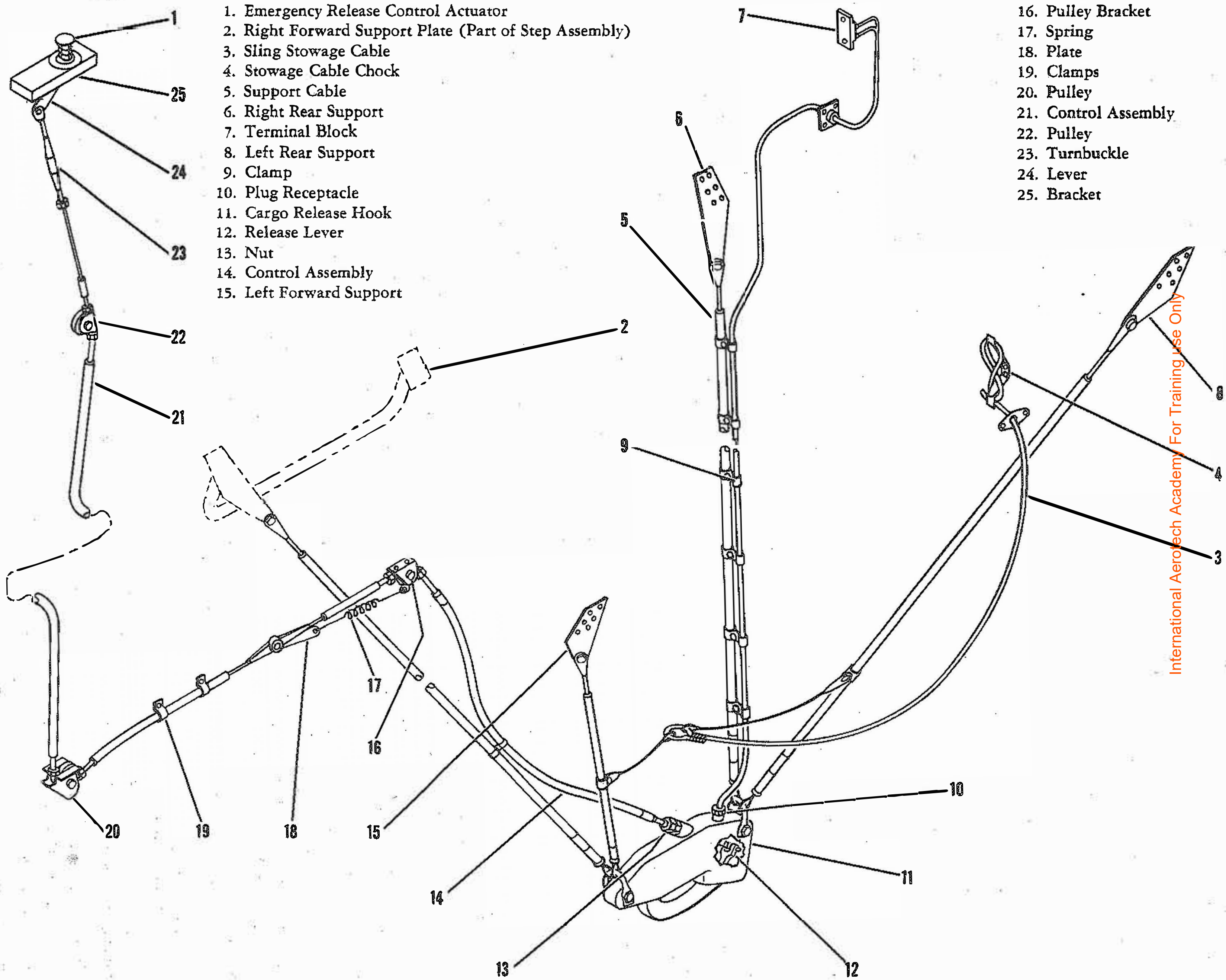
h. Install the retaining caps (7 and 13) on the litter poles (8) and tighten the straps to prevent the litters from shifting forward and aft.

2—169. FURNISHINGS.

2—170. DESCRIPTION. Furnishings are provided for the helicopter as follows: an external cargo sling in addition to the cargo space inside; protective covers for each external opening to keep foreign matter out of the transmission and engine sections while the helicopter is inactive; soundproofing installed in the cockpit on the canted bulkhead, over the main drive shaft tunnel and extension, on the cabin ceiling under the transmission deck and on the aft side of the transmission fitting bulkhead.

2—171. CARGO SLING INSTALLATION.

2—172. DESCRIPTION. *(See figure 2—14.)* An external cargo sling, designed to carry loads up to 4000 pounds, is provided for the helicopter. The sling consists of four cables suspended from mounting supports on the fuselage bottom structure, a cargo release hook suspended from the four cables, a mechanical emergency release control actuator, electrical control wiring and sling stowage provisions. The cargo release hook must be closed manually, but may be opened either electrically or mechanically. Opening the hook electrically may be accomplished automatically or by means of the "CARGO RELEASE" switch on either the pilot's or observer's cyclic control. The primary electrical control for the hook is the three-position "MASTER CARGO SLING-SAFE-AUTO" switch on the overhead control panel. To lock the hook in the closed position, the switch is placed in the "SAFE" position. To release cargo by means of the "CARGO RELEASE" switches, the "MASTER" switch is placed in the "CARGO SLING" position. To release cargo automatically, the switch is place in the "AUTO" position. The hook will then discharge cargo weighing 120 pounds or more upon contact with the ground. For loads under 120 pounds, the "CARGO RELEASE" switch must be used. The emergency release control actuator is located on the cockpit floor to the right of the pilot and is used only in an emergency. Pressing the mechanical actuator with the



1. Emergency Release Control Actuator
2. Right Forward Support Plate (Part of Step Assembly)
3. Sling Stowage Cable
4. Stowage Cable Chock
5. Support Cable
6. Right Rear Support
7. Terminal Block
8. Left Rear Support
9. Clamp
10. Plug Receptacle
11. Cargo Release Hook
12. Release Lever
13. Nut
14. Control Assembly
15. Left Forward Support
16. Pulley Bracket
17. Spring
18. Plate
19. Clamps
20. Pulley
21. Control Assembly
22. Pulley
23. Turnbuckle
24. Lever
25. Bracket

Figure 2—14. Cargo Sling Installation

foot will open the hook regardless of the position of the "MASTER" switch. The cargo sling is stowed from inside the helicopter by pulling the hook up under the left side of the helicopter with the sling stowage cable and securing the cable to the chock on the cabin wall. Power for the cargo sling control is taken from the primary bus on the overhead control panel.

Note

The cargo sling should be stowed at all times except when actually in use.

2—173. REMOVAL.

a. Remove the clutch access door. (Refer to paragraph 2—19.)

b. From inside the clutch compartment remove the screws, washers and nuts that secure the guide fitting to the bracket (25, figure 2—14) on the right-hand side of the cockpit floor.

c. Remove the bolt, washers, nut and cotter pin that positions the forked end fitting of the tube on the lever (24) of the actuator (1). Remove the screw, washers and nut from the forked end fitting.

d. Remove the bolt, washers, nut and cotter pin attaching the control assembly turnbuckle (23) to the lever (24).

e. Remove the bolt, washers, nut and cotter pin that holds the lever (24) between the left- and right-hand brackets which extend downward from the bracket (25). Remove the lever.

f. Remove the screws, washers and nuts that secure the left- and right-hand brackets to the cockpit floor and bracket (25). Remove the brackets.

g. From inside the cockpit, remove the tube, spring, spacer and guide fitting from the cockpit floor and bracket (25).

h. Back off the control assembly nut from the pulley (22) located on the cabin forward bulkhead. Remove the bolt, washers, nut and cotter pin that secures the pulley (22) to the bracket and remove the pulley. Remove the screws, washers and nuts that secure the clamps and control assembly to the cabin forward bulkhead.

i. Remove the grommet from the floor. Open the fuel selector valve and strainer door and back off the nut attaching the control assembly to the pulley (20) located on the underside of the helicopter.

j. Remove the bolt, washers, nut and cotter pin that secure the pulley (20) in the bracket and remove the pulley from the bracket.

k. Remove the screws and washers from the control assembly clamps (19) beneath the helicopter and remove the clamps.

l. Disconnect the tension spring (17) from the plate (18) and pulley bracket (16). Remove the nut and bolt that secure the terminals of the two control assemblies together; remove the control assembly (21) and plate (18).

m. Remove the bolt, washers, nut and cotter pin that secures the pulley in the bracket (16). Remove the pulley from the bracket.

n. Remove the cable attaching access door in the aft end of the cargo release hook (11) by removing the screws and lock washers.

o. Remove the cotter pin from the release lever (12) inside the access hole and release the ball-swaged cable end of the control assembly from the forked end of the lever.

p. Unscrew the control assembly nut (13) at the top of the hook and pull the cable of the control assembly (14) out of the hook (11). Remove the control assembly.

q. Disconnect the plug from the receptacle (10) on the hook (11) and remove the clamps (9) that secure the wiring to the right, rear support cable.

Note

On helicopters bearing USAF Serial Nos 53-4492 and subsequent, remove the adapter from the hook.

r. From inside the cabin, disconnect the wiring at the terminal block above the opening where the wiring enters the cabin.

s. Remove the clamps that secure the wiring to the cabin wall and remove the grommet from the floor.

t. Remove the screws, washers and lock washers that secure the junction shell to the fuselage on the outside of the helicopter.

u. Pull the wiring out from the helicopter and slide the junction shell and gasket off the wiring.

v. Remove the bolts and washers that secure the front left and two rear supports (6, 8 and 15) to the sides of the fuselage and remove the supports with the cables attached.

w. Remove the bolts and washers that secure the step assembly (2) to the fuselage below the cargo door opening on the right side of the helicopter. Remove the step assembly with the right support cable attached.

x. Remove the bolt, washer and nut that secures each support cable terminal to each support. Remove the support cables from the front left and two rear supports and the step assembly (2).

Note

The front right support plate (2) is part of a step assembly and is not removable.

y. To remove the cargo release hook (11) from the support cables, remove the bolt, washer, nut and cotter pin that secures the shackle to each end of the hook. Remove the shackles from the support cables.

Note

The shackles are part of the hook and should be kept with the hook.

z. Disconnect the clamps and terminals of the stowage cable (3) from the two left support cables by removing the screws, washers and nuts. Release the upper end of the stowage cable from the chock inside the cabin and pull the cable out of the helicopter.

aa. Release the fasteners and hinge down the cockpit dome light panel. Disconnect the wiring from the cargo sling release relay (8, figure 7–9) and remove the screws and washers. Remove the relay.

2–174. INSTALLATION.

a. Install the cargo sling release relay (8, figure 7–9) above the cockpit dome light panel and secure it with the screws and washers. Connect the wiring to the relay. Hinge up the panel and secure it with the fasteners.

b. Slide the thimbled ends of the support cables over the shackles and secure a shackle on each end of the hook with the bolt, washer, nut and cotter pin.

c. Secure the terminal of a support cable (5) to each of the mounting supports (6, 8 and 15) and to the support welded to the step assembly (2) with the bolts, washers and nuts.

CAUTION

Install each bolt with the head inboard.

d. Position the front left and two rear supports (6, 8 and 15), with the cables attached, on the sides of the helicopter and install the bolts and washers. Position the step assembly (2), with the cable attached, on the fuselage below the cargo door opening on the right side of the helicopter and install the bolts and washers.

CAUTION

Check to see that the bolt that secures each cable to a support or to the step assembly is installed with the head inboard.

Note

Install the hook and attaching support cables with the tongue facing aft.

e. Connect the clamps and terminals of the stowage cable (3) to the two left support cables with the screws, washers and nuts. Feed the stowage cable through the fair-lead in the fuselage and secure it to the chock inside the cabin.

f. Position the junction shell and gasket on the wiring. Feed the upper end of the wiring through the opening in the fuselage adjacent to the right, rear support fitting. Install the grommet in the cabin floor.

g. Connect the wiring to the terminal block (7) above the opening where the wiring enters the cabin. Clamp the wiring to the cabin wall.

h. Secure the junction shell and gasket to the fuselage with the screws, washers and lock washers.

i. Connect the plug to the receptacle (10) on the hook (11) and clamp the wiring to the right rear support cable.

CAUTION

Leave sufficient slack to allow for cable stretch under load conditions.

Note

On helicopters bearing USAF Serial Nos 53-4492 and subsequent, install the adapter.

j. Install the lower control assembly (14) on the pulley and tighten the nuts on each end of the pulley. Position and secure the pulley in the bracket (16) aft of the main landing gear beneath the helicopter with the bolt, washers, nut and cotter pin. Install the cotter pin through the two sections of the pulley to lock it in position.

Note

Do not overtighten the nut. The pulley must rotate freely.

k. Feed the ball-swaged end of the control assembly (14) through the fitting at the top of the cargo release hook and insert the cable end through the fork in the release lever (12). Install the cotter pin in the lever.

Note

Make sure the ball-swaged end of the cable is seated in the cavity in the lever (12).

l. Install the cable attaching access door with the screws and lock washers.

m. Screw the nut (13) on the control assembly (14) into the fitting at the top of the cargo release hook.

n. Position the control assemblies at the bottom of the helicopter and connect the two control assembly terminals and the plate (18) with the bolt and nut.

o. Clamp the control assembly (21) in place with the clamps (19) and install the pulley (20) in the bracket on the bottom of the helicopter with the bolt, washers, nut and cotter pin. Connect the control assembly to the pulley and attach the spring (17) to the plate (18) and pulley bracket (16).

Note

Do not overtighten the nut. The pulley must rotate freely.

p. Connect the control assembly to the pulley assembly. Pull the control assembly up through the hole in the floor and insert the grommet.

q. Position the pulley (22), located on the upper end of the control assembly (21), in the bracket on the cabin forward bulkhead and secure it in place with the bolt, washers, nut and cotter pin.

Note

Do not overtighten the nut. The pulley must rotate freely.

r. Clamp the control assembly to the bulkhead with the screws, washers and nuts.

s. Secure the guide fitting to the bracket (25) on the right-hand side of the cockpit floor with the screws, washers and nuts.

Note

Lubricate the inside surface of the fitting with graphite grease (index 24, paragraph 1—32).

t. From inside the cockpit, position the tube, spring and spacer on the guide fitting.

u. Secure the left- and right-hand brackets to the cockpit floor and bracket (25, figure 7—9) with the screws, washers and nuts.

v. Position the lever (24) between the left- and right-hand brackets and install the bolt, washers, nut and cotter pin.

Note

Place a washer on each side of the lever for centering purposes.

Note

Do not tighten the nut. The lever must rotate freely.

w. Attach the control assembly turnbuckle (23) to the lever (24) with the bolt, washers, nut and cotter pin.

x. Secure the forked end fitting of the tube to the lever (24) with the bolt, washers, nut and cotter pin. Install the screw, washers and nut on the forked end fairing.

Note

Install enough washers on each side of the forked end fitting to build up a dimension of 0.875 inch between the outside edges of the outermost washers. Do not overtighten the nut.

y. Lockwire the turnbuckle.

Note

The release cable should be rigged slack when the hook release lever is in the normal position.

z. Replace the clutch access door in the forward cabin bulkhead.

Note

The cargo sling should be stowed at all times except when actually in use.

2—175. PROTECTIVE COVERS. See figure 2—15 for the location of the protective covers. See table V for the method of installation.

2—176. SOUNDPROOFING.

2—177. DESCRIPTION. The soundproofing (21, figure 2—10) consists of a cloth and spun-glass quilted blanket installation which deadens engine and transmission noise in the cockpit and cabin. In the cockpit, the blanket is snap-fastened to the forward side of the canted bulkhead and cemented to the auxiliary servo and mixer covers and the drive shaft tunnel. In the cabin, it is snap-fastened to the ceiling under the transmission deck, to the aft side of the transmission fitting bulkhead and to the drive shaft tunnel extension. It is cemented to the oil drain cover in the ceiling.

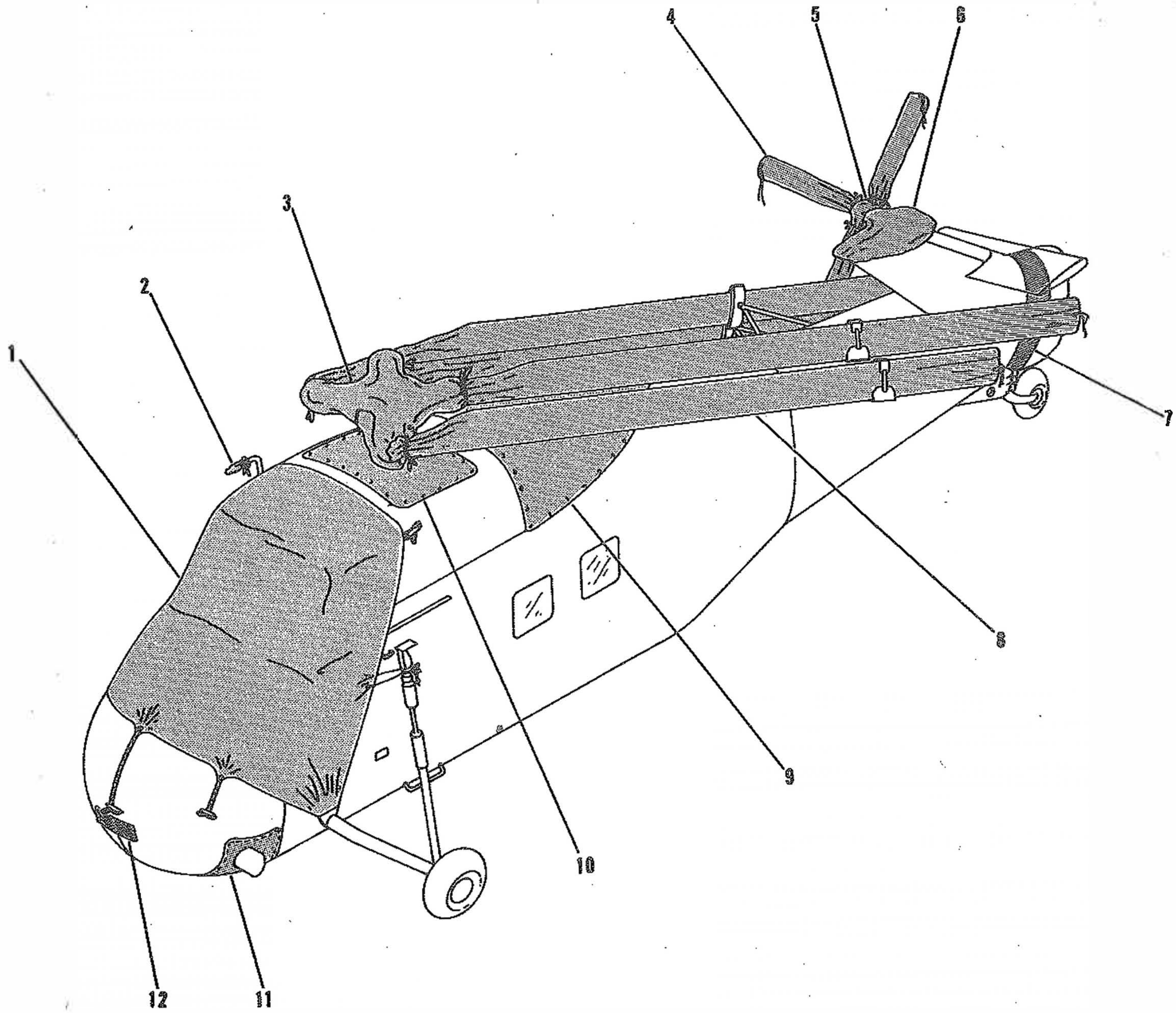
2—178. EMERGENCY EQUIPMENT.

2—179. DESCRIPTION. The equipment provided in the helicopter for emergency use includes first aid kits, fire extinguisher, fire detector system and alarm bell for accidents and fires.

2—180. FIRST AID KITS.

2—181. DESCRIPTION. Two first aid kits (17 and 25, figure 2—10) are provided in the helicopter. One kit (25) is located on the forward left side of the cabin rear bulkhead above the electronics compartment opening. The second first aid kit (17) is mounted on the door in the auxiliary servo and mixer cover between the pilot's and observer's seat backs. Mounting provisions have been made for a third first aid kit on the forward, right side of the cabin rear bulkhead above the electronics compartment opening. The first aid kits may be removed by unsnapping the fasteners.

2—182. FIRE EXTINGUISHER. For description of the fire extinguisher, refer to paragraph 4—80.



1. Windshield Cover	5. Tail Rotor Assembly Cover	9. Main Gear Box Oil Cooler Air Exit Cover
2. Pitot Tube Cover	6. Tail Rotor Gear Box Cover	10. Main Transmission Screen Cover
3. Main Rotor Head Assembly Cover	7. Lower Pylon Cover	11. Engine Air Exit Cover
4. Tail Rotor Blade Covers	8. Main Rotor Blade Covers	12. Nose Door Air Outlet Cover

Figure 2–15. Protective Covers

2–183. FIRE DETECTOR SYSTEM. For description, removal and installation of the fire detector system, refer to paragraph 4–73.

2–184. ALARM BELL. For description, removal and installation, refer to paragraph 7–201.

2–185. MISCELLANEOUS EQUIPMENT.

2–186. DESCRIPTION. Additional equipment provided in the cockpit and cabin includes a relief tube, a map case and flight report holder, ash trays, windshield wiper, cargo tie-down fittings, cargo tie-down belts, cargo skid rails, black-out curtains, anti-glare curtains and assist handles. One set of tinted panels for blind flying training is provided for every seven helicopters.

2–187. RELIEF TUBE.

2–188. DESCRIPTION. A relief tube (6, figure 2–10), accessible to personnel in both the cabin and cockpit, is located on the cabin forward bulkhead to the left of the pilot's ladder. The horn of the relief tube is supported by a bracket on the right side of the main drive shaft

TABLE V
INSTALLATION OF PROTECTIVE COVERS

DESCRIPTION	METHOD OF INSTALLATION
Main Rotor Head Assembly Cover (3, figure 2—15)	Fit the cover over the main rotor assembly and tie the binding tight at the main transmission screen. Secure the binding outboard of each sleeve-spindle and slide-fasten the joining seams of the vertical openings.
Main Rotor Blade Covers (8)	Position the main rotor blades as in mooring. (Refer to paragraph 1—24, steps b. and c.) Slide a cover on each blade from the tip inboard to the main rotor assembly. Secure each cover at the main rotor sleeve-spindle assembly with the inboard tape attached to the cover. To prevent the main rotor blades from flapping when covered in flight position, secure each outboard cover tape to the main landing gear strut in the same manner used when securing the tip socks. (Refer to paragraph 1—24, step f.) **Note** If the cover has a hole near the outboard end, install the cover with the hole facing down.
Tail Rotor Assembly Cover (5)	Fit the cover on the tail rotor hub. Tie the binding inboard of the hub. Secure the slide fasteners on the joining seams of the horizontal openings.
Tail Rotor Blade Covers (4)	Position the tail rotor blades at an angle of 45° to the center line of the helicopter. Slide a cover on each blade and secure the cover at the inboard end of each blade with the attached tape. To prevent the tail rotor blades from flapping when covered in flight position, wrap the outboard tape on each cover around the pylon and tie the tapes with a suitable knot. **CAUTION** Do not tighten the tapes enough to bend the blades.
Windshield Cover (1)	Position the cover over the cockpit canopy with the pitot tube through the opening in the right-hand side of the cover and the loop antenna in the boot on top of the cover. Secure the tapes at the following locations: each landing gear strut, each landing gear leg, the nose door handles, the main gear box drive shaft and the latch on each service platform.
Pitot Tube Cover (2)	Slip the cover over the end of the pitot tube and secure it in position with the drawstrings.
Main Gear Box Oil Cooler Air Exit Cover (9)	Snap-fasten each edge of the cover to the canopy and fuselage skins that surround the louvered fairing.
Main Transmission Screen Cover (10)	Snap-fasten each edge of the cover to the service platform doors, the cockpit canopy and the canopy fairing. Snap-fasten the cover around the main gear box drive shaft and the control arms and servo unit assemblies.
Tail Rotor Gear Box Cover (6)	Fit the cover over the tail rotor gear box fairing and the gear box shaft and tie the binding at the base of the fairing. Secure the slide fastener on the joining seams beneath the tail rotor gear box shaft.
Lower Pylon Cover (7)	Fit the cover over the pylon screen fairing aft of the hinge bulkhead and the pylon grill aft of the intermediate gear box. Assure that the tapes are extending downward. Wrap the belt around the bottom of the pylon and fasten with the buckle. Secure the cover at the ends with the attached tapes.
Engine Air Exit Cover (11)	Position the cover over the engine air exit with the sleeve on the cover over the tail pipe. Snap-fasten the cover to the lower edge of the nose doors and to the fuselage bottom skin. Secure the tie around the tail pipe. When the engine pre-heat duct is not installed, close the opening in the cover by securing the tie on the sleeve.
Nose Door Air Outlet Cover (12)	Snap-fasten the cover over the openings in the nose doors below the latch handles.

CAUTION

Make certain that all warning streamers are visible when installing each protective cover.

tunnel aft of the console. Tubing, clamped by a guide on the bulkhead, passes at floor level forward through the bulkhead, down through the bottom structure and out of the helicopter to a venturi secured to the underside of the fuselage.

2—189. REMOVAL.

a. Lift the horn out of the bracket and disconnect the tubing below the horn.

b. Remove the tape at the joint between the tube and the venturi. Remove the screws, washers and nuts and remove the venturi.

c. Remove the grommets from the cabin floor assembly and the bottom structure plating. Pull the tubing down through the guide, through the cabin forward bulkhead and out the bottom structure.

2—190. CLEANING. Clean the horn after flight with disinfectant deodorant solution.

2—191. INSTALLATION.

a. From within the cabin, insert the end of the tubing through the guide at the cabin forward bulkhead.

b. Work the tubing through the cabin forward bulkhead and out the bottom structure. Install the grommets in the cabin floor assembly and bottom structure panel.

c. Attach the venturi to the tube. Tape (index 40, paragraph 1—32) and shellac (index 41, paragraph 1—32) the tube attachment point to the venturi. Secure the venturi to the bottom structure panel with the washer head screws, washers and nuts.

d. Tape (index 40, paragraph 1—32) and shellac (index 41, paragraph 1—32) the tube to the horn and position the horn in the bracket.

2—192. MAP CASE AND FLIGHT REPORT HOLDER.

2—193. DESCRIPTION. A map case and flight report holder (18, figure 2—10) is secured above the pilot's seat back and to the right of the overhead control panel. The map case is removed by removing the screws, bolt, washer and nut which hold the map case and cover stop to the brackets mounted on the cockpit canopy and the forward side of the cockpit canted bulkhead.

2—194. DATA CASE.

2—195. DESCRIPTION. A data case (22, figure 2—10) is mounted above the observer's seat back and to the left of the overhead control panel. The data case is removed by removing the screws, bolt, washer and nut which secure the data case and cover stop to the brackets installed on the cockpit canopy and the forward side of the cockpit canted bulkhead.

2—196. PILOT'S CHECK LIST.

2—197. DESCRIPTION. A check list (2, figure 2—10) is attached by a bead chain to the right side of the instrument panel. The chain allows the pilot to use the check list when seated. A screw and nut fasten the chain to the instrument panel and a snap fastener is provided at the other end to make removal of the list from the chain possible.

2—198. ASH TRAYS.

2—199. DESCRIPTION. The helicopter is equipped with two ash trays (3 and 4, figure 2—10) located beneath the cockpit instrument panel. One ash tray is on the pilot's side and the other is on the observer's side of the panel. The ash tray bracket assembly is riveted in place beneath the instrument panel and cannot be removed. The ash tray is removed in the conventional manner.

2—200. WINDSHIELD WIPER. *(See 5, figure 2—10.)* For description, removal and installation of the windshield wiper system, refer to paragraph 4—68.

2—201. CARGO TIE-DOWN FITTINGS.

2—202. DESCRIPTION. A total of 35 ring fittings (28, figure 2—10) are installed in four rows in the cabin floor. The ring fittings serve the following functions: provide the lower connections for the inboard litter strap assemblies, the receptacles for the troop seat support legs and the attachment points for the cargo tie-down belts.

2—203. REMOVAL. Remove the bolts that secure the fittings to the cabin floor panels and remove the fittings.

2—204. INSTALLATION. Position the cargo tie-down fittings on the floor panels and install the bolts.

2—205. CARGO TIE-DOWN BELTS.

2—206. DESCRIPTION. Ten adjustable cargo tie-down belts (27, figure 2—10) are provided for each helicopter. The belts fasten to the tie-down fittings in the cabin floor and are readily removed by releasing the ring fasteners. When not in use, the belts are stowed on the aft, left side of the cabin at floor level.

2—207. SKID RAIL INSTALLATION.

2—208. DESCRIPTION. Five rows of skid rails (29, figure 2—10) are installed on the cabin floor to protect the floor panels and access covers when loading and unloading cargo. Five short skid rails in the center row are riveted to fuel cell access covers; the remaining skid rails are easily removed by removing the attaching screws.

2—209. ANTI-GLARE CURTAIN.

2—210. DESCRIPTION. An anti-glare curtain (33, figure 2—10) is snap-fastened below the cockpit opening to the cabin. Access to the cockpit is gained through a

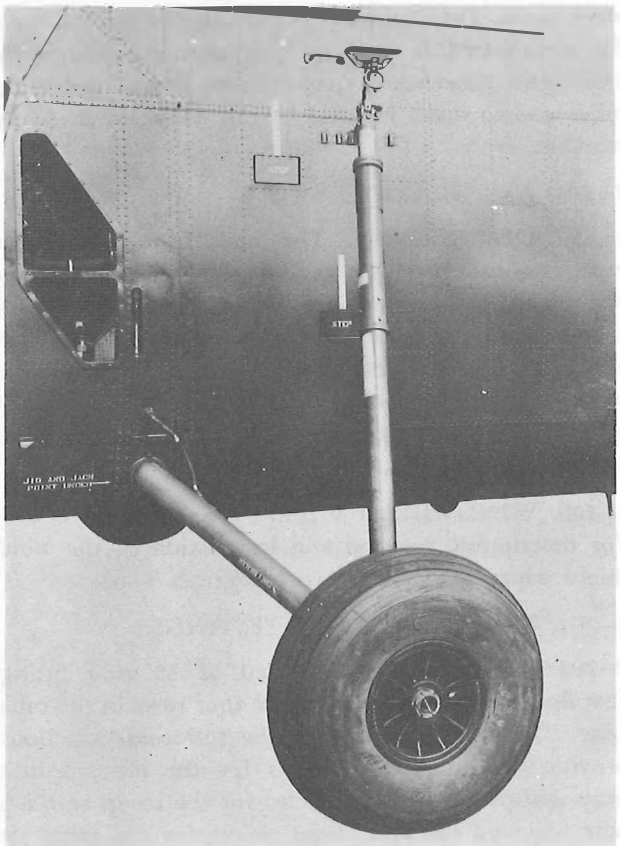


Figure 2–16. Main Landing Gear

zippered opening in the center of each side of the curtain. Three straps are attached to the top of the curtain to secure the curtain when it is rolled up in the stowed position.

2–211. BLACK-OUT CURTAINS.

2–212. DESCRIPTION. Four black-out curtains (30, figure 2–10) are provided for the windows in the cabin. Reinforced cut-outs in the curtain fit over the troop seat support fittings. All the curtains are marked to show their proper location. The curtains are secured in place by snap fasteners. When not in use, the black-out curtains are stowed in the stowage bag at the left side of the cabin.

2–213. ASSIST HANDLES.

2–214. DESCRIPTION. Assist handles (1, figure 2–10) are provided for both the pilot and observer to aid them in climbing up into the cockpit from the cabin. The handles are attached to the tail rotor control pedal torque tube forward of the pilot's and observer's seats. The handles are removed by removing the bolts, washers and nuts which clamp the handles to the torque tube.

2–215. TINTED PANELS (BLIND FLYING).

2–216. DESCRIPTION. A set of blind flying panels (9, figure 2–10) of tinted plastic is used for training purposes. The blind flying panels are secured in place by snap fasteners and cover each section of the windshield. One set of five panels is provided for every seven helicopters.

2–217. CANTEEN INSTALLATION.

2–218. DESCRIPTION. Provisions are made for the installation of a canteen forward of the cargo door on the right side of the cabin.

2–219. HYDRAULIC RESCUE HOIST.

2–220. DESCRIPTION. Internal structural provisions for a hydraulic rescue hoist are incorporated in the helicopter. A door is installed in the right service platform to provide clearance for the hoist when the service platform is hinged down. (Refer to paragraph 2–28.)

2–221. STOWAGE OF EQUIPMENT. A stowage bag, located on the aft left side of the cabin, is used for stowing the following equipment when the equipment is not in use: litter supports, troop seat fittings, black-out curtains and engine pre-heat ducts.

2–222. LANDING GEAR.

2–223. DESCRIPTION. *(See figures 2–16 and 2–20.)* The landing gear on the helicopter is of the conventional, nonretractable type. The two main landing gear assemblies have a hydraulic wheel brake system and the single tail wheel landing gear assembly has a locking system controlled from the cockpit to lock the wheel in the trailing position.

2–224. MAINTENANCE.

a. Wash the landing gear periodically with mild soap and water. Rinse thoroughly and dry.

b. Clean exposed fittings and sections of the oleo rod with a cloth dampened with hydraulic oil (index 6, paragraph 1–32).

c. Touch up chipped paint and corroded areas in accordance with instructions in paragraph 2–108 through 2–126.

d. Service the landing gear in accordance with the instructions on the name plate and paragraphs 2–228 and 2–264.

2–225. MAIN LANDING GEAR ASSEMBLY.

2–226. DESCRIPTION. *(See figure 2–16.)* Two nonretractable main landing gear assemblies are installed on the fuselage forward section of the helicopter. Each landing gear assembly consists primarily of a leg and axle assembly, a shock strut assembly and a wheel assembly. The leg and axle assembly is installed in fittings in the fuselage bottom structure. The wheel is mounted on the axle of the leg and axle assembly. The shock strut assembly is connected at its lower end to a universal assembly on the leg and axle assembly and at its upper end to a fitting on the fuselage. Each wheel has an individually controlled hydraulic brake that can be locked by a control handle, marked "PARKING BRAKE," located in the cockpit. A static ground assembly is installed on the leg and axle assembly of the left landing gear. A step is welded on each landing gear leg to assist personnel in entering and leaving the cockpit.

2—227. REMOVAL. *(See figure 2—17.)*

a. Lock and chock the tail wheel. Jack the helicopter at the jack pad on the landing gear fitting (step 1). (Refer to paragraph 1—14.)

b. Release the air pressure and remove the main shock strut assembly. (Refer to paragraphs 2—229 and 2—232.)

c. Disconnect the brake hydraulic line from the fuselage at the quick disconnect coupling at "A" (step 5, figure 2—17). Rotate the leg and axle assembly, with the wheel attached, aft and upward as at "B" (step 5) and pull the leg out of the fuselage fittings.

d. Remove the lock ring and scraper from the fuselage fitting (step 6).

2—228. SERVICING THE SHOCK STRUT WITH AIR. The following information is furnished to be used in conjunction with the instructions given on the name plate located on the shock strut tube assembly:

A. Inflating the Shock Strut.

a. Remove the air valve cap and check that the ⅝-inch hex swivel nut is tight.

b. Attach the air filling chuck of the gage assembly to the valve core housing.

c. Loosen the ⅝-inch hex swivel nut on the air valve to a maximum of ¾ of a complete turn counterclockwise.

CAUTION

Excess loosening of the swivel nut will result in the valve core and housing dropping into the strut and the swivel nut interfering with the gage and damaging the housing.

d. Inflate the strut with air until the strut starts to extend.

Note

Roll the helicopter forward two to three feet before inflating to relieve any possible friction in the strut.

e. Take gage reading of the air pressure in the strut.

f. Locate air pressure reading on name plate "inflation table" under "gage pressure." Read "strut ext. dim. X."

g. Inflate the strut to the dimension indicated. Air pressure will remain constant and will be governed by the gross weight of the helicopter.

h. Tighten the ⅝-inch hex swivel nut with 50 to 70 inch-pounds torque.

i. Remove the gage assembly from the valve and replace the air valve cap.

CAUTION

Check for leaks before replacing the cap.

B. Deflating the Shock Strut.

a. Remove the air valve cap and check that the ⅝-inch hex swivel nut is tight.

b. Release any air pressure in the valve by depressing the valve core with a Schrader tool, part No. 3265.

Note

Do not use a match-stick type of tool.

c. When the air pressure within the valve is completely released, remove the valve core with the Schrader tool.

WARNING

Do not remove the valve core until all air pressure is released.

d. Loosen the ⅝-inch hex swivel nut to a maximum of one complete turn and allow the air pressure within the strut to exhaust.

CAUTION

Excess loosening of the swivel nut will result in the valve housing dropping into the strut.

C. Checking Inflation of the Shock Strut.

a. Remove the air valve cap and check that the ⅝-inch hex swivel nut is tight.

b. Attach the gage assembly to the valve core housing.

c. Loosen the ⅝-inch hex swivel nut a maximum of ¾ of a complete turn and take a gage reading of the air pressure in the strut.

CAUTION

Excess loosening of the swivel nut will result in the valve core and housing dropping into

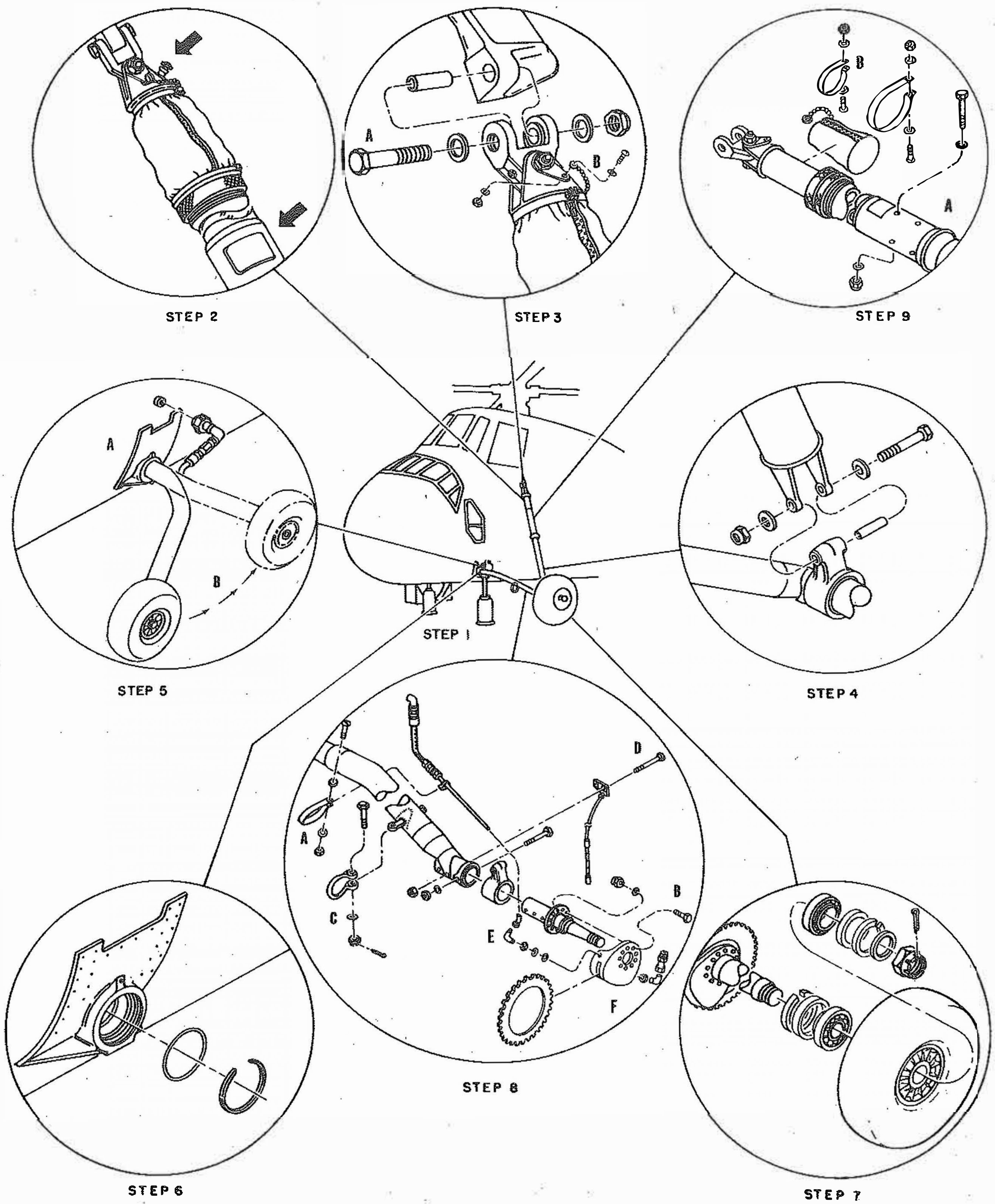


Figure 2–17. Main Landing Gear Removal and Disassembly

the strut and the swivel nut interfering with the gage and damaging the housing.

d. Locate the air pressure reading on the name plate "inflation table" under "gage pressure." Read "strut ext. dim. X."

e. Inflate or deflate the strut to the dimension indicated. Air pressure will remain constant and will be governed by the weight of the helicopter.

f. Tighten the ⅝-inch hex swivel nut with 50 to 70 inch-pounds torque.

g. Remove the gage assembly from the valve and replace the air valve cap.

CAUTION

Check for leaks before replacing the cap.

2—229. INSTALLATION. *(See figure 2—17.)*

a. Install the scraper in the fuselage fitting and secure it with the lock ring (step 6).

b. Insert the leg and axle assembly into the fuselage fitting and turn it down and forward as at "B" (step 5). Connect the brake hydraulic line at the quick disconnect coupling at "A" (step 5).

c. Install the main shock strut assembly. (Refer to paragraph 2—241.)

d. Remove the support from the helicopter (step 1, figure 2—17).

e. Check the fluid level and inflate the strut assembly in accordance with the instructions given on the name plate and in paragraph 2—228.

CAUTION

Release the tail wheel lock control before moving the helicopter.

2—230. MAIN SHOCK STRUT ASSEMBLY.

2—231. DESCRIPTION. *(See figure 2—16.)* The main shock strut assembly extends diagonally upward from a universal assembly on the leg and axle assembly to a fitting on the fuselage. The strut assembly consists primarily of a tube which is bolted to an oleo assembly. A universal assembly is installed on the upper end of the oleo assembly. The shock strut cushions the impact of the helicopter when landing. The helicopter can be leveled by adjusting the air pressure in the shock struts.

2—232. REMOVAL. *(See figure 2—17.)*

a. Lock and chock the tail wheel. Jack the helicopter at the fuselage jack pad on the main landing gear fitting (step 1). (Refer to paragraph 1—14.)

b. Release the air from the strut in accordance with instructions on the name plate and in paragraph 2—228.

WARNING

The air pressure in the strut assembly must be released before removing the strut assembly.

c. Disconnect the strut assembly from the universal assembly on the axle by removing the bolt, washers, nut and spacer (step 4).

d. Support the strut assembly and disconnect the universal assembly on the upper end of the oleo assembly from the fitting on the fuselage by removing the bolt, washers, nut and spacer at "A" (step 3).

e. If a new strut assembly is to be installed, disconnect the chain on the boot from the clip near the upper universal fitting by removing the screw, washers and nut at "B" (step 3). Remove the screws, washers, nuts and clamps at "B" (step 9) and remove the boot.

2—233. DISASSEMBLY. *(See figure 2—18.)*

a. Disconnect the universal (5) from the oleo assembly by removing the bolt (6), nut, spacer (4) and clips (3).

b. Separate the tube assembly (23) from the oleo assembly by removing the bolts, washers and nuts (22).

Note

Disassembly of the oleo assembly is accomplished according to the following instructions.

c. Release the air pressure in the oleo assembly. (Refer to paragraph 2—228.) Cut the lock wire and unscrew and remove the air valve (2, figure 2—18) from the top of the rod assembly (1). Drain the hydraulic oil from the oleo through the air valve opening.

WARNING

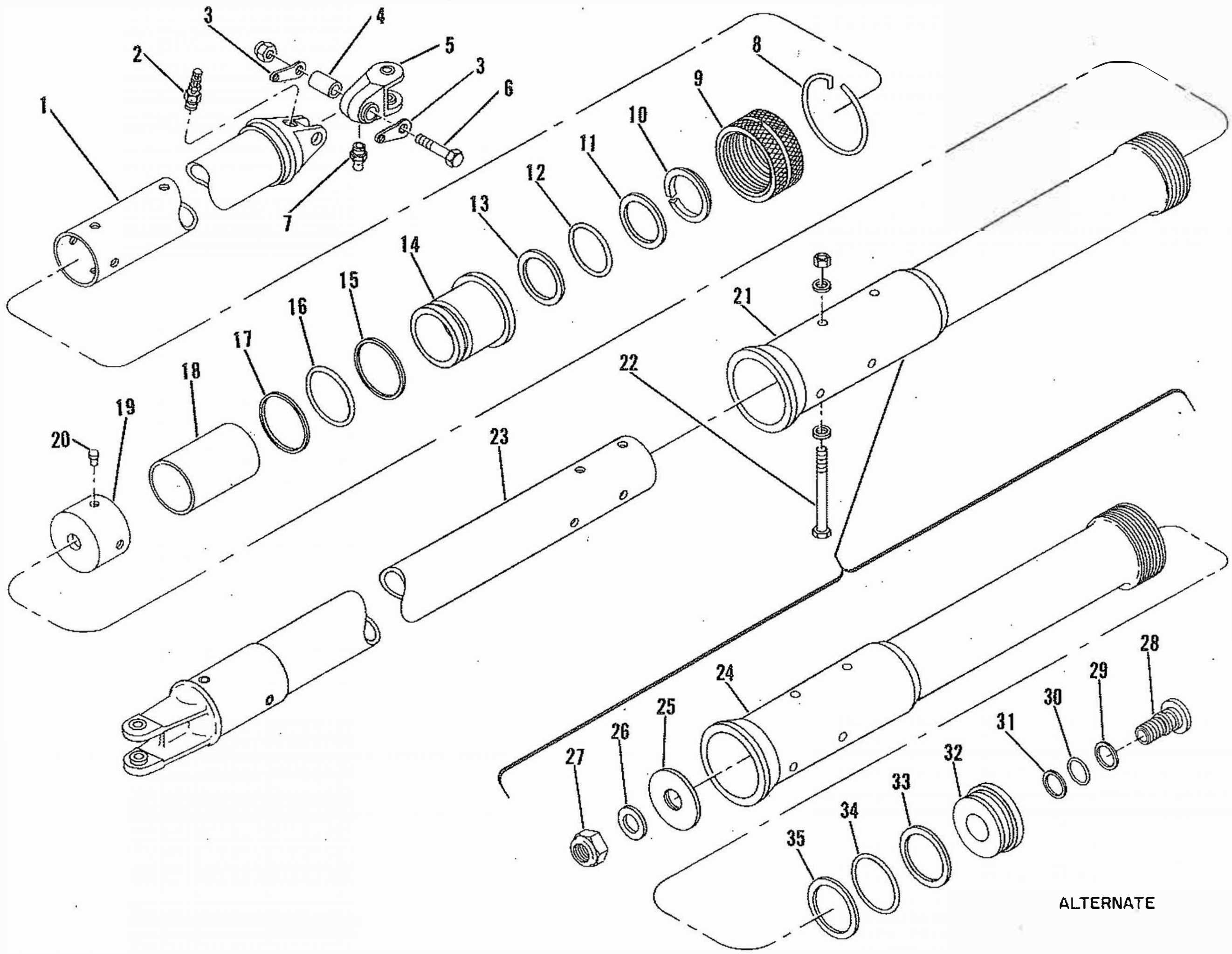
Release the air pressure in the oleo assembly and remove the air valve before disassembling the oleo assembly.

d. Remove the oleo nut lock ring (8) from the bearing retaining nut (9).

e. Unscrew the nut (9) and remove the nut and rod assembly (1) from the cylinder (21).

f. Remove the four pins (20) that secure the orifice (19) to the rod assembly (1) and remove the orifice (19) and spacer (18).

g. Remove the bearing (14), scraper (10) and nut (9) from the rod assembly. Remove the rings (11, 13, 15 and



1. Rod Assembly
2. Air Valve
3. Clip
4. Spacer
5. Universal
6. Bolt, Washer, Nut
7. Lubrication Fitting
8. Lock Ring
9. Bearing Retaining Nut
10. Scraper
11. Ring
12. Packing
13. Ring
14. Bearing
15. Ring
16. Gasket
17. Ring
18. Spacer
19. Orifice
20. Pin
21. Cylinder
22. Bolt, Washers, Nut
23. Tube Assembly
24. Cylinder (Alternate)
25. Washer
26. Washer
27. Nut
28. Retainer
29. Ring
30. Packing
31. Ring
32. Plug
33. Ring
34. Gasket
35. Ring

Figure 2—18. Main Shock Strut Disassembled

17), gasket (16) and packing (12) from the bearing (14).

h. On oleo assemblies which contain a plug in the cylinder, remove the nut (27) and washers (25 and 26) that secure the plug (32) in place in the cylinder (24). Remove the plug (32) from the cylinder (24).

i. Remove the rings (33 and 35) and gasket (34) from the plug (32).

j. Remove the retainer (28) from the plug (32).

k. Remove the rings (29 and 31) and packing (30) from the retainer (28).

2—234. CLEANING.

a. Clean dirt and corrosive matter from the exposed surface of the oleo rod and wipe with a cloth soaked in hydraulic oil (index 6, paragraph 1—32) before and after each flight.

b. Clean all parts of the disassembled strut assembly with solvent (index 3, paragraph 1—32).

TABLE VI
TABLE OF FITS AND CLEARANCES — MAIN SHOCK STRUT ASSEMBLY

PART NO.	NOMENCLATURE	MANUFACTURING DIMENSIONS (INCHES)	MATING PART NO.	NOMENCLATURE	MANUFACTURING DIMENSIONS (INCHES)	SERVICE TOLERANCE (INCHES)
S1625-50141	Orifice	3.123 3.122 OD	S1625-50135	Cylinder	3.127 3.125 ID	0.002 L 0.005 L
S1625-50144	Bearing	2.627 2.626 ID	S1625-51037	Rod	2.623 2.622 OD	0.005 L 0.003 L

2—235. INSPECTION.

a. Magnaflux all steel parts.

b. Zyglo all magnesium, aluminum and bronze parts.

c. Inspect all parts for damage, corrosion and/or excessive wear.

d. Inspect all parts which exhibit excessive wear for the dimensions given in table VI.

2—236. FITS AND CLEARANCES. Refer to table VI for fits and clearances and service tolerances for the mating parts of the main shock strut assembly. The following code is used in table VI:

ID—Inside Diameter

L—Loose

OD—Outside Diameter

2—237. REPLACEMENT.

a. Replace the oleo rod if it is dented, scratched or scored to a depth exceeding 25 micro-inches.

b. Replace the cylinder if it is dented or if the inside surface is scratched or scored to a depth exceeding 25 micro-inches.

c. Replace all packings, gaskets, back-up rings and scrapers.

d. Replace all damaged or worn parts that do not conform to the service tolerances given in table VI.

2—238. ASSEMBLY. *(See figure 2—18.)*

Note

The assembly of the oleo assembly alone is covered in steps a. through h.

a. On oleo assemblies which contain a plug in the cylinder, install the rings (29 and 31) and packing (30) on the retainer (28) and thread the retainer (28) into the plug (32).

b. Install the rings (33 and 35) and gasket (34) on the plug (32), position the plug (32) and washers (25 and 26) in the cylinder (24) and secure them in place with the nut (27).

c. Screw the air valve (2) into the upper end of the rod assembly (1) and tighten the nut with 100 to 110 inch-pounds torque. Lockwire the nut.

d. Install new rings (11, 13, 15 and 17), gasket (16) and packing (12) in the bearing (14) and position the nut (9), scraper (10) and bearing (14) on the rod assembly (1) on all oleo assemblies.

e. Replace the spacer (18) and orifice (19) on the rod assembly (1) and secure the orifice in place with the four pins (20).

f. Position the rod assembly (1) inside the cylinder (21 or 24) and tighten the bearing retaining nut (9).

g. Install the oleo nut lock ring (8) on the nut.

h. Install the universal assembly (5), with the lubrication fitting (7) on the opposite side from the air valve (2), in the fork on the end of the oleo assembly and secure it with the bolt, (6), nut and spacer (4). Install the clips (3).

i. Slide the tube assembly (23) into the oleo assembly and secure the two components together with the bolts, washers and nuts (22).

j. Test the assembled strut assembly. (Refer to paragraph 2—239.)

k. Fill and bleed the strut assembly in accordance with the instructions in paragraph 2—240.

2—239. TESTING. Pressure test the assembled main shock strut assembly as follows:

a. Connect a hose to the air valve port from a hydraulic test stand.

b. Apply 1000 psi hydraulic pressure for at least two minutes and check for leakage at the weld on the rod assembly (1, figure 2—18) and at the areas around the scraper (10) and the nut (9). No external leakage should occur.

2—240. FILLING AND BLEEDING. Filling and bleeding the strut assembly can be performed while the landing gear is installed as well as before installation. To bleed the strut while the landing gear is installed, jack the helicopter at the fuselage jack pad on the main landing gear fitting to allow extension and compression of the strut. (Refer to paragraph 1–14.)

a. Remove the air valve cap and check that the ⅝-inch swivel nut is tight.

b. Release any air pressure in the valve by depressing the valve core with a Schrader tool, part No. 3265.

Note

Do not use a match-stick type of tool.

c. When the air pressure within the valve is completely released, remove the valve cone with the Schrader tool.

WARNING

Do not remove the valve core until all air pressure is released.

d. Loosen the ⅝-inch swivel nut one to two turns and allow the air pressure within the strut to exhaust.

CAUTION

Excess loosening of the swivel nut will result in the valve housing dropping into the strut.

e. Cut the lock wire and unscrew the air valve from the strut assembly.

f. Fully compress the strut assembly while holding it in an upright position and fill the oleo assembly with hydraulic oil (index 6, paragraph 1–32) through the air valve opening.

g. Slowly pull the oleo rod up and down several times to work out any air bubbles that may be trapped in the cylinder. Refill the oleo assembly with hydraulic oil to the level of the air valve opening.

h. Install the air valve and tighten the nut with 100 to 110 inch-pounds torque. Lockwire the valve.

2–241. INSTALLATION. *(See figure 2–17.)*

a. If the boot was removed from the strut assembly, replace the boot and secure it with the clamps, screws, washers and nuts at "B" (step 9). Secure the chain on the boot to the clip on the strut assembly with the screw, washers and nut at "B" (step 3).

Note

The slide fastener on the boot should face outboard.

b. Secure the universal assembly on the upper end of the oleo assembly to the fitting on the fuselage with the bolt, washers, nut and spacer at "A" (step 3).

Note

The air valve should point aft and the same plates should face outboard.

c. Secure the strut assembly to the universal assembly on the axle with the bolt, washers, nut and spacer (step 4).

d. Remove the support from the helicopter (step 1).

e. Check the fluid level and inflate the strut assembly in accordance with the instructions on the name plate (step 2) and in paragraph 2–228.

CAUTION

Release the tail wheel lock control before moving the helicopter.

f. Lubricate the universal fitting at each end of the strut assembly. (See figure 1–16.)

2–242. LEG AND AXLE ASSEMBLY.

2–243. DESCRIPTION. *(See figure 2–16.)* The leg and axle assembly, which is installed in fittings in the fuselage bottom structure, serves as a support for the wheel assembly and an attachment for the shock strut assembly. The hydraulic lines that lead to the wheel brake, a jack pad, a tie-down ring and a step are installed on the leg and axle assembly. A static ground assembly is connected to the lower part of the leg and axle assembly of the left main landing gear.

2–244. REMOVAL. *(See figure 2–17.)*

a. Lock and chock the tail wheel. Jack the helicopter at the fuselage jack pad on the main landing gear fitting (step 1). (Refer to paragraph 1–14.)

b. Remove the wheel assembly. (Refer to paragraph 2–251, steps b., d. and e.)

c. Release the air from the strut assembly. (Refer to paragraph 2–228.)

WARNING

The air pressure in the strut assembly must be released before removing the leg and axle assembly.

d. Disconnect the strut assembly from the universal assembly on the axle by removing the bolt, washers, nut and spacer (step 4).

e. Disconnect the brake hydraulic line from the fuselage at the quick disconnect coupling at "A" (step 5). Rotate the leg and axle assembly aft and upward as at "B" (step 5) and pull the leg out of the fuselage fittings.

f. Remove the screws, washers, nuts and clamps at "A" (step 8) and remove the brake hydraulic hose.

2–245. DISASSEMBLY. *(See figure 2–17.)*

a. Remove the bolt, washer, nut and cotter pin at "C" (step 8) and remove the tie-down ring.

b. Remove the bolts, washers and nuts at "D" (step 8). Remove the static ground assembly from the left leg and axle assembly. Pull the axle out of the leg. Slide the universal assembly off the axle.

2–246. MAINTENANCE. Refer to paragraph 2–224 for maintenance instructions.

2–247. ASSEMBLY. *(See figure 2–17.)*

a. Slide the universal assembly onto the axle. Insert the axle into the leg and secure it with the bolts, washers and nuts at "D" (step 8).

Note

Secure the static ground assembly to the left leg and axle assembly with the two inboard bolts. Do not install washers with these bolts.

CAUTION

If a new axle or leg is being installed, the axle must be fully inserted into the leg before drilling and line reaming. Exercise caution when reaming the axle to prevent enlargement of the holes in the leg.

b. Install the tie-down ring at the fitting on the leg and secure it with the bolt, washer and nut at "C" (step 8). Install the cotter pin.

Note

Do not tighten the nut beyond the point where the ring will swing freely.

2–248. INSTALLATION. *(See figure 2–17.)*

a. Insert the leg into the fuselage fittings and rotate it forward and down as at "B" (step 5).

b. Install the wheel assembly. (Refer to paragraph 2–253, steps a., b., c. and e.)

CAUTION

Do not remove the support from the helicopter.

c. Connect the brake hydraulic line to the quick disconnect coupling on the fuselage at "A" (step 5, figure 2–17). Secure the hose to the leg and axle assembly with the clamps, screws, washers and nuts at "A" (step 8).

d. Connect the strut assembly to the universal assembly on the axle with the bolt, washer, nut and spacer (step 4).

e. Install the wheel assembly. (Refer to paragraph 2–253.)

f. Remove the support (step 1, figure 2–17) and remove the chocks.

g. Check the fluid level and inflate the strut assembly in accordance with the instructions on the name plate (step 2) and in paragraph 2–228.

h. Lubricate the universal fitting at each end of the strut assembly. (See figure 1–16.)

CAUTION

Release the tail wheel lock control before moving the helicopter.

2–249. MAIN WHEEL ASSEMBLY.

2–250. DESCRIPTION. *(See figure 2–16.)* The main wheel assembly consists primarily of an 11.00 x 12, type 3 helicopter, six-ply rating nylon tire, an 11.00 x 12 tube, a two-section rim, bearings and a brake.

2–251. REMOVAL. *(See figure 2–17.)*

a. Lock and chock the tail wheel. Jack the helicopter at the jack pad on the leg and axle assembly. (Refer to paragraph 1–14.)

b. Remove the nut, washer and cotter pin from the axle (step 7, figure 2–17). Pull the wheel off the axle. Remove the restrainers, snap rings and wheel bearings.

c. Remove the tire and tube from the rim.

WARNING

Deflate the tire completely before removing the nuts that hold the two sections of the rim together.

d. Disconnect the brake hydraulic line from the elbow in the brake assembly at "E" (step 8).

e. Remove the bolts, washers and nuts at "B" (step 8) and remove the brake assembly from the axle. If a new brake assembly is to be installed, remove the check valve, cap, elbow, nut and gasket at "F" (step 8) and remove the elbow, nut, gasket and ring at "E" (step 8).

2–252. MAINTENANCE.

a. Wash the wheel bearings in clean solvent (index 3, paragraph 1–32).

b. Pack the wheel bearings with grease (index 21, paragraph 1–32).

2–253. INSTALLATION. *(See figure 2–17.)*

a. If a new brake assembly is being installed, remove the nut and bleeder that are furnished with the brake and install the check valve, cap, elbow, nut and gasket at "F" (step 8). Also install the elbow, nut, gasket and ring at "E" (step 8).

b. Position the brake assembly on the axle and secure it with the bolts, washers and nuts at "B" (step 8).

c. Connect the brake hydraulic line to the elbow in the brake assembly at "E" (step 8).

d. Mount the tire and tube on the rim. Secure the two halves of the rim together. Tighten the nuts to 15 foot-pounds torque. Inflate the tire in accordance with figure 1—15.

Note

Be sure that the slippage marks on the tire and wheel are aligned properly. When installing a new tire, paint slippage marks in accordance with applicable directives.

e. Install the wheel bearings, retainers and snap rings in the wheel. Install the wheel assembly on the axle and secure it with the washer and nut (step 7, figure 2—17). Tighten the nut just enough to remove end play and install the cotter pin.

f. Remove the support (step 1) and remove the chocks.

CAUTION

Release the tail wheel lock control before moving the helicopter.

2—254. WHEEL BRAKE SYSTEM.

2—255. DESCRIPTION. *(See figure 2—19.)* The wheel brake system consists primarily of the toe brake control on each of the pilot's tail rotor control pedals, a brake cylinder attached to each of the pilot's pedals, a dual parking brake valve and a handle, marked "PARKING BRAKE," on the observer's side of the cockpit, a wheel brake assembly at each main landing gear wheel, and interconnecting hydraulic tubing and hoses. A quick disconnect coupling for the hydraulic line to each wheel brake is provided where the line passes through the side of the fuselage. Each main wheel can be braked separately. Depressing the toe brake control actuates the piston in the brake cylinder to apply the wheel brake. Depressing both toe brake controls and pulling out the "PARKING BRAKE" handle closes the dual parking brake valve and locks both wheel brakes. Depressing both brake pedals or the right pedal only will release the parking brakes. The parking brake valve incorporates a dual temperature compensator which provides for independent brake line operation. Access to the system is gained through the cockpit and through the clutch compartment.

2—256. TROUBLE SHOOTING.

Trouble	Probable Cause	Remedy
Brakes spongy or do not hold	Air in system	Bleed and fill system
	Lack of hydraulic oil	Bleed and fill system
	Internal leakage in brake cylinder	Replace brake cylinder
	Worn wheel brake assembly	Replace wheel brake assembly
Parking brake does not hold; brakes hold when toe brake controls are depressed	Internal leakage in parking brake valve	Replace valve
Unusual loss of hydraulic oil	Leakage in system	Check system for leaks, correcting as necessary

2—257. REMOVAL. *(See figure 2—19.)*

a. Disconnect the hydraulic line from each brake cylinder at "A" (step 1). Unbolt each brake cylinder from the stud on the tail rotor control pedal at "B" (step 1) and from the bracket on the support tube at "C" (step 1). Remove the brake cylinders.

Note

Drain the hydraulic oil from each cylinder into a receptacle.

b. Disconnect the terminal on the end of the "PARKING BRAKE" handle and rod from the lever on the valve at "A" (step 2) by removing the cotter pin and pin. Separate the half clamp and bracket from the pedal support by removing the bolts and nuts at "B" (step 2). Remove the handle, bracket and half clamp from the pedal support.

c. Disassemble the handle and bracket, if necessary, by removing the cotter pin and terminal from the rod. Remove the cotter pin, washer, spring and washer from the rod. Pull the handle assembly out of the support. Remove the handle from the rod by drifting out the roll pin (step 3).

d. Disconnect the hydraulic lines from the valve at "A" and "B" (step 4). Unbolt and remove the valve from the bracket at "C" (step 4).

e. Remove any sections of hose or tubing, if necessary, by disconnecting them at the couplings and removing the securing clamps.

f. For removal instructions pertaining to the portion of the wheel brake system that is located on the main landing gear, refer to paragraphs 2—244 and 2—251.

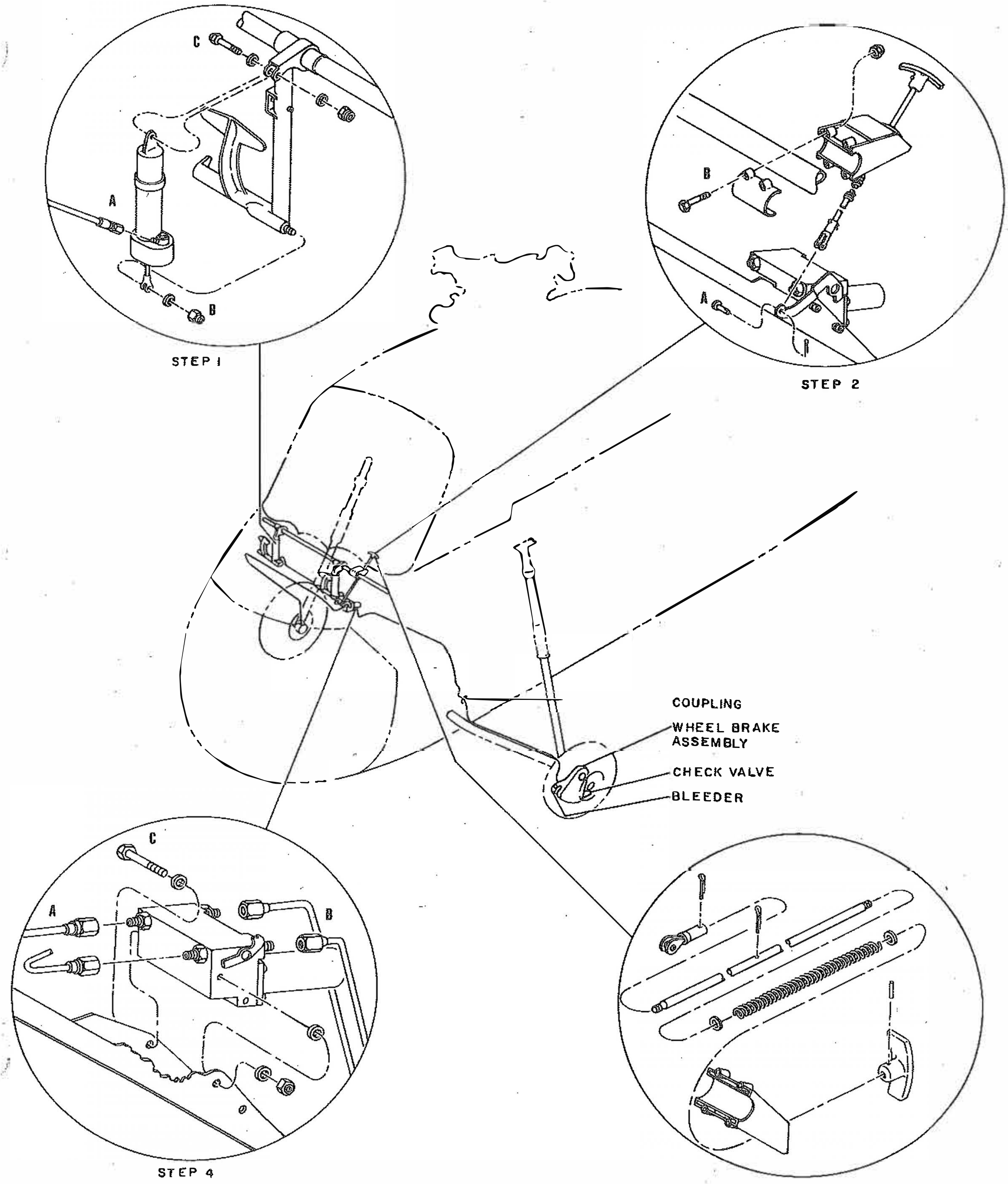


Figure 2–19. Wheel Brake System – Toe and Parking

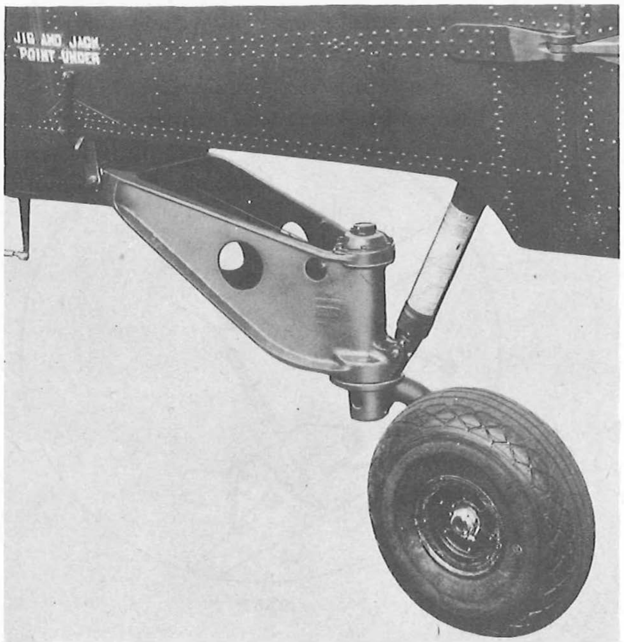


Figure 2–20. Tail Landing Gear

2–258. TESTING BRAKE CYLINDER.

a. Fill the cylinder with hydraulic oil (index 5, paragraph 1–32).

b. Insert a plug gage into the outlet port.

c. Pull on the rod-end fitting until a pressure of 1000 psi is noted on the gage.

d. Inspect the cylinder for any signs of leakage. If leakage occurs, replace the cylinder.

2–259. INSTALLATION. *(See figure 2–19.)*

a. Replace any sections of hose or tubing that were removed by connecting them at their couplings and installing the securing clamps.

b. Refer to paragraphs 2–248 and 2–253 for installation instructions pertaining to the portion of the wheel brake system that is located on the main landing gear.

c. Secure the valve to its bracket with the bolts, washers and nuts at "C" (step 4, figure 2–19). Connect the hydraulic lines to the valve at "A" and "B" (step 4).

d. Assemble the control handle and bracket (step 3). Secure the handle to the rod with the roll pin. Slide the handle assembly into the support. Install the washer, spring and washer on the rod and secure them with the cotter pin. Secure the terminal to the rod with the cotter pin.

Note

If a new handle assembly is being installed, position the lock control assembly on the pedal support, secure the terminal to the lever on the valve and secure the half clamp and bracket to the support. Screw the handle assembly into the terminal until the proper adjustment is obtained. Holding the handle horizontally in the correct unparked position, drill through the terminal and forward end of the rod and insert the cotter pin.

e. Position the handle and bracket on the pedal support. Secure the half clamp to the support with the bolts and nuts at "B" (step 2). Connect the terminal to the lever of the valve with the pin and cotter pin at "A" (step 2).

f. Position the brake cylinders at the tail rotor control pedals. Secure each cylinder to the bracket at "C" (step 1) and to the stud on the pedal at "B" (step 1). Connect the hydraulic line to each cylinder at "A" (step 1).

g. Fill and bleed the brake system. (Refer to paragraph 2–260.)

h. Check the operation of the parking brake. Set the brake and release it by depressing the right toe brake pedal.

2–260. BLEEDING. Bleed each side of the wheel brake system by the following procedure:

a. Connect a hydraulic line from a hand pump to the check valve at the wheel brake.

b. Remove the filler plug and connect a transparent overflow line to the filler opening of the brake cylinder in the cockpit. Set the end of the overflow line in a receptacle.

c. Open the bleeder plug at the top of the brake.

d. Pump hydraulic oil (index 6, paragraph 1–32) from the hand pump through the check valve until the oil flows from the bleeder plug at the brake with no indication of air bubbles.

e. Close the bleeder plug at the brake.

f. Continue pumping hydraulic oil into the system and check the flow of oil from the overflow line at the brake cylinder until there is no indication of air bubbles.

g. Remove the overflow line from the brake cylinder and replace the plug. Disconnect the hand pump line from the check valve on the wheel brake.

2–261. TAIL LANDING GEAR ASSEMBLY.

2–262. DESCRIPTION. *(See figure 2–20.)* The non-retractable tail landing gear assembly is secured to structural attachment fittings in the aft end of the tail cone. The assembly consists primarily of a yoke and fork assembly and a strut assembly. The yoke and fork assembly includes the tail wheel. The tail wheel can swivel through 360 degrees, but is self-centering and can be locked in the trailing position by the tail wheel lock control system.

2–263. REMOVAL. *(See figure 2–21.)*

a. Chock the main wheels and jack the helicopter at the jack pad just forward of the yoke assembly (step 1). (Refer to paragraph 1–14.)

b. Remove the strut assembly. (Refer to paragraph 2–268.)

c. Disconnect the wheel lock control cable from the lockpin at "A" (step 4, figure 2–21).

d. Place a support under the yoke and fork assembly. Unbolt the yoke and fork assembly from the tail cone attachment fittings at "B" (step 4). Lower the yoke and fork assembly from the tail cone.

e. Disconnect the hose from the air valve on the right side of the tail cone at "A" (step 3). Cut the lock wire and remove the air valve (step 2).

2–264. SERVICING THE STRUT ASSEMBLY WITH AIR. The procedure for servicing the tail landing gear strut is the same as for the main landing gear strut. (Refer to paragraph 2–228.)

2–265. INSTALLATION. *(See figure 2–21.)*

a. Install the air valve in the fitting on the right side of the tail cone (step 2). Lockwire the valve. Connect the hose to the valve at "A" (step 3).

b. Position the yoke and fork assembly at the fittings in the tail cone. Install the bolts, washers, nuts and spacers at "B" (step 4).

c. Connect the wheel lock control cable to the lockpin at "A" (step 4).

d. Install the strut assembly. (Refer to paragraph 2–277.)

e. Remove the jack (step 1, figure 2–21).

f. Inflate the strut assembly with air in accordance with instructions on the name plate and in paragraph 2–264.

2–266. TAIL WHEEL STRUT ASSEMBLY.

2–267. DESCRIPTION. *(See figure 2–20.)* The tail wheel strut assembly consists primarily of an oleo assembly with a universal assembly attached to each end. The upper end of the strut assembly is attached to a fitting inside the tail cone and the lower end is connected to lugs on the yoke and fork assembly. Access to the upper end of the strut assembly is gained through the tail cone. The strut assembly cushions shock when landing or taxiing.

2–268. REMOVAL. *(See figure 2–21.)*

a. Chock the main wheels and jack the helicopter at the jack pad just forward of the yoke assembly (step 1). (Refer to paragraph 1–14.)

b. Release the air from the strut in accordance with instructions on the nameplate and in paragraph 2–264.

WARNING

The air pressure in the strut must be released before removing the strut assembly.

c. Inside the tail cone, disconnect the air hose from the oleo assembly at "C" (step 3). Disconnect the universal on the upper end of the strut assembly from the fitting by removing the bolt, washers, nut and spacer at "B" (step 3).

d. Disconnect the chain from the tab on the boot at "D" (step 3).

e. Disconnect the universal on the lower end of the strut assembly from the lugs on the yoke and fork assembly by removing the bolt, washer, nut and spacer (step 5). Lower the strut assembly from the tail cone.

f. Remove the elbow, nut, gasket and ring from the upper end of the strut assembly at "C" (step 3).

g. Remove the screws, washers, nuts and clamps at "E" (step 3) and remove the boot.

2–269. DISASSEMBLY. *(See figure 2–22.)*

a. Remove the universal assembly (3 and 21) from each end of the oleo assembly by removing the bolts, washers, nuts (5 and 23) and spacers (2 and 22).

b. Drain the hydraulic oil from the oleo assembly through the air valve hose opening.

Note

To disassemble the oleo assembly, proceed as follows:

c. Remove the oleo nut lock ring (7) from the bearing retaining nut (8).

d. Unscrew the nut (8) and remove the nut and rod assembly (1) from the cylinder assembly (20).

e. Remove the four pins (18) that secure the orifice (19) to the rod assembly (1) and remove the orifice (19) and spacer (17).

f. Remove the bearing (13) scraper (9) and nut (8) from the rod assembly (1). Remove the rings (10, 12, 14 and 16), gasket (15) and packing (11) from the bearing (13).

2–270. CLEANING.

a. Clean dirt and corrosive matter from the exposed surface of the oleo rod and wipe with a cloth soaked in hydraulic oil (index 6, paragraph 1–32) before and after each flight.

b. Clean all parts of the disassembled strut assembly with solvent (index 3, paragraph 1–32).

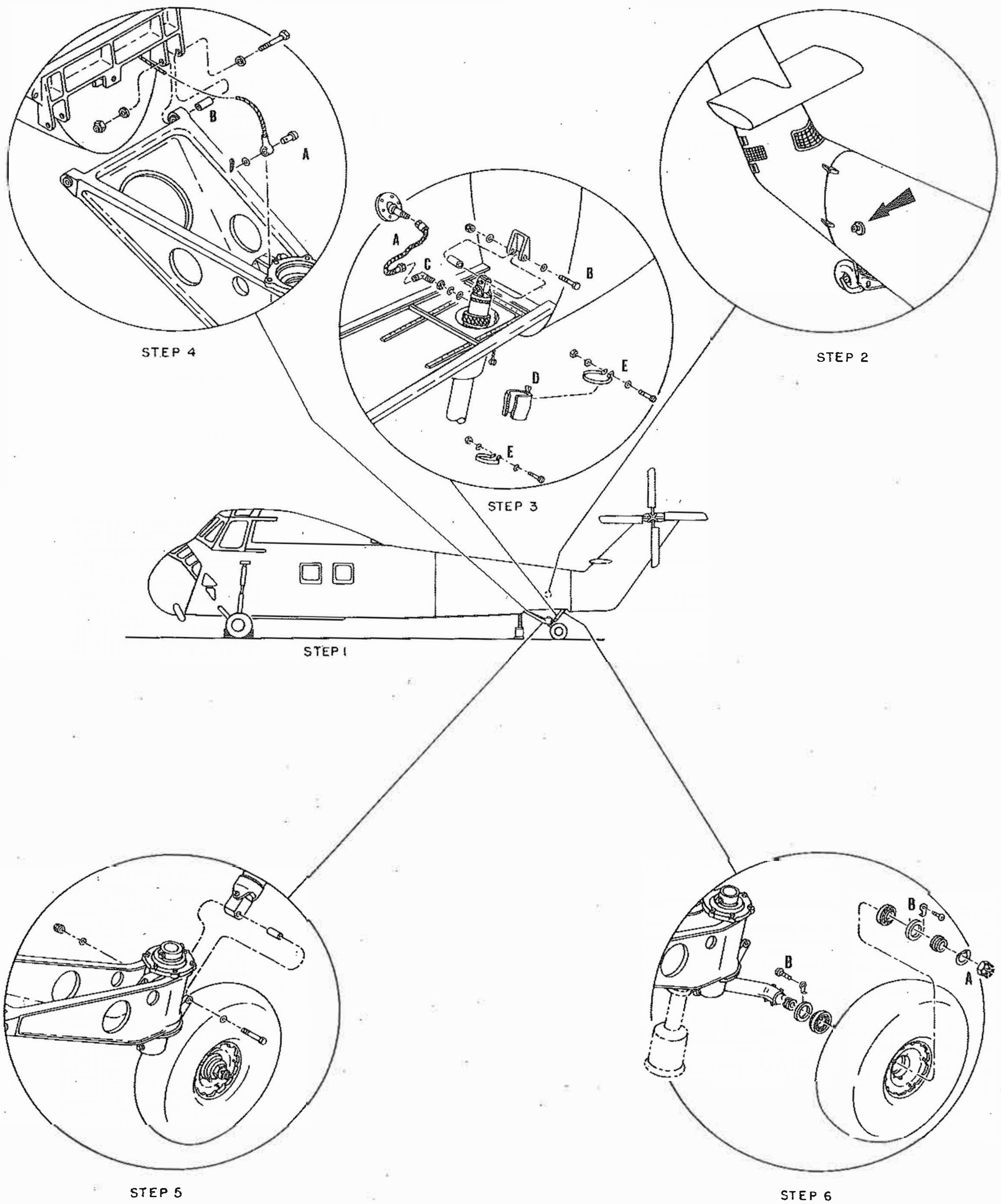
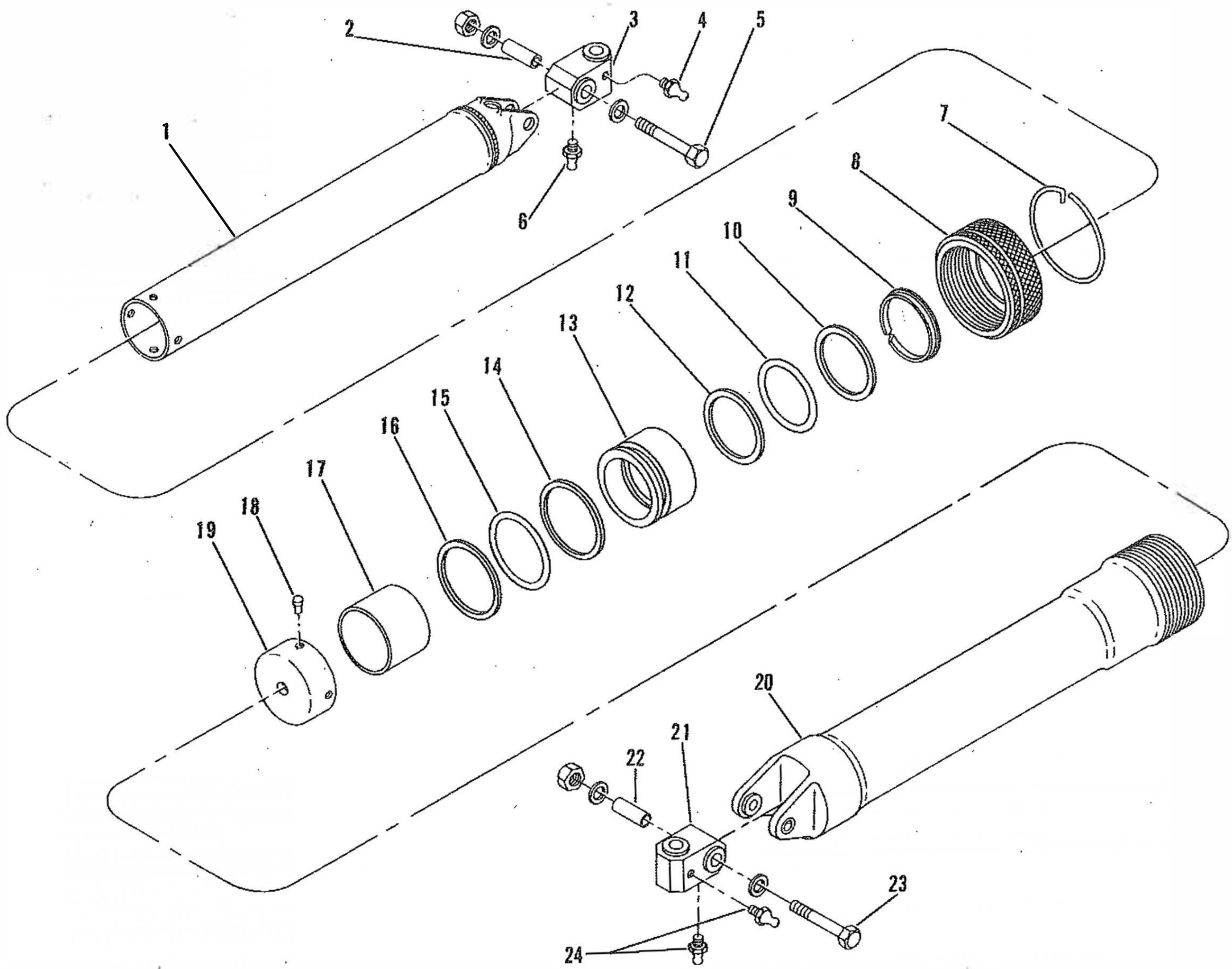


Figure 2–21. Tail Landing Gear Removal and Disassembly



1. Rod Assembly
2. Spacer
3. Universal
4. Lubrication Fitting
5. Bolt, Washers, Nut
6. Lubrication Fitting
7. Lock Ring
8. Bearing Retaining Nut
9. Scraper
10. Ring
11. Packing
12. Ring
13. Bearing
14. Ring
15. Gasket
16. Ring
17. Spacer
18. Pin
19. Orifice
20. Cylinder Assembly
21. Universal
22. Spacer
23. Bolt, Washers, Nut
24. Lubrication Fittings

Figure 2–22. Tail Wheel Strut Assembly Disassembled

2–271. INSPECTION.

a. Magnaflux all steel parts.

b. Zyglo all magnesium, aluminum and bronze parts.

c. Inspect all parts for damage, corrosion and/or xcessive wear.

d. Inspect all parts which exhibit excessive wear for the dimensions given in table VII.

2–272. FITS AND CLEARANCES. Refer to table VII for fits and clearances and service tolerances for the mating parts of the tail wheel strut assembly. The following code is used in table VII:

ID — Inside Diameter
L — Loose
OD — Outside Diamtetr

2–273. REPLACEMENT.

a. Replace the oleo rod (1, figure 2–22) if it is dented, scratched or scored to a depth exceeding 25 micro-inches.

b. Replace the cylinder (20) if it is dented or if the inside surface is scratched or scored to a depth exceeding 25 micro-inches.

c. Replace all packings, gaskets, back-up rings and scrapers.

TABLE VII
TABLE OF FITS AND CLEARANCES — TAIL WHEEL STRUT ASSEMBLY

PART NO.	NOMENCLATURE	MANUFACTURING DIMENSIONS (INCHES)	MATING PART NO.	NOMENCLATURE	MANUFACTURING DIMENSIONS (INCHES)	SERVICE TOLERANCE (INCHES)
S1625-50539	Orifice	2.248 2.246 OD	S1625-50530	Cylinder	2.252 2.250 ID	0.002 L 0.006 L
S1625-50540	Bearing	2.0020 2.0000 ID	S1625-50534	Rod	1.9975 1.9965 OD	0.0055 L 0.0025 L

d. Replace all damaged or worn parts that do not conform to the service tolerances given in table VII.

2–274. ASSEMBLY. *(See figure 2–22.)*

Note

Soak all packings and gaskets in hydraulic oil, (index 6, paragraph 1–32) for five minutes before assembly.

a. Install new rings (10, 12, 14 and 16), gasket (15) and packing (11) on the bearing (13) and position the nut (8), scraper (9) and bearing (13) on the rod assembly (1).

b. Replace the spacer (17) and orifice (19) on the rod assembly (1) and secure the orifice in place with the four pins (18).

c. Position the rod assembly (1) inside the cylinder assembly (20) and tighten the bearing retaining nut (8).

d. Install the oleo nut lock ring (7) on the nut (8).

e. Install the universal assembly (3 and 21) on each end of the oleo assembly with the bolts, washers, nuts and spacers (2, 5, 22 and 23).

f. Pressure test the assembled tail wheel strut assembly. (Refer to paragraph 2–275.)

g. Fill and bleed the strut assembly. (Refer to paragraph 2–276.)

2–275. TESTING. Pressure test the assembled tail wheel strut assembly in the following manner:

a. Connect a hose to the air valve port from a hydraulic test stand.

b. Apply 1000 psi hydraulic pressure for at least two minutes and check for leakage at the weld on the rod (1, figure 2–22) and at the areas around the scraper (9) and the nut (8). No external leakage should occur.

2–276. FILLING AND BLEEDING. The filling and bleeding procedure for the tail landing gear strut is the same as for the main landing gear strut. (Refer to paragraph 2–240.)

2–277. INSTALLATION. *(See figure 2–21.)*

a. Position the boot on the strut assembly and secure it with the clamps, screws, washers and nuts at "E" (step 3).

b. Install the elbow, nut, gasket and ring in the upper end of the strut assembly at "C" (step 3).

c. Position the strut assembly in the tail cone. Connect the universal on the lower end of the strut assembly to the lugs on the yoke and fork assembly with the bolt, washer, nut and spacer (step 5).

d. Connect the universal on the upper end of the strut assembly to the tail cone fitting with the bolt, washer, nut and spacer at "B" (step 3). Inside the tail cone, connect the air hose to the oleo assembly at "C" (step 3).

e. Connect the chain to the tab on the boot at "D" (step 3).

f. Remove the support from the helicopter (step 1).

g. Check the fluid level and inflate the strut assembly in accordance with the instructions on the name plate (step 2) and in paragraph 2–264.

2–278. YOKE AND FORK ASSEMBLY.

2–279. DESCRIPTION. *(See figure 2–20.)* The yoke and fork assembly supports the tail wheel and serves as an attachment point for the lower end of the tail wheel strut assembly. The yoke is attached at its forward end to fittings on the tail cone; the strut assembly attaches to the aft end of the yoke. The yoke and fork assembly houses the swiveling components for the tail wheel and contains the lockpin assembly of the tail wheel lock control system. A jack pad is installed on the yoke forward of the lockpin assembly.

2–280. REMOVAL. *(See figure 2–21.)*

a. Chock the main wheels and jack the helicopter at the jack pad just forward of the yoke assembly (step 1). (Refer to paragraph 1–14.)

b. Release the air from the strut assembly. (Refer to paragraph 2–264.)

WARNING

The air pressure in the strut must be released before disconnecting the strut assembly.

c. Disconnect the universal on the lower end of the strut assembly from the lugs on the yoke and fork assembly by removing the bolt, washer, nut and spacer (step 5).

d. Disconnect the wheel lock control cable from the lockpin at "A" (step 4). Place a support under the yoke and fork assembly. Unbolt the assembly from the tail cone attachment fitting at "B" (step 4). Lower the yoke and fork assembly from the tail cone.

2—281. DISASSEMBLY.

a. Bend back the tang of the lock washer and remove the nut, lock washer and spacer at "A" (step 6, figure 2—21). Pull the wheel assembly off the axle.

b. Remove the bolt (1, figure 2—23), washers (2 and 16) and nut (17) from the cap (3) at the top of the yoke assembly (5). Cut the lock wire and remove the bolts (14) and washers (15). Lift off the cap (3) and remove the cams (4 and 18), key (19), retainer (20) and spring (21).

Note

Use care when removing the bolts (14) which secure the cap (3). Spring tension will force the components up. Release the tension on the spring gradually.

c. Cut the lock wire and remove the nut (22), washer (23), bearing cone (24) and bearing cup (25).

d. Pull the shaft (31) and fork assembly (35) out of the yoke assembly (5) as a unit. Remove the seal (30), bearing cone (29) and bearing cup (28) from the yoke.

e. Remove the bolts (33), washers (34 and 36) and nuts (37) from the fork assembly (35) and remove the shaft (31). Push the retainer (32) out of the shaft.

f. Remove the bolts (38), washers (39), and nuts (40) from the fork assembly (35) and pull the axle (42) out of the fork assembly. Remove the bushing (41) from the axle.

g. Remove the retaining ring (27) and pull the lockpin assembly (26) out of the bottom of the yoke assembly. Disassemble the lockpin assembly by removing the retaining ring (9) from the housing (13) and separating the retainer (10), spring (11), pin (12) and housing (13).

Note

To replace a broken or bent lockpin without removing the yoke and fork assembly, refer to paragraph 2—293, step e.

h. Cut the lock wire and remove the bolts (8) and washers (7) and remove the jack pad (6) from the yoke assembly (5).

2—282. CLEANING. Clean the components of the yoke and fork assembly with solvent (index 3, paragraph 1—32) or kerosene (index 19, paragraph 1—32). Make certain that the drain hole on the bottom of the yoke assembly is free from obstructions.

2—283. REPLACEMENT OF PARTS.

a. Replace parts that are obviously damaged or unusually worn.

b. Replace the seal (30, figure 2—23).

c. Replace the bearing cones (24 and 29) and bearing cups (25 and 28) if they show signs of brinelling, friction oxidation, scoring or unusual wear.

2—284. ASSEMBLY. *(See figure 2—23.)*

a. Secure the jack pad (6) to the yoke assembly (5) with the bolts (8) and washers (7). Lockwire the bolts.

b. Apply a light coat of grease (index 24, paragraph 1—32) on the pin (12, figure 2—23) and spring (11) of the lockpin assembly (26). Insert the pin, spring and retainer (10) into the housing (13) and secure them with the retaining ring (9). Install the lockpin assembly in the yoke assembly (5) and secure it with the retaining ring (27).

c. Place the bushing (41) in the axle (42), insert the axle into the fork assembly (35) and install the bolts (38), washers (39) and nuts (40).

d. Position the retainer (32) inside the shaft (31). Slide the shaft into the fork assembly (35) and secure the retainer, shaft and fork assembly with the bolts (33), washers (34 and 36) and nuts (37).

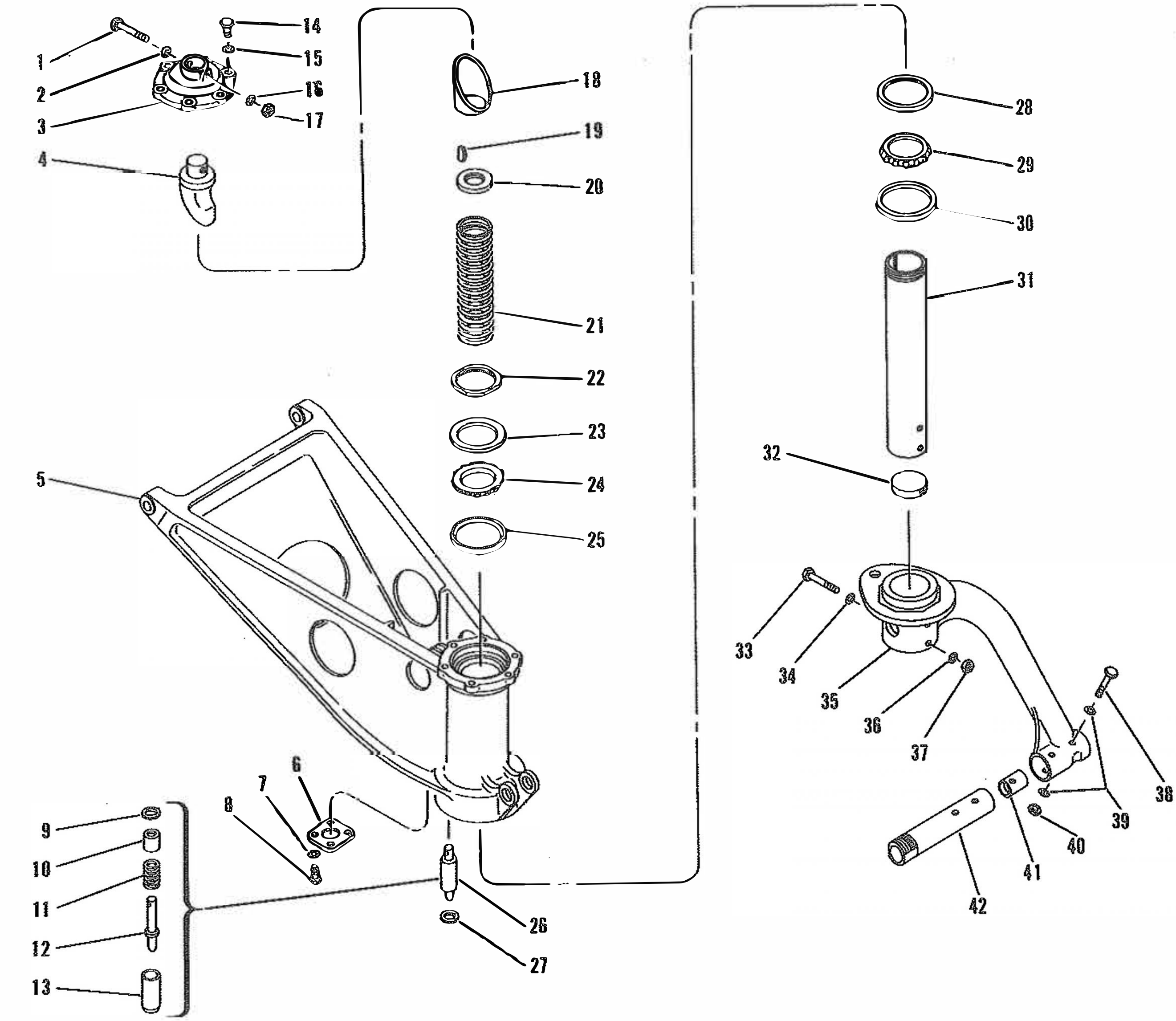
Note

The upper of the two bolts (33) secures the retainer (32) inside the shaft (31).

e. Install the bearing cup (28) in the yoke assembly. Hand pack the bearing cup (28) and the bearing cone (29) with grease (index 21, paragraph 1—32) and install the bearing cone. Install the seal (30, figure 2—23).

f. Insert the shaft (31) through the bearing cone (29) and push it up into position. Carefully work the shoulder of the fork assembly (35) into the seal (30).

g. Install the bearing cup (25). Pack the bearing cup (25) and the bearing cone (24) with grease (index 21, paragraph 1—32) and install the bearing cone on the shaft (31, figure 2—23). Install the washer (23) and the nut (22). Tighten the nut (22) until the bearings start to drag. Back off the nut until the shaft rotates freely with no end play. Lockwire the nut in two places so that it cannot move in either direction.



1. Bolt	12. Pin	23. Washer	33. Bolt
2. Washer	13. Housing	24. Bearing Cone	34. Washer
3. Cap	14. Bolt	25. Bearing Cup	35. Fork Assembly
4. Cam	15. Washer	26. Lockpin Assembly	36. Washer
5. Yoke Assembly	16. Washer	27. Retaining Ring	37. Nut
6. Jack Pad	17. Nut	28. Bearing Cup	38. Bolt
7. Washer	18. Cam	29. Bearing Cone	39. Washer
8. Bolt	19. Key	30. Seal	40. Nut
9. Retaining Ring	20. Retainer	31. Shaft	41. Bushing
10. Retainer	21. Spring	32. Retainer	42. Axle
11. Spring	22. Nut		

Figure 2—23. Yoke and Fork Disassembled

h. Pack the spring (21) lightly with grease (index 24, paragraph 1—32). Coat the surfaces of the retainer (20, figure 2—23) and cams (4 and 18) with grease (index 24, paragraph 1—32).

i. Install the spring (21, figure 2—23) and retainer (20) inside the shaft (31). Place the key (19) in the cam (18) and install the cam and key in the shaft. Set the cam (4) on the cam (18) and set the cap (3) on the cam (4). Compress the unit and, with the cap positioned to allow the installation of the bolt (1), bolt the cap (3) to the yoke assembly (5) with the bolts (14) and washers (15). Lockwire the bolts in threes.

Note

If a new cam (4) or cap (3) is installed, position the fork in its static fore-and-aft position, pick up the pilot hole or old hole in the cap (3) and line drill a •.250 inch hole through the cam (4) and cap (3) for the bolt (1).

j. Install the bolt (1), washer (2 and 16) and nut (17).

k. Pack the wheel bearings with grease (index 50, paragraph 1–42). Install the wheel assembly on the axle (42, figure 2–23). Install the spacer, lock washer and nut at "A" (step 6, figure 2–21). Tighten the nut and bend one edge of the washer over the nut.

2–285. INSTALLATION. *(See figure 2–21.)*

a. Position the yoke and fork assembly at the fittings in the tail cone. Install the bolts, washers, nuts and spacers at "B" (step 4). Connect the wheel lock control cable to the lockpin at "A" (step 4).

b. Connect the universal on the lower end of the strut assembly to the lugs on the yoke and fork assembly with the bolt, washer, nut and spacer (step 5).

c. Lower the jack and remove the chocks.

d. Inflate the strut assembly in accordance with the instructions on the name plate and in paragraph 2–264. Check that the tire is properly inflated. (See figure 1–15.)

2–286. TAIL WHEEL ASSEMBLY.

2–287. DESCRIPTION. *(See figure 2–20.)* The tail wheel assembly consists of a six-ply rating, type 3, 6.00 x 6 tire, a 6.00 x 6 tube, a two-section rim and wheel bearings.

2–288. REMOVAL. *(See figure 2–21.)*

a. Chock the main wheels (step 1) and jack the helicopter at the jack pad on the yoke assembly (step 6.) (Refer to paragraph 1–14.)

b. Bend back the tang of the lock washer and remove the nut, lock washer and spacer at "A" (step 6, figure 2–21). Pull the wheel assembly off the axle. Remove the screws and retainers and remove the wheel bearings at "B" (step 6).

WARNING

Deflate the tire completely before removing the nuts that hold the two sections of the rim together.

2–289. MAINTENANCE.

a. Wash the wheel bearings in clean solvent (index 3, paragraph 1–32) or kerosene (index 19, paragraph 1–32). Dry the bearings thoroughly.

b. Hand pack the wheel bearings with grease (index 24, paragraph 1–32).

2–290. INSTALLATION. *(See figure 2–21.)*

a. Install the lubricated wheel bearings and retainers in the wheel assembly at "B" (step 6) and secure with screws. Install the wheel assembly on the axle. Install the spacer, lock washer and nut at "A" (step 6). Tighten the nut and bend one edge of the washer over the nut.

Note

Check that the tire is properly inflated. (See figure 1–15.)

b. Remove the jack (step 6) and chocks (step 1).

2–291. TAIL WHEEL LOCK CONTROL SYSTEM.

2–292. DESCRIPTION. *(See figure 2–24.)* The tail wheel lock control system consists primarily of a handle marked "TAIL WHEEL LOCK" and a bell crank mounted below the pilot's instrument panel, a two-section cable which extends from the cockpit along the right side of the helicopter to a spring-loaded bell crank in the tail cone and a second cable which extends from the spring-loaded bell crank to the spring-loaded tail wheel lockpin on the yoke and fork assembly of the tail wheel. The cables are routed through pulleys, guards and fair-leads. A turnbuckle barrel connects the two sections of the forward cable. Pulling the "TAIL WHEEL LOCK" handle under the instrument panel releases the tension on the tail wheel lockpin and locks the tail wheel in the trailing position. The lockpin is grooved so it will shear before damaging the collar if the lockpin is not properly disengaged.

CAUTION

Do not tow the helicopter with the tail wheel lock engaged.

2–293. REMOVAL. *(See figure 2–24.)*

a. Disconnect the cable from the bell crank at "A" (step 1) on the pilot's side of the cockpit. Disconnect the control assembly from the bell crank at "B" (step 1) and unbolt the bell crank from the support at "C" (step 1). Unbolt the swivel which supports the control assembly from the support at "D" (step 1) and remove the control assembly and spacer.

b. Disassemble the control assembly by unscrewing the fork and by removing the washers, nut and swivel.

c. In the tail cone, disconnect both cables from the ends of the bell crank at "A" and "B" (step 2.) Unhook the spring from the bell crank and from the bracket at "C" (step 1). Unbolt the bell crank from its brackets at "D" (step 2).)

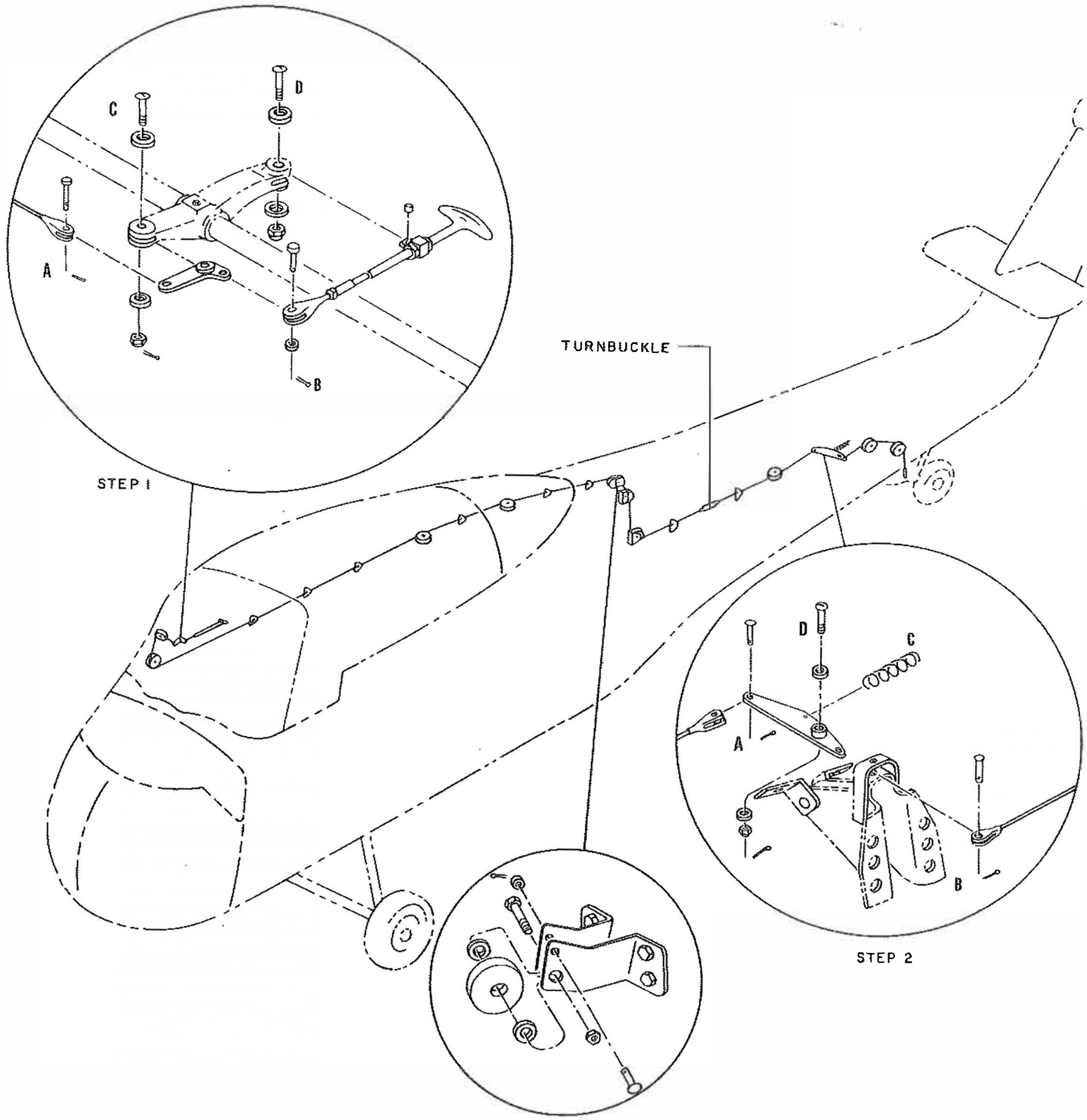


Figure 2—24. Tail Wheel Lock Control System

d. Cut the lock wire and disconnect the cables at the turnbuckle barrel in the tail cone. Work the sections of cable through the pulleys and fair-leads to remove them.

e. Disconnect the cable from the lockpin on the tail landing gear yoke and fork assembly at "A" (step 4, figure 2—21). Remove the cable.

Note

To replace a broken or bent lockpin (12, figure 2—23), disconnect the cable from the lockpin, depress the retainer (10). With a screwdriver, remove the retaining ring (9) and pull the lockpin up out of the housing (13). Use a drift against the bottom of the lockpin, if necessary.

f. Unbolt any pulleys that must be removed. Remove the pins, washers, and cotter pins from the brackets. (See pulley detail, figure 2—24.)

2–294. INSTALLATION. *(See figure 2–24.)*

a. Replace any pulleys that were removed. (See pulley detail, figure 2–21.)

b. Work the aft cable through the pulleys and pin it to the lockpin on the yoke and fork assembly at "A" (step 4, figure 2–21).

c. Work the sections of the forward cable into position through the fair-leads and pulleys. Connect the cables at the turnbuckle barrel in the tail cone.

d. In the tail cone, bolt the bell crank to the bracket at "D" (step 2) and replace the spring at "C" (step 2). Pin the cables to the ends of the bell crank at "A" and "B" (step 2).

e. Install the swivel and fork on the control assembly. Adjust the distance from the center of the hole in the fork to the end of the rod in the control to a length of 1-11/16 inches and lock the lock nut.

f. Install the spacer and bolt the control assembly to the support at "D" (step 1). Bolt the bell crank to the support at "C" (step 1). Pin the control assembly to the bell crank at "B" (step 1) and pin the cable to the bell crank at "A" (step 1).

g. Adjust the tail rotor lock control system. (Refer to paragraph 2–295.)

2–295. ADJUSTMENT. Adjust the length of the cable at the turnbuckle barrel in the tail cone 1½ inches of travel at the control handle and ⅝-inch of travel of the lockpin on the tail wheel yoke and fork assembly from the locked to the unlocked position. Lockwire the turnbuckle barrel.

2–296. MAIN ROTOR.

2–297. DESCRIPTION. The main rotor consists of the main rotor head assembly and the main rotor blades. The main rotor head assembly is mounted above the transmission compartment of the helicopter on the main shaft of the main gear box. The four main rotor blades, which provide the lift necessary to maintain flight, are attached to the sleeves of the main rotor head assembly. The main rotor is inclined at a three-degree angle forward of the perpendicular. (Refer to paragraph 1–15.)

2–298. MAIN ROTOR BLADES.

2–299. DESCRIPTION. The four main rotor blades are secured to the sleeves of the main rotor head assembly by taper pins and nuts. Each blade consists of a hollow, extruded aluminum spar, twenty-three aluminum trailing edge pockets bonded to the spar, a tip cap fastened with screws to the spar and the outboard pocket and a cuff bolted to the inboard end of the spar to provide the means of attachment to the main rotor head assembly. The aluminum spar forms the leading edge of the blade. Each blade is balanced statically and dynamically within close tolerances thus permitting the blades to be interchanged or replaced individually.

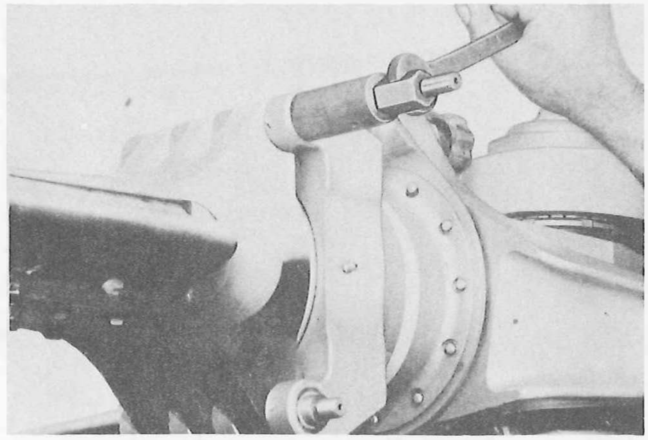


Figure 2–25. Using Special Puller to Remove Main Rotor Blade Taper Pins

2–300. REMOVAL. Remove each individual blade as follows:

a. Support the blade at both ends.

b. Remove the nut and washer from each taper pin. (See step 1, figure 2–29.)

c. Remove each taper pin by threading the puller, Sikorsky part No. S1570-10338-6, onto the threads on the large end of the taper pin and tightening the puller until the pin is pulled free. Remove the pin. (See figure 2–25.)

d. Remove the blade from the sleeve of the main rotor head assembly and store it in a padded rack with the leading edge down.

2–301. REPLACEMENT. Each blade is interchangeable with any other blade.

CAUTION

The main rotor blades are painted and balanced after fabrication. Any attempt to paint the blades in the field will change their balance and set up undesirable flight characteristics.

2–302. CLEANING. Wash the main rotor blades with mild soap and water only.

WARNING

Never use solvents or cleaners such as lacquer thinner, naphtha, carbon tetrachloride or other organic compounds to clean the blades. These compounds will weaken the bonding of the blades.

Figure 2–26. Tracking Main Rotor Blades

2–303. PREPARATION FOR SHIPMENT. Pack the main rotor blades securely in a padded container with the leading edge down.

2–304. INSTALLATION. Install each individual blade as follows:

a. Support the blade at both ends and line up the cuff of the blade with the sleeve of the main rotor head assembly.

Note

The leading edge of the blade must face the direction of rotation.

b. Insert the taper pins into the sleeve and cuff from the leading edge side. Lightly tap the pins into position with a soft-headed mallet. (See step 1, figure 2–29.)

CAUTION

Do not hammer the pins after they are once seated.

c. Install the washer and nut on each taper pin. Tighten the nut with 30 to 35 inch-pounds torque.

d. Track the blades. (Refer to paragraph 2–305.)

2–305. TRACKING. *(See figure 2–26.)* Tracking the main rotor blades consists of checking the blades under actual operating conditions to make sure that all blades rotate in the same horizontal plane or track. Adjustment of the pitch of the blade is made, as necessary, to compensate for inherent blade angle differences. Unless the main rotor blades are in proper track, vibrations will occur in the helicopter with every revolution of the main rotor. Tracking the blades is to be performed by a qualified pilot and one or more maintenance men.

Note

Tracking must be performed whenever the helicopter has been re-rigged, or the blades, the main gear box or the main rotor head assembly have been replaced.

a. Mark the tip of each blade with chalk or wax crayon of the same color as the color coding on the cuff of the blade itself.

b. Face the helicopter into the wind. Set the pole of the trackometer, Sikorsky part No. S1670-10396, on the ground on the right side of the helicopter and about 12 inches outside the rotating disc area of the blades. Mark the position of the trackometer pole on the ground and adjust the height of the trackometer to bring the middle of the flag level with the tips of the rotating blades.

c. Hold the trackometer pole on the marked position on the ground and tilt the trackometer outward and downward away from the blades.

d. Engage the clutch, operate the engine at 2200 rpm and increase collective pitch to medium pitch. Hold both control sticks steady.

WARNING

The helicopter should be in firm contact with the ground while tracking the blades. If necessary to track the blades with greater power, or if the helicopter is very light, the helicopter should be weighed down.

e. Stand facing in the same direction as the helicopter so that the advancing blades come from behind and are viewed after they pass overhead. Keep the pole in the

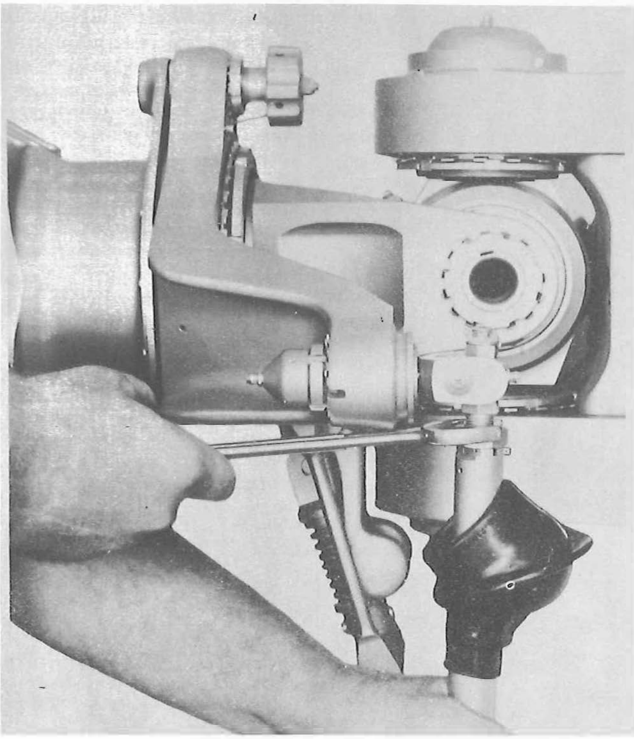


Figure 2–27. Adjusting Main Rotor Blade Pitch

marked position on the ground with the flag pointing slightly in the direction of rotation. Slowly move the trackometer into the tip path of the blades. Allow each blade to make one contact with the trackometer flag. Tilt the trackometer away from the blades as quickly as possible when contact with the blades has been made.

Note

There is no "feel" received from the rotor blades striking the trackometer. If there is any hesitation on tipping the trackometer out after contact has been made, more than one set of marks will be made on the trackometer.

f. Examine the blade markings on the flag. If the spread of the marks is greater than ½-inch, adjust the pitch of the blade or blades that are out of track in accordance with instructions in steps g. and h.

Note

Check the tracking a second, or even a third, time before making the adjustment. A sudden gust of wind or slight movement of the controls will cause a false indication of blade track.

g. To adjust the pitch of a blade lengthen or shorten the rod assembly which extends from the rotating star to the yoke on the horn of the sleeve-spindle assembly. (See figure 2–27.) Remove the lock wire, loosen the jam nut below the yoke and turn the fitting. Shorten the

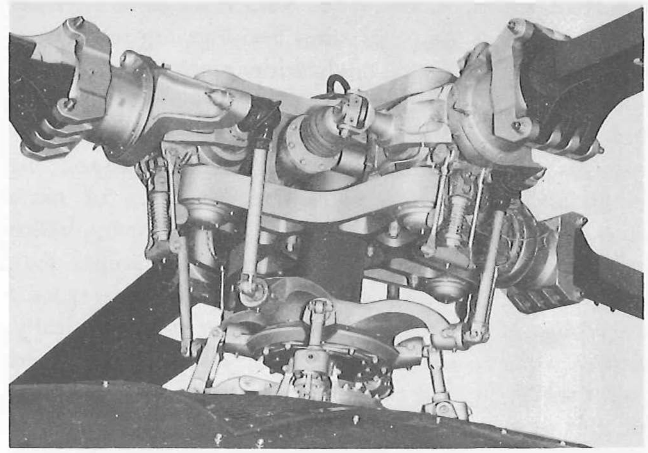


Figure 2–28. Main Rotor Head Assembly Installed

rod to lower the tip path plane; lengthen the rod to raise the tip path plane.

h. Tighten the jam nut.

i. Clean the trackometer flag.

j. Track the blades again to determine if the adjustments are satisfactory. Readjust if necessary.

Note

Although a spread of ½-inch for the track mark of the blades is allowable, it is recommended that the blades be adjusted until they are in perfect track.

k. Check to see that the jam nut is tightened. Lockwire the washer to the jam nut.

Note

If the helicopter is rough after tracking the blades at medium pitch and power, recheck the tracking at high power with take-off rpm and main rotor pitch increased until the helicopter is almost hovering, but still in firm contact with the ground. Adjust as necessary.

2–306. MAIN ROTOR HEAD ASSEMBLY.

2–307. DESCRIPTION. *(See figure 2–28.)* The main rotor head assembly is splined to and is supported by the main drive shaft of the main gear box. The main rotor head assembly supports the main rotor blades, is rotated by torque from the main gear box and provides the means of transmitting the movements of the flight controls to the blades. The principal components of the main rotor head assembly are the main rotor hub assembly and the star assembly. The main rotor hub assembly consists primarily of an upper and lower plate secured to a hub and spacers, hinge assemblies which are located between each arm of the plates and to which sleeve-spindle assemblies are attached, and four dampers. The star assembly consists of a rotating star and a stationary star. Other components of the main rotor head assembly are: the damper fluid tank, four anti-flapping restrainers, four droop restrainers, the stationary and the rotating scissors and four control rods. The star assembly and the four control rods permit the movements of the flight controls to be transmitted to the main rotor blades. The hinge assemblies allow each blade to hunt, or move horizontally, about its vertical axis; the dampers, which are supplied with hydraulic oil from the damper fluid tank, restrict this horizontal motion. The sleeve-spindle assemblies allow each blade to flap, or move vertically, about its horizontal axis; the anti-flapping restrainers and the droop restrainers restrict this vertical motion when the rotor head is not rotating. The stationary scissors is secured to the stationary star and the main gear box; the rotating scissors is secured to the rotating star and the main rotor hub assembly.

2—308. TROUBLE SHOOTING.

Note

Malfunctioning of the main rotor head assembly results in abnormal low frequency vibrations.

Trouble	Probable Cause	Remedy
Low frequency vibration noticed through control stick	Faulty servo unit	Replace faulty servo unit
Low frequency vibration noticed through fuselage	Rotor blades out of track	Track and adjust blades
	Main rotor blade damaged	Repair or replace blade
	Loss of hydraulic fluid in damper fluid tank	Service fluid tank; replace leaking tank, line or damper if excessive loss continues
	Dirty hydraulic fluid in dampers	Drain and refill dampers and fluid tank
	Air in damper	Work air out of damper
	False damper rate	Correct for excessive play or binding at attachment points
	Uneven damper rate	Replace dampers
	Improper relief valve action in damper	Replace damper
	Sleeve bearings bad	Replace main rotor hub assembly
	Hinge bearings bad	Replace main rotor hub assembly
	Hub assembly improperly installed	Install correctly
	Loose lock nut on main gear box shaft	Tighten to specified torque
	Main gear box improperly installed	Install correctly; check torques of attachment bolts
	Failure of fuselage at main gear box attachment point	Repair structure
	Failure of main gear box supports	Replace support legs
	Excessive side play in main gear box shaft	Replace main gear box

2—309. REMOVAL.

a. Remove the main rotor blades. (Refer to paragraph 2—300.)

Note

Before proceeding with the removal of the main rotor head assembly, adjust the air pressure in the main shock struts or jack the helicopter until the main shaft of the main gear box is in a true vertical position. The elimination of the three-degree forward angle of the main gear box shaft will facilitate removal of the rotor head.

b. Disconnect a hose assembly from a damper at "A" (step 2, figure 2—29) and drain the fluid tank.

c. Disconnect the other three hose assemblies from the dampers at "A" (step 2). Unbolt and lift the fluid tank assembly from the main rotor head at "B" (step 2).

d. Unbolt the four rod assemblies from the eyebolts on the rotating star at "A" (step 3). Unbolt the rotating scissors from the bracket on the lower plate of the hub assembly at "B" (step 3).

e. Remove the nuts and washers and remove the lock from the two bolts at "A" (step 4).

CAUTION

Do not remove the two bolts that hold the lock.

f. Set the wrench, S1670-10399, on the lock nut. Mate the splines of the drive cylinders, S1570-10190-1 and S1570-10190-2, together and mate the splines of a drive cylinder into the wrench. Bolt the flange adapter, S1570-10191, to the housing, KS-2172, and bolt the arm assembly, S1570-10189 or S1670-10447, to the flange adapter.

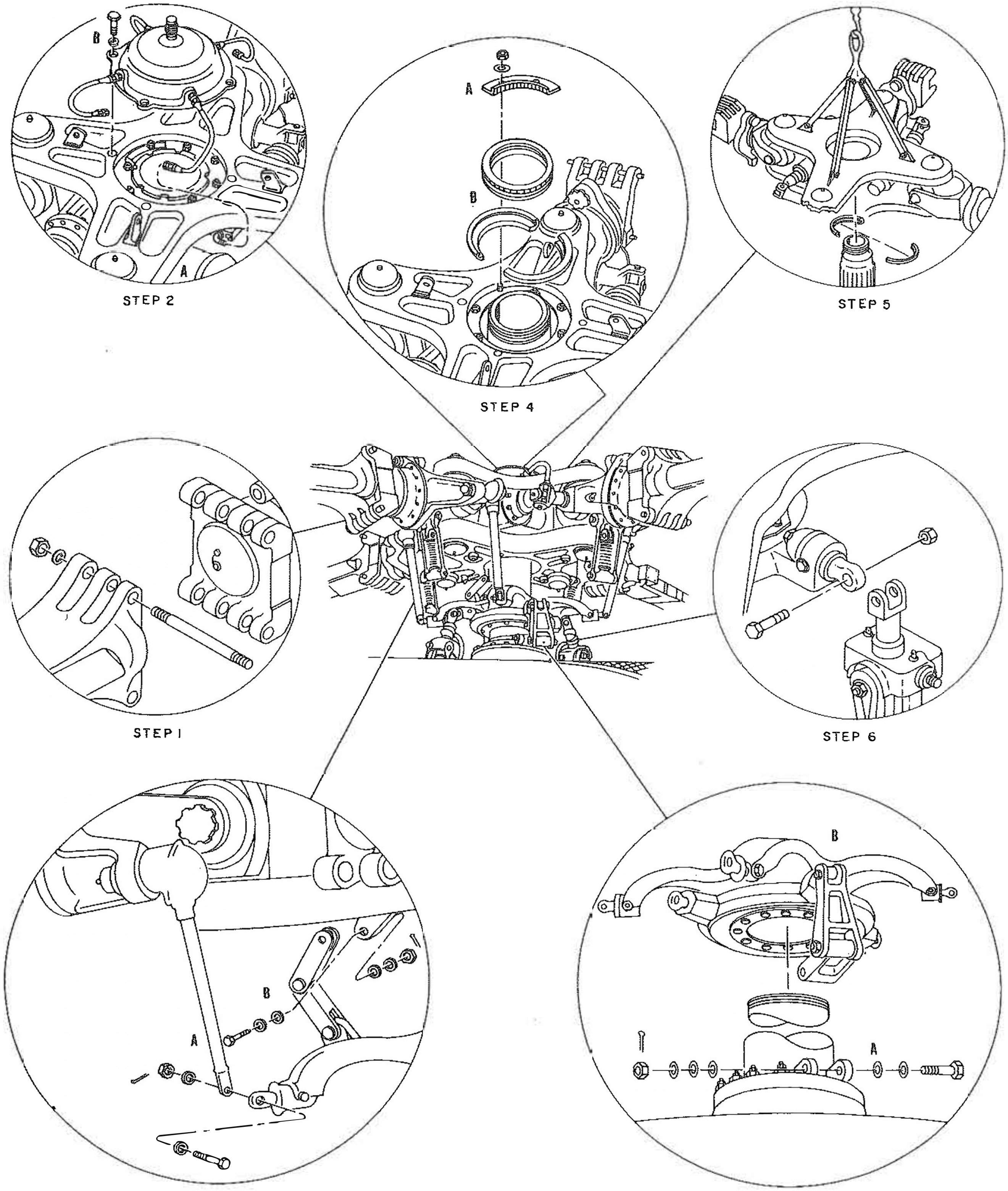


Figure 2–29. Main Rotor Head Assembly Removal – Installation

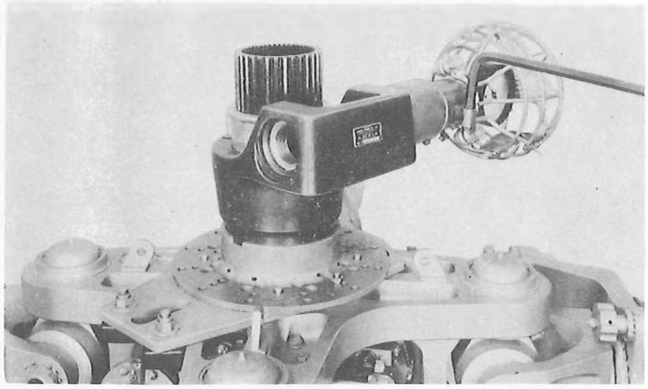


Figure 2–30. Using Special Tools on Main Rotor Nut

Set the assembled unit over the drive cylinders. Screw the Hydra-Pak ram and gage assembly, HSP-ST5006, into the housing, KS-2172. Slide the forged ball arm sleeve, KS-2069, revision "C" or later, or KS-2187 over the splines of the drive cylinder and use the Hydra-Pak ram and gage assembly to loosen the lock nut. (See figure 2–30.)

WARNING

Do not, under any circumstances, use the welded arm sleeve KS-2069, revision "A" or "B." Use only the forged ball arm sleeve, KS-2069, revision "C" or later, or KS-2187.

g. Unscrew and lift out the lock nut and the upper split cone at "B" (step 4, figure 2–29).

Note

The split cones, both upper and lower, must be maintained in matched sets.

h. Bolt the sling, Sikorsky part No. S1670-10402, to the hoisting lugs on the hub upper plate. Hoist the hub assembly off the main gear box shaft. Lift out the halves of the lower split cone when the hub assembly clears the shaft (step 5).

i. Unbolt the three servo units from the eyebolts on the stationary star assembly (step 6).

j. Unbolt the stationary scissors from the lugs on the main gear box at "A" (step 7). Lift off the star assembly at "B" (step 7).

2–310. CLEANING. Clean the surfaces of the main rotor head assembly components with solvent (index 3, paragraph 1–32) or kerosene (index 19, paragraph 1–32).

Note

Check that the drain hole in each control rod trunnion boot is clear of foreign matter.

2–311. DISASSEMBLY AND ASSEMBLY. Disassembly and assembly of the main rotor head assembly in the field is limited to removal and replacement of the following items: dampers (paragraphs 2–315 through 2–323), fluid tank (paragraphs 2–342 through 2–347), anti-flapping restrainers (paragraphs 2–324 through 2–329), droop restrainers (paragraphs 2–330 through 2–333), stationary scissors (paragraphs 2–334 through 2–337), rotating scissors (paragraphs 2–338 through 2–341), star assembly (paragraphs 2–348 through 2–354) and flight control rods (paragraphs 2–355 through 2–358). Forward the main rotor head assembly, including the above listed components, to an Overhaul Depot for repair.

2–312. PREPARATION FOR SHIPMENT.

a. Lubricate the main rotor head assembly. (See figure 1–16.)

b. Coat the taper pin holes, the splines inside the hub and the ends of the control rods with corrosion-preventive compound (index 4, paragraph 1–32).

c. Prepare the dampers for shipment. (Refer to paragraph 2–321.)

d. Cover the taper pin holes and caps of the sleeves with greaseproof paper (index 8, paragraph 1–32) and secure with tape (index 9, paragraph 1–32). Pack the main rotor head assembly securely in a suitable container.

Note

When returning the main rotor head assembly for overhaul, include the dampers, fluid tank, anti-flapping restrainers, droop restrainers, stationary scissors, rotating scissors, control rods, taper pins and star assembly.

2–313. PLACING IN SERVICE AFTER SHIPMENT.

a. Clean the corrosion-preventive compound from inside the taper pin holes in the sleeves and from the splines inside the hub with solvent (index 3, paragraph 1–32).

b. Install the main rotor head assembly. (Refer to paragraph 2–314.)

c. Lubricate the main rotor head assembly. (See figure 1–16.)

d. Prepare the damper for service. (Refer to paragraph 2–322.)

2–314. INSTALLATION. *(See figure 2–29.)*

a. Install the star assembly on the main gear box shaft at "B" (step 7). Bolt the stationary scissors to the lugs on the main gear box at "A" (step 7), with two thrust washers, bolt, washer and nut. Shim evenly with the other washers to obtain a fit with no end play or binding. Do not install the nut tight enough to cause deflection of the lugs and binding. Install the cotter pin.

b. Connect the three servo units to the eyebolts on the stationary star assembly with the bolts and nuts (step 6).

c. Apply transmission or engine oil (index 34, paragraph 1–32) to the split cones and apply grease (index 21, paragraph 1–32) to the splines. Apply thread lubricant (index 43, paragraph 1–32) to the threads of the hub.

d. Lower the hub assembly onto the main shaft with the sling, Sikorsky part No. S1670-10402. Set the halves of the lower split cones inside the hub and hold the halves in place until the hub is set on the shaft (step 5, figure 2–29). Have the main shaft perpendicular. (Refer to Note, step a., paragraph 2–309.)

e. Position the halves of the upper cone on the lock nut and set both in place on the hub at "B" (step 4, figure 2–29). Screw on the lock nut. Set the wrench, S1670-10399, on the lock nut. Mate the splines of the drive cylinders, S1570-10190-1 and S1570-10190-2, together and mate the splines of a drive cylinder into the wrench. Bolt the flange adapter, S1570-10191 to the housing, KS-2172, and bolt the arm assembly, S1570-10189 or S1670-10447, to the flange adapter. Set the assembled unit over the drive cylinders. Screw the Hydra-Pak ram and gage assembly, HSP-ST5006, into the housing, KS-2172. Slide the forged ball arm, KS-2069, revision "C" or later, or KS-2187 over the splines of the drive cylinder.

WARNING

Do not, under any circumstances, use the welded arm sleeve KS-2069, revision "A" or "B." Use only the forged ball arm sleeve, KS-2069, revision "C" or later, or KS2187.

f. Use the Hydra-Pak ram and gage assembly to tighten the lock nut with 2000 to 2500 foot-pounds torque. (See figure 2–30.)

WARNING

After the first five flying hours have accumulated on the main rotor head assembly, retighten the lock nut with 2000 to 2500 foot-pounds torque.

g. Install the lock on any two bolts, except the bolt with index zero, and tighten the nuts at "A" (step 4, figure 2–29) with 560 to 690 inch-pounds torque.

h. Connect the rotating scissors to the bracket on the lower plate with the two thrust washers, bolt, washer and nut at "B" (step 3). Do not overtighten the nut. Install the cotter pin.

i. Connect each control rod to an eyebolt on the rotating star with the bolt, washers and nut. Do not overtighten the nut. Install the cotter pin.

j. Secure the fluid tank to the hub with the bolts and washers at "B" (step 2).

k. Connect the hose assemblies to the dampers at "A" (step 2).

l. Install the main rotor blades. (Refer to paragraph 2–304.)

m. If the main rotor head assembly was leveled by means of the struts, service the landing gear with air as outlined in paragraph 2–228.

n. Lubricate the main rotor head assembly. (See figure 1–16.)

o. Check the flight control rigging. (Refer to paragraph 2–523.)

p. Track the main rotor blades. (Refer to paragraph 2–305.)

2–315. DAMPER.

2–316. DESCRIPTION. *(See figures 2–31 and 2–32.)* A damper is installed between the upper and lower plate of the main rotor hub assembly inboard of each hinge assembly. The piston of the damper is connected by a trunnion assembly to each hinge assembly. Hydraulic oil for the damper is supplied from the fluid tank. Self-bleeding of the damper is accomplished by an internal differential valve. The dampers restrain the hunting of the blades during rotation and also absorb shocks between the blades and the main rotor hub assembly during clutch engagement or when the main rotor rpm or blade pitch is changed.

2–317. REMOVAL. *(See figure 2–31.)*

a. Disconnect the hose assembly from the damper at "A" (step 1) and drain the hydraulic oil from the fluid tank.

b. Extend the damper piston by moving the sleeve. Remove the cotter pin, nut and bolt. Separate the washers, pin, spacer, trunnion and damper fork from the horizontal pin at "B" (step 1).

c. Unbolt the upper and lower brackets from the upper and lower plates of the hub assemblies and remove the damper at "C" (step 1). Remove the bracket assemblies.

Note

If interference is encountered between the damper and the hub-to-upper-plate bolt, proceed as indicated in steps d. through f.

d. Remove the fluid tank assembly. (Refer to paragraph 2–344.)

e. If the interfering bolt is not the bolt in the off-set position (stamped "O" on the upper plate) or one of

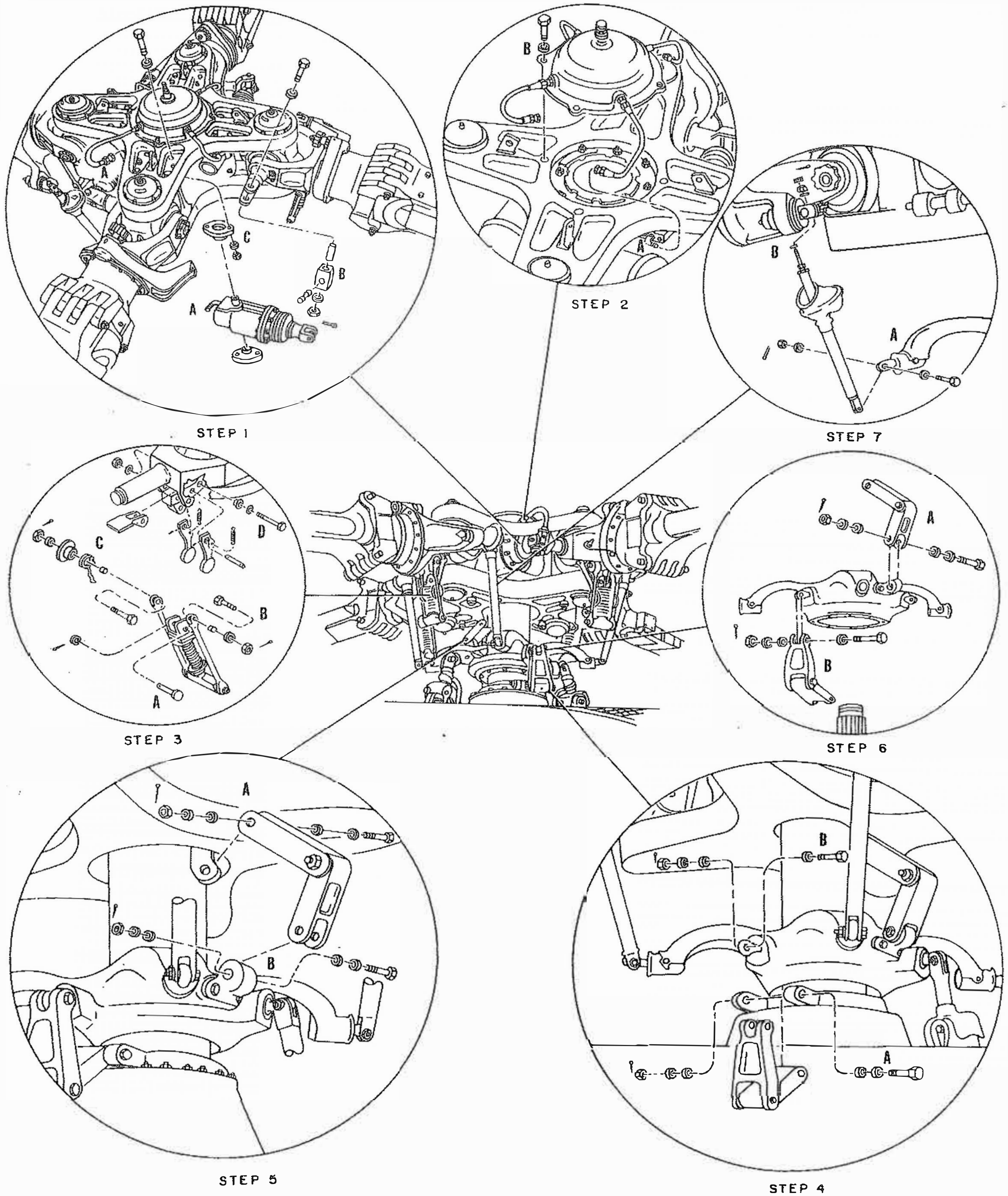


Figure 2–31. Main Rotor Head Assembly Components Removal

the bolts which secure the lock nut lock, remove the bolt to provide the necessary clearance and remove the damper.

f. If the bolt is either the off-set bolt (stamped "O" on the upper plate) or one of the bolts which secure the lock nut lock, remove the damper to the right of the one being removed to provide clearance. Remove the damper.

2–318. FILLING WITH PRESSURE EQUIPMENT.

a. Cut the lock wire and unscrew the plug from the damper cylinder head.

b. Cut the lock wire and remove the larger of the two plugs at the other end of the cylinder.

Note

This plug is the inner one of the two plugs in the top of the off-set pad.

c. Connect a line from a hydraulic pump to the port in the cylinder head.

d. Hold the damper at an angle with the elbow end up and pump hydraulic oil (index 6, paragraph 1–32) into the damper until it runs freely without air bubbles from the open port and elbow at the upper end.

e. Disconnect the line and reverse the position of the damper, connecting the line to the elbow on the other end.

f. Pump hydraulic oil into the damper through the elbow until the oil flows without air bubbles out the cylinder head port and the other open port.

g. Install and lockwire the two plugs in the damper.

h. Disconnect the pressure line and cap of the elbow.

Note

For instructions on bleeding the dampers, refer to paragraph 2–323, step g.

2–319. FILLING WITHOUT PRESSURE EQUIPMENT.

a. Cut the lock wire and unscrew the plug from the damper cylinder head.

b. Cut the lock wire and remove the larger of the two plugs at the other end of the cylinder.

Note

This plug is the inner one of the two plugs in the top of the off-set pad.

c. Fill a receptacle with hydraulic oil (index 6, paragraph 1–32) and submerge the damper completely in the oil. Wait until all air bubbles disappear.

d. Keeping the damper submerged, cycle the piston in and out by hand until all air is expelled.

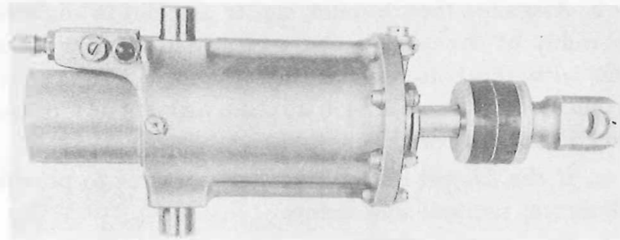


Figure 2–32. Main Rotor Damper

Note

After cycling the piston, hold the damper with the elbow end higher than the cylinder head end and check for evidence of trapped air at the port in the off-set pad.

e. Install the plugs and cap of the elbow while the damper is still submerged.

f. Lockwire the two plugs.

Note

For instructions on bleeding the dampers, refer to paragraph 2–323, step g.

2–320. DISASSEMBLY AND ASSEMBLY. The damper is to be disassembled and assembled only at on Overhaul Depot.

2–321. PREPARATION FOR SHIPMENT.

a. Drain out the hydraulic oil and fill the damper with hydraulic equipment preservative oil (index 5, paragraph 1–32) and cap the elbow.

b. Coat the exposed part of the piston rod with corrosion-preventive compound (index 4, paragraph 1–32).

c. Wrap the damper in greaseproof paper (index 8, paragraph 1–32) and secure with tape (index 9, paragraph 1–32).

2–322. PLACING IN SERVICE AFTER SHIPMENT.

Note

Leave the preservative oil in the damper until time for installing.

a. Remove the corrosion-preventive compound from the exposed part of the piston with solvent (index 3, paragraph 1–32).

b. Drain the preservative oil from the damper. Fill the damper. (Refer to paragraphs 2–318 and 2–319.)

2–323. INSTALLATION. *(See figure 2–31.)*

a. Set the bracket assemblies on the damper, set the damper in position between the upper and lower plates at "C" (step 1) and install the bolt, two washers and nut in each end of the bracket. Tighten the nuts with 320 to 390 inch-pounds torque.

b. Assemble the trunnion, spacer and pin in the fork assembly of the damper and secure it to the horizontal pin with the bolt, washers and nut at "B" (step 1). Tighten the nut with 450 to 500 inch-pounds torque and install the cotter pin.

c. If the damper on the right was removed to provide clearance, reinstall that damper.

d. Install the hub-to-upper-plate bolt and tighten the nut with 560 to 690 inch-pounds torque.

e. Install the fluid tank assembly. (Refer to paragraph 2—347.)

f. Fill the fluid tank with hydraulic oil (index 6, paragraph 1—32).

g. Cycle each damper four or five times by moving each main rotor blade back and forth horizontally in the hunting motion to bleed any trapped air in the dampers out through the differential check valve.

Note

This operation, together with the instructions in paragraphs 2—318 and 2—319, completes the damper bleeding requirements.

2—324. ANTI-FLAPPING RESTRAINERS.

2—325. DESCRIPTION. An anti-flapping restrainer is installed on each of the four hinge assemblies of the main rotor head assembly. The anti-flapping restrainers are spring-loaded locks which prevent the main rotor blades from flapping on their horizontal hinges when the main rotor is not rotating. When the main rotor is rotating, centrifugal force holds the anti-flapping restrainers outward from the locked position thus permitting free flapping and coning of the main rotor blades.

2—326. REMOVAL. *(See figure 2—31.)*

a. Remove the cotter pin, washer and pin at "A" (step 3) at the plunger.

b. Remove the cotter pin, nut, washer, spacer and bolt at "B" (step 3).

c. Remove the cotter pin, nut, washer, bolt, collar, spacer and spring at "C" (step 3). Remove the anti-flapping restrainer.

2—327. DISASSEMBLY.

a. Remove the cotter pin, nut and washer from each arm end and remove the arms from the shaft.

b. Compress the spring slightly and remove the cotter pin, washer and pin from the housing and plunger. Pull the plunger from the housing.

c. Take out the screw and remove the lock nut and cup. Remove the spring and retainer from the housing.

2—328. ASSEMBLY.

a. Install the retainer, spring and cup on the housing and install the lock nut and the screw.

b. Insert the plunger in the housing. Line up the openings in the housing and plunger and install the pin, washer and cotter pin.

c. Install the shaft through the housing and connect an arm to each end of the shaft with the washer, nut and cotter pin.

2—329. INSTALLATION. *(See figure 2—31.)*

a. Install the spacer, position the arm and install the bolt, spring, collar, washer, nut and cotter pin at "C" (step 3).

Note

The spring should hold the anti-flapping restrainer inward toward the hub.

b. Install the spacer, position the arm and install the bolt, washer, nut and cotter pin at "B" (step 3).

c. Connect the plunger of the anti-flapping restrainer to the hinge by installing the pin, washer and cotter pin at "A" (step 3).

2—330. DROOP RESTRAINERS.

2—331. DESCRIPTION. A droop restrainer for each blade is installed on the vertical hinge assembly. The droop restrainer, which limits the droop of the blade when the blade is at rest, consists of a flap, two cam arms attached to a shaft, a spring to hold each cam arm in position and a torsion spring which forces the flap down when the cam arms are extended. When the rotor head is rotating, centrifugal force throws the cam arms out and permits unrestricted vertical movement of the blades.

2—332. REMOVAL. *(See "D," step 3, figure 2—31.)*

a. Unhook the spring from each cam arm.

b. Pull the rollpin and remove one cam arm from the shaft.

c. Lift the anti-flapping restrainer up out of the way and work the shaft out with the other cam arm attached.

d. Unbolt and remove the flap from the spindle, remove the bolt and springs.

2—333. INSTALLATION. *(See "D," step 3, figure 2—31.)*

a. Install the springs on the bolt and bolt the flap to the spindle.

b. Lift the anti-flapping restrainer up and slide the shaft in place with one cam arm attached.

c. Install the other cam arm on the shaft and secure it with the rollpin.

d. Connect the lower end of the springs to the cam arms.

2—334. STATIONARY SCISSORS.

2—335. DESCRIPTION. The stationary scissors is attached to lugs on the seal retainer of the main gear box and to an eyebolt on the stationary star. The stationary scissors prevents the stationary star from rotating.

2–336. REMOVAL. *(See figure 2–31.)*

a. Disconnect the stationary scissors from the lugs on the seal retainer of the main gear box by removing the cotter pin, nut, washer, thrust washers and bolt at "A" (step 4).

b. Disconnect the scissors from the eyebolt on the stationary star by removing the cotter pin, nut, washers and bolt at "B" (step 4).

2–337. INSTALLATION. *(See figure 2–31.)*

a. Connect the stationary scissors to the lugs on the seal retainer of the main gear box by installing the bolt and two thrust washers. Shim with washers as required to obtain a line-to-line fit with no binding. Do not overtighten the nut. Install the cotter pin at "A" (step 4).

b. Connect the scissors to the eyebolt on the stationary star by installing the bolt and two washers. Shim with washers as required. Do not overtighten the nut. Install the cotter pin at "B" (step 4).

2–338. ROTATING SCISSORS.

2–339. DESCRIPTION. The rotating scissors is attached to a bracket on the bottom of the lower plate of the main rotor hub assembly and to a bracket on the rotating star assembly. The rotating scissors causes the rotating star to rotate with the main rotor hub assembly.

2–340. REMOVAL. *(See figure 2–31.)*

a. Disconnect the rotating scissors from the bracket on the lower plate of the hub assembly by removing the cotter pin, nut, thrust washers, washers and bolt at "A" (step 5).

b. Disconnect the scissors from the bracket on the rotating star by removing the cotter pin, nut, washers and bolt at "B" (step 5).

2–341. INSTALLATION. *(See figure 2–31.)*

a. Connect the rotating scissors to the bracket on the rotating star by installing the bolt, four washers, nut and cotter pin at "B" (step 5).

b. Connect the scissors to the bracket on the lower plate of the hub assembly by installing the bolt, thrust washers, other washers as required and nut at "A" (step 5). Do not overtighten the nut. Install the cotter pin.

2–342. FLUID TANK ASSEMBLY.

2–343. DESCRIPTION. The fluid tank assembly serves as a reservoir for the hydraulic oil for the dampers and is installed in the center of the rotor head assembly over the hub. Each damper is connected to the fluid tank by a hose assembly. Markings on the transparent plastic top indicate the required oil level.

2–344. REMOVAL. *(See figure 2–31.)*

a. Disconnect the hose assemblies from the elbows on the dampers at "A" (step 2). Drain the fluid tank.

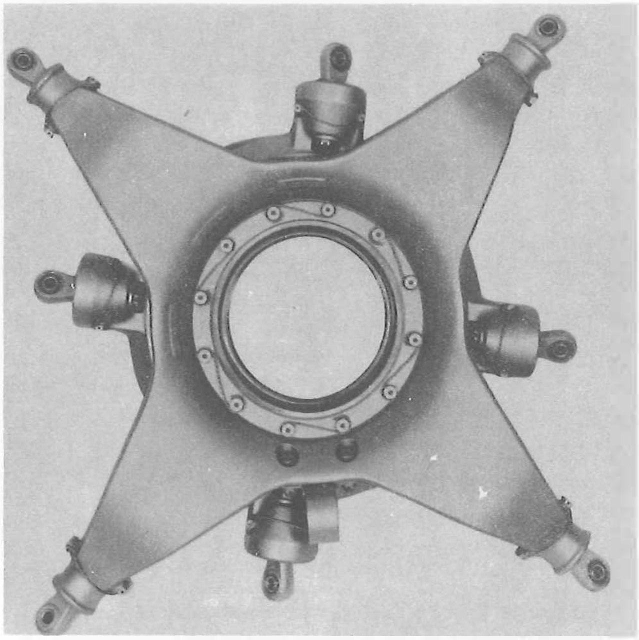


Figure 2–33. Main Rotor Star Assembly

b. Unbolt the tank at "B" (step 2) and remove it from the main rotor head assembly.

2–345. DISASSEMBLY.

a. Remove the plastic fluid tank from the reservoir by unscrewing the stud and removing the spring and washer. Take out the gasket from the reservoir. Remove the ring from the fluid tank.

b. Unscrew the oil hole cover and remove the strainer from the stud.

2–346. ASSEMBLY.

a. Insert the strainer in the stud and screw the oil hole cover on the stud. Set the gasket in the reservoir and the ring in the fluid tank.

b. Install the fluid tank on the reservoir by installing the washer, spring and stud.

2–347. INSTALLATION. *(See figure 2–31.)*

a. Secure the fluid tank assembly on the main rotor head assembly with the four bolts and washers at "B" (step 2).

b. Connect the hose assemblies to the elbows on the dampers at "A" (step 2). Fill the fluid tank assembly to the markings with hydraulic oil (index 6, paragraph 1–32).

2–348. STAR ASSEMBLY.

2–349. DESCRIPTION. *(See figure 2–33.)* The star assembly transmits the movements of the main rotor flight controls to the main rotor blades through the main rotor hub assembly. The star assembly consists of a rotating star connected to the main rotor hub assembly by the

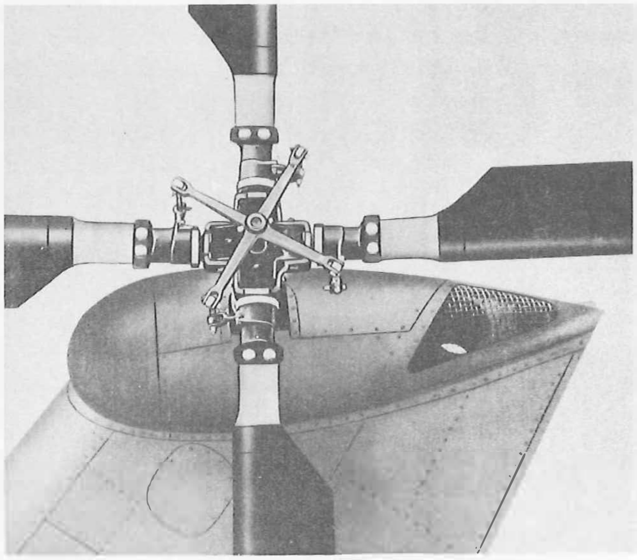


Figure 2–34. Tail Rotor Assembly Installed

rotating scissors and a stationary star which is prevented from rotating by the stationary scissors which is connected to the main gear box. A ball-ring socket assembly allows the star assembly as a unit to be tilted on its horizontal plane as well as raised and lowered on its vertical axis. When the three primary servo units which are connected to the stationary star are actuated by the main rotor flight control system, the movement of the stationary star is transmitted to the rotating star. From the rotating star the control movements are transmitted by control rods to the horns of the sleeve-spindle assemblies to change the angle of incidence of the blades.

2–350. REMOVAL. *(See figure 2–31.)*

a. Remove the main rotor head assembly and the star assembly from the main shaft of the main gear box. (Refer to paragraph 2–309.)

b. Disconnect the stationary scissors from the eyebolt on the stationary star by removing the cotter pin, nut, washers and bolt at "B" (step 6, figure 2–31).

c. Remove the rotating scissors from the bracket on the rotating star by removing the cotter pin, nut, four washers and bolt at "A" (step 6).

2–351. DISASSEMBLY AND ASSEMBLY. The star assembly is to be dissembled and assembled only by qualified personnel at an Overhaul Depot.

2–352. PREPARATION FOR SHIPMENT. Lubricate the star assembly. (See figure 1–16.) Cover machined surfaces with corrosion-preventive compound (index 4, paragraph 1–32).

2–353. PLACING IN SERVICE AFTER SHIPMENT. Remove the corrosion-preventive compound from the star assembly with solvent (index 3, paragraph 1–32).

2–354. INSTALLATION. *(See figure 2–31.)*

a. Connect the rotating scissors to the bracket on the rotating star by installing the bolt, four washers, nut and cotter pin at "A" (step 6).

b. Connect the stationary scissors to the eyebolt on the star by installing the bolt, two washers and other washers as required. Do not overtighten the nut. Install the cotter pin at "B" (step 6).

c. Install the star assembly and the main rotor head assembly on the main shaft of the main gear box. (Refer to paragraph 2–314, steps a. through h.)

2–355. CONTROL ROD ASSEMBLY.

2–356. DESCRIPTION. A control rod assembly extends from each eyebolt on the rotating star to the yoke on each horn assembly. All control movements of the star assembly are transmitted by the control rods to the main rotor blades through the horn assemblies of the sleeve-spindle assemblies. The horizontal plane or track of each blade can be adjusted by increasing or decreasing the length of the control rods.

2–357. REMOVAL. *(See figure 2–31.)*

a. Disconnect the control rod assembly from the eyebolt on the rotating star by removing the bolt, nut, washers and cotter pin at "A" (step 7).

b. Disconnect the control assembly from the yoke on the horn assembly by removing the boot, the cotter pin, the check nut, nut and thrust washers at "B" (step 7).

2–358. INSTALLATION. *(See figure 2–31.)*

a. Connect the control rod assembly to the eyebolt on the rotating star by installing the bolt, washers, nut and cotter pin at "A" (step 7).

b. Connect the control rod to the yoke on the horn assembly as follows: Place one thrust washer on the end of the rod and insert the rod through the yoke of the horn assembly. Place another thrust washer on the rod end and screw on the thicker nut at "B" (step 7). Tighten the nut until there is no end play. Tighten the check nut against the thicker nut. The rod should rotate by hand with no end play. Install the cotter pin in the check nut. Install the boot.

c. Check the flight control rigging. (Refer to paragraph 2–523.)

d. Track the main rotor blades. (Refer to paragraph 2–305.)

2–359. TAIL ROTOR ASSEMBLY.

2–360. DESCRIPTION. *(See figure 2–34.)* The four-bladed tail rotor assembly, which is located on the left side of the helicopter at the top of the pylon, is supported and driven by the horizontal shaft of the tail rotor gear box. The tail rotor produces anti-torque forces which may be varied by the pilot to control the flight heading of the helicopter. Changing the pitch of the blades is accomplished through the pitch change beam attached to the actuator shaft which moves through the horizontal shaft of the tail rotor gear box. The pitch change beam is connected to the arms of the sleeves by links. Four flapping hinges to which the spindles are connected permit coning (flapping) of the blades to ten degrees.

2—361. TROUBLE SHOOTING.

Note

Malfunction of the tail rotor assembly will result in abnormal medium frequency vibrations that will be felt through the helicopter structure.

Trouble	Probable Cause	Remedy
Medium frequency vibration of helicopter	Tail rotor assembly out of balance	Balance tail rotor assembly
	Tail rotor flight controls improperly rigged	Rig tail rotor flight controls correctly
	Tail rotor blade or blades damaged	Repair or replace damaged blades
	Tail rotor assembly spindle bearings damaged	Replace tail rotor hub and spindle assembly
	Tail rotor assembly flapping hinge bearings damaged	Replace tail rotor hub and spindle assembly
	Ball ends in pitch change links worn. (Check by working tail blades against links)	Replace links
	Structural damage, especially at flight control pulley brackets, bell cranks, and tail rotor gear box mounting	Repair damage

2—362. REMOVAL. *(See figure 2—35.)*

a. Disconnect each link of the pitch control installation from the arm on the sleeve by removing the pin, washers, nut and bolt at "A" (step 1).

b. Disconnect the pitch beam from the actuator shaft by removing the cotter pin, nut, washer and taper pin (step 2) using the taper pin, wrench, Sikorsky part No. S1670-10441.

c. Remove the tail rotor assembly from the tail rotor gear box drive shaft by removing the lock nut as follows: Bend back the tang of the lock washer and, using wrench, Sikorsky part No. S1670-10310, remove the nut and washer (step 3).

d. If replacing the links or the pitch beam, disconnect each link from the pitch beam by removing the pin, washers, bolt and nut at "B" (step 1).

2—363. CLEANING.

a. Clean the tail rotor assembly with solvent (index 3, paragraph 1—32) or kerosene (index 19, paragraph 1—32.)

b. Wash the tail rotor blades with mild soap and water only.

WARNING

Never use solvents or cleaners such as lacquer thinner, naphtha or carbon tetrachloride to clean the blades. Such cleaners will weaken the bonding of the blades.

2—364. REMOVAL OF BLADES. *(See figure 2—35.)*

Note

This paragraph contains instructions for removing the tail rotor blades from the spindles on the hub assembly. The instructions in this paragraph apply only when replacing one or more of the blades.

Note

To remove the blades with the spindles attached, refer to paragraph 2—365.

a. Remove each blade by removing the nuts, washers, shims and bolts. Tap out the bolts with a fiber mallet. Remove any balance shims (step 4, figure 2—35).

b. Store the blades in a padded rack with the leading edge down.

Note

No further disassembly of the tail rotor assembly is permitted except as outlined in paragraph 2—365.

2—365. REMOVAL OF BLADES WITH SPINDLES. *(See figure 2—35.)*

Note

This paragraph contains instructions for removing the tail rotor blades, with the spindles attached, from the hub assembly. The instructions in this paragraph apply only when preparing the complete tail rotor assembly for shipment.

Note

To remove only the blades from the hub assembly, refer to paragraph 2—364.

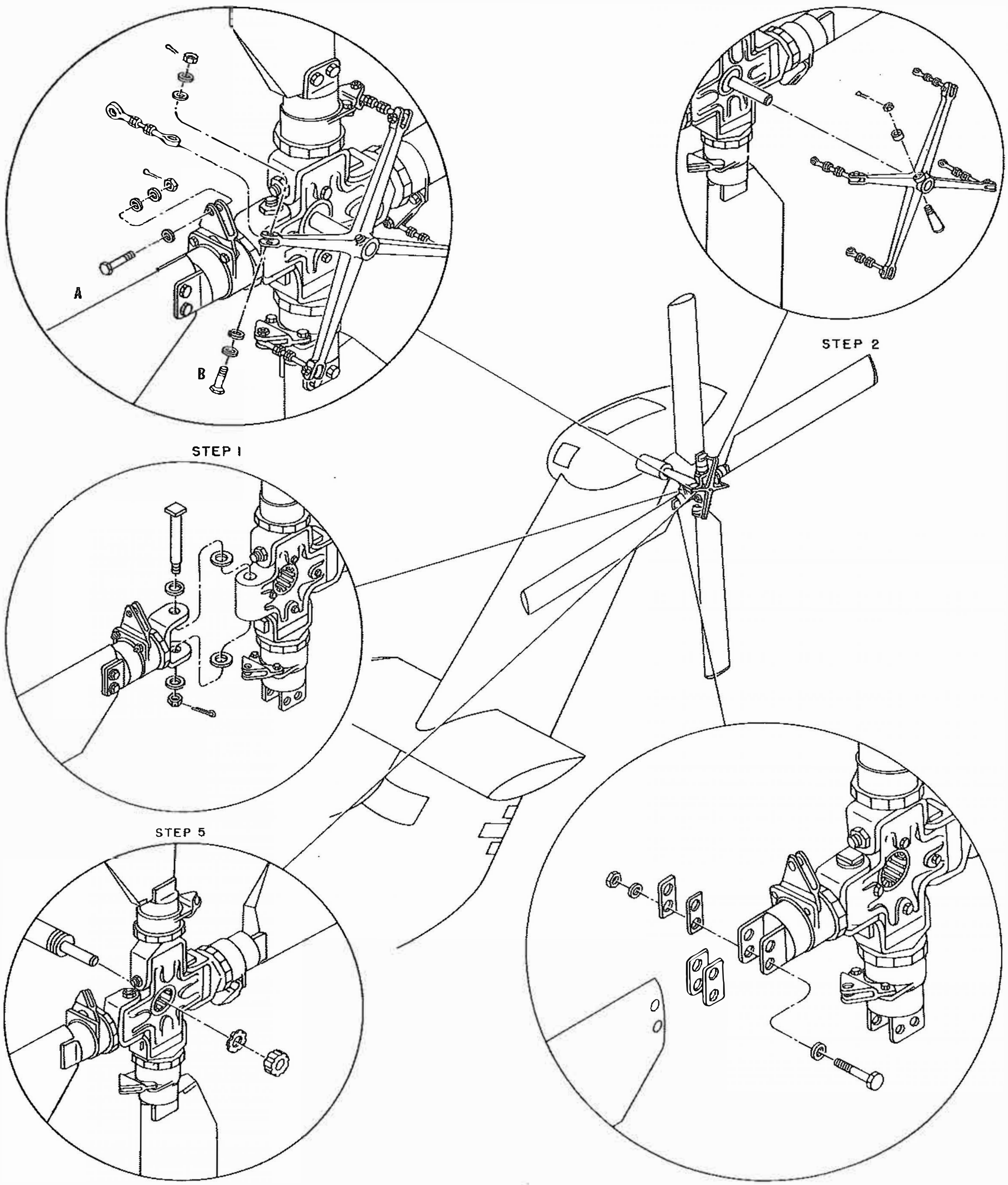


Figure 2—35. Tail Rotor Assembly Removal and Disassembly

a. Support each tail rotor blade and spindle and remove the pin, washers, nut and cotter pin which secure the spindle to the arm of the hub assembly. (See figure 2—35, step 5.)

b. Remove the thrust washers located between the ears of the spindle and the hub. Remove the blade, with the spindle attached, from the hub.

Note

No further disassembly of the tail rotor assembly is permitted except as outlined in paragraph 2—364.

2—366. PREPARATION FOR SHIPMENT.

a. Remove the blades, with the spindles attached, from the tail rotor hub assembly. (Refer to paragraph 2—365.)

b. Pack the blades, with the spindles attached, in a padded box with the leading edge of the blade down.

c. Lubricate the tail rotor hub and each spindle assembly. (See figure 1—16.)

d. Coat all exposed machined surfaces with corrosion-preventive compound (index 4, paragraph 1—32).

e. Wrap the tail rotor hub assembly in greaseproof barrier material (index 8, paragraph 1—32) and secure it with adhesive tape (index 9, paragraph 1—32). Pack in a suitable box.

2—367. PLACING IN SERVICE AFTER SHIPMENT.

a. Remove the corrosion-preventive compound from all surfaces with solvent (index 3, paragraph 1—32).

b. Install the tail rotor blades, with the spindles attached, on the hub. (Refer to paragraph 2—369.)

2—368. INSTALLATION OF BLADES. *(See figure 2—35.)*

Note

This paragraph contains instructions for installing the tail rotor blades on the spindles of the hub assembly. The instructions in this paragraph apply when replacing one or more of the blades.

Note

To install the blades with the spindles attached, refer to paragraph 2—369.

a. Position the tail rotor blade and shims between the ears of the sleeve on the spindle assembly. Secure the blade and shims to the sleeve with the bolts, washers and nuts. Tighten the nuts only fingertight.

Note

Shrink the bolts for 30 minutes to one hour in a mixture of dry ice and zinc-chromate primer (index 10, paragraph 1—32), prior to installation. Install the bolts while wet with primer.

Note

The blade attachment nuts will be tightened with 36 to 40 foot-pounds torque after balancing.

b. Balance the tail rotor assembly. (Refer to paragraph 2—374.)

2—369. INSTALLATION OF BLADES WITH SPINDLES. *(See figure 2—35.)*

Note

This paragraph contains instructions for installing the tail rotor blades, with the spindles attached, to the hub assembly. The instructions in this paragraph apply only when placing previously balanced tail rotor assemblies in service after shipment.

Note

To install only the blades on the spindles of the hub assembly, refer to paragraph 2—368.

a. Position the blade, with the spindle attached, on the arm of the tail rotor hub.

CAUTION

Each blade and spindle must be installed on the proper arm of the hub to maintain the balance of the tail rotor assembly. The position of each blade and spindle on the hub is indicated by the color coding on the hub and on the spindle.

b. Position one thrust washer between the arm of the hub and each ear of the spindle.

Note

Install each thrust washer with the grooves on the hub sides.

c. Secure the spindle to the hub with the pin, washers and nut. Tighten the nut with 25 to 38 foot-pounds torque. Install the cotter pin. (See figure 2—35, step 5.)

Note

The pin must be installed with the head toward the leading edge of the blade.

2—370. INSTALLATION. *(See figure 2—35.)*

a. If the links or the pitch beam have been replaced, connect each link to the pitch beam with the bolt, washers, nut and pin at "B" (step 1). Tighten the nuts with 40 to 60 inch-pounds torque.

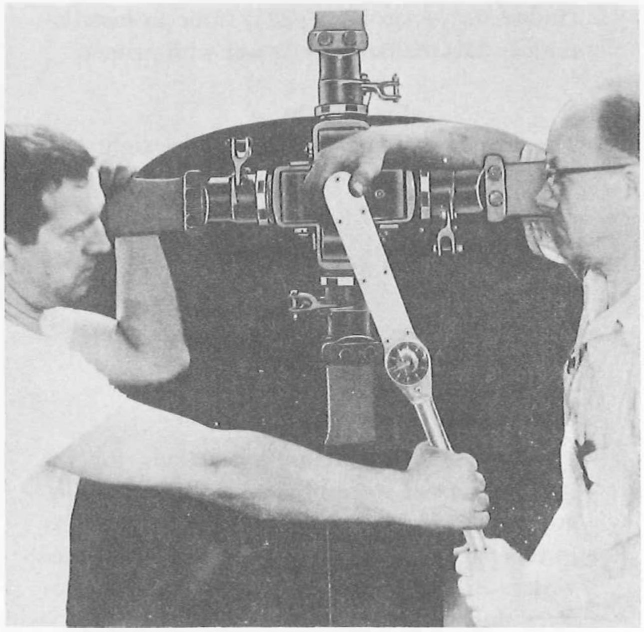


Figure 2–36. Torquing Tail Rotor Nut

Note

To eliminate any side play, shim as required between the rod end of the link and the fork on the pitch change beam.

b. Install the balanced tail rotor assembly on the tail rotor gear box drive shaft as follows: Line up the indexed master splines on the tail rotor gear box shaft and on the tail rotor assembly. Slide the tail rotor assembly on the shaft.

c. Install the lock washer. Use thread lubricant (index 43, paragraph 1–32) on the nut. Tighten the nut with 180 to 220 foot-pounds torque using wrench, Sikorsky part No. S1670-10310, and a torque wrench. (See figure 2–36.) Bend down a tang of the lock washer (step 3, figure 2–35).

d. Secure the pitch beam on the actuator shaft with the taper pin, washer and nut. Tighten the nut with 40 to 60 inch-pounds torque. Install the cotter pin. If a new pitch beam is installed, taper ream through the drilled pilot hole, picking up the reamed hole in the shaft (step 2).

Note

The small end of the tapered shank of the taper pin must not extend more than 1/16-inch above the surface of the pitch beam.

e. Connect each link to the arm on the sleeve by installing the bolt, washers, nut and pin. Tighten the nut with 40 to 60 inch-pounds torque.

Note

To eliminate any side play shim as required between the rod end of the link and the arm on the sleeve.

f. Lubricate the tail rotor and spindle assemblies. (See figure 1–16.)

g. Work the tail rotor controls with the auxiliary servo system off to ascertain that there is no binding or interference. Check the tail rotor control rigging. (Refer to paragraph 2–524.)

Note

If new links are being installed, lockwire the rod ends of the links after the tail rotor control rigging has been checked.

2–371. TAIL ROTOR BLADES.

2–372. DESCRIPTION. Each tail rotor blade is constructed of a sheet aluminum skin bonded to a solid aluminum leading edge spar and to a honeycomb core. The skin covers the spar from the tip to within six inches of the root end of the spar. Each blade is bolted through the root end of the spar to the sleeve of the spindle assembly. Each of the tail rotor blades is interchangeable with any other blade. The tail rotor assembly must be balanced after blade replacement.

2–373. REPLACEMENT OF BLADES. When replacing a blade, the tail rotor assembly must be balanced before installing it on the helicopter. Once the blades have been installed on the tail rotor and the assembly has been balanced, the blades should always be installed on the same sleeve from which they were removed so balancing will not have to be repeated.

CAUTION

The tail rotor blades are painted and balanced after fabrication. Any attempt to paint the blades in the field will change their balance and set up undesirable flight characteristics.

2–374. BALANCING TAIL ROTOR ASSEMBLY. *(See figure 2–37.)*

Note

Balance the tail rotor assembly without the pitch change beam and links. If possible, balance the tail rotor assembly with the hub and spindle assembly free of service lubricant except for the lubricant in prepacked bearings. If the tail rotor assembly has been lubricated previously, assure even distribution of the grease by lubricating the assembly at all the lubrication fittings. Wipe off excess grease from the external surfaces.

a. Install the tail rotor assembly on the balancing arbor assembly, S1670-10301, and place the arbor on a leveled propeller balancing stand.

b. Set two blades in a horizontal position and note which blade falls. Compensate the lighter blade by placing steel shims and pairs of AN960-816 washers or pairs of AN960-816L washers, if necessary, under the nuts of the blade attaching bolts.

Note

Rough adjustment balance weight is added by the steel shims. Fine adjustment balance weight is added by the pairs of AN960-816 or AN960-816L washers. The washers must be added in pairs, with one washer of each pair on each blade attaching bolt to preserve balance.

c. When the blades are close to balance, determine if they are within the allowable tolerance by using two AN960-816L washers as a tolerance weight gage. Place one washer on each blade attaching bolt of the lighter blade. Observe whether or not the blade comes into the horizontal position or falls below horizontal.

Note

The tail rotor assembly must be balanced within 0.7 inch-ounce. The two tolerance weight AN960-816L washers which furnish the tolerance weight gage are the equivalent of 0.7 inch-ounce when they are placed on the blade attaching bolts. If the lighter blade comes into the horizontal position or falls below the horizontal position, the blades are satisfactorily balanced.

d. Remove the two AN960-816L tolerance washers and install the remaining washers and shims under the nuts of the blade attaching bolts.

e. Set the other pair of blades in a horizontal position and repeat steps b. through d.

f. Recheck the balance of the blades which were balanced first.

g. Tighten the blade attachment nuts on all blades with 36 to 40 foot-pounds torque.

2—375. FLIGHT CONTROLS.

2—376. DESCRIPTION. *(See figures 2—38 and 2—48.)* The flight control system consists of the cyclic control system, collective pitch control system and the tail rotor control system. The systems, in turn, consist of a series of push-pull rods, bell cranks, servos, pulleys and cables which transmit control movements to the main rotor and to the tail rotor. The cyclic and collective control systems provide directional and vertical control. The tail rotor control system compensates for main rotor torque and provides a means for changing the heading of the helicopter. The flight control system contains two

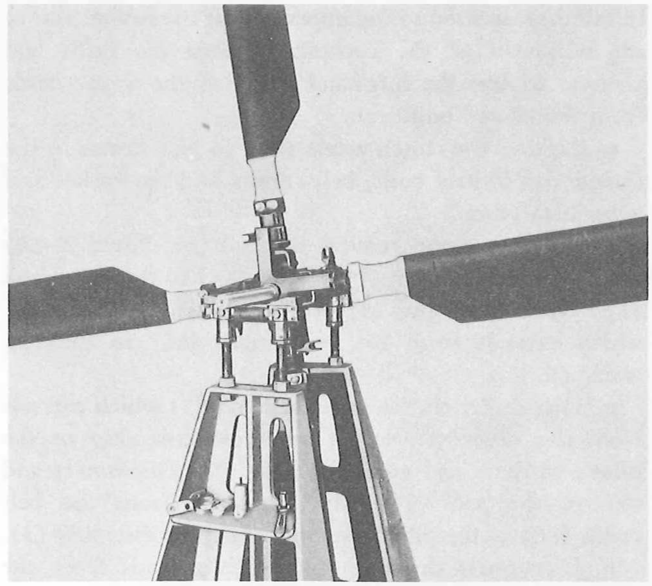


Figure 2—37. Use of Tail Rotor Balancing Arbor

electrically interconnected servo systems: the primary and the auxiliary servo system. Dual controls are provided for the three control systems.

2—377. CYCLIC CONTROL SYSTEM.

2—378. DESCRIPTION. *(See figure 2—38.)* The cyclic control system provides directional control for the helicopter. The cyclic control system consists of the following components: a pilot's and observer's cyclic control stick, a socket and yoke located at the base of each control stick, push-pull rods extending from the socket and yokes to bell cranks and the mixing unit and push-pull rods extending from the mixing unit to bell cranks and the main rotor servos. Moving the control stick in any direction tilts the tip-path plane of rotation of the main rotor blades in that direction and moves the helicopter in the same direction. The grip of each control stick contains a trigger-type microphone and radio switch, a cargo release switch and a stick trim switch.

2—379. REMOVAL.

a. Disconnect the pilot's and observer's cyclic control stick electrical wiring at the disconnect plugs (4 and 68, figure 2—38) located a few inches forward of the control sticks. Remove the boots (6 and 69).

b. Back off the knurled nut securing the observer's cyclic control stick (66) to the socket (70) of the observer's socket and yoke assembly. Remove the control stick by sliding it up and out of the socket.

c. Unbolt the pilot's cyclic control stick and socket (7) from the yoke of the pilot's support and yoke assembly (5). Remove the control stick by sliding it up and out of the yoke.

d. Remove the pilot's seat. (Refer to paragraph 2—138.) Remove the auxiliary servo and mixer covers installation secured to the upper end of the tunnel and to the bulkhead of the cockpit. Remove the bolts and washers to free the left-hand panel of the upper cover from the canted bulkhead.

e. Remove the clutch access door to gain access to the directional control rods, bell cranks and the socket and yoke installation.

f. Disconnect and remove the rod (88, figure 2—38) which extends from the bell crank (84) to the bell crank (1). Disconnect and remove the rod assembly (83) which extends from the bell crank (84) to the bell crank (82).

g. Disconnect and remove the rod (85) which extends from the observer's socket and yoke assembly to the pilot's support and yoke assembly (5). Disconnect and remove the rod (87) which extends from the bell crank (86) to the pilot's support and yoke assembly (5).

h. Disconnect the rod (8) which extends from the bell crank (86) to the auxiliary servo unit assembly (13). Disconnect the rod (67) which extends from the bell crank (84) to the servo unit assembly (13). Remove the main drive shaft tunnel extension cover from the cabin forward bulkhead and pull out both rods (8 and 67).

i. Remove the bolt, washers, spacers and nut which secure the universal (81) to the bell crank (82) to disconnect the universal.

j. Disconnect the cylinder (76) at the yoke (78).

k. Disconnect and remove the rods (3 and 74) which extend from the bell cranks (1 and 82) to the sockets of the socket and yoke assemblies.

l. Disconnect and remove the bell cranks (1 and 82) from the supports (2 and 80). Remove the bolts, washers and nuts securing the supports (2 and 80) and remove the supports.

m. Cut the lock wire and remove the bolts, washers and nuts securing the bell crank (84) and support. Remove the bell crank and support. Disassemble the bell crank and support by removing the bolts, washers and nuts which secure the bell crank to the supports.

n. Remove the bolts, washers and nuts securing the bell crank (86) and remove the bell crank with the supports attached. Disassemble the bell crank (86) by removing the bolts, washers and nuts which secure the bell crank to the supports.

o. Remove the bolts, washers and nuts securing the support (72) in position. Remove the support (72), yoke assembly (71) and socket (70) as a unit.

p. Remove the cotter pin and nut securing the support (72) to the yoke assembly (71). Remove the socket (70) from the yoke assembly by removing the bolt, washers, nut and cotter pin which secure it to the yoke.

q. Cut the lock wire and remove the bolts, washers and nuts securing the support (73) to the bulkhead and remove the support.

r. Remove and disassemble the pilot's support and yoke assembly (5) in the same manner as the observer's socket and yoke assembly, steps o. through q.

Note

> The socket was removed with the stick and socket assembly in step c.

s. Hinge down the service platforms. Disconnect and remove the rod (57) which extends from the bell crank (55) to the bell crank (54).

t. Disconnect and remove the rod (59) which extends from the bell crank (58) to the bell crank (20).

u. Disconnect and remove the rod (51) which extends from the bell crank (55) to the bell crank (50).

v. Disconnect and remove the rod (52) which extends from the bell crank (58) to the bell crank (49).

w. Disconnect and remove the rod (45) which extends from the bell crank (50) to the bell crank (30).

x. Disconnect and remove the rod (29) which extends from the bell crank (33) to the bell crank (27).

y. Disconnect and remove the rod (39) which extends from the bell crank (33) to the bell crank (37).

z. Remove the three main rotor primary servo and control arm assemblies. (Refer to paragraph 2—395.)

aa. Disconnect and remove the bell crank (37, figure 2—38) from the support (36). Remove the nuts and washers securing the support (36) to the lower housing of the main gear box. Remove the support.

ab. Disconnect and remove the bell crank (50). Disconnect and remove the link (53) from the support (15).

ac. Disconnect and remove the bell cranks (55 and 58) from the support (56). Remove the bolts, washers and nuts securing the support (56) in position and remove the support.

ad. Disconnect and remove the bell crank (49) from the support (46). Remove the washers and nuts securing the support (46) to the lower housing of the main gear box and remove the support.

ae. Disconnect and remove the bell crank (33) from the support (34). Remove the nuts and washers securing the support (34) to the lower housing of the main gear box and remove the support.

af. Remove the actuating cylinder assembly (18) which extends from the arm on the right-hand side of the auxiliary servo unit assembly (13) to the support (32). (Refer to paragraph 2—410.)

ag. Disconnect and remove the bell crank (30, figure 2—38) from the support (32). Remove the nuts and washers securing the support (32) to the input housing of the main gear box and remove the support.

ah. Disconnect the rod (63) from the input arm of the servo unit.

ai. Disconnect the main rotor auxiliary servo hydraulic lines at the bracket (23) on the support (15). Remove the bolts, washers and nuts securing the servo and mixer assembly to the transmission deck between stations 112 and 121. Remove the servo and mixer assembly as a unit.

aj. Disconnect and remove the two rods (43 and 41) which extend from the two bell cranks (54 and 20) up to the mixer assembly. Disconnect and remove the bell cranks (54 and 20) from the supports (14 and 15).

ak. Disconnect and remove the rod (24) which extends from the bell crank (27) to the mixer. Disconnect and remove the bell crank (27) from the support (14).

al. Disconnect and remove the three links (19) linking the mixer to the servo. Remove the caps (25 and 42) from the supports (14 and 15) and remove the mixer assembly.

am. Disconnect and remove the three rods (31) from the mixer. Disconnect and remove the two bell cranks (44) from the arm (21). Disconnect and remove the bell crank (28) from the arm (22).

an. Remove the cotter pin, nut, bearing and washers (48) from the shaft (47). Slide the bell crank (40) off the shaft.

ao. Remove the taper pins, washers and nuts which secure the arm (21) to the shaft (47). Slide the arm (21) and bell crank (26) off the shaft (47).

ap. Remove the taper pins, washers and nuts which secure the arm (22) to the shaft (47). Slide the arm (22) and the spacer and bearing off the shaft (47).

aq. Cut the lock wire and remove the bolts and washers securing the auxiliary servo unit assembly (13) to the support (14 and 15) and remove the servo unit and the left-hand panel of the upper servo and mixer cover. (See detail "A," step 6, figure 2–42.)

ar. Disconnect the collective open loop spring cylinder (16, figure 2–38) from the bracket (17) at the upper end and from the center fork of the front end plate of the servo unit.

as. Unbolt and remove the cylinder support bracket (17) from the servo unit.

Note

The auxiliary servo unit assembly (13) must be disassembled only by qualified personnel at an Overhaul Depot.

at. Unbolt and remove the bracket (23) from the support (14).

au. Remove the beam located between the supports (14 and 15) by removing the bolts, washers and nuts which secure it at either end to the supports.

2–380. INSTALLATION.

WARNING

If four or more threads are showing on the adjustable rod ends, add spacers or washers under the nut until less than four threads show.

Note

Refer to table VIII for basic rod lengths of the component rod assemblies of the cyclic control system.

a. Position the bracket (23, figure 2–38) on the support (14) and secure with the bolts, washers and nuts. Position the beam between the two supports (14 and 15) and secure the beam at either end to the supports (14 and 15) with the bolts, washers and nuts.

b. Position the auxiliary servo unit assembly (13) between the supports (14 and 15) and secure the servo unit to the support (14) with the bolts and washers. Position the left-hand panel of the upper servo and mixer cover outboard of the support (15) and secure the panel, support (15) and auxiliary servo unit (13) with bolts and washers. Lockwire the bolts of both supports (14 and 15). (See detail "A," step 6, figure 2–42.)

c. Position the bracket (17, figure 2–38) on the servo unit and bolt it in place.

d. Install the collective open loop spring cylinder (16) and bolt it to the front end plate and to the support bracket (17).

e. Install the bearing and spacer on the shaft (47, figure 2–38). Slide the arm (22) and the bell crank (26) onto the shaft. Slide the arm (21) and the bell crank (40) onto the shaft. Install the washers, bearing, nut and cotter pin (48). Secure the arms (21 and 22) in position on the shaft (47) with the taper pins, washers and bolts.

f. Install the two bell cranks (44) on the arm (21). Install the bell crank (28) on the arm (22). Install the three rods (31).

g. Place the mixer assembly in position on the supports (14 and 15) and install the caps (42 and 25). Tighten the bolts securing the cap (42) to the support (15) with 80 to 100 inch-pounds torque. Tighten the bolts securing the cap (25) to the support (14) with 320 to 390 inch-pounds torque.

h. Install the two bell cranks (20 and 54). Install the rods (41 and 43) which extend from the bell cranks (20 and 54) on the supports (14 and 15) to the bell crank (44) on the mixer assembly.

i. Place the servo and mixer assembly in position on

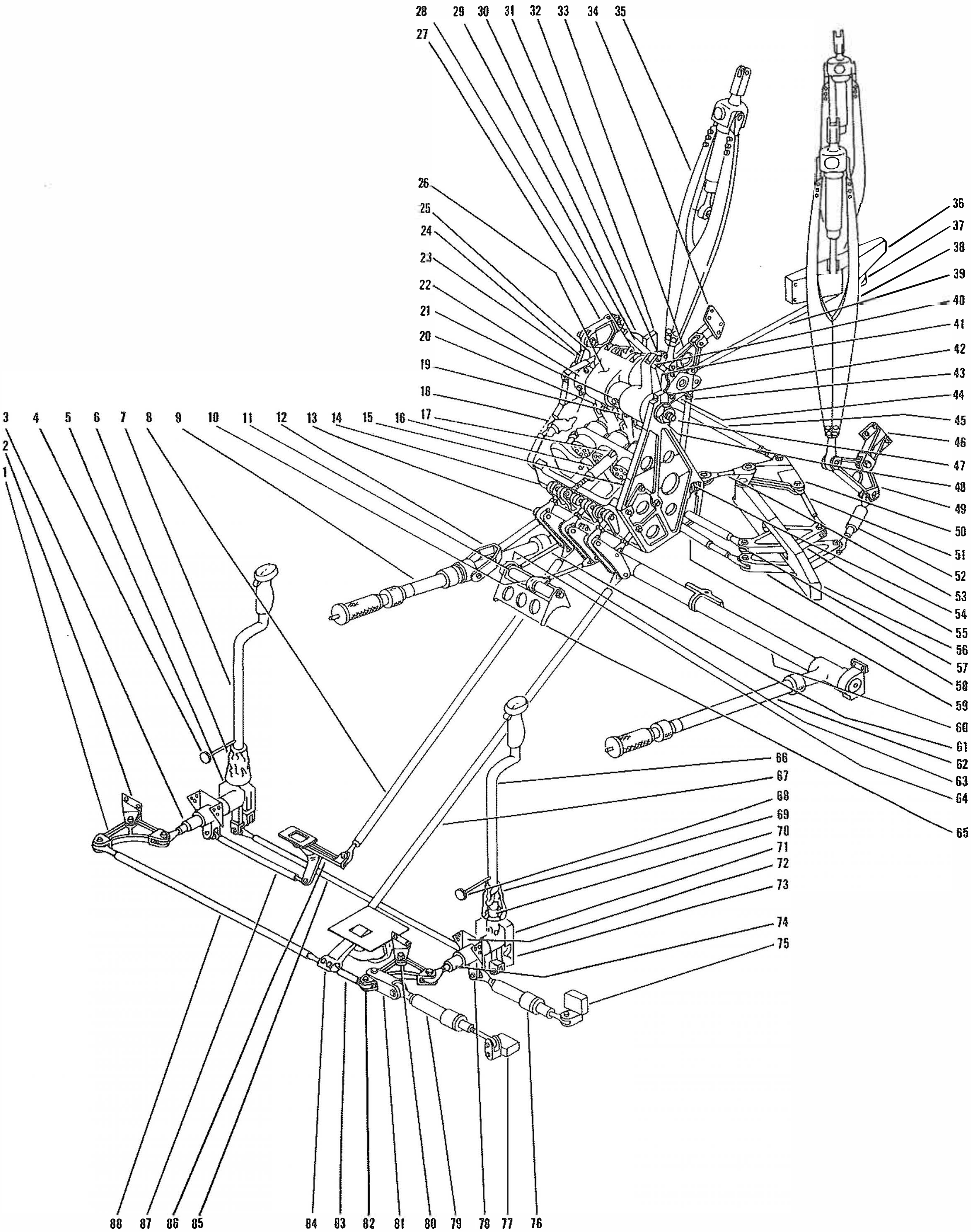


Figure 2–38. Main Rotor Flight Controls System

Key to Figure 2—38

1. Bell Crank
2. Support
3. Rod
4. Disconnect Plug
5. Pilot's Support and Yoke
6. Boot
7. Pilot's Cyclic Control Stick and Socket
8. Rod
9. Pilot's Collective Pitch Control Stick
10. Arm
11. Tube
12. Drag
13. Auxiliary Servo Unit
14. Support
15. Support
16. Collective Open Loop Spring Cylinder
17. Bracket
18. Actuating Cylinder
19. Link
20. Bell Crank
21. Arm
22. Arm
23. Bracket
24. Rod
25. Cap
26. Bell Crank
27. Bell Crank
28. Bell Crank
29. Rod
30. Bell Crank
31. Rod
32. Support
33. Bell Crank
34. Support
35. Control Arm and Servo Unit Assembly
36. Support
37. Bell Crank
38. Control Arm
39. Rod
40. Bell Crank
41. Rod
42. Cap
43. Rod
44. Bell Crank
45. Rod
46. Support
47. Shaft
48. Nut, Cotter Pin, Bearing, Washers
49. Bell Crank
50. Bell Crank
51. Rod
52. Rod
53. Link
54. Bell Crank
55. Bell Crank
56. Support
57. Rod
58. Bell Crank
59. Rod
60. Stick Shaft
61. Rod
62. Observer's Collective Pitch Control Stick
63. Rod
64. Arm
65. Bracket
66. Observer's Cyclic Control Stick
67. Rod
68. Disconnect Plug
69. Boot
70. Socket
71. Yoke Assembly
72. Support
73. Support
74. Rod
75. Magnetic Brake Unit
76. Cylinder
77. Magnetic Brake Unit
78. Yoke
79. Cylinder
80. Support
81. Universal
82. Bell Crank
83. Rod
84. Bell Crank
85. Rod
86. Bell Crank
87. Rod
88. Rod

TABLE VIII
BASIC FLIGHT CONTROL ROD LENGTHS

ROD ASSEMBLY INDEX AND FIGURE NO.	*LENGTH (CENTER-TO-CENTER OF MOUNTING BOLT HOLES IN INCHES)	ROD ASSEMBLY INDEX AND FIGURE NO.	*LENGTH (CENTER-TO-CENTER OF MOUNTING BOLT HOLES IN INCHES)
3, figure 2—38	Adjustable	83, figure 2—38	4-5/8
8, figure 2—38	Adjustable	85, figure 2—38	Adjustable
24, figure 2—38	4-1/16	87, figure 2—38	11
29, figure 2—38	19-7/16	88, figure 2—38	Adjustable
31, figure 2—38	5-1/2 (RH Lateral)	3, figure 2—48	Adjustable
31, figure 2—38	4-11/16 (LH Lateral)	12, figure 2—48	Adjustable
31, figure 2—38	4-11/16 (Fore & Aft)	34, figure 2—48	10-7/8 (S1640-64009-3)
39, figure 2—38	23-3/32	34, figure 2—48	10-23/32 (S1640-61157-6)
41, figure 2—38	8-9/32	36, figure 2—48	Adjustable
43, figure 2—38	6-17/32	38, figure 2—48	44-5/32 (S1640-64007-1)
45, figure 2—38	13-11/16	38, figure 2—48	44-5/16 (S1640-61157-5)
51, figure 2—38	8-27/32	41, figure 2—48	26-7/16 (S1640-64009-2)
52, figure 2—38	11	41, figure 2—48	26-3/8 (S1640-61157-4)
57, figure 2—38	Adjustable	43, figure 2—48	Adjustable
59, figure 2—38	Adjustable	67, figure 2—48	Adjustable
61, figure 2—38	6-1/8	76, figure 2—48	16-5/8
63, figure 2—38	Adjustable	82, figure 2—48	Adjustable
67, figure 2—38	Adjustable	83, figure 2—48	15-5/8
74, figure 2—38	Adjustable		

*Note: All rod lengths given are basic. If necessary, the rod assemblies with adjustable rod ends may be adjusted to obtain proper rigging.

WARNING

If four or more threads are showing on the adjustable rod ends, add spacers or washers under the nut until less than four threads show.

the transmission deck and secure with the bolts, washers and nuts. Tighten the bolts securing the left-hand side of the servo and mixer assembly with 180 to 225 inch-pounds torque. Tighten the bolts securing the right-hand side of the servo and mixer assembly with 80 to 100 inch-pounds torque. Connect the hydraulic lines.

j. Position the bell crank (27) between the support (14) and the bracket (23) and secure with the bolt, washers and nut. Connect the rod (24) to the bell crank (27) and the mixer arm (22).

k. Place the support (32) in position on the input housing of the main gear box and secure with the washers and nuts. Install the bell crank (30) on the support (32). Install the actuating cylinder assembly (18). (Refer to paragraph 2—414.)

l. Place the support (34, figure 2—38) in position on the lower housing of the main gear box and secure with the washers and nuts. Install the bell crank (33) on the support (34).

m. Place the support (36) in position on the lower housing of the main gear box and secure with the washers and nuts. Install the bell crank (37) on the support (36).

n. Install the rod (39) which extends from the bell crank (37) to the bell crank (33). Install the rod (29) which extends from the bell crank (33) to the bell crank (27).

o. Place the support (46) in position on the lower housing of the main gear box and secure with the washers and nuts. Install the bell crank (49) on the support (46).

p. Place the bell cranks (55 and 58) in position in the support (56) and secure with the bolt, washers and nut. Place the bell crank (50) and the link (53) in position on the support (56) and secure with the bolt, washers and nut. Install the rod (51) which extends from the bell crank (55) to the bell crank (50). Place the bell crank in position on the transmission deck and secure with the bolts, washers and nuts. Secure the free end of the link (53) to the support (15).

q. Install the rod (52) which extends from the bell crank (58) to the bell crank (49). Install the rod (57) which extends from the bell crank (55) to the left-hand bell crank (54). Install the rod (59) which extends from the bell crank (58) to the right-hand bell crank (20). Install the rod (45) which extends from the bell crank (50) to the bell crank (30).

r. Install the three control arm and servo unit assemblies (35). (Refer to paragraph 2—399.)

s. Assemble and install the pilot's support and yoke and observer's socket and yoke assemblies. Place the support (73, figure 2—38) in position on the cabin forward bulkhead and secure with the bolts, washers and nuts. Lockwire the bolts. Install the socket (70) in the yoke (78). Place the support (72) on the yoke (78). Install the nut on the yoke and turn it in fingertight. Place the yoke in position in the support (73). Secure the support (72). Tighten the nut and install the cotter pin.

Note

Avoid tightening the nut so as to cause binding of the bearings in the supports (72 and 73). On helicopters which incorporate sockets which allow the bearings to move, shim as required to eliminate end play in yoke in excess of 0.005 inch.

t. Install the supports (80 and 2) and the bell cranks (82 and 1). Assemble and install the bell crank and support (84). Attach the supports and install the bell crank (86).

u. From the cabin install the rod (67) which extends from the bell crank and support (84) to the auxiliary servo unit assembly (13). Install the rod (8) which extends from the bell crank (86) to the auxiliary servo unit assembly (13). Connect the rod (67) to the input arm of the servo unit. Replace the main drive shaft tunnel extension cover.

v. Install the rod (74) which extends from the bell crank (82) to the socket of the observer's socket and yoke assembly. Install the rod (3) which extends from the bell crank (1) to the socket of the pilot's support and yoke assembly.

w. Connect the cylinder (76) to the yoke (78). Connect the universal (81) to the bell crank (82).

x. Install the rod assembly (83) which extends from the bell crank and support (84) to the bell crank (82). Install the rod (85) which extends from the yoke of the pilot's support and yoke assembly to the yoke of the observer's socket and yoke assembly.

y. Install the rod (88) which extends from the bell crank and support (84) to the bell crank (1).

z. Install the rod (87) which extends from the yoke of the pilot's support and yoke assembly, to the bell crank (86).

aa. Insert the observer's cyclic control stick (66) into the socket (70) of the observer's socket and yoke assembly and secure by tightening the knurled nut. Install the boot (69). Connect the observer's cyclic control stick wiring.

ab. Insert the pilot's cyclic control stick and socket (7) into the yoke of the pilot's support and yoke assembly (5) and secure with the bolt, washer and nut. Install the boot (6). Connect the pilot's cyclic control stick wiring.

ac. Check the adjustment of the stick trim system. (Refer to paragraph 2—387.)

ad. Check the adjustment of the collective open loop spring cylinder. (Refer to paragraph 2—392.)

ae. Install the bolts and washers securing the left-hand panel of the upper servo and mixer cover to the canted bulkhead. Replace the auxiliary servo and mixer covers. Install the pilot's seat. (Refer to paragraph 2—139.)

af. Check the main rotor flight control rigging. (Refer to paragraph 2—523.)

2—381. CYCLIC CONTROL STICK TRIM SYSTEM (FORCE GRADIENT INSTALLATION).

2—382. DESCRIPTION. *(See figure 2—38.)* The cyclic control stick trim system (force gradient installation) provides control stick feel and returns the control stick to the position for which it was set. The system includes two electrically operated magnetic brakes, control switches and two spring cylinder assemblies. One magnetic brake and one spring cylinder are installed for lateral control and one magnetic brake and one spring cylinder are installed for fore-and-aft control. Both magnetic brakes are mounted in the left side of the clutch compartment where they are connected to the cyclic control system by the spring cylinders. The switch marked "STICK TRIM — ON" on the overhead switch panel provides master control of the system. When the master switch is placed in the "ON" position, the circuit is energized and the stick trim system is inactive. When the master switch is placed in the "STICK TRIM" position, the circuit is de-energized and the action of the magnetic brakes holds the arms on the magnetic brakes in the position they were in at the moment the system was turned on. The cyclic stick may be moved from the fixed position, but the resistance created by the spring cylinders increases progressively. When pressure on the sticks is released, the action of the spring cylinders brings the sticks back to the original position. The stick trim system may be disengaged by pushing in the "STICK TRIM" switch on either cyclic control stick grip. The "STICK TRIM" switch energizes the circuit to release the magnetic brake. When the switch is released, the magnetic brakes again function to position the arms and the trim action of the system is moved to operate around the new position. The dc power for the system is supplied from the secondary bus through a circuit breaker on the overhead circuit breaker and fuse panel.

2—383. REMOVAL.

a. Disconnect the wiring at the plugs on the magnetic brake units (11 and 14, figure 2—39).

b. At the lateral stick trim cylinder rod ends (7 and 24), remove the bolts, washers and nuts (8 and 12) securing the cylinder assembly (16) at the observer's stick yoke and at the magnetic brake unit (11). Remove the cylinder assembly (16).

c. Unbolt the lateral magnetic brake unit (11) from the forward side of the cabin forward bulkhead and lift the magnetic brake from the bulkhead.

d. Remove the bolt, washers, and nut (1) attaching the fore-and-aft stick trim cylinder assembly universal (3) at the bell crank forward of the observer's cyclic control stick yoke. Remove the spacers (2). At the outboard cylinder assembly rod end (24), remove the bolt, washers and nut (13) and remove the cylinder assembly (16) from the fore-and-aft magnetic brake unit (14). Separate the universal (3) from the cylinder assembly (16) by removing the bolt, washers, spacer and nut (4).

e. Remove the bolts and washers (15) and lift the magnetic brake unit (14) from the bracket on the cockpit floor.

2—384. DISASSEMBLY. The magnetic brake is not disassembled. Disassemble each stick trim cylinder assembly as follows:

CAUTION

Measure the exact length of both cylinders from hole center to hole center of the rod ends before disassembly.

a. Loosen the check nuts (6, 9 and 25, figure 2—39) and remove the rod ends (5, 7 and 24) from the rod (23) and cylinder piston (32). Remove the check nuts (6, 9 and 25).

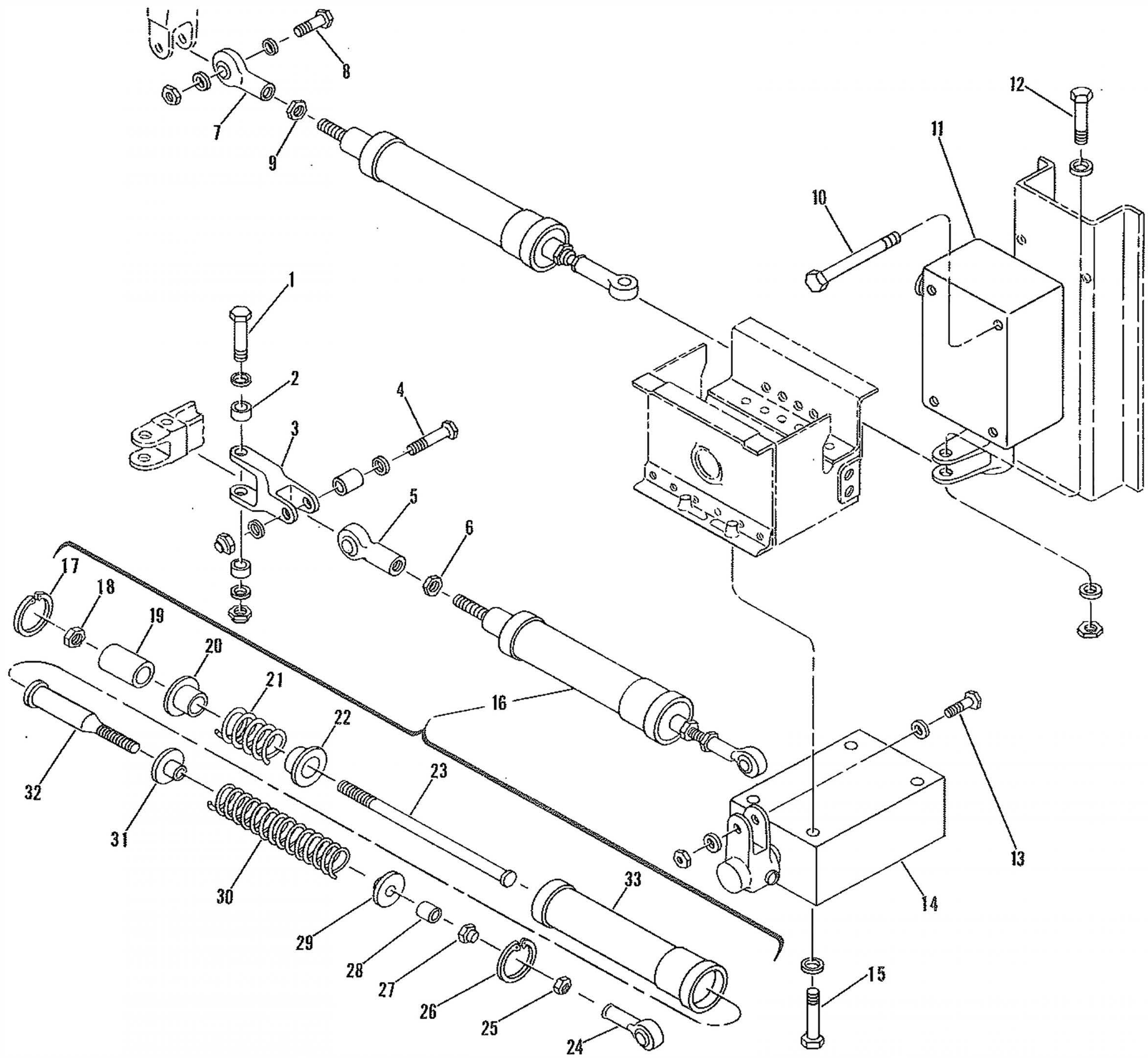
b. At each end of the cylinder (33), remove the retaining rings (17 and 26) which position the rod assembly and piston assembly within the cylinder (33). Remove the piston assembly and rod assembly.

c. Unscrew the adjustment nut (18) from the rod assembly and slide the spacer (19), flange (20), spring (21) and flange (22) off the rod (23). Unscrew the adjustment nut (27) from the piston assembly and slide off the spacer (28), flange (29), spring (30), and flange (31).

2—385. ASSEMBLY. Assemble each stick trim cylinder assembly as follows:

a. Position and install the flanges (20, 22, 31 and 29, figure 2—39), springs (21 and 30) and spacers (19 and 28), on the rod (23) and piston (32) with the adjustment nuts (18 and 27).

b. Fit the piston and rod assemblies within the cylinder (33) and secure them in place with the retaining rings (17 and 26) at the cylinder ends. Adjust the nuts to eliminate all end play on the rod (23) and piston (32) within the cylinder (33).



1. Bolt, Washers, Nut
2. Spacer
3. Universal
4. Bolt, Washers, Spacer, Nut
5. Rod End
6. Check Nut
7. Rod End
8. Bolt, Washers, Nut
9. Check Nut
10. Bolt
11. Magnetic Brake Unit
12. Bolt, Washers, Nut
13. Bolt, Washers, Nut
14. Magnetic Brake Unit
15. Bolt, Washers
16. Cylinder Assembly
17. Retaining Ring
18. Adjustment Nut
19. Spacer
20. Flange
21. Spring
22. Flange
23. Rod
24. Rod End
25. Check Nut
26. Retaining Ring
27. Adjustment Nut
28. Spacer
29. Flange
30. Spring
31. Flange
32. Piston
33. Cylinder

Figure 2—39. Spring Cylinders and Magnetic Brake

c. Install the check nuts (6, 9 and 25) and rod ends (5, 7 and 24).

Note

On helicopters bearing USAF Serial Nos 53-4498 and subsequent, adjust each spring cylinder per instructions in steps d. through h.

d. Tighten the adjustment nut (18 and 27, figure 2—39) on each end of the cylinder (16) until 1/16-inch to 1/8-inch clearance is obtained between the retaining ring (17 and 26) and flange (20 and 29). Back off each nut in turn only enough to eliminate the end play between the retaining ring and flange.

Note

Do not loosen the adjustment nut enough to cause end play between the spacer and flange.

e. With the rod end (5) held securely, apply an 8-pound pull as measured by scale to the piston end (24). There should be no movement of the piston shaft.

f. With a 10.5 pound ±1.5 pound pull, the cylinder springs should start to deflect.

g. The ratio between cylinder deflection and load should fall within the values in table IX.

TABLE IX
CYLINDER DEFLECTION UNDER LOAD

DEFLECTION (INCHES)	+20% −10% LOAD APPLIED (POUNDS)
1/8	19.25
1/4	23.8
1/2	29.6
1	45.5

h. Tighten or loosen the cylinder rod ends (5 and 24) and check nuts (6 and 25) as required to adjust the cylinder to the exact length as determined in paragraph 2—384.

Note

Apply graphite grease (index 24, paragraph 1—32) sparingly to all rubbing surfaces on installation.

2—386. INSTALLATION.

a. With the washers and bolts (15, figure 2—39), secure the fore-and-aft cyclic control stick trim magnetic brake unit (14) to the bracket on the cockpit floor.

b. Position the fore-and-aft magnetic brake unit arm to allow equal travel in both directions. Secure the universal (3) to the rod end (5) with the bolt, washers, spacer and nut (4). Install the universal (3) at the bell crank with the spacers (2) and secure with the bolt, washers, and nut (1). Secure the cylinder assembly (16) to the arm on the magnetic brake unit (14) with the bolt, washers and nut (13).

c. Install the lateral magnetic brake unit (11) at the cabin forward bulkhead with the bolts.

d. Position the lateral magnetic brake unit arm to allow equal travel in both directions. Tighten the check nuts (9 and 25), connect the cylinder assembly outboard rod end (24) to the brake arm and connect the inboard rod end (7) at the observer's stick yoke with the bolts, washers and nuts (12 and 8).

e. Connect the stick trim wiring at the plugs on the brake units (11 and 14).

f. Adjust the cyclic control stick trim system. (Refer to paragraph 2—387.)

2—387. ADJUSTMENT.

a. Remove the clutch access door. Center the cyclic control sticks fore-and-aft and laterally by installing a 1/4 x 10 inch rigging pin (table X) through both socket yoke assemblies (5 and 71, figure 2—38) and a 3/16 x 6 inch rigging pin through the bell cranks (1 and 82).

b. Disconnect the cylinder (16, figure 2—39) from the arm on the magnetic brake unit (11). Disconnect the cylinder (16) from the arm on the magnetic brake unit (14).

c. Connect a source of external power and place the battery-generator switch in the "BATT. ONLY" position. Check that the "STICK TRIM" switch on the overhead switch panel is in the "STICK TRIM" position. Center the arms of the magnetic brake units (11 and 14) in the midpoint of travel by pressing the "STICK TRIM" switch on either cyclic control stick.

Note

When the "STICK TRIM" switch on either cyclic control stick is pressed in, the arm on the fore-and-aft brake unit must rotate 45 degrees in either direction from the vertical. The lateral brake unit arm must rotate 45 degrees in either direction from the neutral forward position. If necessary, position the arm on the shaft of the magnetic brake unit to obtain this movement.

d. Bolt the cylinder (16) to the magnetic brake unit (11) and the cylinder (33) to the magnetic brake unit (14). Remove the rigging pins which were installed.

Note

Check the cylinders for end play and spring resistance by following the instructions in steps e. through h.

e. Hold the cyclic stick in neutral position to center the magnetic brake arm, place the master control switch on the overhead control panel in "STICK TRIM" position and press the "STICK TRIM" button on the circuit breaker panel.

f. Apply external hydraulic pressure to the auxiliary servo system at the disconnects.

g. Check that the pilot's cyclic stick free play in a fore-and-aft or lateral direction does not exceed 1/8-inch when the stick is subject to a 1/4-pound load.

h. Connect a scale to the grip. The pull required to feel the spring resistance of the force gradient cylinder should be between 1 1/8 and 1 3/4 pounds in any direction.

Note

Check the stick trim system for operation by following the instructions in steps i. and j.

i. Move either cyclic control stick to the full forward, full aft, full left lateral, and full right lateral positions until it hits the stops. Check the stick for a force of from 2 to 4 1/2 pounds at each extreme of travel.

j. Press the "STICK TRIM" switch on either cyclic control stick and move the stick to the full forward, full aft, full left lateral, and full right lateral positions until it hits the stops with no resistance from the cylinders. Release the switch when the stick is in each extreme of travel and check that the stick stays in each position. While the stick is in each extreme of travel, move the stick to the opposite extreme of travel without pressing the "STICK TRIM" switch and check for a force of 2 to 7 pounds in this position. Check that the stick returns to each position for which it was set.

k. Replace the clutch access door.

2–388. COLLECTIVE PITCH CONTROL SYSTEM.

2–389. DESCRIPTION. *(See figure 2–38.)* The collective pitch control system provides vertical control for the helicopter and consists of the following components: a pilot's and observer's collective pitch control stick connected to a torque shaft, a push-pull rod extending from the torque shaft to the bell crank installation mounted on the tunnel, and push-pull rods extending from the bell crank installation to the servo and mixer assembly and on up to the main rotor servo units. Movement of the collective pitch control stick actuates the mixing unit so that all of the primary servos are actuated at one time and the pitch of all four blades is increased or decreased equally and simultaneously. A nut on the pilot's pitch control stick can be rotated to apply friction to the control or to prevent the pitch stick from creeping in flight. The rotatable grip of each stick is a throttle which is partially synchronized to the vertical movement of the pitch stick so that an increase in pitch will automatically increase the throttle setting and a decrease in pitch will decrease the throttle setting. The engine starter button, the landing light control box and the servo switch are also located on the pilot's collective pitch control stick.

2–390. REMOVAL.

a. Remove the observer's seat from the cockpit. (Refer to paragraph 2–138.)

b. Remove the control box installation from the pilot's collective pitch control stick (9, figure 2–38).

c. Place the collective pitch control in the low pitch position. Disconnect and remove the drag (12) extending from the bracket on the aft bulkhead of the cockpit to the pilot's pitch stick (9).

d. Cut the lock wire, remove the lock ring and back off the knurled nuts securing the pitch sticks (9 and 62) to the stick shaft (60). Remove the collective sticks.

e. Cut the lock wire and remove the screws and washers from each end of the throttle control outer tube (32, figure 5–13). Slide the tube to the right to gain access to the coupling on the torque tube. Cut the lock wire and remove the screw from the coupling.

f. Slide the coupling to the right until it disengages from the collective pitch stick shaft (60, figure 2–38).

g. Cut the lock wire and remove the screw that secures the adapter to the stick shaft (60). Remove the adapter.

h. Disconnect and remove the rod (61) extending from the stick shaft (60) to the arm (64) of the torque shaft installation. Remove the bolts, washers and nuts and remove the stick shaft (60) from the cockpit.

i. Disconnect and remove the rod (63) extending from the arm (10) to the auxiliary servo unit assembly (13).

j. Remove the cotter pin, nut and washers. Remove the two taper pins, washers, nuts and cotter pins securing the arm (10) in position on the tube (11). Remove the arm (64) and tube (11) from the bracket (65), sliding the arm (10) from the tube.

Note

Retain any shims found on the tube (11). These shims have been installed to reduce end play of the tube (11) in the bracket (65) and should be installed upon reassembly of the torque shaft.

k. Remove the taper pins, washers, nuts and cotter pins securing the arm (64) to the tube (11) and remove the arm from the tube.

l. Remove the four bolts, washers and nuts securing the bracket (65) to the tunnel and remove the bracket and shims, as necessary.

2—391. INSTALLATION.

WARNING

If four or more threads are showing on the adjustable rod ends, add spacers or washers under the nut until less than four threads show.

Note

Refer to table VIII for basic rod lengths of the component rod assemblies of the collective pitch system.

a. Place the collective pitch control stick shaft (60, figure 2—38) and support fittings in position in the cockpit and secure the fittings with the bolts, washers and nuts.

b. Place the bracket (65) in position on the tunnel, shim with thin washers, as required, and secure with the bolts, washers and nuts.

c. Place the arm (64) in position on the tube (11) and secure with the taper pins, washers, nuts and cotter pins.

d. Slide the tube (11) into the right-hand mounting hole of the bracket (65). Slide the arm (10) onto the tube (11) and complete the installation of the tube in the bracket. Install the washer, nut and cotter pin.

Note

Inboard of the bracket left mounting hole, shim as required to reduce end play of the tube (11) in the bracket (65) without preloading the bearings.

e. Install the taper pins, washers, nuts and cotter pins securing the arm (10) in position on the tube (11).

f. Install the rod (61) which extends from the stick shaft (60) to the arm (64). Install the rod (63) which extends from the arm (10) to the servo auxiliary unit assembly (13).

g. Place the pilot's and observer's collective sticks (9 and 62) into their respective fittings on the stick shaft (60). Tighten the knurled nut at the base of each pitch stick, install the lock ring and lockwire.

Note

The collective sticks should be in the low pitch position.

Note

Shim, as required, at the base of each inner stick tube to eliminate end play of more than 0.006 inch at the throttle grip.

h. Position and secure the drag (12) to the pilot's pitch stick (9) and the bracket located on the aft bulkhead of the cockpit.

i. Slide the throttle control adapter onto the collective pitch stick shaft (60).

Note

The small end of the adapter should be to the left. The threaded hole in the small end of the adapter should be at the top.

j. Adjust the pitch stick shaft and the throttle control torque tube so there is a gap of 1/16-inch between the ends of the shaft and tube. Slide the coupling to the left until an equal amount of each shaft is inside the coupling. Secure the coupling with the screw. Lockwire the screw.

k. Slide the outer tube (32, figure 5—13) to the left onto the adapter. Secure the outer tube to the adapter with the screws and washers. Lockwire the screws. Align the holes in the outer tube (32) with the holes in the outer tube assembly (31) and install the screws and washers. Lockwire the screws.

Note

If the holes in the outer tube (32) and outer tube assembly (31) do not align, slide the outer tube and adapter to the right until the adapter disengages from the collective pitch stick shaft. Turn the outer tube and adapter one serration and replace it on the stick shaft.

l. Secure the adapter to the stick shaft with the screw. Lockwire the screw.

Note

With the pilot's throttle grip held firmly in mid-position check the backlash at the outboard throttle control lever (28) located on the tube assembly (31) attached to the right end of the stick shaft (60, figure 2—38). If the backlash exceeds 5 degrees, replace the stick (9) and/or the shaft (60). Repeat the above check on the observer's throttle grip.

m. With one throttle grip locked and a 50 inch-pound load applied on the other grip, check that the deflection obtained is less than 10% and that the throttle linkage does not take a permanent set. One or both of the universals on the torque shaft must be replaced if this limit is exceeded.

n. Check the throttle control system for proper operation.

o. Check the adjustment of the collective open loop spring cylinder. (Refer to paragraph 2—392.)

p. Install the control box installation on the pilot's pitch stick (9). Install the observer's seat. (Refer to paragraph 2—139.)

q. Check the main rotor flight control rigging. (Refer to paragraph 2—523.)

2—392. ADJUSTMENT OF COLLECTIVE OPEN LOOP SPRING CYLINDER.

a. Apply 1500 psi hydraulic pressure to the auxiliary servo system.

b. Back off the collective pitch stick friction adjustment so that stick motion is not restrained.

c. Loosen the rod-end check nut at the lower end of the collective open loop spring cylinder and slide the washer along the shaft so the rod end is free to turn.

d. If the collective pitch stick drops when let go after being placed in mid position, screw the shaft out of the rod end until the stick remains stationary where placed.

e. If the stick rises when released, screw the shaft into the rod end until it remains stationary where placed. Secure the rod end with the lock washer and check nut.

2—393. MAIN ROTOR PRIMARY SERVO UNITS.

2—394. DESCRIPTION. *(See figure 2—40.)* The three main rotor primary servo units furnish a hydraulic power boost for relieving main rotor control forces whenever the primary hydraulic system is in operation. Each servo unit is attached to a lug on the main gear box, at its lower end, to a flight control arm at its pilot valve and to an arm of the stationary star at its upper end. Each servo unit is brought into operation whenever its pilot valve is displaced to allow hydraulic oil flow for extending or retracting the servo unit piston. The movement of the flight control rod through a sloppy link at the attachment point of the control arm to the servo unit displaces the pilot valve. The movement of the piston continues until the pilot valve and sloppy link become centered in the neutral position. A pressure and return line are connected to each servo unit. Access to the units may be gained by hinging down the service platforms.

2—395. REMOVAL.

a. Disconnect the two hydraulic hoses from each servo unit (1, figure 2—40). Plug the hose lines and the servo unit fittings.

b. Remove the cotter pin, nut, washers and bolt (9) securing the control arm (8) to the bell crank on the lower housing of the main gear box.

CAUTION

Exercise great care to avoid spreading the control arms. At removal of each control arm (8) and attaching servo unit (1), separate the two components only as outlined below.

c. Remove the nuts, washers and bolts (10) securing the control arm fittings (7) to each control arm (8). Remove each control arm.

d. Remove the nuts (4) and washers attaching the fittings (7) to each servo unit (1). Slide the fittings (7) and chamfered washers (3) outboard off the servo yoke studs.

Note

On helicopters bearing USAF Serial Nos 53-4503 and subsequent, a special washer is installed under each nut. A one-inch diameter counterbore is provided in each fitting to accommodate this washer.

e. Remove the nut and bolt (5) securing each servo unit to the main gear box lugs. Remove the bushings (6) from each lug.

f. Remove the nut and bolt (2) attaching each servo unit to the stationary star.

2—396. DISASSEMBLY AND ASSEMBLY. The servo units (1, figure 2—40) must be disassembled and assembled only by qualified personnel at an Overhaul Depot.

2—397. PREPARATION FOR STORAGE OR SHIPMENT.

a. Fill the main rotor servo unit with hydraulic equipment preservative oil (index 5, paragraph 1—32).

CAUTION

During storage of the servo unit and control arm assembly, avoid spreading the control arm. Reinstall the fittings (7, figure 2—40) at each control arm (8) and servo unit (1), push the servo unit piston into the housing, pass lock wire through the piston rod end, and fasten each end of the lock wire to the control arm. Complete the storage preparation according to steps c. through e.

b. Push the piston rod up into the housing.

c. Coat the rod-end bearings with grease (index 38, paragraph 1—32). Lubricate the rod end of the servo unit (1, figure 2—40) with grease (index 38, paragraph 1—32) by applying the Shafer Bearing Corporation nozzle, part No. N-2, to each rod-end flush-type fitting.

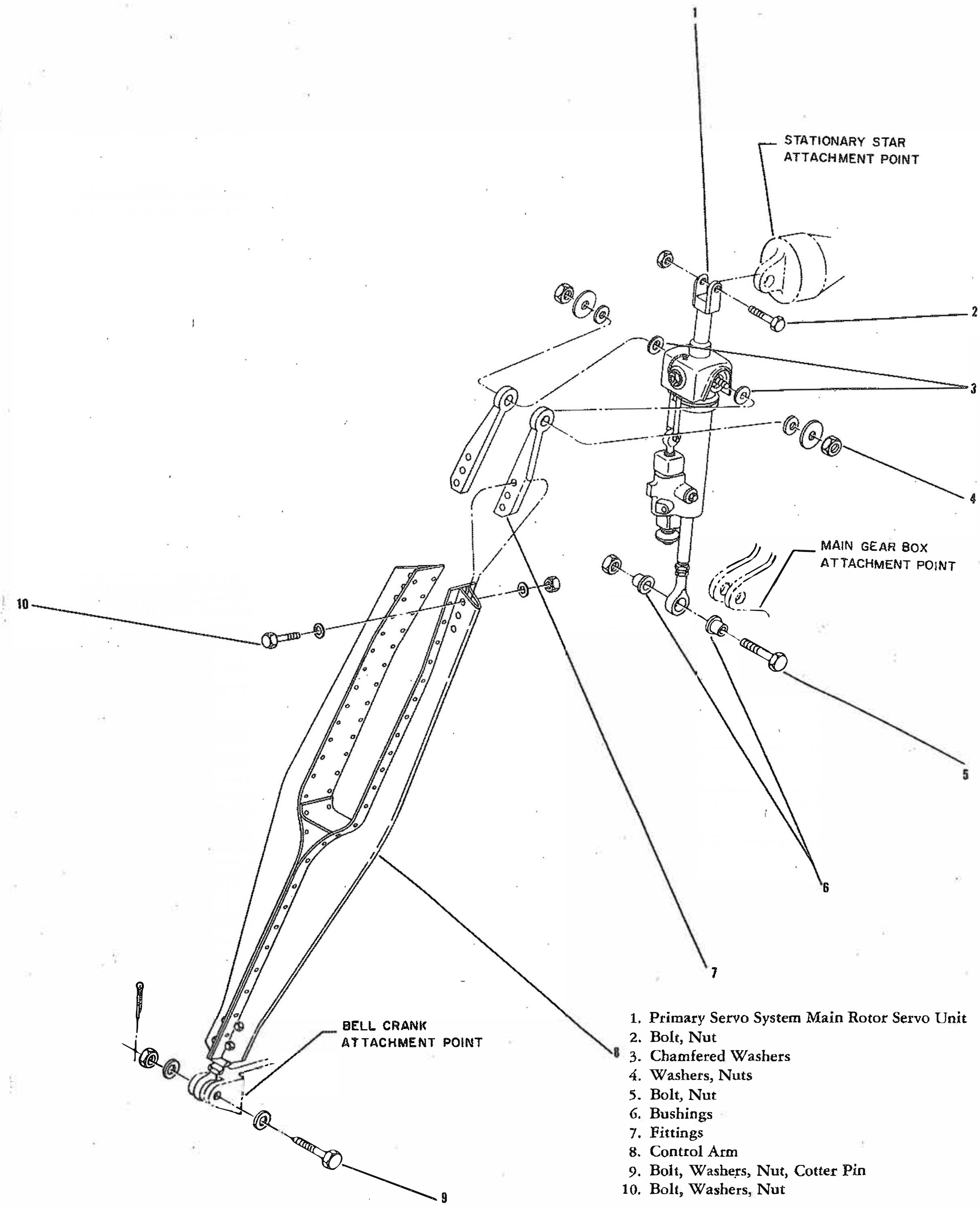
d. Wrap the entire unit in greaseproof barrier material (index 8, paragraph 1—32).

e. Secure with adhesive tape (index 9, paragraph 1—32).

2—398. PLACING IN SERVICE.

a. Remove the tape and barrier material.

b. Drain the preservative oil and flush the servo units with hydraulic oil (index 6, paragraph 1—32).



1. Primary Servo System Main Rotor Servo Unit
2. Bolt, Nut
3. Chamfered Washers
4. Washers, Nuts
5. Bolt, Nut
6. Bushings
7. Fittings
8. Control Arm
9. Bolt, Washers, Nut, Cotter Pin
10. Bolt, Washers, Nut

Figure 2—40. Main Rotor Primary Servo and Control Arm Removal and Disassembly

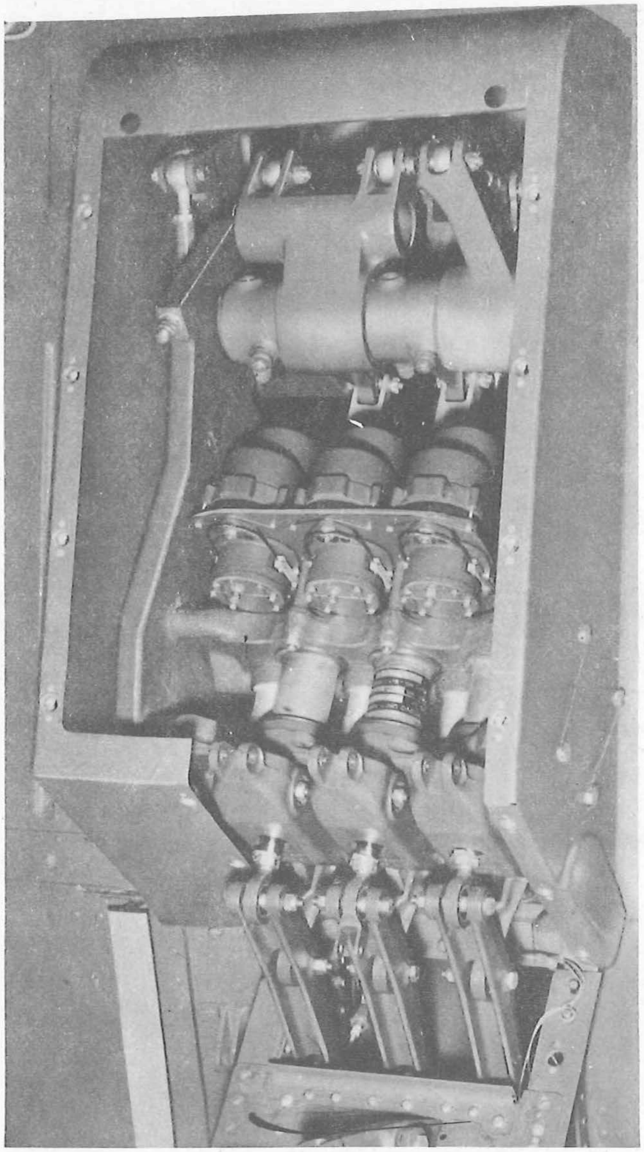


Figure 2—41. Main Rotor Auxiliary Servo and Mixer Assembly Installed

CAUTION

At the control arm and servo unit assembly unfasten the lock wire securing the control arm at the servo unit piston rod.

2—399. INSTALLATION.

a. If not assembled, temporarily install the fittings (7, figure 2—40) at the servo unit (1) and control arm (8).

b. Check the lengths of the servo unit and control arm for the dimensions given in figure 2—56 and table XII.

c. To avoid spreading the control arm during installation, remove the fittings (7, figure 2—40) from the control arm (8) and the servo unit (1).

d. Secure each servo unit (1) at the stationary star with the bolt (2) and nut.

e. Install the bushing (6) in each main gear box lug. At the piston rod end, secure each servo unit (1) to the main gear box lugs with the bolt (5) and nut.

f. Install the chamfered washers (3) on the servo yoke studs.

Note

The surface of the washer containing the small diameter chamfer must be against the servo unit.

g. Slide the fittings (7) onto the servo yoke studs.

Note

The surface containing the counterbore should face out.

h. Secure the fittings with the washers and nuts (4).

Note

Install the smaller washer into the counterbore of the fitting and the large washers under the nuts.

i. Slide the control arm (8) onto the fittings (7) and secure it with the bolts (10), washer and nuts.

j. Secure the control arm (8) to the bell crank on the lower housing of the main gear box with the bolt (9), washers, nut and cotter pin.

k. Connect the pressure and return lines to each servo unit.

l. Check the main rotor flight control rigging. (Refer to paragraph 2—523.)

2—400. MAIN ROTOR AUXILIARY SERVO UNIT.

2—401. DESCRIPTION. *(See figure 2—41.)* The main rotor auxiliary servo unit assembly contains the three power pistons necessary for control of the main rotor by the auxiliary hydraulic system, the three pilot valves for control of the power pistons and a torque shaft which rotates to bypass the hydraulic oil when the auxiliary hydraulic system is shut off. The servo unit assembly is located in the flight control system just forward of the mixing unit. The power pistons of the assembly are sections of the flight control linkage. When the auxiliary hydraulic system is operating, the main rotor auxiliary servo unit assembly provides a hydraulic power boost to relieve main rotor control forces. The power pistons are controlled by the movement of pilot valves which move in sloppy links to direct the flow of hydraulic oil to either side of the power piston for the movement of the controls. Movement of the pilot valves is accomplished manually through the flight controls. If the auxiliary hydraulic system is not operating, hydraulic oil is internally bypassed and the power pistons function only as control rods. Access to the servo unit assembly is gained by hinging down the access panel on the upper servo and mixer cover between the pilot and observer.

2—402. REMOVAL.

a. Remove the pilot's seat. (See step 1, figure 2—42 and refer to paragraph 2—138.)

b. Hinge down and remove the panel at "A" (step 2, figure 2—42) from the upper servo and mixer cover. Unfasten and remove the lower cover from the main drive shaft tunnel at "B." Unbolt the right-hand panel supporting the covers at "C." Remove the panel.

c. Unbolt the three links on the mixer assembly from the aft ends of the pistons (step 3).

d. Unbolt the control rods from the input arms on the servo unit (step 4).

e. Hinge down the right service platform. Disconnect the hydraulic lines to the servo unit at the servo unit bracket inboard of the right transmission support assembly at "A" (step 5) and at the forward end of the servo unit.

f. Unbolt the fork on the actuating cylinder assembly from the lever on the servo unit at "B" (step 5).

g. Cut the lock wire, unbolt the servo unit from the supports and remove it at "A" (step 6). Remove the hydraulic tubing at "B."

2—403. CLEANING. Clean the exposed surfaces of the power pistons with a soft, clean rag dampened in hydraulic oil (index 6, paragraph 1—32).

2—404. DISASSEMBLY AND ASSEMBLY. The auxiliary main rotor servo unit must be disassembled and assembled only by qualified personnel at an Overhaul Depot. The collective open loop spring cylinder and bracket may be removed. (Refer to paragraph 2—379, steps ar. and as.)

2—405. PREPARATION FOR STORAGE OR SHIPMENT.

a. Fill the servo unit with hydraulic equipment preservative oil (index 5, paragraph 1—32). Clean the servo unit with solvent (index 3, paragraph 1—32). Coat external machined surfaces, except the power pistons, with corrosion-preventive compound (index 4, paragraph 1—32).

b. Wrap the unit in barrier material (index 8, paragraph 1—32) and secure with tape (index 9, paragraph 1—32).

c. Pack the unit securely in a suitable box.

2—406. PLACING IN SERVICE. Unpack the unit, drain the hydraulic preservative oil and strip the corrosion-preventive compound from exterior surfaces with solvent (index 3, paragraph 1—32).

2—407. INSTALLATION.

Note

If the collective open loop spring cylinder and support bracket were removed, install them according to the instructions in paragraph 2—380, steps c. and d.

a. Install the sections of hydraulic tubing at "B" (step 6, figure 2—42). Position the servo unit and bolt it to the supports at "A." Lockwire the bolts.

b. Bolt the fork of the actuating cylinder assembly to the lever on the servo unit at "B" (step 5) and install the cotter pin.

c. Connect the servo unit hydraulic lines at the bracket on the transmission deck at "A" (step 5) and at the forward end of the servo unit.

d. Bolt the control arms to the input arms on the servo unit and install the cotter pins. (See step 4.)

e. Position the washers and bolt the three links on the mixer assembly to the aft ends of the power pistons. Install the cotter pins. (See step 3.)

f. Apply a source of 1000 to 1500 psi pressure to the auxiliary servo hydraulic system and check for a clearance of 0.002 to 0.007 inch between the cam and roller. (See detail "A," figure 2—43.) Adjust, if necessary, at the fork of the actuating cylinder.

Note

Hydraulic pressure may be obtained by running the engine or by connecting an external pressure source at the disconnect panel on the right side of the engine.

g. Bolt the right-hand panel to the canted bulkhead at "C" (step 2, figure 2—42). Fasten the lower cover to the main drive shaft tunnel at "B." Install and hinge the panel into position at "A."

h. Install the pilot's seat. (See step 1 and refer to paragraph 2—139.)

i. Check the adjustment of the collective open loop spring cylinder. (Refer to paragraph 2—392.)

j. Check the main rotor flight control rigging. (Refer to paragraph 2—523.)

2—408. ACTUATING CYLINDER ASSEMBLY.

2—409. DESCRIPTION. *(See figure 2—43.)* The actuating cylinder assembly is located at the right of the auxiliary servo and mixer assembly; and is attached to a support on the input housing of the main gear box at the aft end, and a lever of the auxiliary servo unit at the forward end. When the auxiliary servo system is shut off or when the pressure in the system falls below 1000 psi, the actuating cylinder turns a torque shaft in the servo unit to bypass the hydraulic pressure around

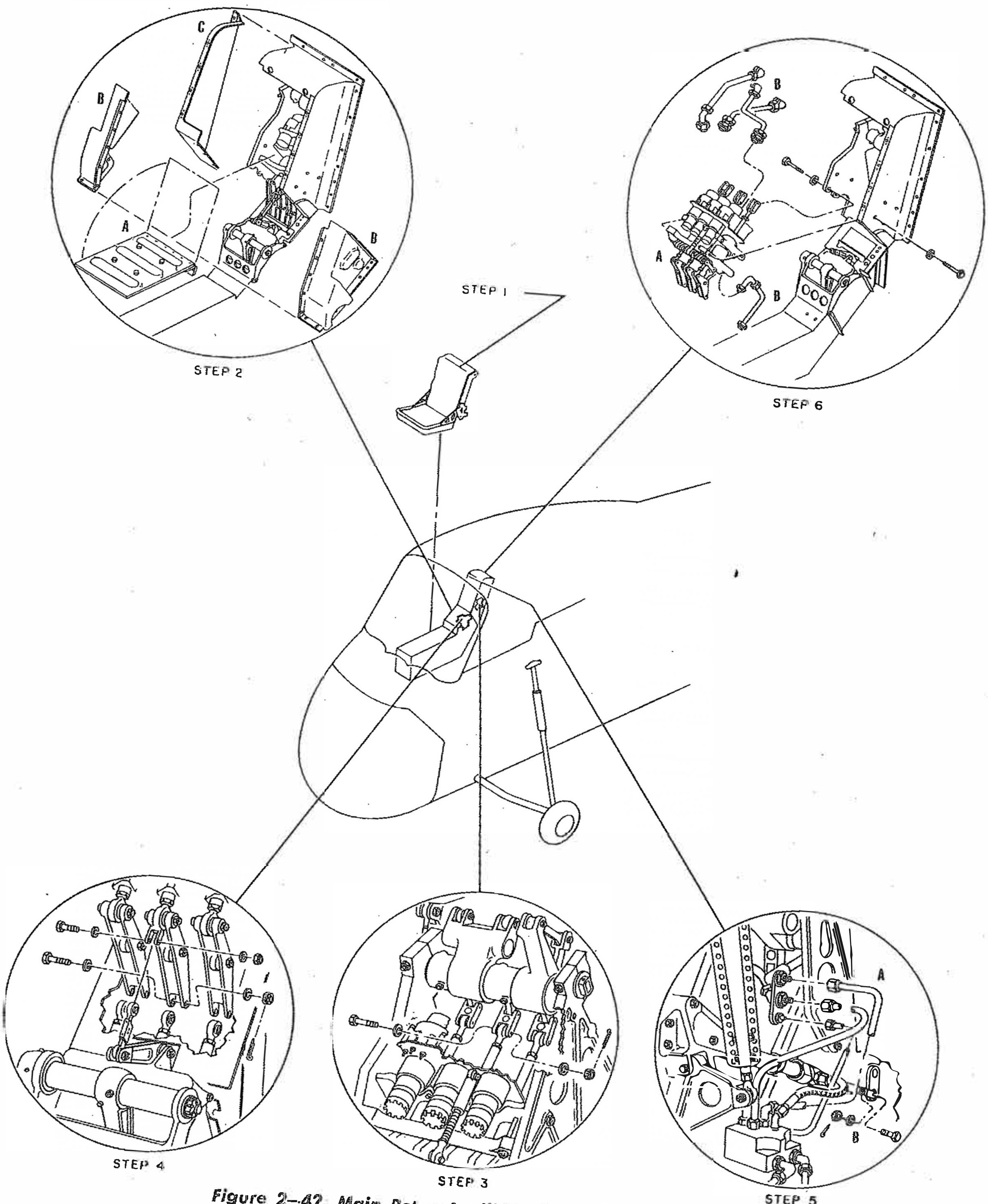


Figure 2–42. Main Rotor Auxiliary Servo Unit Removal

the servo cylinders and rotate the auxiliary servo unit cam and roller to manual position. Conversely, the actuating cylinder turns the torque shaft to close the bypass tubes and rotate the roller and cam for the pilot valves to the servo position when the auxiliary hydraulic system is on and the pressure is above 1000 psi. Access is gained by opening the hinged panel on the upper servo and mixer cover in the cockpit and by hinging down the right service platform.

2—410. REMOVAL.

a. Disconnect the hose (6, figure 2—43) from the actuating cylinder (2). Remove the union (7) and gasket (5).

b. At the actuating cylinder support (1), located on the main gear box input housing, remove the cotter pin, nut, washers and bolt (8).

c. Remove the cotter pin, nut, washer and bolt (3) securing the cylinder fork end to the lever arm (4) of the servo unit. Remove the cylinder (2) from the servo unit.

2—411. DISASSEMBLY AND ASSEMBLY. The actuating cylinder (2, figure 2—43) must be disassembled and assembled only by qualified personnel at an Overhaul Depot.

2—412. PREPARATION FOR STORAGE OR SHIPMENT.

a. Fill the actuating cylinder with hydraulic equipment preservative oil (index 5, paragraph 1—32). Coat the piston rod with preservative oil by working the rod in and out of the housing.

b. Coat the upper end cap bearing with grease (index 38, paragraph 1—32).

c. Push the piston rod up into the housing and wrap the entire actuating cylinder in waterproof wrapping material (index 8, paragraph 1—32).

d. Secure with adhesive tape (index 9, paragraph 1—32).

2—413. PLACING IN SERVICE.

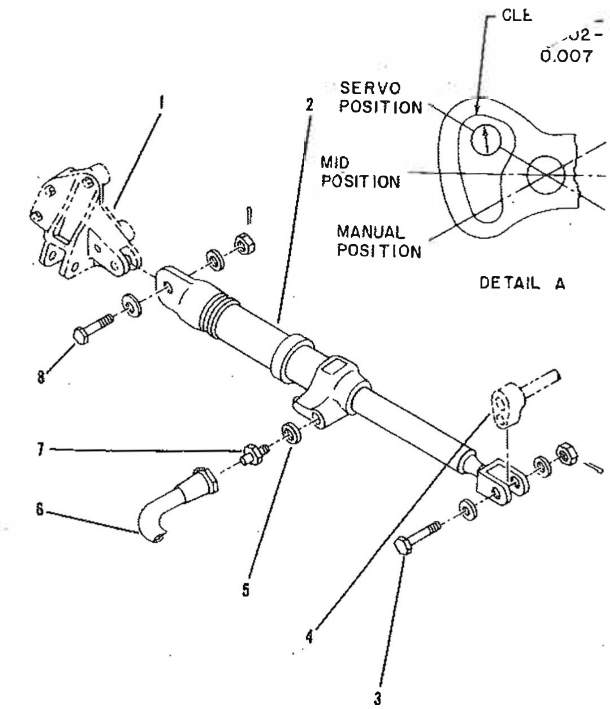
a. Remove the tape and wrapping material.

b. Drain the preservative oil and refill the actuating cylinder with hydraulic oil (index 6, paragraph 1—32).

2—414. INSTALLATION.

a. Fully extend the actuating cylinder (2, figure 2—43) and check center-to-center distance between the end cap and fork end attachment points of the cylinder. Adjust to obtain a length of 16-39/64 inches by threading the fork end in or out of the cylinder. Tighten the lock nut, but avoid bending the lock washer tangs until final adjustment is made.

b. With the bolt, washers, nut and cotter pin (8),



1. Support
2. Actuating Cylinder Assembly
3. Bolt, Washer, Nut, Cotter Pin
4. Lever Arm
5. Gasket
6. Hydraulic Hose
7. Union
8. Bolt, Washers, Nut, Cotter Pin

Figure 2—43. Actuating Cylinder Assembly Removal

install the fully extended actuating cylinder (2) at the input housing support (1).

c. Install the gasket (5) and union (7) at the cylinder (2). Connect the hose (6) to the union (7). Apply a pressure of 1000 to 1500 psi to the auxiliary hydraulic system until the actuating cylinder piston is fully retracted to approximately 14-31/64 inches (2-1/8 inch travel).

Note

Hydraulic pressure may be obtained by running the engine or by connecting external pressure to the disconnect panel on the right side of the engine.

d. At the cylinder fork end, secure the cylinder (2) to the servo unit lever arm (4) with the bolt (3), washer, nut and cotter pin.

e. Check for a clearance of 0.002 to 0.007 inch between the cam and roller. (See detail "A.") If necessary, adjust for proper clearance by disconnecting the fork end from the servo unit lever arm (4), threading the fork end in or out of the power piston to obtain the desired clearance and securing the fork end to the servo unit lever arm with the bolt, washer, nut and cotter pin (3).

f. Tighten the fork end nut. Bend the lock washer tangs only after the proper clearance has been obtained. Recheck for 0.002 to 0.007 inch clearance between cam and roller. Relieve the pressure in the actuating cylinder.

2—415. MAIN ROTOR SERVO UNIT HYDRAULIC SYSTEMS.

2—416. DESCRIPTION. Two pressurized hydraulic servo systems are installed on the helicopter, the primary servo hydraulic system and the auxiliary servo hydraulic system. Hydraulically, each system functions independently of the other.

2—417. PRECAUTIONS FOR HYDRAULIC SYSTEM MAINTENANCE. To eliminate the possibilities of interrupted operation in the hydraulic system during flight, the following precautions must be observed by maintenance personnel:

a. Observe extreme care to obtain clean assembly and prevent foreign matter from entering the hydraulic system. Blow all lines clear at installation.

b. Store hydraulic oil in clean, covered containers.

c. Form flares in tubing carefully and in accordance with approved standards. Check flares for distortions and out-of-round condition before installation. Install the tubing carefully and never bend the tubing after installation as undue stress will be created. Remove tubing which must be bent and bend it with the proper tools, observing the standard bend radius.

Note

Defective flares and tubing overstressed during installation will often appear to be satisfactory and will pass initial pressure tests. The tubing, however, cannot be depended upon for continuous service.

d. Coat all threads with hydraulic oil (index 6, paragraph 1—32) or petrolatum, (index 45, paragraph 1—32) before installation.

CAUTION

Wipe off excess petrolatum to make sure it does not enter the lines.

e. Tighten fittings carefully and do not overtighten.

f. Recheck all fittings and tubing in the hydraulic system after several hours of flight.

2—418. PRIMARY HYDRAULIC SYSTEM.

2—419. DESCRIPTION. *(See figure 2—44.)* The primary hydraulic system operates at 1500 psi to relieve the cyclic and collective pitch control sticks of the control forces of the main rotor. Normally the primary hydraulic system is in operation whenever the main rotor is turning, but it may be shut off if the system malfunctions. When this occurs, the auxiliary hydraulic system alone will relieve control forces and flight controls will respond in a normal manner. The primary hydraulic system alone will also relieve control forces of the main rotor allowing main rotor controls to respond normally if the auxiliary hydraulic system is shut off. Increased tail rotor control pedal loads will be evident, however, because the primary hydraulic system does not function for the tail rotor flight controls. The primary and auxiliary hydraulic systems are separate systems hydraulically, but they are interconnected electrically. Should the pressure in the auxiliary hydraulic system fall below 1000 psi, the primary hydraulic system is prevented from being shut off by a pressure switch on the auxiliary hydraulic panel which breaks the circuit to the solenoid valve when the low pressure condition exists. Similarly, a pressure switch on the primary system hydraulic panel prevents the auxiliary hydraulic system from being shut off if the pressure in the primary hydraulic system is below 1000 psi. Hydraulic pressure for the primary hydraulic system is indicated on the pressure indicator mounted on the instrument panel. (Refer to paragraph 6—110.) The primary hydraulic system utilizes a hydraulic pump, a filter, a pressure relief valve, a three-way solenoid valve, a pressure switch, a restrictor, a snubber, a pressure transmitter, three main rotor primary servo units, a servo switch, a reservoir and necessary tubing and hose with quick disconnects. Several of the units are grouped into a hydraulic panel at the left side of the main gear box. (See figure 2—45.) Access to the primary hydraulic system components may be gained by hinging down the service platforms.

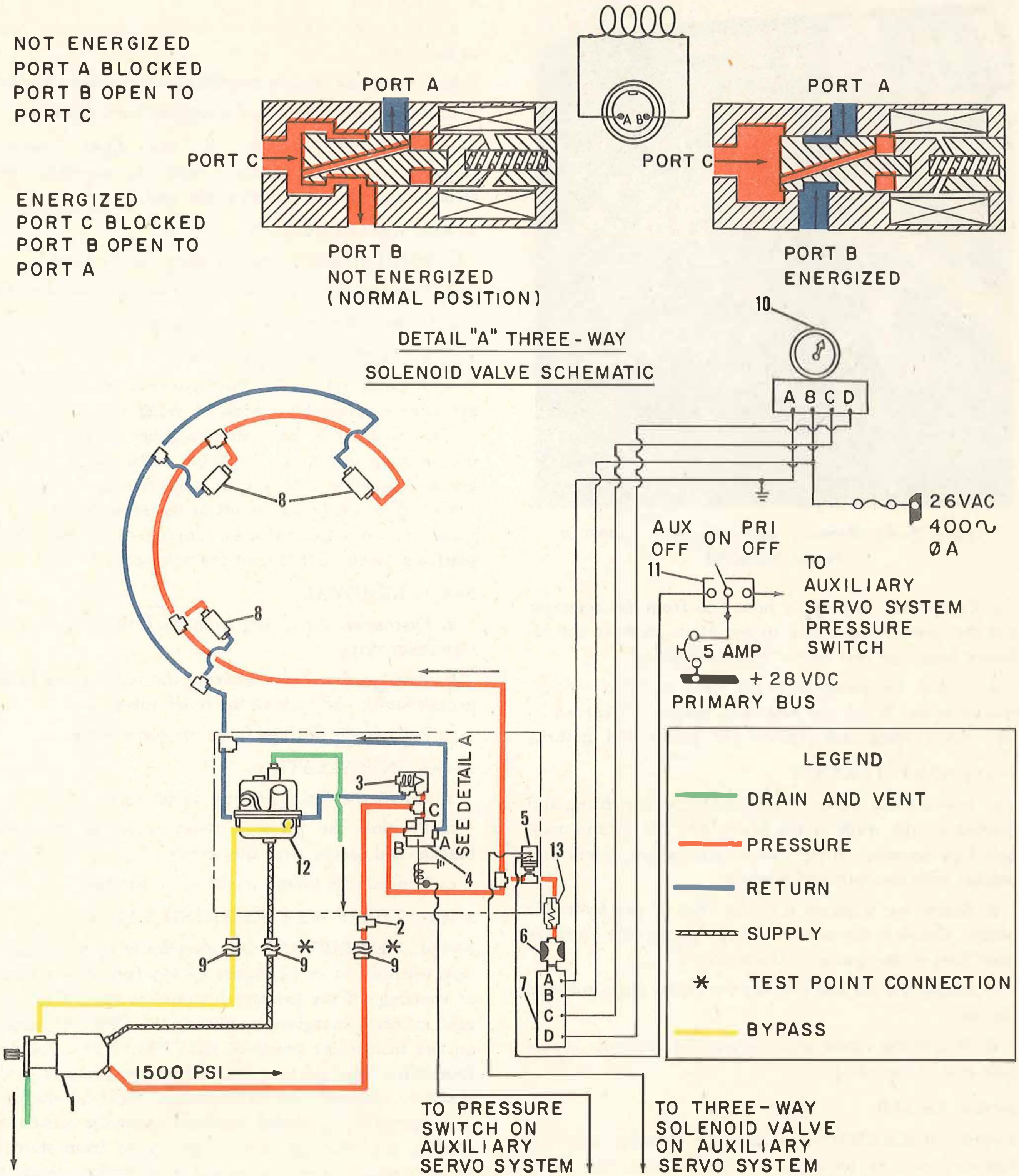
2—420. HYDRAULIC PUMP.

2—421. DESCRIPTION. A gear-type, constant displacement, variable delivery pump (1, figure 2—40) delivers hydraulic oil at 1500 psi to meet the demands of the primary hydraulic system. Hydraulic oil is drawn from the reservoir to the pump; at the pump the oil is sent into the system or bypassed internally and returned to the reservoir. An overboard drain is provided. The pump is mounted on the left-hand side of the main gear box rear accessory cover. Access to the pump is gained by hinging down the service platform on the left side of the helicopter.

2—422. REMOVAL.

a. At the top of the hydraulic pump, disconnect the bypass hose line to the reservoir and unscrew the elbow from the pump.

b. Disconnect the drain tubes at the tee at the bottom of the pump. Unscrew and remove the tee.



1. Pump
2. Filter
3. Pressure Relief Valve
4. Three-Way Solenoid Valve
5. Pressure Switch (Normally Open)
6. Restrictor
7. Pressure Transmitter
8. Primary Servo System Main Rotor Servo Units
9. Quick Disconnects
10. Pressure Indicator
11. Servo Switch
12. Reservoir
13. Snubber

Figure 2–44. Primary Servo Hydraulic System Schematic Diagram

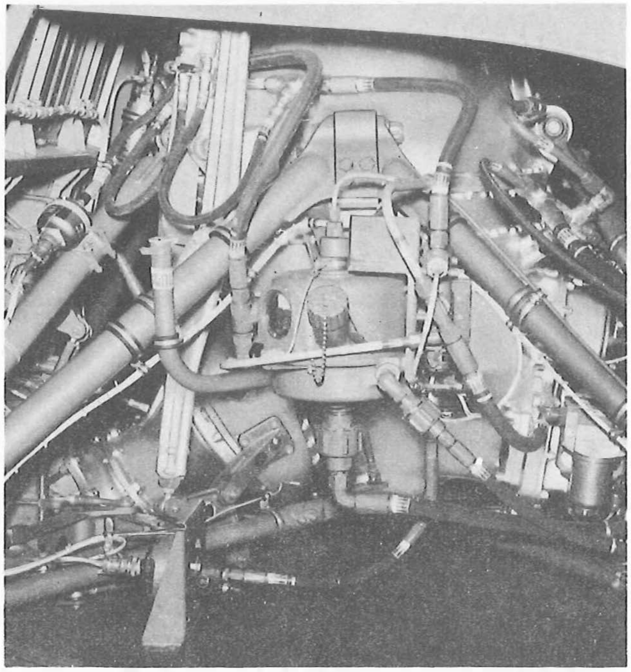


Figure 2—45. Primary Servo System Hydraulic Panel Installed

c. Disconnect the supply hose line from the reservoir and the pressure hose line to the filter. Remove the reducers from the rear of the hydraulic pump.

d. Unbolt the pump from the main gear box rear accessory cover. Work the filter and bracket off the accessory cover studs and remove the pump and gaskets.

2--423. INSTALLATION.

a. Position the gasket, hydraulic pump and filter, and bracket on the studs at the lower left side of the main gear box accessory cover. Secure the gasket, pump and bracket with the nuts and washers.

b. Screw the reducers into the rear of the hydraulic pump. Connect the reservoir supply and the pressure hose lines to the pump at the reducers.

c. Install the tee and connect the pump drain tubes to the tee.

d. Install the elbow and connect the reservoir bypass hose line to the pump.

2—424. FILTER.

2—425. DESCRIPTION. A line-type cartridge filter (2, figure 2—44) is installed in the pressure line from the hydraulic pump to remove foreign matter from the hydraulic oil before it enters the system. Should the filter element become clogged, one of the two relief valves opens at 50 psi differential pressure to allow oil to bypass the filter. Access to the filter is gained by hinging down the service platform on the left side of the helicopter.

2—426. REMOVAL.

a. Disconnect the hoses at the inlet and outlet ports of the filter.

b. Unbolt and remove the filter from the filter bracket.

c. Remove the elbow and coupling from the filter.

2—427. MAINTENANCE. If the filter becomes clogged, remove the cover, remove the micronic filter element and replace it with a new unit.

2—428. INSTALLATION.

a. Install the elbow and coupling on the filter.

b. Position the filter and bolt it to the filter bracket.

c. Connect the hoses to the inlet and outlet ports.

2—429. PRESSURE RELIEF VALVE.

2—430. DESCRIPTION. The system is protected from excessive pressure by a pressure relief valve (3, figure 2—44) mounted at the hydraulic panel on the left side of the main gear box. The relief valve has a cracking pressure relief at 1750 psi; at this pressure it begins to open and return hydraulic oil to the reservoir. Access is gained to the relief valve by hinging down the service platform on the left side of the helicopter.

2—431. REMOVAL.

a. Disconnect the tubing from the fittings of the pressure relief valve.

b. Remove the screws securing the relief valve to the panel bracket and remove the relief valve.

c. Remove the fittings from the relief valve.

2—432. INSTALLATION.

a. Install the fittings on the relief valve.

b. Position the pressure relief valve at the panel bracket and secure with the screws.

c. Connect the tubing to the valve fittings.

2—433. THREE-WAY SOLENOID VALVE.

2—434. DESCRIPTION. An electrically operated three-way solenoid valve (4, figure 2—44) furnishes a means of shutting off the primary hydraulic system. The solenoid circuit is energized by placing the "SERVO" switch on the instrument panel in the "PRI. OFF" position. (See detail "A," figure 2—44.) When the pressure in the auxiliary hydraulic system falls below 1000 psi, the pressure necessary for proper auxiliary hydraulic system operation, the solenoid valve is prevented from shutting off the primary hydraulic system by a pressure switch in the auxiliary hydraulic system. The three-way solenoid valve is located on the hydraulic panel on the left side of the main gear box. Access is gained by hinging down the service platform on the left side of the helicopter.

2—435. REMOVAL.

a. Unplug the wiring at the solenoid valve receptacle.

b. Disconnect the inlet, outlet and return lines at the solenoid valve.

c. Unbolt and lift the solenoid valve off the hydraulic panel bracket.

d. Remove the fittings from the valve.

2—436. INSTALLATION.

a. Install the fittings on the solenoid valve.

b. Position and bolt the solenoid valve to the hydraulic panel bracket.

c. Connect the inlet, outlet and return lines at the solenoid valve.

d. Plug the wiring into the solenoid valve receptacle.

2—437. PRESSURE SWITCH.

2—438. DESCRIPTION. A hydraulic pressure switch (5, figure 2—44), located on the primary hydraulic system hydraulic panel, prevents the three-way solenoid valve in the auxiliary hydraulic system from being energized and the system from being shut off if the hydraulic pressure in the primary hydraulic system is below 1000 psi, the necessary pressure for proper primary hydraulic system operation. The electric contacts in the switch are closed when the primary hydraulic system is above 1000 psi pressure. If the primary hydraulic system pressure is below 1000 psi, the contacts are open. Access to the switch is gained by hinging down the service platform on the left side of the helicopter.

2—439. REMOVAL.

a. At the pressure switch receptacle, unplug the pressure switch wiring.

b. Disconnect the tubing from the tee fitting. Disconnect the hose line from the elbow in the restrictor.

c. Unbolt and lift the pressure switch, tee fitting, snubber and restrictor off the hydraulic panel bracket. Unscrew the pressure switch from the tee fitting.

2—440. INSTALLATION.

a. Screw the pressure switch onto the tee fitting. Position and bolt the pressure switch, tee fitting, restrictor and snubber as a unit on the hydraulic panel bracket.

b. Connect the tubing to the tee fitting. Connect the hose line to the elbow in the restrictor.

c. Plug the pressure switch wiring to the pressure switch receptacle.

2—441. RESTRICTOR AND SNUBBER.

2—442. DESCRIPTION. A restrictor (6, figure 2—44) and snubber (13) are installed in the pressure hydraulic line to the pressure transmitter. The restrictor and snubber prevent surges of pressure to the pressure transmitter and thereby stabilize the pressure reading which will be indicated on the pressure indicator on the instrument panel. Access to the restrictor and snubber may be gained by hinging down the service platform on the left side of the helicopter. The restrictor and snubber are removed by disconnecting the pressure transmitter hose line and elbow from the restrictor and removing the restrictor and snubber from the tee on the pressure switch.

2—443. PRESSURE TRANSMITTER.

2—444. DESCRIPTION. The pressure transmitter (7, figure 2—44) electrically transmits the hydraulic pressure indication in the primary hydraulic system to the primary hydraulic pressure indicator on the instrument panel. The unit is shock-mounted on a support attached to the main transmission deck forward of the hydraulic panel. Access to the pressure transmitter is gained by hinging down the service platform on the left side of the helicopter.

2—445. REMOVAL.

a. Unplug the wiring from the pressure transmitter.

b. Disconnect the pressure hose from the elbow at the pressure transmitter.

c. Unbolt and lift the pressure transmitter out of the transmitter support.

d. Remove the elbow from the pressure transmitter.

2—446. INSTALLATION.

a. Install the elbow in the pressure transmitter.

b. Bolt the pressure transmitter in the transmitter support.

c. Connect the pressure hose line to the elbow in the transmitter.

d. Plug the pressure indicator wiring into the pressure transmitter.

2—447. SERVO SWITCH.

2—448. DESCRIPTION. The "SERVO" switch (11, figure 2—44 or 16, figure 2—46) is mounted on the control box on the pilot's collective pitch control and makes it possible to shut off either the primary or the auxiliary hydraulic system. When the switch is placed in either the "PRI. OFF" or "AUX OFF" position, the solenoid valve in the indicated hydraulic system is energized and the flow of hydraulic oil in that system stops. Only one system may be shut off at a time and then only if sufficient operating pressure is available in the other system. The switch is normally left in the "ON" position so both hydraulic systems are functioning.

2—449. RESERVOIR.

2—450. DESCRIPTION. The primary hydraulic system reservoir (12, figure 2—44) is mounted on the hydraulic panel. A sight level gage and filler tube are provided on the reservoir. A vent line, the supply and return lines, the bypass line from the hydraulic pump, and relief tubing to the return port of the relief valve are connected to the reservoir. Ports are provided for a rescue hoist supply and return line. Access to the reservoir may be gained by hinging down the left service platform. A window (41, figure 1—4, sheet 1) is installed in the copilot's side of the canted bulkhead to allow in-flight visual inspection of the primary servo reservoir sight gage and main gear box.

2—451. REMOVAL.

a. Drain the reservoir.

b. Disconnect the servo supply, pump bypass, relief valve, servo return, solenoid valve and reservoir vent lines at the reservoir.

c. Unbolt and remove the reservoir from the hydraulic panel and reservoir support brackets.

d. Remove the fittings from the reservoir.

2—452. INSTALLATION.

a. Install the fittings in the reservoir.

b. Position the reservoir on the hydraulic panel and reservoir brackets and secure it in place with the washers and bolts. Lockwire the bolts.

Note

To insure proper support of the reservoir at the reservoir support bracket, adjust the length of the strut assembly.

c. Connect the reservoir vent, relief valve, pump bypass, servo return, servo supply, and solenoid valve lines at the reservoir.

d. Fill the reservoir with hydraulic oil (index 6, paragraph 1—32) in accordance with the servicing instructions. (Refer to paragraph 1—28.)

2—453. AUXILIARY HYDRAULIC SYSTEM.

2—454. DESCRIPTION. *(See figure 2—46.)* The auxiliary hydraulic system operates at 1500 psi to relieve the control forces of the main and tail rotors. Normally the auxiliary hydraulic system is always in operation when the engine is running, but it may be shut off if it malfunctions. When this occurs, the primary hydraulic system will relieve the control forces on the main rotor controls. Increased tail rotor pedal loads will be felt because the servo unit for the tail rotor is included in only the auxiliary hydraulic system. If the primary hydraulic system is shut off, on the other hand, the auxiliary hydraulic system will relieve all control forces, and flight controls will respond in a normal manner with no increase in control loads. Hydraulically, the auxiliary and primary hydraulic systems are separate systems, but they are interconnected electrically through pressure switches that prevent the auxiliary hydraulic system from being shut off if the primary hydraulic system pressure is below 1000 psi, the pressure necessary for proper primary servo operation; and conversely, prevent the primary hydraulic system from being shut off unless at least 1000 psi is available in the auxiliary hydraulic system. Components of the auxiliary hydraulic servo system include a hydraulic pump, a filter, a three-way solenoid valve, a pressure relief valve, a pressure switch, a hydraulic fuse, a tail rotor pedal damper, a pressure transmitter, a restrictor, a snubber, a pressure indicator (paragraph 6—104), an actuating cylinder, main rotor auxiliary servo unit, a tail rotor servo unit, a servo switch, a reservoir and necessary interconnecting tubing and quick disconnects. Several of the units are grouped into a hydraulic panel in the clutch compartment. (See figure 2—47.)

2—455. HYDRAULIC PUMP.

2—456. DESCRIPTION. The gear-type constant displacement, variable delivery hydraulic pump (1, figure 2—46) for the auxiliary hydraulic system is mounted on the rear accessories section of the engine where it is driven by an accessory drive. The pump draws its supply of hydraulic oil from the auxiliary hydraulic system reservoir and furnishes 1500 psi pressure to meet the needs of the system. An oversupply of hydraulic oil is bypassed and returned to the reservoir. An overboard drain is provided. Access to the pump may be gained by opening the nose doors.

2—457. REMOVAL.

a. At the top of the hydraulic pump, disconnect the bypass hose line.

b. Disconnect the pump drain tube.

c. Disconnect the supply hose line and the pressure hose line.

d. Remove the washers and nuts that secure the pump and cooling tube bracket to the drive adapter on the accessory section of the engine. Remove the bracket pump and gasket.

Note

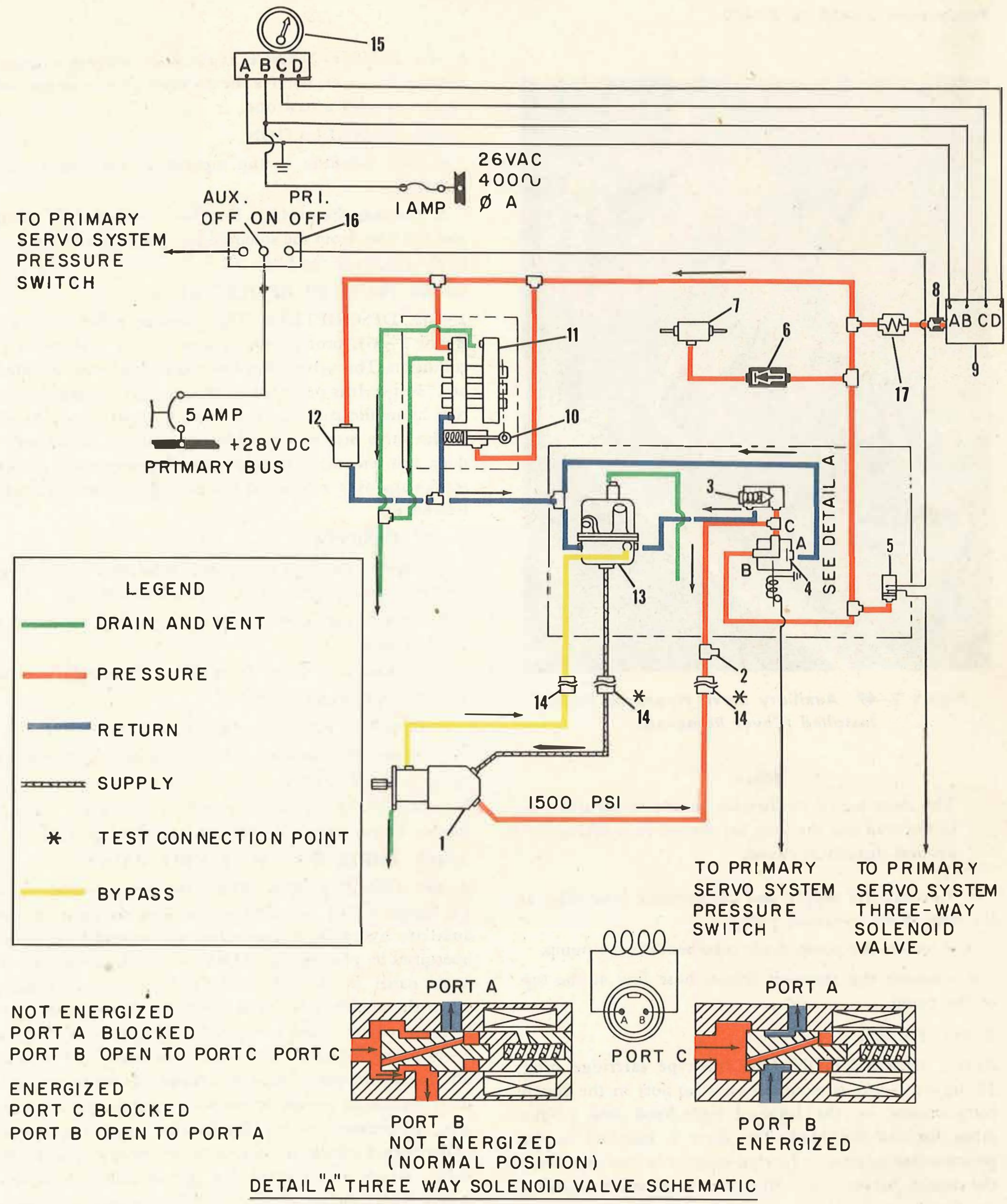
Do not remove the drive shaft coupling from the drive shaft inside the drive adapter.

e. Remove the fittings from the pump.

2—458. INSTALLATION.

a. Install the fittings in the hydraulic pump.

b. Check to see that the drive shaft coupling is installed in the end of the drive shaft inside the drive adapter on the accessory section of the engine. Position the pump and gasket on the drive adapter with the bypass port up. Position the cooling tube bracket on the upper left-hand stud. Secure the pump with the washers and nuts.



1. Pump
2. Filter
3. Pressure Relief Valve
4. Three-Way Solenoid Valve
5. Pressure Switch
6. Hydraulic Fuse
7. Pedal Damper Assembly
8. Restrictor
9. Pressure Transmitter
10. Actuating Cylinder Assembly
11. Auxiliary Servo System Main Rotor Servo Units
12. Tail Rotor Servo Unit
13. Reservoir
14. Quick Disconnects
15. Pressure Indicator
16. Servo Switch
17. Snubber

Figure 2–46. Auxiliary Servo Hydraulic System Schematic Diagram

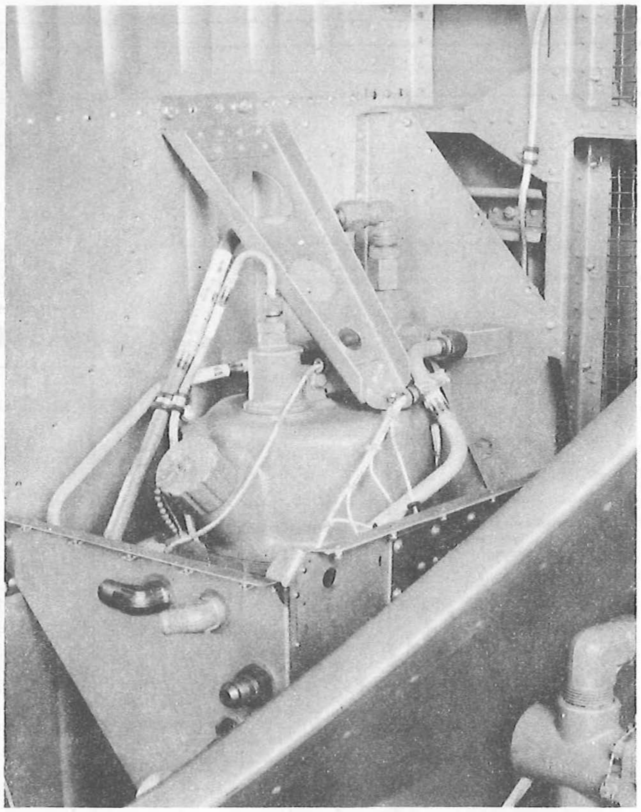


Figure 2–47. Auxiliary Servo Hydraulic Panel Installed (Cover Removed)

Note

The short leg of the bracket should be secured to the stud and the long leg should be pointing up and directly forward.

c. Connect the supply and the pressure hose lines at the rear of the hydraulic pump.

d. Connect the pump drain tube beneath the pump.

e. Connect the reservoir bypass hose line at the top of the pump.

2–459. FILTER.

2–460. DESCRIPTION. The line-type cartridge filter (2, figure 2–46) is mounted on a support in the clutch compartment on the forward right-hand side of the cabin forward bulkhead. The filter is installed in the pressure line to remove foreign matters before they enter the system. Access to the filter may be gained by opening the clutch access door.

2–461. REMOVAL.

a. Disconnect the pressure lines from each side of the filter.

b. Unbolt and lift the filter from the support located in the clutch compartment.

2–462. MAINTENANCE. If the filter becomes clogged, remove the cover, remove the micronic filter element and replace it with a new one.

2–463. INSTALLATION.

a. Bolt the filter to the support in the clutch compartment.

b. Connect the pressure line from the hydraulic pump and the lines from the solenoid and pressure relief valves to the elbows in the filter.

2–464. PRESSURE RELIEF VALVE.

2–465. DESCRIPTION. The pressure relief valve (3, figure 2–46), protects the system from a high pressure condition. The valve furnishes a cracking pressure relief at 1750 psi. It is mounted on the auxiliary hydraulic system hydraulic panel in the clutch compartment. Access to the valve may be gained by opening the clutch access door and removing the upper panel casing secured with screws against the forward left side of the cabin forward bulkhead.

2–466. REMOVAL.

a. Remove the hydraulic panel from the lower casing. (Refer to paragraph 2–489, steps a. through l.)

b. Remove the screws and lift the pressure relief valve off the panel.

c. Remove the elbows from the pressure relief valve.

2–467. INSTALLATION.

a. Install the elbows on the pressure relief valve.

b. Secure the pressure relief valve on the hydraulic panel with the screws.

c. Install the hydraulic panel in the lower casing. (Refer to paragraph 2–490, steps i. through t.)

2–468. THREE-WAY SOLENOID VALVE.

2–469. DESCRIPTION. The three-way solenoid valve (4, figure 2–46) furnishes a means of shutting off the auxiliary hydraulic system when the solenoid circuit is energized by placing the "SERVO" switch on the instrument panel in the "AUX OFF" position. Normally, when the auxiliary hydraulic system is in operation, the solenoid circuit is not energized. (See detail "A," figure 2–46.) The solenoid valve cannot be energized to shut off the system unless enough pressure exists in the primary hydraulic system to maintain proper servo operation. A pressure switch breaks the energizing circuit under such a condition. Access to the three-way solenoid valve, which is mounted on the auxiliary hydraulic system hydraulic panel, is gained by opening the clutch access door and removing the upper panel casing secured with screws against the forward left side of the cabin forward bulkhead.

2–470. REMOVAL.

a. Remove the hydraulic panel from the lower casing. (Refer to paragraph 2–489, steps a. through l.)

b. Free the manifold from the solenoid valve pressure port.

c. Disconnect the solenoid valve return tubing from the valve elbow.

d. Remove the pressure tubing from the elbow above the valve expander.

e. Disconnect the electrical wiring at the receptacle.

f. Remove the screws and lift the valve off the panel.

g. Remove the expander and elbow from the top return port of the valve. Remove the remaining fittings from the valve.

2—471. INSTALLATION.

a. Install the fittings and expander in the top return port of the solenoid valve. Install the elbow at the expander.

b. Install the solenoid valve at the hydraulic panel with the screws.

c. Install the manifold at the valve pressure port.

d. Connect the electrical wiring at the receptacle.

e. Connect the pressure tubing to the elbow above the expander on the solenoid valve.

f. Connect the return tubing at the elbow on the valve.

g. Install the hydraulic panel in the lower casing. (Refer to paragraph 2—490, steps i. through t.)

2—472. PRESSURE SWITCH.

2—473. DESCRIPTION. The pressure switch (5, figure 2—46), mounted on the auxiliary system hydraulic panel, prevents the primary hydraulic system from being shut off if the pressure in the auxiliary hydraulic system is less than 1000 psi by preventing the primary hydraulic system three-way solenoid valve from being energized. The contacts in the pressure switch are open below 1000 psi pressure and closed above 1000 psi pressure. Access to the pressure switch may be gained by opening the clutch access door and removing the upper panel casing secured with screws against the forward left side of the cabin forward bulkhead.

2—474. REMOVAL.

a. Remove the hydraulic panel from the lower casing. (Refer to paragraph 2—489, steps a. through l.)

b. Free the pressure switch tubing to the manifold at the pressure switch elbow.

c. Disconnect the electrical wiring at the receptacle.

d. Remove the screws and lift the pressure switch off the panel.

e. Remove the elbow from the switch.

2—475. INSTALLATION.

a. Install the elbow on the switch.

b. Install the pressure switch at the hydraulic panel with the screws.

c. Connect the tube joining the manifold to the pressure switch and the tubing elbow.

d. Connect the electrical wiring at the receptacle.

e. Install the hydraulic panel in the lower casing. (Refer to paragraph 2—490, steps i. through t.)

2—476. HYDRAULIC FUSE.

2—477. DESCRIPTION. A hydraulic fuse (6, figure 2—47) is installed in the hydraulic pressure line to the pedal damper assembly. In the event of a rupture in the tubing the fuse will prevent loss of hydraulic oil. The fuse is mounted to the right of the main drive shaft at the beam in the clutch compartment ceiling. Access to the fuse may be gained by opening the clutch access door.

2—478. REMOVAL.

a. Disconnect the pressure tubing from the unions at each end of the fuse.

b. Remove the nuts, washers and screws and free the fuse from the clamps.

c. Remove the unions from the fuse.

2—479. INSTALLATION.

a. Install a union at each end of the hydraulic fuse.

b. Position and secure the fuse to the beam with the clamps by installing the screws, washers and nuts.

c. Connect the pressure tubing at the unions located on each fuse end.

2—480. RESTRICTOR AND SNUBBER.

2—481. DESCRIPTION. A restrictor (8, figure 2—47) and snubber (17) are installed in the pressure hydraulic line to the pressure transmitter. The restrictor and snubber dampen pulsations in hydraulic pressure and thereby permit the pressure transmitter to transmit a steady indication to the pressure indicator. Access to the restrictor and snubber may be gained by hinging down the right service platform. The restrictor and snubber are removed by disconnecting the pressure transmitter hose line outboard of the restrictor and by removing the restrictor and snubber from the elbow at the manifold on the transmission deck.

2—482. PRESSURE TRANSMITTER.

2—483. DESCRIPTION. The pressure transmitter (9, figure 2—47) for the auxiliary hydraulic system transmits an electrical indication of the hydraulic pressure in the system to the pressure indicator on the instrument panel. The transmitter is shock-mounted on a support located on the right side of the main transmission deck behind the cockpit canopy bulkhead. Access may be gained by hinging down the right-hand service platform.

2–484. REMOVAL.

a. Unplug the wiring from the pressure transmitter.

b. Disconnect the pressure hose from the elbow at the pressure transmitter.

c. Unbolt and lift the pressure transmitter out of the transmitter support. Unscrew and remove the elbow from the transmitter.

2–485. INSTALLATION.

a. Install the elbow and bolt the pressure transmitter in the transmitter support.

b. Connect the pressure hose line to the elbow on the transmitter.

c. Plug the pressure indicator wiring into the pressure transmitter.

2–486. SERVO SWITCH.
(Refer to paragraph 2–447.)

2–487. RESERVOIR.

2–488. DESCRIPTION. The auxiliary hydraulic system hydraulic oil reservoir (13, figure 2–47) is mounted on the hydraulic panel in the clutch compartment. A sight level gage, inspection light, filler tube and vent line are provided as well as the supply and return lines. Access to the reservoir may be gained by removing the clutch access door and the upper panel casing secured with screws against the forward left side of the cabin forward bulkhead.

2–489. REMOVAL.

a. Remove the screws which secure the upper casing to the bulkhead. Remove the upper casing.

b. Disconnect and remove the pressure tubing from the manifold to the elbow on the inside of the lower casing.

c. Disconnect and remove the return tubing between the pressure relief valve and the reservoir.

d. Disconnect and remove the pressure line from the pressure relief valve to the tee on the inside of the lower casing.

e. Disconnect and remove the pump bypass tubing from the reservoir to the elbow beneath the tee on the inside of the lower casing.

f. Disconnect the reservoir supply tubing at the elbow on the inside of the lower casing. Drain the reservoir.

g. Disconnect the pump pressure tubing to the top of the solenoid valve at the tee on the inside of the lower casing.

h. Disconnect the main return line at the elbow on the inside of the lower casing.

i. Disconnect the reservoir inspection light wiring at the light assembly, and disconnect the servo wiring and light wiring at the terminal block.

j. In the cabin, cut the lock wire and remove the bolts which secure the reservoir to the bulkhead.

k. Support the panel assembly, cut the lock wire, and remove the bolts securing the bracket to the cabin forward bulkhead.

l. Remove the panel assembly from the lower casing.

m. Disconnect the overboard vent tubing above the reducer located on top of the reservoir.

n. Disconnect and remove the pump pressure tubing to the top of the solenoid valve.

o. Disconnect and remove the solenoid valve return tubing to the reservoir at the elbow.

p. At the bottom of the reservoir, disconnect and remove the reservoir supply tubing to the pump at the elbow.

q. Remove the reservoir inspection light from the reservoir bracket.

r. Cut the lock wire and remove the nuts, bolts and washers securing the reservoir to the panel bracket at the top and lower side of the reservoir.

s. Cut the lock wire and remove the bolt securing the reservoir to the lower end of the bracket.

t. Disconnect the fittings from the reservoir.

2–490. INSTALLATION.

a. Install the fittings at the reservoir.

b. Position and secure the top and lower side of the reservoir to the panel bracket with the bolts, washers and nuts. Lockwire the bolts.

c. Secure the reservoir to the lower end of the bracket with the bolt and lockwire the bolt.

d. Position and secure the lamp to the reservoir bracket.

e. At the bottom of the reservoir, connect the reservoir supply tubing to the pump at the elbow.

f. Connect the solenoid valve return tubing to the reservoir at the elbow.

g. Connect the pump pressure tubing to the top of the solenoid valve.

h. Connect the overboard vent tubing above the reducer located on top of the reservoir.

i. Position the panel assembly in the lower casing, and secure the reservoir to the bulkhead with the bolts. Lockwire the bolts.

j. Secure the bracket to the cabin forward bulkhead with the bolts. Lockwire the bolts.

k. Connect the main return line at the elbow on the inside of the lower casing.

l. Connect the pump pressure tubing to the top of the solenoid valve at the tee on the inside of the lower casing.

m. Connect the reservoir supply tubing at the elbow on the inside of the lower casing.

n. Connect the pump bypass tubing at the reservoir and to the elbow beneath the tee on the inside of the lower casing.

o. Connect the pressure line from the pressure relief valve to the tee on the inside of the lower casing.

p. Connect the return tubing between the pressure relief valve and the reservoir at the elbows.

q. Connect the pressure tubing from the manifold to the elbow on the inside of the lower casing.

r. Connect the reservoir inspection light wiring at the light assembly, and the servo wiring and light wiring at the terminal block.

s. Secure the upper casing to the cabin forward bulkhead and lower casing with the screws.

t. Fill the reservoir with hydraulic oil (index 6, paragraph 1–32) according to the servicing instructions. (Refer to paragraph 1–28.)

2–491. REPLACEMENT OF VENT FILTER ELEMENT.

a. Remove the screws which secure the upper casing to the bulkhead. Remove the upper casing.

b. Disconnect the overboard vent tubing above the reducer located on top of the reservoir.

c. Unscrew and remove the adapter and gasket from the reservoir assembly.

d. Remove the retainer ring and filter element from theadapter.

e. Place a new filter element in the adapter and install the retainer ring.

f. Install the adapter and gasket in the reservoir and connect the overboard vent tubing to the reducer. Replace the upper casing.

2–492. HYDRAULIC PRESSURE INDICATORS. For information on the hydraulic pressure indicators, refer to paragraph 6–108.

2–493. TAIL ROTOR CONTROL SYSTEM.

2–494. DESCRIPTION. *(See figure 2–48.)* The functions of the tail rotor control system are to compensate for main rotor torque and to provide a means of changing the heading of the helicopter. The tail rotor control system consists of the following components: two sets of tail rotor control pedals (figure 2–49), a pilot's and observer's adjustor assembly, push-pull rods extending from the pedals to the forward quadrant, cables extending from the quadrant through a servo unit assembly to the aft quadrant and push-pull rods and bell cranks terminating at the tail rotor gear box. The cables are routed through pulleys, with fair-leads, channels and guides located on the fuselage structure between the pulleys. Two pedal adjustment control knobs are located below the instrument panel and above each set of control pedals. The control pedals may be adjusted for leg length by turning the knob clockwise or counterclockwise. A hydraulic pedal damper is incorporated at the control linkage at the quadrant between the pilot's and observer's control pedals to prevent sudden movement of the control pedals which would cause sudden changes in thrust developed by the tail rotor and possible damage to the helicopter. A tail rotor hydraulic servo unit mounted aft of the main gear box assists in the operation of the tail rotor flight control system.

2–495. REMOVAL.

Note

At removal of the tail rotor control cables, detach the securing fair-leads, channels and guides from the fuselage structure.

a. Remove the turnbuckles (15 and 59, figure 2–48) in the cabin to relieve tension on the cables (13 and 61). Unbolt and remove the pulleys (1, 2, 14, 60, 64 and 65) in the cockpit. Disconnect and remove the cables (13 and 61) from the quadrant (80).

b. Disconnect the tail wheel lock control cable from the control handle and bell crank at the support (10).

c. Disconnect and remove the rods (83 and 76) which extend from the adjustor assemblies (84) to the quadrant (80).

d. Disconnect and remove the rods (3, 82, 12 and 67) which extend from the adjustor assemblies (84) to the control pedals.

e. Remove the retaining rings which secure the handles (9 and 62) in position and remove the handles. Remove the parking brake valve and handle (81). (Refer to paragraph 2–259, step b.)

f. Disconnect the two brake cylinders (85, figure 2–48) from their upper and lower attachment points on the pilot's pedals.

g. Unbolt the tube fitting (4) and the tube (5) from the fuselage. Supporting the instrument panel by an auxiliary means, unbolt the support (63) of the pedal and support installation from the instrument panel shock mounts. Remove the pilot's pedal and support assembly from the cockpit. Unbolt and remove the fitting (4) and support (63) from the pedal and support assembly.

h. Remove the retaining rings and washers securing the pedal and control assembly (6) to the tube (5) and remove the pedal and control. Unbolt the wheel lock control handle and bell crank from the support (10).

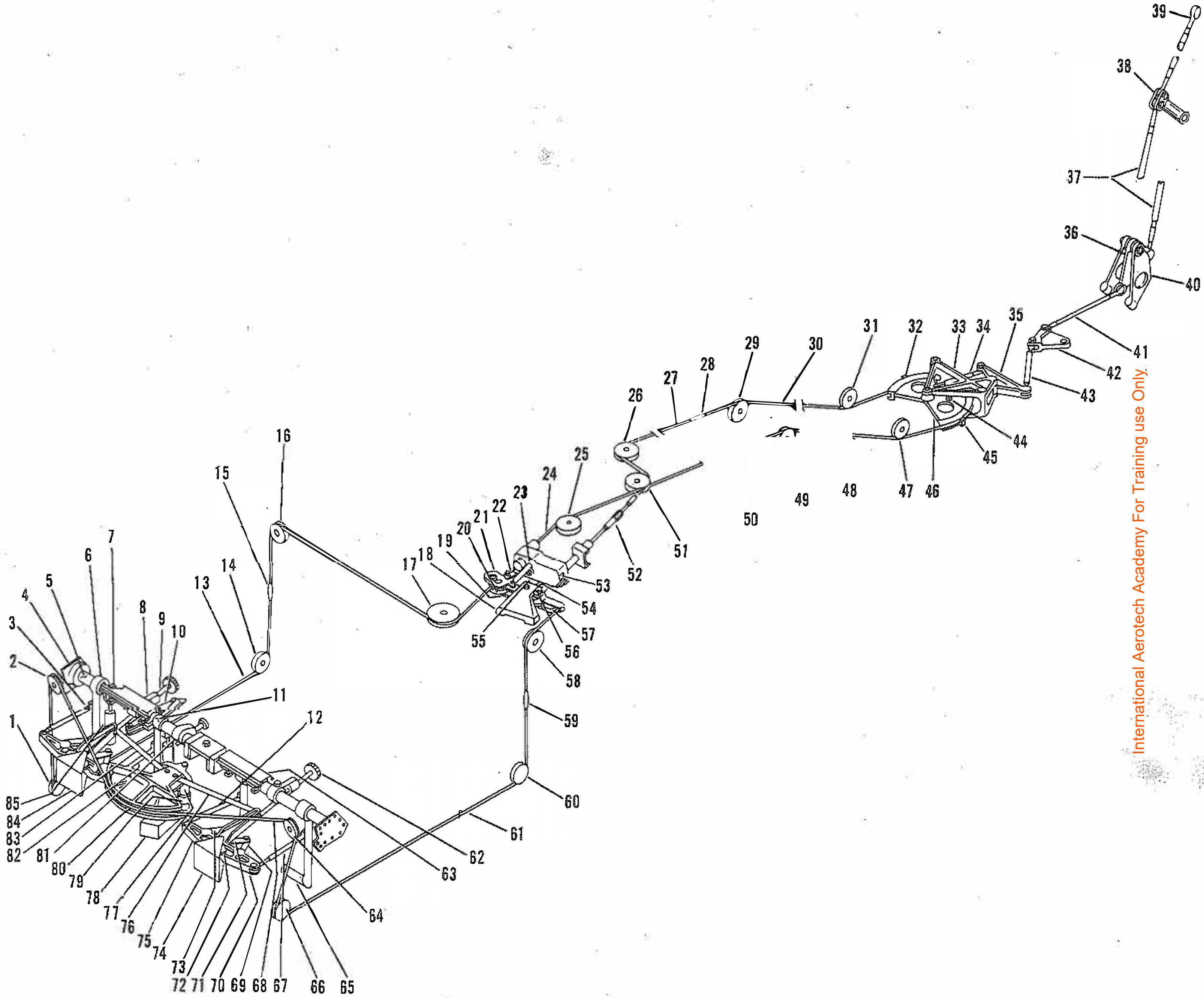


Figure 2—48. Tail Rotor Flight Controls System

Key to Figure 2-48

1. Pulley
2. Pulley
3. Rod
4. Fitting
5. Tube
6. Pedal and Control Assembly
7. Bracket
8. Fitting
9. Handle
10. Support
11. Pedal and Control Assembly
12. Rod
13. Cable
14. Pulley
15. Turnbuckle
16. Pulley
17. Pulley
18. Pedestal
19. Pulley Support
20. Pulley
21. Cam
22. Arm
23. Link
24. Cable
25. Pulley
26. Pulley
27. Cable
28. Turnbuckle
29. Pulley
30. Cable
31. Pulley
32. Guard
33. Support
34. Rod
35. Bell Crank
36. Rod
37. Idler
38. Rod
39. Bell Crank
40. Bracket
41. Rod
42. Idler
43. Rod
44. Pins, Washers, Cotter Pins
45. Guard
46. Quadrant
47. Pulley
48. Cable
49. Pulley
50. Turnbuckle
51. Pulley
52. Terminal
53. Lug
54. Cable
55. Servo Unit Assembly
56. Bolt, Washers, Clip
57. Pulley
58. Pulley
59. Turnbuckle
60. Pulley
61. Cable
62. Handle
63. Support
64. Pulley
65. Pulley
66. Observer's Pedal and Support Assembly
67. Rod
68. Rod
69. Link
70. Yoke
71. Bell Crank
72. Arm
73. Link
74. Fitting
75. Arm
76. Rod
77. Shaft
78. Damper Assembly
79. Arm
80. Quadrant
81. Parking Brake and Handle
82. Rod
83. Rod
84. Pilot's Adjustor Assembly
85. Brake Cylinder

i. Unbolt and remove the bracket (7), the fitting (8) and the support (10) from the tube (5).

j. Remove the retaining rings and washers securing the pedal and control assembly (11) to the tube (5) and remove the pedal and control.

k. Remove and disassemble the observer's pedal and support assembly (66) in the same manner as the pilot's pedal and support assembly.

l. Cut the lock wire and remove the screws and washers securing the rod (68) to the adjustor bell crank (71). Remove the rod (68) by unscrewing it from the yoke (70).

m. Disconnect and remove the two links (69 and 73) which extend from the yoke (70) to the adjustor arms (72 and 75). Remove the yoke (70).

n. Disconnect and remove the arms (72 and 75) from the bell crank (71).

o. Disconnect and remove the bell crank (71) from the fitting (74) by removing the cotter pin, nut, bolt, washers and shims. Unbolt and remove the fitting (74).

p. Remove and disassemble the pilot's adjustor assembly (84) in the same manner as the observer's adjustor assembly.

q. Disconnect the damper assembly (78) from the arm (79). Remove the two bolts securing the quadrant assembly to the fuselage pedal support and remove the quadrant assembly.

r. Remove the taper pins, washers and nuts securing the arm (79) to the shaft (77) and remove the arm. Remove the taper pins, washers and nuts securing the quadrant (80) to the shaft (77) and separate the quadrant from the shaft.

s. Hinge down the service platforms. Remove the aft skin panels. Unbolt and remove the pulleys (16, 17, 57 and 58). Unbolt and remove the pulley (69) and the bearings from the pulley support (19).

t. Remove the pulley (25). Remove the turnbuckle (50). Cut the lock wire and remove the screw which secures the guides at the tail rotor servo unit assembly (55). Remove the guides and the cable (24). Reinstall the guide screw in the servo unit.

u. Remove the pulleys (51 and 26) and the turnbuckle (28). Disconnect the cable (27) from the terminal (52). Remove the cotter pin, terminal and check nuts from the aft end of the cable (54) and remove the cable.

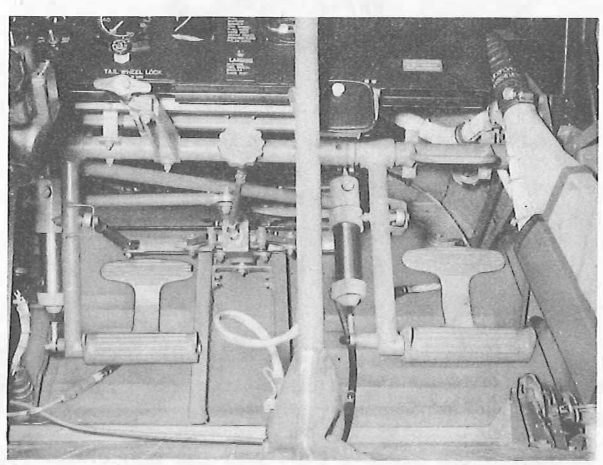


Figure 2-49. Pilot's Tail Rotor Control Pedals

v. Remove the tail rotor servo unit. (Refer to paragraph 2—508.)

Note

The servo unit assembly (55, figure 2—48) must be disassembled only by qualified personnel at an Overhaul Depot.

w. Disconnect and remove the pulleys (29, 31, 49 and 47) in the tail cone. Remove the pins, washers and cotter pins (44) from the quadrant (46). Remove the screws, washers and nuts securing the guards (32 and 45) and remove the guards.

x. Unbolt and remove the cables (30 and 48) from the quadrant (46).

y. Unbolt the rod (34) from the quadrant (46).

z. Fold and secure the pylon. Disconnect the rods (43) from the bell crank (35). Unbolt and remove the bell crank (35) from the support.

aa. Within the tail cone, unbolt and remove the quadrant (46) and the support (33).

ab. Disconnect and remove the rod (41) which extends from the idler (42) to the bell crank (39). Disconnect the rod (43) from the idler (42). Unbolt and remove the idler (42).

ac. Remove the intermediate gear box access panel and the support bearing access panel. Disconnect and remove the rod (38) which extends from the bell crank (39) to the idler (37).

ad. Unbolt and remove the bell crank (39) from the bracket (40). Unbolt and remove the bracket (40).

ae. Remove the pylon top fairing. Disconnect and remove the rod (36) which extends from the idler (37) to the tail rotor gear box. Unbolt and remove the idler (37).

2—496. INSTALLATION.

WARNING

If four or more threads are showing on the adjustable rod ends, add spacers or washers under the nut until less than four threads show.

Note

Refer to table VIII for basic rod lengths of the component rod assemblies of the tail rotor control system.

a. Install the idler (37, figure 2—48). Install the rod assembly (36) which extends from the tail gear box assembly to the idler (37).

b. Install the bracket (40) and the bell crank (39). Install the rod assembly (38) which extends from the idler (37) to the bell crank (39). Replace the support bearing access panel.

c. Install the idler (42). Install the rod assembly (41) which extends from the bell crank (39) to the idler (42).

d. Position the support (33) at the tail cone hinge bulkhead. Between the support and bulkhead angle at the bolt holes, shim the support with washers, as necessary. Install the attaching bolts, washers and nuts. Position the bell crank (35) on the support and secure with bolt, washers, nut and cotter pin. Install the rod (43) which extends from the idler (42) to the bell crank (35).

e. Unfold and secure the pylon. Position the quadrant (46) on the support (33) and secure with the bolt, washers, nut and cotter pin.

f. Position the cables (30 and 48) on the quadrant and secure with the bolts, washers and nuts. Install the pins, washers and cotter pins (44). Install the guards (32 and 45).

Note

At installation of the tail rotor control cables, secure the fair-leads, channels and guides to the fuselage structure.

g. Install the rod assembly (34) which extends from the bell crank (35) to the quadrant (46).

h. Position the cable (30) on the pulleys (29 and 31) and install the pulleys. Position the cable (48) on the pulleys (47 and 49) and install the pulleys.

i. Place the servo unit assembly (55) in position and secure with the bolts, washers and nuts. Secure the clamp to the cabin frame with the screws. (See figure 2—52, step I.)

j. Install the pulley (57, figure 2—48) in the pulley support (19). Place the two center pulleys in the pulley support and position and secure the pulleys and the pulley support (19) to the pedestal (18) with the bolt, washers, nut and cotter pin. Position the pulley (20), cam (21) and the bearings on the pulley support (19) and secure with the bolt, washers and nut.

k. Install the pulley support and pedestal, securing with the two bolts and washers.

l. Position the cable (27) on the pulleys (26 and 51) and install the pulleys. Connect the two cables (27 and 30) by installing the turnbuckle (28).

m. Position the cable (24) on the pulley (25) and install the pulley. Connect the two cables (24 and 48) by installing the turnbuckle (50). Run the forward end of the cable (24) through the servo unit assembly (55) and from right to left around the top center pulley of the pulley support (19). Position the cable around the pulley (57) and on the pulley (58). Install the pulley (58). Install and secure the guides at the tail rotor servo unit assembly (55) with the screw. Lockwire the screws to the servo unit.

n. Position the cable (54) on the pulleys (16 and 17) and install the pulleys. Run the cable aft around the pulley (20) and from right to left around the bottom center pulley of the pulley support (19). Install the pins and cotter pins.

o. Thread the aft end of the cable (54) through the piston assembly of the servo unit assembly (55). Install a check nut on the aft terminal of the cable (54). Position the cable in the servo by tightening the check nut until the ball terminal of the cable seats itself snugly against the forward end of the piston assembly. Lock in position with a second check nut. Tighten the check nuts with 15 to 18 inch-pounds torque.

p. Install the terminal (52) on the aft terminal of the cable (54) and secure with the cotter pin. Connect the cable (27) to the terminal with the bolt, washer and nut.

q. Install the arm (22). Secure the cam (21) to the arm (22) with the bolt, washers and nut.

r. Install the link (23) which extends from the cam (21) to the servo unit assembly (55).

s. Install the bolt, washers and clip (56) securing the rod assembly of the servo to the pulley support (19). Safety wire the bolt to the clip. Install the lug (53) at the servo unit assembly (55) with screws and washers. Safety wire the screws to each other.

t. Connect the hydraulic lines to the servo unit assembly (55).

u. Assemble the quadrant assembly prior to installation as follows: Position the quadrant (80) on the shaft (77) and secure with the taper pins, washers and nuts. Position the arm (79) on the shaft (77) and secure with the taper pins, washers and nuts. Place the quadrant assembly in position on the fuselage pedal support and secure at the upper and lower ends of the shaft (77) with the bolts.

Note

Shim as required between the lower end of the shaft (77) and the bearing of the pedal support to reduce end play on the shaft.

v. Connect the damper assembly (78) to the arm (79).

w. Install the fitting (74). Position the bell crank (71) on the fitting (74) and secure with the bolt, washers, nut and cotter pin.

Note

Shim as required between the upper end of the bell crank (71) and fitting (74) to reduce end play on the bell crank.

x. Connect the arms (72 and 75) to the bell crank (71) with the bolts, washers, nuts and cotter pins.

y. Connect the links (69 and 73) to the arms (72 and 75). Place the yoke (70) in position in the bell crank (71). Connect the links (69 and 73) to the yoke (70) and secure with bolts, washers, nuts and cotter pins.

z. Thread the rod (68) into the yoke (70) and secure the rod to the bell crank (71) with the screws and washers. Safety wire the screws.

aa. Repeat steps w. through z. for assembly and installation of the pilot's adjustor assembly (84).

ab. Install the rods (76 and 83).

ac. Assemble the pilot's pedal and support assembly prior to installation as follows: Slide the pedal and control assembly (11) onto the tube (5) and secure with the retaining rings and washers.

Note

Prior to installation of the pedal and control assemblies (6 and 11) on the tube (5), lubricate the bearings of the pedal and control assemblies liberally with grease (index 21, paragraph 1–32).

ad. Position the support (10, figure 2–48), fitting (8) and bracket (7) on the tube (5) and secure with bolts, washers and nuts. Slide the pedal and control assembly (6) onto the tube (5) and secure with retaining rings and washers. Position the fitting (4) on the end of the tube (5) and secure with the bolt, washers and nut. Do not overtorque the nut.

ae. Install the support (63) with the bolts, washers and nuts. Install the tail wheel lock control handle and bell crank at the support (10) with the bolts, washers, nuts and cotter pin.

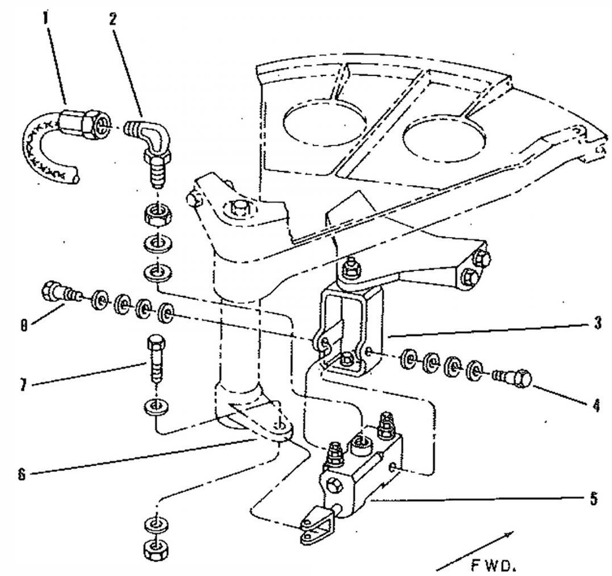
af. Inserting the rod of the pilot's adjustor assembly (84) into the fitting (8), place the pedal and support assembly in position in the cockpit and secure at either end with the bolts, washers and nuts. Secure the support (63) at the instrument panel shock mounts with the bolts and washers.

ag. Repeat steps ac. through af. for assembly and installation of the observer's pedal and support assembly (66).

ah. Connect the brake cylinders (85) at their upper and lower attachment points on the pilot's pedal and support assembly.

ai. Install the parking brake valve and handle (81). (Refer to paragraph 2–259, step e.)

aj. Install the rods (3, 12, 67 and 82, figure 2–48)



1. Hydraulic Hose
2. Elbow, Nut, Ring, Gasket
3. Trunnion Assembly
4. Trunnion, Washers
5. Pedal Damper Assembly
6. Quadrant Arm
7. Bolt, Washers, Nut
8. Trunnion, Washers

Figure 2–50. Pedal Damper Removal

extending from the adjustor assemblies to the pedal and support assemblies.

Note

With one pedal held firmly, adjust to eliminate play of more than ±1/16-inch maximum in other pedal.

ak. Secure the handles (9 and 62) to the rods (68) with the retaining rings.

al. Position the cable (13) on the pulleys (1, 2 and 14) and install the pulleys. Connect the cables (13 and 54) by installing the turnbuckle (15). Position the cable (13) on the quadrant (80) and secure with bolt, washer and nut.

am. Position the cable (61) on the pulleys (60, 64 and 65) and install the pulleys. Connect the cables (24 and 61) by installing the turnbuckle (59). Position the cable (61) on the quadrant (80) and secure with bolt, washer and nut.

an. Connect the tail wheel lock control cable at the control handle and bell crank installed on the support (10).

ao. Check the tail rotor flight control rigging. (Refer to paragraph 2–524.)

ap. Check the adjustment of the tail rotor servo unit. (Refer to paragraph 2–514.)

Note

Replace access panels after the rigging has been checked.

2–497. TAIL ROTOR PEDAL DAMPER.

2–498. DESCRIPTION. *(See figure 2–50.)* A pedal damper assembly is located in the cockpit, forward and to the left of the pilot's tail rotor control pedals. The damper prevents rapid movements of the pedals which would result in abrupt changes and overcontrol of the tail rotor. Except for a small amount of initial movement of the piston allowed by internal spring construction, the amount of resistance set up by the damper varies directly with the rapidity of movement of the tail rotor pedals. The damper incorporates a differential check valve assembly to direct the flow of hydraulic oil from the auxiliary hydraulic system to each side of a piston. Hydraulic pressure of 1500 psi is supplied to the damper by the auxiliary servo system.

2–499. REMOVAL.

a. Disconnect the hose (1, figure 2–50) from the elbow (2) on the damper (5) by unscrewing the nut.

b. Remove the nut, washers and bolt (7) that attach the piston yoke to the arm on the quadrant assembly (6).

c. Cut the safety wire on the two trunnions (4 and 8) which secure the damper housing to the trunnion assembly (3) and remove the trunnions and pedal damper.

d. Unscrew the elbow (2) and nut from the damper (5). Remove the ring and gasket. Plug the damper port.

2–500. CLEANING. Clean the exposed portion of the piston with a soft, clean cloth dampened in hydraulic oil (index 6, paragraph 1–32).

2–501. DISASSEMBLY AND ASSEMBLY. The pedal damper assembly must be disassembled and assembled only by qualified personnel at an Overhaul Depot.

2–502. PREPARATION FOR STORAGE OR SHIPMENT.

a. Fill the damper with hydraulic equipment preservative oil (index 5, paragraph 1–32). Clean with solvent (index 3, paragraph 1–32). Coat external machined surfaces, except the piston, with corrosion-preventive compound (index 4, paragraph 1–32).

b. Wrap the unit in barrier material (index 8, paragraph 1–32) and secure with tape (index 9, paragraph 1–32).

c. Pack the unit securely in a suitable box.

2–503. PLACING IN SERVICE. Unpack the unit, drain the preservative oil, and strip corrosion-preventive compound from exterior surfaces with solvent (index 3, paragraph 1–32). Fill the damper with hydraulic oil (index 6, paragraph 1–32).

2–504. INSTALLATION.

a. Install the gasket and ring on the elbow, and screw the nut and elbow (2, figure 2–50) into the damper assembly (5).

b. Position the damper in the trunnion assembly (3). Install the two trunnions (4 and 8) and washers attaching the damper to the trunnion assembly (3) and secure with safety wire.

c. Attach the piston yoke to the arm of the quadrant assembly (6) with the bolt (7), washers and nut.

d. Connect the hose (1) to the elbow (2).

2–505. TESTING.

a. Check the air pressure in the pedal damper, using a suitable gage. If an air preload of 1500 psi does not exist, recharge the pedal damper.

b. With 1500 psi applied at the auxiliary hydraulic system and with 50 pounds load applied at the control pedals, check for an elapsed time of 10 to 14 seconds for full travel of the pedal damper piston from one extreme to the other.

Note

If the damper rate is high, check the tail rotor control rigging for excessive binding in the cables.

c. Test the rate of the pedal damper which has been removed from a helicopter by applying a 150 pound load at the piston and checking the piston for an elapsed time of 18 seconds $\pm$ 3 seconds for full travel from one extreme to the other with 1500 psi hydraulic pressure.

2–506. TAIL ROTOR SERVO UNIT.

2–507. DESCRIPTION. *(See figure 2–51.)* The tail rotor servo unit is mounted on the transmission deck to the left of the main rotor brake disc. The servo unit, operating hydraulically under 1500 psi, provides a power boost for the tail rotor controls in the auxiliary hydraulic system. Movement of the control cables, to which the servo unit is linked, actuates a pilot valve which controls the direction of hydraulic oil flow to the servo unit power piston. Should the servo unit fail, manual control is still possible through the control cables as the servo unit makes automatic adjustment and bypasses hydraulic fluid internally permitting the control. Access to the servo unit is gained by hinging down the left service platform and removing the canopy skin assemblies.

2–508. REMOVAL.

a. In the cabin at the frame aft of the tail rotor servo unit, unfasten the soundproofing and unbolt the terminal from the control cable. Remove the cotter pin, back off the check nuts and remove the terminal and check

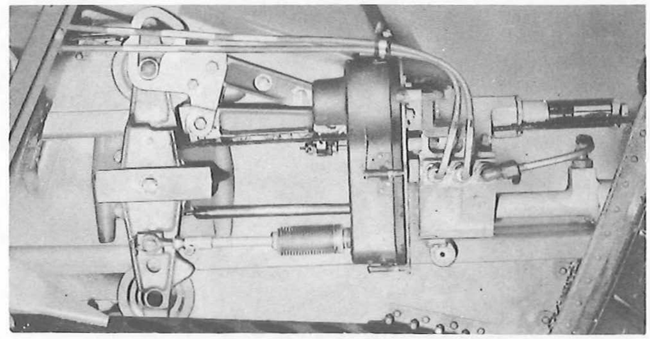


Figure 2–51. Tail Rotor Servo Unit Installed

nuts from the cable at "A" (step 1, figure 2–52). Remove the clamp around the servo unit cylinder at the frame at "B."

b. In the tail cone, disconnect the tail rotor control cable at the turnbuckle on the left side and work the cable through the pulleys. (See step 2.) Remove the pulleys as necessary.

c. Hinge down the service platforms. Remove the aft skin panel. (See step 3.)

d. Pull the control cable out through the power piston. Take out the screw, remove the guides and pull the other control cable out through the housing at "A" (step 4). Reinstall the screw.

e. Disconnect the hydraulic lines from the servo unit housing at the couplings at "B" (step 4).

f. Cut the lock wire and remove the screws, washers and lug from the servo unit housing. (See step 5.)

g. Cut the lock wire and remove the bolt, washers and clip from the pedestal assembly at "A" (step 6).

h. Cut the lock wire and unbolt the link to the cam from the rod end at "B" (step 6).

i. Unbolt the servo unit from the supporting channels and remove it from the helicopter. (See step 7.)

2–509. CLEANING.

a. Clean the exterior surfaces of the tail rotor servo unit with a cloth dipped in solvent (index 3, paragraph 1–32).

b. Clean the exposed portion of the power piston with a clean cloth dipped in hydraulic oil (index 6, paragraph 1–32).

2–510. DISASSEMBLY AND ASSEMBLY. The tail rotor servo unit must be disassembled and assembled only by qualified personnel at an Overhaul Depot.

2–511. PREPARATION FOR STORAGE OR SHIPMENT.

a. Fill the servo unit with hydraulic equipment preservative oil (index 5, paragraph 1–32) and plug the ports.

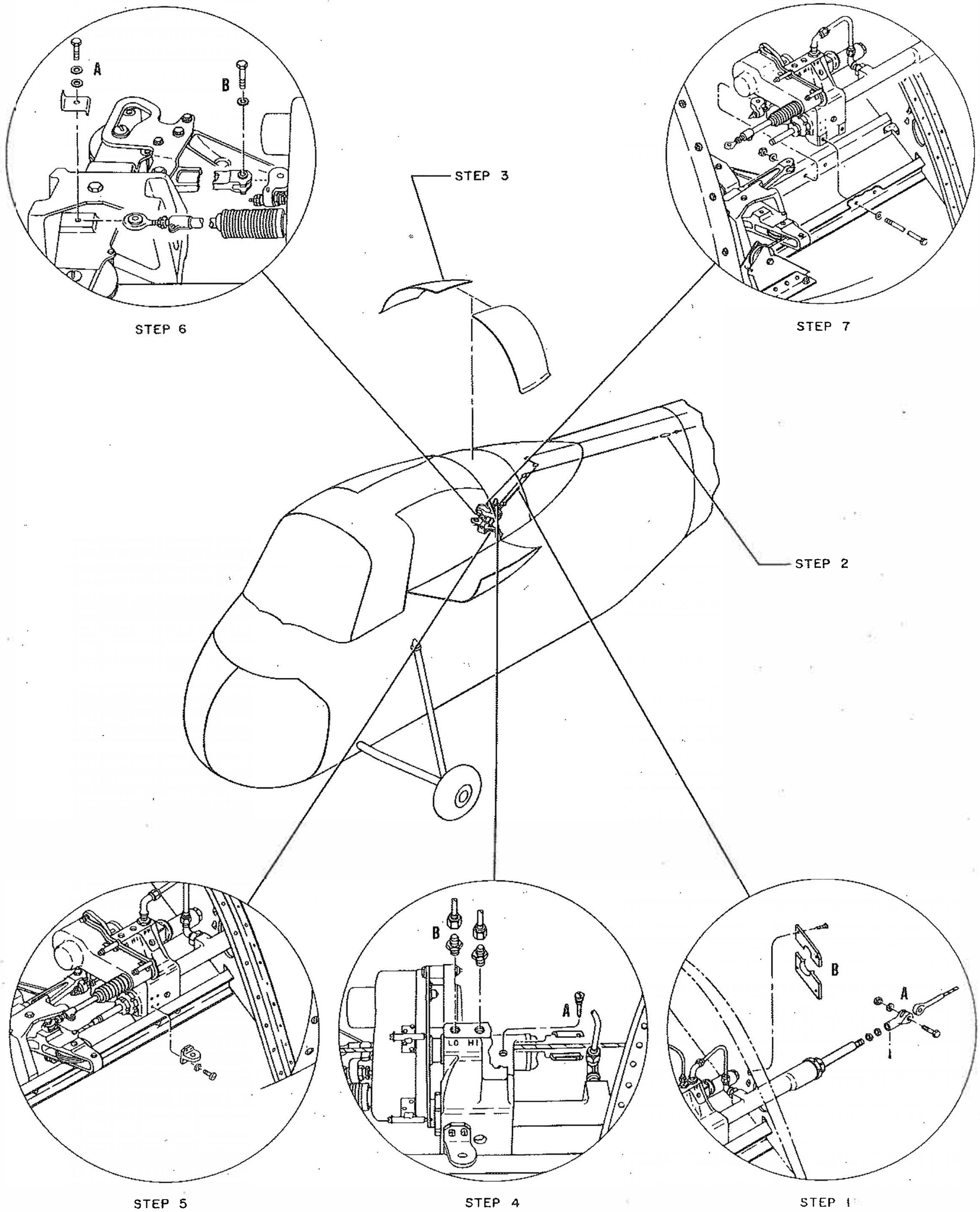


Figure 2—52. Tail Rotor Servo Unit Removal

b. Coat the rod-end bearings with grease (index 38, paragraph 1–32).

c. Wrap the unit in greaseproof barrier material (index 8, paragraph 1–32), secure with adhesive tape (index 9, paragraph 1–32), and pack the unit securely in a suitable box.

2–512. PLACING IN SERVICE.

a. Unpack the unit and remove the tape and barrier material.

b. Drain the preservative oil and refill the servo unit with hydraulic oil (index 6, paragraph 1–32).

2–513. INSTALLATION.

a. Bolt the tail rotor servo unit to the supporting channel. (See step 7, figure 2–52.)

b. Bolt the link which connects the cam to the actuating rod at the rod end at "B" (step 6). Lockwire the bolt.

c. Bolt the rod from the servo unit pilot valve and the clip to the pedestal assembly and lockwire the bolt to the clip at "A" (step 6).

d. Install the lug at the servo unit housing. (See step 5.) Lockwire the screws.

e. Connect the hydraulic lines to the servo unit housing at "B" (step 4).

f. Insert the control cable which has the ball stop swaged to it through the power piston. In the cabin, install the clamps around the servo unit cylinder opening in the frame at "B" (step 1). Install a check nut on the aft terminal of the cable. Position the cable in the servo by tightening the check nut until the ball terminal of the cable seats itself snugly against the forward end of the piston assembly. Lock in position with a second check nut. Tighten the check nut with 15 to 18 inch-pounds torque. Install the terminal at the cable terminal and secure with the cotter pin. Connect the terminal to the aft control cable "A" (step 1).

g. Insert the other control cable through the housing into the cabin. Remove the screw from the servo unit housing and install the guides with the screw at "A" (step 4). Work the control cable through the pulleys and into the tail cone. Install any pulleys which were removed. Connect the cable at the turnbuckle on the left side of the tail cone (step 2). Fasten the cabin soundproofing in place.

h. Check the tail rotor flight control rigging (paragraph 2–524).

i. Adjust the tail rotor servo unit (paragraph 2–514).

j. Replace the canopy skin assemblies and close the service platforms. (See step 3.)

2–514. ADJUSTMENT.

a. Connect an auxiliary source of hydraulic pressure at 1500 psi to the auxiliary hydraulic system at the quick disconnect panel on the right side of the engine.

b. Check that the cam roller is in the servo position and that it clears the cam by 0.002 to 0.007 inch. Adjust for the position at the rod end on the bypass piston rod, secure the lock nut, bend down the tang of the lock washer and safety wire the lock nut and washer.

c. Attach a hand pump to the pressure inlet port and lower the hydraulic pressure in the servo unit until the cam roller moves down to the bypass index position. Hold the hydraulic pressure and adjust the actuator bolt until it just contacts the flange of the valve extension. Advance or back off the actuator bolt the minimum amount necessary to allow cotter pin installation. Tighten the actuator bolt lock nut and install the cotter pin. Shut off hydraulic pressure completely. Check that the cam roller is in the manual position and the bypass actuator is extended. Adjust the nut on the bottom of the valve extension to obtain 0.010 inch clearance with the contact bolt. Back off the nut the minimum amount necessary to install the cotter pin. Tighten the small lock nut and install the cotter pin.

d. Bring the hydraulic pressure back up to 1500 psi. Center the cam roller in the cam slot by adjusting the rod end of the servo unit rod assembly. Cut off the hydraulic pressure and observe the roller and cam as the actuator returns the cam to manual position. There is to be no lateral movement of the cam throughout this transition period. Check operation of tail rotor control pedals from one extreme to the other.

e. Disconnect the pedal damper from the arm of the quadrant assembly (figure 2–50). Apply 1500 psi hydraulic pressure to the auxiliary servo system and check the force required to move the tail rotor control pedal. If the force required exceeds 10 pounds, check the tail rotor control rigging for excessive binding or interference.

f. Connect the pedal damper to the arm of the quadrant.

g. Disconnect the auxiliary source of hydraulic pressure.

2–515. TAIL ROTOR SERVO UNIT HYDRAULIC SYSTEM. The tail rotor servo unit utilizes the same hydraulic system as the main rotor auxiliary servo unit. (Refer to paragraph 2–453.)

2–516. STABILIZER.

2–517. DESCRIPTION. *(See figure 2–53.)* The horizontal stabilizer is secured to the pylon to increase longitudinal stability of the helicopter during forward flight. The stabilizer is an airfoil section and consists of magnesium and aluminum frames covered by magnesium

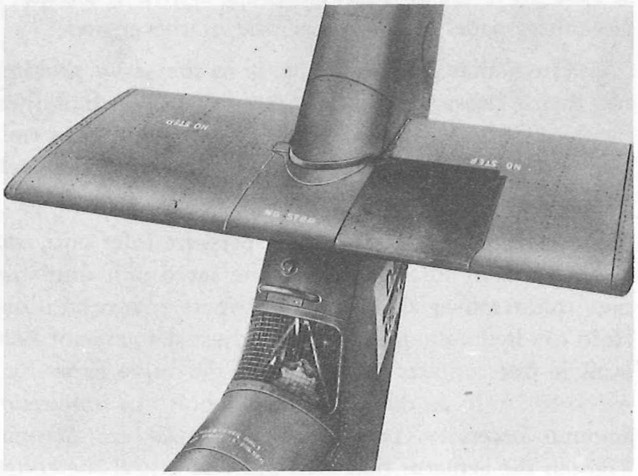


Figure 2–53. Stabilizer Installed

skin. The stabilizer is attached by hinge fittings on the stabilizer aft spar to fittings on the pylon front spar (forward beam). The turnbuckle assembly (figure 2–54), secured at the stabilizer forward spar, is attached by a fitting to the pylon front spar and provides for adjustment of the angle of incidence of the stabilizer. The adjustment is made only while on the ground. A step area, forward and left of the stabilizer attaching point, is reinforced to sustain weight of personnel during maintenance of the tail rotor pylon and pylon equipment.

2–518. REMOVAL.

a. Remove the upper and lower stabilizer fairings (4, sheet 1, figure 1–4) by removing the washer head screws and washers.

b. Cut the lock wire and detach the turnbuckle assembly (figure 2–54) by removing the cotter pin, nut, washers and bolt.

c. Remove the cotter pins, nuts, washers and bolts that secure the stabilizer to the upper pylon front spar fitting and remove the stabilizer.

2–519. INSTALLATION.

a. Position and install the stabilizer at the pylon fitting with the bolts and washers. Secure the bolts with nuts and cotter pins.

b. Attach the turnbuckle assembly by installing the bolt, washers, nut and cotter pin. (See figure 2–54.) Secure the turnbuckle assembly to the pylon fitting with lock wire.

c. Install the upper and lower stabilizer fairings (4, sheet 1, figure 1–4) in place with the washers and washer head screws.

2–520. ADJUSTMENT. To set the stabilizer in neutral

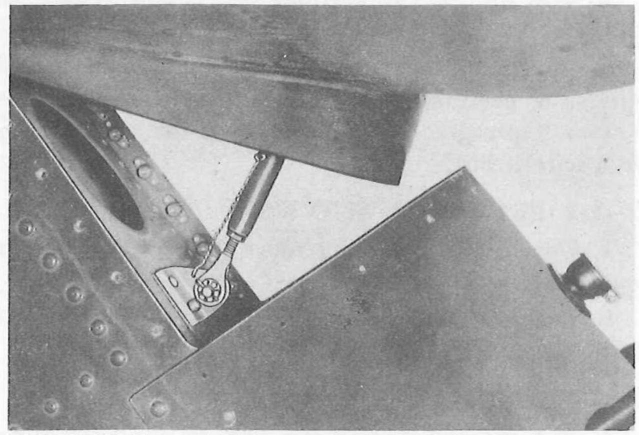


Figure 2–54. Stabilizer Adjustment Turnbuckle

position, adjust the turnbuckle, at installation, to measure 6.812 inches from center to center of each turnbuckle assembly fork.

2–521. RIGGING OF FLIGHT CONTROLS.

2–522. GENERAL. Rigging the helicopter requires coordinating the movements of the flight controls and establishing the relation between the main rotor and its controls and the tail rotor and its controls by checking and adjusting the positions and lengths of the flight control components. The necessary range of control required for satisfactory flight operations is thereby obtained. The main rotor control system consists of the cyclic controls and collective pitch controls. The cyclic control changes the angle of incidence of each main rotor blade individually and unequally; the collective control changes the angle of incidence of all blades equally and simultaneously. The cyclic and collective controls are rigged together. The tail rotor control system changes the angle of incidence of the tail rotor blades to control the effect of torque of the main rotor. The tail rotor controls are rigged separately from the main rotor controls. Proper rigging of the helicopter is an extremely important procedure and must be carefully performed.

WARNING

> Immediately after a main rotor head assembly, a main gear box, or any other main rotor flight control component has been replaced, make a careful check of main rotor control rigging. Immediately after a tail rotor assembly, a tail rotor gear box, or any other component of the tail rotor flight control system has been replaced, make a careful check of tail rotor control rigging.

Note

A complete set of rigging pins may be fabricated from drill rod as indicated in table X.

TABLE X
RIGGING PINS (FABRICATE FROM DRILL ROD)

NO. REQUIRED	DIAMETER	LENGTH (INCHES)
6	3/16	6
2	1/4	10
1	1/4	11
1	5/16	13

2—523. RIGGING MAIN ROTOR FLIGHT CONTROLS.

WARNING

If four or more threads are showing on the adjustable rod ends, add spacers or washers under the nut until less than four threads show.

a. Level the main rotor head assembly fore and aft and laterally on the upper plate with a standard propeller protractor, a bevel protractor, or a level by jacking at the fuselage jacking points.

Note

If jacks are not available, level the main rotor by inflating or deflating the main and tail landing gear oleo assemblies.

b. Hinge down the service platforms and connect an auxiliary source of 1500 psi hydraulic pressure to the primary hydraulic system at the three quick disconnect couplings.

Note

All main rotor rigging is performed with only the primary hydraulic system operative.

c. Remove the clutch access door. Disconnect one end of the rods (85 and 88, figure 2—38) from the socket and yoke assembly and bell crank. Unbolt the short fore-and-aft rods (3 and 74) from the bell cranks (1 and 82). Install a 1/4 x 10 inch rigging pin through the yoke assemblies (5 and 71) of both cyclic control sticks. Install a 3/16 x 6 inch rigging pin to position each bell crank (1 and 82) with the length of rod (83) fixed as specified in table VIII. Adjust the length of the short fore-and-aft rods (3 and 74, figure 2—38) to fit and bolt them to the bell cranks. Adjust the length of the long rods (85 and 88) to fit, and bolt them to the support and yoke and bell cranks.

Note

If the rigging pins mentioned in step c. can be installed in each socket and yoke assembly and in each bell crank without disconnecting the rods, install the four pins and disregard the remaining instructions in step c. If all four pins cannot be installed, perform all of the instructions in step c.

Note

When the rigging pins are installed in the yoke assemblies and bell cranks, the cyclic control sticks are centered in the neutral position.

d. Hinge down the servo and mixer cover panel between the cockpit seats. Check that the actuating cylinder assembly (18) has returned the auxiliary servo cams to the servo off (manual) position. Disconnect the flight control rod (63) in the tunnel from the collective pitch input arm assembly of the auxiliary servo unit assembly. Disconnect the control rods (8 and 67) from the bell cranks (86 and 84).

Note

If the rigging pins mentioned in step e. can be installed in the collective pitch arm and in the mixing unit without disconnecting the rods and if dimensions "A" and "B," mentioned in step f., agree with the dimensions given in table XI, install the two rigging pins and disregard the remaining instructions in steps d. through g. If one or both rigging pins cannot be installed, or if dimensions "A" or "B" do not agree with the dimensions given in table XI, perform all of the instructions in steps d. through g.

e. Install the 1/4 x 11 inch rigging pin in the collective pitch arm (64, figure 2—38) and the bracket assembly (65) below the auxiliary servo unit. Install the 5/16 x 13 inch rigging pin through the mixing unit above the auxiliary servo unit.

Note

The 1/4 x 11 inch rigging pin centers the collective control stick in the mid position and the 5/16 x 13 inch rigging pin centers the mixing unit in the neutral position.

f. Using vernier calipers, carefully measure dimensions "A" and "B" (figure 2—55), on the power pistons of the auxiliary servo unit for the lengths given in table XI. Disconnect the auxiliary servo unit rod ends and adjust, if necessary, to obtain the dimensions.

Note

The closer dimensions "A" and "B" are set, the more accurate will be the angular results.

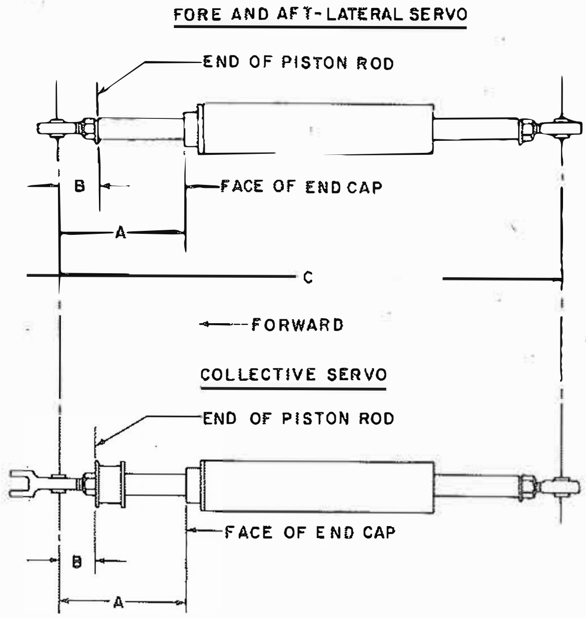


Figure 2—55. Rigging Dimensions — Main Rotor Auxiliary Servo Units

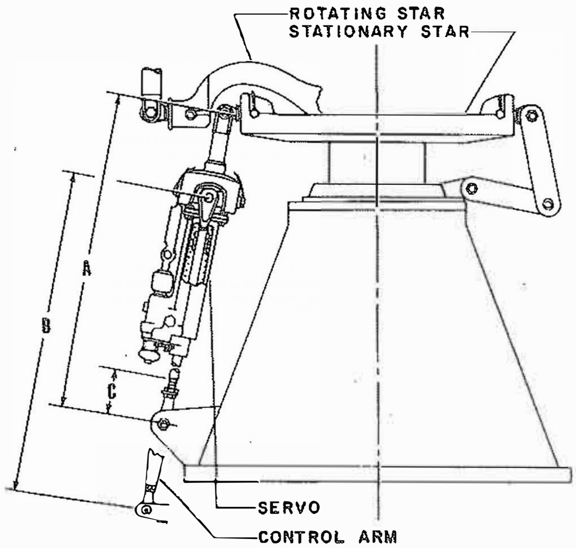


Figure 2—56. Rigging Dimensions — Main Rotor Primary Servo Units

g. Adjust the length of the flight control rod (63, figure 2—38) below the auxiliary servo unit and connect it to the collective pitch input arm assembly of the auxiliary servo unit assembly (13). Adjust the length of the control rods (8 and 67) at the bell cranks (86 and 84) and connect them to the bell cranks.

TABLE XI
MAIN ROTOR AUXILIARY SERVO UNIT DIMENSIONS

INDEX, FIGURE 2—55	DIMENSIONS
A	2.59375 inches (2-19/32 inches)
B	1.058 inches
C	13.375 inches (13-3/8 inches)

h. Disconnect the outboard end of the control rods (57 and 59) behind the mixing unit from the two outboard bell cranks (55 and 58) on the transmission deck. Install a 3/16 x 6 inch rigging pin through both bell cranks, adjust the two disconnected control rods (57 and 59) for length and connect them to the bell cranks (55 and 58).

Note

If the rigging pin mentioned in step h. can be installed in both bell cranks, install the rigging pin, disregard the remaining instructions in step h. and proceed with the remaining steps in this paragraph. If the rigging pin cannot be installed in both bell cranks, perform all of the instructions in step b. before proceeding with the remaining steps in this paragraph.

i. Using vernier calipers, trammel points or rigging blocks, carefully measure dimension "C" (figure 2—56), the distance from the center line of the bolt to the threaded shoulder of the piston rod, on the main rotor primary servo units for the length given in table XII. Adjust the rod end to obtain dimension "C." Carefully measure dimension "A" (figure 2—56), for the length given in table XII. Adjust dimension "B" at the rod end on the bottom of the control arm assembly to obtain dimension "A."

TABLE XII
MAIN ROTOR PRIMARY SERVO UNIT DIMENSIONS

SERVO UNIT	FIGURE 2—56, DIMENSION A	FIGURE 2—56, DIMENSION B	FIGURE 2—56, DIMENSION C
Left-Hand Lateral	18.65 inches	32.80 inches (32-4/5 inches)	3.10 inches
Right-Hand Lateral	18.81 inches	35.04 inches (35-1/25 inches)	3.26 inches
Fore and Aft	18.65 inches	32.93 inches	3.10 inches

CAUTION

These dimensions are critical and extreme accuracy must be used when establishing them.

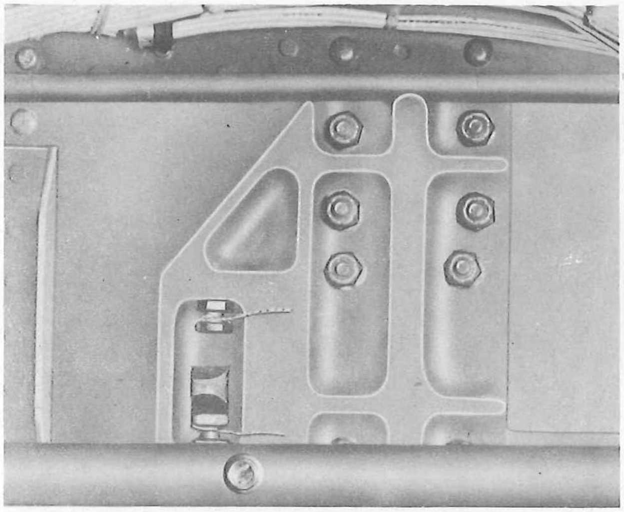


Figure 2–57. Collective Pitch Control Stops (RH Side)

Note

Dimension "B" (figure 2–56), is a reference dimension only.

j. Remove the 3/16 x 6 inch rigging pin from the bell cranks (55 and 58, figure 2–38) on the transmission deck, the 5/16 x 13 inch rigging pin from the mixing unit and the ¼ x 11 inch rigging pin from the collective pitch arm (64).

CAUTION

Be sure that these rigging pins have been removed before proceeding, as damage to the system may occur if the pins have not been removed and the collective pitch control is moved.

k. Back off both sets of collective pitch control stops (figure 2–57) in the cabin. Move the collective control pitch to the low pitch position until the collective pitch power piston in the auxiliary servo unit bottoms. Lock the collective pitch control in this position.

Note

The main rotor auxiliary servo unit (13, figure 2–38) is equipped with an external adjustable stop (spool) and shims on the collective power piston in the low pitch position. Insure that the external stop does not come into play at this time. If the servo unit has been incorrectly adjusted on the bench and the spool does hit before the internal stop, remove the adjacent rod end, counting the number of turns made to remove the rod end in order to insure reinstallation to dimension "B" (figure 2–55).

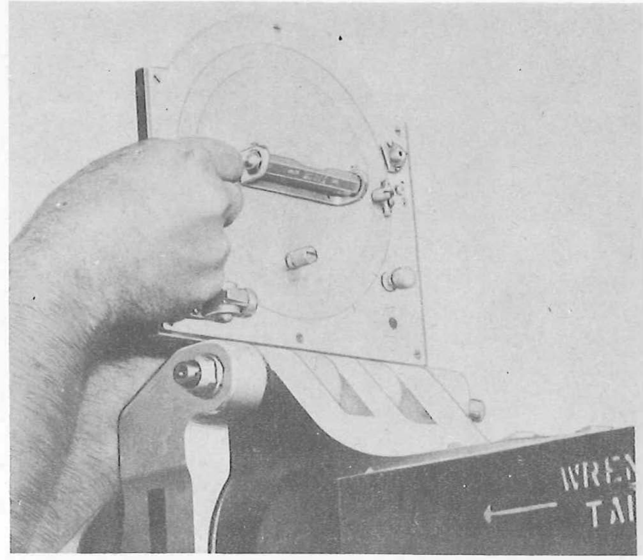


Figure 2–58. Measuring Pitch on Main Rotor Blade

Remove one or more of the stop shims, reinstall the rod end and recheck for a clearance of 0.010 to 0.032 inch between the spool and the end of the piston cylinder and dimension "B" at the rod end. The external stop will be used to adjust the autorotation rpm during the flight check of control rigging. (Refer to table XIV.)

l. Leave the collective pitch control in the low pitch position. Check that the star assembly is level fore and aft and laterally. Adjust, if necessary, at the rod end on the bottom of each control arm (38, figure 2–38).

m. At the main rotor head, pull each blade to its full forward autorotative position until the damper is against its inboard stop. Place a bevel protractor on the top of the main rotor blade attachment lugs on each sleeve assembly and check for a low collective control stick pitch reading of +7 degrees ±½ degree with the blade pitch control rod assembly directly over the left-hand lateral main rotor servo unit. (See figure 2–58.) Make adjustment at the top of each control rod assembly that extends from the rotating star to the horn assembly. After shortening or lengthening the control rod assembly, tighten the lock nut and safety wire the lock to the lock nut.

Note

Be sure to check and adjust all blades in the same position.

n. Unlock the collective pitch control and move it to the high pitch position until the collective pitch power piston in the auxiliary servo unit bottoms. Lock the collective pitch control in place. Check at the main rotor

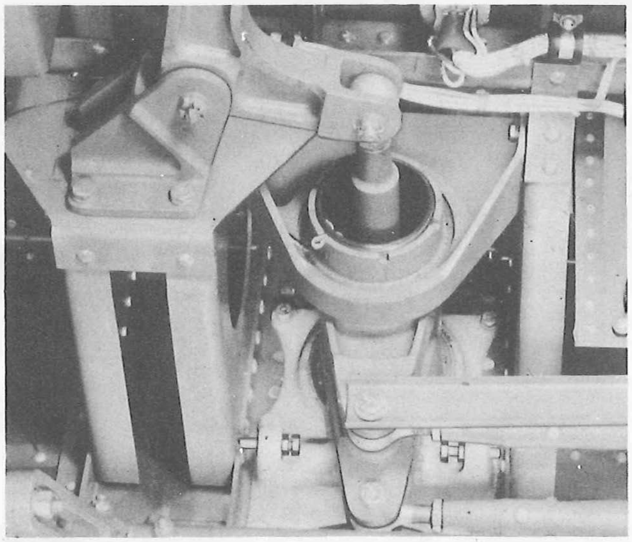


Figure 2—59. Cyclic Control Stick Lateral Stops (RH Side)

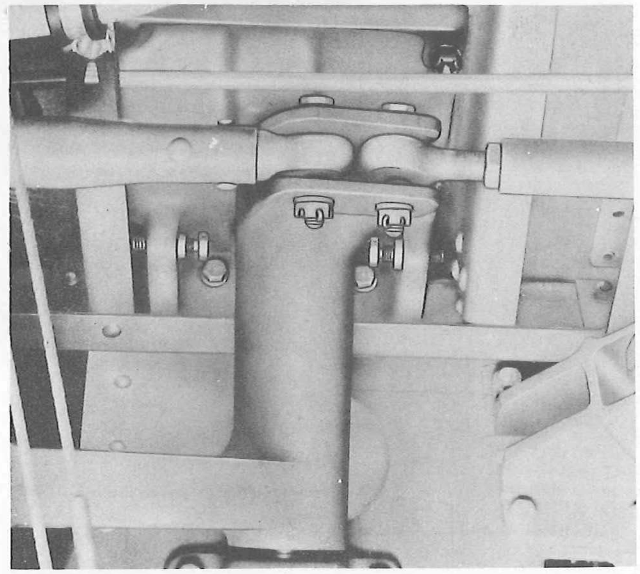


Figure 2—60. Cyclic Control Stick Fore-and-Aft Stops

blade attachment lugs with a protractor for a high collective control stick reading of +18-½ degrees ±½ degree with the blade pitch control rod assembly directly over the left-hand lateral main rotor servo unit. Adjust both high pitch stops (figure 2—57) in the cabin to a 0.010 inch clearance. Lockwire the stops.

o. Unlock the collective pitch control, move it to the low pitch position and lock it in place. Remove the ¼ x 10 inch rigging pins from both cyclic control stick socket and yoke assemblies (5 and 71, figure 2—38) and the 3/16 x 6 inch rigging pins from both cyclic control bell cranks (1 and 82) in the clutch compartment. Back off both sets of cyclic control stick lateral stops. (See figure 2—59.) Move the cyclic control stick to the extreme left position until the lateral control power piston in the auxiliary servo unit bottoms. Check for a left lateral cyclic control stick reading of —2 degrees ±½ degree with a bevel protractor at the main rotor blade attachment lugs with the blade pitch control rod assembly directly over the left-hand lateral main rotor servo unit. Adjust both left lateral cyclic stick stops in the clutch compartment to a 0.010 inch clearance. Lockwire the stops. Move the cyclic control stick to the extreme right position until the lateral control power piston in the auxiliary servo unit bottoms. Check for a right lateral cyclic control stick reading of +16 degrees ±½ degree with a protractor at the main rotor blade attachment lugs with the blade pitch control rod assembly directly over the left-hand lateral main rotor servo unit. Adjust both right-hand lateral control stops in the clutch compartment to a 0.010 inch clearance. Lockwire the stops.

p. Back off the cyclic control stick fore-and-aft stops (figure 2—60) in the clutch compartment. With the collective pitch control still locked in the low pitch position, move the cyclic control stick to extreme forward position until the fore-and-aft control power piston in the auxiliary servo unit bottoms. Check with a bevel protractor for a forward cyclic control stick reading of —5 degrees ±½ degree at the main rotor blade attachment lugs with the blade pitch control rod assembly directly over the fore-and-aft main rotor servo unit. Adjust the forward control stop in the clutch compartment to a 0.010 inch clearance. Lockwire the stop. Move the cyclic control stick to the extreme aft position until the power piston in the fore-and-aft control auxiliary servo unit bottoms. Check with a protractor for an aft cyclic control stick reading of +19 degrees ±½ degree at the main rotor blade attachment lug with the blade control rod assembly directly over the fore-and-aft main rotor servo unit. Adjust the aft control stop in the clutch compartment to a 0.010 inch clearance. Lockwire the stop.

q. Adjust the collective open loop spring cylinder. (Refer to paragraph 2—392.)

r. Adjust the cyclic control stick trim system. (Refer to paragraph 2—387.)

s. Replace the clutch access door and the servo and mixer covers.

t. Track the main rotor blades (paragraph 2—305) and flight check the control rigging (paragraph 2—525).

2–524. RIGGING TAIL ROTOR FLIGHT CONTROLS.

WARNING

If four or more threads are showing on the adjustable rod ends, add spacers or washers under the nut until less than four threads show.

Note

The tail rotor controls are rigged with the hydraulic systems inoperative.

a. Insert a 3/16 x 6 inch rigging pin (table X) into the quadrant (80, figure 2–48) behind the instrument panel to lock the quadrant in mid position.

b. Screw the pedal adjustment handles (9 and 62) for the pilot's and observer's tail rotor control pedals in or out to position the pedals in the middle of their fore-and-aft adjustment. Check that both sets of pedals line up vertically and horizontally under the control pedal tubes (5). Adjust the position of the pedals, if necessary, by lengthening or shortening the rod ends of the rods (3 and 82 or 12 and 67) which attach to the pedals.

c. Loosen the tail rotor control cables at the turnbuckles (15 and 59) in the cabin, one (15) just aft of the cargo door and the other (59) just forward of the front left-hand cabin window, and at the two turnbuckles (28 and 50) in the tail cone. Lock the quadrant (46) at the aft end of the tail cone with a 3/16 x 6 inch rigging pin.

d. Hinge down the left service platform and remove the left rear skin panel.

e. Check that the cam on the tail rotor servo unit is in the manual position. (See Cam Detail, figure 2–61.) Using vernier calipers, carefully measure dimension "A" (figure 2–61), the distance from the face of the servo unit housing to the forward end of the power piston, for a dimension of 4.78125 (4-25/32) inches. Set the power piston for this dimension and hold it in position with blocks and "C" clamps.

Note

Use two split sets of phenolic blocks machined to fit the power piston shaft and clamp a set on the shaft at each end of the servo unit in contact with the end cap.

f. Adjust the length of the cables at the four turnbuckles (15, 28, 50, and 59, figure 2–48) for the set position of the power piston. Tighten the cables to the tension given in table XIII according to the ambient temperature.

CAUTION

The cables must be tightened evenly to avoid bending the rigging pins or damaging the quadrants. Check the rigging pins continually while tightening the cables to see that the pins remain movable and are movable after the cables reach the proper tension.

TABLE XIII

TEMPERATURE CORRECTED TAIL ROTOR CABLE TENSION CHART

TEMPERATURE RANGE (DEGREES F)	TEMPERATURE RANGE (DEGREES C)	CABLE TENSION IN POUNDS
−65 to −56	−53.9 to −48.9	35 to 54
−55 to −36	−48.3 to −37.8	55 to 71
−35 to −16	−37.2 to −26.7	72 to 88
−15 to +4	−26.1 to −15.6	89 to 104
+5 to +24	−15.0 to −4.5	105 to 119
+25 to +44	−3.9 to +6.6	120 to 133
+45 to +64	+7.2 to +17.7	134 to 149
+65 to +84	+18.3 to +28.8	150 to 167
+85 to +104	+29.4 to +40.0	168 to 185
+105 to +124	+40.6 to +51.1	186 to 203
+125 to +144	+51.7 to +62.2	204 to 221
+145 to +160	+62.8 to +71.1	222 to 239

Note

This table is for ambient air temperatures with the cables at the same temperature as the outside skin of the helicopter. Park the helicopter out of the sun for a minimum of one-half hour before setting initial cable tension. Do not check cable tension until one-half hour has elapsed after helicopter has been moved to an area of different temperature.

CAUTION

If it is necessary to check cable tension with the helicopter parked in the sun, a 25 percent deviation from this table is allowable, but cable tension must never exceed 240 pounds. If the 25 percent deviation is exceeded, allow the helicopter to stand at constant temperature for a minimum of one-half hour before resetting cable tension.

g. Remove the blocks and "C" clamps from the tail rotor servo unit power piston. Recheck dimension "A" (figure 2–61). If the dimension has varied from 4.78125 (4-25/32), adjust the turnbuckles as necessary to obtain the proper dimension at the same time maintaining proper cable tension and quadrant position. (Refer to the CAUTION in step f.) Lockwire the turnbuckles.

h. Remove the intermediate gear box access panel and install a rigging pin in the bell crank (39, figure 2–48),

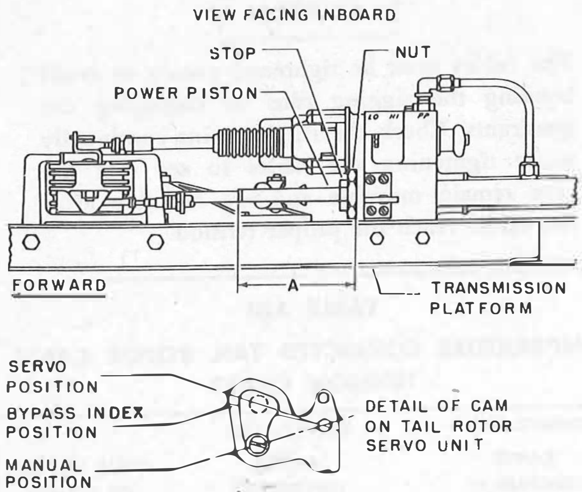


Figure 2—61. Tail Rotor Servo Unit Neutral Position

if possible. If the rigging pin will not fit, adjust as follows: Fold the pylon (paragraph 1—21). Back off the lock nut at the aft end of the rod (43, figure 2—48). Disconnect the forward end of the rod from the bell crank (35). Insert the rigging pin in the bell crank (41). Unfold and lock the pylon (paragraph 1—22). Adjust the rod (43, figure 2—48) and secure the forward end to the bell crank (35). Fold the pylon, tighten the lock nut at the aft end of the rod and unfold and lock the pylon.

CAUTION

Do not attempt to fold or unfold the pylon while there is a rigging pin in the quadrant (46) and bell crank (39) and the rod (43) is secured to the bell crank (35) and the idler (42).

i. Remove the screen and the cover from the top of the pylon. Check that the input arm on the tail rotor gear box is parallel with the frame to which the gear box is attached. This will position the center of the hole in the input arm 2.875 (2⅞) inches from the frame surface. Adjust, if necessary, at the rod end of the control rod (36). Replace the screen and cover on the top of the pylon.

j. Turn a tail rotor blade to a forward horizontal position. Secure the blade from flapping by installing the blade restrainer assembly, S1670-10417. Place a protractor on the tail rotor pitch change shaft and establish a "O" reference on the protractor. Level the forward blade horizontally. Measure the blade angle on the flat of the sleeve for a reading of +6 degrees from the "O" reference established. (See figures 2—62 and 2—63.) Adjust the link from the pitch change beam to obtain

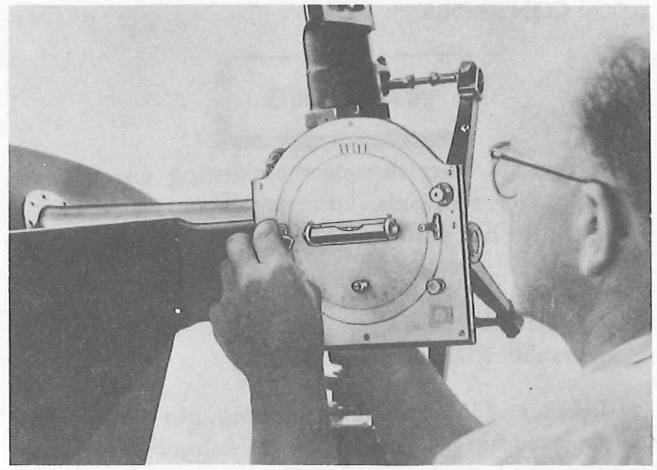


Figure 2—62. Measuring Pitch on Tail Rotor Blade

the angle and tighten the attaching nut with 40 to 60 inch-pounds torque. Repeat the measuring procedure with every blade after turning the blade to the forward horizontal position.

Note

When the leading edge of the forward blade points inboard towards the fuselage, the angle of the blade with respect to vertical is known as a PLUS angle and the blade is in left rudder position. When the leading edge points outboard away from the fuselage, the angle from vertical is a MINUS angle and the blade is in right rudder position.

k. Remove the 3/16 x 6 inch rigging pins from the quadrant (80, figure 2—48) behind the instrument panel, from the quadrant (46) at the aft end of the tail cone and from the bell crank (39) in the pylon. Replace the intermediate gear box access panel.

l. Back off the tail rotor pedal stops at the quadrant (80) behind the instrument panel. Actuate the left tail rotor pedal to the full left position. Turn a tail rotor blade to the forward horizontal position, and with the blade restrainer assembly, S1670-10417 installed, measure at the flat of the sleeve for a full left pedal angle of +23 ±½ degrees. (See figures 2—62 and 2—63.) Adjust for the proper blade angle by loosening the lock nut and screwing the power piston stop on the forward side of the tail rotor servo unit in or out until the power piston is bottomed on its stop. (See figure 2—61.) Tighten the lock nut. Lockwire the stop and lock nut. Set the left pedal stop at the quadrant (80, figure 2—48) behind the instrument panel to a 0.010 inch clearance.

m. Actuate the right tail rotor pedal to the full right position. Measure a tail rotor blade which is in the forward horizontal position, with the blade restrainer assembly, S1670-10417, installed, for a full right pedal angle of —10 ±½ degrees. (See figures 2—62 and 2—63.) Adjust for the proper blade angle by loosening the lock nut and screwing the power piston stop on the aft side of the tail rotor servo unit in or out until the power piston is bottomed on its stop. (See figure 2—61.) Tighten the lock nut and lockwire the stop and lock nut. Set the right pedal stop at the quadrant (80, figure 2—48) behind the instrument panel to 0.010 inch clearance.

n. Check the adjustment of the servo unit pilot valve but do not disconnect the auxiliary means of pressure. (Refer to paragraph 2—514.)

o. Check the pedal damper rate. (Refer to paragraph 2—505.)

p. Remove the blade restrainer assembly from the tail rotor blade, replace the left rear skin panel at the transmission and close the service platform.

q. Flight check the control rigging. (Refer to paragraph 2—525.)

2—525. FLIGHT CHECK OF CONTROL RIGGING.

2—526. DESCRIPTION. After a helicopter has been rigged, a flight test must be made by a qualified pilot to check that a sufficient amount of main rotor and tail rotor control movement is available. If the flight checks meet the standards of "REQUIRED PERFORMANCE" listed in table XIV, the rigging is correct and the proper range of the flight controls is available. The flight test must be made with a gross weight and the center of gravity as specified. (Refer to the applicable handbook for correct information on the location of the center of gravity and the loading of the helicopter.) The required performance figures for the rigging check have been calculated for standard atmospheric conditions, but sufficient margin is provided in rigging to allow for differences in atmospheric conditions. Autorotation should be checked first to assure that there is enough low pitch available for a safe autorotative rpm before proceeding with the other checks. Refer to table XI for the flight check chart.

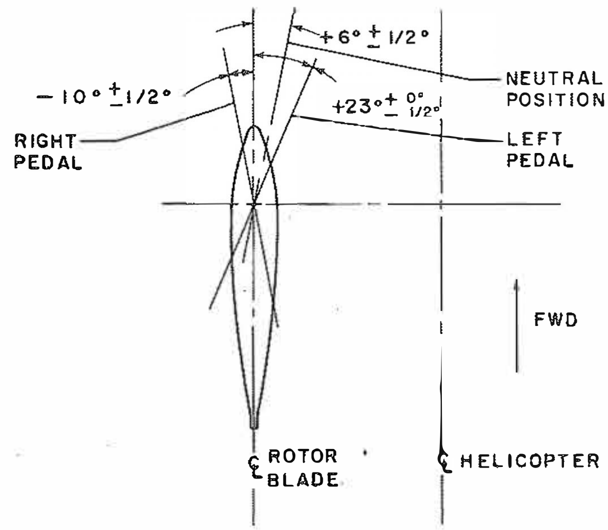


Figure 2—63. Tail Rotor Rigging Angles

WARNING

In addition to the usual "Before Take-Off" check, make certain the control surfaces respond in the proper direction to the movement of the collective control stick, cyclic control stick and the tail rotor control pedals.

CAUTION

Immediately after the helicopter is air-borne, a general check should be made of flight controls for over-all operating safety. With the helicopter in a hovering position, the cyclic control stick should be approximately in its neutral position. Check the tail rotor control pedals while hovering by pressing one pedal and then the other pedal to see if there is control in each direction. Fly short distances forward, backward, and sideways, turning the helicopter to the right and to the left.

TABLE XIV
FLIGHT CHECK CHART

FLIGHT CHECK	CONDITIONS OF CHECK	REQUIRED PERFORMANCE	ADJUSTMENT FOR CORRECTION
Autorotation (low pitch check)	1. 11,300 lb gross weight 2. 137.7 inches cg (neutral) 3. 60 knots IAS 4. Full low pitch	230 ±5 main rotor rpm	Add sufficient shims to the external collective power piston stop on the auxiliary main rotor servo unit to reduce the autorotative setting to 230 rotor rpm and adjust both collective low pitch stops to a 0.010 inch clearance. Lockwire the stops
High pitch check (level flight)	1. 11,300 lb gross weight 2. 137.7 inches cg (neutral) 3. 2300 engine rpm 4. 39.5 inches Hg 5. Normal mixture 6. Sea level to 1000 feet	Approximately 120 knots IAS with a slight reserve of collective pitch remaining	Recheck rigging if control is not available
(climb)	1. 11,300 lb gross weight 2. 137.7 inches cg (neutral) 3. 2500 engine rpm 4. Normal mixture 5. Carburetor air — direct if possible 6. 60 knots IAS 7. Start climb with 47.5 inches Hg; decrease power 0.5 inches Hg up to 3500 feet; hold full throttle above 3500 feet	Engine rpm should drop from 2500 to approximately 2300 rpm at 10,000 feet when full collective pitch is applied	
Tail rotor control	Sideward flight 1. 2500 engine rpm 2. 35 knots IAS 3. Sea level to 1000 feet	Sideward flight at 35 knots IAS while maintaining a constant heading	Recheck rigging if control is not available

TABLE XIV (Cont)

FLIGHT CHECK	CONDITIONS OF CHECK	REQUIRED PERFORMANCE	ADJUSTMENT FOR CORRECTION
Forward cg controllability check **CAUTION** Be sure that the area is clear prior to take-off; take-off with the helicopter heading into the wind; and exercise care when turning downwind until aft control has been proven adequate.	1. 11,300 lb gross weight 2. 130.7 inches cg (most forward)	1. Adequate aft control should be available in hovering 2. At 30 knots rearward flight with 2500 engine rpm, adequate aft control should be available to pitch the nose up slightly 3. In forward flight up to high speed no unusual vibrations or control positions should be evident	Recheck rigging if control is not available
Aft cg controllability check	1. 11,300 lb gross weight 2. 146.7 inches cg (most aft) 3. 2500 engine rpm 4. Sea level to 1000 feet	At least 3 inches of forward control should remain at high speed forward flight	Recheck rigging if control is not available
Throttle synchronizer **Note** Check the throttle synchronizer if the main blade low pitch angle has been changed	1. Helicopter on ground 2. Full low pitch 3. 2500 ±50 rpm	Raise collective pitch until take-off is accomplished. Rpm should remain at 2500 ±50 rpm	Lengthen throttle control adjustment rod in clutch compartment to lower rpm. Shorten rod to increase rpm

SECTION III

HYDRAULIC, PNEUMATIC SYSTEMS

TABLE OF CONTENTS

Paragraph		Page
3—1.	**HYDRAULIC SYSTEMS**	**159-160**
3—3.	WHEEL BRAKE SYSTEM	159-160
3—5.	MAIN ROTOR PRIMARY SERVO HYDRAULIC SYSTEM	159-160
3—7.	MAIN ROTOR AUXILIARY SERVO HYDRAULIC SYSTEM	159-160
3—9.	HYDRO-MECHANICAL CLUTCH SYSTEM	159-160
3—11.	ROTOR BRAKE SYSTEM	159-160
3—13.	**PNEUMATIC SYSTEM**	**159-160**

3—1. HYDRAULIC SYSTEMS.

3—2. DESCRIPTION. Five separate hydraulic systems are installed in the helicopter: the wheel brake system, the main rotor primary servo hydraulic system, the main rotor auxiliary servo hydraulic system, the hydro-mechanical clutch system and the rotor brake system.

3—3. WHEEL BRAKE SYSTEM.

3—4. DESCRIPTION. For complete information on the wheel brake hydraulic system, refer to paragraph 2—254.

3—5. MAIN ROTOR PRIMARY SERVO HYDRAULIC SYSTEM.

3—6. DESCRIPTION. For complete information on the main rotor primary servo hydraulic system, refer to paragraph 2—418.

3—7. MAIN ROTOR AUXILIARY SERVO HYDRAULIC SYSTEM.

3—8. DESCRIPTION. For complete information on the main rotor auxiliary servo hydraulic system, refer to paragraph 2—453.

3—9. HYDRO-MECHANICAL CLUTCH SYSTEM.

3—10. DESCRIPTION. For complete information on the hydro-mechanical clutch, refer to paragraph 5—314.

3—11. ROTOR BRAKE SYSTEM.

3—12. DESCRIPTION. For complete information on the rotor brake system, refer to paragraph 5—387.

3—13. PNEUMATIC SYSTEM.

3—14. DESCRIPTION. There are no pneumatic systems installed in the model H-34A helicopter.

SECTION IV

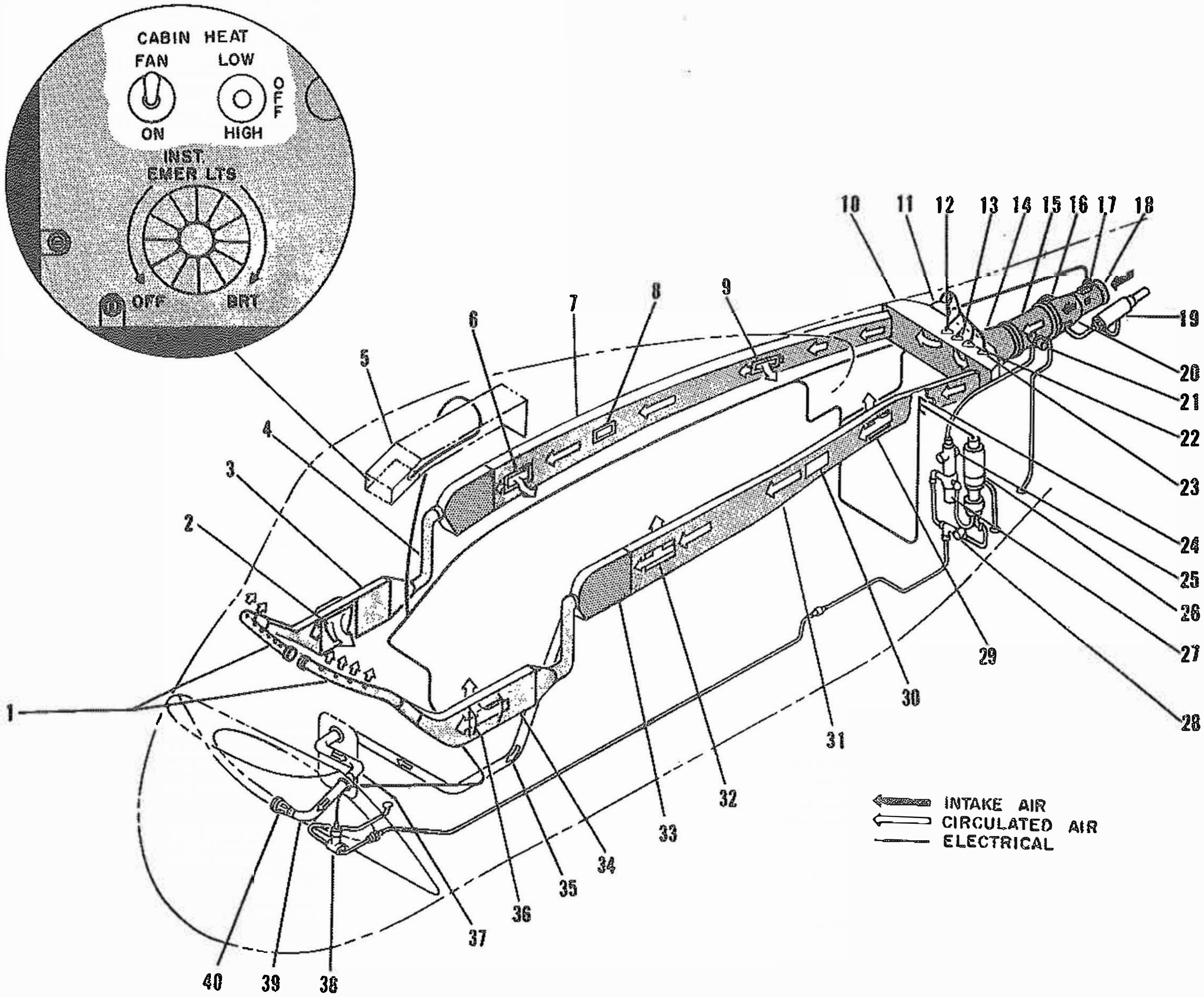
UTILITY SYSTEMS

TABLE OF CONTENTS

Paragraph		Page
4—1.	**HEATING AND VENTILATING SYSTEM**	**161**
4—3.	HEATER	163
4—9.	DAMPER ASSEMBLY	164
4—16.	AIR PRESSURE SWITCH	165
4—20.	THERMAL SWITCHES	165
4—22.	BLOWER	166
4—26.	IGNITION UNIT	166
4—31.	HEATER DUCTS	166
4—35.	ENGINE PRE-HEAT DUCT	167
4—39.	HEATER FUEL SYSTEM	168
4—41.	FUEL PUMP	168
4—45.	PRESSURE RELIEF VALVE	169
4—49.	FORWARD FUEL SHUT-OFF VALVE AND SYSTEM STRAINER	169
4—55.	AFT FUEL SHUT-OFF VALVE	170
4—61.	FUEL FILTER	170
4—66.	CABIN VENTS	171
4—68.	**WINDSHIELD WIPER SYSTEM**	**171**
4—73.	**FIRE DETECTOR SYSTEM**	**172**
4—79.	**FIRE EXTINGUISHER**	**175-176**
4—81.	**CARGO SLING**	**175-176**

4—1. HEATING AND VENTILATING SYSTEM.

4—2. DESCRIPTION. *(See figure 4—1.)* The heating and ventilating system consists primarily of a 50,000 BTU internal combustion heater and a plenum duct located in the heater compartment, a blower and an ignition unit mounted just aft of the heater in the forward part of the tail cone, two flexible defroster ducts mounted just below the windshield in the cockpit, ducts and anemostats, or registers, to convey and distribute the air from the heater to the cabin and cockpit, and a fuel system to carry fuel from the forward fuel tank to the heater. An engine pre-heat duct, when installed, supplies warm air to the carburetor during cold weather operation. Air is drawn into the blower from the tail cone through the air intake scoop attached to the aft end of the blower. From the blower the air passes through an adapter into the heating chamber of the heater and on into the plenum duct. From the plenum duct the air is distributed to the cabin, the cockpit and the defroster ducts. A flexible duct and a damper assembly mounted on top of the heater and adapter supplies air from the adapter to the combustion chamber of the heater. The ignition unit supplies the necessary spark to the heater spark plug to support combustion. An exhaust tube from the combustion chamber of the heater extends through the left side of the helicopter. An air pressure switch, mounted on the right side of the plenum duct, prevents the heater from operating should there be an inadequate supply of air for combustion. The main heating ducts carry the heated air from the plenum duct forward along each side of the cabin and cockpit and terminate at the defroster ducts. Eight controllable anemostats, or registers, are installed in the main heating ducts, three on each side of the cabin and one on each side of the cockpit. A switch on the overhead control panel marked



1. Flexible Defroster Duct
2. Cockpit Anemostat (Register)
3. Cockpit Duct
4. Adapter
5. Overhead Control Panel
6. Cabin Anemostat (Register)
7. Main Heating Duct
8. Cabin Anemostat (Register)
9. Cabin Anemostat (Register)
10. Plenum Duct
11. Air Pressure Switch
12. 350°F Thermal Switch
13. 120°F Thermal Switch
14. Forward Adapter
15. Heater
16. Damper Assembly
17. Blower
18. Air Intake Scoop
19. Ignition Unit
20. Aft Adapter
21. Exhaust Tube
22. 285°F Thermal Switch
23. 150°F Thermal Switch
24. Relays
25. Aft Fuel Shut-Off Valve
26. Heater Fuel Pump
27. Pressure Relief Valve
28. Fuel Filter
29. Cabin Anemostat (Register)
30. Cabin Anemostat (Register)
31. Main Heating Duct
32. Cabin Anemostat (Register)
33. Adapter
34. Cockpit Duct
35. Pre-Heat Duct (Aft Section)
36. Cockpit Anemostat (Register)
37. Pre-Heat Duct (Center Section)
38. Forward Shut-Off Valve
39. Pre-Heat Duct (Forward Section)
40. Connector Assembly

Figure 4–1. Heating and Ventilating System Diagram

"CABIN HEAT," with the positions "LOW," "OFF," "HIGH," controls the heater and fan for heating operations. When the switch is placed in either the "LOW" or "HIGH" position both the blower and heater are turned on. When the switch is turned to the "OFF" position, the blower continues to operate until the air temperature within the plenum duct drops to 48.9°C (120°F), thereby expelling all exhaust gases from the heater and permitting the system to cool quickly and safely. A second switch on the overhead control panel marked "CABIN HEAT," with the positions "FAN," "ON," controls the fan when only cool air ventilation is desired. Four thermal switches mounted on the plenum duct control the output temperature of the heater when it is in operation. The 48.9°C (120°F) switch will automatically turn the blower on whenever the secondary bus of the electrical system is energized and the temperature within the plenum duct reaches 48.9°C (120°F).

4—3. HEATER.

4—4. DESCRIPTION. *(See figure 4—1.)* The 50,000 BTU heater (15) is located at the top of the heater compartment just aft of the electronics compartment rear bulkhead. The heater is cylindrical in shape and is fabricated of heat-resisting alloy steel welded gas tight. Combustion takes place inside a cylindrical combustion chamber which is surrounded by a double-walled radiator. At the inlet end of the heater are the fuel and combustion air inlets and the exhaust outlet. At the opposite end, four cross-over passages connect the combustion chamber to the radiator. Enclosing the combustion chamber and radiator for the length of the radiator is a stainless steel "wrap-around" jacket with a self-sealing joint. It is held at a uniform distance from the radiator by spacers and is held in place by three jacket clips on the outside of the jacket. A removable spray-type head, in which are mounted the fuel spray nozzle, spark plug and ground electrode, is fitted over the inlet end of the combustion chamber. Fuel is admitted under pressure to the combustion chamber through the spray nozzle. Air is admitted to the combustion chamber through the combustion air inlet at the top of the heater. The cone-shaped fuel spray produced by the nozzle is mixed with combustion air and ignited by the spark plug. Electric current for the spark plug is supplied by a high potential ignition unit (19) operating from the helicopter dc power supply. A shielded lead connects the ignition coil to the spark plug. A small amount of the combustion air is introduced around the spray nozzle. This air is taken from a tapping in the combustion air inlet and fed through a tube to the nozzle holder. The fresh air thus introduced around the nozzle inhibits carbon formation. Air for combustion enters the combustion chamber at right angles to its length and on a tangent to its inner surface. This causes the air to have a whirling or spinning action. The vaporized fuel mixes with this spinning air, and, after igniting, produces a whirling flame. Combustion, therefore, takes place throughout the full length of the combustion chamber. At the other end of the combustion chamber, the burned gases pass through cross-over passages into the radiator and return through the radiator to the inlet end where the gases pass through the outlet flue to the exhaust tube (21). Air to be heated passes through the heater between the combustion chamber and radiator and between the radiator and outer jacket. After absorbing the heat generated by combustion, the air emerges from the outlet end of the heater.

4—5. TROUBLE SHOOTING.

Trouble	Probable Cause	Remedy
Heater does not light	Ignition system failure:	
	1. No power to ignition unit	Close switches, replace burned out fuses, repair open circuits
	2. Inoperative vibrator in ignition unit	Replace vibrator
	3. Faulty spark plug	Replace spark plug
	4. Faulty shielded lead	Replace shielded lead
	5. Worn ground electrode	Replace electrode
	6. Ignition unit inoperative	Overhaul or replace ignition unit
	Insufficient fuel:	
	1. Fuel solenoid valve not energized	Close switches, check circuits to solenoid valves, replace burned out fuses, replace inoperative thermal switches, or repair open circuits
	2. Faulty pressure relief valve	Replace pressure relief valve
	3. Fuel filter clogged	Replace filter element or clean if new one is not available
	4. Spray nozzle clogged	Clean spray nozzle

Trouble	Probable Cause	Remedy
Heater does not light (cont)	5. Fuel solenoid valve inoperative	Replace solenoid valve
	6. Strainer in forward tank sump clogged	Clean strainer
	Insufficient combustion air:	
	1. Leaks or obstruction in combustion air inlet line	Repair leaks or remove obstructions
Heater is cycled off and on by 176.7°C (350°F) overheat switch	Overheat switch out of calibration or faulty	Calibrate or replace switch
	48.9°C (120°F) switch out of calibration or inoperative	Calibrate or replace switch
	Blower air stream may be obstructed	Remove obstructions
Backfiring, pulsating combustion, or smoky exhaust	Fouled spark plug	Clean or replace spark plug
	Excessive fuel flow into heater:	
	1. Spray nozzle dirty or loose	Overhaul nozzle
	2. Spray nozzle is oversize	Replace with proper size nozzle
	3. Faulty pressure relief valve	Replace pressure relief valve
	4. Core loose in spray nozzle	Repair and tighten core in nozzle
	Restriction in exhaust line	Remove restriction
	Insufficient combustion air	Correct as instructed above

4—6. REMOVAL.

a. Remove the screws that secure the cover plate to the bottom of the aft adapter (20, figure 4—1) and slide the cover plate back along the ignition lead. Reach into the access opening and disconnect the ignition lead from the spark plug. Withdraw the lead from the adapter.

b. Disconnect the tube leading to the air pressure switch (11) at the combustion air inlet of the heater (15). Remove the nipple from the inlet.

c. Unclamp and remove the damper assembly (16) from the combustion air inlet on top of the heater (15).

d. Disconnect the fuel inlet tube at the fuel inlet connection on the heater.

e. Disconnect the fuel drain tube from the heater.

f. Unclamp and remove the exhaust tube (21) from the heater.

g. Support the heater and remove the two jacket clamps at each end of the heater. Remove the heater.

4—7. MAINTENANCE. Under normal conditions of operation, the heater will need only the customary service inspection after 100 hours of heater operation. Operation, maintenance and overhaul will be in accordance with applicable directives.

4—8. INSTALLATION.

a. Position the heater (15, figure 4—1) between the two adapters (14 and 20) and secure it to the adapters with the jacket clamps.

b. Install the exhaust tube (21) in the left side of the heater (15) and secure it with the clamp.

c. Connect the fuel drain tube to the heater.

d. Connect the fuel inlet tube to the fuel inlet connection on the heater.

e. Secure the damper assembly (16) to the combustion air inlet on top of the heater (15) with the clamp.

f. Install the nipple in the combustion air inlet. Connect the tube from the air pressure switch (11) to the nipple.

g. Insert the ignition lead into the access opening at the bottom of the aft adapter (20) and connect the lead to the spark plug in the heater (15). Slide the cover plate up against the adapter and secure it with the screws.

4—9. DAMPER ASSEMBLY.

4—10. DESCRIPTION. *(See figure 4—1.)* The damper assembly (16) is located on top of the heater combustion air inlet and is connected to the aft adapter (20) by a flexible duct. A one-way door in the damper assembly permits air from the blower (17) to enter the combustion chamber of the heater. A rivet in the bottom of the damper assembly tube prevents the one-way door from opening in the opposite direction. This, in turn, precludes any possibility of combustion gases entering the blower.

4—11. REMOVAL.

a. Unclamp and remove the flexible duct from the aft end of the damper assembly (16, figure 4—1).

b. Unclamp and remove the damper assembly from the combustion air inlet on top of the heater (15).

4–12. DISASSEMBLY.

a. Remove the screws and washers that secure the door to the shaft inside the damper assembly tube. Remove the door.

b. Remove the nut from the screw on each side of the tube.

c. Remove the screw and bearing from the boss on each side of the tube. Remove the bearing from inside each screw.

d. Remove the shaft from the tube.

4–13. MAINTENANCE.

a. Inspect the welds on the damper assembly tube for possible cracks.

b. Check the rivet in the damper tube for security.

c. Inspect the bearings for binding or ratcheting.

4–14. ASSEMBLY.

a. Position the shaft inside the damper assembly tube.

b. Position a bearing in each of the two screws.

c. Install a screw and bearing in each of the bosses on the sides of the tube. Install a nut on each screw.

d. Position the door against the shaft inside the tube. Secure the door to the shaft with the screws and washers.

CAUTION

The door must be positioned inside the tube so the bottom is past the rivet, permitting the rivet, permitting the door to swing inward toward the bend in the tube.

e. Adjust the screws so the shaft is supported firmly but does not bind. Lock each screw with the nut. Check again to be sure the shaft does not bind.

4–15. INSTALLATION.

a. Position the damper assembly (16, figure 4–1) on the combustion air inlet on top of the heater (15) and secure it with the clamp.

WARNING

Install the damper so that the door hangs vertically and opens forward.

b. Slide the end of the flexible duct onto the damper assembly (16) and secure it with the clamp.

4–16. AIR PRESSURE SWITCH.

4–17. DESCRIPTION. *(See figure 4–1.)* The air pressure switch (11) is mounted in the heater compartment on a bracket riveted to the right side of the plenum duct (10). The switch is actuated by the pressure of air from the blower (17) as it enters the combustion air inlet of the heater (15). The air pressure at the combustion air inlet is transmitted to the air pressure switch through an aluminum tube. When the pressure from the blower reaches 2.0 ± 0.25 inches water differential, the switch closes an electrical circuit which actuates the ignition unit (19) and opens both the forward fuel shut-off valve (38) and the aft fuel shut-off valve (25). Should the air pressure drop more than 0.50 ± 0.25 inch water differential, the point at which the supply of air would be insufficient for proper combustion within the heater, the air pressure switch opens the electrical circuit, thereby shutting off the supply of fuel to the heater and turning off the ignition unit.

4–18. REMOVAL.

a. Disconnect the electrical plug from the receptacle on the air pressure switch (11, figure 4–1).

b. Disconnect the tube from the reducer in the high pressure port of the switch. Remove the reducer and packing.

c. Remove the washers and nuts that secure the air pressure switch to the bracket and remove the switch.

4–19. INSTALLATION.

a. Position the air pressure switch (11, figure 4–1) on the plenum duct bracket with the electrical receptacle up. Secure the switch to the bracket with the washers and nuts.

b. Install the reducer and packing in the high pressure port of the switch. Connect the tube to the reducer.

c. Connect the electrical plug to the receptacle.

4–20. THERMAL SWITCHES.

4–21. DESCRIPTION. *(See figure 4–1.)* Four thermal switches (12, 13, 22 and 23) for controlling the heating system are installed on the plenum duct (10). The 48.9°C (120°F) and 176.7°C (350°F) thermal switches are normally open; the 65.6°C (150°F) and 141.5°C (285°F) thermal switches are normally closed. The normally open 176.7°C (350°F) thermal switch provides an overheat shut-off for the system. If the temperature in the plenum duct goes above 176.7°C (350°F), the thermal switch shuts off the heating system, except for the blower (17), until the "CABIN HEAT" switch on the overhead switch panel (5) is placed in the "OFF" position and then turned back to "HIGH" or "LOW." The normally open 48.9°C (120°F) thermal switch allows the blower to run whenever the temperature in the plenum duct is above 48.9°C (120°F) and the secondary bus of the electrical system is energized. The 65.6°C (150°F) and 141.5°C (285°F) thermal switches regulate the heating system for the "LOW" and "HIGH" positions, respectively, of the "CABIN HEAT" switch by turning the heating system on and off to maintain the desired "LOW" or "HIGH" heat range in the plenum duct. The thermal switches may be removed from the plenum duct by disconnecting the wiring and removing the screws from each switch.

4—22. BLOWER.

4—23. DESCRIPTION. *(See figure 4—1.)* The blower (17) is installed at the rear of the heater (15) and is separated from the heater by the aft adapter (20). The fan in the blower circulates heated air in the helicopter when the "CABIN HEAT" switch on the overhead control panel (5) is placed in either the "HIGH" or "LOW" position. The switch marked "FAN," located adjacent to the "CABIN HEAT" switch on the overhead control panel, is placed in the "ON" position when only cool air ventilation is desired. The blower will also go on automatically whenever the temperature in the plenum duct (10) is above 48.9°C (120°F) and the secondary bus of the electrical system is energized. The motor which powers the blower has a rating of 0.3 horsepower at 12,000 rpm. The blower fan has a rating of 175 cfm at 5.0 inches of static pressure measured in inches of water.

4—24. REMOVAL.

a. Disconnect the electrical wiring from the top of the blower (17, figure 4—1).

b. Remove the bolts, washers and nuts securing the blower to the aft adapter (20).

c. Support the blower and remove the bolts, washers and nuts securing the blower to the support and angles. Remove the blower.

d. Unbolt and remove the air intake scoop (18) from the blower.

4—25. INSTALLATION.

a. Position the air intake scoop (18, figure 4—1) on the blower (17) and secure it with the bolts, washers and nuts.

b. Position the blower behind the aft adapter (20) and secure the blower to the support and angles with the bolts, washers and nuts.

c. Secure the blower to the aft adapter with the bolts, washers and nuts.

d. Connect the electrical wiring to the receptacle on top of the blower.

4—26. IGNITION UNIT.

4—27. DESCRIPTION. The ignition unit (19, figure 4—1) is secured with clamps to the left side of the tail cone beside the blower (17). The ignition unit converts 28-volt direct current to high voltage and produces a continuous spark between the spark plug and the ground electrode within the heater (15). The unit is equipped with a coil assembly, two radio noise shields and a vibrator.

4—28. REMOVAL.

a. Disconnect the electrical plug from the receptacle on the ignition unit (19, figure 4—1).

b. Disconnect the ignition lead from the ignition unit.

c. Loosen the clamps securing the ignition unit to the side of the tail cone and slide the ignition unit out of the clamps.

4—29. MAINTENANCE. When the points in the ignition unit vibrator become pitted, burned or out of line, it is recommended that the vibrator or ignition unit be replaced.

4—30. INSTALLATION.

a. Slide the ignition unit (19, figure 4—1) into the clamps on the side of the tail cone and tighten the two clamps.

b. Connect the ignition lead to the ignition unit.

c. Connect the electrical plug to the receptacle on the ignition unit.

4—31. HEATER DUCTS.

4—32. DESCRIPTION. *(See figure 4—1.)* The heater ducts consist of the main heating ducts (7 and 31) which are located in the cabin and the electronics compartment, an adapter (4 and 33) and cockpit duct (3 and 34) on each side of the cockpit and the flexible defroster ducts (1) mounted below the windshield in the cockpit. Each main heating duct is connected at one end to an outlet on the plenum duct (10) and at the other end to one of the adapters in the cockpit. Each adapter is connected to a flexible defroster duct by one of the cockpit ducts. Three anemostats, or registers (6, 8, 9, 29, 30 and 32), are installed in each main heating duct and one anemostat (2 and 36) is installed in each cockpit duct. The passage of air from each anemostat can be controlled by a knob on the anemostat marked "OPEN" and "CLOSE." A cover is installed over a fourth opening in each main heating duct.

4—33. REMOVAL.

a. Remove the anemostats (6, 8, 9, 29, 30 and 32, figure 4—1) from each main heating duct (7 and 31) by removing the four spring nuts and screws from each unit.

Note

A cover is installed over a fourth opening in each main heating duct. In the left-hand duct, the opening is located between the forward and center anemostats (30 and 32). In the right-hand duct, the opening is located between the center and aft anemostat (8 and 9).

b. Remove the Fiberglas tape from all duct connections.

c. Remove the screws from the clips supporting the main heating ducts (7 and 31). Remove the main heating ducts.

d. Remove the screws, washers and nuts from the clamps at the top of the adapters (4 and 33). Loosen the wing bolts on the bottom clamps of the adapters and remove the adapters.

e. Remove the anemostats (2 and 36) from each cockpit duct (3 and 34) by removing the securing screws.

f. Remove the clamps securing the cockpit ducts (3 and 34) to the flexible defroster ducts (1). Remove the metal straps holding the cockpit ducts in place by removing the screws and nuts. Remove the cockpit ducts.

g. Remove the screws and clamps from the flexible defroster ducts (1) and remove the ducts.

4–34. INSTALLATION.

a. Position the flexible defroster ducts (1, figure 4–1) under the windshield in the cockpit and secure them with the clamps and screws.

b. Insert a cockpit duct (3 and 34) into each flexible defroster duct (1) and secure it with a clamp. Secure the cockpit ducts in position with the metal straps, screws and nuts.

c. Secure the anemostat (2 and 36) in each cockpit duct (3 and 34) with the screws.

d. Insert an adapter (4 and 33) into the end of each cockpit duct (3 and 34) and secure it with the clamps. Tighten the wing bolt on each clamp. Fasten the top part of each adapter to the cabin bulkhead with a clamp, screw, washer and nut.

e. Position each main heating duct (7 and 31) against the cabin wall and secure them in place with the mounting clips and screws.

f. Seal all duct connections with two-inch wide Fiberglas tape (index 48, paragraph 1–32).

g. Position the anemostats (6, 8, 9, 29, 30 and 32) in each main heating duct (7 and 31) and secure them in place with the spring nuts and screws.

Note

A cover is installed over a fourth opening in each main heating duct. In the left-hand duct, the opening is located between the forward and center anemostats (30 and 32). In the right-hand duct, the opening is located between the center and aft anemostat (8 and 9).

4–35. ENGINE PRE-HEAT DUCT.

4–36. DESCRIPTION. *(See figure 4–1.)* The engine pre-heat duct extends from the adapter (33) on the forward end of the left main heating duct to the carburetor air intake duct and supplies warm air to the carburetor in subnormal temperatures. When not in use, the openings in the adapter and in the clutch access (carburetor induction heat) door are capped and the ducts stored in the stowage bag at the left rear of the cabin.

4–37. REMOVAL.

a. Open the nose doors.

b. Disconnect the forward section of the engine pre-heat duct (39, figure 4–1) from the connector assembly (40) at the carburetor air intake duct. Remove the coupling securing the connector assembly (40) to the air intake duct and remove the connector assembly.

c. Unclamp the foward section of the engine pre-heat duct from the side cowl panel on the engine and remove the duct from the flange mounted on the canted bulkhead. Remove the screws, washers and nuts securing the clamp to the cowl panel and remove the clamp.

d. Remove the duct (39) and close the nose doors.

e. Disconnect the aft section of the duct (35) from the adapter (33) on the left main heating duct and from the flange on the clutch access (carburetor induction heat) door. Remove the duct (35) and install the cap in the adapter opening.

f. Release the Camloc fasteners and pull the clutch access door away from the bulkhead sufficiently to disconnect the center section of the duct (37) from the flange on the forward side of the door. Remove the door.

g. Remove the clamp securing the center section of the engine pre-heat duct to the auxiliary hydraulic pressure tube.

h. Reach into the clutch compartment and disconnect the duct (37) from the flange mounted on the canted bulkhead. Remove the duct.

i. Position the clutch access door on the bulkhead and secure it with the Camloc fasteners. Install the cap in the opening in the door.

j. Stow the engine pre-heat ducts and attaching parts in the stowage bag at the left rear of the cabin.

4–38. INSTALLATION.

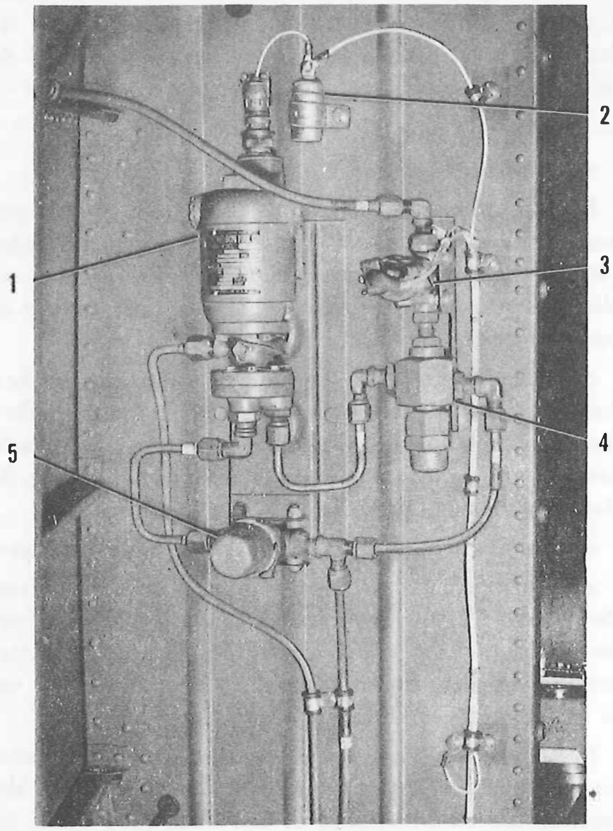
a. Release the Camloc fasteners and remove the clutch access (carburetor induction heat) door.

b. Reach into the clutch compartment and connect the center section of the engine pre-heat duct (37, figure 4–1) to the flange mounted on the canted bulkhead.

c. Secure the duct (37) to the auxiliary hydraulic pressure tube with the clamps, screw, washer and nut.

d. Connect the duct (37) to the flange on the inside of the clutch access door. Position the door on the bulkhead and secure it with the Camloc fasteners.

e. Remove the caps and connect the aft section of the duct (35) to the adapter on the left main heating duct (31) and to the flange on the clutch access duct.



1. Heater Fuel Pump
2. Noise Filter
3. Aft Fuel Shut-Off Valve
4. Pressure Relief Valve
5. Fuel Filter

Figure 4–2. Heater Fuel Pump, Valves and Filters

f. Open the nose doors.

g. Install the connector assembly (40) on the warm air entrance of the carburetor air intake duct and secure it with the coupling.

h. Connect one end of the forward section of the duct (39) to the connector assembly (40) and the other end to the flange mounted on the canted bulkhead.

i. Secure the duct (39) to the side cowl panel on the engine with the clamp, screws, washers and nuts.

j. Close the nose doors.

4–39. HEATER FUEL SYSTEM.

4–40. DESCRIPTION. *(See figures 4–1 and 4–2.)* The heater fuel system carries fuel from the forward fuel tank (figure 5–17) to the fuel inlet port of the heater (15, figure 4–1). The heater fuel system consists of the following components: the forward fuel shut-off valve (38), fuel filter (28), fuel pump (26), pressure relief valve (27), aft fuel shut-off valve (25), and the necessary fuel lines. Fuel is carried from the forward tank sump to the forward fuel shut-off valve which is located in the fuselage bottom structure. From this valve the fuel is carried to the fuel filter located in the heater compartment on the aft side of the electronics compartment rear bulkhead. From the filter, the fuel passes to the fuel pump located directly above the filter and then to the pressure relief valve which is suspended from the aft fuel shut-off valve. From the pressure relief valve the fuel passes through the aft fuel shut-off valve and then to the inlet port of the heater.

CAUTION

When removing any component of the heater fuel system be sure the "CABIN HEAT" switch on the overhead control panel is in the "OFF" position. Drain the fuel in the lines into a suitable container.

4–41. FUEL PUMP.

4–42. DESCRIPTION. *(See figure 4–1.)* The heater fuel pump (26) is secured to a bracket on the forward bulkhead in the heater compartment. The pump delivers fuel through the pressure relief valve (27) and aft fuel shut-off valve (25) to the heater (15). A drain line attached to the pump extends down and through the bottom of the helicopter. The fuel pump has a rated flow of 4 gph and an operating pressure of 25 psi. The electric motor which operates the fuel pump is a 27-volt dc, 1.0 ampere, explosion-proof unit.

4–43. REMOVAL.

a. Disconnect the electrical wiring from the top of the pump (1, figure 4–2).

b. Disconnect the drain, inlet and outlet tubes from the pump.

c. Cut the lock wire and remove the screws and washers that secure the pump to the bracket. Remove the pump.

d. Disconnect the wiring from the top of the noise filter (2). Unscrew the clamp and remove the clamp and noise filter from the bulkhead.

e. Remove the nipple from the drain port of the pump. Remove the union and gasket from the outlet port of the pump. Remove the elbow, gasket and nut from the inlet port of the pump.

4–44. INSTALLATION.

a. Install the elbow, gasket and nut in the inlet port of the pump (1, figure 4–2). Install the union an gasket in the outlet port of the pump. Install a nipple i. the drain port of the pump.

b. Position the pump on the bracket and secure it with the screws and washers. Lockwire the screws.

c. Connect the drain, inlet and outlet tubes to the pump.

d. Install the noise filter (2) on the bulkhead and clamp in place. Connect the wiring to the top of the filter.

e. Connect the electrical wiring to the receptacle at the top of the pump.

f. Check all connections for possible leakage while the neater is operating.

4—45. PRESSURE RELIEF VALVE.

4—46. DESCRIPTION. *(See figure 4—1.)* The pressure relief valve (27) is attached to the bottom of the aft fuel shut-off valve (25) which is secured to a bracket on the forward bulkhead in the heater compartment. The pressure relief valve opens at 12 psi and bypasses fuel back to the heater fuel pump (26).

4—47. REMOVAL.

a. Disconnect the inlet and outlet tubes from the elbows in the pressure relief valve (4, figure 4—2).

b. Disconnect the electrical wiring and the outlet tube from the aft-shut-off valve (3).

c. Remove the screws, washers, nuts and spacers that hold the shut-off valve to the bracket. Remove the pressure relief valve (4) and aft shut-off valve (3) as a unit.

d. Loosen the jam nut and unscrew the pressure relief valve (4) from the union in the inlet port of the aft shut-off valve (3).

e. Remove the elbow, gasket and nut from each port of the pressure relief valve (4).

4—48. INSTALLATION.

a. Install an elbow, gasket and nut in each port of the pressure relief valve (figure 4—2).

Note

These ports are directly opposite each other.

b. Check to see that a jam nut and gasket are installed on the union in the inlet port of the aft shut-off valve (3). Screw the pressure relief valve (4) onto the union. Tighten the jam nut.

Note

The inlet port of the pressure relief valve must be to the left.

c. Position both valves as a unit on the bracket in the heater compartment and secure the unit with the screws, washers, nuts and spacers.

d. Connect the electrical wiring and the outlet tube to the aft shut-off valve (3).

e. Connect the inlet and outlet tubes to the elbows in the pressure relief valve (4).

f. Check all connections for possible leakage while the heater is operating.

4—49. FORWARD FUEL SHUT-OFF VALVE AND SYSTEM STRAINER.

4—50. DESCRIPTION. *(See figure 4—1.)* The forward fuel shut-off valve (38), which controls the flow of fuel to the cabin heater fuel system, is mounted on a bracket in the fuselage bottom structure directly beneath the clutch compartment floor and on the center line of the helicopter. Access to the valve is provided by means of a hinged panel at the bottom of the helicopter. The valve is controlled by the "CABIN HEAT" switch on the overhead control panel (5). The heater fuel system strainer is installed in the sump of the forward fuel tank.

4—51. REMOVAL.

a. Drain the forward fuel tank.

b. Open the hinged access panel at the bottom of the helicopter at the forward end of the fuel lines fairing.

c. Disconnect the electrical wiring and the inlet and outlet tubes from the forward shut-off valve (38, figure 4—1).

d. Remove the screws, washers, nuts and spacers that hold the valve to the bracket. Remove the valve.

e. Remove the elbow, gasket and nut from each port of the valve.

f. Remove the fairing panel from the bottom of the helicopter beneath the forward fuel tank sump.

g. Release the clamps and remove the heater fuel tube which extends from the elbow in the forward fuel tank sump to the forward shut-off valve.

h. Remove the elbow and heater fuel strainer from the sump housing.

4—52. MAINTENANCE. Under normal conditions of operation, the valve will usually require no service between regular heater overhaul periods. If the valve is defective, replace or overhaul the valve in accordance with applicable directives. To clean the heater fuel strainer, wash the screen in unleaded gasoline until all sediment and dirt have been removed. If the dirt sticks, use a medium soft bristle brush to remove the imbedded particles. Clean other parts as necessary.

4—53. INSTALLATION.

a. Install the heater fuel strainer and elbow in the forward fuel tank sump housing.

b. Install an elbow, gasket and nut in each port of the forward shut-off valve (38, figure 4—1).

c. Position the valve on the bracket in the fuselage bottom structure and secure it with the screws, washers, nuts and spacers.

d. Connect the inlet and outlet tubes and the electrical wiring to the valve. Connect the valve inlet tube to the elbow at the forward fuel tank sump. Clamp the tube to the emergency fuel system tube.

Note

The inlet and outlet ports of the valve may be identified by the flow direction arrow on the valve.

e. Fill the forward fuel tank with fuel.

f. Check all fittings at the valve for possible leakage.

g. Close the hinged access panel at the bottom of the helicopter and install the fairing panel beneath the forward fuel tank sump.

4—54. TESTING.

a. Apply operating voltage with an ammeter in the line. Turn the power on and off several times to check valve operation. Refer to the valve specifications for correct amperage reading. A clicking sound will indicate that the valve is opening. If it does not function, replace the entire valve.

b. To check the valve for leakage, apply 35 psi air pressure to the inlet end of the valve and submerge the outlet end in water. If the valve leaks more than 20 bubbles per minute, clean the valve and make the air check again. If excessive leakage persists, replace or overhaul the valve in accordance with applicable directives.

CAUTION

Do not submerge valve coil in water while making this test.

4—55. AFT FUEL SHUT-OFF VALVE.

4—56. DESCRIPTION. *(See figure 4—1.)* The aft fuel shut-off valve (25) is mounted on the forward bulkhead in the heater compartment just to the right of the heater fuel pump (26). The valve controls the flow of fuel from the fuel pump to the cabin heater. The valve is contralled by the "CABIN HEAT" switch on the overhead control panel (5) and, during operation of the heater, by the 285°F and 150°F thermal switches (22 and 23). The pressure relief valve (27) is installed on a union in the intake port of the shut-off valve.

4—57. REMOVAL.

a. Disconnect the inlet and outlet tubes from the elbows in the pressure relief valve (4, figure 4—2).

b. Disconnect the electrical wiring and the outlet tube from the aft shut-off valve (3).

c. Remove the screws, washers, nuts and spacers that hold the shut-off valve to the bracket. Remove the pressure relief valve (4) and aft shut-off valve (3) as a unit.

d. Loosen the jam nut and unscrew the aft shut-off valve (3) from the union in the outlet port of the pressure relief valve (4).

4—58. MAINTENANCE. For maintenance instructions applicable to this valve, refer to paragraph 4—52.

4—59. INSTALLATION.

a. Check to see that a jam nut and gasket are installed on the union in the outlet port of the pressure relief valve (4, figure 4—2). Screw the inlet port of the aft shut-off valve (3) onto the union. Tighten the jam nut.

Note

The inlet and outlet ports of the shut-off valve (3) may be identified by the flow direction arrow on the valve. The inlet port of the pressure relief valve (4) must be to the left.

b. Position both valves as a unit on the bracket in the heater compartment and secure the unit with the screws, washers, nuts and spacers.

c. Connect the electrical wiring and the outlet tube to the aft shut-off valve (3).

d. Connect the inlet and outlet tubes to the elbows in the pressure relief valve (4).

e. Check all connections for possible leakage while the heater is operating.

4—60. TESTING. For testing instructions applicable to this valve, refer to paragraph 4—54.

4—61. FUEL FILTER.

4—62. DESCRIPTION. *(See figure 4—1.)* The heating system fuel filter (28) is secured to a bracket on the forward bulkhead of the heater compartment below the heater fuel pump (26). The filter is used to remove the solid foreign matter from the fuel supplied to the heater. The filter has a replaceable element of the compressed disc type. Fuel, passing between the discs, leaves impurities on the outside edge of the discs. Direction of fuel flow is from the outside of the filter element to the inside. Spring tension maintains the compression on the filter discs.

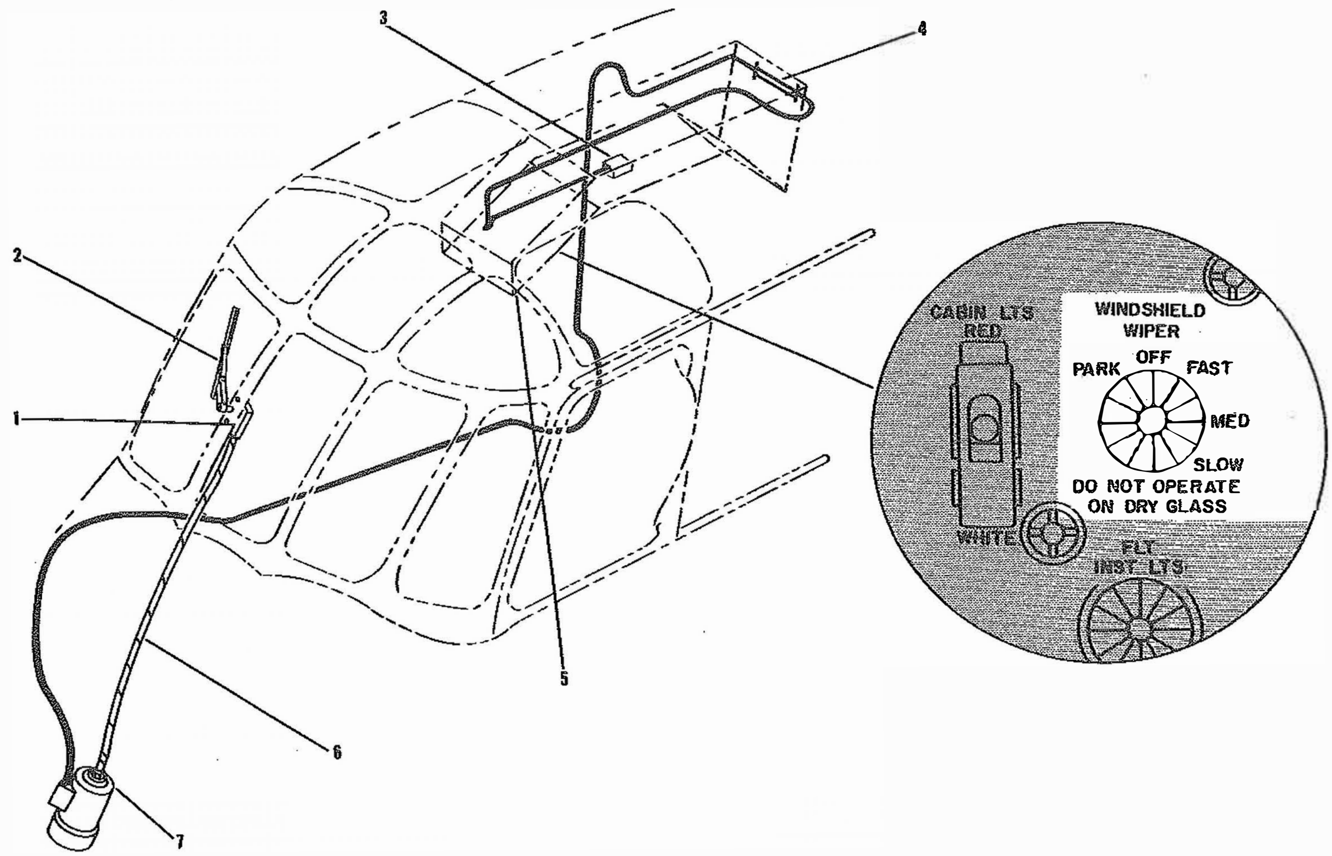
4—63. REMOVAL.

a. Disconnect the tubing from the outlet port of the filter (5, figure 4—2). Disconnect the tubing from the tee in the inlet port of the filter.

b. Remove the screws, washers and nuts that secure the filter to the bracket. Remove the filter.

c. Remove the union and gasket from the outlet port of the filter. Remove the tee, gasket and nut from the inlet port of the filter.

4—64. MAINTENANCE. Under normal conditions of operation, service will usually not be required between



1. Converter
2. Wiper Blade and Arm Assembly
3. Circuit Breaker
4. Resistors
5. Overhead Control Panel
6. Flexible Drive
7. Motor

Figure 4–3. Windshield Wiper System Diagram

heater overhaul periods. If the filter does require such service, replace or clean the filter element as follows:

a. Cut the lock wire and unscrew the filter bowl. Remove the filter element and retaining spring. Remove the gasket.

b. Replace the filter element. If a replacement is not available clean the element by applying compressed air to the open end of the element or by rinsing the element in clean gasoline and blowing in the open end.

c. Position the gasket, filter and retaining spring in that order in the filter head and install the bowl.

d. Tighten the filter bowl and lockwire the bowl to the head.

4–65. INSTALLATION.

a. Install the tee, gasket and nut in the "IN" port of the filter (5, figure 4–2). Install the union and gasket in the "OUT" port of the filter.

b. Position the filter on the bracket in the heater compartment and secure it with the screws, washers and nuts.

c. Connect the tubing to the tee in the inlet port of the filter and to the union in the outlet port.

4–66. CABIN VENTS.

4–67. DESCRIPTION. A vent is installed on both the left and right side of the cabin near the cabin rear bulkhead to allow the passage of air from the helicopter. An arm on the vent marked "OPEN, CLOSED" controls a valve mounted on a shaft inside the vent exhaust tube. A cap and screen, secured with screws, protects the internal opening of the exhaust tube from the entrance of foreign matter. A louver is riveted over the external opening of the exhaust tube. The vents are secured in place with rivets and are not removable.

4–68. WINDSHIELD WIPER SYSTEM.

4–69. DESCRIPTION. *(See figure 4–3.)* A single windshield wiper is installed on the right-hand, or pilot's side of the cockpit windshield. The wiper blade and the arm assembly (2), which operate over a 120-degree sector of the windshield, are connected to the shaft of a converter (1) on the windshield frame. The converter is driven by a dc electric motor (7) through a flexible drive (6). The motor is mounted on a bracket located at the canted fire wall behind the instrument panel just to the right of the center line of the helicopter. Access to the motor is gained by removing the instrument panel cowl. The windshield wiper is controlled by a "WINDSHIELD WIPER" switch on the overhead control panel (5) with the marked positions "PARK," "OFF," "FAST," "MED," "SLOW." The circuit is protected by a circuit breaker (3). Two resistors (4) to regulate the speed of the motor are installed in the relay and resistor installation (figure 7–9) located behind the cockpit dome light panel.

4–70. REMOVAL.

a. Remove the windshield wiper blade from the arm assembly (2, figure 4–3). Cut the lock wire and remove the bolt that holes the arm assembly to the shaft of the converter (1). Remove the arm.

b. Remove the instrument panel cowl. Disconnect the flexible drive (6) at the converter (1) and at the motor (7). Remove the screw and washer that secure the clamp around the flexible drive. Remove the clamp and the flexible drive.

c. Remove the bolts, washers and nuts that secure the converter (1) to the bracket. Remove the converter.

d. Disconnect the electrical wiring from the motor (7). Cut the lock wire and remove the bolts and washers that secure the motor to the bracket. Remove the motor.

4–71. INSTALLATION.

a. Secure the motor (7, figure 4–3) to the bracket with the bolts and washers. Lockwire the bolts. Connect the electrical wiring to the motor.

b. Position the converter (1) on the bracket and secure it with the bolts, washers and nuts.

c. Connect the flexible drive (6) to the converter (1) and to the motor (7). Position the clamp around the flexible drive and secure it to the post with the screw and washer. Replace the instrument panel cowl.

Note

For normal operation of the windshield wiper, the minimum recommended operating bend radius for the flexible drive (6) is six inches.

d. Secure the arm assembly (2) to the shaft of the converter (1) with the bolt. Do not lockwire the bolt. Install the wiper blade on the arm assembly.

e. Adjust the windshield wiper. (Refer to paragraph 4–72.)

4–72. ADJUSTMENT.

a. Loosen the nut on the wiper blade. Adjust the blade so the center line of the blade is eight degrees from the center line of the arm assembly with the outer end of the blade above the center line of the arm assembly. Tighten the nut.

Note

Move the arm assembly to the horizontal position before adjusting the blade.

b. Unbolt and remove the wiper blade and arm assembly (2, figure 4–3) from the shaft of the converter (1). Turn the "WINDSHIELD WIPER" switch to the "PARK" position and hold it there until the converter shaft stops moving. Turn the switch to "OFF." Install the wiper blade and arm assembly on the converter shaft with the blade at the top of the windshield and parallel to the left frame of the windshield. Secure the control arm to the shaft with the bolt. Lockwire the bolt.

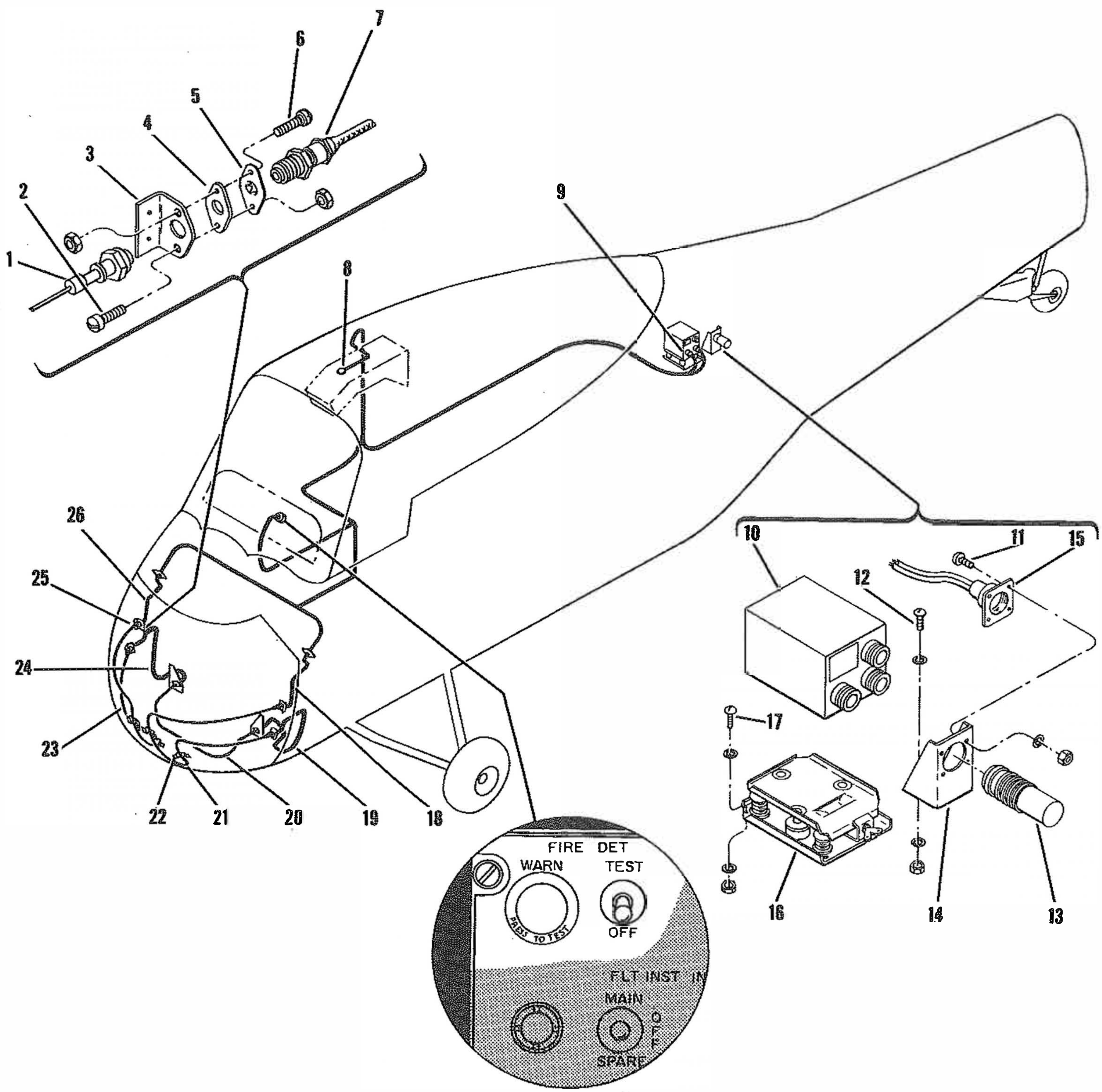
c. Move the wiper blade and arm (2) to the extreme outboard limit of blade travel. Adjust the tension screw on the arm channel until the blade exerts between 1½ and 2 pounds pressure against the windshield. Measure the tension at the tip of the arm in a direction perpendicular to the windshield surface.

4–73. FIRE DETECTOR SYSTEM.

4–74. DESCRIPTION. *(See figure 4–4.)* The fire detector system lights a red warning light in the cockpit in the event of fire in the engine compartment. The light is marked "FIRE DET WARN" and is located at the top of the main switch panel on the instrument panel. The fire detector system consists primarily of three sensing elements (20, 21 and 23), a relay (13) and a control unit (10). Each sensing element consists of two fine wires imbedded in a ceramic core which in turn is tightly fitted into an inconel tube. A fire detector sensing element is mounted on the inner surface of each nose door of the helicopter. The third sensing element is mounted beside the oil cell outlet tube near the bottom of the engine compartment. The relay and the control unit are both located in the electronics compartment on the shelf directly over the inverters. The sensing elements respond only to abnormal temperatures, 260°C (500°F) or above, making them continuously responsive to flame but not sensitive to normal engine temperature. A switch marked "FIRE DET TEST OFF" is located to the right of the "FIRE DET WARN" light at the top of the main switch panel. When this switch is placed in the "TEST" position, the "WARN" light will flash on if the system is in operating condition.

4–75. REMOVAL.

a. Cut the lock wire and disconnect the sensing elements (20, 21 and 23, figure 4–4) at the cap and plate assembly (25) at the supports near the hinged edge of



1. Pin Fitting
2. Screw and Nut
3. Support
4. Plate
5. Cap
6. Screw and Nut
7. Socket Fitting
8. Circuit Breaker
9. Plug
10. Control Unit
11. Screw, Washer, Nut
12. Screw, Washer, Nut
13. Relay
14. Bracket
15. Receptacle
16. Mounting Base
17. Screw, Washer, Nut
18. Cable Assembly
19. Cable Assembly
20. Sensing Element
21. Sensing Element
22. Shield
23. Sensing Element
24. Cable Assembly
25. Cap and Plate Assembly
26. Cable Assembly

Figure 4—4. Fire Detector System Diagram each nose door and at the supports located beside the oil cell outlet tube in the bottom of the helicopter.

b. Remove the screws from the clamps and remove the clamps, grommets and tabs from each sensing element. Remove the lower sensing element (20) from its position in the bottom structure.

Note

Index the position of each tab to simplify installation.

c. Remove the sensing element (21 and 23) from each nose door by working the sensing element out from under the shields (22).

d. Remove the screws and nuts (2 and 6) securing the cap (5) and plate (4) to the supports (3) on the doors and in the bottom structure.

e. Unscrew the plate (4) from the socket fitting (7) on each cable assembly (18, 19, 24 and 26) and remove the cap (5).

f. Remove the screws, clamps and grommets and remove each cable assembly.

g. Disconnect the three plugs (9) at the control unit (10) located on a shelf on the right side of the electronics compartment. Release the fastener that secures the control unit to its mounting base and remove the control unit.

h. Remove the screws, washers and nuts (17) from the mounting base (16) and remove the base.

i. Remove the relay (13) from the receptacle (15). Remove the screws, washers and nuts (11) securing the receptacle to the bracket (14). Remove the receptacle from the bracket.

j. Remove the screws, washers and nuts (12) securing the bracket (14) to the electronics compartment shelf. Remove the bracket.

4—76. REPLACEMENT. Since the fire detecting system is of the resetting type, replacement of the sensing element is not necessitated by exposure to fire. Replacement of a sensing element is necessary only when physical damage such as chafing, bending, twisting, or breaking has occurred.

4—77. INSTALLATION.

a. Position the fire detector relay bracket (14, figure 4—4) on the electronics compartment shelf and secure it with the screws, washers and nuts (12).

b. Position the receptacle (15) on the bracket (14) and secure it with the screws, washers and nuts (11). Insert the relay (13) into the receptacle.

c. Secure the control unit mounting base (16) to the electronics compartment shelf with the screws, washers and nuts (17).

d. Position the control unit (10) on its mounting base (16) and secure it in place with the fastener. Connect the three electrical plugs (9) to the control unit.

Note

To adjust the control unit (10), remove the unit from its mounting base (16), disconnect the electrical plug from the receptacle (J101) at the lower right corner of the unit, connect an 18,000 ohm resistor between pins "A" and "B" of the receptacle, loosen the potentiometer clamp nut and turn the adjusting screw to its full clockwise position. Turn the "BATT" and "FLT-MAIN-OFF-SPARE" switches on, turn the adjusting screw counterclockwise very slowly until the "FIRE DET WARN" light comes on and tighten the clamp nut.

e. Replace the cap (5) over the hex nut on the socket fitting (7) of each cable assembly (18, 19, 24 and 26) and screw the plate (4) on the fitting.

f. Line up the holes in the cap (5) and plate (4) and secure the cap and plate assemblies (25) to the supports (3) on each nose door and in the bottom structure with the screws and nuts (2 and 6). Lockwire the nuts.

g. Position the four cable assemblies (18, 19, 24 and 26) and secure each in place with the clamps and screws.

h. Work a sensing element (21 and 23) under the shields (22) on each nose door. Position the sensing element (20) in the bottom structure near the oil outlet tube. Secure each pin fitting (1) of each sensing element to the socket fitting (7) on the end of the related cable assembly. Tighten the nut on each pin fitting with 60 to 80 inch-pounds torque.

CAUTION

The sensing elements must not be kinked, twisted or bent sharply. The minimum allowable curve radius is one inch.

i. Position the clamps and grommets on each sensing element (20, 21 and 23) and secure them with the screws.

Note

Install a tab under the clamp at the indexed positions. (Refer to paragraph 4—75, step b.)

4—78. TESTING.

Note

Equipment required to perform this test is limited to an ohmmeter for checking continuity and a megger (500-volt maximum output) with which the insulation resistance can be determined.

Note

Before power is applied, the following tests are to be performed.

a. The continuity check is made on the pin contact at both ends of the sensing elements (20, 21 and 23, figure 4—4) and should indicate a value equivalent to approximately 7-ohms-per-foot of element.

b. The insulation resistance of the system from pin contact to ground should be determined. This resistance, expressed in megohms, shall not be less than the insulation resistance divided by the number of elements in the system.

Note

There are three sensing elements (20, 21 and 23) employed in the fire detector system of the helicopter.

Note

If the preceding tests indicate the system is in satisfactory condition, power should be applied to the circuit. The steps listed below should then be followed.

c. The control unit (10) must be allowed to warm up for at least 30 seconds before operating the test switch.

d. Operate the test switch; this should cause the warning light of the system to operate, thereby indicating the continuity of the entire system inclusive of the control unit circuit.

4—79. FIRE EXTINGUISHER.

4—80. DESCRIPTION. *(See figure 4—5.)* A portable, pressurized fire extinguisher of one-quart capacity is installed in the forward, right corner of the cabin. It is held in place by a bracket with a tight-fitting, quick-release, spring-steel clamp. The bracket is secured with screws to a riveted bracket assembly on the transmission fitting bulkhead. To use the extinguisher, break the soft metal sealing wire installed between the filler cap and the handle. After breaking the wire, lift the handle up to uncover the trigger. The extinguisher is now ready for use. Squeeze the trigger and direct the stream at the base of the flame. The effective range of this fire extinguisher is 25 feet.

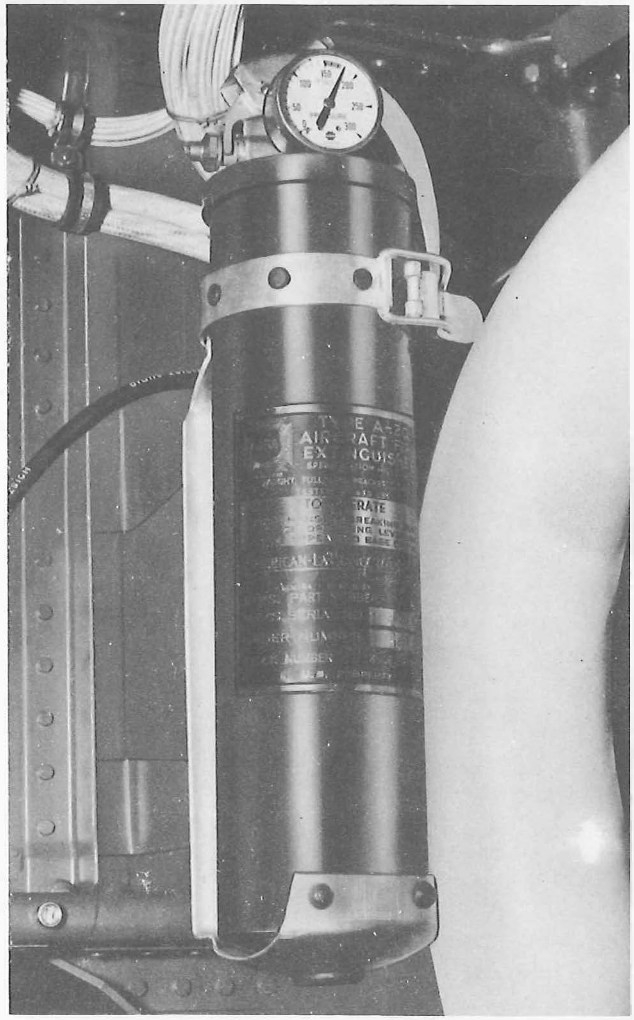


Figure 4—5. Fire Extinguisher Installed

4—81. CARGO SLING.

4—82. DESCRIPTION. Refer to paragraph 2—171 for description, removal and installation of the cargo sling.

SECTION V

POWER PLANT AND RELATED SYSTEMS

TABLE OF CONTENTS

Paragraph		Page
5—1.	**POWER PLANT SYSTEM**	**180**
5—3.	ENGINE	180
5—5.	ENGINE RATINGS	180
5—6.	ENGINE SPECIFICATIONS	180
5—8.	PRE-OILING ENGINE	180
5—9.	CLEANING INSTALLED ENGINE	181
5—10.	POWER PACKAGE	181
5—16.	ENGINE TOP OVERHAUL STAND	191
5—17.	ENGINE MOUNT	191
5—24.	DOUBLE BRACKET ASSEMBLIES	194
5—29.	ACCESSORY COMPARTMENT SHROUD	195
5—34.	FIRE SEAL	196
5—38.	ACCESSORY SECTION AND ENGINE MOUNT COOLING TUBES	197
5—42.	ENGINE CONTROLS	198
5—44.	THROTTLE CONTROL SYSTEM	198
5—49.	ADJUSTMENT	210
5—50.	CARBURETOR MIXTURE CONTROL SYSTEM	211
5—57.	ADJUSTMENT	214
5—58.	CARBURETOR AIR TEMPERATURE CONTROL SYSTEM	215
5—65.	ADJUSTMENT	216
5—66.	CONTROL QUADRANT	216
5—70.	ADJUSTMENT	217
5—71.	**FUEL SYSTEM**	**217**
5—73.	PRESSURE TESTING THE FUEL SYSTEM	217
5—77.	FORWARD FUEL TANK	219
5—82.	CENTER FUEL TANK	225
5—87.	AFT FUEL TANK	229
5—92.	EMERGENCY FUEL SYSTEM	233
5—97.	TESTING CHECK VALVES	234
5—98.	FUEL TANK VENT SYSTEM	235
5—103.	CARBURETOR	236
5—108.	IDLE ADJUSTMENT	237
5—109.	FUEL SELECTOR VALVE SYSTEM	238
5—111.	FUEL SELECTOR VALVE CONTROL	238
5—116.	RIGGING OF FUEL SELECTOR VALVE CONTROL	242
5—117.	FUEL SELECTOR VALVE	242
5—122.	FUEL SYSTEM STRAINER	244
5—127.	FUEL TANK STRAINERS	244
5—132.	ENGINE-DRIVEN FUEL PUMP	245
5—137.	ADJUSTMENT	246
5—138.	FUEL BOOSTER PUMP	246
5—143.	ADJUSTMENT	247

TABLE OF CONTENTS (Cont)

Paragraph		Page
5—144.	FUEL TRANSFER PUMPS	247
5—149.	ADJUSTMENT	248
5—150.	FUEL TRANSFER PUMP SWITCHES	248
5—152.	LEVEL CONTROL VALVE	248
5—157.	FUEL OVERFLOW SAFETY SYSTEM	249
5—161.	FUEL LOW PRESSURE WARNING SYSTEM	249
5—166.	TESTING LOW PRESSURE WARNING SYSTEM	250
5—167.	FUEL LOW LEVEL WARNING SYSTEM	251
5—172.	TESTING	251
5—173.	FUEL TANK SUMPS	251
5—178.	FUEL SYSTEM DRAIN	253
5—183.	FUEL TANK DRAINS	253
5—187.	FUEL QUANTITY SYSTEM	253
5—192.	ADJUSTMENT OF SYSTEM	255
5—193.	TESTING SYSTEM	256
5—195.	FUEL QUANTITY INDICATOR	257
5—201.	ADJUSTMENT	257
5—202.	TANK PROBES	257
5—207.	TESTING	258
5—208.	**LUBRICATION SYSTEM**	**258**
5—210.	OIL CELLS	258
5—212.	PRESSURE TESTING OIL CELLS	259
5—216.	OIL COOLER (OIL TEMPERATURE REGULATOR)	261
5—221.	OIL DILUTION SYSTEM	263
5—226.	DRAIN VALVE AND SWING CHECK	264
5—231.	**IGNITION SYSTEM**	**264**
5—234.	TESTING	265
5—235.	IGNITION HARNESS	265
5—236.	SPARK PLUGS	265
5—241.	IGNITION SWITCH	266
5—245.	TESTING	267
5—246.	INDUCTION VIBRATOR	267
5—250.	**STARTER SYSTEM**	**267**
5—252.	STARTER	267
5—257.	STARTER RELAY	268
5—261.	THROTTLE LIMIT SWITCH	268
5—265.	ADJUSTMENT	269
5—266.	**ENGINE COOLING SYSTEM**	**269**
5—271.	CONTRAVANE ASSEMBLY	271
5—275.	ADJUSTMENT	272
5—276.	**CARBURETOR AIR INDUCTION SYSTEM**	**272**
5—283.	CLEANING AIR FILTER	275
5—286.	**ENGINE EXHAUST COLLECTOR**	**276**
5—291.	**ENGINE INSTRUMENTS**	**277**
5—293.	FUEL PRESSURE GAGE SYSTEM	277
5—298.	FUEL QUANTITY SYSTEM	278
5—299.	FUEL LOW LEVEL WARNING SYSTEM	278
5—300.	FUEL LOW PRESSURE WARNING SYSTEM	278
5—301.	ENGINE OIL PRESSURE INDICATOR SYSTEM	278
5—302.	ENGINE OIL TEMPERATURE INDICATOR SYSTEM	278
5—303.	DUAL TACHOMETER INDICATOR SYSTEM	278
5—305.	ENGINE TACHOMETER-GENERATOR	278
5—309.	MANIFOLD PRESSURE GAGE SYSTEM	279
5—310.	CARBURETOR AIR TEMPERATURE INDICATOR SYSTEM	279
5—311.	CYLINDER HEAD TEMPERATURE INDICATOR SYSTEM	279

TABLE OF CONTENTS (Cont)

Paragraph		Page
5—312.	**TRANSMISSION SYSTEM**	**279**
5—314.	**HYDRO-MECHANICAL CLUTCH SYSTEM**	**279**
5—318.	CLUTCH AND FAN ASSEMBLY	279
5—323.	REPLACEMENT OF FAN BLADES	282
5—324.	BALANCING THE FAN ASSEMBLY	282
5—328.	CLUTCH PUMP	286
5—333.	**MAIN DRIVE SHAFT ASSEMBLY**	**287**
5—337.	MINOR REPAIRS	287
5—338.	MISALIGNMENT	288
5—340.	**MAIN GEAR BOX AND ROTOR QUICK CHANGE UNIT**	**288**
5—348.	**MAIN GEAR BOX ASSEMBLY**	**297**
5—354.	REPLACEMENT OF PARTS	299
5—364.	ADJUSTING OIL PRESSURE	301
5—365.	RUN-IN OF MAIN GEAR BOX	302
5—372.	METAL PARTICLES CONTAMINATION OF MAIN GEAR BOX	304
5—375.	**FORWARD AND AFT TRANSMISSION INSTALLATION**	**305**
5—377.	**MAIN GEAR BOX OIL COOLER AND BLOWER**	**306**
5—385.	ADJUSTMENT	309
5—386.	REPLACEMENT OF PULLEY BELTS	309
5—387.	**ROTOR BRAKE SYSTEM**	**309**
5—392.	FILLING AND BLEEDING ROTOR BRAKE SYSTEM	310
5—393.	ADJUSTMENT	311
5—394.	MASTER BRAKE CYLINDER	312
5—398.	ACCUMULATOR	312
5—402.	ROTOR BRAKE	313
5—406.	ADJUSTMENT	313
5—407.	**TAIL ROTOR DRIVE SHAFT**	**314**
5—418.	MINOR REPAIR	316
5—431.	ALIGNMENT OF TAIL ROTOR DRIVE SHAFT	320
5—432.	TAIL ROTOR DRIVE SHAFT RUBBER COUPLINGS	322
5—436.	**PYLON TRANSMISSION INSTALLATION**	**322**
5—438.	**TAIL ROTOR DRIVE SHAFT DISCONNECT COUPLING**	**322**
5—445.	REPLACEMENTS	325
5—448.	**DISCONNECT SHAFT ASSEMBLY**	**326**
5—451.	ALIGNMENT OF DISCONNECT SHAFT	326
5—453.	**INTERMEDIATE GEAR BOX**	**327**
5—463.	**PYLON DRIVE SHAFT**	**329**
5—469.	ALIGNMENT OF PYLON DRIVE SHAFT	329
5—472.	**TAIL ROTOR GEAR BOX ASSEMBLY**	**330**

5—1. POWER PLANT SYSTEM.

5—2. DESCRIPTION. The power plant system includes the engine, engine mount, engine accessories, engine controls, fuel system, lubrication system, ignition system, cooling system, air induction system and exhaust system.

5—3. ENGINE.

5—4. DESCRIPTION. A Wright model R-1820-84 nine-cylinder, air-cooled, single-row radial engine is installed in the model H-34A helicopter. The engine is equipped with a single-stage, single-speed supercharger and a direct-drive propeller shaft. The engine is installed facing aft with the propeller shaft approximately 35 degrees above the horizontal. The engine is supported by the engine mount which is bolted to the forward bulkhead of the fuselage bottom structure. A hydro-mechanical clutch is splined to the propeller shaft. The installation of the engine provides for ease of maintenance by allowing ready access to all accessories and components when the nose doors are open. The engine is installed in the helicopter as a power package and should be handled as a power package for purposes of removal or installation. (Refer to paragraph 5—10.)

5—5. ENGINE RATINGS. Refer to table XV for engine ratings.

TABLE XV

ENGINE RATINGS—WRIGHT MODEL R-1820-84

RATINGS	BHP	RPM	ALT IN FEET
Take-off			
(a) Sea Level	1425	2800	SL
(b) Critical	1425	2800	2900
Military			
(a) Sea Level	1400	2700	SL
(b) Critical	1400	2700	2950
Normal			
(a) Sea Level	1275	2500	SL
(b) Critical	1275	2500	3500

5—6. ENGINE SPECIFICATIONS. Refer to table XVI for engine specifications.

5—7. TROUBLE SHOOTING. Trouble shooting should be undertaken only by qualified personnel and in accordance with the manufacturer's recommendations. Refer to the Handbook of Service Instructions, T.O. 2R-R1820-42.

TABLE XVI

ENGINE SPECIFICATIONS—WRIGHT MODEL R-1820-84

NOMENCLATURE	SPECIFICATION
Type	Radial air-cooled
Number of Cylinders	9
Bore	6.125 inches
Stroke	6.875 inches
Compression Ratio	6.80:1
Weight Dry	1460 pounds
Length	52.0 inches
Diameter	55.74 inches
Propeller Shaft Rotation (Viewed from rear)	Clockwise
Impeller Ratio	7.21:1
Impeller Diameter	11.4 inches
Propeller Shaft Spline	No. 51
Fuel	(Index 1, paragraph 1—32)
Oil	(Index 2, paragraph 1—32)

5—8. PRE-OILING ENGINE.

CAUTION

The following procedure must be performed prior to starting the engine after an engine change, after the engine has been idle for more than 72 hours, or after air has been allowed to enter the oil inlet line to the engine in any manner.

a. Fill the oil tanks.

b. Open the nose doors and take out all of the rear spark plugs.

c. Remove the 1/4-inch pipe plug from the pre-oil connection on left side of oil pump body and the magnetic drain plugs from the front sump and the supercharger rear housing.

d. Remove the 1/4-inch pipe plug from the pre-oil connection forward of the check valve at the system Y-drain in the oil inlet line at the oil tanks. Expel all the air from the pre-oiler, attach the pre-oiler to the connection at the Y-drain, and, with the engine oil (index 2, paragraph 1—32) heated to 100° to 175°F (38° to 79°C), start the pre-oiler and crank the engine with the starter until clear oil with no air bubbles comes out of the 1/4-inch pre-oil connection on the oil pump body. Disconnect the pre-oiler and replace and safety the plug at the inlet line.

CAUTION

Be sure that the ignition switch is off and the mixture control is in the idle cut-off position. Do not crank the engine with the starter for more than 20-second periods.

e. Expel the air from the pre-oiler and attach the pre-oiler to the connection at the oil pump body. With the oil heated to 100° to 175°F (38° to 79°C), pump two to three gallons of engine oil (index 2, paragraph 1—32) into the engine. Crank the engine with the starter as soon as the oil pressure starts to rise.

f. As soon as the two or three gallons of oil have been pumped into the engine, discontinue pre-oiling.

g. Disconnect the pre-oiler. Install and lockwire the pre-oil plug, the front sump magnetic drain plug, and the supercharger rear housing magnetic drain plug. Install the spark plugs. Close the nose doors.

h. Operate the engine as soon as possible after pre-oiling. Start the engine in the normal manner, observing the engine oil pressure gage for indicated oil pressure.

CAUTION

Stop the engine if pressure does not begin to rise within five seconds and does not reach 40 psi within ten seconds after starting. Pre-oil the engine again before another start is attempted.

5—9. CLEANING INSTALLED ENGINE.

a. Spray the engine with a mixture of one part aircraft cleaning compound (index 25, paragraph 1—32) and nine parts of solvent (index 3, paragraph 1—32) or kerosene (index 19, paragraph 1—32). Allow the mixture to remain on the engine for 10 to 15 minutes.

b. Wash the engine with water.

c. Dry the engine with a clean cloth or with compressed air.

WARNING

Clean the engine with the helicopter away from buildings, vehicles or other helicopters. Ground the helicopter. Avoid breathing fumes by working from the windward side.

d. Lightly spray the engine with a mixture containing 75 percent engine oil (index 2, paragraph 1—32) and 25 percent aircraft engine corrosion compound (index 26, paragraph 1—32).

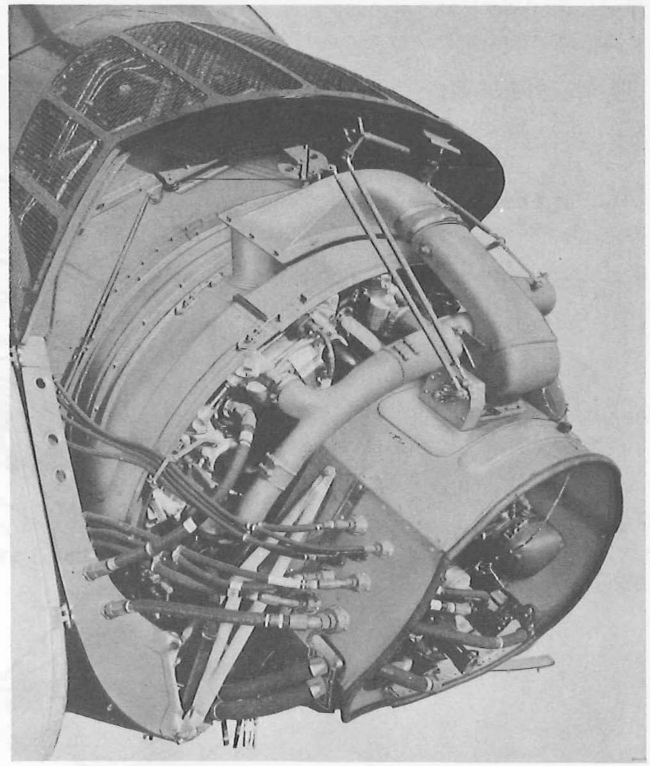


Figure 5—1. Power Package Installed

5—10. POWER PACKAGE.

5—11. DESCRIPTION. *(See figure 5—1.)* The engine is installed in the helicopter as a power package and should be handled as a power package when being hinged down for maintenance or top overhaul and during removal or installation. The power package is an engine quick-change pack-up comprising a Wright R-1820-84 engine installed on a special engine mount, all engine accessories, the cooling system, air induction system, exhaust system and the hydro-mechanical clutch. Also included in the power package are portions of the following systems: electrical wiring, ignition, fuel, lubrication, instrument, engine controls and flight controls hydraulic. Disconnect points are provided in each of the systems to separate the power package portion of the system from the fuselage portion. Directional references for the power package or its components are given as viewed from the accessory section of the engine. All other directional references are given as viewed from the airframe.

5—12. REMOVAL.
(See figure 5—2.)

CAUTION

Prior to removing the power package, perform a preservation run-in of the engine in accordance with applicable directives.

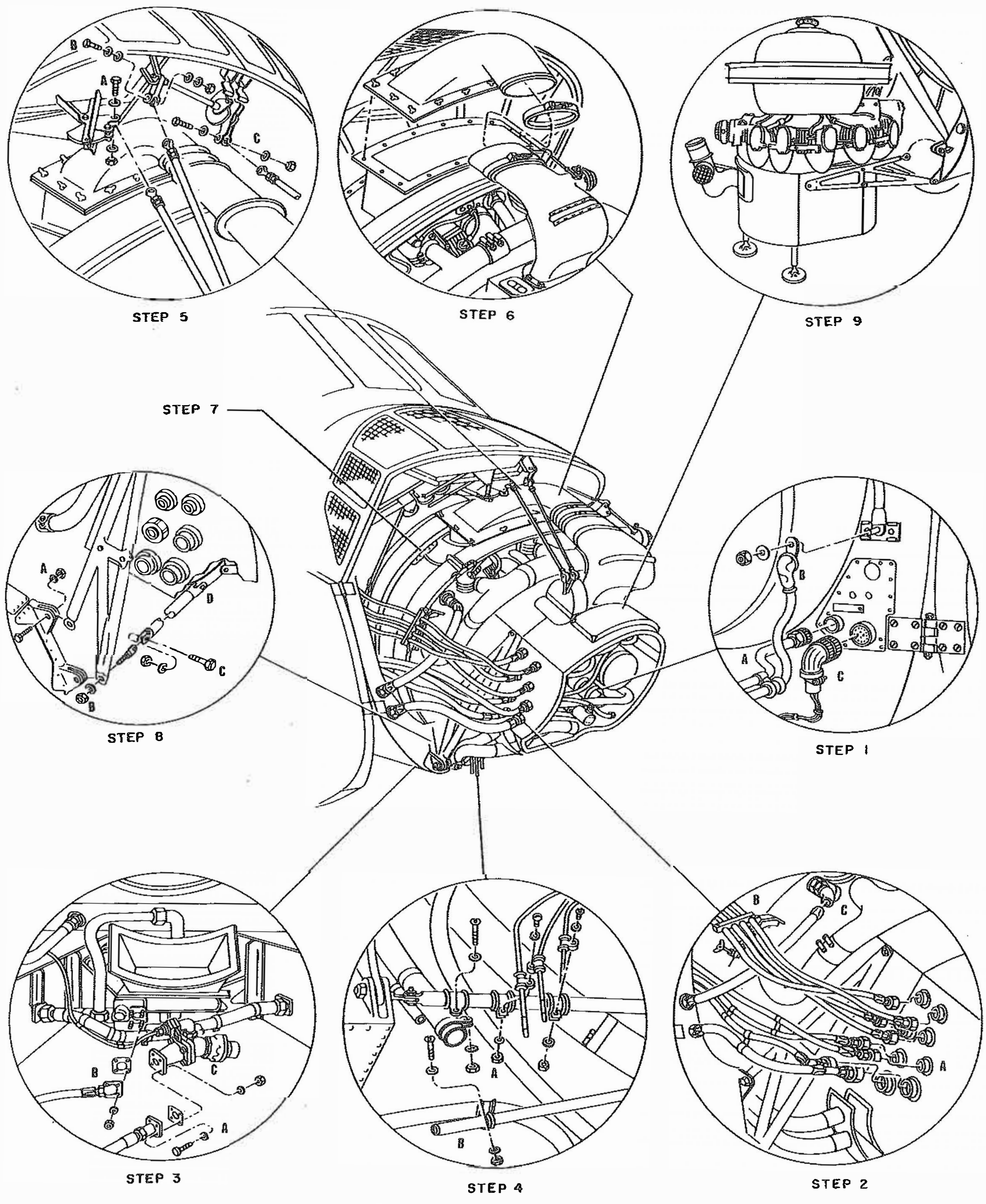


Figure 5–2. Power Package Removal — Installation

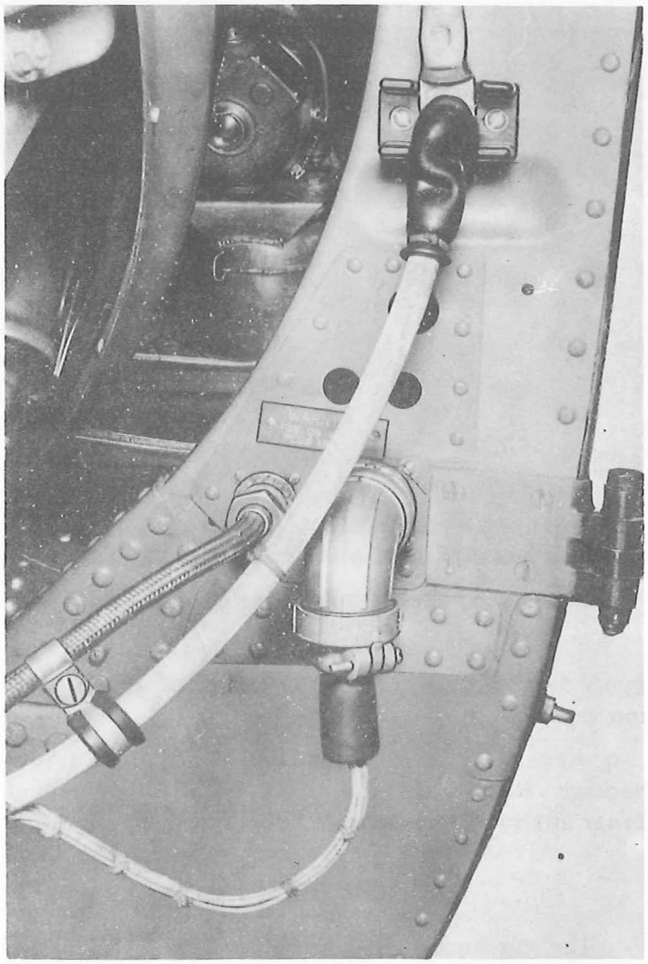


Figure 5–3. Power Package Electrical Disconnects

Note

Directional references for the power package or its components (paragraph 5–10) are given as viewed from the accessory section of the engine. All other directional references are given as viewed from the airframe.

a. Open the nose doors.

b. Place the fuel selector valve control (figure 5–16) in the "OFF" position.

c. Drain both oil cells at the drain valve at "C" (step 3, figure 5–2) just forward of the oil cooler.

d. Disconnect the ignition conduit at "A" (step 1), starter cable at "B" (step 1) and main electrical plug at "C" (step 1) at the left forward bulkhead in the engine compartment. (See figure 5–3.)

e. Disconnect the eight hose lines at the outboard side of the left accessory compartment shroud panel at "A" (step 2, figure 5–2). (See figure 5–4.)

f. Loosen the wing nut at the support assembly at "B" (step 2, figure 5–2) that supports the manifold pressure, oil pressure, fuel pressure and vapor return

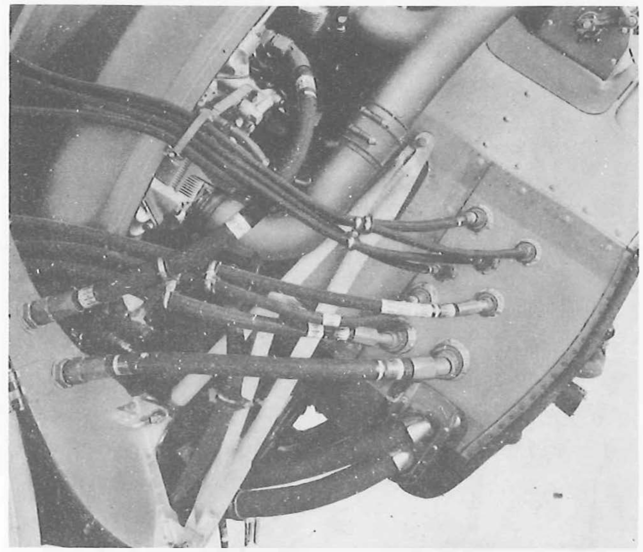


Figure 5–4. Power Package Hose Line Disconnects

hose lines at the intake rocker box of number eight cylinder. Open the support assembly and free the hose lines.

g. Disconnect the engine oil vent line at "C" (step 2) at the elbow in the intercylinder air deflector between number eight and number nine cylinders.

h. Cut the lock wire and loosen the nuts that secure the engine oil inlet hose line flange at "A" (step 3) to the forward flange of the housing at the drain valve just forward of the oil cooler. Drain the oil from the hose. Remove the bolts, washers and nuts and remove the hose line flange and gasket.

i. Cut the lock wire and loosen the nuts that secure the engine oil outlet hose line flange at "B" (step 3) to the inlet port at the forward, right corner of the oil cooler. Drain the oil from the hose. Remove the washers and nuts and remove the hose line flange and gasket.

j. Remove the clamps that secure the engine oil vent, fuel pump drain, hydraulic pump drain and supercharger drain lines to the left engine mount sway brace at "A" (step 4).

k. Remove the clamps that secure the intake pipe drain lines at "B" (step 4) of number four, number five and number six cylinders to the interconnecting tube between the oil cells.

l. Disconnect the upper end of the throttle control rod at "A" (step 5), the carburetor mixture control rod at "B" (step 5) and the carburetor air temperature control rod at "C" (step 5) at the canted bulkhead.

m. Remove the air induction system cold air elbow (step 6). (Refer to paragraph 5–278.) Disconnect the engine pre-heat duct. (Refer to paragraph 4–37, steps b. and c.)

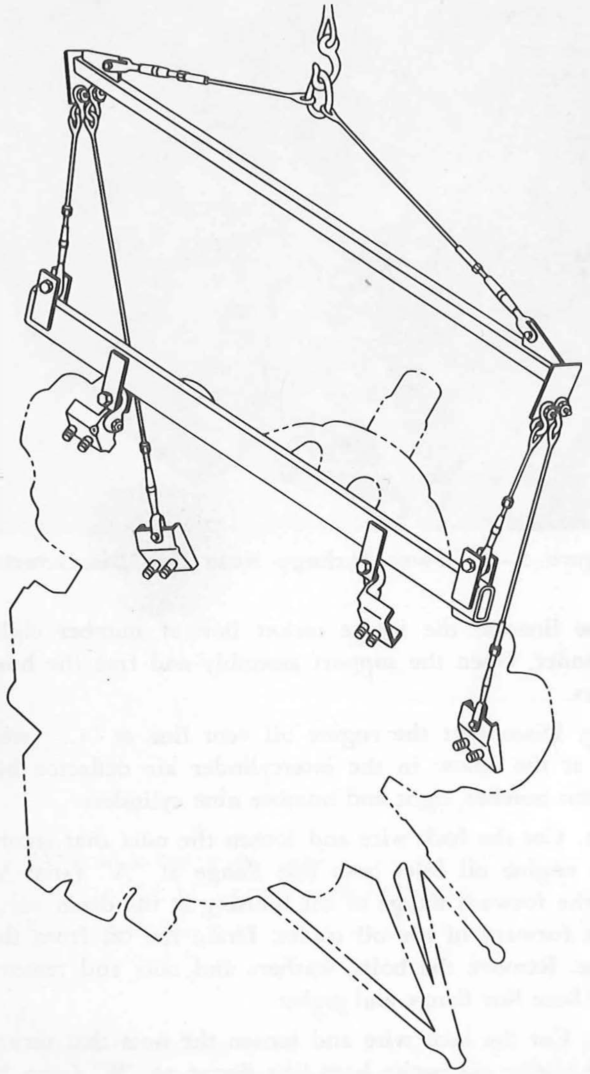


Figure 5–5. Use of Special Sling on Power Package

n. Unsnap the clamps and remove the top and side engine cowling panels and the right section of the lower cowling panel (step 7, figure 5–2).

o. Remove the clutch access door from the cabin forward bulkhead. Disconnect the clutch oil inlet and oil outlet lines at the clutch. Disconnect the clutch restraining cable at the clutch. Remove the bolts, washers and nuts that secure the upper rubber coupling of the main drive shaft to the splined flange at the top of the clutch.

p. Attach the two fittings that are secured to the short beam assembly of a sling, Sikorsky part No. S1670-10397, to the forward surface of the intake rocker box of number two and number nine cylinders. Attach the two fittings that are secured to the end of each cable of the sling to the forward surface of the intake rocker box of number four and number seven cylinders. (See

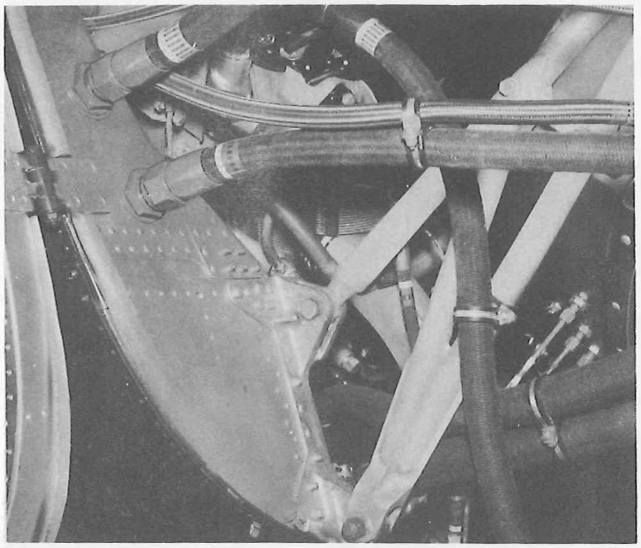


Figure 5–6. Engine Mount Attachment Points

figure 5–5.) Attach the sling to a hoist of at least two-ton capacity.

q. Raise the hoist to apply a slight lift to the power package. Relieve the torque on both engine mount lower attachment eyebolts at "B" (step 8, figure 5–2).

CAUTION

The nut on each engine mount lower attachment eyebolt must be loosened before the upper attachment bolts are removed for either hinging the power package down or removing the power package. (See figure 5–6.)

Note

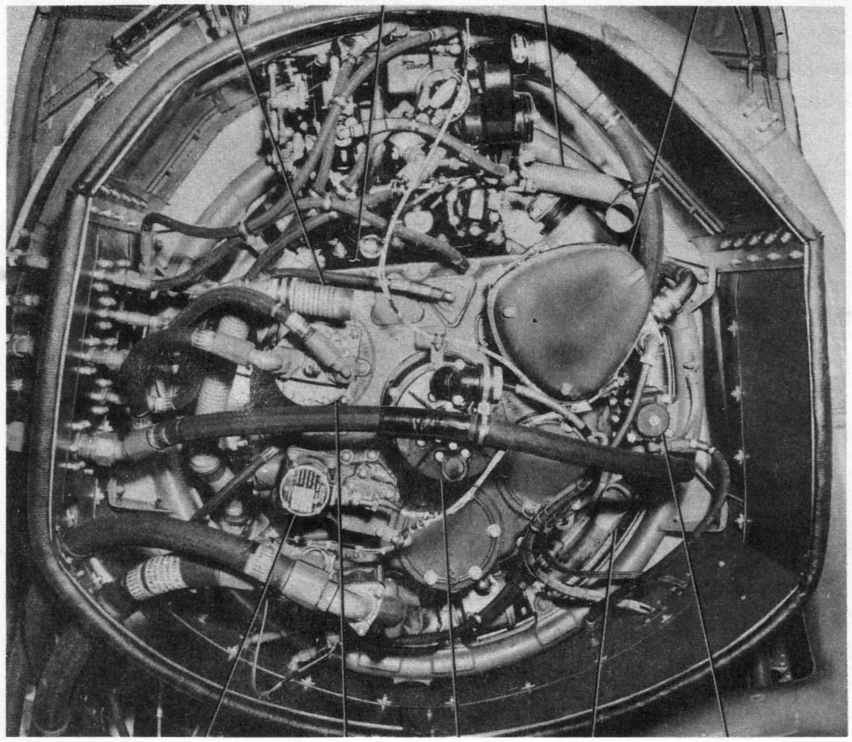
To hinge the power package down for maintenance or top overhaul, proceed with steps r. through t. To remove the power package from the helicopter, omit steps r. through t.

r. Install the engine top overhaul stands. (Refer to paragraph 5–16.)

s. Remove both engine mount upper attachment bolts at "A" (step 8, figure 5–2). Lower the power package to a horizontal position (step 9) with the sling, using the lower attachment eyebolts as hinge points. Support the power package in this position with the top overhaul stands. Remove the left section of the lower engine cowling panel. Remove the sling.

CAUTION

Do not attempt to support the power package in the hinged down position with the S14-50-4194



1. Flexible Magneto Cooling Tube
2. Carburetor
3. Flexible Magneto Cooling Tube
4. Dual Magneto Distributor
5. Engine-Driven Fuel Pump
6. Engine Mount Cooling Tube
7. Starter
8. Hydraulic Pump (Auxiliary Servo System)
9. Tachometer-Generator

Figure 5—7. Engine Accessory Section

link support, or any other link, between the holes in the engine mount arms and the corresponding holes in the brackets on the bottom structure, as structural failure may result. Always support the power package with the sling or the top overhaul stands.

t. Remove the clutch and fan from the engine shaft (paragraph 5—231, steps g. through p.) and remove the contravane assembly (paragraph 5—273) if it is necessary to gain access to the nose section of the engine.

Note

If the clutch and fan is to be replaced with a new or overhauled clutch and fan, remove the elbow, nut and gasket from the inlet port of the clutch. These items are not furnished with a new or overhauled clutch and fan.

u. Relieve the torque on the nut at the inboard end of each sway brace at "D" (step 8, figure 5—2). Remove the bolt, washer and nut that secure the outboard end of each sway brace to the lower attachment eyebolt at "C" (step 8). Swing the end of each sway brace away from the eyebolt.

v. Remove both engine mount upper attachment bolts first at "A" (step 8). Remove both engine mount lower attachment eyebolts at "B" (step 8).

w. Remove the power package from the helicopter. Remove the left section of the lower cowling panel.

x. Mount the power package on a suitable stand. Remove the sling from the engine.

Note

If the power package is to be disassembled, leave the sling on the engine.

Note

If the power package is to be replaced with a new power package, remove the elbow, nut and gasket from inlet port of the clutch. These items are not furnished with a new power package.

5—13. DISASSEMBLY.

Note

Directional references for the power package or its components (paragraph 5—10) are given as viewed from the accessory section of the engine. (See figure 5—7.)

a. Remove the clutch and fan from the engine drive shaft. (Refer to paragraph 5—321, steps g. through p.)

b. Remove the contravane assembly from the nose section of the engine. (Refer to paragraph 5—273.)

c. Remove the exhaust collector. (Refer to paragraph 5—288.)

d. Remove the air intake duct and carburetor. (Refer to paragraph 5—105.)

e. Remove the right accessory compartment shroud panel and engine-driven fuel pump. (Refer to paragraph 5—134.)

f. Remove the hydraulic pump. (Refer to paragraph 2—457.)

g. Disconnect the wiring from the oil temperature bulb at "A" (step 1, figure 5—8) in the bottom of the oil pump. Remove the bulb and install a protective plug.

h. Remove the left accessory compartment shroud panel (step 2). (Refer to paragraph 5—31.)

i. Disconnect the bonding jumper from the carburetor control pad on the upper, left corner of the supercharger rear housing at "D" (step 2, figure 5—8).

j. Remove the starter (step 3). (Refer to paragraph 5—255.)

k. Remove the tachometer-generator. (Refer to paragraph 5—307.) Remove the wiring clamp bracket from the right-hand tachometer substituting cover and the ground wire terminal from the tachometer drive housing mounting pad (step 4, figure 5—8).

l. Disconnect the manifold pressure hose line at the restrictor assembly in the manifold pressure connection at "A" (step 5, figure 5—8). Remove the restrictor assembly from the connection port and install a protective plug.

m. Disconnect the oil pressure hose line at the restrictor assembly in the main oil pressure transmitter flange at "B" (step 5). Remove the restrictor assembly from the transmitter flange port and install a protective plug.

n. Remove the fuel and oil lines support assembly (step 6) from the intake rocker box of number eight cylinder.

o. Disconnect the oil vent tube from the elbow in the flange on the crankcase front section of the engine and from the elbow in the intercylinder air deflector between number eight and number nine cylinders. Remove the elbow, nut and washer from the deflector.

p. Remove the elbows, cover and gasket from the oil separator pad.

q. Remove the clamps that secure the oil breather hose to the left engine support arm. Disconnect the hose from the elbow in the intercylinder air deflector between number seven and number eight cylinders. Remove the elbow, nut and washer from the deflector.

r. Disconnect the tube and hose line from each of the three elbows in the lower, left portion of the shroud cover (step 7). Remove the elbows, washers and nuts from the cover.

s. Remove the hose line, gasket, nut and elbow from the supercharger drain port of the engine at "A" (step 8). Install a protective plug in the port.

t. Disconnect the pump vent tube and hose line from the elbow in the lower, right portion of the shroud cover at "B" (step 8). Remove the elbow, washer and nut from the cover.

u. Disconnect the ignition conduit from the magneto (step 9).

v. Disconnect the leads from the cylinder temperature bulb at the number seven cylinder. Remove the temperature bulb (step 10).

w. Remove the grommet and phenolic support from each of the two holes where the engine wiring and ignition conduit pass through the lower, right portion of the shroud cover at "C" (step 8).

x. Remove all clamps and brackets that secure the engine wiring to the engine. Pull all wiring through to the outside of the shroud cover.

y. Remove the accessory section and engine mount cooling tubes. (Refer to paragraph 5—40.)

CAUTION

Do not damage the asbestos seals in the fire seal when removing the tubes.

z. Remove the engine mount from the engine. (Refer to paragraph 5—18.)

aa. Remove the accessory compartment fire seal (step 12, figure 5—8). (Refer to paragraph 5—36.)

Note

The special engine adapting parts are shown as shaded items in figure 5—9. These items will always be removed when changing an engine as they are not included with replacement engines received from stock.

5—14. ASSEMBLY.

Note

Directional references for the power package or its components (paragraph 5—10) are given as viewed from the accessory section of the engine. (See figure 5—7.)

a. Install the accessory compartment fire seal (step 12, figure 5—8). (Refer to paragraph 5—37.)

b. Install the engine mount on the engine. (Refer to paragraph 5—23.)

c. Install the accessory section and engine mount cooling tubes. (Refer to paragraph 5—41.)

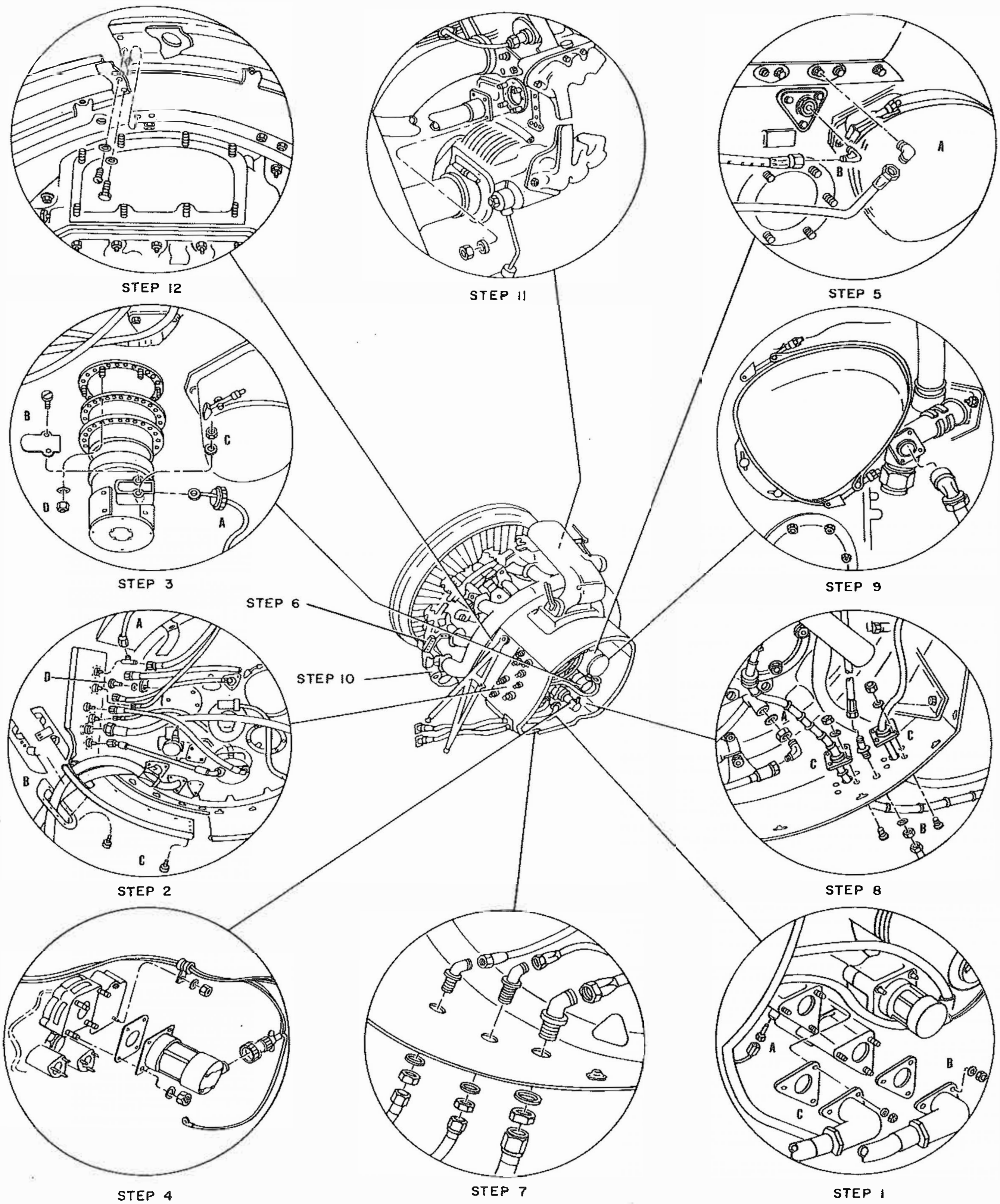
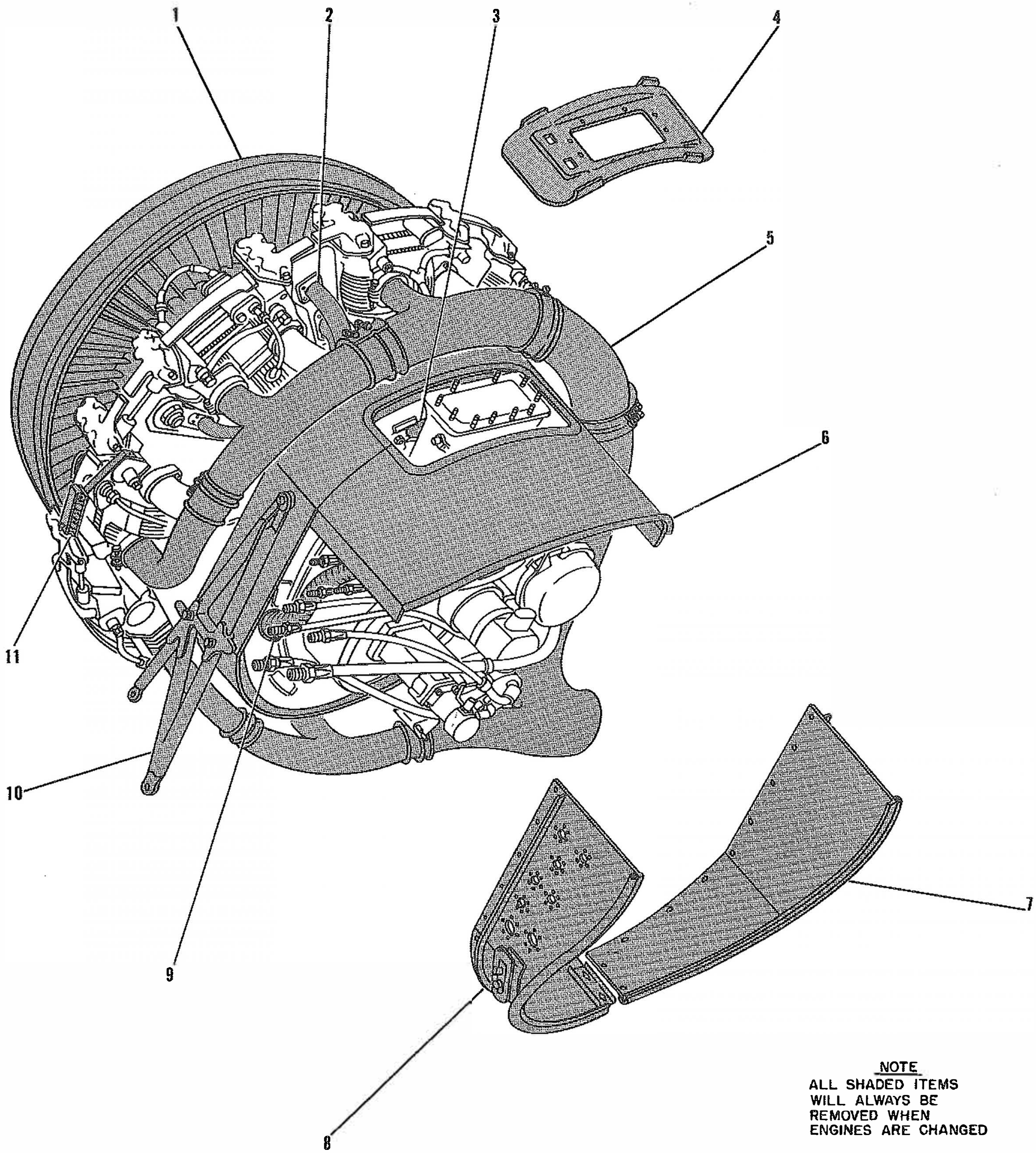


Figure 5—8. Power Package Assembly — Disassembly



1. Contravane Assembly
2. Cooling (Blast) Tube
3. Fire Seal
4. Well
5. Exhaust Collector
6. Accessory Compartment Shroud Cover Assembly
7. Right Shroud Panel
8. Left Shroud Panel
9. Flexible Tube
10. Engine Mount Assembly
11. Support Assembly

Figure 5—9. Engine Adapting Parts Diagram

Note

If a new fire seal is being installed, the asbestos seal must be cut carefully to obtain a tight seal around each cooling tube and to maintain the fire seal qualities of the seal. There must be a minimum of 1/8-inch of asbestos around each tube after installation.

d. Insert the inboard end of the ignition conduit through the upper hole in the lower right portion of the shroud cover at "C" (step 8, figure 5—8). Insert the inboard end of the engine compartment wiring through the lower hole at "C" (step 8).

e. Install the cylinder temperature bulb in the number seven cylinder (step 10). Connect the leads to the temperature bulb.

Note

Tape each of the two connections separately with friction tape (index 40, paragraph 1—32) and then tape both connections together. Apply a heavy coat of shellac (index 41, paragraph 1—32) over the tape.

f. Connect the ignition conduit to the magneto (step 9, figure 5—8).

g. Install the elbow, washers and nut in the lower, right portion of the shroud cover of "B" (step 8). Connect the pump vent tube and hose line to the elbow.

h. Install the elbow, nut and gasket in the supercharger drain port of the engine at "A" (step 8). Connect the hose line to the elbow.

i. Install the three elbows in the lower left portion of the shroud cover and secure them with the washers and nuts (step 7). Connect the tube and hose line to each elbow.

j. Install the elbow in the intercylinder air deflector between number seven and number eight cylinders and secure it with the washer and nut. Connect the oil breather hose to the elbow. Install the clamps that secure the hose to the left engine support arm.

k. Install the cover and gasket on the oil separator pad. Install the elbows in the cover.

l. Install the elbow in the intercylinder air deflector between number eight and number nine cylinders and secure it with the nut and washer. Connect the oil vent tube to the elbow and to the elbow in the flange on the crankcase front section of the engine.

m. Install the fuel and oil lines support assembly (step 6) at the intake rocker box of number eight cylinder.

n. Install the restrictor assembly in the port of the main oil pressure transmitter flange at "B" (step 5). Connect the hose line to the restrictor assembly.

o. Install the elbow in the manifold pressure connection port at "A" (step 5). Connect the hose line to the restrictor assembly.

p. Install the tachometer-generator. (Refer to paragraph 5—308.) Secure the wiring clamp bracket to the lower right-hand stud that attaches the right-hand tachometer substituting cover and connect the tachometer elecrical wiring. Secure the ground wire terminal on the lower left stud of the tachometer drive housing mounting pad (step 4, figure 5—8).

q. Install the starter (step 3, figure 5—8). (Refer to paragraph 5—256.)

r. Connect the bonding jumper to the carburetor control pad on the upper, left corner of the supercharger rear housing at "D" (step 2, figure 5—8).

s. Install the left accessory compartment shroud panel at "C" (step 2). (Refer to paragraph 5—33.)

t. Install the oil temperature bulb in the bottom of the oil pump at "A" (step 1, figure 5—8). Connect the wiring to the bulb.

u. Install the hydraulic pump. (Refer to paragraph 2—458.)

v. Install the engine-driven fuel pump and right accessory compartments shroud panel. (Refer to paragraphs 5—136 and 5—33.)

w. Install the carburetor and air intake duct. (Refer to paragraphs 5—33 and 5—107.)

x. Install all clamps and brackets that secure the engine wiring to the engine. Install the grommet and two-piece phenolic support at each of the two holes where the engine wiring passes through the lower, right portion of the shroud cover at "C" (step 8, figure 5—8).

y. Install the exhaust collector. (Refer to paragraph 5—290.)

z. Install the contravane assembly. (Refer to paragraph 5—274.)

aa. Install the clutch and fan. (Refer to paragraph 5—327, steps b. through s.)

5—15. INSTALLATION.
(See figure 5—2.)

Note

Directional references for the power package or its components (paragraph 5—10) are given as viewed from the accessory section of the engine. All other directional references are given as viewed from the airframe.

Note

If the power package was removed from the helicopter, omit steps a. and e. If the power package was hinged down for maintenance or top overhaul, omit steps c., d. and h.

a. Install the contravane assembly (paragraph 5—274) and the clutch and fan (paragraph 5—327, steps b. through s.) if they were removed.

Note

If a new or overhauled clutch and fan is being installed, install the elbow nut and gasket in the clutch inlet port. (Refer to paragraph 5—12, step s.)

b. Install a sling, Sikorsky part No. S1670-10397, on the engine. (Refer to paragraph 5—12, step p.) Attach the sling to a hoist of at least two-ton capacity.

c. Remove the power package from the stand and position it at the front of the helicopter. Position the left section of the lower engine cowling panel on the engine.

d. Align the lower attachment hole in each engine mount support arm with the corresponding hole in the bracket on the fuselage bottom structure. Install the eyebolts, washers and nuts at "B" (step 8, figure 5—2).

Note

Install each eyebolt from the inboard side of the bracket.

e. Support the weight of the power package with the hoist. Check to see that the nut on each lower attachment eyebolt at "B" (step 8) is loose. Position the lower engine cowling panel on the engine. Raise the power package to the installed position using the lower attachment eyebolt as hinged points.

f. Align the upper attachment holes. Install the upper attachment bolts, washers and nuts at "A" (step 8).

Note

Install the bolt with the head of the bolt outboard.

Note

To assist in aligning the upper attachment holes, disconnect the cable fitting from number four and number seven cylinders. The holes may then be aligned by raising the upper cable assembly.

g. Tighten the nut on each upper attachment bolt at "A" (step 8) with 400 to 460 inch-pounds torque. Install the cotter pin.

h. Position the outboard end of each sway brace over the corresponding lower attachment eyebolt. Install the bolt, washer and nut to secure each sway brace to the eyebolt at "C" (step 8). Tighten the nuts with 50 to 55 inch-pounds torque. Tighten the nut at the inboard end of each sway brace with 50 to 55 inch-pounds torque at "D" (step 8).

i. Tighten the nut on each lower attachment eyebolt with 400 to 460 inch-pounds torque at "B" (step 8).

j. Remove the sling from the engine. Remove the engine top overhaul stands from the engine mount ring.

k. Install the lower rubber coupling of the main drive shaft. (Refer to paragraph 5—339, step c.) Connect the clutch restraining cable at the clutch. Connect the clutch oil inlet and oil outlet lines at the clutch. Replace the clutch access door in the cabin forward bulkhead.

l. Install the top and slide engine cowling panels and the right section of the lower panel (step 7, figure 5—2). Secure the clamps on each of the four panels.

Note

To assure proper alignment of the upper cowl panel and the carburetor intake duct, align the red stripe on the upper panel with the red stripe on the bead of the contravane assembly.

m. Install the air induction system cold air elbow (step 6). (Refer to paragraph 5—285.) Connect the engine preheat duct to the air intake duct. (Refer to paragraph 4—38, steps g. through i.)

n. Connect the upper end of the throttle control rod at "A" (step 5, figure 5—2), the carburetor mixture control rod at "B" (step 5) and the carburetor air temperature control rod at "C" (step 5) at the canted bulkhead.

o. Install the clamps that secure the intake pipe drain line at "B" (step 4) of number four, number five and number six cylinders to the interconnecting tube between the oil cells.

p. Install the clamps that secure the engine oil breather, fuel pump drain, hydraulic pump drain and supercharger drain lines to the left engine mount sway brace at "A" (step 4).

q. Install a new gasket at "B" (step 3) at the inlet port at the forward, right corner of the oil cooler. Secure the engine oil outlet hose line flange to the port with the washers and nuts. Lockwire the nuts.

r. Install a new gasket at "A" (step 3) on the flange of the housing at the drain valve just forward of the oil cooler. Secure the oil inlet hose line flange to the fitting with the bolts, washers and nuts. Lockwire the nuts.

s. Connect the engine oil vent line at "C" (step 2) to the elbow in the intercylinder air deflector between number eight and number nine cylinders.

t. Connect the eight hose lines at the outboard side of the left accessory compartment shroud panel at "A" (step 2).

u. Secure the fuel and oil lines support assembly at "B" (step 2) around the manifold pressure, oil pressure, fuel pressure, and vapor return hose lines at the intake rocker box of number eight cylinder by means of the wing nut.

v. Connect the ignition conduit at "A" (step 1), starter cable at "B" (step 1), and main electrical plug at "C" (step 1) at the left, forward bulkhead in the engine compartment.

w. Close the drain valve at "C" (step 3) just forward of the oil cooler. Fill the oil cells. (See figure 1–14.)

WARNING

Do not overfill. Overfilling reduces necessary foaming space.

x. Place the fuel selector valve control (figure 5–16) in the "ON" position. Check all fuel system hose lines and fittings for leakage with the booster pump on.

y. Check the adjustment of the throttle control system (paragraph 5–49), the carburetor mixture control system (paragraph 5–57) and the carburetor air temperature control system (paragraph 5–65).

z. Pre-oil the engine.

CAUTION

The engine must be pre-oiled immediately prior to starting after an engine change, after the engine has been idle for more than 72 hours, or after air has been allowed to enter the oil inlet line to the engine in any manner. For instructions on pre-oiling the engine, refer to paragraph 5–8.

aa. Perform an engine "run-in" in accordance with applicable directives.

ab. Close the nose doors.

5–16. ENGINE TOP OVERHAUL STAND. Two engine stands, Sikorsky part No. S1670-10442, are provided for top overhaul or maintenance of the power package. The stands are used to support the power package when it is in the hinged down position and allow freedom of access to the nose section of the engine without interference from the sling. To install the stands, proceed as follows:

a. Remove the upper accessory compartment shroud panel. (Refer to paragraph 5–31, steps k. and l.)

b. Position an engine stand support fitting on the engine mount ring behind the upper mounting bracket (7, figure 5–11) of each upper double bracket assembly and secure the fitting with the bolt and washer.

c. With the base bolted to the jack screw at the lower end of the support tube and the jack screw in all the way, fit the upper end of a tube over each support fitting on the engine mount ring. Hold both tubes on the support fittings while the power package is lowered to a horizontal position with the sling.

d. Lengthen the tubes to support the power package in the desired position by unscrewing the jack screws at the bottom of the tubes.

e. Remove the sling.

5–17. ENGINE MOUNT.

5–18. DESCRIPTION. *(See figure 5–10.)* The engine mount supports the engine within the engine compartment at the front of the helicopter. The engine mount assembly consists primarily of the accessory compartment shroud (paragraph 5–29) and the engine mount ring to which are bolted two engine mount support arms. The engine mount ring supports three double bracket assemblies (paragraph 5–24) which are bolted to six of the engine mounting lugs. The engine mount support arms, which support the engine mount ring, are bolted at the lower end to brackets on the forward bulkhead of the fuselage bottom structure (figure 5–6). A sway brace extends from each support arm lower attachment eyebolt to a plate on the engine mount ring. The accessory compartment shroud cover assembly encircles the engine mount ring and is installed between the ring and the support arms.

5–19. REMOVAL.

a. Remove the power package from the helicopter. (Refer to paragraph 5–12.)

b. Disassemble the power package. (Refer to paragraph 5–13, steps a., c., e. through k. and q. through x.)

c. Remove the two flexible tubes from the accessory section of the engine. (Refer to paragraph 5–40, steps a. and b.)

d. Attach the sling, Sikorsky part No. S1670-10397, to a hoist of at least two-ton capacity. Remove the power package from the stand.

e. Install a hoisting eye on the engine propeller shaft. Attach a hoist of at least two-ton capacity to the hoisting eye.

f. Carefully transfer the weight of the power package from the sling to the hoisting eye.

CAUTION

Keep the power package clear of the floor at all times.

g. Remove the sling from the engine.

h. Cut the lock wire and remove the two internal wrenching bracket bolts (5, figure 5–11) and spherical washers (6) from the double bracket assembly at the bottom of the engine using the hex wrench, LAW 114. Remove the bolts, washers and nuts (3) that secure the double bar (2) and remove the double bar.

i. Disconnect magneto lead elbow from the magneto.

j. Cut the lock wire and relieve the torque on the internal wrenching bracket bolts (5) that secure the two upper double bracket assemblies to the engine mounting lugs. Support the engine mount and remove each bolt and spherical washer (6).

k. Lower the engine mount from the engine.

CAUTION

The magneto lead elbow must pass between the right-hand double bracket assembly double bar (2) and the engine mount ring. The oil sump external oil tube must pass between the brackets of the lower double bracket.

l. Replace the double bar (2) on the lower double bracket assembly and secure it loosely with the bolts, washers and nuts (3).

m. Replace the internal wrenching bracket bolts (5) and spherical washers (6) in each double bracket assembly.

n. Connect the magneto lead elbow to the magneto.

Note

Disposition of the engine should be made in accordance with applicable directives.

5—20. DISASSEMBLY.

a. Unbolt each sway brace from the plate on the engine mount ring (step 1, figure 5—10).

Note

Index each sway brace to the plate to insure proper installation.

b. Remove the bolts, washers and nuts that secure each support arm to the mount ring (step 2). Remove each support arm.

c. Remove the screw, nut and phenolic spacer that secure the shroud cover assembly to each clamp on the engine mount ring (step 3).

d. Remove the ring "A" (step 4, figure 5—10) from inside the cover assembly "C" (step 4). Remove the clamps "B" (step 4) from the ring.

e. Remove each double bracket assembly "D" (step 5) from the engine mount ring "A" (step 5). (Refer to paragraph 5—26.)

f. Disconnect both bonding jumpers from the lugs on the engine mount ring (step 6).

5—21. MAINTENANCE.

a. Inspect the welded joints on each sway brace.

b. Inspect all welded joints and bushings on the support arms.

c. Inspect all welded joints on the engine mount ring.

d. Inspect the double bracket assemblies in accordance with applicable directives.

5—22. ASSEMBLY.

a. Install each double bracket assembly "D" (step 5, figure 5—10) on the lugs of the engine mount ring "A" (step 5). (Refer to paragraph 5—28.)

b. Secure the bonding jumpers to the lugs on the engine mount ring (step 6, figure 5—10).

Note

Scrape the paint from the sides of the lugs to insure a satisfactory electrical connection.

c. Position the clamps "B" (step 4) around the engine mount ring "A" (step 4). Position the engine mount ring inside the shroud cover assembly "C" (step 4).

Note

The plate on the engine mount ring to which the sway braces attach must extend through the narrow slot in the lower shroud cover skirt.

CAUTION

If a new shroud cover is installed, the asbestos seal over the slot must be carefully cut to obtain a tight fit around the welded sway brace plate and to maintain an effective fire seal.

d. Position each support arm against the shroud cover skirt and the engine mount ring brackets. Align the holes in the support arms, shroud cover skirt and mount ring brackets (step 2).

e. Secure each support arm to the mount ring brackets with the bolts, washers and nuts (step 2). Tighten the nuts with 320 to 390 inch-pounds torque.

f. Insert the phenolic spacers between the clamps and the inner surface of the shroud cover. Secure the cover to the clamps with the bolts, washers and nuts (step 3).

g. Secure the inboard end of each sway brace to the plate on the engine mount ring (step 1).

Note

Each sway brace must be installed in its original position. Tighten the nuts fingertight at this time.

5—23. INSTALLATION.

a. If the engine mount is to be installed on a new or overhauled engine, install a hoisting eye on the engine propeller shaft and remove the engine from the shipping container. Also remove from the container the carburetor, carburetor screen and two gaskets, the spark

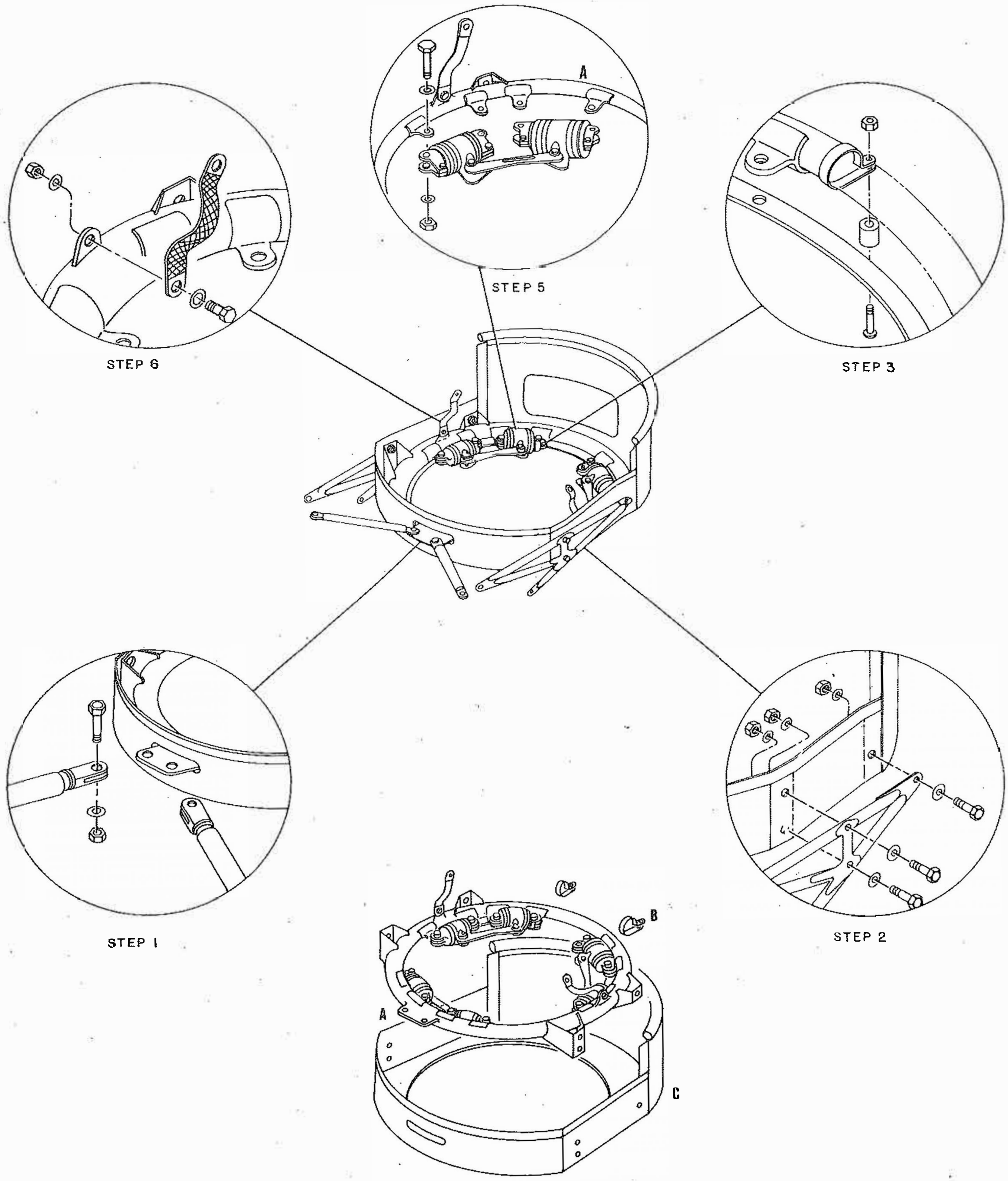
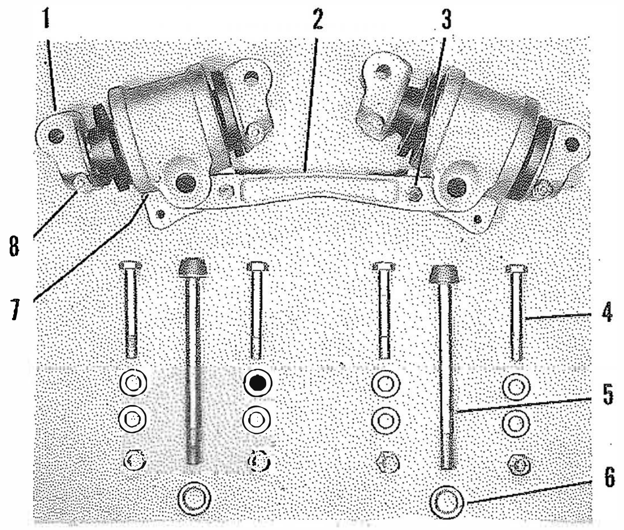


Figure 5—10. Engine Mount Build-Up



1. End Plate
2. Double Bar
3. Double Bar Bolt, Washers, Nut
4. Mounting Ring Bolt
5. Internal Wrenching Bracket Bolt
6. Spherical Washer
7. Bracket
8. Bolt, Washers, Nut

Figure 5—11. Double Bracket Assembly

plugs and the exhaust collector clamps. Depreserve the engine and carburetor in accordance with applicable directives.

b. Assemble the engine mount in accordance with instructions in paragraph 5—22 if a new engine mount is to be installed.

c. Disconnect the magneto lead elbow from the magneto.

d. Remove the internal wrenching bracket bolts (5, figure 5—11) and spherical washers (6) from each double bracket assembly.

e. Remove the bolts, washers and nuts (3) that secure the double bar (2) to the double bracket at the bottom of the engine mount ring. Remove the double bar.

f. Raise the engine mount into position against the fire seal at the rear of the supercharger front housing.

Note

The magneto lead and elbow must pass between the engine mount ring and the double bar (2) of the right-hand double bracket assembly. The oil sump external oil tube must pass between the brackets of the lower double bracket assembly.

g. Insert an internal wrenching bracket bolt (5), with a spherical washer (6) under the head, through the hole in each bracket (7) of the upper double bracket assemblies, through the end of the double bar (2) and fire seal and into the engine mounting lug. Using the hex wrench LAW 114, tighten each bolt with 800 to 1000 inch-pounds torque. Lockwire the bolt to the pin adjacent to the bolt head.

h. Replace the double bar (2) on the lower bracket assembly and secure it with the bolts, washers and nuts (3). Tighten the nuts with 60 to 80 inch-pounds torque.

i. Install the internal wrenching bracket bolts (5) and spherical washers (6) to secure the lower double bracket assembly to the engine mounting lugs. Tighten each bolt with 800 to 1000 inch-pounds torque. Lockwire the bolt to the pin adjacent to the bolt head.

j. Connect the magneto lead elbow to the magneto.

k. Install a sling, Sikorsky part No. S1670-10397, on the engine. (Refer to paragraph 5—12, step p.) Attach the sling to a hoist of at least two-ton capacity.

l. Carefully transfer the weight of the power package from the hoisting eye to the sling.

CAUTION

Keep the power package clear of the floor at all times.

m. Mount the power package on a suitable stand. Remove the hoisting eye from the engine propeller shaft. Remove the sling from the engine.

n. Install the two flexible tubes in the accessory section of the engine. (Refer to paragraph 5—41, steps e. through g.)

o. Assemble the power package. (Refer to paragraph 5—14, steps d. through j., p. through v., x., y. and aa.)

p. Install the power package in the helicopter. (Refer to paragraph 5—15.)

5—24. DOUBLE BRACKET ASSEMBLIES.

5—25. DESCRIPTION. *(See figure 5—11.)* Flexible mounting for the engine is provided by three cored-out type, Dynafocal, double bracket assemblies attached to lugs on the engine mount ring. Each double bracket assembly can be removed from or installed on the engine mount ring without disassembly of the unit, but the double bar on the lower double bracket assembly must be removed when removing or installing the engine mount.

5—26. REMOVAL.

a. Loosen the small nut (8, figure 5—11) at each end plate (1).

b. Loosen each double bar nut (3).

c. Support each double bracket assembly and remove the mounting ring bolt (4), washers and nut that secure each end plate (1) to the lug on the engine mount ring. Remove each double bracket assembly.

d. Replace the mounting ring bolt (4), washers and nut in each end plate (1).

e. Replace each internal wrenching bracket bolt (5) and spherical washer (6) in the double bracket assemblies.

5—27. MAINTENANCE. Maintenance or overhaul of the double bracket assemblies should be accomplished in accordance with applicable directives.

5—28. INSTALLATION.

Note

The double bracket assemblies are shipped by the manufacturer ready for mounting. The nuts are not torqued and must be torqued after installation. If a used double bracket assembly is being installed, loosen all nuts prior to installation.

a. Remove the mounting ring bolt (4, figure 5—11), washers and nuts from each end plate (1).

b. Position the double bracket assembly against the lugs on the engine mount ring.

Note

Each end plate (1) rests against the forward surface of the engine mount ring lug. The spherical seat at each internal wrenching bracket bolt hole should face aft.

c. Install the mounting ring bolt (4), washers and nut at each engine mount ring lug. Tighten these nuts with 450 to 500 inch-pounds torque.

d. Tighten each double bar nut (3) with 60 to 80 inch-pounds torque.

e. Tighten the small nut (8) at each end plate (1) with 60 to 80 inch-pounds torque.

5—29. ACCESSORY COMPARTMENT SHROUD.

5—30. DESCRIPTION. The accessory compartment shroud forms a fireproof enclosure which isolates the accessory section of the engine. The shroud consists primarily of three panels supported by a cover assembly. The cover assembly is installed between the engine mount ring and the engine support arms and is one of the two major components of the engine mount assembly. The cover assembly cannot be removed from the engine without removing and disassembling the engine mount.

5—31. REMOVAL.

a. Open the nose doors.

Note

Steps b. through h. apply to the left shroud panel. Steps e. and i. apply to the right shroud panel. Steps j. and k. apply to the upper shroud panel. To remove only the well, remove the induction system air intake duct (paragraph 5—279) and lift the well from the shroud cover.

b. Disconnect the hose lines at each side of the left shroud panel at "A" (step 2, figure 5—2) and at "A" (step 2, figure 5—8).

c. Drain the oil from both oil cells at the drain at "C" (step 3, figure 5—2) just forward of the oil cooler. Disconnect the oil inlet line at "C" (step 1, figure 5—8) and oil outlet line at "B" (step 1) at the engine oil pump. Drain each of these lines.

d. Remove the screws that secure the retainer to the shroud panel at the opening where the oil lines pass through the panel at "B" (step 2). Slide the retainer and half slides away from the panel.

e. Remove the screws that secure the left shroud panel to the right shroud panel at "C" (step 2).

f. Remove the screws that secure the left shroud panel to the shroud cover. Pull the panel free of the oil lines.

g. Remove the screws that hold the two half slides together at "B" (step 2). Remove the half slides and the retainer from the hoses.

Note

To maintain a complete panel assembly, replace the half slides and retainers.

h. Remove the tee and nut from the carburetor vapor return line quick disconnect. Remove each disconnect from the panel.

i. Remove the screws that secure the right panel to the shroud cover. Remove the panel.

j. Remove the terminal block cover and disconnect the carburetor air temperature bulb wires at the terminal block on the upper shroud panel. Pull the lower wires down into the accessory section. Remove the terminal block and grommet from the panel.

k. Release the fasteners that secure the upper panel to the shroud cover. Pull the panel out from under the well.

l. Remove the engine mount from the engine. (Refer to paragraph 5—19.)

m. Disassemble the engine mount. (Refer to paragraph 5—20.)

5—32. MAINTENANCE.

a. Check the condition of the seal along the aft edge of each shroud panel.

b. Check all rivets for security.

c. Check all components for possible cracks and security of nut plates and receptacles.

5—33. INSTALLATION.

a. Assemble the engine mount. (Refer to paragraph 5—22.)

b. Install the engine mount on the engine. (Refer to paragraph 5—23.)

c. Install the power package in the helicopter. (Refer to paragraph 5—15.)

Note

Steps d. and e. apply to the upper shroud panel. Steps f., g. and k. apply to the right shroud panel. Steps h. through n. apply to the left shroud panel. If only the well was removed, position it on the shroud cover and install the induction system air intake duct. (Refer to paragraph 5—284.)

d. Position the top shroud panel on the shroud cover under the well. Secure the panel to the cover with fasteners.

e. Install the terminal block on the top panel. Draw the lower carburetor air temperature bulb wires up through the hole in the panel. Install the grommet in the hole. Connect the wires to the terminal block. Replace the terminal block cover.

f. Position the right shroud panel on the shroud cover and secure it with the screws.

g. Install the hose line quick disconnects in the left shroud panel. Install the tee in the inboard side of the carburetor vapor return line disconnect and secure it with the nut.

h. Slide the retainer onto the oil inlet and outlet hose lines at "B" (step 2, figure 5—8). Position the two half slides around the hoses and secure them together with the screws.

i. Position the left shroud panel on the shroud cover and at the same time work the end of each oil hose through the opening in the panel. Secure the panel to the cover with the screws at "C" (step 2).

j. Secure the left shroud panel to the right shroud panel with the screws.

k. Position the half slides and retainer against the left panel. Secure the retainer to the panel with the screws.

l. Install new gaskets and connect the oil inlet line at "C" (step 1) and oil outlet line at "B" (step 1) to the engine oil pump. Fill both oil cells.

WARNING

Do not overfill. Overfilling reduces necessary foaming space.

m. Connect the hose lines at the quick disconnects at each side of the left shroud panel at "A" (step 2, figure 5—2) and at "A" (step 2, figure 5—8).

CAUTION

Check that each hose line is attached to the proper disconnect.

n. Close the nose doors.

o. Pre-oil the engine.

CAUTION

The engine must be pre-oiled immediately prior to starting after an engine change, after the engine has been idle for more than 48 hours, or after air has been allowed to enter the oil inlet line to the engine in any manner. For instructions on pre-oiling the engine, refer to paragraph 5—8.

5—34. FIRE SEAL.

5—35. DESCRIPTION. The fire seal consists of three titanium sections secured together with screws and bolted to the rear of the supercharger front housing. Ten openings are provided to accommodate the magneto lead, the oil sump external oil tube and the eight accessory section and engine mount cooling tubes. Five of the openings have flanges to support the engine mount cooling tubes. The remaining openings have asbestos seals to insure tight fits for the tubes or leads passing through the openings.

5—36. REMOVAL.

a. Remove the engine mount. (Refer to paragraph 5—19.)

b. Remove the accessory section and engine mount cooling tubes. (Refer to paragraph 5—40, steps c. through e.)

c. Remove the screws and washers that secure the three sections together.

d. Cut the lock wire and remove the bolts and washers that secure the sections to the rear of the supercharger front housing.

e. Remove each section of the fire seal.

CAUTION

Do not damage the asbestos seals when removing the fire seal sections.

5—37. INSTALLATION.

Note

If a new fire seal is installed, the five asbestos seals will be solid. Only the magneto lead seal and the oil tube seal are to be cut at this time. The remaining three seals are cut during installation of the accessory section cooling tubes. (Refer to paragraph 5—41.)

a. Position the upper, right section of the fire seal against the rear of the supercharger front housing and cut the magneto lead seal to form a tight seal around the lead. Align the two holes at the inner edge of the section with the engine mounting lugs and install two bolts to position the section temporarily.

CAUTION

The asbestos seal must be cut carefully to obtain a tight fit around the tube or lead which passes through it and to maintain the fire seal qualities. There must be a minimum of 1/8-inch of asbestos around each tube or lead after installation.

b. Position the lower section of the fire seal and cut the seal to form a tight seal around the oil sump external oil tube. Install two bolts through the fire seal to secure the section temporarily.

c. Position the upper left section of the fire seal and install two temporary bolts.

d. Secure the three sections together with the screws and washers.

e. Secure the fire seal to the housing with the bolts and washers. Lockwire the bolts and remove the temporary aligning bolts.

f. Install the accessory section and engine mount cooling tubes. (Refer to paragraph 5—41, steps a. through d.)

g. Install the engine mount. (Refer to paragraph 5—23.)

5—38. ACCESSORY SECTION AND ENGINE MOUNT COOLING TUBES.

5—39. DESCRIPTION. Six engine mount and two magneto cooling tubes are installed on the power package. Each tube is bolted to an engine intercylinder deflector at the forward end and is routed aft to the fire seal. Five engine mount cooling tubes (A, table XVII) are secured with collars to flanges on the fire seal. The sixth engine mount cooling tube (C, table XVII) extends through an asbestos seal and under the bead on the aft side of the fire seal. A flexible tube, clamped to the magneto cooling tube (B, table XVII) which extends through an asbestos seal at the 12 o'clock position in the fire seal, ends directly above the magneto and is clamped to the

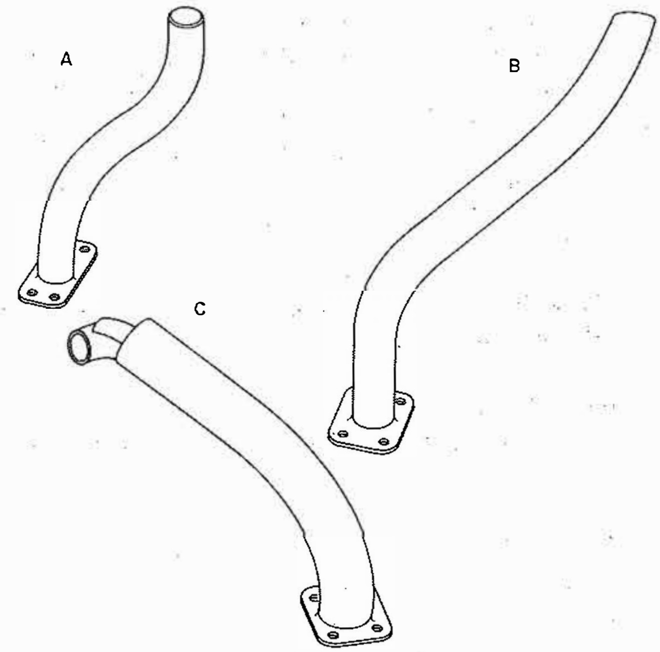


Figure 5—12. Accessory Section and Engine Mount Cooling Tubes (Tube Types)

TABLE XVII
INSTALLATION OF COOLING TUBES

TUBE TYPE (See figure 5—12)	FROM INTERCYLINDER DEFLECTOR BETWEEN CYLINDERS NO.	TO FIRE SEAL POSITION	SPECIAL ROUTING	TYPE CONNECTION ON FIRE SEAL
A	2 and 3	1 o'clock		Flange
A	3 and 4	3 o'clock	Inboard hole of intercylinder deflector	Flange
C	3 and 4	4 o'clock	Outboard hole of intercylinder deflector; through fire seal and under bead on aft side	Asbestos Seal
A	6 and 7	7 o'clock	Inboard hole of intercylinder deflector	Flange
B	6 and 7	8 o'clock	Outboard hole of intercylinder deflector; flexible tube attached at aft side of fire seal	Asbestos Seal
A	8 and 9	9 o'clock		Flange
A	9 and 1	11 o'clock	Inboard hole of intercylinder deflector	Flange
B	9 and 1	12 o'clock	Outboard hole of intercylinder deflector; flexible tube attached at aft side of fire seal	Asbestos Seal

upper right part of the engine mount ring and to the fuel intake line between the fuel pump and the carburetor. The flexible tube on the other magneto cooling tube (B, table XVII) is clamped to brackets on the hydraulic pump and oil strainer pad mounting studs. Air from this tube blows across the accessory section to the magneto.

Note

Directional references are given as viewed from the accessory section of the engine.

5—40. REMOVAL.

a. Unclamp the flexible tubes from the engine mount ring and fuel intake line and from the brackets secured to the hydraulic pump and oil strainer pad mounting studs.

b. Unclamp and remove the flexible tubes from the magneto cooling tubes (B, table XVII).

c. Remove the screws, washers and nuts that secure the flange on the forward end of the engine mount cooling tube (C, table XVII) to the intercylinder deflector. Work the aft end of the tube from under the bead on the fire seal and through the asbestos seal.

d. Remove the bolts and washers that secure the collar to each flange on the forward side of the fire seal and slide the collar onto each engine mount cooling tube (A, table XVII).

e. Remove the screws, washers and nuts that secure the flanges on the forward end of each cooling tube and remove the tubes.

5—41. INSTALLATION.

a. Slide a collar over the aft end of each engine mount cooling tube (A, table XVII), making certain that the mating surface of the collar faces toward the fire seal. Secure the flange on the forward end of each cooling tube to the proper intercylinder deflector with the screws, washers and nuts. Refer to table XVII for proper location and positioning of the tubes.

Note

Each of these tubes passes between an intake pipe and a cylinder. Each tube is secured to the inboard hole in the intercylinder deflector.

b. Secure the collars on the aft ends of the five engine mount cooling tubes (A, table XVII) to the flanges on the forward side of the fire seal with the bolts and washers.

c. Insert the aft ends of the two magneto cooling tubes (B, table XVII) into the asbestos seals at the 8 and 12 o'clock positions on the fire seal. Secure the forward end of each tube to the proper intercylinder deflector with the screws, washers and nuts. Refer to table XVII for proper location and positioning of the tubes.

CAUTION

Care should be exercised when inserting the tubes through the asbestos seals to prevent damaging of the seals. If a new fire seal has been installed, each asbestos seal must be cut and trimmed carefully so that the asbestos will form a tight seal around the tube. There must be a minimum of 1/8-inch of the asbestos seal around the tube after installation.

d. Work the aft end of the remaining engine mount cooling tube (C, table XVII) through the asbestos seal at the 4 o'clock position on the fire seal and under the bead on the aft side of the fire seal. Secure the forward end of the tube to the outboard hole of the intercylinder deflector between cylinders three and four with the screws, washers and nuts.

e. Clamp a flexible tube to the aft end of each of the two magneto cooling tubes (B, table XVII). The longer flexible tube is clamped to the tube extending through the fire seal at the 8 o'clock position.

f. Clamp the flexible tube attached to the magneto cooling tube that extends through the seal in the fire seal at the 12 o'clock position to the upper right part of the engine mount ring and to the fuel intake line between the fuel pump and carburetor so that the open end is directly above the magneto.

g. Clamp the flexible tube attached to the other magneto cooling tube to the brackets on the hydraulic pump and oil strainer pad mounting studs, making certain that the open end faces toward the magneto.

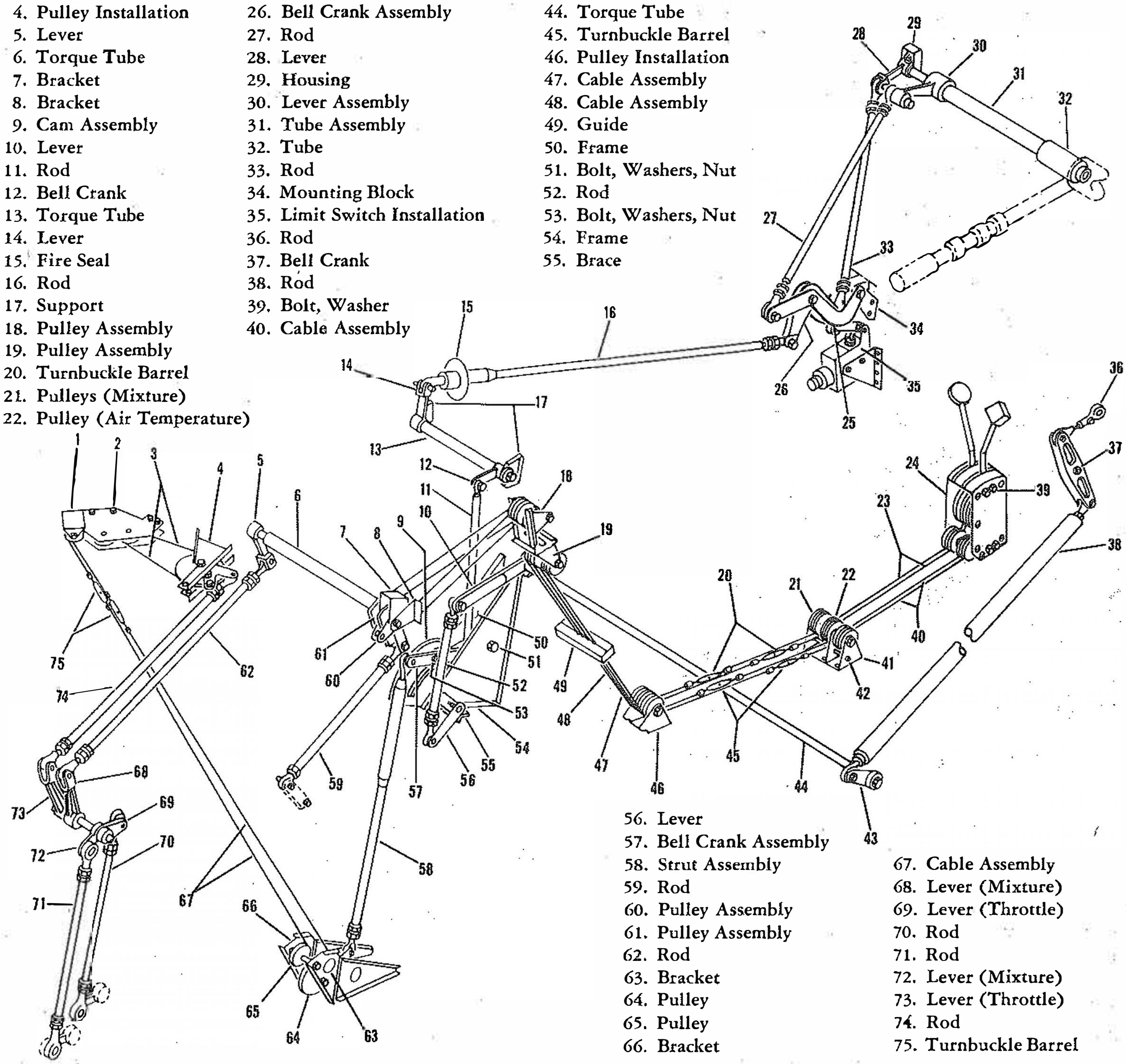
5—42. ENGINE CONTROLS.

5—43. DESCRIPTION. *(See figure 5—13.)* The engine controls consist of the throttle control system, the carburetor mixture control system, the carburetor air temperaure control system and the control quadrant.

5—44. THROTTLE CONTROL SYSTEM.

5—45. DESCRIPTION. The throttle control system provides partial synchronization between the throttle setting and the collective pitch control setting. The throttle control system connects a motorcycle-type grip on both the pilot's and observer's collective pitch control with the throttle arm on the carburetor. The principal components of the system from the cockpit to the engine are: the motorcycle-type grips, a torque tube installation coupled to the right end of the collective pitch control torque tube, a bell crank installation on

1. Pulley Assembly
2. Pulley Assembly
3. Cable Assembly
4. Pulley Installation
5. Lever
6. Torque Tube
7. Bracket
8. Bracket
9. Cam Assembly
10. Lever
11. Rod
12. Bell Crank
13. Torque Tube
14. Lever
15. Fire Seal
16. Rod
17. Support
18. Pulley Assembly
19. Pulley Assembly
20. Turnbuckle Barrel
21. Pulleys (Mixture)
22. Pulley (Air Temperature)
23. Cable Assembly
24. Quadrant
25. Bell Crank Assembly
26. Bell Crank Assembly
27. Rod
28. Lever
29. Housing
30. Lever Assembly
31. Tube Assembly
32. Tube
33. Rod
34. Mounting Block
35. Limit Switch Installation
36. Rod
37. Bell Crank
38. Rod
39. Bolt, Washer
40. Cable Assembly
41. Pulley (Fuel Selector Valve)
42. Guard Pin
43. Lever
44. Torque Tube
45. Turnbuckle Barrel
46. Pulley Installation
47. Cable Assembly
48. Cable Assembly
49. Guide
50. Frame
51. Bolt, Washers, Nut
52. Rod
53. Bolt, Washers, Nut
54. Frame
55. Brace



56. Lever
57. Bell Crank Assembly
58. Strut Assembly
59. Rod
60. Pulley Assembly
61. Pulley Assembly
62. Rod
63. Bracket
64. Pulley
65. Pulley
66. Bracket
67. Cable Assembly
68. Lever (Mixture)
69. Lever (Throttle)
70. Rod
71. Rod
72. Lever (Mixture)
73. Lever (Throttle)
74. Rod
75. Turnbuckle Barrel

Figure 5—13. Engine Controls Diagram

the right cabin wall, a limit switch installation mounted below the bell crank installation, a torque tube mount assembly and a torque tube installation, both mounted on the forward surface of the cabin forward bulkhead in the clutch compartment, a synchronizer assembly (figure 5—14) mounted just below the torque tube mount assembly, three pulley installations mounted on the forward surface of the canted bulkhead and a support assembly mounted beside the carburetor air intake duct. (See figure 5—15.) The three pulley installations are interconnected by cables. The lower pulley installation is connected to the synchronizer by an override strut; all other components of the system are interconnected by rods. The torque tube installation in the clutch compartment is connected to the collective portion of the main rotor auxiliary servo unit by two rods and a bell crank. An increase or decrease in collective pitch causes a corresponding increase or decrease in the throttle setting through the action of the synchronizer assembly. The throttle can be opened or closed by rotating the motorcycle-type grip without moving the collective pitch

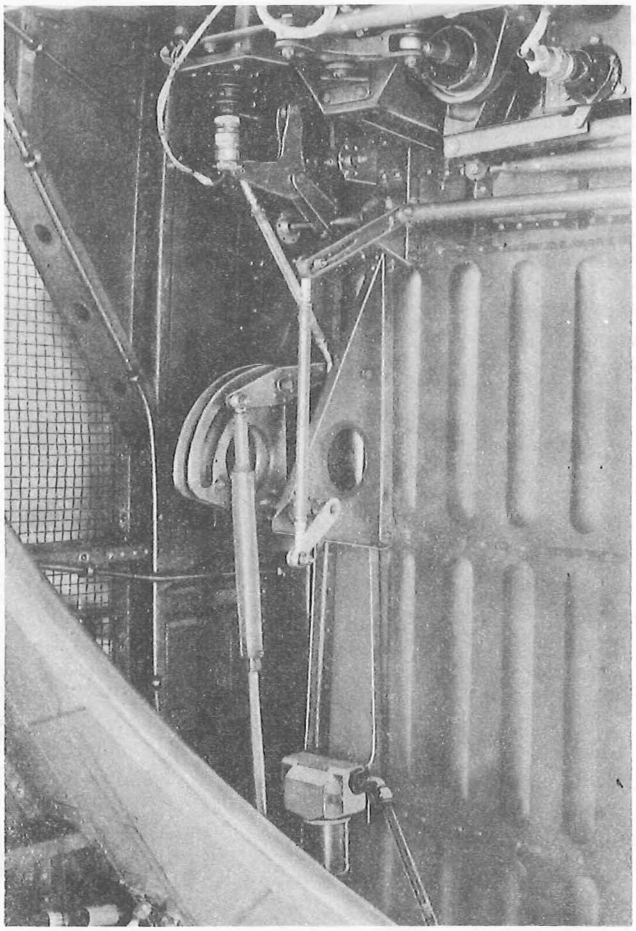


Figure 5–14. Throttle Synchronizer Installed

control. The limit switch prevents the starter from operating unless the collective pitch control is in low pitch position and the throttle closed. The override strut prevents damage to the throttle control system if the collective pitch control is moved while the throttle is at an extreme of travel.

5–46. REMOVAL. To remove an individual component of the throttle control system, refer to table XVIII. To remove the complete throttle control system, proceed as follows:

a. Open the nose doors.

b. Unbolt the lower end of the short throttle rod (70, figure 5–13) from the throttle arm on the carburetor.

c. Remove the bolts that secure the cover to the support assembly located beside the carburetor air intake duct. Remove the cover.

d. Unbolt the upper end of the short throttle rod (70) from the lever (69) inside the support assembly.

TABLE XVIII
REMOVAL OF THROTTLE CONTROL SYSTEM COMPONENTS

COMPONENT	REFER TO PARAGRAPH 5–46, STEPS:
Support Assembly	a. through r.
Pulley Bracket Installation (at top of canted bulkhead)	a., s. through u., z. through ac.
Pulley Installation (at bend of canted bulkhead)	a., t. through y.
Pulley Installation (at bottom of canted bulkhead)	a., t., ad., ai. through ao.
Strut Assembly	ad. through ah.
Synchronizer Assembly	ap. through ax.
Torque Tube Installation (in clutch compartment)	ay. through bb.
Torque Tube Mount Assembly (in clutch compartment)	bc. through bf.
Limit Switch Installation	bp.
Bell Crank Installation	bk. through bo.
Torque Tube Installation (in cabin)	bq. through bw.
Rods and Bell Crank (to auxiliary servo)	bg. through bj.

e. Unbolt the lower end of the long throttle rod (70) from the lever (73) at the side of the support assembly.

f. Unbolt the upper end of the short mixture control rod (71) from the lever (72) inside the support assembly.

g. Unbolt the lower end of the long mixture control rod (62) from the lever (68) at the side of the support assembly.

h. Remove the bolts and washers that secure the bracket over the flange of the carburetor air intake duct. Remove the screws from the bottom of the support. Remove the support assembly. Replace the bolts and washers.

Note

Omit steps i. through r. unless it is necessary to disassemble the remainder of the items inside the support assembly.

Note

On helicopters bearing USAF Serial Nos 53-4517 through 53-4549, the mixture and throttle levers are secured to the shafts with lockwired screws. On helicopters bearing USAF Serial Nos 53-4475 through 53-4516 and 53-4550 through 53-4554, the mixture and throttle levers are secured to the shafts with bolt, washers and nut. On USAF Serial Nos 53-4503 through 53-4554, a spacer is installed between the mixture lever and large bearing inside the support assembly, between each end of the mixture shaft and the throttle levers and between the throttle lever and small bearing inside the support assembly.

i. Cut the lock wire and remove the screw from the throttle lever (73) at the side of the support assembly.

j. Cut the lock wire and remove the screw from the mixture lever (68) at the side of the support assembly.

k. Cut the lock wire and remove the screw from the throttle lever (69) inside the support assembly.

l. Remove the washer and nut from the bolt that supports the throttle shaft in the support assembly. Remove the bolt.

m. Remove the throttle lever (73) from the throttle shaft.

n. Support the throttle lever (69) inside the support assembly and pull the throttle shaft out of the throttle lever and mixture shaft. Remove the throttle lever.

o. Remove the liner from the throttle shaft.

p. Remove the mixture lever (68) from the mixture shaft at the side of the support assembly.

CAUTION

Do not damage the bearing in the housing assembly while removing the mixture shaft.

q. Pull the mixture shaft, with the lever (72) attached, into the support and remove it from the support.

r. Remove the mixture lever (72) from the shaft.

s. Unbolt the upper end of the long rod (74) from the lever on the pulley installation (4) at the canted bulkhead.

t. Cut the lock wire and remove the turnbuckle barrels (75) from the cables (3 and 67) at the canted bulkhead.

u. Remove the flathead pins, washers and cotter pins, from the pulley installation (1 and 2) at the bend in the canted bulkhead. Pull each end of the upper cable (3) free of these pulleys.

Note

Omit steps v. through y. unless it is necessary to remove and disassemble the pulley installation (1 and 2) at the bend in the canted bulkhead.

v. Remove the short bolts, washers and nuts that secure the clip on the small pulley assembly (1) to the canted bulkhead. Support the pulley assembly and remove the long bolts, washers and nuts that secure the angle to the reinforcement on the canted bulkhead. Remove the pulley assembly.

w. Remove the bolt, washers and nut and remove the pulleys from the bracket assembly.

x. Remove the bolt, washers and nut that support each pulley in the large pulley assembly (2). Remove the pulleys and spacers.

y. Remove the short bolts, washers and nuts that secure the gussets of the large pulley assembly (2) to the clips on the canted bulkhead. Support the gussets and remove the long bolts, washers and nuts that secure the gussets to the reinforcement. Remove the gussets.

z. Remove the bolt, washers, nut and spacer near the upper and lower end of the support and support assembly of the pulley bracket installation (4) at the top of the canted bulkhead. Pull the upper cable (3) free of the pulley assembly and supports.

aa. Remove the bolt, washers, nut and spacers that support the pulley assembly. Remove the pulley assembly.

Note

Omit steps ab. and ac. unless it is necessary to disassemble the remainder of the pulley bracket installation (4).

ab. Hold the support and remove the bolts, washers and nuts that secure the support and support assembly to the reinforcement. Remove the support.

ac. Remove the bolts, washers and nuts that secure the brace on the support assembly to the bulkhead. Remove the support assembly.

ad. Remove the clutch access door. Reach into the clutch compartment and unbolt the strut assembly (58) from the arm of the pulley assembly (64) and from the bell crank (57) on the synchronizer assembly. Remove the strut assembly.

Note

Omit steps ae. and af. unless it is necessary to disassemble the strut assembly.

ae. Cut the lock wire and remove the screws and washers that secure the strut assembly guide to the housing assembly sleeve. Pull the piston rod assembly out of the housing assembly.

af. Remove the rod-end bearing and check nut from the end of the piston rod.

ag. Remove the cotter pin, washer and nut from the piston rod. Slide the pistons, spring, washer and guide off the piston rod.

ah. Remove the rod-end bearing and check nut from the rod end attached to the housing assembly sleeve.

ai. Remove the bolt, washers and nut that secure the small pulley (65) of the pulley installation at the bottom of the canted bulkhead. Remove the pulley and spacers.

aj. Remove the flathead pin, washers and cotter pin from the clip that is riveted to each bracket (63 and 66).

ak. Remove the bolt, washers and nut that secure the pulley assembly (64) to the brackets (63 and 66). Remove the pulley assembly with the cable (67) attached.

al. Remove the bolts, washers and nuts that secure the blocks to the lock plates on the pulley assembly (64). Remove the blocks and cable (67).

am. Remove the bolts, washers and nuts the secure the lock plates to the pulley assembly (64). Remove the lock plates.

an. Remove the flathead pin, washer and cotter pin from the top of the brackets (63 and 66).

ao. Remove the adjusting bolt and check nut from the stop on the side of the left bracket (63).

ap. Unbolt the lower end of the rods (11 and 52) from the bell crank (57) and lever (56) on the synchronizer assembly.

aq. Remove the bolts, washers and nuts that secure the bottom flanges of each synchronizer assembly frame (50 and 54) to the brace (55). Remove the bolts, washers and nuts that secure the synchronizer assembly to the bulkhead. Remove the synchronizer assembly.

ar. Remove the bolts, washers and nuts that secure the brace (55) to the frame. Remove the brace.

Note

Omit steps as. through au. unless it is necessary to disassemble the synchronizer assembly.

as. Remove the bolt, washers and nut (53) that secure the bell crank (57) and levers at the slots in the cam assembly (9). Remove the bell crank. Push out the sleeve and let the levers swing free. Remove the spacer and bearings.

at. Remove the nut and washer from the bolt (51) that supports the aft end of each lever. Remove the bolt and washer.

Note

As the bolt is removed, the spacers and levers will drop free.

au. Remove the bolt, washers, nut and spacer from the lower part of the frames (50 and 54).

av. Remove the taper pin, washer and nut that secures the lever (56) to the shaft at the left side of synchronizer. Remove the lever. Remove the washer and nut from the short end of the shaft. Remove the frames (50 and 54) and washer from the shaft.

Note

Omit steps aw. and ax. unless it is necessary to disassemble the cam assembly (9).

aw. Remove the bolts, washers, nuts and spacers from the cams.

ax. Remove the screws, washers, nut and spacers that secure the cams to the shaft. Remove the cams from the shaft.

ay. Unbolt the upper end of the rod (52) from the long lever (10) on the torque tube installation just above the synchronizer assembly. Remove the rod and retainer. Unbolt the lower end of the long rod (38) from the short lever (43) on the torque tube installation.

Note

Omit steps az. through bb. unless it is necessary to remove and disassemble the torque tube installation.

az. Support the torque tube (44) and remove the bolts, washers and nuts that secure the support and bracket to the bulkhead. Remove the torque tube with the support and bracket attached.

ba. Remove the washer and nut from each end of the torque tube (44). Remove the support and bracket from the tube.

bb. Remove the taper pin, washer and nut that secures each lever (10 and 43) to the torque tube (44). Remove the levers from the tube.

bc. Unbolt the upper end of the rod (11) from the bell crank (12) on the torque tube mount assembly. Remove the retainer. Unbolt the forward end of the horizontal rod (16) from the lever (14) on the torque tube mount assembly.

bd. Support the torque tube mount assembly and remove the bolts, washers and nuts that secure the supports (17) to the bulkhead. Remove the torque tube mount assembly.

Note

Omit steps be. and bf. unless it is necessary to disassemble the torque tube mount assembly.

be. Remove the nut from each end of the torque tube (13). Remove the supports (17) from the tube.

bf. Remove the taper pin, washer and nut that secures the bell crank (12) and lever (14) to the torque tube (13). Remove the bell crank and lever from the tube.

bg. Remove the bottom cover from the tunnel extension at the front of the cabin. Support the rod (38) inside the tunnel and unbolt it from the bell crank (37). Remove the rod.

bh. Remove the lower servo and mixer cover at the rear of the cockpit.

bi. Unbolt and remove the short rod (36) from the bell crank (37) and from the rod end on the auxiliary servo unit.

bj. Remove the bolt, washers and nut and remove the bell crank (37) from the ears on the bracket.

bk. Unbolt the aft end of the horizontal rod (16) from the forward arm of the bell crank (26) on the bell crank installation at the right side of the cabin. Pull the rod out of the fire seal (15). Remove the fire seal from the bulkhead.

bl. Unbolt the forward rod (27) from the forward end of the levers (25). Unbolt the aft rod (33) from the aft arm of the bell crank (26).

Note

Omit steps bm. through bo. unless it is necessary to remove and disassemble the bell crank installation.

bm. Support the bell crank assembly and remove the clevis bolts, washers and nuts that secure the mounting block (34) to the frame. Remove the bell crank assembly.

bn. Remove the bolt, washers and nut that secure the bell crank (26) between the levers (25). Remove the bell crank.

bo. Remove the bolt, washers and nut that secure the levers (25) to the mounting block (34). Separate the levers and mounting block.

bp. Remove the throttle limit switch (35). (Refer to paragraph 5—263.)

bq. Unbolt the rods (27 and 33, figure 5—13) from the lever (28) and lever assembly (30) on the torque tube installation at the right of the collective pitch control torque tube. Remove the rods.

br. Cut the lock wire and remove the screws and washers from each end of the outer tube (32). Slide the tube to the right to gain access to the coupling on the torque tube. Cut the lock wire and remove the screw from the coupling.

bs. Support the housing (29) and remove the bolts, washers and nuts that secure the housing to the frame. Slide the coupling to the right until it disengages from the collective pitch control torque shaft. Remove the housing and tubes.

bt. Cut the lock wire and remove the screw that secures the adapter to the collective pitch control torque shaft. Remove the adapter.

Note

Omit steps bu. through bw. unless is is necessary to disassemble the remainder of the torque tube installation.

bu. Remove the coupling from the torque tube. Remove the outer tube (32) from the outer tube assembly (31).

bv. Cut the lock wire and remove the screws and washers that secure the lever assembly (30) to the outer tube assembly (31). Remove the outer tube assembly.

bw. Remove the taper pin, washer and nut that secure the lever (28) to the torque tube between the ears of the housing (29). Hold the lever and pull the torque tube out of the housing. Separate the lever from the housing. Remove the lever assembly (30) from the torque tube.

5—47. MAINTENANCE.

a. Inspect all rod-end bearings for smoothness of operation.

b. Clean all cables and pulleys of dirt, oil and grease.

c. Inspect all cables for possible damage or fraying and for security of fittings.

d. Inspect all pulleys and rods for possible damage.

e. Inspect all other components for possible damage, security of rivets, etc.

5—48. INSTALLATION. To install an individual component of the throttle control system, refer to table XIX. To install the complete throttle control system, proceed as follows:

Note

The installed length for each rod is listed in this paragraph under the step pertaining to installation of the rod. These measurements must be carefully adhered to in order to satisfactorily adjust the system.

Note

Whenever practicable, install the bolts with the bolt head up.

Note

Omit steps a. through c. unless the torque tube installation at the right of the collective pitch control torque tube was disassembled.

a. Slide the end of the torque tube through the lever assembly (30, figure 5—13). Position the lever (28) between the ears of the housing (29). Insert the end of the torque tube through the ears of the housing and through the lever (28). Secure the lever to the torque tube with the taper pin, washer and nut.

TABLE XIX
INSTALLATION OF THROTTLE CONTROL SYSTEM COMPONENTS

COMPONENT	REFER TO PARAGRAPH 5—48, STEPS:
Support Assembly	bq. through bh.
Pulley Bracket Installation (at top of canted bulkhead)	bd. through bh., bo., bp. and cg.
Pulley Installation (at bend of canted bulkhead)	bi. through bo. and cg.
Pulley Installation (at bottom of canted bulkhead)	ap. through av., bc., bo. and cg.
Strut Assembly	aw. through bc. and cg.
Synchronizer Assembly	ad. through ao. and cg.
Torque Tube Installation (in clutch compartment)	y. through ac. and cg.
Torque Tube Mount Assembly (in clutch compartment)	q. through t. and cg.
Limit Switch Installation	k. and cg.
Bell Crank Installation	l. through p. and cg.
Torque Tube Installation (in cabin)	a. through j. and cg.
Rods and Bell Crank (to auxiliary servo)	u. through x. and cg.

CAUTION

The small end of the tapered shank of the taper pin must not extend more than 1/16-inch above the surface of the lever (28).

Note

If a new torque tube is installed, follow the instructions in steps b. through g. before drilling and reaming of the lever (28).

b. Slide the outer tube assembly (31) over the end of the torque tube. Position the end of the tube inside the lever assembly (30). Secure the lever assembly to the tube with the screws and washers. Lockwire the screws.

c. Slide the outer tube (32) onto the outer tube assembly (31). Slide the coupling onto the end of the torque tube.

d. Move the collective pitch control to low pitch position.

e. Slide the adapter onto the collective pitch control torque shaft.

Note

The small end of the adapter should be to the left. The threaded hole in the small end of the adapter should be at the top.

f. Raise the housing and tubes into position at the right end of the collective pitch control torque shaft. Slide the coupling to the left to engage the collective pitch control torque shaft. Secure the housing (29) to the frame with the bolts, washers and nuts.

g. Slide the coupling to the right until it disengages from the collective pitch control shaft. Check that there is a gap of not less than 1/16-inch nor greater than 3/16-inch between the serrated ends of each shaft. Slide the coupling to the left until an equal amount of each shaft is inside the coupling. Secure the coupling with the screw. Lockwire the screw and install the cotter pin.

h. Slide the outer tube (32) to the left and onto the adapter. Secure the outer tube to the adapter with the screws and washers. Lockwire the screws. Align the holes in the outer tube (32) with the holes in the outer tube assembly (31) and install the screws and washers. Lockwire the screws.

Note

If the holes in the outer tube (32) and outer tube assembly (31) do not align, slide the outer tube and adapter to the right until the adapter disengages from the collective pitch control torque shaft. Turn the outer tube and adapter one serration and replace it on the torque shaft.

Note

With the collective pitch control in low pitch position, the center line of the lever assembly (30) should be 9 $\pm$ 5 degrees below the horizontal. For ease of adjustment, keep this reading as near 15 degrees as possible.

Note

With the pilot's throttle grip held firmly in mid position, check the backlash at the outboard throttle control lever (28), located on the tube assembly (31), attached to the right end of the stick shaft (58, figure 2—38). If the backlash exceeds 5 degrees, replace the stick (9) and/or the shaft (58). Repeat the above check with the observer's throttle grip.

i. Secure the adapter to the collective pitch control torque shaft with the screw. Lockwire the screw.

j. Secure the aft rod (33) to the lever (28) with the bolt, washers and nut. Secure the forward rod (27) to the lever assembly (30) with the bolt, washers and nut.

Note

The forward rod (27) must be adjusted to measure 12 inches between the center of the hole in each rod-end bearing. The length of the aft rod (33) may be varied to prevent the lever (28) on the torque tube installation from striking the intercostal. Secure each rod-end bearing with the check nut.

k. Install and adjust the throttle limit switch (35). (Refer to paragraph 5—264.)

Note

Omit steps l. and m. unless the bell crank installation was disassembled.

l. Position the hooked end of a lever (25, figure 5—13) against each side of the mounting block (34) and secure them with the bolt, washers and nut.

Note

The large end of the mounting block (34) should be up.

m. Position the bell crank (26) between the levers (25) and secure it with the bolt, washers and nut.

n. Position the mounting block (34) of the bell crank assembly against the frame at the right side of the cabin and secure it with the clevis bolts, washers and nuts.

o. Secure the forward rod (27) between the forward end of the levers (25). Secure the aft rod (33) to the aft arm of the bell crank (26).

Note

The forward rod (27) must be adjusted to measure 12 inches between the center of the hole in each rod-end bearing. The length of the aft rod (33) may be varied to prevent the lever (28) on the torque tube installation from striking the intercostal. Secure each rod-end bearing with the check nut.

p. Install the fire seal (15) at the opening in the cabin forward bulkhead. Insert the large end of the horizontal rod (16) through the fire seal. Secure the aft end of the horizontal rod to the forward arm of the bell crank (26).

Note

The horizontal rod (16) must be adjusted to measure 26⅞ inches between the center of the hole in each rod-end bearing. Secure each rod-end bearing with the check nut.

Note

Omit steps q. and r. unless the torque tube mount assembly was disassembled.

q. Position the bell crank (12) and lever (14) on the torque tube (13) and secure them with the taper pin, washer and nut.

CAUTION

The small end of the tapered shank of the taper pins must not extend more than 1/16-inch above the surface of the lever (14) and bell crank (12).

Note

When the bell crank (12) is in a horizontal position and pointing forward, the lever (14) should be pointing straight up.

r. Position a support (17) on each end of the torque tube (13) and secure each with the nut.

Note

The flange on each support (17) should face to the right when the torque tube mount assembly is installed.

s. Reach into the clutch compartment and position the torque tube mount assembly against the forward surface of the cabin forward bulkhead just below the end of the horizontal rod (16). Secure the supports (17) to the bulkhead with the bolts, washers and nuts.

t. Secure the forward end of the horizontal rod (16) to the lever (14). Place the serrated surface of the retainer against the serrated face of the bell crank (12). Secure the upper end of the rod (11) from the bell crank on the synchronizer assembly and the retainer to the bell crank (12).

Note

Position the retainer as near the forward end of the bell crank (12) as possible.

Note

The horizontal rod (16) must be adjusted to measure 25-9/16 inches between the center of the hole in each rod-end bearing. The rod (11) from the bell crank on the synchronizer assembly must be adjusted to measure 11-1/8 inches. Secure each rod-end bearing with the check nuts.

u. Secure the bell crank (37) between the ears on the aft side of the bracket below the auxiliary servo unit in the cockpit with the bolt, washers and nut.

v. Secure the short rod (36) to the upper end of the bell crank (37) and to the rod end on the auxiliary servo unit.

Note

The short rod (36) must be adjusted to measure 4-3/32 inches between the center of the hole in each rod-end bearing. Secure each rod-end bearing with the check nut.

w. Install the lower servo and mixer cover.

x. Position the long rod (38) inside the tunnel and secure it to the lower end of the bell crank (37). Replace the bottom cover on the tunnel extension at the front of the cabin.

Note

The long rod (38) inside the tunnel must be adjusted to measure 39-3/32 inches between the center of the hole in each rod-end bearing. Secure each rod-end bearing with the check nut.

Note

Omit steps y. through aa. unless the torque tube installation was disassembled.

y. Position the long lever (10) on the end of the torque tube (44) that has the longest threaded end. Position the short lever (43) on the opposite end of the torque tube. Secure each lever with a taper pin, washer and nut.

Note

The small end of the tapered shank of each taper pin must not extend more than 1/16-inch above the surface of the lever.

Note

With the short lever (43) pointing straight up, the long lever (10) should point 53 degrees forward.

z. Secure the bracket on the same end of the torque shaft (44) as the long lever (10) with the washer and nut.

Note

The flanges on the bracket should point to the right.

aa. Secure the support on the same end of the torque shaft (44) as the short lever with the washer and nut.

Note

The flanges on the support should point to the right.

ab. Reach into the clutch compartment and position the torque tube (44), bracket and support against the forward surface of the cabin forward bulkhead just below the torque tube mount assembly. Secure the bracket with the bolts, washers and nuts. Secure the support with the bolts, washers and nuts.

ac. Secure the lower end of the long rod (38) located in the tunnel to the short lever (43) on the torque tube installation. Position the serrated surface of the retainer against the serrated face of the long lever (10) with the retainer as near the forward end of the lever as possible. Secure the upper end of the rod (52) and the retainer to the lever.

CAUTION

When securing the long rod (38) to the short lever (43), install the bolt with the head towards the main drive shaft.

Note

The long rod (38) located in the tunnel must be adjusted to measure 39-3/32 inches between the center of the hole in each rod-end bearing. The rod (52) from the lever on the synchronizer assembly must be adjusted to measure 12-11/16 inches. Secure each rod-end bearing with the check nut.

Note

Omit steps ad. through al. unless the synchronizer assembly was disassembled.

ad. Position the cams on the shaft. Install the spacers between the flanges of the shaft. Secure the cams and spacers to the shaft with the screws, washers and nuts.

Note

The measurement from the center of the shaft hole to the center line of the slot in each cam is different at one end of the slot than it is at the other end. To position the cams properly on the shaft, hold each cam with the short measurement on the left. The nearest end of the shaft should be the unthreaded end. The small end of the taper pin hole in the unthreaded end of the shaft should point to approximately the middle of the slot.

ae. Install the bolts, washers and nuts in the cams with the spacers between the cams.

Note

The bolt heads must be on the same side of the cams as the unthreaded end of the shaft.

Note

The cams must be parallel to each other within 0.010 inch and at a 90-degree angle to the center line of the shaft.

af. Position the washer on the short end of the cam assembly shaft. Position the shaft in the bearing on each frame (50 and 54). Install the washer and nut on the short end of the shaft.

Note

The long end of the shaft is positioned in the frame with the long bearing. The lip on each frame points outboard.

ag. Install the lever (56) on the long end of the shaft with the welded tube between the lever and the frame (54). Secure the lever on the shaft with the taper pin, washer and nut.

CAUTION

The small end of the tapered shank of the taper pin must not extend more than 1/16-inch above the surface of the tube. The threaded end of the taper pin should be up.

Note

If a new shaft was installed, it must be drilled and reamed for the taper pin. With the aft edge of the cams vertical, position the lever so the center line is 126 degrees forward of the aft edge of the cams.

ah. Install the bolt, washers and nut in the frames (50 and 54) with the spacer between the frames.

ai. Position a washer under the head of the bolt. Insert the bolt through the hole just above the center of the left frame (54). Install the following items on the bolt between the frames (50 and 54) in the order listed: the long spacer, a lever, the medium spacer, the other lever and the short spacer.

aj. Insert the bolt through the hole in the right frame (50) and secure it with the washer and nut.

Note

The long side of the bearing on each lever should be on the outboard side of the lever.

ak. Raise the loose end of the left lever and align it with the slot in the left cam. Insert the sleeve through the hole in the lever. Install the following items on the sleeve in the order listed as the sleeve is pushed through the slot in each cam: a bearing, the spacer, the other bearing and the loose end of the right lever.

Note

Each bearing should now be centered in one of the cams. The ends of the sleeve should be flush with the outer surface of each lever.

al. Position the thin washer under the head of the bolt (53). Position the bell crank (57) beside the cam assembly (9) against the left lever. Insert the bolt through the bell crank and sleeve and secure it with the washer and nut.

Note

The bell crank (57) must be positioned so the plate of the bearing is to the left.

am. Position the synchronizer assembly brace (55) in the clutch compartment against the frame on the right side of the helicopter and secure it with the bolts, washers and nuts.

an. Position the synchronizer assembly on the brace (55) and secure it to the bulkhead with the bolts, washers and nuts. Secure the bottom flange of each frame (50 and 54) to the brace with the bolts, washers and nuts.

ao. Bolt the lower end of the rod (11) from the torque tube mount assembly to the right side of the aft end of the bell crank (54) on the synchronizer assembly. Bolt the lower end of the rod (52) from the torque tube installation to the lever (56) on the left side of the synchronizer assembly.

Note

The rod (11) from the torque tube mount assembly must be adjusted to measure 11-1/8 inches between the center of the hole in each rod-end bearing. The rod (52) from the torque tube installation must be adjusted to measure 12-11/16 inches. Secure each rod-end bearing with the check nut.

Note

Steps ap. through av. apply to the pulley installation at the bottom of the canted bulkhead.

ap. Install the adjusting bolt and check nut in the stop on the side of the left bracket assembly (63).

aq. Position a lock plate on each side of the pulley assembly (64) and secure them with the bolts, washers and nuts.

ar. Position the blocks around the ball on the cable (67). Position the blocks and ball between the lock plates. Secure the blocks with the bolts, washers and nuts.

Note

The short half of the cable should be on the same side of the pulley as the forked arm.

as. Position the pulley assembly (64) with the cable attached, between the brackets (63 and 66) and secure it with the bolt, washers and nut.

Note

The short portion of the pulley shaft must be on the right.

at. Install the flathead pin, washers and cotter pin in the clip that is riveted to each bracket (63 and 66).

Note

The long half of the cable (67) must pass between the flathead pin and the pulley.

au. Position a washer under the head of the bolt. Insert the bolt through the hole at the forward, top corner of the left bracket (63). Install the spacers and small pulley (65) on the bolt. Insert the bolt through the hole in the right bracket (66) and secure it with the washer and nut.

Note

The long spacer must be positioned on the left of the pulley. The long half of the cable (67) must be on the aft side of the pulley.

av. Install the flathead pin, washers and cotter pin in the hole at the top of each bracket (63 and 66).

Note

The short half of the cable (67) must pass between the flathead pin and the pulley.

Note

Omit steps aw. through ba. unless the strut assembly (58) was disassembled.

aw. Install the check nut and rod-end bearing on the rod end of the strut housing assembly.

ax. Install the following items on the piston rod in the order listed: the guide, the washer, a piston, the spring and the other piston.

Note

The flanged end of the guide should bear against the piston. The spring should bear against the flat surface of each piston.

ay. Install the washer and nut on the end of the piston rod. Tighten the nut until the length of the spring is 3.875 inches. Safety the nut with the cotter pin.

az. Install the check nut and rod-end bearing in the end of the piston rod.

ba. Insert the piston rod assembly into the housing assembly. Align the tapped holes in the guide with the holes in the end of the housing assembly and install the screws and washers. Lockwire the screws.

bb. Adjust the rod-end bearings so the measurement between the center of the hole in each rod-end bearing is 29-3/16 inches. Secure the bearings with the check nuts.

bc. Position the strut assembly (58) in the clutch compartment. Secure the upper end of the strut of the right side of the forward end of the bell crank (57) that rides beside the slot in the cam assembly (9). Secure the lower end of the strut to the arm of the pulley assembly (64) at the bottom of the clutch compartment.

Note

Omit steps bd. through bf. unless the pulley bracket installation (4) at the top of the canted bulkhead was completely disassembled.

bd. Position the support assembly of the pulley bracket installation (4) against the reinforcement near the top of the canted bulkhead. Install the bolts, washers and nuts that secure the brace on the support assembly to the bulkhead.

be. Position the support against the reinforcement. Secure the support and support assembly to the reinforcement with the bolts, washers and nuts.

bf. Position the pulley assembly and spacers between the supports and secure them with the bolt, washers and nut.

Note

The pulley assembly should be positioned with the arms of the lever up and the shortest of the two arms forward.

bg. Position the cable (3) on the pulley assembly.

bh. Install the bolt, washers, nut and spacer at both the upper and lower end of the support and support assembly adjacent to the edge of the pulley assembly.

Note

If it is desired, steps bf. through bh. may be accomplished prior to steps bd. and be.

Note

Omit steps bi. through bl. unless the pulley installation (1 and 2) at the bend in the canted bulkhead was completely disassembled.

bi. Position the gussets of the large pulley assembly (2) against the clips and reinforcement at the bend in the canted bulkhead. Install the long bolts, washers and nuts that secure the gussets to the reinforcement.

Install the short bolt, washers and nut that secures each gusset to a clip.

Note

The brackets are positioned with the flange pointing away from each other.

bj. Position a pulley and two spacers between the gussets at each of the two 0.250 inch holes. Secure the pulleys and spacers with the bolts, washers and nuts.

bk. Position the two pulleys of the small pulley assembly (1) between the angle and the clip of the bracket assembly and secure them with the bolts, washers and nuts.

bl. Install a washer under the head of each long bolt. Install the bolts, with the heads down, in the reinforcement. Position the angle of the bracket assembly over the threaded end of the bolts and install the washers and nuts. Secure the clip to the bulkhead with the short bolts, washers and nuts.

bm. Route the short half of the cable (3) from the pulley bracket installation over the lower pulley located between the gussets and down the right side of the forward pulley located between the angle and the clip. Route the long half of the cable over the upper pulley located between the gussets and down the right side of the aft pulley.

bn. Install the flathead pins, washers and cotter pins in the gussets. Install the flathead pin, washer and cotter pin in the angle and clip.

Note

The cable must pass between each flathead pin and the adjacent pulley.

bo. Connect the ends of the upper cable (3) to the ends of the lower cable with the turnbuckle barrels (75). Lockwire the turnbuckle barrels after the system has been adjusted (paragraph 5—49).

Note

Do not allow the cables to cross.

bp. Secure the upper end of the long rod (74) to the long arm of each lever on the pulley assembly (4) at the top of the canted bulkhead.

Note

Omit steps bq. through bv. unless the support assembly was completely disassembled.

bq. Install the mixture lever (72) on the mixture shaft, secure it with the bolt, washer and nut. Tighten the nut with 35 to 45 inch-pounds torque. Position the lever and shaft inside the support; insert the end of the shaft into the large bearing on the side of the support and push the shaft into the bearing.

Note

The lever should be installed on the end of the shaft that contains the single high land. The other end of the shaft contains two high lands, one of which is serrated. The end of the shaft should be flush with the side of the lever.

Note

On helicopters bearing USAF Serial Nos 53-4517 through 53-4549, the mixture and throttle levers are secured to the shafts with lockwired screws.

Note

On helicopters bearing USAF Serial Nos 53-4503 through 53-4554, install a spacer against the flange on the mixture shaft before securing the lever.

br. Install a liner in the recessed area of the throttle shaft between the serrations. Position the throttle lever (69) inside the support. Slide the unserrated end of the shaft into the mixture shaft and through the throttle lever (69) until it touches the small bearing in the left side of the support.

CAUTION

Before installing the lever on the throttle shaft, make sure that both shafts are completely free of dirt, grit or metal chips.

Note

On helicopters bearing USAF Serial Nos 53-4503 through 53-4554, a thin spacer is required between the end of the mixture shaft and the throttle lever inside the support assembly and a wide spacer between the throttle lever and the small bearing in the support.

bs. Position the forked mixture lever (68) on the end of the mixture shaft outside the support.

Note

Rotate the mixture shaft so that, when the forked lever is pointing straight up, the lever inside the support assembly is 70 degrees forward of the forked lever.

bt. Position the forked throttle lever (73), with the bend away from the support, on the end of the throttle shaft outside of the support.

Note

Rotate the mixture shaft so that, when the forked lever is pointing straight up, the throttle lever (69) inside the support assembly is 113 degrees aft of the forked lever.

Note

On helicopters bearing USAF Serial Nos 53-4503 through 53-4554, install the spacer between the end of the mixture shaft and the throttle lever.

bu. Position a washer under the head of the bolt which supports the throttle and mixture shafts and insert it through the throttle shaft and through the small bearing on the left side of the support.

Note

On helicopters bearing USAF Serial Nos 53-4503 through 53-4554, a washer is installed on the bolt between the end of the throttle shaft and the small bearing inside the support.

bv. Tighten the throttle levers on the shaft inside the support assembly with the bolts, washers and nuts. Tighten the nuts with 35 to 45 inch-pounds torque.

Note

On helicopters bearing USAF Serial Nos 53-4475 through 53-4502, position the levers on the shaft so that, with the end of the shaft touching the small bearing in the support, there is a minimum gap of 1/32-inch between the throttle lever (69) and the mixture lever (72).

bw. Tighten the throttle and mixture forked levers on the shafts outside of the support assembly with the bolts, washers and nuts. Tighten the nuts with 35 to 45 inch-pounds torque.

Note

The outboard side of each lever should be flush with the end of the shaft.

bx. Install the washer and nut on the end of the bolt.

by. Remove the bolts and washers from the flange of the carburetor air intake duct. Position the support assembly so the bracket on the side of the support rests on the air intake duct flange. Secure the bracket with the bolts and washers. Install the screws in the bottom of the support.

bz. Secure the lower end of the long mixture control rod (62) to the forked mixture lever (68) at the side of the support assembly.

ca. Secure the upper end of the short mixture control rod (71) to the mixture lever (72) inside the support assembly. Install the washer between the rod end and the lever.

cb. Secure the lower end of the long throttle rod (74) to the forked throttle lever (73) at the side of the support assembly.

cc. Secure the upper end of the short throttle rod (70) to the throttle lever (69) inside the support assembly. Install the washer between the rod end and the lever.

Note

The short throttle rod (70) must be adjusted to measure 8-5/16 inches between the center of the hole in each rod-end bearing. Secure each rod-end bearing with the check nut.

cd. Install the cover on the support and secure it with the bolts.

ce. Secure the lower end of the short throttle rod (70) to the throttle arm on the carburetor.

cf. Check the adjustment of the mixture control system in accordance with the instructions in paragraph 5—43 if any of the carburetor mixture control linkage was unbolted or removed.

cg. Adjust the throttle control system. (Refer to paragraph 5—49.)

ch. Install the clutch access door.

ci. Close the nose doors.

5—49. ADJUSTMENT. Adjustment of the throttle control system consists of: first, synchronizing the closed position of the throttle with the low pitch position of the collective pitch control; second, adjusting the cables at the canted bulkhead to place the pulley at the top of the bulkhead in the closed throttle position; and third, adjusting the rods between the pulley and the throttle arm on the carburetor to place the throttle arm in closed position.

Note

All adjustments are made with the throttle in closed position and the collective pitch control in the low pitch position.

Note

The installed length for each rod is listed in paragraph 5—48 under the step pertaining to installation of the rod. Adhere carefully to each of these measurements.

Note

Steps a. through g. pertain to adjusting the linkage leading from the throttle grip.

a. Disconnect the long throttle rod (74, figure 5—13) from the levers on the pulley assembly at the top of the canted bulkhead.

b. Reach into the clutch compartment and disconnect the upper end of the rod (52) from the serrated surface of the long lever (10) on the torque tube installation located just above the synchronizer assembly. Disconnect the upper end of the strut assembly (58) from the bell crank (57) on the synchronizer assembly.

c. Insert a 0.186 inch diameter flathead pin through the hole in the pulley installation at the bottom of the canted bulkhead to lock the pulley (64) in the closed throttle position.

Note

There should be 1/13-inch clearance between the adjusting bolt head and the lever in the closed throttle position.

d. Place the collective pitch control in the low pitch position.

e. Move the cam assembly (9) in the synchronizer assembly to the full forward position.

f. Secure the strut assembly (58) to the right side of the forward end of the bell crank (57) on the synchronizer assembly.

Note

Do not compress or extend the strut assembly. Hold the collective pitch control in the low pitch position and rotate the throttle grip, if necessary, to align the hole in the bell crank with the hole in the rod-end bearing on the strut assembly.

g. Check to see that the short lever (28) on the torque tube installation in the cabin does not strike the intercostal. Adjust the length of the rod (33) attached to the lever, if necessary, to provide clearance.

Note

Step h. pertains to adjusting the linkage leading from the auxiliary servo unit.

h. After completing the instructions in steps a. through g. of this paragraph, hold the cam assembly (9) in the full forward position and connect the upper end of the rod (52) and the retainer to the serrated surface of the long lever (10) on the torque tube installation located just above the synchronizer assembly.

Note

Do not compress or extend the strut assembly, but secure the rod as near to the forward end of the lever as possible. Adjust the length of the rod, if necessary.

Note

Steps i. through k. pertain to adjusting the cables at the canted bulkhead.

i. Loosen or remove the turnbuckle barrels (75) from the cables (3 and 67) at the canted bulkhead.

j. Insert a 0.186 inch diameter flathead pin through the hole in the pulley bracket installation (4) at the top of the canted bulkhead to lock the pulley in the closed throttle position.

Note

The flathead pin used in step c. of this paragraph should be left in the pulley installation at the bottom of the canted bulkhead while adjusting the cables.

k. Replace the turnbuckle barrels (75) on the cables (3 and 67). Adjust the turnbuckle barrels to produce an equal tension of 35 $\pm$5 pounds on each cable.

Note

Steps l. and m. pertain to adjusting the linkage leading from the pulley installation at the top of the canted bulkhead to the throttle arm on the carburetor.

l. Move the throttle arm on the carburetor to the closed (up) position.

Note

In the closed position the center line of the throttle arm should be 42 degrees above the horizontal.

m. Secure the long rod (74) to the levers on the pulley assembly at the top of the canted bulkhead. Adjust the length of the rod as necessary.

Note

The installed length of the long rod should be approximately 29-3/8 inches.

n. Remove the flathead pin from the pulley bracket installation (4) and the pulley installation.

o. If any new rods were installed, the rod-end bearing on one end only of each new rod will contain a No. 40 (0.098 inch diameter) pilot hole located 90 degrees from the inspection hole. Drill through this pilot hole with a No. 51 (0.067 inch diameter) drill and install a cotter pin in each new rod.

p. Test the adjustment of the throttle control system for the following: with the collective pitch conrol in low pitch position, the throttle should close fully; with the collective pitch control in high pitch position, the throttle should open fully; with the collective pitch control in mid position, the throttle should open fully and close fully.

5–50. CARBURETOR MIXTURE CONTROL SYSTEM.

5–51. DESCRIPTION. The carburetor mixture control system extends from the lever marked "MIXTURE" on the control quadrant (figure 5–16) in the cockpit to

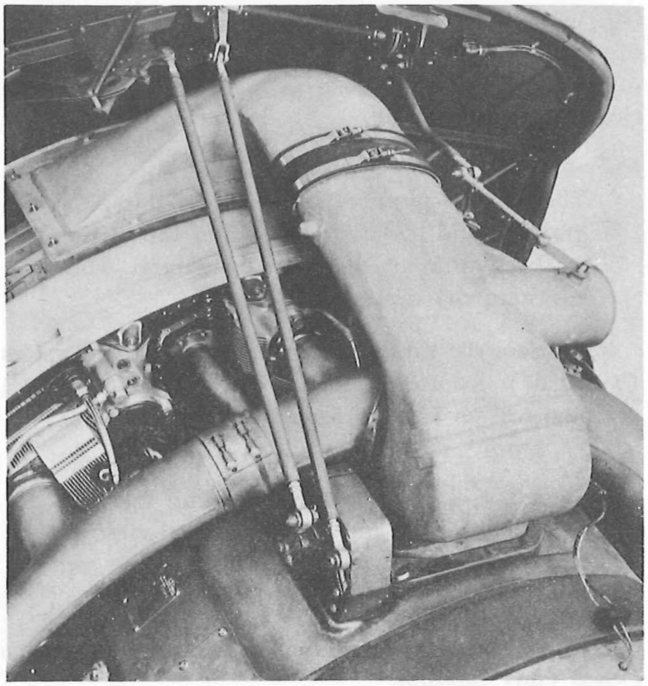


Figure 5–15. Engine Control Rods and Air Induction System Installed

the mixture control arm on the carburetor. The movement of the lever is conveyed by a system of pulleys and cables from the control quadrant to a torque tube installation located on the canted bulkhead. From there the movement is transmitted to the carburetor by rods and levers. (See figure 5–15.) The mixture selected by the pilot when he sets the lever on the control quadrant is automatically produced in the carburetor.

5–52. REMOVAL.

a. Open the nose doors.

b. Unbolt the lower end of the short mixture control rod (71, figure 5–13) from the mixture arm on the carburetor.

c. Remove the mixture controls at the carburetor. (Refer to paragraph 5–46, steps c. through n.)

Note

Since the mixture control and throttle control rods and levers at the carburetor are mounted within the same support assembly, removal of one system necessitates partial removal of the other system.

d. Unbolt the upper end of the rod (62, figure 5–13) from the torque tube lever located at the top of the canted bulkhead.

e. Hinge back the fuse panel door located on the right side of the console in the cockpit. Relieve the tension on the mixture control cables (23 and 48) by means of the turnbuckle barrels (20).

f. Remove the carburetor air temperature pulley assembly (60). (Refer to paragraph 5–60, steps c. through f.)

g. Remove the bolts, washers and nuts that secure the blocks and cable (48, figure 5–13) to the pulley assembly (61). Remove the blocks.

h. Support the torque tube (6) and remove the bolts, washers and nuts that secure the brackets to the bulkhead. Remove the torque tube, pulley assembly and brackets. Slide the bracket (7) off the torque tube.

i. Remove the washer, nut and bracket from the right end of the torque tube (6).

j. Remove the taper pin, washer and nut that secure the pulley assembly (61) and lever (5) to the torque tube. Remove the pulley assembly and lever.

k. Remove the cables and pulleys. (Refer to paragraph 5–53.)

5–53. REMOVAL OF CABLES AND PULLEYS.

Note

Since both the carburetor air temperature and carburetor mixture control cables are routed through the same pulley assemblies, the cables and pulley assemblies for both systems must be removed together.

a. Hinge back the fuse panel door located on the right side of the console in the cockpit.

b. Cut the lock wire and remove the carburetor air temperature turnbuckles (45, figure 5–13) and the carburetor mixture turnbuckles (20).

c. Remove the flathead pin, washer and cotter pin from the pulley installation (46) located at the bend in the cockpit floor.

d. Remove the bolt, washers, nut and spacer that secure the pulleys to the bracket. Remove the pulleys.

e. Remove the screws, washers and nuts securing the cable guide (49) to the canted fire wall.

f. Remove the bolt, washer, nut and spacer that secure the pulleys to the supports of the pulley assembly (19) located above the guide (49) on the canted fire wall. Remove the pulleys.

g. Remove the screws, washers and nuts securing each pulley support to the bracket. Remove the supports.

h. Remove the flathead pin, washer and cotter pin from the pulley assembly (18) located at the top of the canted fire wall.

i. Remove the bolt, washers, nut and spacers that secure the pulleys to the supports. Remove the pulleys.

j. Remove the screws securing the guides to the forward surface of the canted fire wall at the pulley assembly (18).

k. Open the nose doors.

l. Remove the bolts, washers and nuts that secure the blocks to the pulley assemblies (60 and 61) at the top of the canted bulkhead. Pull the cables (47 and 48) through into the engine compartment and off the pulley assemblies.

Note

If the bracket assembly that supports the pulleys (21 and 22) inside the console just aft of the access hole is to be removed, cut the lock wire and remove the turnbuckle barrels from the fuel selector valve control cables.

m. Reach through the access hole in the right side of the console and remove the washer and nut from the bolt on which the pulleys (21 and 22) are suspended. Withdraw the bolt through the small hole in the left side of the console and remove the pulleys and spacers.

n. Push the cables to the rear of the console. Remove the screws, washers and nuts that secure the bracket assembly inside the console. Remove the bracket assembly and guard pin.

o. Remove the cotter pin and washer from each end of the guard pin. Remove the guard pin from the bracket assembly.

p. Reach into the clutch compartment and support the channel located against the lower surface of the top of the tunnel. Remove the screws, washers and nuts from the right end of the channel and remove the channel.

q. Remove the control quadrant to remove the upper cables (23 and 40). (Refer to paragraph 5—68.)

5—54. MAINTENANCE.

a. Inspect all rod-end bearings for smoothness of operation.

b. Clean all cables and pulleys of dirt, oil and grease.

c. Inspect all cables for possible damage or fraying and for security of fittings.

d. Inspect all pulleys and rods for possible damage.

e. Inspect all other components for possible damage, security of rivets, etc.

5—55. INSTALLATION.

Note

Whenever practicable, install the bolts with the bolt head up.

a. Install the cables and pulleys. (Refer to paragraph 5—56.)

b. Position the lever (5, figure 5—13) on the end of the torque tube (6) that has the short rod end. Position the pulley assembly (61) on the opposite end of the torque tube.

Note

Position the pulley assembly on the torque shaft so, when the arms of the pulley assembly point straight up, the lever will point 90 degrees forward. The adapter is on the inboard side of the pulley assembly. The distance between the center line of the pulley assembly and the center line of the forked end of the lever must be 12-1/8 inches.

c. Secure both the lever (5) and the pulley assembly (61) with a taper pin, washer and nut.

Note

The small end of the tapered shank of the taper pin must not extend more than 1/16-inch above the surface of the lever or adapter.

d. Position the bracket on the same end of the torque tube (6) as the lever (5) and secure it with the washer and nut.

e. Position the bracket (7) on the same end of the torque tube (6) as the pulley assembly (61). Position the torque tube and brackets against the bulkhead. Secure the brackets to the bulkhead with the bolts, washers and nuts.

f. Position the blocks around the ball on the cable (48). Position the blocks and cable between the arms of the pulley assembly (61) and secure them with the bolts, washers and nuts.

g. Install the carburetor air temperature pulley assembly (60). (Refer to paragraph 5—63, steps b. through d.)

h. Secure the upper end of the rod (62, figure 5—13) to the lever (5) on the torque tube (6).

i. Install the mixture controls at the carburetor. (Refer to paragraph 5—48, steps bq. through cd.)

j. Secure the lower end of the short mixture control rod (71, figure 5—13) to the mixture arm on the carburetor.

k. Adjust the carburetor mixture control system. (Refer to paragraph 5—57.)

5—56. INSTALLATION OF CABLES AND PULLEYS.

Note

Since both the carburetor air temperature and carburetor mixture control cables are routed through the same pulley assemblies, the cables and pulley assemblies for both systems must be installed together.

Note

Whenever practicable, install the bolts with the bolt head up.

a. Install the control quadrant with the cables (23 and 40, figure 5–13) in place. (Refer to paragraph 5–69.)

b. Reach into the clutch compartment and position the channel against the lower surface of the top of the tunnel. Install the screws, washers and nuts in the right end of the channel.

c. Install the guard pin (42, figure 5–13) in the bracket assembly that supports the pulleys (21 and 22) inside the console. Install a washer and cotter pin at each end of the guard pin.

d. Position the bracket assembly inside the console just aft of the access hole. Secure the bracket assembly and channel with the screws, washers and nuts. Pull the cables forward over the guard pin (42).

e. Insert the bolt, with a washer under the head, through the small hole in the left side of the console and through the hole in the left flange of the support assembly. Install the large spacer, two pulleys (41) and small spacer on the bolt. Push the bolt through the hole in the center flange of the support assembly. Install the two pulleys (22), medium spacer and two pulleys (21) on the bolt. Push the bolt through the hole in the right flange of the support assembly and secure it with the washer and nut.

f. Install the turnbuckle barrels on the fuel selector valve control cables. Check the rigging of the fuel selector valve control. (Refer to paragraph 5–116.)

g. Position the cable (48, figure 5–13) over the right pulley assembly (61) at the top of the canted bulkhead. Position the cable (47) over the left pulley assembly (60). Route the cables through the canted bulkhead and canted fire wall and on into the console.

Note

The short half of each cable should pass over the top of the pulley assembly (60 and 61) and over the right pulley of each pair of pulleys at the pulley assembly (18) at the top of the canted fire wall.

h. Position the blocks around the ball on each cable (47 and 48).

i. Position the blocks and cables on the pulley assemblies (60 and 61) and secure with the bolts, washers and nuts.

j. Secure the guides to the forward surface of the canted fire wall at the pulley assembly (18) with the screws.

k. Insert the bolt, with a washer under the head, through the left support of the pulley assembly (18). Install the small spacer, two pulleys, the medium spacer, two pulleys and the large spacer on the bolt in that order. Push the bolt through the right support and secure it with the washer and nut.

l. Route the cables (47 and 48) over the pulleys. Install the flathead pin in the supports and secure it with the washer and cotter pin.

m. Position the pulley supports of the pulley assembly (19) against the bracket below the pulley assembly (18). Secure the supports with the screws, washers and nuts.

n. Insert the bolt through the left pulley support. Install two pulleys, the spacer and two pulleys on the bolt. Push the bolt through the right pulley support and secure it with the washer and nut.

Note

The cables (47 and 48) must be routed over the forward side of each pulley.

o. Position the cable guide (49) over the cables and secure it with the screws, washers and nuts.

p. Insert the bolt, with a washer under the head, through the left bracket of the pulley assembly (46). Install two pulleys, the spacer and two pulleys on the bolt. Push the bolt through the right bracket and secure it with the washer and nut. Install the flathead pin in the brackets and secure it with the washer and cotter pin.

Note

The cables (47 and 48) must be routed around the forward side of each pulley.

q. Install the turnbuckles (20 and 45) on the carburetor air temperature and carburetor mixture cables.

r. Adjust the carburetor mixture control system (paragraph 5–57) and the carburetor air temperature control system (paragraph 5–65).

5–57. ADJUSTMENT.

a. Unbolt the rod (62, figure 5–13) from the lever (5) on the torque tube (6) at the top of the canted bulkhead.

b. Loosen or remove the turnbuckle barrels (20).

c. Insert a 0.186 inch diameter flathead pin through the hole in the pulley assemblies (60 and 61) at the top of the canted bulkhead.

d. Set the "MIXTURE" lever on the control console in the "NORMAL" position.

e. Replace the turnbuckle barrels (20) on the cables (23 and 48). Adjust the turnbuckle barrels to produce an equal tension of 35 $\pm$ 5 pounds on each cable. Lockwire the turnbuckles.

Note

The "MIXTURE" lever must remain in the "NORMAL" position during this adjustment.

f. Move the mixture lever on the carburetor to mid position.

Note

The rod attached to the mixture lever must measure 4-7/8 inches between the center of the hole in each rod-end bearing.

g. Adjust the rod (62) and secure it to the lever (5) on the torque tube (6).

h. Remove the flathead pin from the pulley assemblies (60 and 61).

i. Hold a piece of thin paper over the idle cut-off stop on the carburetor. Have the "MIXTURE" lever on the control quadrant moved to the full "IDLE CUT-OFF" position. Try to remove the paper. If the paper tears or is difficult to remove, the adjustment is satisfactory.

j. Repeat the paper test with the paper on the rich stop of the carburetor and the "MIXTURE" lever in the full "RICH" position.

5—58. CARBURETOR AIR TEMPERATURE CONTROL SYSTEM.

5—59. DESCRIPTION. The carburetor air temperature control system extends from the lever marked "CARB HEAT" on the control quadrant (figure 5—16) in the cockpit to a lever on the side of the air intake duct located on top of the carburetor. The movement of the "CARB HEAT" lever is conveyed by a system of pulleys and cables from the control quadrant to a torque tube installation located on the canted bulkhead. From there the movement is transmitted to the lever on the air intake duct by a rod. (See figure 5—15.) The carburetor air temperature control system prevents the formation of ice in the carburetor by operating the doors in the cold air and hot air ducts of the air intake duct, thus allowing the pilot to regulate the temperature of the air entering the carburetor. Movement of the "CARB HEAT" lever operates both doors simultaneously and the linkage between the doors is so adjusted that, when one door is fully open, the other door is fully closed.

5—60. REMOVAL.

a. Open the nose doors.

b. Remove the bolt, washers and nut securing the rod (59, figure 5—13) to the air intake duct. Swing the rod down and replace the bolt, washers and nut.

c. Unbolt the rod (59) from the arms of the pulley assembly (60) at the top of the canted bulkhead. Remove the rod.

d. Hinge back the fuse panel door on the right side of the console in the cockpit. Relieve the tension on the carburetor air temperature control cables (40 and 47) by means of the turnbuckle barrels (45).

e. Remove the bolts, washers and nuts that secure the blocks and cable (47) to the pulley assembly (60) at the top of the canted bulkhead. Remove the blocks.

f. Remove the washer and nut from the left end of the torque tube (6). Remove the bolts, washers and nuts that secure the bracket (8) on the left end of the torque tube to the bulkhead. Slide the bracket, washers and pulley assembly (60) off the torque tube.

g. Remove the cables and pulleys. (Refer to paragraph 5—61.)

5—61. REMOVAL OF CABLES AND PULLEYS. Since both the carburetor air temperature and carburetor mixture control cables are routed through the same pulley assemblies, the removal of the cables and pulleys for both systems is covered in paragraph 5—53.

5—62. MAINTENANCE. Refer to paragraph 5—54 for maintenance instructions.

5—63. INSTALLATION.

Note

Whenever practicable, install the bolts with the bolt head up.

a. Install the cables and pulleys. (Refer to paragraph 5—56.)

b. Slide the following items onto the left end of the torque tube (6, figure 5—13) at the top of the canted bulkhead in the order listed: a thin washer, a thick washer, the pulley assembly (60), a thick washer, a thin washer and the bracket (8). Secure the bracket to the bulkhead with the bolts, washers and nuts. Install the washer and nut on the end of the torque tube.

Note

The pulley assembly (60) should be positioned on the torque tube so, when the short arms point up, the long arms point forward.

c. Position the blocks around the ball on the cable (47). Position the blocks and cable between the short arms of the pulley assembly (60) and secure them with the bolts, washers and nuts.

d. Secure the rod (59) to the long arms of the pulley assembly (60).

e. Remove the bolts, washers and nut from the upper lever on the air intake duct. Position the rod (59) on the outer surface of the lever. Secure the rod to the lever with the bolt, washers and nut.

Note

On helicopters bearing USAF Serial Nos 53-4513 through 53-4554, install a washer under the head of the bolt, a washer on each side of the upper lever on the air intake duct and a washer between the rod (59) and the nut.

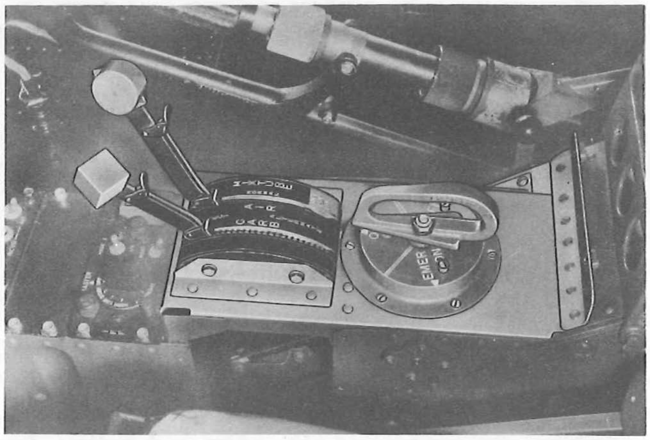


Figure 5–16. Control Quadrant and Fuel Selector Valve Control Handle

f. Adjust the carburetor air temperature control system. (Refer to paragraph 5–65.)

g. Close the nose doors.

5–64. INSTALLATION OF CABLES AND PULLEYS. Since both the carburetor air temperature and carburetor mixture control cables are routed through the same pulley assemblies, the installation of the cables and pulleys for both systems is covered in paragraph 5–56.

5–65. ADJUSTMENT.

a. Unbolt the rod (59, figure 5–13) from the pulley assembly (60) at the canted bulkhead.

b. Loosen or remove the turnbuckle barrels (45).

c. Insert a 0.186 inch diameter flathead pin through the hole in the pulley assemblies (60 and 61) at the top of the canted bulkhead to lock the pulley in mid position.

d. Set the "CARB HEAT" lever on the control console in mid position.

e. Replace the turnbuckle barrels (45) on the cables (40 and 47). Adjust the turnbuckle barrels to produce an equal tension of 35 ± 5 pounds on each cable. Lockwire the turnbuckles.

Note

The "CARB HEAT" lever must remain in mid position during the adjustment.

f. Move the lever on the air intake duct to mid position. Adjust the rod (59) and secure it to the arms on the pulley assembly (60).

g. Remove the flathead pin from the pulley assemblies (60 and 61).

h. Move the "CARB HEAT" lever to the full "DIRECT" position. The door in the warm air duct of the air intake duct should be fully closed. Move the lever to the full "ALTERNATE" position. The door should be fully open.

5–66. CONTROL QUADRANT.

5–67. DESCRIPTION. *(See figure 5–16.)* The control quadrant is installed in the control console between the pilot's and copilot's seat. The quadrant houses two levers. One lever, marked "MIXTURE," operates the carburetor mixture control system. The other lever, marked "CARB AIR," operates the carburetor air temperature control system. A two-way ratchet is installed under the "CARB AIR" lever. This ratchet must be disengaged before moving the lever in either direction. A one-way ratchet is installed under the "MIXTURE" lever between the "NORMAL" and "IDLE CUT-OFF" positions. This ratchet must be disengaged before moving the lever to the "IDLE CUT-OFF" position. The carburetor mixture control and carburetor air temperature control cables are connected to pulleys at the bottom of the control quadrant.

5–68. REMOVAL.

a. Open the hinged fuse panel on the right side of the console in the cockpit. Cut the lock wire and remove the turnbuckles (20 and 45, figure 5–13) from the cables (23 and 40).

b. Reach through the access hole and remove the washer and nut from the end of the bolt on which the pulleys (21 and 22) are suspended. Withdraw the bolt approximately 1-1/2 inches through the small hole in the left side of the console. Remove the pulleys (21), spacer and pulleys (22) from the bolt. Push the cables (23 and 40) to the rear of the console.

Note

It is important that the bolt not be withdrawn enough to release it from the center flange of the bracket assembly since this would affect the rigging of the fuel selector valve control.

c. Remove the screws and washers securing the access panel at the right side of the console. Remove the access panel.

d. Remove the bolts and washers securing the bottom of the control quadrant (24) to the bracket.

e. Remove the screws and washers securing the access panel at the left side of the console. Remove the access panel.

f. Remove the bolts and washers securing the bottom of the control quadrant to the bracket.

g. Support the control quadrant. Remove the bolts and washers (39) securing the top of the quadrant to the brackets. Remove the control quadrant.

5–69. INSTALLATION.

a. Position the control quadrant (24, figure 5–13) in the console. Install the bolts and washers (39) that secure the top of the quadrant to the brackets on the console.

b. Secure the lower left side of the control quadrant to the bracket with the bolts and washers.

c. Position the access panel at the left side of the console and secure it with the screws and washers.

d. Secure the lower right side of the control quadrant to the bracket with the bolts and washers.

e. Position the access panel at the right side of the console and secure it with the screws and washers.

f. Pull the cables (23 and 40) forward under the bolt on which the pulleys (41) are suspended. With the bolt withdrawn only approximately 1-1/2 inches, slide the pulleys (22), spacer and pulleys (21) onto the bolt. Push the bolt through the hole in the left flange of the bracket assembly and secure it with the washer and nut.

g. Install the turnbuckle barrels (20 and 45) on the cables.

h. Adjust the control quadrant. (Refer to paragraph 5–70.)

5–70. ADJUSTMENT. Instructions for adjusting the control quadrant are included with the adjustment of the carburetor mixture control system (paragraph 5–57) and the carburetor air temperature control system (paragraph 5–65).

5–71. FUEL SYSTEM.

5–72. DESCRIPTION. *(See figure 5–17.)* The fuel system is an open-vent system consisting of three main tanks, two electrically operated transfer pumps, one electrically operated booster pump, a mechanical three-position selector valve, a system strainer, a system drain, an engine-driven fuel pump, an electrically operated priming system, fuel pressure and fuel quantity indicating systems, and necessary tubes and hose lines to convey fuel from the tanks to the engine. When the fuel selector valve control is in the "ON" position, the transfer pump switches in the pilot's compartment are energized. The switches, marked "CTR – OFF" and "AFT – OFF," are located on the control box secured to the right side of the console and control the pumping of fuel through internal tubing from the center and aft tanks to the forward tank. The booster pump in the forward tank pumps the fuel through the selector valve and system strainer to the engine-driven fuel pump at the accessories section of the engine. When the fuel selector valve control is in the "EMER ON" position, fuel flows by gravity from all tanks through external tubing directly to the fuel selector valve, then through the system strainer and engine-driven fuel pump to the carburetor.

5–73. PRESSURE TESTING THE FUEL SYSTEM.

5–74. To pressure test the complete fuel cell installation as a unit, proceed as follows:

a. Disconnect the overboard vent tubes at the fittings in the cabin walls.

b. Install a hose assembly between an overboard vent tube in the aft tank and a vent tube in the center tank and between a vent tube in the center and forward tanks.

c. Plug the remaining vent tubes.

d. Disconnect the heater fuel line at the forward tank sump and plug the port.

e. Disconnect the booster pump outlet tube at the elbow on top of the selector valve and plug the line.

f. Disconnect the emergency fuel line at the elbow under the selector valve and plug the line.

g. Disconnect the vapor return line from the union on the filler elbow of the forward tank and cap the union.

h. Connect a water-filled manometer graduated up to 34 inches in increments of 1/16-inch to a source of air pressure. Apply one psi pressure to one filler elbow. The drop in pressure must not exceed 1/16-water-inch within a period of 15 minutes.

Note

Do not attempt to pressure test the fuel cells in extreme temperatures.

5–75. Disconnect the transfer line at the connector in the aft end of the forward tank aft, right cell to pressure test the fuel tanks individually. Cap the connector and proceed as follows:

Forward tank: steps a., c., d., e., f., g., and h., paragraph 5–74.

Center tank: steps a., c., and h., paragraph 5–74.

Aft tank: steps a., c., and h., paragraph 5–74.

5–76. To pressure test the fuel transfer lines, proceed as follows:

a. Disconnect the outlet tube from the aft tank transfer pump.

b. Install a short line from the open tube to a source of air pressure.

c. Remove the cover from the top of the lever control valve in the forward, right cell of the forward tank. Raise the float up to a level position and hold it while applying pressure.

Note

Make sure the ball and pin assembly is as high as it will go. If necessary to free the pin, vibrate the float slightly while lifting.

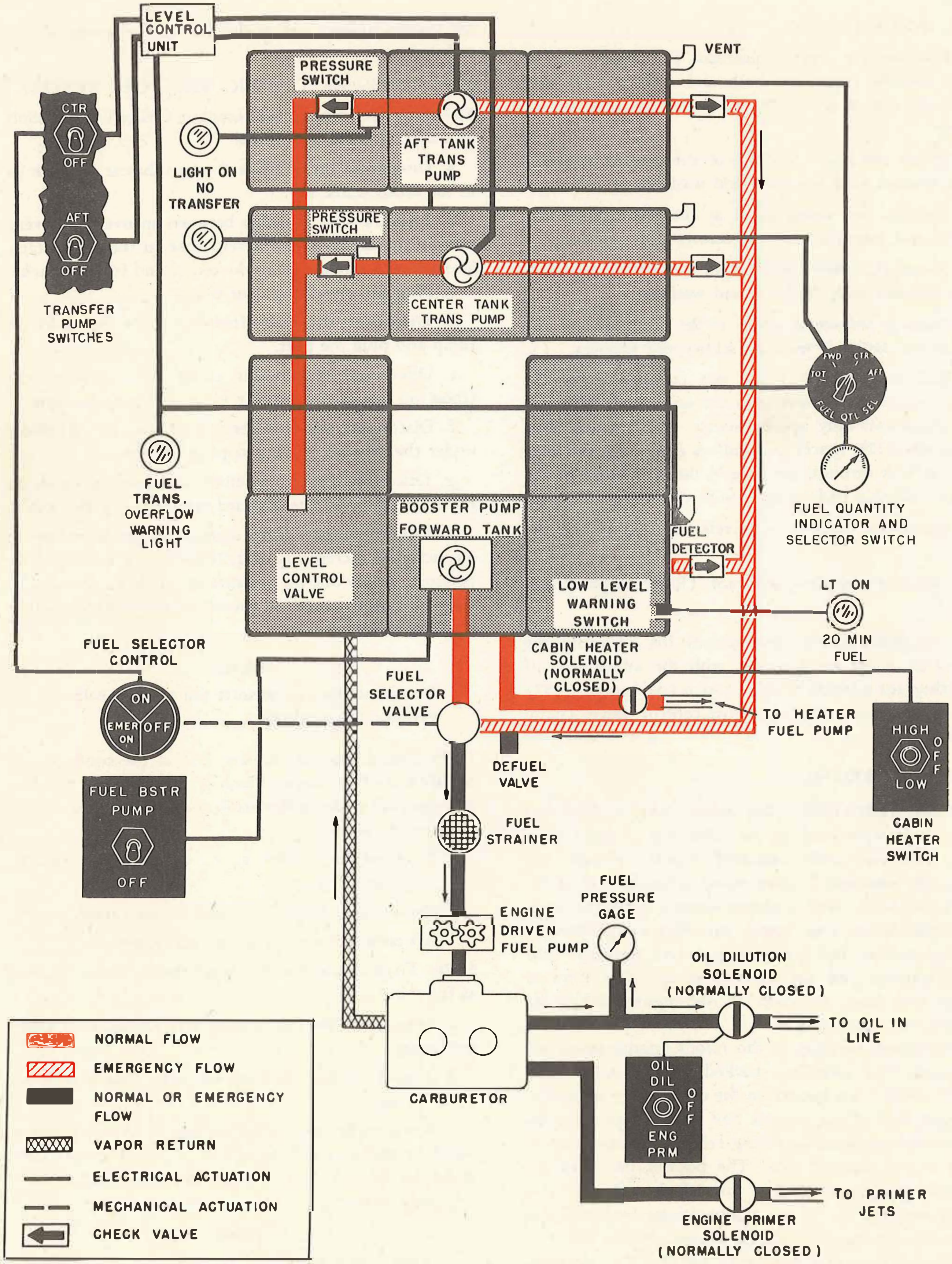


Figure 5—17. Fuel System Schematic Diagram

d. Apply six to eight psi air pressure to the line. The pressure drop must not exceed two psi during a period of five minutes.

5—77. FORWARD FUEL TANK.

5—78. DESCRIPTION. The forward fuel tank consists of five interconnected self-sealing cells located in the cabin bottom structure beneath the cabin floor. Three of the cells are installed across the bottom structure under the forward cabin floor panel; the remaining cells are installed aft of the outboard forward cells. All cells are internally interconnected at a flanged hole in adjacent cell walls. All but the forward, center cell are externally connected to the tank sump by metal tubes. The sump is located in the bottom of the forward, center cell. This cell also contains the fuel booster pump, the tank strainer, the tank drain, and one of the two forward tank, fuel quantity tank probes. The second tank probe is located in the aft, left cell. A level control valve is installed in the forward, right cell. The forward, right and left cells and the aft, left cell each contains two vent fittings which are connected to overboard vent lines. A fuel overflow detector is installed in the forward left cell vent tube. The forward center cell is vented by two vent fittings connected to each adjacent cell. The aft, right cell is vented by two tubes which are routed through the hatch and connected to the aft, left cell. An access cover for each forward cell is installed in the forward cabin floor panel; each aft cell has two access covers in the floor panel over the cell. A filler elbow is installed forward of the cargo door.

5—79. REMOVAL. To remove an individual cell, refer to table XX and accomplish as much of each indicated step as applies to the particular cell. To remove the complete forward tank, proceed as follows:

Note

Extreme care should be exercised when handling the cells in temperatures below 4.4°C (40°F). In regions where temperatures of 4.4°C (40°F) and below exist, provisions should be made to heat the cabin section while working on the cells. The upper limit of temperature is 71°C (160°F).

a. Drain and purge all fuel tanks.

b. Remove the bolts and washers (2 and 3, figure 5—18) that secure the forward center and forward left cell access covers (1 and 4) to the cabin floor. Remove the covers and gaskets (5 and 54).

c. Cut the lock wire and remove the bolts and washers (53) that secure the center cell cover (52) to the support (49). Remove the bolts and washers (6) that secure the forward left cell cover to the support (14). Lift the cell cover up and disconnect the four leads (7, 8, 9 and 10) to the tank probe at the connectors (11). Remove the covers and gaskets.

TABLE XX
REMOVAL OF INDIVIDUAL FUEL CELLS — FORWARD TANK

TO REMOVE	REFER TO PARAGRAPH 5—79, STEPS:
Forward, left cell	a. through c., o. through v., aa., ab.
Forward, center cell	a. through e., i., m., n., p., q., s. through v., aa., ab.
Forward, right cell	a. through c., e., j., k., o. through v., aa., ab.
Aft, left cell	a. through c., f. through o., g. through s., w. through y., aa., ab.
Aft, right cell	a., f., g., j. through l., q. through s., w., x., z. through ab.

Note

Remove the acid resistant lacquer (index 17, paragraph 1—32) from the area around the connectors at the top of the cell cover with lacquer thinner (index 12, paragraph 1—32).

d. Remove the tank sump. (Refer to paragraph 5—175.)

Note

If only the forward, left cell is being removed, remove the clip and pull the probe leads into the center cell.

e. Remove the level control valve. (Refer to paragraph 5—154.)

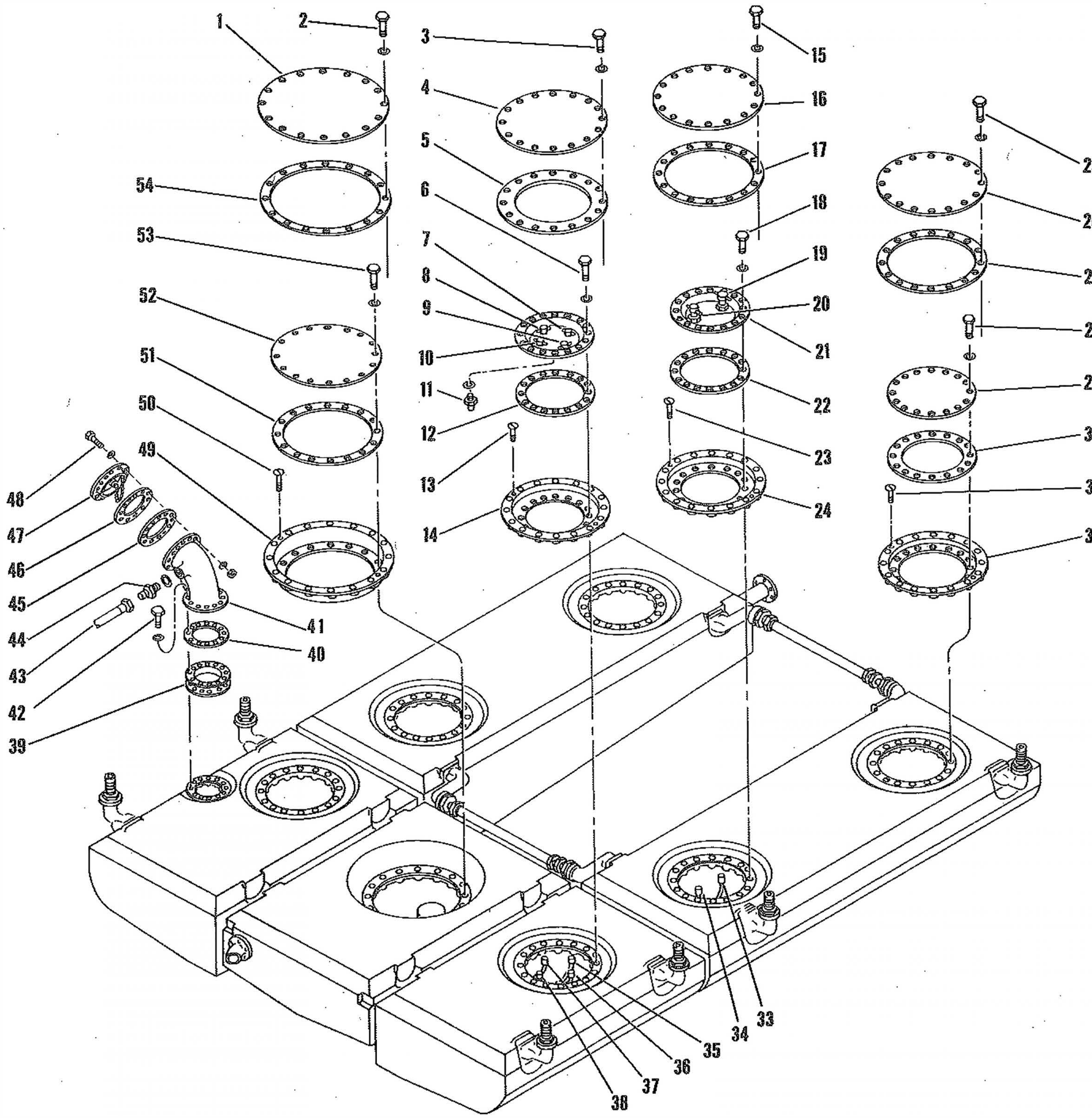
f. Remove the bolts and washers (15 and 25, sheet 1, figure 5—18) that secure each of the aft cell access covers (16 and 26) to the cabin floor. Remove the covers and gaskets (17 and 27).

g. Cut the lock wire and remove the bolts and washers (18 and 28) that secure each of the aft cell covers (21 and 29) to the supports (24 and 32). Remove the covers and gasket (22 and 30).

Note

At the forward access hole of the aft, left cell only disconnect the probe leads from each end of the connectors in the cell cover while remov- the cover.

h. Remove the nuts and washers (66, sheet 2) that secure the tank probe (67) to the mounting posts (66) in the aft, left cell (28). Remove the probe.



1. Access Cover
2. Bolt, Washer
3. Bolt, Washer
4. Access Cover
5. Gasket
6. Bolt, Washer
7. Connector
8. Connector
9. Connector
10. Connector
11. Nipple, Gasket
12. Gasket
13. Screw
14. Support
15. Bolt, Washer
16. Access Cover
17. Gasket
18. Bolt, Washer
19. Connector
20. Connector
21. Cell Cover
22. Gasket
23. Screw
24. Support
25. Bolt, Washer
26. Access Cover
27. Gasket
28. Bolt, Washer
29. Cell Cover
30. Gasket
31. Screw
32. Support
33. Probe Lead
34. Probe Lead
35. Probe Lead
36. Probe Lead
37. Probe Lead
38. Probe Lead
39. Gasket
40. Spacer
41. Elbow
42. Bolt, Washer
43. Vapor Return Line
44. Union
45. Gasket
46. Gasket
47. Filler Cap
48. Bolt, Washer, Nut
49. Support
50. Screw
51. Gasket
52. Cell Cover
53. Bolt, Washer
54. Gasket

Figure 5—18. Forward Fuel Tank (Sheet 1 of 2)

i. Remove the tank probe (61) from the forward, center cell (63). Disconnect the booster pump outlet tube (70) from the fitting (59) at the forward wall of the cell. Remove the tube.

j. Disconnect the short transfer pump tube (4) from the reducer (5) in the forward, right cell (3). Remove the tube. Remove the reducer from the long tube (6).

Note

If only the aft, right cell is being removed, remove the access cover and cell cover from the forward, right cell before disconnecting the short transfer pump tube.

k. Remove the screw, washers and nut from the clip around the transfer pump tube at the front of the aft, right cell (7). Remove the clip.

Note

If only the forward, right cell is being removed, remove the forward access cover and cell cover from the aft, right cell before removing the clip and bracket.

l. Disconnect the long transfer pump tube (6) from the fitting (9) at the aft wall of the aft, right cell (7).

Note

Leave the tube inside the cells at this time.

m. Remove the clutch access door from the cabin forward bulkhead. Remove the fuel tube located just forward of the bulkhead. Loosen the jam nut and remove the elbow and gasket from the fuel strainer fitting. Remove the bolts and washers that secure the small access door to the fitting. Remove the screws that secure the access door to the floor. Remove the door and the gaskets from the strainer fitting flange.

n. Cut the lock wire and remove the bolts and washers (57) that secure the booster pump outlet tube fitting (56) and the gasket (55) to the forward surface of the bulkhead. Remove the corresponding fitting (59) from the forward, center cell (63).

o. Remove the nuts and washers (23) from the two overboard vent fittings (27) inside the forward right (3), forward left (30) and aft left cells (28).

Note

On helicopters bearing USAF Serial Nos 53-4475 through 53-4477, cut the lock wire and remove the bolts and washers from the overboard vent fittings.

p. Cut the lock wire and remove the bolts and washers and nuts (64) at the two interconnecting vent fittings between each forward cell.

q. Remove the bolts, washers and nuts (29) that secure the cell at the interconnecting hole in the forward wall of each aft cell and each side wall of the forward, center cell (63). Remove the bracket secured at the flange in the aft, right cell (7) and the bracket secured at the flange in the forward, left cell (30).

Note

If only the forward, left cell or the forward, center cell is being removed, remove the access cover and cell cover from the adjacent cell or cells before removing the bolts, washers and nuts which interconnect the cells. If only the forward, right cell is being removed, remove the center cell access cover and cell cover before removing the bolts, washers and nuts which interconnect the cells.

r. Remove the plates from beneath the helicopter below the external fuel tubes leading to the sump (71). Remove the tubes (48, 51, 74 and 76). Cut the lock wire and remove the bolts and washers (32, 34, 44 and 47) that secure the fitting (33, 49, 52 and 77) below each outside cell. Remove each fitting and gasket (31, 50, 53 and 75).

s. Remove the screws (13, 23, 31 and 50, sheet 1), that secure the cell cover support (14, 24, 32 and 49) to the lower surface of the floor panel at each cell access hole. Lay the supports on the cells.

Note

Each cell cover support must be detached from the floor panel regardless of the number of forward cells that are being removed.

t. Remove the bolts, washers and nuts (48) that secure the filler cap (47) and the elbow (41) to the scupper in the right cabin wall. Remove the filler cap and flange and gasket (46). Disconnect the vapor return line (43) from the union (44) in the elbow.

u. Cut the lock wire and remove the bolts and washers (42) that secure the elbow (41) to the floor panel. Remove the elbow and gasket (45), but leave the gasket (39) and spacer (40) in position in the floor panel.

v. Remove the bolts and washers that secure the floor panel over the forward cells. Remove the panel.

w. Remove the bolts and washers that secure the floor panel over the aft cells and hatch. Remove the panel.

x. Cut the lock wire and remove the bolts and washers (8 and 22, sheet 2), from the two interconnecting vent tube fittings (15 and 20) inside each aft cell.

y. Remove the nuts and washers (66) that secure the mounting posts inside the aft, left cell (28). Remove the posts.

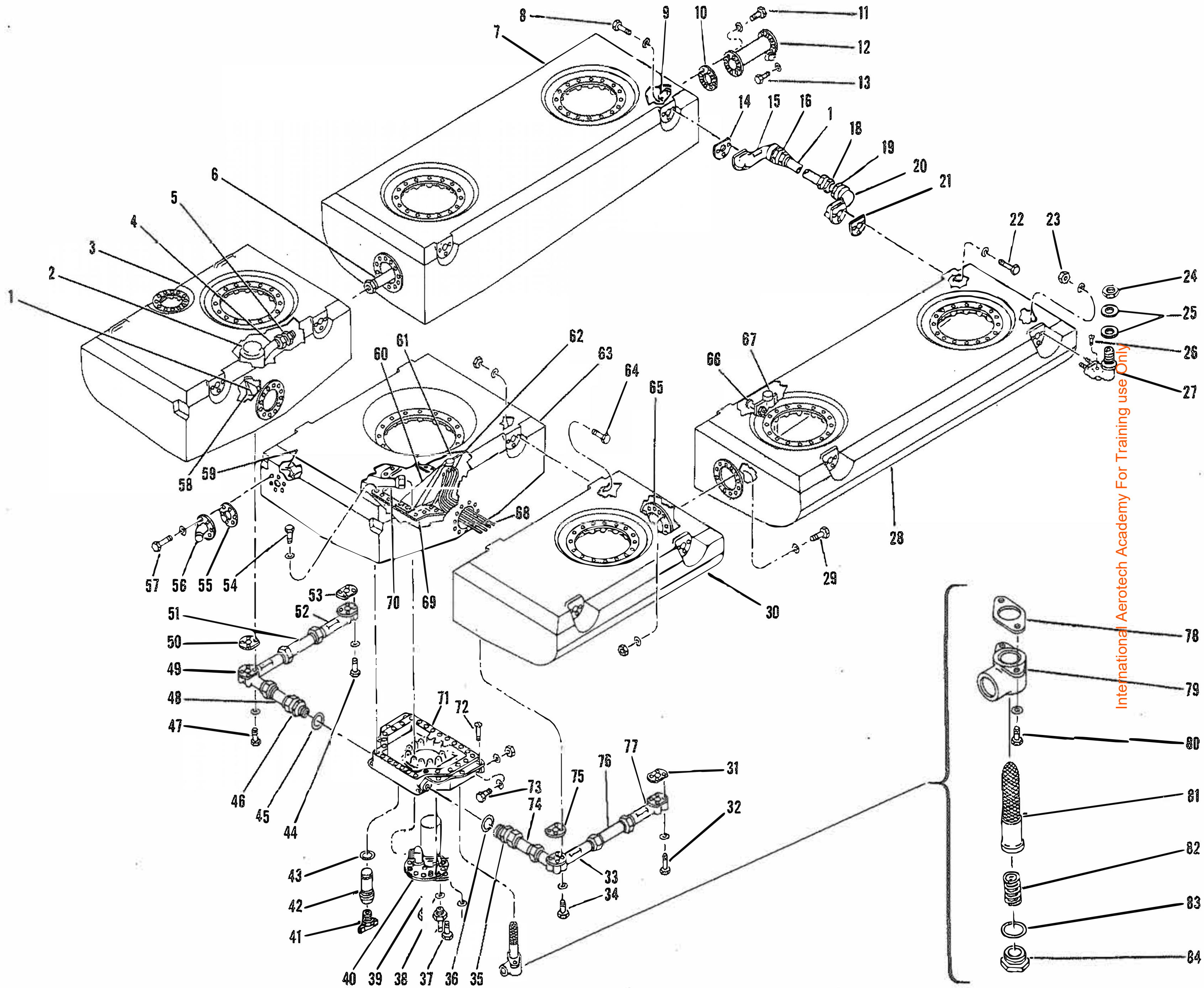


Figure 5—18. Forward Fuel Tank (Sheet 2 of 2)

Key to Figure 5–18 (Sheet 2 of 2)

1. Bracket
2. Level Control Valve
3. Forward Right Cell
4. Short Transfer Pump Tube
5. Reducer
6. Long Transfer Pump Tube
7. Aft Right Cell
8. Bolt, Washer
9. Fitting
10. Gasket
11. Bolt, Washer
12. Transfer Connector
13. Bolt, Washer
14. Gasket
15. Vent Tube Fitting
16. Union
17. Tube
18. Union
19. Nut, Gasket
20. Vent Tube Fitting
21. Gasket
22. Bolt, Washer
23. Nut, Washer
24. Nut
25. Washer
26. Screw
27. Vent Fitting
28. Aft Left Cell
29. Bolt, Washers, Nut
30. Forward Left Cell
31. Gaskets
32. Bolt, Washer
33. Fitting
34. Bolt, Washer
35. Union
36. Gasket
37. Bolt, Washer
38. Drain Fitting
39. Gasket
40. Booster Pump
41. Drain Valve
42. Corrosion Inhibitor Cartridge
43. Gasket
44. Bolt, Washer
45. Gasket
46. Union
47. Bolt, Washer
48. Interconnecting Tube
49. Fitting
50. Gasket
51. Interconnecting Tube
52. Fitting
53. Gasket
54. Bolt, Washer
55. Gasket
56. Booster Pump Outlet Tube Fitting
57. Bolt, Washer
58. Elbow and Swivel Fitting
59. Booster Pump Outlet Tube Fitting
60. Bracket
61. Fuel Quantity Tank Probe
62. Bracket
63. Forward Center Cell
64. Bolt, Washers
65. Flange
66. Mounting Post, Nut, Washer
67. Fuel Quantity Tank Probe
68. Probe Leads
69. Sealing Flange (Part of Cell)
70. Booster Pump Outlet Tube
71. Sump
72. Screw
73. Bolt, Washers, Nut
74. Interconnecting Tube
75. Gasket
76. Interconnecting Tube
77. Fitting
78. Gasket
79. Strainer Housing
80. Bolt, Washer
81. Strainer
82. Spring
83. Gasket
84. Plug

z. Cut the lock wire and remove the bolts and washers (11) that secure the transfer pump tube fitting (9) to the aft wall of the aft, right cell (7). Remove the fitting. Remove the long transfer pump tube (6) from the cell through the aft access hole.

aa. Remove the cell cover support or supports (14, 24, 32 and 49, sheet 1) from the top of each cell.

ab. Deflate each cell as much as possible and remove it from the bottom structure cavity.

CAUTION

Do not damage the cells on projecting fittings or flanges within cavities while removing the cells from the bottom structure.

Note

Disposition of the cells should be made in accordance with applicable directives.

5–80. MAINTENANCE. Maintenance and repair of the fuel cells should be accomplished only by qualified personnel and in accordance with applicable directives.

5–81. INSTALLATION. Refer to table XXI and accomplish as much of each indicated step as applies to the particular cell to install an individual cell. To install the complete forward tank, proceed as follows:

TABLE XXI
INSTALLATION OF INDIVIDUAL FUEL CELLS — FORWARD TANK

TO INSTALL	*REFER TO PARAGRAPH 5–81, STEPS:*
Forward, left cell	a. through d., i. through l., n., o., t., u., x., y., z., aa., ab.
Forward, center cell	a. through d., i. through l., n., p., q., s. through w., y., z., aa., ab.
Forward, right cell	a. through d., i. through o., r., t. through v., x., y., aa., ab.
Aft, left cell	a. through d., f., h., l., n., o., t., u., x. through ab.
Aft, right cell	a. through e., g., h., l. through n., r., u., x., z., aa., ab.

Note

Extreme care should be exercised when handling the cells in temperatures below 4.4°C (40°F). In regions where temperatures of 4.4°C (40°F) and below exist, provisions should be made to heat the cabin section while working on the cells. The upper limit of temperature is 71°C (160°F).

Note

Apply anti-seize compound (index 43, paragraph 1—32) to the threads of all fittings.

a. If a new cell is being installed, remove it from its shipping container in accordance with applicable directives.

b. Inspect the bottom structure cell cavities for cleanliness and make certain they are free of sharp metal edges, burrs and filings.

c. Deflate the cells as much as possible and position them in the bottom structure cavities. Align the openings in each cell with the corresponding openings in the bottom structure.

CAUTION

Care must be exercised while inserting the cells into the bottom structure to avoid damaging the cells on projecting fittings or flanges within the cavities.

d. Lay the cell cover supports (14, 24, 32 and 49, sheet 1, figure 5—18) on top of each cell.

e. Insert the long transfer pump tube (6, sheet 2) into the aft, right cell (7) through the aft access hole.

CAUTION

Do not damage the cell while installing the tube. The forward end of the tube protrudes into the forward, right cell through the interconnecting hole.

f. Install the mounting posts inside the aft, left cell (28) and secure them with the nuts and washers (66). Position the fuel quantity probe (67) against the posts and secure it with the nuts and washers.

g. Secure the transfer pump tube fitting (9) to the aft well of the aft, right cell (7) with the bolts and washers (11). Lockwire the bolts. Connect the long transfer pump tube (6) to the fitting.

h. Install the floor panel over the aft cells and hatch. Secure the panel with the bolts and washers.

i. Install the floor panel over the forward cells and secure it with the bolts and washers.

j. Check to see that the gasket (39, sheet 1) and spacer (40) are correctly positioned at the filler hole in the floor panel. Position the elbow (41) over the hole and secure it to the floor panel with the bolts and washers (42). Tighten the bolts with 25 to 30 inch-pounds torque. Lockwire the bolts. Connect the vapor return line (43) to the union (44) in the elbow.

k. Position the filler cap (47) against the outer surface of the scupper. Install a gasket (45 and 46) against each surface of the scupper. Secure the filler cap and elbow (41) to the scupper with the bolts, washers and nuts (48).

l. Secure a cell cover support (14, 24, 32 and 49, sheet 1) to the lower surface of the floor panel at each cell access hole with the screws (13, 23, 31 and 50).

m. Secure the cells at the interconnecting hole in the forward wall of the aft, right cell (7, sheet 2) with the bolts, washers and nuts (29). Use the two most inboard nuts to secure the bracket against the aft cell. Install the clip around the transfer pump tube and secure it to the bracket with the screw, washers and nut.

Note

If only the forward, right cell is being installed, install the forward cell cover and access cover on the aft, right cell.

n. Install the bolts and washers (8 and 22) at the two interconnecting vent fittings (15 and 20) inside each cell. Lockwire the bolts.

o. Install the nuts and washers (23) at the two overboard vent fittings (27) inside the forward right cell (3), forward left cell (30) and aft left cells (28).

Note

On helicopters bearing USAF Serial Nos 53-4475 through 53-4477, secure the overboard vent fittings with bolts and washers. Lockwire the bolts.

p. Position the booster pump outlet tube fitting (59) at the forward wall of the forward, center cell (63). Install the corresponding fitting (56) and gasket (55) on the forward surface of the bottom structure bulkhead. Secure the two fittings with the bolts and washers (57). Lockwire the bolts.

Note

Access to the forward surface of the bottom structure bulkhead is gained through the small door in the floor just forward of the cabin forward bulkhead. (Refer to paragraph 5—79, step m.)

q. Install the gaskets and access door on the fuel strainer fitting flange just forward of the cabin forward bulkhead. Secure the door to the floor with the screws. Secure the door and gaskets to the strainer fitting flange with the bolts and washers. Install the gasket, jam nut and elbow in the strainer fittings. Tighten the jam nut. Install the fuel tube. Install the clutch access door.

Note

Install as many gaskets on the strainer fitting flange as are required to prevent bending of the access door when the bolts and washers are installed.

r. Install the reducer (5, figure 5—18) in the end of the long transfer pump tube (6) in the forward, right cell (3). Connect the short transfer pump tube (4) to the reducer.

Note

If only the aft, right cell is being installed, connect the short tube to the level control valve and install the cell cover and access cover on the forward, right cell.

s. Insert the booster pump outlet tube (70) into the forward, center cell (63) and connect it to the fitting (59) at the forward wall of the cell. Lay the fuel quantity probe (61) inside the cell.

t. Secure the cells at the interconnecting hole in the forward wall of the aft, left cell and each side wall of the forward cell with the bolts, washers and nuts (29). Install the bracket on the lower bolt in the forward, left cell (30).

Note

Tighten the nuts only fingertight.

u. Inspect each cell for cleanliness. Wipe the cells clean of all dirt and foreign material with a clean, soft cloth dampened with water.

v. Install the level control valve. (Refer to paragraph 5—156.)

Note

Do not fill the fuel tanks at this time.

Note

If only the forward, left cell is being installed, pull the probe leads through the interconnecting hole from the forward, center cell and install the clip.

w. Install the tank sump, but do not install the access cover. (Refer to paragraph 5—177.)

Note

Do not fill the fuel tanks at this time.

x. Install the external fuel tube fitting (33, 49, 52 and 77, figure 5—18) and gasket (31, 50, 53 and 75) at the bottom of the helicopter below each outside cell. Secure each fitting with the bolts and washers (32, 34, 44 and 47). Lockwire the bolts. Install each external fuel tube. Do not install the plates at this time.

y. Tighten the nuts (29) that secure the flanges at the interconnecting hole in the forward wall of the aft, left cell (28) and each side wall of the forward cell.

Note

If only an individual cell is being installed, install the cell cover and access cover on the adjacent cell or cells. If only the forward, right cell is being installed, install the cell cover and access cover on the forward, center cell.

z. Install the cell covers (21, 29 and 52, sheet 1) and gaskets (12, 22, 30 and 51) and the access covers (1, 4, 16 and 26) and gaskets (5, 17, 27 and 54) over all cells. Secure them with the bolts and washers (2, 3, 6, 15, 18, 25, 28 and 53). Lockwire the bolts (6, 18, 28 and 53) that secure the cell covers.

Note

The bolts that secure the cell cover to the support also secure the nut ring, which is a part of the cell, to the support. To assist in positioning the nut ring, thread one end of a piece of drill rod that is 8 to 10 inches long and the same diameter as the bolt. Insert the end of the drill rod through one of the holes in the support and screw it into the corresponding hole in the nut ring. Raise the nut ring into position against the support and use the drill rod to hold the nut ring in position while installing and securing the cell cover.

Note

At the forward, left cell access hole and at the forward access hole of the aft, left cell, connect the probe leads to each end of the connectors in the cell cover while installing the cover.

Note

When installing the connectors, apply acid resistant lacquer (index 17, paragraph 1—32) to the area around the connectors at the top of the cell covers.

aa. Pressure test the forward tank. (Refer to paragraph 5—75.)

ab. Fill all tanks with fuel. Check all external connections for possible leakage. Install all access plates and covers at the bottom of the helicopter.

5—82. CENTER FUEL TANK.

5—83. DESCRIPTION. The center fuel tank consists of three interconnected bladder-type (Pliocel) cells located in the cabin bottom structure beneath the cabin floor just aft of the forward tank. The three cells are internally interconnected at flanged holes in adjacent cell walls. Each outside cell is externally connected to the tank sump by a metal tube. The sump is located in the bottom of the center cell. This cell also contains a fuel transfer pump, the tank strainer, the tank drain, a low pressure warning switch, and a fuel quantity tank probe.

The left cell contains two vent fittings which are connected to the overboard vent lines; the right cell contains one such fitting. The center cell is vented by two vent fittings connected to each adjacent cell. Two access covers for each cell are installed in the floor panel over the cells. A filler elbow is installed at the right cabin bulkhead aft of the cargo door and is connected to the aft, right corner of the right cell.

5—84. REMOVAL. To remove an individual cell, refer to table XXII and accomplish as much of each indicated step as applies to the particular cell. To remove the complete center tank, proceed as follows:

Note

Extreme care should be exercised when handling the cells in temperatures below 4.4°C (40°F). In regions where temperatures of 4.4°C (40°F) and below exist, provisions should be made to heat the cabin section while working on the cells. The upper limit of temperature is 71°C (160°F).

TABLE XXII
REMOVAL OF INDIVIDUAL FUEL CELLS — CENTER TANK

TO REMOVE	REFER TO PARAGRAPH 5—84, STEPS:
Left cell	a. through d., o. through w., y.
Center cell	a. through h., p. through s., u., v., w., y.
Right cell	a. through f., i. through y.

a. Drain and purge all fuel tanks.

b. Remove the low pressure warning switch from the center cell forward cell cover. (Refer to paragraph 5—163, steps b. through h.)

c. Remove the bolts and washers (11, figure 5—19) that secure each access cover (12) to the cabin floor. Remove each cover and gasket (13).

d. Cut the lock wire and remove the bolts and washers (14) that secure each cell cover (15) to the support (18). Remove each cover and gasket (16).

e. Remove the screw, washers and nut from the clamp (52) around the short transfer pump tube (51) at the interconnecting hole in the right cell (64).

f. Disconnect the short transfer pump tube (51) from the check valve (55) at the front of the right cell (64) and from the tee (50) in the center cell (10). Remove the tube.

g. Disconnect the flexible hose (49) from the bushing in the tee (50) in the center cell (10). Remove the hose. Disconnect the tube (41) from the transfer pump (28). Remove the tube and tee.

h. Remove the tank sump. (Refer to paragraph 5—175.)

i. Disconnect the long transfer pump tube (63, figure 5—19) from the union (58) and connector (71) at each end of the right cell (64).

Note

Leave the tube inside the cell at this time.

j. Remove the access covers (26, sheet 1, figure 5—18) from the aft cells of the forward tank. Remove the screws (31) which secure the supports (32) to the floor panel.

k. Remove the bolts and washers that secure the floor panel over the hatch and aft cells of the forward tank. Remove the floor panel.

l. Cut the lock wire and remove the bolts and washers (13, sheet 2) from the aft end of the transfer connector (12) in the bottom structure cavity just forward of the right cell (64, figure 5—19). Remove the "Y" connector (57) and check valve (55) from inside the right cell. Remove the check valve, union (58) and gaskets (55 and 58) from the connector.

m. Remove the forward access cover and cell cover from the right cell of the aft tank. (Refer to paragraph 5—89, steps c. and d.)

n. Remove the bolts, washers and nuts (61, figure 5—20) that secure the connector (71, figure 5—19) to the aft wall of the right cell (64). Remove the connector.

o. Cut the lock wire and remove the bolts and washers (19) from the single overboard vent fitting (24) in the right cell (64) and the two overboard vent fittings in the left cell (20).

Note

On helicopters bearing USAF Serial Nos 53-4537 through 53-4554, washers and nuts are used.

p. Remove the bolts, washers and nuts (53) that secure the flanges (54) at the interconnecting hole in each cell. Remove the flanges. Remove the bracket (52) secured at the flange in the right cell (64).

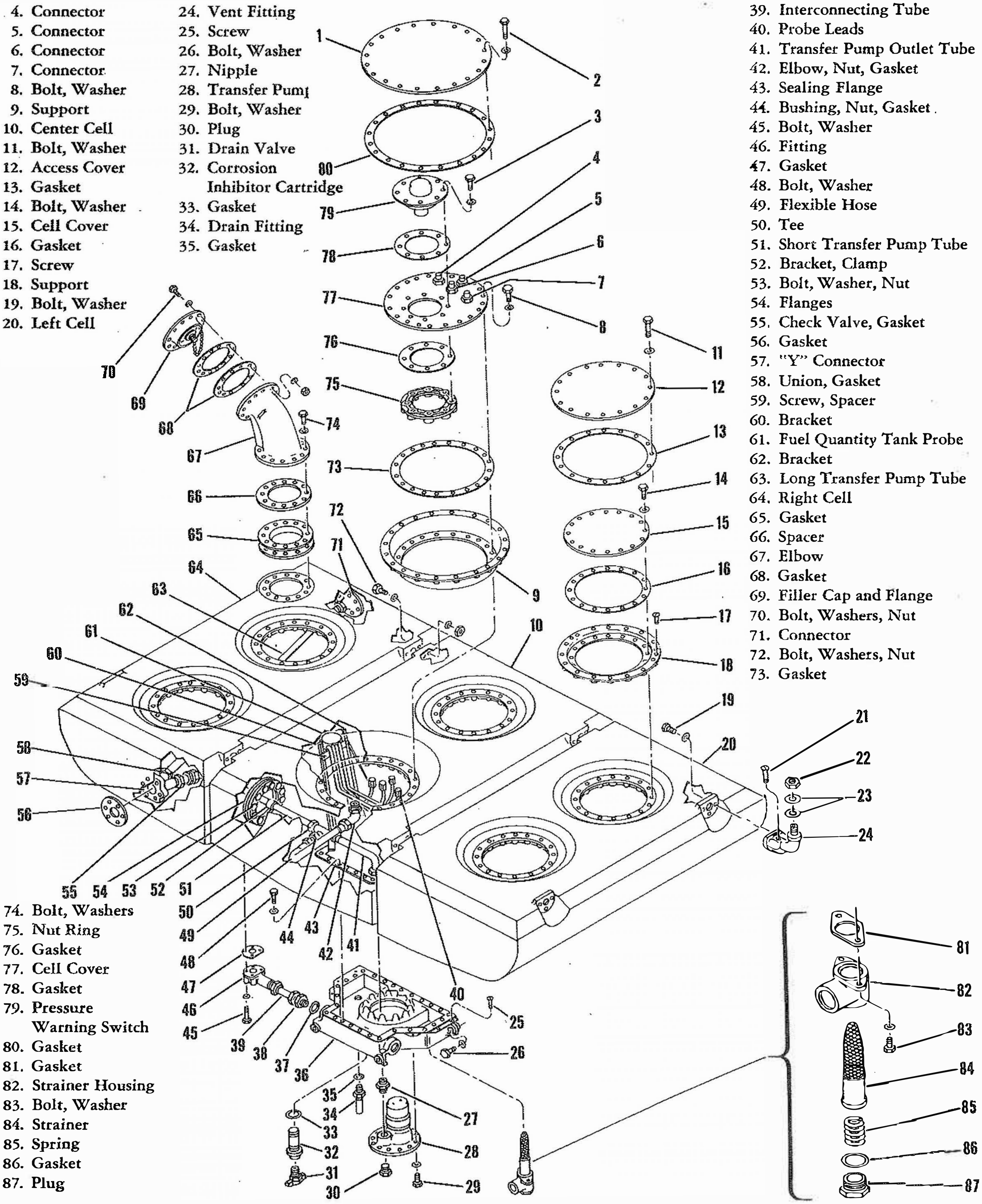
q. Remove the bolts, washers and nuts (72) at the two interconnecting vent fittings between each cell.

r. Remove the bolts, washers and nuts (70) that secure the filler cap (69) and flange and elbow (67) to the scupper in the right cabin wall. Remove the filler cap and gaskets (68).

s. Cut the lock wire and remove the bolts and washers (74) that secure the elbow (67) to the floor panel. Remove the elbow and gasket (68), but leave the gasket (65) and spacer (66) in position in the floor panel.

t. Remove the plates from beneath the helicopter below the external fuel tubes (39) leading to the sump

1. Access Cover
2. Bolt, Washer
3. Bolt, Washer
4. Connector
5. Connector
6. Connector
7. Connector
8. Bolt, Washer
9. Support
10. Center Cell
11. Bolt, Washer
12. Access Cover
13. Gasket
14. Bolt, Washer
15. Cell Cover
16. Gasket
17. Screw
18. Support
19. Bolt, Washer
20. Left Cell
21. Screw
22. Nut
23. Washers
24. Vent Fitting
25. Screw
26. Bolt, Washer
27. Nipple
28. Transfer Pump
29. Bolt, Washer
30. Plug
31. Drain Valve
32. Corrosion Inhibitor Cartridge
33. Gasket
34. Drain Fitting
35. Gasket
36. Sump
37. Gasket
38. Union
39. Interconnecting Tube
40. Probe Leads
41. Transfer Pump Outlet Tube
42. Elbow, Nut, Gasket
43. Sealing Flange
44. Bushing, Nut, Gasket
45. Bolt, Washer
46. Fitting
47. Gasket
48. Bolt, Washer
49. Flexible Hose
50. Tee
51. Short Transfer Pump Tube
52. Bracket, Clamp
53. Bolt, Washer, Nut
54. Flanges
55. Check Valve, Gasket
56. Gasket
57. "Y" Connector
58. Union, Gasket
59. Screw, Spacer
60. Bracket
61. Fuel Quantity Tank Probe
62. Bracket
63. Long Transfer Pump Tube
64. Right Cell
65. Gasket
66. Spacer
67. Elbow
68. Gasket
69. Filler Cap and Flange
70. Bolt, Washers, Nut
71. Connector
72. Bolt, Washers, Nut
73. Gasket



74. Bolt, Washers
75. Nut Ring
76. Gasket
77. Cell Cover
78. Gasket
79. Pressure Warning Switch
80. Gasket
81. Gasket
82. Strainer Housing
83. Bolt, Washer
84. Strainer
85. Spring
86. Gasket
87. Plug

Figure 5—19. Center Fuel Tank

(36). Remove the tubes. Cut the lock wire and remove the bolts and washers (45) that secure the fitting (46) below each outside cell (20 and 64). Remove each fitting and gasket (47).

u. Remove the screws (17), that secure the cell cover supports (9 and 18) to the lower surface of the floor panel at each cell access hole. Lay each support on the cell.

v. Remove the bolts and washers that secure the floor panel over the center tank. Remove the panel.

w. Remove the cell cover supports (9 and 18).

x. Remove the long transfer tube (63) from the right cell (64).

y. Deflate each cell as much as possible and remove it from the bottom structure cavity.

CAUTION

Do not damage the cells on projecting fittings or flanges within the cavities while removing the cells from the bottom structure.

Note

Disposition of the cells should be made in accordance with applicable directives.

5—85. MAINTENANCE. Maintenance and repair of the fuel cells should be accomplished only by qualified personnel and in accordance with applicable directives.

a. Test the check valve for proper operation and possible leakage.

b. Test the flexible hose line for possible leakage.

5—86. INSTALLATION. To install an individual cell, refer to table XXIII and accomplish as much of each indicated step as applies to the particular cell. To install the complete forward tank, proceed as follows:

Note

Extreme care should be exercised when handling the cells in temperatures below 4.4°C (40°F). In regions where temperatures of 4.4°C (40°F) and below exist, provisions should be made to heat the cabin section while working on the cells. The upper limit of temperature is 71°C (160°F).

Note

Apply anti-seize compound (index 43, paragraph 1—32) to the threads of all fittings.

a. If a new cell is being installed, remove it from its shipping container, in accordance with applicable directives.

TABLE XXIII
INSTALLATION OF INDIVIDUAL FUEL CELLS — CENTER TANK

TO INSTALL	REFER TO PARAGRAPH 5—86, STEPS:
Left cell	a. through d., f. through l., p., q., x. through ab.
Center cell	a. through d., f. through k., p., r., s., t., x. through ab.
Right cell	a. through q., t. through ab.

b. Inspect the bottom structure cell cavities for cleanliness and make certain they are free of sharp metal edges, burrs and filings.

c. Deflate the cells as much as possible and position them in the bottom structure cavities. Align the openings in each cell with the corresponding openings in the bottom structure.

CAUTION

Care must be exercised while inserting the cells into the bottom structure to avoid damaging the cells on projecting fittings or flanges within the cavities.

d. Lay the cell cover supports (9 and 18, figure 5—19) on top of each cell.

e. Insert the long transfer pump tube (63) into the right cell (64).

f. Install the floor panel over the center tank. Secure the panel with the bolts and washers.

g. Secure a cell cover support (9 and 18) to the lower surface of the floor panel at each cell access hole with the screws (17).

h. Check to see that the gasket (65) and spacer (66) are correctly positioned at the filler hole in the floor panel. Position the elbow (67) over the hole and secure it to the floor panel with the bolts and washers (74). Tighten the bolts with 25 to 30 inch-pounds torque. Lockwire the bolts.

i. Position the filler cap (69) against the outer surface of the scupper. Install a gasket (65) against each surface of the scupper. Secure the filler cap and elbow (67) to the scupper with the bolts, washers and nuts (76).

j. Install the bolts, washers and nuts (72) at the two interconnecting vent fittings between each cell.

k. Install the flanges (54) at the interconnecting hole in each cell and secure them with the bolts, washers and nuts (53). Use the first two nuts below the center line at the forward edge of the hole to secure the bracket (52) against the flange in the right cell (64).

l. Install the bolts and washers (19) in the single overboard vent fitting in the right cell (64) and the two overboard vent fittings (24) in the left cell (20). Lockwire the bolts.

Note

On helicopters bearing USAF Serial Nos 53-4537 through 53-4554, washers and nuts are used.

m. Position the connector (71) at the aft wall of the right cell (64). Reach into the right cell (62, figure 5—20) of the aft tank and install the bolts, washers and nuts (61) that secure the connector.

n. Install the check valve (55, figure 5—19) union and gaskets (58) in the transfer pump tube "Y" connector (57). Position the "Y" connector (57) at the forward wall of the right cell (64). Secure the connector by installing the bolts and washers (13, sheet 2, figure 5—18) in the aft end of the transfer connector (12) in the bottom structure cavity just forward of the right cell (64, figure 5—19). Lockwire the bolts.

CAUTION

Check to see that the check valve is installed so the direction of flow is forward.

o. Connect the long transfer pump tube (63) to the connector (71) at the aft end of the right cell (64) and the union (58) in the "Y" connector (57) at the forward end of the cell.

p. Inspect each cell for cleanliness. Wipe the cells clean of all dirt and foreign material with a clear, soft cloth dampened with water.

q. At the bottom of the helicopter install the external fuel tube fitting (46) and gasket (47) below each outside cell (20 and 64). Secure each fitting with the bolts and washers (45). Lockwire the bolts. Install each external fuel tube (39). Do not install the plates at this time.

r. Install the tank sump, but do not install the access cover. (Refer to paragraph 5—177.)

Note

Do not fill the fuel tanks at this time.

s. Install the bushing, nut and gasket (44, figure 5—19) in the tee (50). Install the tee in the transfer pump tube (41). Connect the tube to the transfer pump (28). Connect the flexible hose (49) to the bushing (44) in the tee.

t. Connect the short transfer pump outlet tube (51) to the tee (50) in the center cell (10) and to the check valve (55) in the right cell (64). Install the clamp (52) around the tube and secure it to the bracket (52) at the interconnecting hole with screw, washers and nuts.

CAUTION

Check to see that the check valve is installed so the direction of flow is forward.

u. Install the forward cell cover and access cover in the right cell of the aft tank. (Refer to paragraph 5—91, step t.)

v. Install the floor panel over the hatch and aft cells of the forward tank and secure it with the bolts and washers.

w. Secure the supports (9 and 18, figure 5—19) to the floor panel with the screws (17). Install the access covers (16 and 26, sheet 1, figure 5—18) over the aft cells (7 and 28, sheet 2) of the forward tank.

x. Install the low pressure warning switch in the center cell forward cell cover. (Refer to paragraph 5—165, steps c. through g.)

Note

Do not fill the fuel tanks at this time.

y. Install the cell covers (15, figure 5—19) and gaskets (16) and the access covers (12) and gaskets (13). Secure them with the bolts and washers (11). Lockwire the bolts (14) that secure the cell covers. As an aid in positioning the nut ring (75) below the cell cover, use a drill rod as described in paragraph 5—63, step z.

z. Pressure test the center tank. (Refer to paragraph 5—75.)

aa. Fill all tanks with fuel. Check all external connections for possible leakage. Install all access plates and covers at the bottom of the helicopter.

ab. Test the low pressure warning system. (Refer to paragraph 5—166.)

5—87. AFT FUEL TANK.

5—88. DESCRIPTION. The aft fuel tank consists of three interconnected bladder-type (Pliocel) cells located in the cabin bottom structure beneath the cabin floor just forward of the cabin aft bulkhead. The three cells are internally interconnected at flanged holes in adjacent cell walls. Each outside cell is externally connected to the tank sump. The sump is located in the bottom of the center cell. The center cell also contains a fuel transfer pump, the tank strainer, the tank drain, a low pressure warning switch and a fuel quantity tank probe. Each outside cell contains two vent fittings which are connected to overboard vent lines. The center cell is vented by two vent fittings connected to each adjacent cell. Two access covers for each cell are installed in the floor panel over the cells. A filler elbow is installed at the right cabin wall below and slightly aft of the cabin window and is connected to the right cell.

5—89. REMOVAL. To remove an individual cell, refer to table XXIV and accomplish as much of each indicated step as applies to the particular cell. To remove the complete aft tank, proceed as follows:

Note

Extreme care should be exercised when handling the cells in temperatures below 4.4°C (40°F). In regions where temperatures of 4.4°C (40°F) and below exist, provisions should be made to heat the cabin section while working on the cells. The upper limit of temperature is 71°C (160°F).

TABLE XXIV
REMOVAL OF INDIVIDUAL FUEL CELLS — AFT TANK

TO REMOVE	REFER TO PARAGRAPH 5—89, STEPS:
Left cell	a. through d., k. through t.
Center cell	a. through h., l. through o., q. through t.
Right cell	a. through f., i. through t.

a. Drain and purge all fuel tanks.

b. Remove the low pressure warning switch from the center cell forward cell cover. (Refer to paragraph 5—163, steps b. through g.)

c. Remove the bolts and washers (15, figure 5—20) that secure each access cover (16) to the cabin floor. Remove each cover and gasket (17).

d. Cut the lock wire and remove the bolts and washers (18) that secure each cell cover (19) to the support (21). Remove each cover and gasket (20).

e. Remove the screw, washers and nut from the clamp (59) around the transfer pump tube (57) at the interconnecting hole in the right cell (62). Remove the clamp.

f. Disconnect the transfer pump tube (57) from the connector (60) at the front of the right cell (62) and from the check valve (55) in the tee (52) in the center cell (50). Remove the tube.

g. Disconnect the flexible hose (31) from the reducer (54) in the tee (52) in the center cell (50). Remove the hose. Disconnect the outlet tube (30) from the transfer pump (34). Remove the tube and tee.

h. Remove the tank sump. (Refer to paragraph 5—175.)

i. Remove the aft access cover and cell cover from the

Key to Figure 5—20

1. Access Cover
2. Bolt, Washer
3. Gasket
4. Connector
5. Connector
6. Connector
7. Connector
8. Bolt, Washer
9. Gasket
10. Nut Ring
11. Gasket
12. Support
13. Screw
14. Bolt, Washers, Nut
15. Bolt, Washer
16. Access Cover
17. Gasket
18. Bolt, Washer
19. Cell Cover
20. Gasket
21. Support
22. Bolt, Washer
23. Screw
24. Nut
25. Washer
26. Vent Fitting
27. Left Cell
28. Probe Leads
29. Elbow
30. Transfer Pump Outlet Tube
31. Flexible Hose
32. Bolt, Washers, Nut
33. Screw
34. Transfer Pump
35. Bolt, Washer
36. Plug
37. Nipple
38. Drain Fitting
39. Gasket
40. Drain Valve
41. Corrosion Inhibitor Cartridge
42. Gasket
43. Union
44. Interconnecting Tube
45. Sump
46. Gasket
47. Bolt, Washer
48. Fitting
49. Gasket
50. Center Cell
51. Sealing Flange
52. Tee
53. Bolt, Washer
54. Reducer, Gasket
55. Check Valve
56. Bolt, Washer, Nut
57. Transfer Pump Tube
58. Flanges
59. Bracket, Clamp
60. Connector
61. Bolt, Washer, Nut
62. Right Cell
63. Bracket
64. Screw, Spacer
65. Fuel Quantity Tank Probe
66. Bracket
67. Gasket
68. Spacer
69. Screw
70. Bolt, Washer
71. Elbow
72. Gasket
73. Filler Cap and Flange
74. Bolt, Washers, Nut
75. Cell Cover
76. Gasket
77. Pressure Warning Switch
78. Bolt, Washer
79. Gasket
80. Strainer Housing
81. Bolt, Washer
82. Strainer
83. Spring
84. Gasket
85. Plug

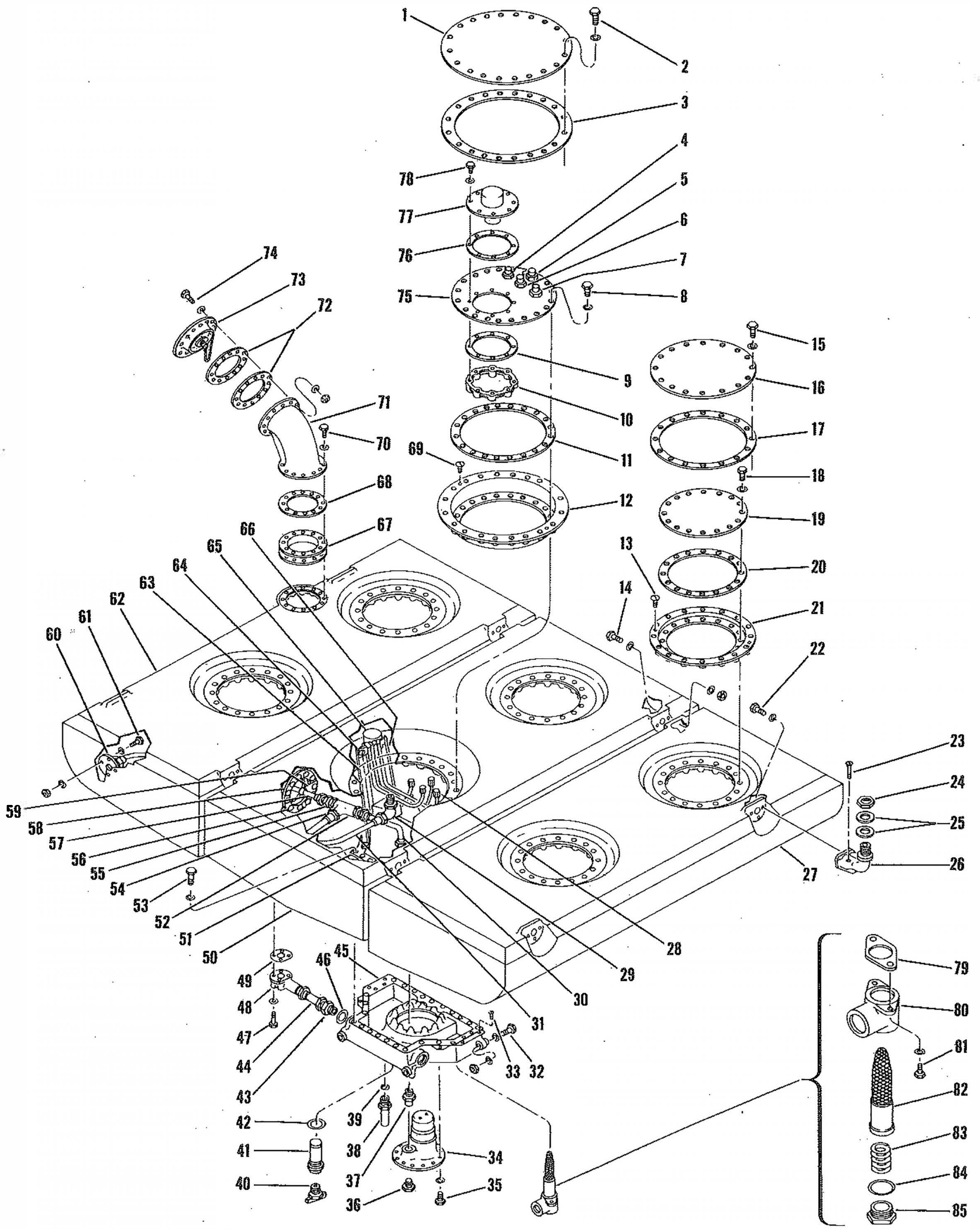


Figure 5—20. Aft Fuel Tank

right cell of the center tank. (Refer to paragraph 5–84, steps c. and d.)

j. Remove the bolts, washers and nuts (61, figure 5–20) that secure the connector (60) at the forward wall of the right cell (62). Remove the connector.

k. Cut the lock wire and remove the bolts and washers (22) from the two overboard vent fittings (26) in each outside cell (27 and 62).

Note

On helicopters bearing USAF Serial Nos 53-4537 through 53-4554, washers and nuts are used.

l. Remove the bolts, washers and nuts (56) that secure the flanges (58) at the interconnecting hole in each cell. Remove the flanges. Remove the bracket (59) secured to the flange (58) in the right cell (62).

m. Remove the bolts, washers and nuts (14) at the two interconnecting vent fittings between each cell.

n. Remove the bolts, washers and nuts (74) that secure the filler cap (73) and elbow (71) to the scupper in the right cabin wall. Remove the filler cap and gasket (72).

o. Cut the lock wire and remove the bolts and washers (70) that secure the elbow (71) to the floor panel. Remove the elbow and gasket (72), but leave the gasket (67) and spacer (68) in position in the floor panel.

p. Remove the plates from beneath the helicopter below the external fuel tubes (44) leading to the sump (45). Remove the tubes. Cut the lock wire and remove the bolts and washers (47) that secure the fitting (48) below each outside cell (27 and 62). Remove each fitting and gasket (49).

q. Remove the screws (13 and 69), that secure the cell cover support (12 and 21) to the lower surface of the floor panel at each cell access hole. Lay each support on the cell.

r. Remove the bolts and washers that secure the floor panel over the aft tank. Remove the panel.

s. Remove the cell cover supports (12 and 21).

t. Deflate each cell as much as possible and remove it from the bottom structure cavity.

CAUTION

Do not damage the cells on projecting fittings or flanges within the cavities while removing the cells from the bottom structure.

Note

Disposition of the cells should be made in accordance with applicable directives.

5–90. MAINTENANCE. Maintenance and repair of the fuel cells should be accomplished only by qualified personnel and in accordance with applicable directives.

a. Test the check valve for proper operation and possible leakage.

b. Test the flexible hose lines for possible leakage.

5–91. INSTALLATION. To install an individual cell, refer to table XXV and accomplish as much of each indicated step as applies to the particular cell. To install the complete forward tank, proceed as follows:

Note

Extreme care should be exercised when handling the cells in temperatures below 4.4°C (40°F). In regions where temperatures of 4.4°C (40°F) and below exist, provisions should be made to heat the cabin section while working on the cells. The upper limit of temperature is 71°C (160°F).

Note

Apply anti-seize compound (index 43, paragraph 1–32) to the threads of all fittings.

a. If a new cell is being installed, remove it from its shipping container in accordance with applicable directives.

TABLE XXV
INSTALLATION OF INDIVIDUAL FUEL CELLS — AFT TANK

TO INSTALL	REFER TO PARAGRAPH 5–93, STEPS:
Left cell	a. through k., m., n., s. through w.
Center cell	a. through j., m., o., p., q., s. through w.
Right cell	a. through n., q. through w.

b. Inspect the bottom structure cell cavities for cleanliness and make certain they are free of sharp metal edges, burrs and filings.

c. Deflate the cells as much as possible and position them in the bottom structure cavities. Align the openings in each cell with the corresponding openings in the bottom structure.

CAUTION

Care must be exercised while inserting the cells into the bottom structure to avoid damaging the cells on projecting fittings or flanges within the cavities.

d. Lay the cell cover supports (12 and 21, figure 5–20) on top of each cell.

e. Install the floor panel over the aft tank. Secure the panel with the bolts and washers.

f. Secure a cell cover support (12 and 21) to the lower surface of the floor panel at each cell access hole with the screws (13 and 69).

g. Check that the gasket (67) and spacer (68) are correctly positioned at the filler hole in the floor panel. Position the elbow (71) over the hole and secure it to the floor panel with the bolts and washers (70). Tighten the bolts with 25 to 30 inch-pounds torque. Lockwire the bolts.

h. Position the filler cap (73) against the outer surface of the scupper. Install a gasket (72) against each surface of the scupper. Secure the filler cap and elbow (71) to the scupper with the bolts, washers and nuts (74).

i. Install the bolts, washers and nuts (14) at the two interconnecting vent fittings between each cell.

j. Install the flanges (58) at the interconnecting hole in each cell and secure them with the bolts, washers and nuts (56). Use the first two nuts below the center line at the forward edge of the hole to secure the bracket (59) against the flange in the right cell (62).

k. Install the bolts and washers (22) in the two overboard vent fittings (26) in each outside cell (27 and 62). Lockwire the bolts.

Note

On helicopters bearing USAF Serial Nos 53-4537 through 53-4554, washers and nuts are used.

l. Position the connector (60) at the forward wall of the right cell (62) and secure it with the bolts, washers and nuts (61).

Note

Reach into the aft access hole of the center tank right cell to install the nuts and washers.

m. Inspect each cell for cleanliness. Wipe the cells clean of all dirt and foreign material with a clean, soft cloth dampened with water.

n. At the bottom of the helicopter, install the external fuel tube fitting (48) and gasket (49) below each outside cell (27 and 62). Secure each fitting with the bolts and washers (47). Lockwire the bolts. Install each external fuel tube (44). Do not install the plates at this time.

o. Install the tank sump, but do not install the access cover. (Refer to paragraph 5–177.)

Note

Do not fill the fuel tanks at this time.

p. Install the union, check valve (55, figure 5–20) reducers and gaskets (54) in the tee (52). Install the tee in the transfer pump tube (57). Connect the tube to the transfer pump (34). Connect the flexible hose (31) to the reducer (54) in the tee.

q. Connect the transfer pump tube (57) to the connector (60) at the front of the right cell (62) and to the check valve (55) in the tee (52) in the center cell (50). Install the clamp (59) around the tube and secure it to the bracket (59) at the interconnecting hole with the screw, washers and nut.

CAUTION

Check to see that the check valve is installed so the direction of flow is forward.

r. Install the aft cell cover (15, figure 5–19) and gasket (16) and access cover (12) and gasket (13) in the right cell (64) of the center tank. Lockwire the bolts (11) that secure the cell cover.

s. Install the low pressure warning switch in the center cell forward cell cover. (Refer to paragraph 5–165, steps c. through g.)

Note

Do not fill the fuel tanks at this time.

t. Install the cell covers (19, figure 5–20) and gaskets (20) and the access covers (16) and gaskets (17). Secure them with the bolts and washers (2 and 15). Lockwire the bolts (18) that secure the cell covers. As an aid in positioning the nut ring (10) below the cell cover, use a drill rod as described in paragraph 5–81, step z.

u. Pressure test the aft tank. (Refer to paragraph 5–75.)

v. Fill all tanks with fuel. Check all external connections for possible leakage. Install all access plates and covers at the bottom of the helicopter.

w. Test the low pressure warning system. (Refer to paragraph 5–166.)

5–92. EMERGENCY FUEL SYSTEM.

5–93. DESCRIPTION. The emergency fuel system is a gravity feed system controlled by the fuel selector valve. In the event of electrical failure or failure of one or more of the electrically driven fuel pumps, fuel can be routed from all fuel tanks directly to the fuel selector valve by placing the selector valve control in the "EMER ON" position. When the selector valve control is in this position, fuel flows from each tank sump through inteconnected metal tubes suspended beneath the helicopter to the "Y" drain connector at the bottom of the selector valve. The metal tubes are connected to the tank sumps at a check valve installed in the tank strainer housing.

All the tubes are covered by removable fairing. The cabin heater fuel tubes are also routed inside this fairing and are clamped to the emergency fuel system tubes.

5–94. REMOVAL.

a. Place the fuel selector valve control in the "OFF" position.

b. Drain and purge all fuel tanks.

c. Remove all sections of the emergency fuel line fairing from the bottom of the helicopter.

d. Loosen the fasteners in the hinged panel below the fuel selector valve and swing the panel down.

e. Remove all the clamps that secure the cabin heater fuel tubes to the emergency fuel tubes.

f. Loosen the connection between the aft long tube and the check valve below the aft fuel tank sump and drain the trapped fuel from the emergency fuel tubes.

g. Disconnect the short tube from the elbow in the "Y" drain connector at the bottom of the selector valve and from the tee below the forward fuel tank. Loosen the jam nut at the bottom of the "Y" drain and remove the elbow, nut and gasket.

h. Disconnect both of the long tubes at the tees. Disconnect the aft tube at the check valve below the aft fuel tank sump.

i. Remove the screw, washers and nut at each of the clamps around the long tubes. Remove the tubes and clamps.

j. Disconnect the short tube from the check valve below the forward and center fuel tank sumps. Remove the tee from each tube.

k. Remove the check valve and gasket from the tank strainer housing attached to the bottom of each tank sump.

5–95. MAINTENANCE.

a. Test the check valves for proper operation and possible leakage.

b. Check all tubes for dents, nicks and possible cracks, Check the end fittings for security.

5–96. INSTALLATION.

Note

Apply anti-seize compound (index 43, paragraph 1–32) to the threads of all fittings.

a. Install a check valve and gasket in the tank strainer housing attached to the bottom of each fuel tank sump.

CAUTION

Check that the check valve is installed so the direction of flow is forward.

b. Connect the short tube to the check valve below the forward and center tank sumps. Install the short leg of the tee in the tube below the center tank sump and one end of the long leg of the tee in the tube below the forward tank sump.

c. Position the aft long tube and connect it to the check valve below the aft tank sump and to the tee below the center tank.

d. Position the forward long tube and connect it to the tees.

e. Position the clamps around the long tube and secure them to the fairing attaching angles with the screws, washers and nuts.

f. Install the elbow, jam nut and gasket at the "Y" drain connector below the fuel selector valve. Tighten the jam nut. Position the short tube and connect it to the elbow in the "Y" drain and the tee below the forward fuel tank.

g. Install the clamps that secure the cabin heater fuel tubes to the emergency fuel tubes.

h. Close the system drain and check to see that the fuel selector valve control is in the "OFF" position. Fill all tanks with fuel.

i. Open the system drain enough to bleed the trapped air from the emergency fuel tubes.

j. Check all connections for possible leakage.

k. Secure the hinged panel in position beneath the fuel selector valve.

l. Install all sections of the emergency fuel line fairing.

5–97. TESTING CHECK VALVES.

a. Drain all the fuel tanks.

b. Connect an auxiliary source of power to the external power receptacle and place the "FLT. INST. INV." switch in the "MAIN" position.

c. Position the fuel selector valve in the "OFF" position. Place the fuel quantity selector switch in the "TOT" position.

d. Add 20 gallons of fuel to the aft tank.

Note

Place the fuel quantity selector switch in the "FWD," "CTR" and "AFT" positions. The forward and center tanks should register empty and the aft tank should register 20 gallons, less trapped fuel.

e. Drain five gallons of fuel from the system drain valve.

Note

Flow from the drain valve will indicate that the aft tank strainer is unobstructed.

f. Place the "FLT. INST. INV." in the "OFF" position.

Note

After each indicated step, place the "FLT. INST. INV." switch in the "OFF" position.

Note

Allow the helicopter to remain in this condition for 30 minutes. Place the "FLT. INST. INV." switch in the "MAIN" position. Note the gage reading for all three tanks, less trapped fuel; any fuel registering in the forward or center tanks will indicate leakage in the corresponding check valve.

g. Add 60 gallons of fuel to the center tank. Place the "FLT. INST. INV." switch in the "MAIN" position. Note the gage reading, less trapped fuel, for all three tanks.

h. Drain five gallons of fuel from the system drain valve.

Note

Failure of fuel to drain from the center tank would indicate a jammed or closed check valve.

i. Note the gage reading for all three tanks.

Note

Allow the helicopter to remain in this condition for 30 minutes. Place the "FLT. INST. INV." switch in the "MAIN" position. Note the gage reading for all three tanks, less trapped fuel; any increase from the previous reading for the forward and aft tanks will indicate leakage in the corresponding check valve.

j. Place the fuel selector valve in the "ON" position. Turn the "AFT" and "CTR" transfer pump switches to "ON" to pump all the fuel to the forward tank. Note the gage reading for all three tanks.

k. Drain five gallons of fuel from the system drain valve.

Note

Flow from the system drain valve will indicate that the forward tank check valve is operating properly.

Note

Allow the helicopter to stand for 30 minutes. Place the "FLT. INST. INV." switch in the "MAIN" position. Note the fuel quantity gage, less trapped fuel; any increase in the center and aft tanks will indicate a reverse flow leakage.

5—98. FUEL TANK VENT SYSTEM.

5—99. DESCRIPTION. The fuel tank vent system vents each fuel tank to the outside air through tubing installed in the cabin walls. The lower end of each vent tube is connected to a vent fitting located just below the cabin floor. The upper end of each tube is connected to an outlet fitting riveted to the inner surface of the fuselage skin. The five forward vents on the left side are covered by a manifold, riveted to the outer surface of the fuselage, which protects the outlets and prevents the fumes from entering the cockpit. The two forward vents on the right side connect with two tube assemblies, clamped to the outer surface of the fuselage skin, which carry the fumes over the cargo door and beyond the cockpit area. The remaining vents are protected by individual hoods riveted to the outside of the fuselage skin. A fuel detector is installed in the vent tube from the forward left cell of the forward tank. In the event of malfunctioning of the level control valve and when the fuel level reaches the detector in the vent tubes, the transfer pumps in the center and aft tanks are automatically shut off.

5—100. REMOVAL.

a. Disconnect the tube from each tank vent fitting (27, sheet 2, figure 5—18) at the right and left sides of the cabin floor.

b. Remove the floor panels located over the fuel tanks. (Refer to paragraph 2—72, steps a. through d.)

c. Remove the bolts and washers (6, 18 and 28, sheet 1, figure 5—18) securing the cell cover (21 and 29) and gasket (12, 22 and 30) to the lip of the support (14, 24 and 32) at the right and left cells of all fuel tanks.

CAUTION

Disconnect the probe leads (33 through 38) from the connectors (7 through 10, 19 and 20) which are installed in the cell cover of each left cell of the forward tank.

d. In the forward tank, remove the nuts and washers (23, sheet 1, figure 5—18) from the vent fittings (27). In the center and aft tanks, cut the lock wire and remove the bolts and washers (19, figure 5—19) from the vent fittings (24) inside of each outboard cell.

e. Remove the screws (26, sheet 2, figure 5—18) which secure the vent fittings (27) to the bottom structure longerons.

f. Support the vent fittings (27). Remove the nut (24) and washers (25) securing each vent fitting to the bottom structure longerons. Remove the fittings.

g. Support the interconnecting vent tube (17) between the aft cells of the forward tank. Disconnect the tube from the unions (16 and 18). Remove the tubes. Remove the unions and nuts and gaskets (19) from the fittings (15 and 20).

h. Support the fittings (15 and 20). Reach into the cells, cut the lock wire and remove the bolts and washers (22) from the fittings. Remove the fittings and gaskets (21).

i. Remove the fuel detector. (Refer to paragraph 5—159.)

j. Remove the screws, washers, nuts and clamps from all tubes.

k. Disconnect all tubes from the unions and elbows. Remove the nuts, washers, unions and elbows.

l. Disconnect the tubes from the fittings which are riveted to the cabin wall at the hoods. Remove all tubes.

m. Disconnect the outside vent tubes on the right side of the fuselage from the vent fittings and remove the screws, washers and nuts that secure the clamps to the fuselage. Remove the tubes and clamps.

5—101. MAINTENANCE.

a. Check all tubes and fittings for dents or leakage.

b. Replace any tubes or fittings that have damaged threads.

c. Inspect all tubes and fittings for foreign matter which might cause stoppage.

5—102. INSTALLATION.

Note

Apply anti-seize compound (index 43, paragraph 1—32) to the threads of all fittings.

a. Position the two tube assemblies and clamps on the right side of the helicopter and install the screws, washers, and nuts. Connect the tubes to the forward vent fittings.

b. Secure a tube to each of the fittings which are riveted to the cabin walls.

c. Install the unions, elbows, washers and nuts in the frames. Connect the tubes to the unions and elbows.

d. Install the fuel detector. (Refer to paragraph 5—159, steps a. and b.)

e. Install all the clamps and secure them with the screws, washers and nuts.

f. Secure the gaskets (21, sheet 2, figure 5—18) and fittings (15 and 20) to the aft cells of the forward tank with the bolts and washers (22). Lockwire the bolts.

g. Install the unions (16 and 18), nuts and gaskets (19) in the fittings (15 and 20). Connect the tubes (17) to the unions (16 and 18).

h. Position the tank vent fittings (24, figure 5—19) in the center and aft tanks at the outboard side of each cell wall. Secure the fittings with the bolts and washers (19). Lockwire the bolts. In the forward tank, secure the fittings (27, figure 5—18, sheet 2) with the nuts and washers (23).

i. Secure the fittings (27) to the bottom structure longerons with the screws (26). Install the washers (25) and nuts (24).

j. Connect the probe leads (33 and 38, sheet 1) to the connectors (7 through 10, 19 and 20) which are installed in each cell cover of the forward tank left cells.

k. Install the cell covers (21 and 29) and gaskets (12, 22 and 30) on the lip of the support at the right and left cells of all fuel tanks. Secure the covers with the bolts and washers (6, 18 and 28).

l. Install the floor panels over the fuel tanks. (Refer to paragraph 2—73, steps a. through d.)

m. Connect a tube to each tank vent fitting (27, sheet 2, figure 5—18).

n. Pressure test the vent system. (Refer to paragraph 5—74.)

5—103. CARBURETOR.

5—104. DESCRIPTION. A double-barrel, downdraft, pressure-type carburetor is installed on a studded pad on top of the supercharger rear housing. The carburetor incorporates a two-point priming system controlled by a solenoid valve. The valve is actuated by the "ENG PRM OFF OIL DIL" switch on the electrical switch panel in the cockpit.

5—105. REMOVAL.

a. Open the nose doors.

b. Remove the air intake duct from the top of the carburetor. (Refer to paragraph 5—279.)

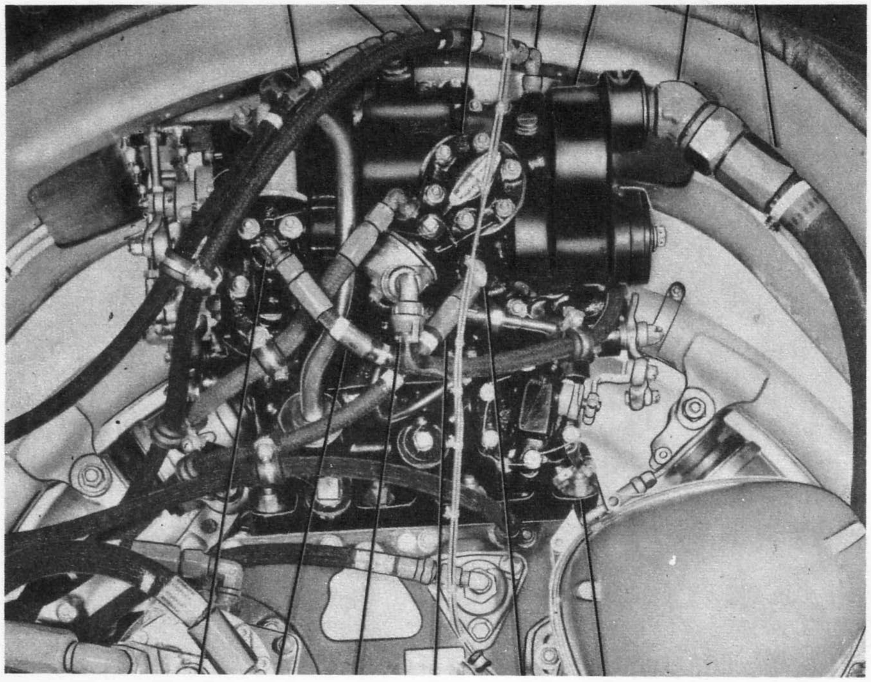
c. Disconnect the carburetor air temperature bulb wires at the terminal block on the top shroud panel. Remove the clamps holding the wires to the panel. Pull the lower wires down through the panel.

d. Remove the well (4, figure 5—9) and the upper shroud panel (6). Install a protective cover over the top deck of the carburetor (6, figure 5—21). Secure the screen and two gaskets under the protective cover.

e. Disconnect the fuel inlet line (8), fuel pressure line (11) and both vapor return lines (1 and 3) from the carburetor. Remove the altitude compensator vent line (13). Remove the elbows (2, 5, 7 and 14) from each of the carburetor ports and install a plug. Remove the restrictor (10) and install a plug.

f. Disconnect the electrical wiring (12) from the primer solenoid (4).

g. Remove the nuts and washers (9) that secure the



1. Vapor Return Line
2. Vapor Return Elbow
3. Vapor Return Line
4. Primer Solenoid
5. Vapor Return Elbow
6. Carburetor
7. Fuel Inlet Elbow
8. Fuel Inlet Line
9. Nut, Washer
10. Fuel Pressure Restrictor
11. Fuel Pressure Line
12. Electrical Wiring to Primer Solenoid
13. Altitude Compensator Vent Line
14. Altitude Compensator Elbow

Figure 5—21. Carburetor Installed

carburetor (6) to the engine. Lift the carburetor off the engine. Remove the gasket from the carburetor port of the engine.

h. Install a protective cover over the carburetor port of the engine and the lower deck of the carburetor.

i. If the carburetor is to be stored or shipped, preserve it in accordance with applicable directives.

5—106. MAINTENANCE. Carburetor maintenance should be accomplished only by qualified personnel and in accordance with applicable directives.

5—107. INSTALLATION.

a. If a new carburetor (6, figure 5—21) is to be installed, depreserve it in accordance with applicable directives.

b. Remove all protective covers and plugs from the carburetor and the carburetor port of the engine.

c. Install a new gasket on the carburetor port flange of the engine. Position the carburetor on the engine and secure it with the washers and nuts (9).

d. Install the fuel inlet elbow (7), fuel pressure restrictor (10), altitude compensator (14) and vapor return elbow (2 and 5) in the carburetor. Connect each hose line (1, 3, 8, 11 and 13) to its respective fitting.

e. Install the upper shroud panel (6, figure 5—9). Position the screen and two gaskets on the top deck of the carburetor. Install the well (4).

f. Install the air intake duct on the top of the carburetor. (Refer to paragraph 5—284.)

g. Route the lower carburetor air temperature bulb wires through the hole in the top shroud panel. Connect the wires to the terminal block on the panel. Install the clamps that secure the wires to the panel. Replace the terminal block cover.

h. Connect the electrical wiring (12, figure 5—21) to the primer solenoid (4).

i. With the mixture control in "IDLE CUT-OFF," place the fuel selector valve control in the "ON" position. Check the hose lines and fittings at the carburetor for leakage with the booster pump on.

j. Check the adjustment of the throttle control linkage (paragraph 5—49), carburetor mixture control linkage (paragraph 5—57), carburetor air temperature control linkage (paragraph 5—65) and the idle adjustment (paragraph 5—108).

k. Close the nose doors.

5—108. IDLE ADJUSTMENT.

a. Adjust the throttle stop on the carburetor to make the engine idle at 1100 rpm with the clutch disengaged, the mixture control in "RICH," the cockpit throttle control closed, and the cylinder head temperature above 125°C (257°F).

b. Adjust the mixture for best power by loosening the carburetor idle mixture adjustment lock screw and

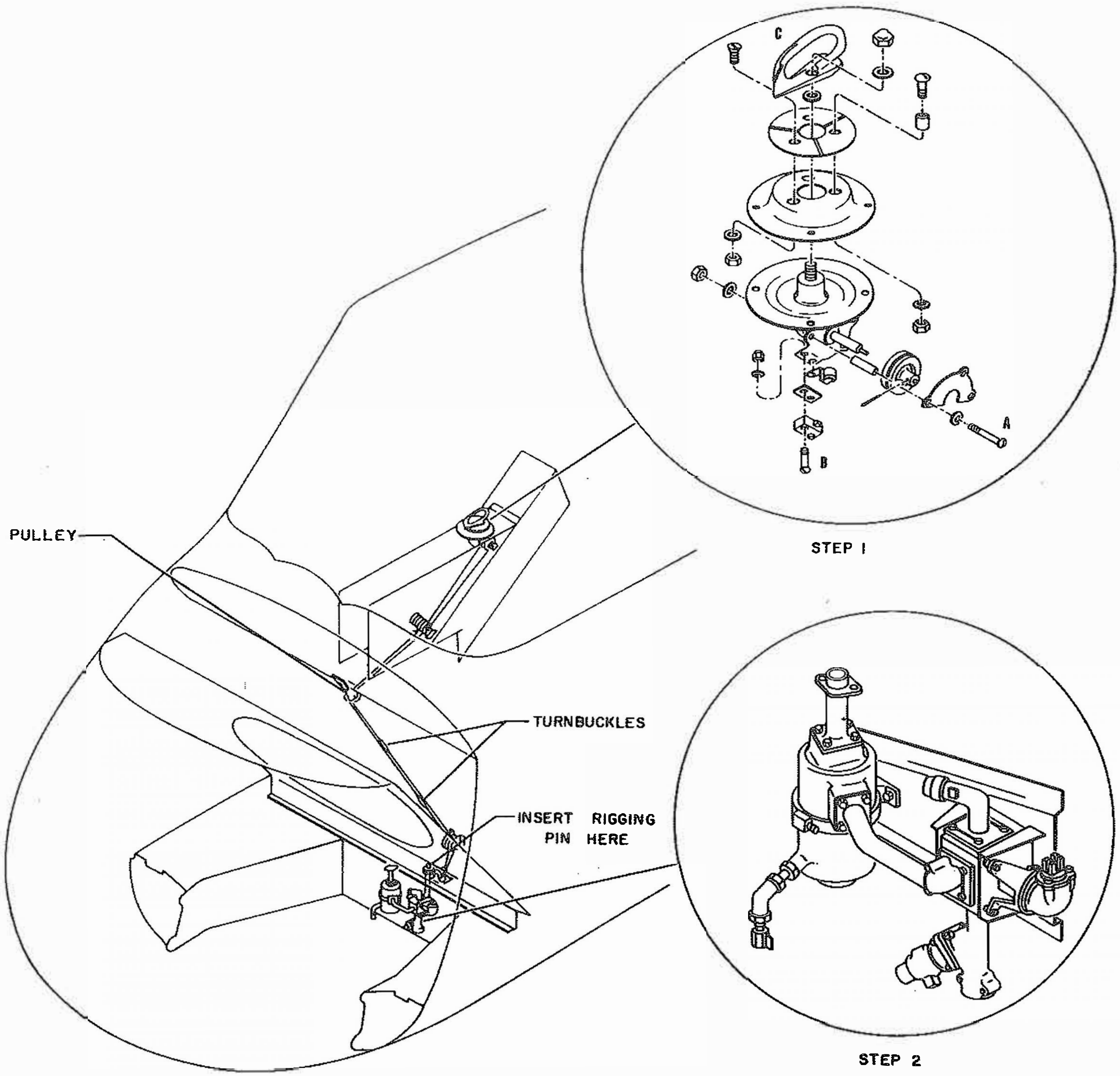


Figure 5—22. Fuel Selector Valve System

turning the idle mixture adjustor one notch at a time until the lowest manifold pressure and the highest rpm is obtained.

c. Readjust the idle to 1100 rpm and recheck the mixture adjustment. Adjust as necessary. Tighten the mixture adjustment lock screw and lockwire.

5—109. FUEL SELECTOR VALVE SYSTEM.

5—110. DESCRIPTION. *(See figure 5—22.)* The fuel selector valve system consists of the fuel selector valve and the fuel selector valve control. The fuel selector valve controls the flow of fuel from the fuel tanks to the engine. The selector valve is positioned in the line between the fuel booster pump and the fuel system strainer. The emergency fuel system terminates at and is controlled by the selector valve. The fuel selector valve control extends from the cockpit to the selector valve and provides the pilot with mechanical control of the valve.

5—111. FUEL SELECTOR VALVE CONTROL.

5—112. DESCRIPTION. *(See figure 5—16.)* The fuel selector valve control consists of a control handle and gear box, which are mounted on the console in the cockpit, and two cables which are routed through pulleys to a pulley assembly mounted above the fuel selector valve.

The shaft of the pulley assembly is connected by a driver to the yoke on the gear box which is mounted on the side of the selector valve. A turnbuckle in each cable provides a means of adjusting the tension of the cable. The control handle dial plate contains three positions marked "OFF — ON — EMER ON." When the control handle is in the "ON" position, fuel is pumped by the fuel booster pump to the selector valve. When the control handle is in the "EMER ON" position, fuel enters the selector valve from the emergency fuel system. A micro-switch, which energizes the transfer pump switches, is mounted on a bracket attached to the control handle gear box and is actuated by a flat spot on one edge of the gear box pulley when the control handle is turned to the "ON" position.

CAUTION

The fuel selector valve control must be rigged whenever a component has been removed or the tension of either or both cables has been changed. Refer to paragraph 5—116 for rigging instructions.

5—113. REMOVAL.
(See figure 5—22.)

a. Place the fuel selector valve control handle in the "ON" position.

b. Remove the clutch access door from the cabin forward bulkhead.

c. Cut the lock wire and remove the turnbuckle barrels from the cables in the clutch compartment. Pull the upper cables clear of the pulley installation located just below the cockpit floor. Pull the lower cables clear of the pulley installation on the cabin forward bulkhead and the vertical bracket installation on the clutch compartment floor.

Note

Remove the cotter pin and pull the guide pin and washer out of the upper end of the brackets that support the pulleys on the bulkhead and below the cockpit floor before pulling the cables off the pulleys. Remove the bolts, washers, nuts and spacers from the vertical bracket installation on the clutch compartment floor before pulling the lower cables clear of the bracket installation.

d. Remove the bolts and washers that secure the pulley bracket to the cockpit floor. Remove the pulley assembly.

Note

To remove the pulleys from the bracket, remove the nut and washer from the bolt on which the pulleys turn and withdraw the bolt and washer.

e. Remove the bolts, washers and nuts that secure the pulleys and brackets to the cabin forward bulkhead.

Note

To remove the pulleys from the brackets, remove the nut and washer from the bolt on which the pulleys turn and withdraw the bolt and washer.

f. Remove the bolts and washers that secure the vertical pulley assemblies to the clutch compartment floor.

Note

To remove either pulley from its brackets, remove the nut and washer from the bolt on which the pulley turns and withdraw the bolt and washer.

g. Remove the bolts, washers and spacers that secure the plate over the horizontal pulley on the clutch compartment floor. Remove the plate.

Note

Prior to removing the plate, check that the selector valve is in the "ON" position by inserting a 3/16-inch diameter pin through the elongated hole in the plate and the corresponding hole in the pulley. Do not rotate the pulley following this check.

h. Remove the bolts and washers that secure the pulley assembly to the floor. Remove the pulley assembly and cables.

Note

Raise the pulley assembly straight up until the driver on the lower end of the shaft disengages from the yoke on the selector valve gear box.

i. Remove the rollpins from the pulley. Remove the cables from the pulley.

Note

Omit steps j. and k. unless it is necessary to disassemble the pulley assembly.

j. Remove the taper pin, washer and nut that secure the pulley to the shaft. Remove the pulley from the shaft.

k. Remove the shaft from the housing.

l. Open the hinged door on the right side of the console in the cockpit. Remove the screws, washers and nuts that secure the seals to the bottom surface of the cockpit floor at the point where the upper cables pass through the floor.

m. Remove the cotter pin from each end of the guard pin below the six pulleys. Remove the guard pin to the left through the access hole in the console. Pull the cables up through the floor. Push the two selector valve cables toward the rear of the console until they are clear of the pulleys. Replace the guard pin and cotter pins.

n. Remove the screws and washers that secure the dial plate support and gear box support to the bracket on the tunnel. Move the control assembly to the right to withdraw the gear box output shaft from the bearing on the side of the bracket. Raise the control assembly and disconnect the electrical leads from the transfer pumps switch. Remove the control assembly and cables from the bracket.

o. Remove the screws, washers, nuts and spacers at "A" (step 1, figure 5—22) that secure the plate to the gear box at the side of the pulley. Remove the plate.

p. Remove the rollpins that secure the cables to the pulley. Remove the cables.

Note

Omit steps q. through t. unless further disassembly of the control assembly is necessary.

q. Remove the rollpin that secures the pulley to the gear box output shaft. Remove the pulley from the shaft.

r. Remove the screws, washers and nuts at "B" (step 1) that secure the transfer pumps switch to the bracket on the gear box. Remove the switch, actuator and spacer.

s. Remove the washer and nut at "C" (step 1) that secure the control handle to the gear box input shaft. Remove the handle and the washer below the handle.

t. Lift the dial plate and support from the gear box support.

Note

Remove the screws, washers, nuts and spacers to separate the dial plate from the support.

Note

Do not disassemble the control assembly gear box beyond this point.

u. Remove the screws, washers and nuts that secure the bearing to the panel on the left side of the bracket on the tunnel. Remove the bearing.

5—114. MAINTENANCE.

a. Replace the control assembly gear box if it is damaged or if the backlash between the gears exceeds 0.002 — 0.010 inch.

b. Inspect all bearings for smoothness of operation.

c. Inspect the cables for possible damage and security of end fittings.

d. Inspect all pulleys, plates and brackets for possible damage.

5—115. INSTALLATION.
(See figure 5—22.)

Note

Whenever practicable, install bolts with the bolt head up.

Note

Omit steps a. through e. unless the control assembly was disassembled.

a. Position the dial plate on the support. Install the screw, washer and nut in the hole below the word "ON." Install the screw, washer, nut and spacer at each of the remaining holes.

Note

The spacers are installed between the dial plate and the head of the screw.

b. Position the dial plate and support on the gear box support.

c. Position the washer on the gear box input shaft. Position the control handle on the shaft. Secure the handle with the washer and nut at "C" (step 1).

d. Position the spacer, actuator and transfer pumps switch on the bracket attached to the gear box and secure them with the screws, washers and nuts at "B" (step 1).

e. Install the pulley on the gear box output shaft. Align the hole in the pulley with the hole in the shaft. Install the rollpin to secure the pulley to the shaft.

Note

Check that the pulley is properly positioned on the shaft by turning the control handle 90 degrees to the left while facing the end of the gear box output shaft. The center of the flat spot on the pulley should now be down and 45 degrees left of center.

f. Position the cables around the pulley. Seat the ball on the end of each cable in the recess in the pulley. Install the rollpins to hold the cables on the pulley.

Note

Install the short cable in the outboard groove of the pulley.

Note

Drive the rollpins flush with the face of the pulley.

g. Install the plate at the side of the pulley and secure it with the screws, washers, nuts and spacers at "A" (step 1).

h. Position the bearing at the small hole in the panel on the left side of the bracket on the tunnel. Secure the bearing to the panel with the screws, washers and nuts.

i. Route the cables through the hole in the bracket on the tunnel and into the console. Connect the electrical leads to the transfer pumps control switch. Position the control assembly on the bracket with the output shaft in the bearing mounted on the panel on the left side of the bracket. Secure the dial plate support and gear box support to the bracket with the screws and washers.

Note

The dial plate and support will rotate on the gear box shaft and should be positioned with the word "ON" in the forward position.

j. Open the hinged door on the right side of the console. Remove the guard pin below the six pulleys through the access hole in the left side of the console. Pull the selector valve cables forward and under the two left pulleys. Install the guard pin and cotter pins.

Note

The short cable rides in the extreme left pulley.

k. Route the two cables through the holes in the cockpit floor. Position the seals around the cables. Secure the seals to the bottom surface of the cockpit floor with the screws, washers and nuts. Close the hinged door.

Note

Omit step l. unless the pulley assembly attached to the bottom of the cockpit floor was disassembled.

l. Position the pulleys between the legs of the bracket. Secure the pulleys and bracket to the clip with the bolt, washers and nut.

m. Position the bracket against the lower surface of the cockpit floor and secure it with the bolts and washers.

Note

The legs of the bracket should be facing forward and down and positioned against the riveted clip.

n. Route the upper cables over the pulleys.

Note

The short cable rides in the left pulley.

o. Insert the guide pin through the holes in the bracket, position the washers and secure the pins with the cotter pins.

Note

The cables should be positioned under the guide pins.

Note

Omit steps p. and q. unless the pulley assembly attached to the clutch compartment floor above the selector valve was disassembled.

p. Insert the shaft through the bottom of the housing.

q. Install the pulley on the upper end of the shaft and secure it with the taper pin, washer and nut.

Note

The head of the taper pin should line up with the small lug on the driver on the lower end of the shaft.

r. Position the cables around the pulley. Seat the ball on the end of each cable in the recess in the pulley. Install the roll pins to hold the cables on the pulleys.

Note

Install the long cable in the upper groove of the pulley.

s. Insert the shaft of the pulley assembly through the clutch compartment floor. Mesh the driver on the shaft with the yoke on the selector valve gear box.

t. Secure the pulley assembly to the floor with the short bolts and washers. Position the plate over the pulley and install the spacers. Secure the plate with the bolts and washers.

Note

Omit step u. unless the vertical pulley assemblies attached to the clutch compartment floor were disassembled.

u. Position a pulley between each pair of brackets and secure it with the bolt, washers and nut.

v. Position the pulley assemblies on the clutch compartment floor and secure them with the bolts and washers.

Note

The pulley assembly brackets which are nearly perpendicular should be positioned and secured to the clutch compartment floor adjacent to the cabin forward bulkhead with the brackets slanting aft.

w. Position the pulley brackets against the cabin forward bulkhead and secure them with the bolts, washers and nuts. Secure the pulleys between the brackets with the bolt, washers and nut.

x. Route the lower cables through the pulleys. Install the turnbuckle barrels. Insert the guard pin through the hole in each bracket on the bulkhead and secure it with the washers and cotter pin. Position the spacers between the pairs of brackets that support the vertical pulleys at the clutch compartment floor. Secure each spacer with the bolt, washers and nut.

Note

The cables should be routed between the pulleys and guide pin and the pulleys and spacers.

y. Rig the selector valve control. (Refer to paragraph 5—116.)

5—116. RIGGING OF FUEL SELECTOR VALVE CONTROL.

CAUTION

The fuel selector valve control must be rigged whenever a component has been removed or the tension of either or both cables has been changed.

Note

The fuel selector valve control may be checked quickly for proper rigging by placing the control handle in the "ON" position and inserting a 3/16-inch diameter pin through the elongated hole in the plate over the horizontal pulley on the clutch compartment floor and on through the corresponding hole in the pulley.

a. Place the fuel selector valve in the "ON" position by rotating the horizontal pulley located just above the clutch compartment floor until a 3/16-inch diameter pin can be inserted through the elongated hole in the plate over the pulley and on through the corresponding hole in the pulley. Leave the pin in the pulley.

b. Lock the control handle in the "ON" position or have it held in that position.

c. Adjust the turnbuckle barrel on each cable so that a tension of 35 $\pm$ 5 pounds is applied to each cable.

d. Unlock the control handle and remove the pin from the pulley and plate. Check the control handle for freedom of movement throughout its entire range.

e. Check to see that the hole in the pulley aligns with the hole in the plate as the control handle is moved over the "ON" position.

f. Lockwire each turnbuckle barrel.

g. Replace the clutch access door.

5—117. FUEL SELECTOR VALVE.

5—118. DESCRIPTION. A mechanical, three-position fuel selector valve is mounted on a bracket in the fuselage bottom structure directly beneath the clutch compartment floor and near the center line of the helicopter. Access to the selector valve is provided by a hinged panel at the bottom of the helicopter and a removable door in the clutch compartment floor. The selector valve is operated by the selector valve control to which it is connected by a gear box mounted at the side of the selector valve. The outlet tube from the fuel booster pump is connected to an elbow at the top of the selector valve; the emergency fuel system outlet tube is connected to a "Y" drain connector at the bottom of the selector valve. The "Y" drain connector also supports the fuel system drain. A flanged fitting at the outlet port of the selector valve connects the selector valve to the fuel system strainer.

5—119. REMOVAL.
(See figure 5—22.)

Note

The fuel selector valve and the fuel system strainer are mounted on the same bracket and must be removed from the fuselage bottom structure as a unit.

a. Drain and purge all fuel tanks. Place the fuel selector valve control in the "ON" position.

b. Remove the forward section of the fuel line fairing from the bottom of the helicopter.

c. Loosen the fasteners in the hinged panel below the fuel selector valve and swing the panel down.

d. Disconnect the emergency fuel system outlet tube from the elbow in the "Y" drain connector at the bottom of the selector valve and from the tee below the forward fuel tank. Loosen the jam nut at the bottom of the "Y" drain and remove the elbow, nut and gasket.

e. Remove the clutch access door from the cabin forward bulkhead. Remove the fuel tube located just forward of the bulkhead. Loosen the jam nut and remove the elbow and gasket from the fuel strainer fitting. Remove the bolts and washers that secure the small access door to the fitting. Remove the screws that secure the access door to the floor. Remove the door and the gaskets from the strainer fitting flange.

f. Disconnect the fuel booster pump outlet tube from the fitting at the forward surface of the bulkhead and from the elbow at the top of the selector valve. Remove the tube.

g. Remove the bolts and washers that secure the upper edge of the selector valve mounting bracket to the bulkhead.

h. At the bottom of the helicopter remove the bolts and washers from the lower end of the "Y" drain connector. Support the selector valve and strainer and remove the bolts and washers that secure the lower edge of the selector valve mounting bracket to the bulkhead. Lower the selector valve, strainer and bracket from the bottom structure as a unit.

Note

Lower the unit straight down until the driver on the lower end of the selector valve control shaft disengages from the yoke on the selector valve gear box.

i. Cut the lock wire and remove the screws and washers that secure the "Y" drain connector to the bottom of the selector valve. Remove the connector and drain valve.

j. Cut the lock wire and remove the screws and washers that secure the elbow to the top of the selector valve. Remove the elbow.

k. Cut the lock wire and remove the screws and washers that secure the flanged fitting to the selector valve. Remove the nuts and washers that secure the fitting to the strainer. Remove the fitting and gasket.

l. Remove the bolts, washers and nuts that secure the gear box and the selector valve to the small brackets. Pull the gear box away from the bracket to disengage the gear box driver from the yoke on the selector valve.

m. Cut the lock wire and remove the bolts and washers that secure the small bracket to the large bracket. Support the selector valve and remove the small bracket. Remove the selector valve.

5–120. MAINTENANCE. Maintenance or overhaul of the fuel selector valve should be accomplished in accordance with applicable directives. Replace the selector valve gear box if it is damaged or if the backlash between the gears exceeds 0.002–0.010 inch.

5–121. INSTALLATION.
(See figure 5–22.)

Note

The fuel selector valve and the fuel system strainer are mounted on the same bracket and must be installed in the fuselage bottom structure as a unit.

a. Position the fuel selector valve against the small bracket that is riveted to the selector valve mounting bracket. Position the other small bracket on the mounting bracket and secure it with the bolts and washers. Lockwire the bolts.

Note

The yoke on the selector valve should point toward the wide end of the mounting bracket.

b. Mesh the driver on the gear box with the yoke on the selector valve. Position the gear box and support against the small bracket. Secure the gear box and selector valve to the small brackets with the bolts, washers and nuts.

c. Position a sealing ring at the outlet port of the selector valve and a gasket at the inlet port of the strainer. Secure the flanged fitting to the strainer with the washers and nuts and to the selector valve with the screws and washers. Lockwire the screws.

Note

Three sealing rings, part No. 10-1448-2-2, are furnished with the selector valve by the manufacturer.

d. Position the elbow and a sealing ring at the top of the selector valve. Secure the elbow to the valve with the screws and washers. Lockwire the screws.

e. Position a sealing ring and the "Y" drain connector, with the drain valve attached, at the bottom of the selector valve. Secure the connector to the valve with the screws and washers. Lockwire the screws.

f. Position the mounting bracket with the selector valve and strainer attached, in the bottom structure by inserting it through the access hole in the bottom of the helicopter. Mesh the driver on the lower end of the selector valve control shaft with the yoke on the selector valve gear box as the bracket is raised into position.

Note

To insure ease of installation, the selector valve and the selector valve control should both be in the "ON" position.

g. Install the bolts and washers that secure the lower edge of the mounting bracket to the bulkhead. Install the bolts and washers at the lower end of the "Y" drain connector.

h. Reach through the access door in the clutch compartment floor and install the bolts and washers that secure the upper edge of the mounting bracket to the bulkhead.

i. Connect the fuel booster pump outlet tube to the fitting at the forward surface of the bulkhead and to the elbow at the top of the selector valve.

Note

Apply anti-seize compound (index 43, paragraph 1–32) to the threads of all fittings.

j. Install the gaskets and access door on the fuel strainer fitting flange. Secure the door to the floor with the screws. Secure the door and gaskets to the strainer fitting flange with the bolts and washers. Install the gasket, jam nut and elbow in the strainer fitting. Tighten the jam nut. Install the fuel tube.

Note

Install as many gaskets on the strainer fitting flange as are required to prevent binding of the access door when the bolts and washers are installed.

k. Install the gasket, jam nut and elbow in the bottom of the "Y" drain connector. Tighten the jam nut. Connect the emergency fuel system tube to the elbow and to the tee below the forward fuel tank.

l. Fill all tanks with fuel. Check all connections for possible leakage with the fuel booster pump on. Test the selector valve for proper operation in all positions.

m. Secure the hinged panel in place below the selector valve. Replace the fuel line fairing and the clutch access door.

5—122. FUEL SYSTEM STRAINER.

5—123. DESCRIPTION. The fuel system strainer is mounted on a bracket in the fuselage bottom structure directly beneath the clutch compartment floor and near the center line of the helicopter. Access to the strainer is provided by a hinged panel at the bottom of the helicopter and a removable door in the clutch compartment floor. A flanged fitting at the inlet port of the strainer connects the strainer to the fuel selector valve. A drain cock is installed at the bottom of the strainer.

5—124. REMOVAL.
(See figure 5—22.)

Note

The fuel system strainer and the fuel selector valve are mounted on the same bracket and must be removed from the fuselage bottom structure as a unit.

a. Remove the strainer, selector valve and mounting bracket from the bottom structure. (Refer to paragraph 5—119, steps a. through h.)

b. Remove the nuts and washers that secure the flanged fitting to the inlet port of the strainer.

c. Remove the nuts and washers that secure the fitting to the top of the strainer. Remove the fitting and gasket.

d. Remove the bolts, washers and nuts that secure the strainer to the mounting bracket. Remove the strainer. Remove the gasket from the strainer inlet port.

e. Loosen the jam nuts at the elbow above the drain cock. Remove the drain cock, nut and gasket from the elbow. Remove the elbow, nut and gasket from the union. Remove the union and gasket from the strainer housing.

5—125. MAINTENANCE.

a. Clean the strainer in accordance with approved methods.

b. Repair or replace any damaged parts in accordance with applicable directives.

5—126. INSTALLATION.
(See figure 5—22.)

Note

The fuel system strainer and the fuel selector valve are mounted on the same bracket and must be installed in the fuselage bottom structure as a unit.

Note

Apply anti-seize compound (index 43, paragraph 1—32) to the threads of all fittings.

a. Install the union and gasket in the drain port at the bottom of the fuel strainer. Install the elbow, jam nut and gasket on the union. Install the drain cock, jam nut and gasket in the elbow. Tighten the jam nuts.

b. Position the strainer on the mounting bracket. Install a gasket at the strainer inlet port. Secure the strainer to the bracket with the bolts, washers and nuts.

c. Secure the flanged fitting and gasket to the strainer inlet port with the nuts and washers.

d. Position the fitting and gasket at the top of the strainer. Secure the fitting to the strainer with the nuts and washers.

e. Install the strainer, selector valve and mounting bracket in the bottom structure. (Refer to paragraph 5—121, steps f. through m.)

5—127. FUEL TANK STRAINERS.

5—128. DESCRIPTION. A finger-type strainer is installed in the strainer housing that is secured to the bottom of each fuel tank sump. This housing also serves as a connection point for the emergency fuel system hose lines (paragraph 5—92). Each strainer housing is covered by a fairing panel.

5—129. REMOVAL.

Note

The removal procedure is the same for each fuel tank strainer.

a. Place the fuel selector valve control in the "OFF" position.

b. Drain and purge all fuel tanks.

c. Remove the fairing panel from the bottom of the helicopter beneath the tank sump (71, sheet 2, figure 5—18) from which the strainer (81) is to be removed.

d. Remove the plug (84) and gasket (83) from the bottom of the strainer housing (79).

e. Remove the spring (82) from the housing.

f. Remove the fuel strainer (81) from inside the housing and sump.

g. Remove the sealing compound (index 18, paragraph 1—32) from the strainer collar.

5—130. MAINTENANCE.

a. Clean the fuel strainer in accordance with approved methods.

b. Replace any damaged parts.

5—131. INSTALLATION.

Note

The installation procedure is the same for each fuel tank strainer.

a. Roll a small amount of sealing compound (index 18, paragraph 1—32) between the hands to form a length of compound resembling a string.

b. Apply the sealing compound around the bevel at the large end of the strainer collar.

c. Insert the fuel strainer (81, sheet 2, figure 5—18) into the strainer housing (79) and push it up until it bottoms against the beveled shoulder inside the housing.

CAUTION

Remove all excess sealing compound that may protrude into the housing after the insertion of the strainer with a pointed wooden dowel or similar object. Do not use a metal object.

d. Insert the spring (82) into the housing.

e. Position the gasket (83) on the plug (84). Install the plug in the bottom of the housing.

f. Check for possible leakage around the strainer housing plug.

g. Replace the fairing panel.

5—132. ENGINE-DRIVEN FUEL PUMP.

5—133. DESCRIPTION. *(See figure 5—23.)* A rotary vane, positive displacement type fuel pump is mounted on the engine pump drive pad on the right side of the supercharger rear housing. The pump incorporates an integral relief valve and is driven by direct coupling with the engine pump drive. Four hose lines are attached to the pump: the fuel inlet line from the system strainer, the fuel outlet line to the carburetor, the fuel drain line which is connected at the mounting flange and leads overboard, and the fuel vent line which is connected at the valve housing cover and also leads overboard. The drain line provides a drain for any possible leakage of fuel past the seal on the drive shaft. The vent line provides positive balance on the relief valve under varying altitude conditions. Access to the pump is gained by opening the engine access doors and removing the right accessory compartment shroud panel.

5—134. REMOVAL.

a. Open the nose doors.

b. Remove the right accessory compartment shroud panel. (Refer to paragraph 5—31.)

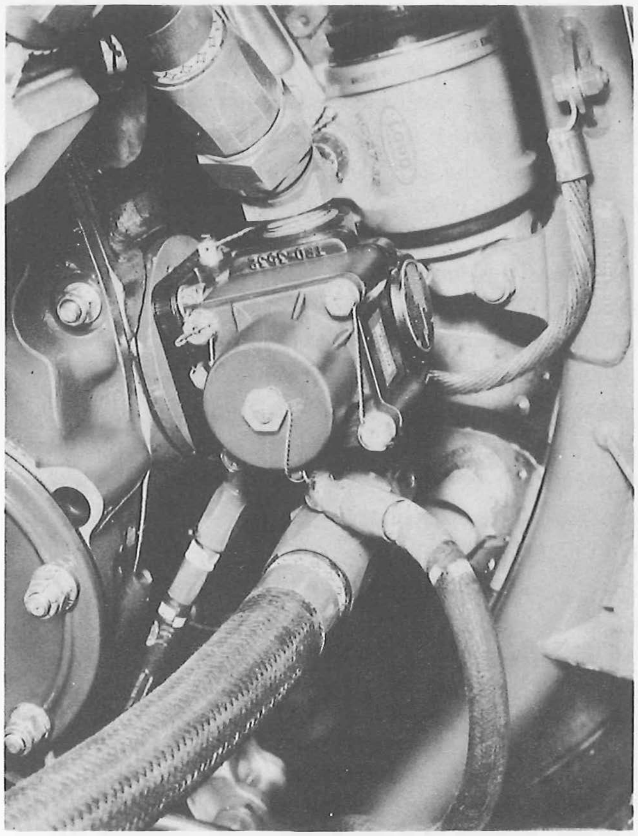


Figure 5—23. Engine-Driven Fuel Pump Installed

c. Place the fuel selector valve control (figure 5—16) in the "OFF" position.

d. Disconnect the inlet, outlet and drain lines from the elbows and the vent line from the restrictor in the pump ports.

e. Remove the nuts and washers from the mounting studs. Remove the bonding jumper from the forward stud. Remove the fuel pump and gasket from the engine pump drive pad.

f. Remove the inlet, outlet and drain elbows and the vent restrictor from the pump ports.

5—135. MAINTENANCE. Maintenance or overhaul of the engine-driven fuel pump should be accomplished in accordance with applicable directives.

5—136. INSTALLATION.

Note

Coat the threads of all fittings with anti-seize compound (index 43, paragraph 1—32) at installation.

a. Install the inlet, outlet, drain and vent elbows in the pump ports.

b. Install a new gasket on the engine pump drive pad.

c. Position the pump on the drive pad with the relief valve pointing down and forward. Position the end of the bonding jumper on the forward mounting stud. Secure the pump with the washers and nuts. Tighten the nuts with 150 to 170 inch-pounds torque.

d. Connect the inlet, outlet and drain lines to the elbows and the vent line to the restrictor in the pump ports.

e. Place the fuel selector valve control in the "ON" position. Check the hose lines and fittings at the pump for leakage with the booster pump on.

f. Replace the right accessory compartment shroud panel. (Refer to paragraph 5—33.)

g. Adjust the discharge pressure of the pump. (Refer to paragraph 5—137.)

h. Close the nose doors.

5—137. ADJUSTMENT.

a. Loosen the lock nut at the outboard end of the relief valve.

b. Adjust the pump by means of the adjusting screw to deliver 200 gph at 23 to 25 psi at the fuel inlet port on the carburetor.

Note

Turn the adjusting screw clockwise to increase the pressure, counterclockwise to decrease the pressure.

c. Tighten the lock nut.

Note

When the lock nut is tightened, the discharge pressure may change slightly. It is advisable to take this condition into account when the adjustment is being made.

d. Make certain the lock nut is properly safetied.

5—138. FUEL BOOSTER PUMP.

5—139. DESCRIPTION. The electrically operated fuel booster pump is mounted on the sump in the forward, center cell of the forward tank, and pumps fuel from the forward tank to the fuel selector valve. The pump is controlled by a switch marked "FUEL BSTR PUMP — OFF" located on the main switch panel in the cockpit. A built-in filter is incorporated in the pump to prevent radio interference. A seal drain fitting is installed on the pump and protrudes through the access cover at the bottom of the helicopter.

5—140. REMOVAL.

a. Drain and purge all tanks.

b. Remove the bolts and washers (2, sheet 1, figure 5—18) that secure the forward, center cell access cover (1) to the cabin floor. Remove the cover and gasket (54).

c. Cut the lock wire and remove the bolts and washers (51) that secure the cell cover (52) to the support (49). Remove the cover and gasket (51).

d. Reach into the cell (63, sheet 2) and disconnect the outlet tube (70) from the elbow on the booster pump (40).

e. Remove the fairing panel that is fastened to the bottom of the helicopter below the forward tank sump (71). Remove the access cover and the grommet around the pump drain fitting (38). Disconnect the electrical leads to the pump (40).

f. Cut the lock wire at the bolts (37) that secure the booster pump (40) to the sump (71). Support the pump and remove the bolts and washers. Lower the pump and gasket from the sump.

g. Remove the drain fitting (38) and gasket (39) from the pump (40).

5—141. MAINTENANCE. Maintenance or overhaul of the booster pump should be accomplished in accordance with applicable directives.

5—142. INSTALLATION.

Note

Apply anti-seize compound (index 43, paragraph 1—32) to the threads of all fittings.

a. Remove the plug from the seal drain port of the booster pump (40, sheet 2, figure 5—18). Position the gasket (39) on the drain fitting (38). Install the drain fitting in the drain port.

b. Raise the pump (40) into position through the hole in the forward tank sump (71). Position the pump with the outlet elbow facing 45 degrees to the right of forward.

Note

Be sure the gasket that is furnished with the pump is positioned on the upper surface of the pump mounting flange.

c. Secure the pump mounting flange and gasket to the sump (71) with the bolts and washers (37). Lockwire the bolts.

d. Connect the electrical leads to the pump (40).

e. Reach into the cell (63) from inside the cabin and connect the outlet tube (70) to the elbow on the booster pump (40).

f. Position the cell cover (52, sheet 1) and gasket (51) on the support (49) and secure them with the bolts and washers (53). Lockwire the bolts.

g. Position the forward, center cell access cover (1) and gasket (54) and secure them to the cabin floor with the bolts and washers (2).

h. Pressure test the tanks. (Refer to paragraph 5—74.)

i. Fill the tanks and check for leakage around the pump mounting flange.

j. Install the access cover below the forward tank sump (71, sheet 2, figure 5—18). Install the grommet around the drain fitting (38). Install the fairing panel.

Note

> If a new drain fitting (38) is installed, cut a bevel on the lower end of the fitting at an angle of 30 degrees to the horizontal. The bevel must face aft. Apply primer (index 10, paragraph 1—32) to the bevel.

5—143. ADJUSTMENT. The fuel booster pump is a centrifugal-type pump and no adjustment is possible. The pump operates with an output pressure of 19 to 21 psi.

5—144. FUEL TRANSFER PUMPS.

5—145. DESCRIPTION. An electrically operated fuel transfer pump is mounted on the sump in the center cell of both the center and aft fuel tanks. Each pump is controlled individually by one of the "FUEL TRANS PUMPS" switches in the cockpit. These switches, in turn, are energized only when the fuel selector valve control is in the "ON" position. Both the center and aft transfer pumps empty into the forward, right cell of the forward tank. The flow of fuel into the forward tank is controlled by a mechanical level control valve. A pressure switch installed in the tank with each transfer pump will cause the corresponding amber "LT ON NO TRANS" light adjacent to the pump switch to light if a pressure drop should occur in a transfer pump outlet line. A filter is incorporated in each transfer pump circuit to prevent radio interference. A seal drain fitting is installed in the bottom of each transfer pump and protrudes through the access cover at the bottom of the helicopter.

5—146. REMOVAL.

a. Drain and purge all tanks.

b. Remove the low pressure warning switch (79, figure 5—19) from the center cell cover (77) of the tank from which the pump (28) is to be removed. (Refer to paragraph 5—163, steps a. through g.)

c. Reach into the cell (10, figure 5—19) and disconnect the outlet tube (41) from the nipple (27) in the outlet port of the pump (28).

d. Remove the fairing panel that is fastened to the bottom of the helicopter below the sump (36) of the tank from which the pump (28) is being removed. Remove the access cover and the grommet around the pump drain fitting (34). Disconnect the electrical leads to the pump.

e. Cut the lock wire at the bolts (29) that secure the transfer pump (28) to the sump (36). Support the pump and remove the bolts and washers (29). Lower the pump and gasket from the sump.

f. Remove the drain fitting (34) and gasket (35) from the bottom of the pump (28). Remove the nipple (27) from the outlet port of the pump. Remove the plug (30) from the bottom of the pump below the outlet port.

5—147. MAINTENANCE. Maintenance or overhaul of the transfer pumps should be accomplished in accordance with applicable directives.

5—148. INSTALLATION.

Note

> Apply anti-seize compound (index 43, paragraph 1—32) to the threads of all fittings.

a. Remove the plug from the seal drain port of the transfer pump (79, figure 5—19). Position the gasket (35) on the drain fitting (34). Install the drain fitting in the drain port.

b. Remove the plug from the outlet port of the pump (28) and install the nipple (27).

c. Install a plug (30) in the bottom of the pump (28) below the outlet port.

d. Raise the pump (28) into position through the hole in the sump (36). Position the pump with the outlet port forward.

Note

> Be sure the gasket that is furnished with the pump is positioned on the upper surface of the pump mounting flange.

e. Secure the pump mounting flange and gasket to the sump (36) with the bolts and washers (29). Lockwire the bolts.

f. Connect the electrical leads to the pump (28).

g. Reach into the cell (10) from inside the cabin and connect the outlet tube (41) to the nipple (27) in the outlet port of the pump (28).

h. Install the low pressure warning switch (79) in the cell cover (77). (Refer to paragraph 5—165, steps c. through h.)

i. Pressure test the tanks. (Refer to paragraph 5—73.)

j. Fill the tanks and check for leakage around the pump mounting flange.

k. Install the access cover below the sump. Install the grommet around the drain fitting (34, figure 5—19). Install the fairing panel.

Note

> If a new drain fitting (34) is installed, cut a bevel on the lower end of the fitting at an angle

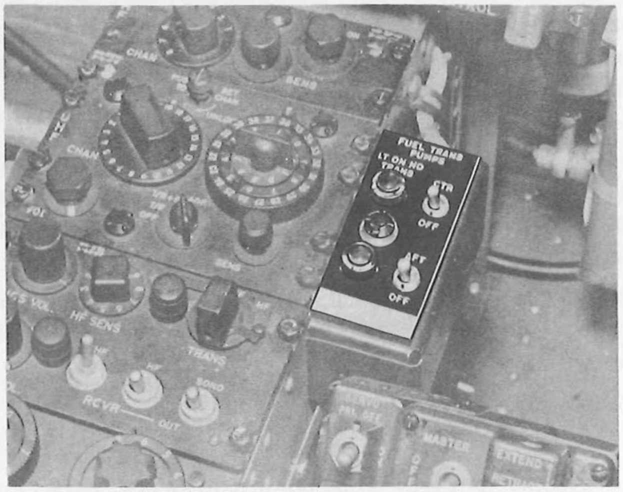


Figure 5–24. Fuel Transfer Pump Switch Panel

of 30 degrees to the horizontal. The bevel must face aft. Apply primer (index 10, paragraph 1–32) to the bevel.

5–149. ADJUSTMENT. The fuel transfer pumps are centrifugal-type pumps and no adjustment is possible. Each pump operates with an output pressure of 5 psi.

5–150. FUEL TRANSFER SWITCHES.

5–151. DESCRIPTION. *(See figure 5–24.)* Two switches, marked "CTR-OFF" and "AFT-OFF," are installed on a "FUEL TRANS PUMPS" switch panel secured to the right side of the console in the cockpit. Each switch controls the transfer pump in its respective fuel tank. The switches are energized only when the fuel selector valve control is in the "ON" position. An amber warning light, marked "LT ON NO TRANS" is installed adjacent to each switch and is illuminated whenever the corresponding switch is on and a pressure drop occurs in the transfer pump outlet line. This pressure drop may occur for any of the following reasons; malfunction of the transfer pump; fuel in the tank exhausted; fuel overflow safety system has turned off the transfer pump.

5–152. LEVEL CONTROL VALVE.

5–153. DESCRIPTION. A mechanical, floor-type level control valve is installed in the forward, right cell of the forward fuel tank at the discharge end of the transfer pump fuel tube. This valve prevents the forward tank from being overfilled by the transfer pumps.

5–154. REMOVAL.

a. Drain and purge all fuel tanks.

b. Remove the bolts and washers (2, sheet 1, figure 5–18) that secure the access cover (1) of the forward, right cell of the forward fuel tank to the cabin floor. Remove the cover and gasket.

c. Cut the lock wire and remove the bolts and washers (53) that secure the cell cover (52) to the support (49). Remove the cover and gasket (51).

d. Reach into the cell (3, sheet 2) and disconnect the short transfer pump tube (4) from the swivel elbow (58) at the bottom of the control valve (2).

e. Remove the four bolts, washers, spacers and nuts that secure the valve bracket (1) to the side of the cell. Remove the valve (2) and bracket from the cell.

f. Cut the lock wire and remove the bolts and washers that secure the valve (2) and swivel fitting (58) to the bracket (1). Separate the valve, bracket, swivel fitting, swivel elbow and gaskets.

5–155. MAINTENANCE. Maintenance of the level control valve should be accomplished in accordance with applicable directives.

a. Check the valve bracket for possible cracks and security of rivets.

b. Check the swivel fitting and swivel elbow for possible cracks and smoothness of mating surfaces.

5–156. INSTALLATION.

a. Secure the bracket and fittings against the bottom surface of the control valve with the bolts and washers in the following order: valve (2, sheet 2, figure 5–18), gasket, bracket (1), gasket, swivel fitting (58) and swivel elbow. Lockwire the bolts.

Note

Before tightening the bolts adjust the elbow so it will point aft and 30 degrees to the right when the valve is installed in the fuel cell. This measurement can be made from the surface of the valve bracket vertical flange.

b. Position the valve (2) and bracket (1) inside the forward, right cell (3) of the forward fuel tank at the interconnecting hole in the left wall. Secure the bracket against the wall of the cell with the four bolts, washers, spacers and nuts.

Note

The bracket should be positioned at the four upper bolt holes.

c. Connect the short transfer pump tube (4) to the swivel elbow (58) at the bottom of the valve.

Note

Apply anti-seize compound (index 43, paragraph 1–32) to the threads of the elbow.

d. Position the cell cover (52, sheet 1, figure 5–18) and gasket (51) on the lip of the support (49) and secure them with the bolts and washers (53). Lockwire the bolts.

e. Secure the access cover (1) and gasket (54) to the cabin floor with the bolts and washers (2).

f. Pressure test the transfer lines. (Refer to paragraph 5—76.)

g. Fill all fuel tanks.

5—157. FUEL OVERFLOW SAFETY SYSTEM.

5—158. DESCRIPTION. The fuel overflow safety system consists of a fuel detector and a level control unit. The fuel detector is located in the overboard vent tube of the forward left cell of the forward fuel tank. In the event of failure of the mechanical level control valve allowing the fuel level to reach the detector, the detector transmits a signal to the level control unit which is mounted on a shelf on the right side of the electronics compartment. A relay in the level control unit is de-energized automatically turning off the transfer pumps and illuminating the "FUEL TRANS OVERFLOW" light on the main switch panel in the cockpit. This, in turn, illuminates the "LT ON NO TRANS" light on the "FUEL TRANS PUMP" switch panel in the cockpit. Within a period of 80 seconds after the fuel level falls below the detector, the relay within the level control unit is re-energized and the transfer pumps turned on.

5—159. REMOVAL.

Note

Steps a. and b. apply to removal of the fuel detector; steps c. and d. apply to removal of the level control unit.

a. Disconnect the fuel detector wiring from the terminal strip and ground at the left side of the cabin forward bulkhead.

b. Disconnect the short tubes at each end and remove the fuel detector from the vent tube.

c. Unplug the wiring at the level control unit in the electronics compartment on the right side of the helicopter.

d. Remove the screws, washers and nuts and remove the level control unit from the electronics compartment shelf.

5—160. INSTALLATION.

Note

Steps a. and b. apply to installation of the fuel detector; steps c. and d. apply to installation of the level control unit.

a. Install the fuel detector between the two short tubes and connect the tubes at each end.

b. Connect the wiring to the terminal strip and ground.

c. Position the level control unit on the right-hand shelf in the electronics compartment and install the screws, washers and nuts.

d. Plug the wiring into the level control unit.

5—161. FUEL LOW PRESSURE WARNING SYSTEM.

5—162. DESCRIPTION. The fuel low pressure warning system consists of a low pressure warning switch mounted on the forward center cell cover of both the center and aft fuel tanks and an amber "LT ON NO TRANS" warning light for each tank mounted on the "FUEL TRANS PUMPS" switch panel in the cockpit. A flexible hose connected to each switch and to a tee in the output line of the transfer pump below the switch carries the pump output pressure to the switch. If the output pressure of either transfer pump drops below the pressure for which the corresponding switch is set, the switch will close and illuminate the "LT ON NO TRANS" light for that tank. A check valve installed in each transfer pump output line forward of the tee to which the pressure switch flexible hose is connected prevents the output pressure of the transfer pump in one tank from reaching the pressure switch in the other tank.

5—163. REMOVAL.

a. Drain and purge all fuel tanks.

b. Remove the bolts and washers (2, figure 5—19) that secure the center cell forward access cover (1) to the cabin floor. Remove the cover and gasket (80).

c. Disconnect the electrical leads at the pressure warning switch (79).

d. Cut the lock wire and remove the bolts and washers (3) that secure the warning switch (79) to the cell cover (77).

CAUTION

These bolts hold a nut ring beneath the cell cover which must be supported before all the bolts are removed. Thread one end of a piece of drill rod that is the same diameter as the bolts and eight to ten inches long. Remove one bolt and washer and replace the bolt with the drill rod. Use the rod to support the nut ring while the balance of the bolts and washers are removed. Raise the switch and replace two of the bolts and washers. Remove the rod.

e. Raise the switch (79) enough to obtain access to the flexible hose (49) secured to the elbow (42) in the bottom of the switch. Disconnect the hose from the elbow. Remove the switch. Remove the nut, gasket and elbow (42) from the bottom of the switch.

f. Disconnect the electrical leads at the connectors (4, 5, 6 and 7) in the cell cover (77).

g. Cut the lock wire and remove the bolts and washers (8) that secure the cell cover (77) to the support (9). Raise the cover enough to disconnect the probe leads (40) at the lower end of the connectors (4, 5, 6 and 7). Remove the cover and gasket (73). Remove the nut ring (75) and gaskets (76 and 78) from the cover.

Note

On helicopters bearing USAF Serial Nos 53-4475 through 53-4529, four connectors are installed in the cover (77) with electrical leads attached to the connectors. The two middle connectors (5 and 6) contain dummy leads and are taped with electrical tape (index 51, paragraph 1—32). On helicopters bearing USAF Serial Nos 53-4530 through 53-4554, two connectors are installed in the cell cover (77, figure 5—19).

Note

Before disconnecting the probe leads from the connectors, index each lead and connector.

h. Reach into the cell (10) and disconnect the flexible hose (49) from the bushing (44) or reducer in the tee (50) in the transfer pump outlet tube (41). Remove the hose from the cell. Remove the bushing, nut and gasket (44) or the reducer and gasket from the tee. Install a plug in the tee.

Note

A bushing, nut and gasket (44) are used in the center fuel tank. A reducer and gasket (54, figure 5—20) are used in the aft tank.

i. Remove the "LT ON NO TRANS" lights and lamps from the "FUEL TRANS PUMP" switch panel in the cockpit.

5—164. MAINTENANCE. Maintenance, testing or adjustment of the pressure switches should be accomplished in accordance with applicable directives.

5—165. INSTALLATION.

a. Install the "LT ON NO TRANS" lights and lamps on the "FUEL TRANS PUMP" switch panel in the cockpit.

b. Reach into the cell (10, figure 5—19) and remove the plug from the tee (50) in the transfer pump outlet tube (41). Install the bushing, nut and gasket (44) or the reducer and gasket in the tee. Connect the flexible hose (49) to the bushing or reducer.

Note

A bushing, nut and gasket (44) are used in the center fuel tank. A reducer and gasket (54, figure 5—20) are used in the aft fuel tank.

Note

Apply anti-seize compound (index 43, paragraph 1—32) to the threads of all fittings.

c. Position the nut ring (75, figure 5—19) and a gasket (76) against the lower surface of the cell cover (77) and a gasket (78) against the upper surface. Secure the gaskets and nut ring loosely to the cover with two bolts and washers (3). Position the cell cover and gasket (73) on the lip of the support (9). Connect the probe leads to the lower end of the connectors (4, 5, 6 and 7) in the cell cover. Secure the cell cover and gasket to the support with the bolts and washers (8). Lockwire the bolts.

Note

When installing the cover, apply acid resistant lacquer (index 17, paragraph 1—32) to the area around the connectors on the top of the cell cover.

d. Install the elbow, nut and gasket (42, figure 5—19) in the bottom of the pressure switch (79). Draw the end of the flexible hose (49) through the hole in the cell cover (77) and secure it to the elbow (42).

e. Insert the drill rod (paragraph 5—163, step d.) through the flange of the pressure switch (79, figure 5—19) and into the nut ring (75). Remove the two bolts and washers (3) and position the switch on the gasket (78). Secure the switch with the bolts and washers. Lockwire the bolts.

f. Connect the electrical leads (40) to the connectors (4, 5, 6 and 7) in the cell cover (77) and to the pressure switch (79).

Note

On helicopters bearing USAF Serial Nos 53-4475 through 53-4529, four connectors are installed in the cover (77) with electrical leads attached to the connectors. The two middle connectors (5 and 6) contain dummy leads and are taped with electrical tape (index 51, paragraph 1—32). On helicopters bearing USAF Serial Nos 53-4530 through 53-4554, two connectors are installed in the cell cover (77, figure 5—19).

g. Install the access cover (1) and gasket (80) and secure them with the bolts and washers. (2).

h. Fill all fuel tanks.

5—166. TESTING LOW PRESSURE WARNING SYSTEM.

a. Fill the center and aft tanks with fuel.

b. Connect an auxiliary source of power to the external power receptacle.

c. Place the battery switch in the "BATT" position.

Note

The "WARN LTS" light and "FUEL PUMP — BSTR" circuit breakers should be pushed in.

d. Press the amber "LIGHT ON NO TRANS" lights to determine that they function correctly.

e. Place the fuel selector valve control in the "OFF" position, and place the "FUEL TRANS PUMP" switches for the center and aft tanks in the "CTR" and "AFT" positions respectively.

f. Check to see that both amber "LIGHT ON NO TRANS" lights come on and remain on.

g. Place the fuel selector valve control in the "ON" position. Each transfer pump should start.

Note

Allow time for the transfer pumps to build up pressure.

h. Check to see that both amber "LIGHT ON NO TRANS" lights go off indicating that each pressure switch is operating properly.

Note

After moving the fuel selector valve control to "ON," if either the "CTR" or "AFT" amber "LIGHT ON NO TRANS" light remains on go to the cabin section and listen for the transfer pump indicated by the illuminated "LIGHT ON NO TRANS" light. If the transfer pump is running, replace the pressure switch.

5—167. FUEL LOW LEVEL WARNING SYSTEM.

5—168. DESCRIPTION. The fuel low level warning system consists of a "Thervel" type level switch and a red "LT ON 20 MIN FUEL" warning light. The level switch is an integral part of the fuel quantity tank probe in the center cell of the forward tank; the warning light is mounted on the main switch panel on the instrument panel.

5—169. REMOVAL.

a. Remove the "Thervel" type level switch. (Refer to paragraph 5—205.)

b. Remove the "LT ON 20 MIN FUEL" light and lamp from the main switch panel on the instrument panel.

5—170. MAINTENANCE. Maintenance, testing or adjustment of the level switch should be accomplished in accordance with applicable directives.

5—171. INSTALLATION.

a. Install the "LT ON 20 MIN FUEL" light and lamp on the main switch panel on the instrument panel.

b. Install the "Thervel" type level switch. (Refer to paragraph 5—206.)

5—172. TESTING.

a. Pump a minimum of 50 gallons of fuel into the forward fuel tank.

b. Connect an auxiliary source of power to the external power receptacle.

c. Place the battery switch in the "BATT" position.

d. Press the "LT ON 20 MIN FUEL" light to determine that it functions correctly.

e. Open the forward tank sump drain and drain fuel from the tank until the "LT ON 20 MIN FUEL" light flashes on.

Note

Close the drain as soon as the light flashes on.

f. Drain the remaining fuel from the forward tank into a separate container and measure it. If the low level indicator is functioning properly, the remaining fuel will be not less than 37 gallons.

5—173. FUEL TANK SUMPS.

5—174. DESCRIPTION. A sump is installed in the bottom of the center cell of each of the three main fuel tanks. All cells of a particular tank are connected to the sump by external metal tubing. The tank drain and strainer are installed in the sump. The forward tank sump supports the booster pump; the center and aft tank sumps each support a transfer pump.

5—175. REMOVAL.

a. Drain and purge all fuel tanks.

b. Remove the tank drain. (Refer to paragraph 5—185.)

c. Remove the tank strainer. (Refer to paragraph 5—129.)

d. Remove the booster pump (paragraph 5—140) or the transfer pump (paragraph 5—146).

e. From inside the cabin reach into the forward, center cell (63, sheet 2, figure 5—18) and remove the bolts, washers and spacers that secure the fuel quantity tank probe (61) to the brackets (62). Lay the probe on the bottom of the cell.

Note

Step e. applies to the forward tank; step f. applies only to the center and aft tanks.

f. From inside the cabin reach into the center cell (10, figure 5—19) and remove the screws and spacers that secure the fuel quantity tank probe (61) to the brackets (62). Remove the tank probe from the cell.

g. Cut the lock wire and remove the bolts and washers (54, sheet 2, figure 5—18) that secure the tank unit brackets (60) to the sealing flange (69) on the top of the sump (71). Remove both brackets from the cell (63).

Note

Index each bracket to the sealing flange to insure proper installation.

h. Cut the lock wire and remove the bolts and washers (48, figure 5—19) that secure the sealing flange (43) to the sump (36). Remove the flange from the center or aft cell.

i. Remove the screws (25) securing the sump (36) to the skin.

Note

To gain access to the screws from inside the cell, slide the cell opening to the right side of the sump, remove the screws. Repeat the same removal for the left side.

j. Disconnect the emergency fuel system tube from the check valve in the strainer housing (82).

Note

All fuel tanks must be drained and purged before disconnecting this tube.

k. Cut the lock wire, remove the bolts and washers (83) that secure the strainer housing (82) to the sump (36) and remove the strainer housing and gasket (81).

l. Disconnect both interconnecting tubes (48 and 74, sheet 2, figure 5—18) from the unions (35 and 46) in the sump (71) and the fittings (33 and 49) below the adjacent cells (3 and 30).

m. Disconnect the cabin heater fuel line at the elbow in the cabin heater strainer assembly installed in the forward fuel tank. Remove the elbow, with the nut and gasket attached, from the strainer assembly. Remove the strainer assembly.

Note

To clean the cabin heater fuel strainer, refer to paragraph 4—48.

n. Remove the bolt, washers and nuts (73, figure 5—18) that secure the sump (71) to the bottom structure frame. Remove the sump.

o. Remove the union (35 and 46) and gasket (36 and 45) from each side of the sump (71).

5—176. MAINTENANCE.

a. Check the Rosan inserts and rings for security.

b. Check the floating nuts and rivets for security.

c. Wipe the interior of the sump body clean.

d. Check the sump body for possible cracks. Replace if necessary.

5—177. INSTALLATION.

Note

Apply anti-seize compound (index 43, paragraph 1—32) to the threads of all fittings.

a. Install the gasket (36 and 45, sheet 2, figure 5—18) and unions (35 and 46) for the interconnecting tubes (48 and 74) in each side of the sump (71).

b. Raise the sump (71) into position against the bottom of the center fuel cell (63). Secure the sump to the bottom structure frame with the bolts, washers and nuts (73).

Note

The sump is positioned with the straight edge to the rear.

c. Connect each interconnecting tube (48 and 74) to the unions (35 and 46) in the sump (71) and the fitting (33 and 49) below the adjacent cells (3 and 30).

d. Secure the strainer housing (79) and gasket (78) to the sump (71) with the bolts and washers (80). Lockwire the bolts.

Note

The check valve installed in the strainer housing should face forward.

e. Install the cabin heater strainer assembly in the forward tank sump. Install the elbow, with the nut and gasket attached, in the strainer assembly. Connect the cabin heater fuel line to the elbow.

f. Connect the emergency fuel system tube to the check valve in the strainer housing (79).

Note

The check valve should be installed so the direction of flow is forward.

g. Install the screws (72) which secure the sump (71) to the skin.

Note

To locate the holes on the sump, slide the cell opening to the right side of the sump. Install the screws. Repeat the procedure for the left side.

h. Reach into the cell (10, figure 5—19) from inside the cabin and position the sealing flange (43) on the sump (36). Position both tank probe brackets (62) on the flange. Secure the brackets and flange to the sump with the bolts and washers (48). Lockwire the bolts.

i. Secure the tank probe (61, sheet 2, figure 5—18) to the brackets (62).

j. Install the booster pump (paragraph 5—142) or the transfer pump (paragraph 5—148).

Note

Do not fill the fuel tanks at this time.

k. Install the tank strainer. (Refer to paragraph 5—131.)

Note

Do not fill the fuel tanks at this time.

l. Install the tank drain. (Refer to paragraph 5—186.)

m. Check to see that all drain valves are closed.

n. Pressure test the fuel tanks. (Refer to paragraph 5—74.)

o. Fill the tanks with fuel and check for possible leakage around the sump (71, sheet 2, figure 5—18), drain valve (41), strainer housing (79) and booster or transfer pump mounting flange.

p. Replace the cover and grommet below the sump. Replace the fairing panel.

5—178. FUEL SYSTEM DRAIN.

5—179. DESCRIPTION. The fuel system drain is attached to a "Y" drain connector on the bottom of the fuel selector valve. Fuel from all tanks is carried to the "Y" drain connector through the emergency fuel system tubing. Access to the fuel system drain is provided by means of a hinged panel at the bottom of the helicopter.

5—180. REMOVAL.

a. Loosen the fasteners in the hinged panel below the fuel system drain and swing the panel down.

b. Drain and purge all fuel tanks.

c. Cut the lock wire and remove the bolts and washers from the lower holes in the drain valve flange.

d. Support the drain valve and remove the bolts, washers and nuts from the upper holes in the drain valve flange. Remove the valve and gasket.

5—181. MAINTENANCE. Maintenance or overhaul of the drain valve should be accomplished in accordance with applicable directives.

5—182. INSTALLATION.

a. Position the drain valve and gasket against the side port of the "Y" drain connector that is attached to the bottom of the fuel selector valve.

Note

The wing nut on the valve should point down.

b. Secure the valve to the connector with the bolts, washers and nuts at the upper holes in the drain valve flange and the bolts and washers at the lower holes. Lockwire the lower bolts.

c. Fill all tanks with fuel.

Note

Be sure the drain valve is closed before filling the tanks.

d. Check the drain valve and mounting flange for possible leakage.

e. Secure the hinged panel in place below the fuel system drain.

5—183. FUEL TANK DRAINS.

5—184. DESCRIPTION. A corrosion inhibitor cartridge with a drain valve is installed in each fuel tank sump to provide a means of draining the individual fuel tanks. Each drain valve is accessible from beneath the helicopter without removing the fuel lines fairing.

5—185. REMOVAL.

Note

The removal procedure is the same for each fuel tank drain.

a. Place the fuel selector valve control in the "OFF" position.

b. Drain and purge all fuel tanks.

c. From beneath the helicopter unscrew the drain valve (41, sheet 2, figure 5—18) and remove it from the corrosion inhibitor cartridge (42).

d. Unscrew the cartridge (42) and remove the cartridge and gasket (43) from the sump (71).

5—186. INSTALLATION.

Note

The installation procedure is the same for each fuel tank drain.

Note

Apply anti-seize compound (index 43, paragraph 1—32) to the threaded portion of the cartridge and drain valve.

a. Position the gasket (43, sheet 2, figure 5—18) on the flange of the cartridge (42). Screw the cartridge into the sump (71).

b. Screw the drain valve (41) into the cartridge (42).

c. Close the drain valve and fill all tanks with fuel.

d. Check the drain valve for possible leakage.

5—187. FUEL QUANTITY SYSTEM.

5—188. DESCRIPTION. *(See figure 5—25.)* A capacitance-type fuel quantity system is installed in the helicopter. Cylinder-type capacitors serve as probes in the fuel tanks. The tank units are connected directly to the fuel quantity selector switch and the quantity indicator which incorporates the bridge unit. The fuel quantity selector switch has four positions, "TOT," "FWD," "CTR" and "AFT" and makes possible indications on the quantity gage for each individual tank as well as a total indication for all tanks. Any change in fuel level changes the capacitance in the circuit, thus unbalancing the bridge and creating a signal which is amplified and

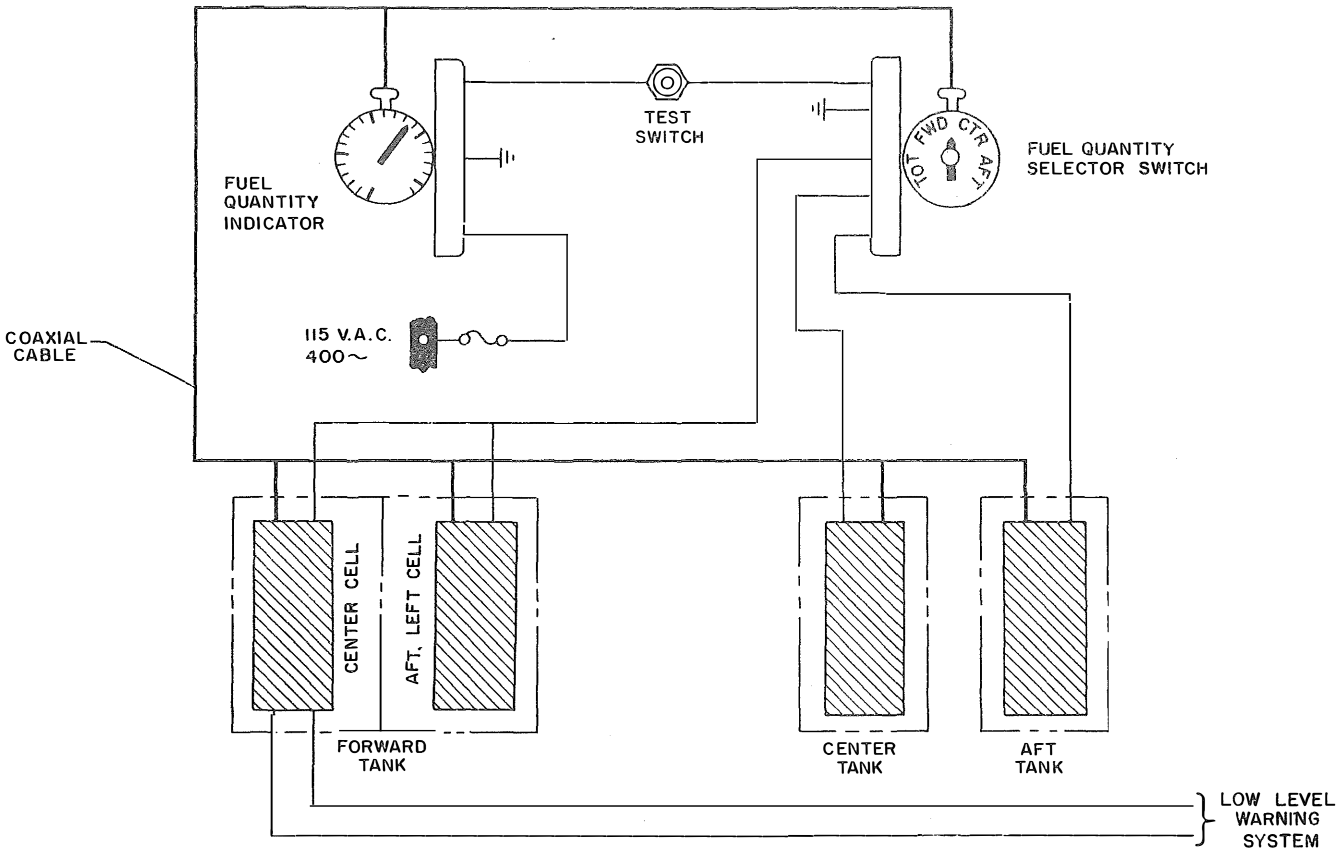


Figure 5—25. Fuel Quantity System Schematic Diagram

transmitted to the forward section of the fuel quantity indicator. The signal operates a servo motor in the indicator which, in turn, varies the potentiometer so as to restore balance in the bridge. The servo motor rotates the potentiometer and the indicator pointer by means of a gear reduction train. The "FUEL GAGE TEST" switch on the instrument panel breaks the circuit from the amplifier and allows the indicator pointer to move toward zero to determine that the indicator is functioning properly. When the switch is released, the needle should return to a position indicating the proper quantity of fuel in the tank.

5—189. TROUBLE SHOOTING.

Trouble	Probable Cause	Remedy
Indicator does not move when test switch is activated	No power to the system	Check the 15-volt, 400-cycle power supply to the system
	Faulty test switch	Check test switch
	Defective indicator unit	Replace indicator
	Defective wiring between tank probes and indicator	Check circuit wiring
	Coaxial cable shorted to ground	Check cables
	Tank probe shorted	Replace tank probe
Indicator remains at empty end of scale	Open electrical lead	Check leads
	Open coaxial cable	Check cables
	Tank probe shorted or open	Replace tank probe
Indicator remains at full end of scale	Electrical lead shorted to coaxial lead	Check leads
	Tank probe shorted	Replace tank probe
Indicator operation sluggish	Low resistance between electrical lead and coaxial cable	Check resistance of leads and tank probes

Trouble	Probable Cause	Remedy
Indicator reads higher than known quantity of fuel in tank	Circuit out of adjustment	Adjust the circuit
	DC resistance of coaxial cable to ground has deteriorated	Check resistance of coaxial cables
	DC resistance between coaxial cable and electrical lead has deteriorated	Check dc resistance of coaxial cables and electrical leads
Indicator reads lower than known quantity of fuel	Circuit out of adjustment	Adjust the circuit
	Malfunction of one or more tank probes	Check empty capacitance of tank circuit

5—190. REMOVING COMPONENTS OF SYSTEM.

a. Remove the tank probes. (Refer to paragraph 5—205.)

b. Remove the indicator. (Refer to paragraph 5—199.)

5—191. INSTALLING COMPONENTS OF SYSTEM.

a. Install the tank probes. (Refer to paragraph 5—206.)

b. Install the indicator. (Refer to paragraph 5—200.)

5—192. ADJUSTMENT OF SYSTEM.

a. Drain and purge all fuel tanks.

b. Connect a source of external power to the helicopter and place the "FLT. INST. INV." switch in the "MAIN" position.

c. Allow for the fuel quantity system to warm up.

d. Adjust the fuel quantity indicator to read zero by means of the zero adjustment knob on the rear of the indicator.

e. Disconnect the shielded and unshielded leads from the two plugs located forward of the instrument panel to the right of the instrument panel quick disconnect.

f. Connect the two leads of a precision condenser to the plugs to accomplish a direct connection to the indicator.

g. Simulate the total full capacitance value of the tank probes by substituting a 145.4 mmf with the precision condenser.

Note

A reading of approximately 1700 pounds on the indicator indicates proper functioning of the indicator. In this case, steps i. through k. may be omitted. If the indicator fails to read approximately 1700 pounds, proceed as follows:

h. Disconnect the precision condenser leads from the plug and connect the shielded and unshielded leads.

i. Readjust the zero setting on the indicator as required and repeat steps e. through g.

j. Set the precision condenser to 72.6 mmf to simulate the total empty capacitance of the tank probes if the indicator still fails to read approximately 1700 pounds. Adjust the indicator to zero.

k. Repeat step g. If a reading of approximately 1700 pounds is obtained, the indicator is functioning properly, but some other component of the system is defective. (Refer to paragraph 5—193 to determine the defective component.) If an incorrect reading is obtained, the indicator is defective and must be replaced before continuing. Repeat step h.

l. Position the helicopter in a 3-degree nose down attitude and fill the tanks, checking the indicator readings as outlined in table XXVI. Replace the tank probe in any tank where the indicator readings fail to stay within the limits given.

TABLE XXVI
ALLOWABLE INDICATION LIMITS OF FUEL QUANTITY INDICATOR

Gallons	Allowable Indicator Limits (Pounds)
Forward Tank	
0	25 to 35
17	60 to 135
34	160 to 240
51	255 to 345
68	355 to 450
85	450 to 555
102	550 to 665
Center Tank	
119	645 to 770
136	745 to 875
153	840 to 980
170	940 to 1085
Aft Tank	
187	1035 to 1190
204	1130 to 1295
221	1230 to 1400
238	1330 to 1505
255	1425 to 1615
262	1465 to 1660

5—193. TESTING SYSTEM. This paragraph contains instructions for testing the components and leads of the fuel quantity system. These tests should be accomplished when malfunctioning of one or more components of the system is known or suspected. A precision condenser is necessary when testing for a malfunctioning component; a volt-ohmmeter is necessary to detect leakage and resistance in the leads.

Note

A reading on the fuel quantity indicator that is inconsistent with the known quantity of fuel in the tanks may indicate inaccurate "EMPTY" adjustment of the fuel quantity indicator (figure 6—1). Therefore, the system should be adjusted in accordance with instructions in paragraph 5—192 before proceeding with the testing.

Note

If the adjustment outlined in paragraph 5—192 can be accomplished satisfactorily, the fuel quantity indicator is functioning properly. If the adjustment cannot be accomplished satisfactorily, proceed as follows:

a. Replace the fuel quantity indicator with a unit known to function properly. Adjust the system once again in accordance with instructions in paragraph 5—192.

Note

Steps b. through g. outline the procedure necessary to test an individual tank probe for proper capacitance. The test should be accomplished on one tank probe at a time until a defective unit is located.

b. Drain the fuel from all fuel tanks.

c. Disconnect the electrical lead and the coaxial cable from the connectors of the probe which is to be tested.

Note

The connectors are located in the cell cover of the left cell of the forward tank, left aft cell of the forward tank, center cells of the center and aft tanks. When removing the coaxial cables and electrical leads from the connectors, note the identification symbols on the cables and leads. Remove only the leads which are a part of the system being tested.

Note

As each individual tank probe is being tested, turn the selector switch to the corresponding tank position.

d. Connect the leads of a precision condenser to the fuel quantity system in place of the tank probe.

e. Set the precision condenser to the empty reading for the particular tank probe being tested.

Note

Refer to table XXVII for the individual tank probe capacitance values.

TABLE XXVII
TANK UNIT EMPTY CAPACITANCE VALUES

TANK UNIT	TANK	CAPACITANCE
165-0461-1478A	Fwd tank, center cell	13.10
165-0460-1477A	Fwd tank, aft cell	16.13
165-0461-1442A	Center tank	19.00
165-0461-1443A	Aft tank	24.40
Tolerance ±0.5 UUF		

f. Observe the position of the fuel quantity indicator pointer.

Note

If the fuel quantity indicator pointer is now at zero, the tank probe being tested is defective. If the pointer is not at zero, one or more of the other tank probes is defective.

g. Disconnect the precision condenser from the fuel quantity system. Connect the electrical lead and the coaxial cable to the connectors in the cell covers.

h. Repeat steps b. through g. on each tank probe in the system.

Note

If the above tests fail to isolate a malfunctioning component, it must be assumed that more than one probe is defective. To correct this, replace one tank probe at a time with a probe known to function properly. Observe the fuel quantity indicator each time. When it indicates zero, the defective units have been replaced.

5—194. MAINTENANCE.

a. Inspect for accumulation of dust, foreign matter or water that may cause leakage paths and subsequent impaired operation or complete failure. Correct as necessary.

b. Clean corroded electrical contacts with a piece of fine sandpaper, making certain to brush off all sand residue.

c. Remove all dirt from electrical components by a cloth dampened with acetone (index 47, paragraph 1—32).

5—195. FUEL QUANTITY INDICATOR.

5—196. DESCRIPTION. *(See figure 5—25.)* The fuel quantity indicator is mounted near the top of the instrument panel and is contained within a hermetically sealed cylindrical aluminum housing. The indicator dial is calibrated in hundreds of pounds with a range of zero to approximately 2000 pounds. Total or individual fuel tank quantity readings on the indicator are obtained by using the fuel quantity selector switch which is mounted on the lower center portion of the instrument panel. The indicator unit consists of a two-phase motor, a potentiometer, a gear reduction train, an amplifier circuit and a bridge circuit. As fuel is being consumed, constant signals are transmitted from the tank probes to the bridge circuit of the indicator. These signals are then transmitted through the amplifier to drive the two-phase motor which, in turn, changes the position of the indicator pointer on the dial.

5—197. TROUBLE SHOOTING.
(Refer to paragraph 5—189.)

5—198. TESTING.
(Refer to paragraph 5—193.)

5—199. REMOVAL.

a. Remove the cowl panel from over the instrument panel. Disconnect the electrical wiring from the rear of the fuel quantity indicator.

b. Remove the mounting screws from the front of the indicator. Remove the indicator.

5—200. INSTALLATION.

a. Place the fuel quantity indicator in position in the instrument panel and install the mounting screws and nuts.

b. With the electrical power off, connect the electrical wiring at the rear of the indicator. Replace the cowl panel over the instrument panel.

5—201. ADJUSTMENT.
(Refer to paragraph 5—192.)

5—202. TANK PROBES.

5—203. DESCRIPTION. *(See figure 5—25.)* Four capacitance-type tank probes are used to measure the quantity of fuel in the three fuel tanks. A probe is installed in each of the following cells: center cell, forward tank; aft left cell, forward tank; center cell, center and aft tanks. Each probe consists of a metal cylinder mounted within a larger metal cylinder. The cylinders are insulated and act as plates of a condenser. The dielectric between the plates is gasoline. The tank probes are connected in parallel by electrical leads and coaxial cables to the fuel quantity indicator. The "Thervel" type level switch of the low level warning system is a part of the probe in the center cell of the forward tank; a "Thervel" type level switch of the low level shut-off system is a part of the probe in the center cell of both the center and aft tanks.

5—204. TROUBLE SHOOTING.
(Refer to paragraph 5—189.)

5—205. REMOVAL.

a. Remove the bolts and washers which secure the access cover to the cabin floor over the cell in which each probe is located. Remove the covers and gaskets.

Note

To remove the tank probes it is necessary to remove only the following access covers; center cell, forward left cell, center tank; aft left cell, forward tank (forward cover only); center cell, center and aft tanks.

b. Disconnect the electrical leads from the top of the connectors in each cell cover.

Note

The connectors for the center cell forward tank probe are located in the forward left cell of the forward tank. A coaxial cable and three electrical leads extend from three tank probes to the connectors. Two of the electrical leads are connected to the level switch on the probes. The fourth probe is located in the aft left cell of the forward tank and contains only a coaxial cable and one electrical lead.

c. Cut the lock wire and remove the bolts and washers that secure each of the cell covers to the lip of the support. Raise each cover and disconnect the electrical leads from the bottom of the connectors. Remove the covers and gaskets.

Note

When removing the cell covers from the aft and center tanks, refer to paragraph 5—163, steps c. through g.

d. Reach into the cell and remove the bolts, washers and spacers securing the probe to the brackets in the center cell of each tank. Remove the probes.

e. Remove the washers and nuts securing the probe to the post in the aft left cell of the forward tank. Remove the probe.

5—206. INSTALLATION.

a. Secure the probe to the post in the aft left cell of the forward tank with the washers and nuts.

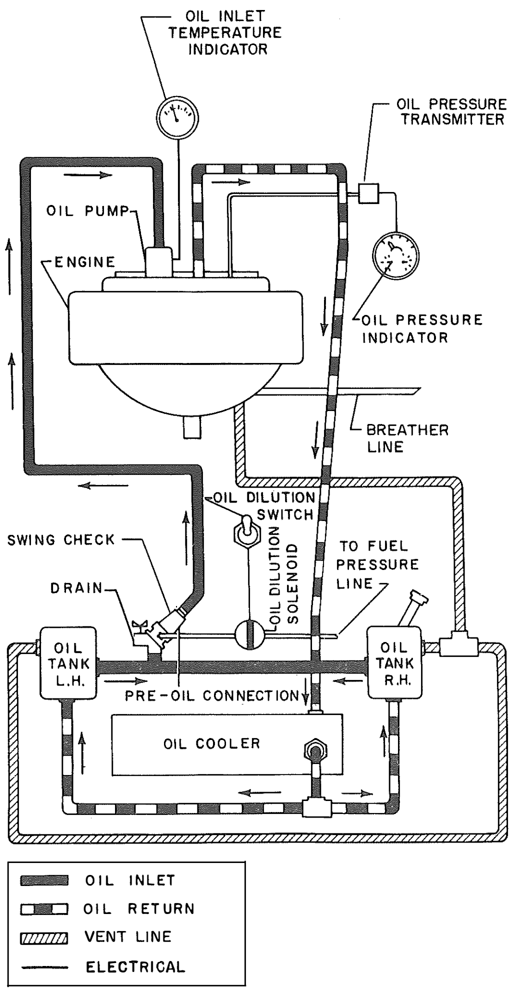


Figure 5—26. Lubrication System Schematic Diagram

b. Position the probe in the center cell of each tank. Secure each probe to the brackets with the bolts, washers and spacers.

c. Install the pressure switch in the cell cover of the aft and center tanks. (Refer to paragraph 5—165, steps c. through e.)

d. Connect the electrical leads to the bottom of the connectors in the cell covers.

Note

A coaxial cable and three electrical leads extend from three of the tank probes to the connectors. Two of these electrical leads are connected to the level switch on the probe. The probe located in the aft left cell of the forward tank contains only a coaxial cable and one electrical lead. The connectors for the center cell forward tank probe are located in the cell cover of the forward left cell of the forward tank.

e. Position the gaskets and cell cover on each support and secure them with the bolts and washers. Lockwire the bolts.

f. Secure the access covers and gaskets to the cabin floor with the bolts and washers.

5—207. TESTING.
(Refer to paragraph 5—193.)

5—208. LUBRICATION SYSTEM.

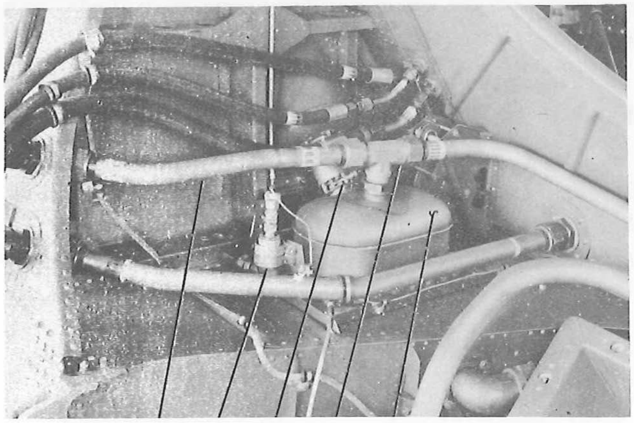
5—209. DESCRIPTION. *(See figures 5—26 through 5—28.)* The engine lubrication system consists of two oil cells, a drain valve in the sump of each cell, an oil cooler, a system drain valve, a swing check, the oil dilution system and necessary tubes and hose lines to convey the oil from the cells to the engine and back to the cells. The oil flows by gravity through an interconnecting tube between the cells to the system drain valve and swing check and then through the engine inlet hose line to the engine oil pump. Oil from the engine is carried by the engine outlet hose line to the oil cooler and then by a second interconnecting tube to the oil cells. The system drain valve drains most of the oil from the oil cells. The cell drain valves provide for draining of the cell sumps. A large hex-head plug at the forward, right corner of the oil cooler drains the cooler and the attached tube. A drain is provided in the engine sump for draining oil from the engine. The engine inlet and outlet hose lines are drained by disconnecting one end of each line. The swing check prevents the drainage of oil from the engine when the engine is idle. An overboard breather line is attached to the oil separator pad on the crankcase front section of the engine. A vent line extends from the engine aft to the cover of the right oil cell and then across to the cover of the left oil cell. The clutch oil pump is mounted on the cover of the left cell.

CAUTION

The engine must be pre-oiled immediately prior to starting after an engine change, after the engine has been idle for more than 72 hours, or after air has been allowed to enter the oil inlet line to the engine in any manner. For instructions on pre-oiling the engine, refer to paragraph 5—8.

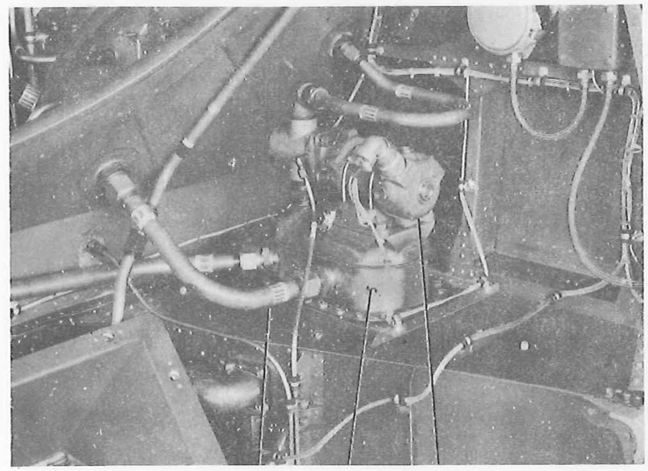
5—210. OIL CELLS.

5—211. DESCRIPTION. *(See figures 5—27 and 5—28.)* A bladder-type oil cell is installed in each side of the fuselage bottom structure in the engine compartment. The two cells are interconnected by the oil cell inlet and oil cell return tubes. A drain fitting and drain valve are installed in the bottom of each cell. An access hole in the top of each cell is covered by a stainless steel cover. The engine vent line is attached to a fitting in each of



1. Vent Tube
2. Oil Dilution Solenoid Valve
3. Coupling
4. Tee
5. Right Cell Cover

Figure 5—27. Right Oil Cell



1. Clutch Oil Return Tube
2. Left Cell Cover
3. Clutch Oil Pump

Figure 5—28. Left Oil Cell

these covers. Both cells are filled through a single oil filler which is located on the right side of the helicopter just below the screened air intake opening. The oil level dip stick is attached to the oil filler cap which is secured by a chain to the neck of the filler. The oil filler projects into the right cell through the cell cover and access hole. The clutch oil pump is mounted on the cover over the left cell.

5—212. PRESSURE TESTING OIL CELLS. To pressure test the oil cells, plug all openings and apply 1/2 psi air pressure. The pressure drop must not exceed 1/16-water-inch within a period of 15 minutes. Use the same gage as referred to in paragraph 5—74.

5—213. REMOVAL.

Note

Extreme care should be exercised when handling the oil cells in temperature below 4.4°C (40°F). In regions where temperatures of 4.4°C (40°F) and below exist, provisions should be made to heat the engine compartment while working on the cells. The upper limit of temperature is 71°C (160°F).

a. Open the nose doors.

b. Remove or hinge down the power package. (Refer to paragraph 5—12.)

Note

Preservation of the engine should be accomplished, based on the length of time the engine will be inactive.

c. Drain each cell sump at the drain valve.

d. Remove the clutch oil pump (3, figure 5—28) from the left cell cover (2). (Refer to paragraph 5—331.)

e. Remove the screws that secure the oil filler flange to the scupper in the right wall of the helicopter. Loosen the strap-type coupling (3, figure 5—27) located around the filler at the right cell cover (5). Pull the filler out through the scupper.

Note

Slide the coupling (3), collar and gasket off the filler while removing the filler from the scupper.

f. Disconnect the clutch oil return tube (1, figure 5—28) from the elbow in the left cell cover (2).

g. Remove the screw, washers, nut and clamp that support the long engine vent tube (3, figure 5—29) between the two cell covers. Disconnect the tube from the fitting in each cell cover. Remove the tube.

h. Disconnect the short engine vent tube (1, figure 5—27) from the tee (4) in the right cell cover (5) and the elbow at the engine compartment forward bulkhead. Remove the tube.

i. Disconnect both oil dilution tubes at the oil dilution solenoid valve (2) near the right oil cell cover.

j. Cut the lock wire and remove the bolts and washers that secure each cell cover (5, figure 5—27 and 2, figure 5—28). Move the oil dilution solenoid valve (2, figure 5—27) and bracket to one side and remove each cover and gasket.

k. Remove the drain valve and gasket from each cell sump. Cut the lock wire and remove the bolts and washers that secure the retainers to the support adapters. Remove the retainers. Reach into each cell and remove the drain fitting.

l. Cut the lock wire from the bolts that secure the oil outlet tube connector (6 and 13, figure 5—29) to the side of each cell. Support the outlet fitting inside each cell and loosen the bolts. Remove the fitting from each cell. Support the outlet tube (8) and remove the bolts and washers. Remove the tube and gaskets.

Note

Do not bend the oil dilution tube while removing the oil outlet tube.

m. Cut the lock wire from the bolts that secure the oil return tube elbow and flange to the side of each cell. Support the return fitting inside each cell and loosen the bolts. Remove the fitting from each cell. Remove the bolts and washers from each flange and remove the gasket under each flange.

n. Release the snap fasteners that secure the top of each cell to the bottom structure skin.

o. Collapse each cell as much as possible and remove it from the bottom structure cavity.

CAUTION

Care must be exercised while removing the cells from the bottom structure to avoid damaging the cells.

Note

Disposition of the cells should be made in accordance with applicable directives.

5—214. MAINTENANCE. Maintenance and repair of the oil cells should be accomplished only by qualified personnel and in accordance with applicable directives.

5—215. INSTALLATION.

Note

Extreme care should be exercised when handling the oil cells in temperatures below 4.4°C (40°F). In regions where temperatures of 4.4°C (40°F) and below exist, provisions should be made to heat the engine compartment while working on the cells. The upper limit of temperature is 71°C (160°F).

Note

Apply anti-seize compound (index 43, paragraph 1—32) to the threads of all fittings.

a. Remove a new cell from its shipping container before installation.

b. Inspect the bottom structure cell cavities for cleanliness and make certain they are free of sharp metal edges, burrs and filings.

c. Collapse each cell as much as possible and position it in the bottom structure cavity. Align the openings in each cell with the corresponding openings in the bottom structure.

d. Secure the top of each cell to the bottom structure skin with the snap fasteners.

e. Install a new gasket between each oil return line flange and the bulkhead. Install the bolts and washers. Position the return fitting inside each cell and secure it with the bolts. Lockwire the bolts.

Note

The opening on each return fitting should point forward.

f. Position the oil outlet tube (7, figure 5—29) between the cells. Install a new gasket between each connector (6 and 13) and the bulkhead. Install the bolts and washers. Position the outlet fitting inside each cell and secure with the bolts. Lockwire the bolts.

Note

The sloping surface of each outlet fitting should be up.

g. Position the drain fitting inside each cell. Position a retainer against the support adapter below each cell. Secure each drain fitting, gasket and retainer to the support adapter with the bolts and washers. Lockwire the bolts.

h. Install a drain valve and gasket in each drain fitting.

i. Position a gasket and cell cover (5, figure 5—27 and 2, figure 5—28) over each cell access hole and secure them with the bolts and washers.

Note

In order to line up the nut ring when installing the cell covers, thread one end of a piece of drill rod 8 to 10 inches long and the same diameter as the bolts. Insert the drill rod through one of the holes in the reinforcing ring and gasket and pick up the corresponding hole in the nut ring. Raise the nut ring into position against the reinforcing ring and slide the cell cover and gasket over the drill rod.

Note

Do not install the forward center bolt or the bolt just to the left of it in the right cell cover at this time.

j. Position the oil dilution solenoid (2, figure 5—27) and bracket or the flange of the right cell cover (5) and secure with the bolts and washers. Lockwire all bolts in both covers.

Note

Position the right hole in the solenoid bracket over the forward, center hole in the cell cover flange.

k. Connect both oil dilution tubes to the oil dilution solenoid (2).

l. Connect the short engine vent tube (1) to the elbow at the engine compartment forward bulkhead and to the tee (4) in the right cell cover.

m. Connect the long engine vent tube (3, figure 5—29) to the tee (4, figure 5—27) in the right cell cover (5) and to the aft union in the left cell cover (2, figure 5—28). Install the clamp near the center of the tube and secure it with the screw, washers and nut.

n. Connect the clutch oil return tube (1) to the forward elbow in the left cell cover (2).

o. Insert the end of the oil filler through the scupper in the right wall of the helicopter. Slide the coupling (3, figure 5—27), collar and gasket onto the end of the filler. Insert the filler into the right cell cover.

Note

Replace the collar if the largest diameter exceeds 2-5/8 (2.625) ±1/32 (0.03125) inches. Use only an AN6230B4 gasket.

p. Secure the filler flange to the scupper with the screws. Slide the gasket and collar down against the lip on the sleeve and secure them with the coupling (3).

Note

Tighten the coupling until the gap between the ends is reduced to 1/8 (0.125) ±1/16 (0.0625) inch.

q. Install the clutch oil pump (3, figure 5—28) in the left cell cover. (Refer to paragraph 5—332.)

r. Install or hinge the power package up into position. (Refer to paragraph 5—15.)

s. Pressure test the oil cells. (Refer to paragraph 5—212.)

t. Check to see that all drain valves are closed. Fill the cells with oil. (See figure 1—14.)

WARNING

Do not overfill. Overfilling reduces necessary foaming space.

u. Pre-oil the engine.

CAUTION

The engine must be pre-oiled immediately prior to starting after an engine change, after the engine has been idle for more than 72 hours, or after air has been allowed to enter the oil inlet line to the engine in any manner. For instructions on pre-oiling the engine, refer to paragraph 5—8.

5—216. OIL COOLER (OIL TEMPERATURE REGULATOR).

5—217. DESCRIPTION. *(See figure 5—29.)* The engine oil cooler (oil temperature regulator) is suspended in the engine compartment in the space between the two forward sections of the fuselage bottom structure. Ram air from the engine cooling system is supplied to the oil cooler through a metal duct attached to the lower engine cowling panel. Oil from the engine flows to the oil cooler through a flexible hose line; oil from the cooler returns to the oil cells through a metal tube which interconnects the two cells. The oil cooler is automatic in operation. When the engine is started and while the oil is cold, the oil cooler core is bypassed. As the oil begins to warm up, a thermostatically controlled valve allows a portion of the oil to pass through the oil cooler core. As the oil temperature increases, the amount of oil passing through the core increases until, finally, all oil passes through the core. The temperature of the oil is then maintained at the proper operating level by thermostatically controlled shutters below the core which regulate the flow of air through the core.

5—218. REMOVAL.
(See figure 5—29.)

a. Open the nose doors.

b. Drain the oil from both oil cells at the drain valve (8) just forward of the oil cooler (4).

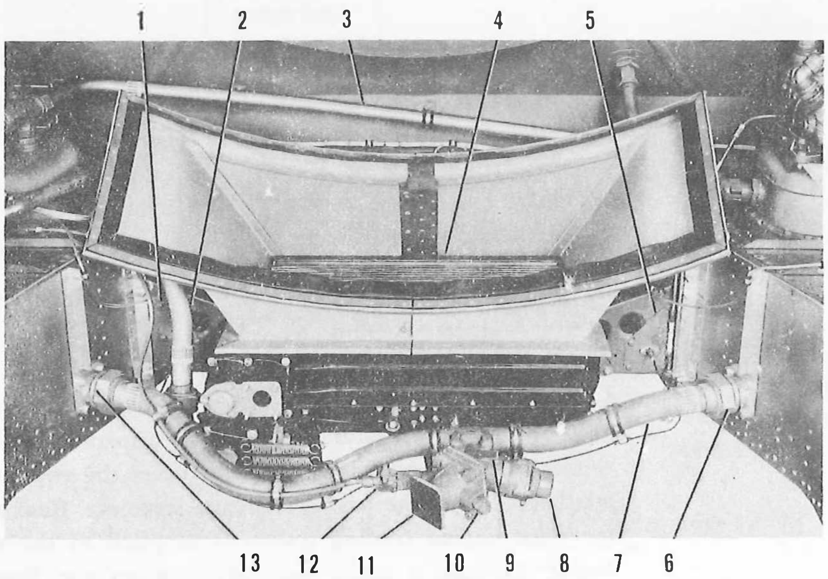
c. Remove the large, hex-head plug at the forward, right corner of the oil cooler (4) and drain the cooler.

d. Cut the lock wire and remove the nuts and washers to disconnect the engine oil outlet hose at the oil cooler. Remove the gasket.

Note

On helicopters bearing USAF Serial Nos 53-4475 through 53-4480, an adapter is installed on the mounting pad of the inlet port. Remove the adapter and gasket.

e. Remove the nuts and washers that connect the oil cell return tube (2), fitting, flange and gasket to the outlet port on the right side of the cooler.



1. Bracket
2. Oil Return Tube
3. Vent Tube
4. Oil Cooler (Oil Temperature Regulator)
5. Bracket
6. Outlet Tube Connector
7. Outlet Tube
8. Drain Valve
9. "Y" Fitting
10. Swing Check
11. Housing
12. Valve
13. Outlet Tube Connector

Figure 5—29. Oil Cooler Installed

f. Remove the bolts, washers and nuts that secure the long bracket to the brackets (1 and 5) on each side of the cooler. Remove the long brackets.

g. Remove the nuts and washers from the bolts that secure the cooler (4) to the brackets (1 and 5). Support the cooler and remove the bolts. Lower the cooler and remove it from the helicopter.

h. Remove the bolts, washers and nuts that secure the lower flange of the oil cooler duct to the brackets on the bottom structure bulkheads. Remove the bolts, washers and nuts that secure the brackets to the clips. Remove the brackets.

Note

To remove the oil cooler duct, remove or hinge down the power package. (Refer to paragraph 5—12.) The duct may then be unbolted from the brackets on the top surface of the bottom structure and removed from the helicopter and the brackets unbolted from the forward keel beams and removed.

5—219. MAINTENANCE. Maintenance of the oil cooler should be accomplished in accordance with applicable directives.

a. Inspect the oil cooler duct and all brackets for possible cracks or damage.

b. Inspect the oil cooler duct for security of rivets.

c. Check the condition of the seals on the oil cooler duct.

d. Inspect the clips attached to the bottom structure bulkheads for possible cracks.

e. Clean the oil cooler, if necessary.

Note

Cleaning of the oil cooler is accomplished in the same manner as the transmission oil cooler. (Refer to paragraph 5—382.)

5—220. INSTALLATION.
(See figure 5—29.)

a. Position a bracket on each forward keel beam and secure it with the bolts, washers and nuts.

b. Position a bracket (1 and 5) against each clip on the bottom structure bulkhead and secure it with the bolts, washers and nuts.

Note

If new brackets are being installed, drill through the brackets with a No. 10 (0.1935 inch diameter) drill. Deburr the holes.

c. Position the oil cooler duct against the keel beam brackets and secure it with the bolts and washers.

d. Secure the lower flange of the oil cooler duct to the bulkhead brackets with the bolts, washers and nuts.

e. Position the oil cooler (4) between the bulkhead brackets (1 and 5).

Note

The inlet and outlet ports are at the right front corner of the cooler.

f. Insert the bolts through the bulkhead brackets (1 and 5) and cooler brackets.

Note

The eyebolts are installed in the forward brackets. The head of each eyebolt should be aft.

g. Secure the bolts with the washers and nuts.

Note

Tighten the nuts at the right side of the cooler first.

h. Position the long bracket between the bulkhead brackets (1 and 5) on each side of the cooler and secure it to the eyebolt and clip with the bolts, washers and nuts.

Note

If new brackets are being installed, drill through the pilot hole in the aft end of each bracket with a No. 10 (0.1935 inch diameter) drill. Deburr the hole in each bracket.

i. Secure the oil cell return tube (2), fitting, flange and gasket to the outlet port on the right side of the cooler (4) with the washers and nuts.

j. Install or hinge the power package up into position if it was removed or hinged down. (Refer to paragraph 5—15.)

k. Secure the engine oil outlet hose and gasket to the inlet port of the cooler with the washers and nuts. Lockwire the nuts.

Note

On helicopters bearing USAF Serial Nos 53-4475 through 53-4479, the adapter and gasket should be secured to the mounting pad and the engine outlet hose and gasket secured to the adapter.

l. Check to see that the large, hex-head drain plug is installed at the forward, right corner of the cooler (4, figure 5—26). Fill the cells with oil. (See figure 1—14.)

WARNING

Do not overfill. Overfilling reduces necessary foaming space.

m. Pre-oil the engine.

CAUTION

The engine must be pre-oiled immediately prior to starting after an engine change, after the engine has been idle for more than 72 hours, or after air has been allowed to enter the oil inlet line to the engine in any manner. For instructions on pre-oiling the engine, refer to paragraph 5—8.

5—221. OIL DILUTION SYSTEM.

5—222. DESCRIPTION. *(See figure 5—26.)* The oil dilution system supplies fuel from the fuel pressure gage line to the "Y" fitting in the engine oil inlet line. The flow of fuel is controlled by a solenoid valve which is actuated by "OIL DIL OFF ENG PRM" switch on the electrical switch panel in the cockpit. The oil dilution line is connected in the fuel pressure gage line at a resistor tee on the forward surface of the canted bulkhead. The solenoid valve is installed in a bracket above the right oil cell. A manually operated shut-off valve is installed in the oil dilution line at the "Y" fitting.

Note

The manually operated shut-off valve should be open at all times when operating in climatic conditions requiring oil dilution.

5—223. REMOVAL.

a. Disconnect the lower oil dilution tube at the valve (12, figure 5—29) in the "Y" fitting (9) just forward of the oil cooler (4) and at the solenoid valve (2, figure 5—27) above the right oil cell. Remove the clamps securing the tube to the oil cell outlet tube (7, figure 5—29). Remove the oil dilution tube.

b. Remove the valve (12) and gasket from the "Y" fitting (9).

Note

Have a plug ready to install in the "Y" fitting as soon as the valve is removed to prevent spillage of oil.

c. Disconnect the upper oil dilution tube at the solenoid valve (2, figure 5—27) and at the restrictor tee in the fuel pressure gage line on the forward surface of the canted bulkhead. Remove the tube. Install a plug in the tee.

d. Disconnect the electrical wiring from the solenoid valve (2).

e. Remove the screws and washers that secure the clamps and solenoid valve (2) to the bracket. Remove the clamps and valve. Remove the elbow, nipple and reducers from the valve.

f. Cut the lock wire and remove the bolts and washers that secure the bracket on the oil cell cover. Remove the bracket. Replace the bolts and washers.

5—224. MAINTENANCE. Maintenance of the valve should be accomplished in accordance with applicable directives.

a. Inspect the bracket and tubes for damage or possible cracks.

b. Blow the tubes clean with compressed air.

5—225. INSTALLATION.

a. Remove the forward, center bolt and the bolt just to the left of it from the right oil cell cover (5, figure 5—27). Position the solenoid valve bracket (2) over these two holes and replace the bolts and washers. Lockwire the bolts.

b. Install a reducer in each port of the solenoid valve (2). Install the elbow in the inlet port and the nipple in the outlet port.

Note

The open end of the elbow should point up.

c. Position the clamps and solenoid valve (2) on the bracket. Secure the clamps with the screws and washers.

d. Connect the electrical wiring to the valve (2).

e. Remove the plug from the restrictor tee in the fuel pressure gage line on the forward surface of the canted bulkhead. Connect the upper oil dilution tube to the tee and to the solenoid valve (2).

f. Remove the plug from the "Y" fitting (9, figure 5—29) just forward of the oil cooler (4). Install the valve (12) and gasket in the "Y" fitting.

g. Connect the lower oil dilution tube to the valve (12) in the "Y" fitting and to the solenoid valve (2, figure 5—27). Install the clamps securing the tube to the oil cell outlet (7, figure 5—29).

CAUTION

Pre-oil the engine in accordance with instructions in paragraph 5—8 immediately prior to starting the engine after the valve in the "Y" fitting has been removed.

5—226. DRAIN VALVE AND SWING CHECK.

5—227. DESCRIPTION. *(See figure 5—29.)* The lubrication system drain valve is installed in the engine oil inlet line "Y" fitting located just forward of the oil cooler. The valve drains most of the oil from each oil cell and from the oil outlet tube. The swing check is installed between the "Y" fitting and the housing to which the engine oil inlet hose is attached. The swing check prevents the drainage of oil from the engine when the engine is idle.

5—228. REMOVAL. *(See figure 5—29.)*

a. Drain the oil from both cells at the drain valve.

b. Cut the lock wire and unscrew and remove the drain valve (8) from the "Y" fitting (9). Remove the gasket.

c. Loosen the nuts that secure the housing (11) and swing check (10) to the "Y" fitting. Drain the engine oil inlet hose. Remove the bolts, washers and nuts. Swing the housing aside and remove the swing check and gaskets.

d. Remove the washers and nuts that secure the "Y" fitting (9) to the flange on the cell outlet tube (7). Remove the "Y" fitting and gasket.

5—229. MAINTENANCE. Maintenance of the drain valve and swing check should be accomplished in accordance with applicable directives.

5—230. INSTALLATION.
(See figure 5—29.)

a. Position the gasket and "Y" fitting (9) on the flange on the oil cell outlet tube (7). Secure them with the washers and nuts.

b. Position the swing check (10) and gasket against the "Y" fitting (9). Position a gasket and the housing (11) on the aft end of the engine oil inlet hose against the swing check. Secure the housing and swing check to the "Y" fitting with the bolts, washers and nuts.

Note

Check to see that the swing check (10) is installed with the edge stamped "TOP" up.

c. Install the gasket on the drain valve (8). Screw the drain valve into the "Y" fitting (9). Lockwire the valve to the fitting.

d. Check to see that the drain valve (8) is closed. Fill the oil cells with oil. (See figure 1—14.)

WARNING

Do not overfill. Overfilling reduces necessary foaming space.

e. Pre-oil the engine.

CAUTION

The engine must be pre-oiled immediately prior to starting after an engine change, after the engine has been idle for more than 72 hours, or after air has been allowed to enter the oil inlet line to the engine in any manner. For instructions on pre-oiling the engine, refer to paragraph 5—8.

5—231. IGNITION SYSTEM.

5—232. DESCRIPTION. *(See figure 5—30.)* The ignition system consists of a dual magneto distributor, a low tension ignition harness carrying electrical current to a coil mounted on each cylinder, high tension leads from the coil to each spark plug in the cylinder, an ignition switch and an induction vibrator.

5—233. TROUBLE SHOOTING.

Trouble	Probable Cause	Remedy
Excessive drop off during magneto check	Bad spark plug	Replace spark plug
	Loose spark plug	Tighten spark plug

Trouble	Probable Cause	Remedy
Excessive drop off during magneto check (cont)	Excessive leakage in ignition harness	Check harness for leakage. Replace if necessary
	Worn or loose connections in harness	Tighten connections. Replace harness if necessary
	Magneto points worn, pitted or improperly set	Replace magneto
	Leaking condenser	Replace magneto

5—234. TESTING. Check each distributor of the magneto at 2200 engine rpm with 25 inches Hg manifold pressure. Maximum drop-off for either distributor should not exceed 75 rpm.

Note

If the drop-off for either distributor is above the maximum listed, the trouble may be localized in the ignition lead or spark plug by a cold cylinder check. Warm up the engine for three to five minutes on the distributor which registered the excessive drop-off, shut off the engine and feel each cylinder by hand. A cool cylinder indicates a bad spark plug or ignition lead.

5—235. IGNITION HARNESS. Refer to the Handbook of Service Instructions, T.O. 2R-R1820-42, for information on the ignition harness.

5—236. SPARK PLUGS.

5—237. DESCRIPTION. Two spark plugs are installed in each cylinder of the engine. The spark plugs are shielded to prevent radio interference.

5—238. TROUBLE SHOOTING.

Trouble	Probable Cause	Remedy
Malfunctioning spark plugs	Carbon coating	Clean the spark plug
	Closed spark gap	Replace the plug
	Worn spark plug bushings or gaskets	Replace with specified bushings or gaskets
	Loose wiring terminals and elbows	Tighten the connections
	Corroded or damaged ignition cable	Replace the cable
	Burned shell electrodes	Replace the plug
	Damaged spark plug	Replace the plug

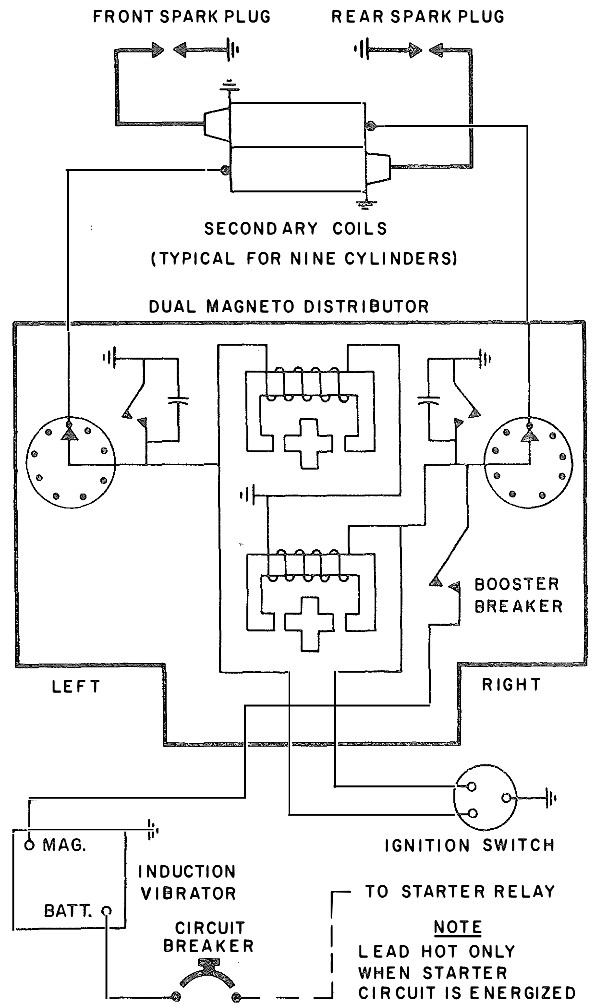


Figure 5—30. Ignition System Schematic Diagram

Trouble	Probable Cause	Remedy
Failure of engine to idle properly	Faulty or loose spark plug	Change or tighten the plug
	Defective spark plug contacts	Change plug
Rough running engine	Faulty or loose spark plug	Change or tighten the plug
Dead cylinder	Faulty or loose spark plug	Change or tighten the plug
Loss of compression	Loose spark plug	Tighten the plug
	Faulty insert or gasket	Replace with specified insert or gasket
Detonation	Loose spark plug	Tighten spark plug

5—239. REMOVAL.

a. Remove the ignition lead from the spark plug.

Note

Hold the ignition lead elbow with one hand while loosening the coupling nut to avoid damaging the spark plug due to side loading.

b. Install a lead protector on the ignition lead.

c. Remove the spark plug with a suitable socket wrench. Remove the spark plug gasket.

Note

If the spark plug is seized, apply penetrating oil to the base of the plug and the spark plug insert. If this fails to loosen the plug, install a conical metal adapter over the plug with a hole at the apex just large enough to accommodate the funnel of a carbon dioxide bottle. Apply carbon dioxide to chill the plug. After chilling, vibrate the plug and, at the same time, apply pressure on the wrench to loosen the plug.

d. Place the spark plug in a rack to prevent damage.

e. Install a dummy in the spark plug insert.

5—240. INSTALLATION.

CAUTION

Always handle spark plugs carefully. If a plug is dropped, do not guess as to its effectiveness; always obtain a new plug.

a. Remove the dummy plug from the spark plug insert.

b. Check the threads of the spark plug insert and spark plug for cleanness. Place a new gasket on the spark plug.

c. Lightly lubricate the first two threads of the spark plug with anti-seize compound (index 43, paragraph 1—32).

Note

Never allow anti-seize compound to get on the electrodes of the plug since this compound is conductive and will short out the plug. The compound must not be applied to the connector.

Note

Apply the anti-seize compound with a brush, not with the fingers, as the moisture of the fingers will tend to nullify the anti-seize effect of the compound.

d. Install the spark plug in the insert and screw it down with the fingers until the gasket is seated. Tighten the spark plug with 300 to 360 inch-pounds torque.

e. Make certain that the inside and outside of each spark plug barrel is clean and dry.

f. Remove the protector from the ignition lead. Use a clean, dry cloth and wipe each connector clean.

Note

Do not touch the connector with the fingers.

g. Visually inspect each connector insulator and spring. Apply a light film of insulating compound (index 53, paragraph 1—32) to each connector with a clean cloth.

WARNING

The insulating compound contains minutely ground silica and mica which are irritating to the eyes and skin. Gloves should be worn when insulating compound is handled frequently.

h. Insert the connector into the spark plug barrel. Turn the coupling nut down fingertight. Hold the lead in proper position and tighten the coupling nut 15 degrees more.

CAUTION

To prevent cracking the spark plug barrel, the connector must be inserted straight into the barrel and not "cocked." To avoid damaging the spark plug due to side loading, hold the ignition lead elbow with one hand while tightening the coupling nut.

5—241. IGNITION SWITCH.

5—242. DESCRIPTION. The ignition switch is located on the main switch panel in the cockpit. The face of the switch is marked with four positions: "L," "R," "BOTH" and "OFF." When the switch is in the "L" position, the rear spark plugs are firing; when in the "R" position the forward spark plugs are firing; when in the "BOTH" position all spark plugs are firing.

5—243. REMOVAL.

a. Loosen the fasteners and lift the main switch panel away from the instrument panel.

b. Disconnect the ignition conduit from the back of the ignition switch.

c. Remove the cover from the back of the switch and disconnect the electrical leads.

d. Remove the screws that hold the switch to the panel and remove the switch.

5—244. INSTALLATION.

a. Position the ignition switch on the main switch panel and secure it with the screws.

b. Connect the electrical leads inside the switch. Replace the cover on the back of the switch.

c. Connect the ignition conduit to the back of the switch.

d. Position the switch panel on the instrument panel and secure it with the fasteners.

5—245. TESTING. With the engine idling smoothly at 1100 rpm, turn the ignition switch off momentarily and then on again to ascertain that the switch turns the engine off and on.

5—246. INDUCTION VIBRATOR.

5—247. DESCRIPTION. The induction vibrator is mounted just aft of the left engine nose door frame. The vibrator supplies 27-volt, 2.7 amp pulsating current to the primary coil of the magneto to aid in providing sufficient current when starting the engine. After the engine starts, the magneto takes over the function of the vibrator.

5—248. REMOVAL.

a. Open the engine access doors.

b. Disconnect the ignition conduits from the ignition vibrator.

c. Remove the cover from the face of the vibrator and disconnect the electrical leads.

d. Remove the screws and washers holding the vibrator in place and remove the vibrator.

5—249. INSTALLATION.

a. Position the induction vibrator behind the left engine access door frame just aft of the junction box and secure it with the screws and washers.

Note

The vibrator is automatically grounded when installed and secured. Check to see that the mounting surfaces are clean and will provide a good ground.

b. Connect the electrical leads inside the vibrator. Replace the cover on the front of the vibrator.

c. Connect the ignition conduits to the top and bottom of the vibrator.

d. Close the engine access doors.

5—250. STARTER SYSTEM.

5—251. DESCRIPTION. *(See figure 5—31.)* The starter system consists of the starter, starter relay, throttle limit switch and starter switch. The starter is installed on the accessory section of the engine and is driven by dc power from the primary bus in the power relay junction box. This circuit is controlled by the starter relay which is located in the power relay junction box and is operated

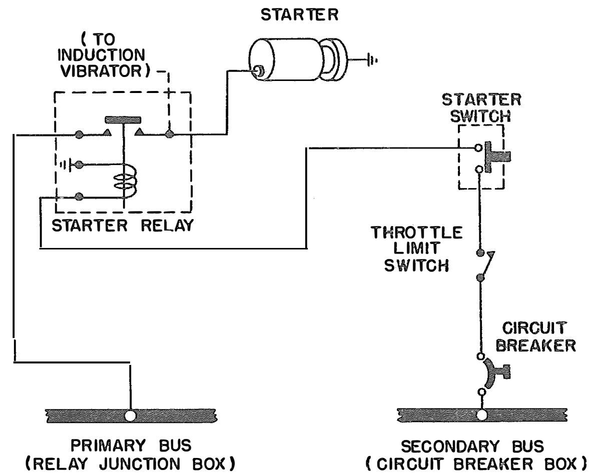


Figure 5—31. Starter System Schematic Diagram

by dc power from the secondary bus in the overhead switch panel. The starter relay is closed by pressing the starter switch button on the pilot's collective pitch control. The throttle limit switch, located on the right wall near the front of the cabin, breaks the starter relay energizing circuit, thereby preventing the starter from being energized unless the collective pitch control is in low pitch position and the throttle is closed. The starter relay energizing circuit is protected by a circuit breaker in the overhead switch panel.

5—252. STARTER.

5—253. DESCRIPTION. The 28-volt, direct-cranking starter (7, figure 5—7) is mounted on the accessory section of the engine. The starter is actuated by the starter switch on the pilot's collective pitch stick. When the starter switch is pressed, the starter jaw engages the engine jaw and cranks the engine. When the engine starts, the engine jaw overrides the starter jaw and disengagement is automatic.

5—254. TROUBLE SHOOTING.

Trouble	Probable Cause	Remedy
Starter turns engine sluggishly or fails completely	Worn, dirty or sticky brushes	Remove starter for overhaul
	Weak brush springs	Remove starter for overhaul
	Pitted, dirty or worn commutator	Remove starter for overhaul
	Weak or discharged battery	Replace battery; use external power for starting
	Poor electrical connections	Clean and tighten connections
	Starter restrictor switch open	Adjust switch; replace if defective

Trouble	Probable Cause	Remedy
Starter turns engine sluggishly or fails completely (cont)	Starter relay defective	Replace relay
	Starter defective	Remove starter for overhaul
Starter relay clicks on and off	Weak or discharged battery	Replace battery; use external power for starting
	Starter relay defective	Replace relay

5—255. REMOVAL.

a. Loosen the knurled nut and remove the terminal cover. Disconnect starter cable from the terminal post.

b. Support the starter and remove the nuts and washers at the mounting flange.

c. Remove the starter and gasket from the starter mounting pad.

5—256. INSTALLATION.

a. Check the jaw of a new starter with the engine jaw for size, number and slant of teeth. Check the starter for proper direction of rotation.

b. Wipe the mounting pad and the starter mounting flange clean. Place a clean, dry gasket on the mounting pad.

Note

Remove paint, dirt, grease, etc., from the nuts, washers and starter flange to assure proper grounding.

c. Position the starter on the mounting pad with the terminal post pointing up.

d. Secure the starter to the mounting pad with the washer and nuts. Tighten the nuts with 280 to 300 inch-pounds torque.

e. Connect the starter cable to the terminal post. Replace the terminal cover and knurled nut.

5—257. STARTER RELAY.

5—258. DESCRIPTION. A starter relay is mounted in the power relay junction box. The relay supplies dc power to the starter when the starter switch on the pilot's collective pitch control is pressed.

5—259. REMOVAL.

a. Remove the cover from the power relay junction box (figure 7—8).

WARNING

Do not remove the junction box cover unless the battery-generator switch is in the "OFF" position, external power is disconnected and the engine is not operating. Serious fires can result.

b. Disconnect all wiring from the relay.

c. Disconnect the nuts and washers from the bus bar and the reverse current cut-out relay and remove the bus bar.

d. Remove the bolts and washers from the base of the starter relay and remove the starter relay.

5—260. INSTALLATION.

a. Secure the starter relay inside the power relay junction box (figure 7—8) with the bolts and washers.

b. Connect the bus bar to the relays and secure in place with washers and nuts.

c. Connect the wiring to the relay.

d. Replace the cover on the junction box.

WARNING

Make certain that the connections in the power relay junction box are correctly made and secure. Check that no foreign objects are left in the box and that the cover is secured properly in place. Short circuits in the power relay junction box can result in dangerous fires.

5—261. THROTTLE LIMIT SWITCH.

5—262. DESCRIPTION. A throttle limit switch (35, figure 5—13) is installed on a bracket on the right wall near the front of the cabin. The switch is actuated by the lower end of the aft throttle rod (33) and prevents the starter from being energized unless the collective pitch control is in low pitch position and the throttle is closed.

5—263. REMOVAL.

a. Turn the battery-generator switch to "OFF" and disconnect external power. Disconnect the wiring from the switch.

b. Remove the screws, washers and nuts and remove the switch from the bracket.

5—264. INSTALLATION.

a. Position the switch between the flanges of the bracket and secure it with the screws, washers and nuts.

Note

The roller on the actuating arm of the switch should be forward.

b. Turn the battery-generator switch to "OFF" and disconnect external power. Connect the wiring to the switch.

5—265. ADJUSTMENT. The throttle limit switch must be adjusted to open when the gap between the carburetor throttle lever and the throttle stop on the carburetor is as near 0.000 inch as possible. This gap must not exceed 0.070 inch under any circumstances. To adjust the throttle limit switch within this tolerance, proceed as follows:

CAUTION

The throttle limit switch must be adjusted after each engine change, carburetor change or after replacement of any component of the throttle control system.

a. Place the collective pitch control in the low pitch position and the throttle twist grip in the closed position. Move the throttle twist grip out of the closed position to establish a gap not to exceed 0.070 inch between the carburetor throttle lever and the throttle stop on the carburetor.

b. Loosen the bronze adjusting nut located between the actuator and the actuator support arm of the throttle limit switch.

c. Position the roller on the end of the actuator against the rod-end bearing of the collective pitch rod (33, figure 5—13). Tighten the adjusting nut.

d. Disconnect the K69A18 wire from the terminal on the throttle limit switch. Attach one wire of a test light to the terminal on the limit switch and ground the other light wire to the structure of the helicopter.

Note

If a test light is not available, the point at which the throttle limit switch closes may be determined by listening for a click in the throttle limit switch while performing the procedures outlined in steps e. and g.

e. Raise the collective pitch control out of the low pitch position. Move the control slowly back to low pitch position, but stop movement of the control immediately when the test light goes on, indicating that the throttle limit switch has closed.

f. Measure the gap between the throttle lever and the throttle stop on the carburetor.

Note

The gap must not exceed 0.070 inch and should be as near 0.000 inch as possible. Repeat steps b. through f. if the gap is greater than 0.070 inch.

g. Move the throttle twist grip out of the closed position. Move the twist grip slowly back to the closed position, but stop movement of the twist grip immediately when the test light goes on, indicating that the throttle limit switch has closed.

h. Measure the gap between the throttle lever and the throttle stop on the carburetor.

Note

The gap must not exceed 0.070 inch and should be as near 0.000 inch as possible. Repeat steps b. through h. if the gap is greater than 0.070 inch.

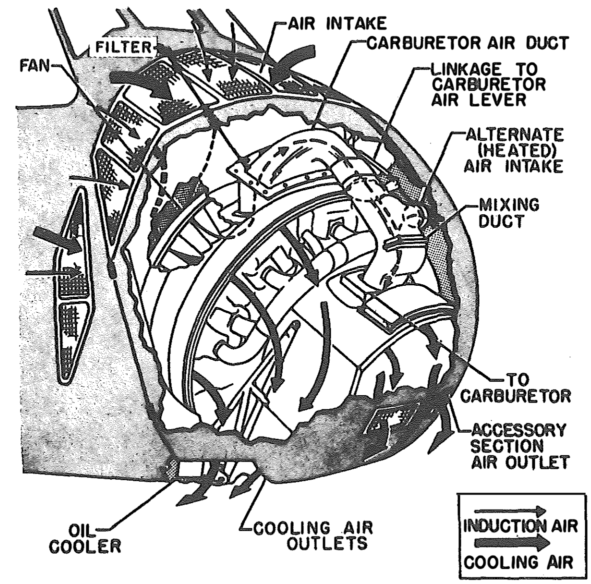
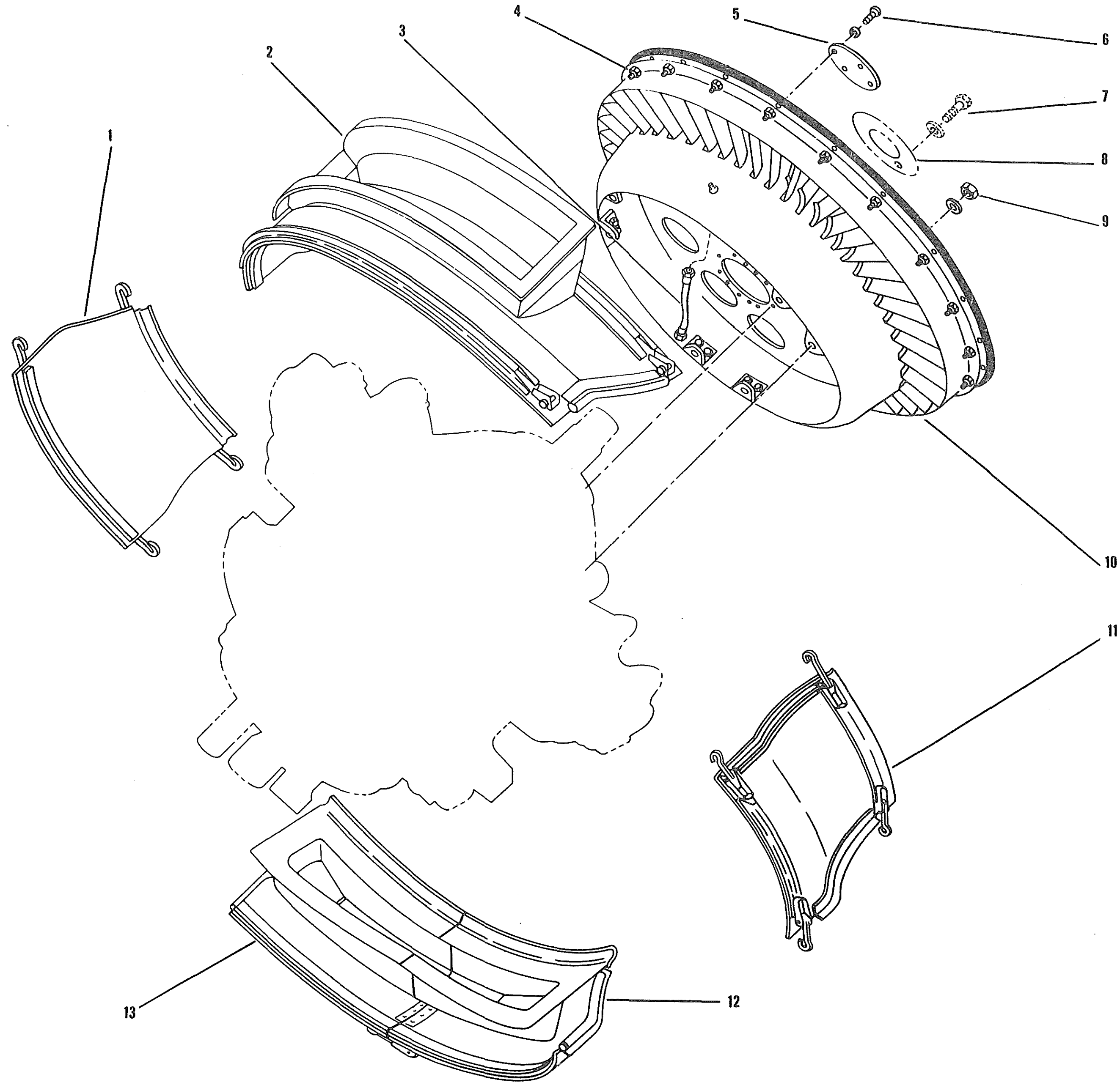


Figure 5—32. Engine Cooling System Schematic Diagram

5—266. ENGINE COOLING SYSTEM.

5—267. DESCRIPTION. *(See figures 5—32 and 5—33.)* The engine cooling system is composed primarily of a five-piece metal cowling and a contravane assembly, attached to the nose section of the engine, which supports the cowling. Air enters the cooling system through the screened openings below the cockpit windshield and is directed downward between the inclined fire wall (cockpit floor) and the canted bulkhead to the clutch fan. The clutch fan forces ram air inside the cowling; the cowling guides the ram air between the cylinder cooling fins. Part of this air is directed into the accessory section by three metal cooling tubes attached to cylinder air deflectors. Cooling system air is expelled from the engine compartment through an opening at the bottom of the compartment and a screened opening in the lower part of each engine access door. Ram air is drawn from the cooling system for the carburetor air induction system and the engine oil cooler.



1. Side Cowl Panel
2. Upper Cowl Panel
3. Anti-Corrosion Injection Hose
4. Nut
5. Cover
6. Screw, Washer
7. Screw, Washer
8. Flange Spacer
9. Washer, Nut
10. Contravane Assembly
11. Side Cowl Panel
12. Lower Cowl Panel (Right Section)
13. Lower Cowl Panel (Left Section)

Figure 5—33. Engine Cooling System Removal

5—268. REMOVAL.

a. Open the nose doors.

b. Remove the cold air elbow. (Refer to paragraph 5—278.)

c. Unsnap the clamps that secure each side cowl panel (1 and 9, figure 5—33) to the upper panel (2) and the lower panels (12 and 13). Remove the side panels.

Note

If the engine pre-heat duct is installed, remove it. (Refer to paragraph 4—37, steps b. and c.)

d. Unsnap the clamps securing the two sections of the lower panel together and remove the right section (12, figure 5—33).

Note

The left section (13) of the lower cowl panel cannot be removed unless the power package is removed from the helicopter or hinged down. (Refer to paragraph 5—12.)

e. Remove the upper panel (2, figure 5—33).

f. Remove the accessory section and engine mount cooling tubes. (Refer to paragraph 5—40.)

g. Remove the contravane assembly. (Refer to paragraph 5—273.)

h. Remove the accessory compartment shroud. (Refer to paragraph 5—31.)

5—269. MAINTENANCE.

a. Inspect each cooling tube for security of welds and possible cracks.

b. Inspect each cowl panel for security of welds and rivets and for possible cracks. Check the condition of the seals.

c. Check the condition of the clamps and pins on each cowl panel.

d. Inspect the vanes on the contravane assembly for damage and security of rivets.

e. Inspect the contravane assembly for security of rivets and possible cracks.

5—270. INSTALLATION.

Note

The left section (13, figure 5—33) of the lower cowl panel must be installed at the same time the power package is installed or hinged up into position. (Refer to paragraph 5—15.)

a. Install the accessory compartment shroud. (Refer to paragraph 5—33.)

b. Install the contravane assembly. (Refer to paragraph 5—274.)

c. Install the accessory section and engine mount cooling tubes. (Refer to paragraph 5—41.)

d. Align the reference mark on the upper cowl panel with the reference mark on the bead of the contravane and position the cowl panel (2, figure 5—33) on the engine.

e. Position the right section (12) of the lower cowl panel on the engine and secure the clamps to the pins on the left section.

f. Position each side panel (1 and 9) on the engine and secure the clamps to the pins on the lower panels (12 and 13) and the upper panel (2).

Note

To install the engine pre-heat duct, refer to paragraph 4—38, steps g. and h.

g. Install the cold air elbow on the upper cowl panel. (Refer to paragraph 5—285.)

h. Close the nose doors.

5—271. CONTRAVANE ASSEMBLY.

5—272. DESCRIPTION. The contravane assembly encloses the clutch fan, directs ram air from the fan down onto the engine and is attached to the front of the engine by the thrust nut cover gap screws and at the crankcase front section attaching studs. The contravane assembly consists primarily of a web and inner cowl, an outer cowl ring and fan shroud assembly, and 72 vanes. The vanes are positioned between the inner cowl and the outer cowl ring and support the outer cowl ring. The vanes straighten the flow of air from the clutch fan and reduce turbulence of the air inside the engine cowling. The aft edge of each cowling panel is supported by the outer cowl ring. Removable covers are secured to the contravane assembly web to provide access to the crankcase front section attaching studs. Access to engine oil breather tubes is also provided by these covers.

5—273. REMOVAL.

a. Hinge the power package down. (Refer to paragraph 5—12.)

b. Remove the clutch and fan from the engine drive shaft. (Refer to paragraph 5—321, steps h. and p.)

c. Remove the screws and washers (5, figure 5—33) that secure the covers (4) to the contravane assembly web. Remove the covers.

d. Reach through the access hole over the union in the oil breather line. Disconnect the upper tube from the union and from the elbow in the cover on the oil separator pad. Remove the tube.

e. Remove the clamp that secures the lower tube to the bracket on the contravane assembly. Remove the bracket from the contravane assembly.

f. Disconnect the lower tube from the elbow in the intercylinder air deflector between number seven and number eight cylinders. Remove the tube.

g. Disconnect the anti-corrosion injection hose (3) from the fitting in the upper right side of the inner cowl.

h. Reach through the access holes and remove the washers and nuts (9) that secure the contravane assembly (10) to the crankcase front section attaching studs.

i. Cut the lockwire and remove the screws and washers (7) that secure the contravane around the engine shaft. Remove the crankcase front section flange spacer (8).

j. Index the contravane assembly to the engine to assist in installation. Lift the contravane assembly from the engine.

CAUTION

Replace the crankcase front section flange spacer (6) and secure it with the screws and washers immediately after removing the contravane assembly.

5–274. INSTALLATION.

a. Apply tape (index 55, paragraph 1–32) around the beading on the contravane assembly, making certain that there are no wrinkles left in the tape.

b. Remove the screws and washers (7, figure 5–33) that secure the crankcase front section flange spacer (8) to the nose section of the engine. Remove the flange spacer.

c. Position the contravane assembly (10) on the nose section of the engine.

Note

The contravane assembly will seat on the engine studs in only one position.

d. Install the flange spacer on the contravane assembly web and secure it with the screws and washers (7). Tighten the screws with 350 to 400 inch-pounds torque. Lockwire the screws in pairs.

e. Reach through the access holes and install the nuts and washers (9) on the crankcase front section attaching studs. Tighten the nuts with 275 to 300 inch-pounds torque.

f. Connect the anti-corrosion injection hose (3) to the fitting on the inner cowl.

g. Position the lower oil breather tube inside the contravane assembly and connect it to the elbow in the intercylinder air deflector between number seven and number eight cylinders.

h. Position the upper tube inside the contravane assembly and connect it to the elbow in the cover on the oil separator pad and the union in the lower tube.

i. Install the bracket on the contravane assembly. Secure the lower tube to the bracket with the clamp.

j. Position the covers (5) over the access holes and secure them to the contravane assembly web with the screws and washers (6).

k. Install the clutch and fan on the engine drive shaft. (Refer to paragraph 5–327, steps b. through r.)

l. Adjust the contravane assembly. (Refer to paragraph 5–275.)

m. Hinge the power package up into position. (Refer to paragraph 5–15.)

5–275. ADJUSTMENT. The fan shroud assembly (figure 5–33) must be positioned so an adequate clearance is maintained between the clutch fan blades and the shroud assembly. To permit adjustment of the shroud assembly in relation to the clutch fan blades, the 24 holes in the flange of the shroud assembly are larger than the bolts used in the holes.

a. Measure the clearance between the tip of four equally spaced clutch fan blades and the fan shroud assembly. This clearance should be equal and must be between 0.052 and 0.103 inch.

Note

Omit steps b. through d. if the clearance is within the limits given.

b. Loosen the nut (4) on each of the 24 bolts that secure the fan shroud assembly to the outer cowl.

c. Adjust the fan shroud assembly to obtain the clearance given in step a. Tighten each of the nuts (4).

CAUTION

To prevent movement of and resultant damage to the fan shroud assembly, each nut must be tightened with 18 to 23 inch-pounds torque.

d. Recheck the clearance after tightening the nuts (4).

5–276. CARBURETOR AIR INDUCTION SYSTEM.

5–277. DESCRIPTION. *(See figures 5–15, 5–32 and 5–34.)* The carburetor air induction system consists of a cold-air elbow (7, figure 5–34) secured to the top of the filter support that is riveted to the upper cowl assembly and an air intake duct (3) attached to the top of the carburetor. An air filter is installed in the filter support of the upper engine cowl panel. Cold ram air from the engine cooling system is supplied to the cold air entrance of the mixing section through the cold air elbow. An entrance on the right side of the air intake duct over the exhaust collector supplies warm air to the air intake duct. Doors in both the cold air and warm air entrances of the air intake duct enable the pilot to control the temperature of the air entering the carburetor. The bell cranks that control these doors are connected by a rod assembly so that the movement of each door is synchronized; i.e., when one door is opening the other is closing. Provisions are made for the installation of an engine pre-heat duct on the warm air intake duct.

5—278. REMOVAL OF COLD AIR ELBOW AND FILTER.

a. Open the nose doors.

b. Unbolt the three engine control rods (59, 62 and 74, figure 5—13) at the pulleys near the top of the canted bulkhead. Swing the rods forward over the accessory section of the engine.

c. Remove the clamp (6, figure 5—34) that secures the boot (5) to the cold air elbow (7). Fold the boot back onto the air intake duct.

d. Release the fasteners that secure the cold air elbow (7) to the filter support that is riveted to the upper engine cowl panel (2, figure 5—33). Remove the elbow.

e. Remove the air filter from the entrance duct of the upper engine cowling panel.

5—279. REMOVAL OF AIR INTAKE DUCT.

a. Open the nose doors.

b. Unbolt and remove the three engine control rods (59, 62 and 74, figure 5—13). Replace the bolt, washers and nut (9, figure 5—34) on the air intake duct lever (8).

Note

If the engine pre-heat duct is installed, remove the duct. (Refer to paragraph 4—37, step b.)

c. Unclamp and remove the upper section of the exhaust collector.

d. Remove the clamp (4, figure 5—34) that secures the boot (5) to the air intake duct (3). Fold the boot back onto the cold air elbow (7).

e. Disconnect the electrical wiring at the carburetor air temperature bulb (15).

f. Remove the throttle and mixture control assembly. (Refer to paragraph 5—46, steps c. through h.)

g. Remove the remaining bolts and washers (16, figure 5—34) that secure the air intake duct (3) to the carburetor deck. Remove the air intake duct, cushion retainer (2), cushions (1) and spacers (17).

h. Remove the cushion retainer, cushions and spacers from the air intake duct.

5—280. DISASSEMBLY OF AIR INTAKE DUCT.

a. Cut the lock wire and remove the carburetor air temperature bulb (15, figure 5—34). Remove the gasket (14) from the bulb. Reach into the bottom of the air intake duct (3) and remove the grommet from the angle on the inner wall of the duct.

b. Unbolt and remove the control rod (11) from the bell crank (12) and lever (8).

c. Remove the taper pin, washer and nut that secures the bell crank (12) to the shaft (13) in the warm air entrance. Remove the bell crank (12) and washer from the shaft.

d. Reach into the warm air entrance and remove the screws, washers and nuts that secure the door to the shaft (13). Remove the door through the warm air entrance.

e. Pull the shaft (13) out of the bosses in the warm air entrance.

f. Remove the taper pin, washer and nut that secures the lever (8) to the shaft (10) in the cold air entrance. Remove the lever (8) and washer from the shaft.

g. Reach into the cold air entrance and remove the screws, washers and nuts that secure the door and bar to the shaft (10). Remove the door and bar through the cold air entrance.

h. Pull the shaft (10) out of the bosses in the cold air entrance.

5—281. ASSEMBLY OF AIR INTAKE DUCT.

a. Install the shaft (10, figure 5—34) in the bosses in the cold air entrance of the air intake duct (3).

Note

The plain end of the shaft should be on the same side of the duct as the warm air entrance.

b. Insert the door into the cold air entrance and position it against the flat surface of the shaft (10). Install a screw and washer in each hole in the shaft. Install the bar against the door. Secure the bar and door to the shaft with the nuts and washer.

c. Install the washer and lever (8) on the shaft.

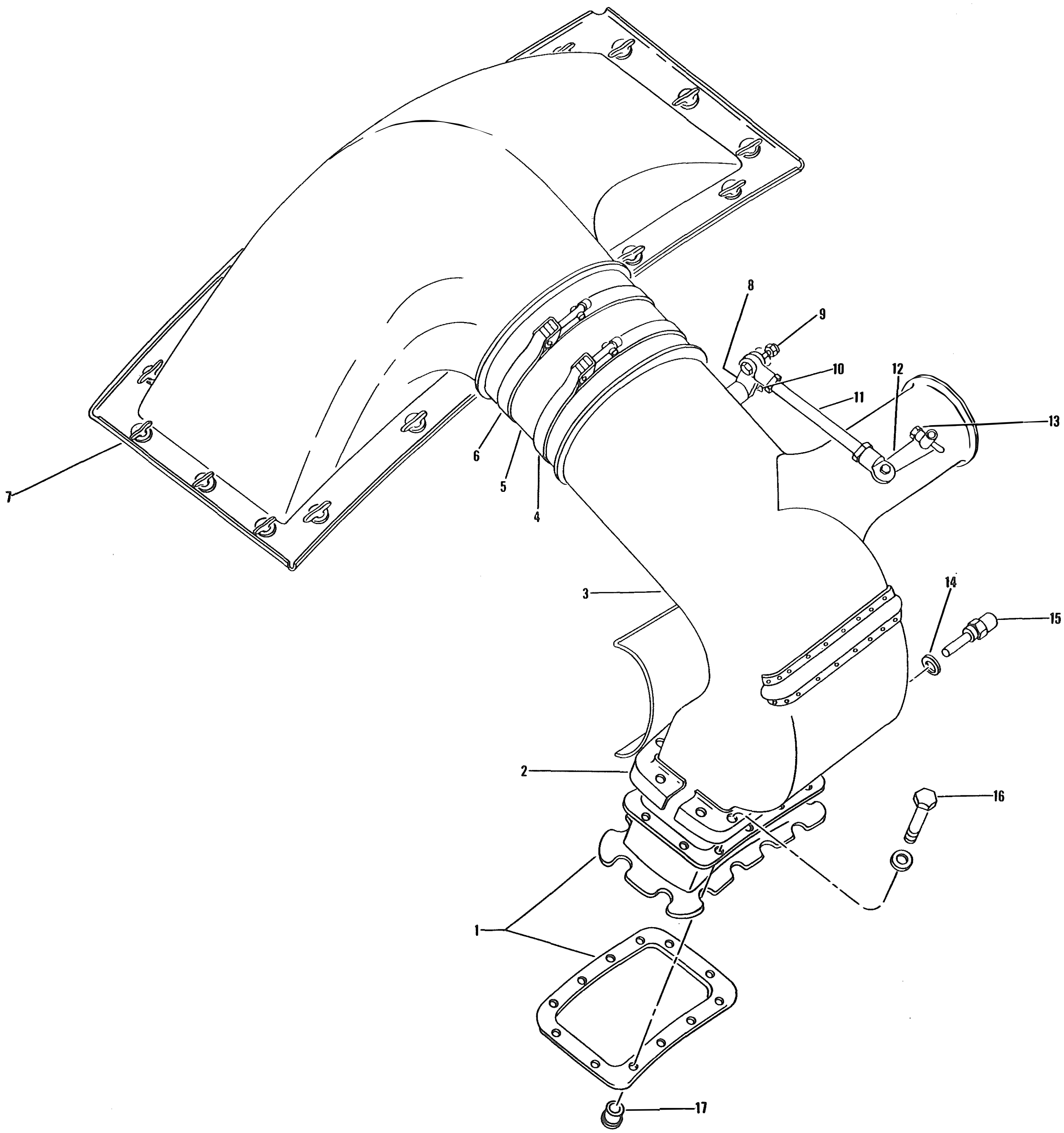
Note

The lever should be installed with the bend away from the air intake duct. The lever should be positioned so there is 72-1/2 degrees between the door and the center line of the lever. This angle should be measured from the surface of the door that contacts the stop on the inner surface of the duct.

d. Secure the lever (8) to the shaft (10) with the taper pin, washer and nut.

Note

If a new lever or shaft is being installed, it must be drilled and taper reamed. The small end of the tapered shaft of the taper pin must not extend more than 1/16-inch above the surface of the work.



1. Cushions
2. Cushion Retainer
3. Air Intake Duct
4. Clamp
5. Boot
6. Clamp
7. Cold Air Elbow
8. Lever
9. Bolt, Washers, Nut
10. Shaft
11. Control Rod
12. Bell Crank
13. Shaft
14. Gasket
15. Carburetor Air Temperature Bulb
16. Bolt, Washer
17. Spacers

Figure 5—34. Carburetor Air Induction System Removal

e. Install the shaft (13) in the bosses in the warm air entrance of the air intake duct (3).

Note

The plain end of the shaft should point up.

f. Insert the door into the warm air entrance and position it against the flat surface of the shaft (13). Secure the door to the shaft with the screws, washers and nuts.

g. Install the washer and bell crank (12) on the shaft.

Note

The bell crank should be installed with the boss outboard. The bell crank should be positioned so there is 37-1/2 degrees between the door and the center line of the bell crank. This angle should be measured from the inboard surface of the door, when the door is fully open and at the edge of the door that contacts the stop on the inner surface of the duct.

h. Secure the bell crank (12) to the shaft (13) with the taper pin, washer and nut.

Note

If a new bell crank or shaft is being installed, it must be drilled and taper reamed. The small end of the tapered shaft of the taper pin must not extend more than 1/16-inch above the surface of the work.

i. Position the control rod (11) against the lever (8) and bell crank (12) and secure it with the bolts, washers and nuts (9).

Note

The control rod is positioned against the inboard surface of the lever (8) and the outboard surface of the bell crank (12). The long bolts at the lever (8) will be used to secure the carburetor air temperature control rod (59, figure 5—13).

j. Reach into the bottom of the air intake duct (3, figure 5—34) and install the grommet in the angle on the inner wall of the duct. Install the carburetor air temperature bulb (15) and gasket (14) in the duct. Lockwire the bulb.

k. Adjust the synchronization of the doors, if necessary. (Refer to paragraph 5—282, step d.)

5—282. MAINTENANCE.

a. Check the cold air elbow (7, figure 5—34) and the air intake duct (3) for possible cracks, with particular attention given to the area near the mounting flange. Repair or replace if necessary.

b. Check the reinforcements and bosses on the air intake duct (3) for security and possible cracks. Repair or replace if necessary.

c. Check the condition of the seal on each door in the air intake duct.

d. Check the synchronization of the doors in the air intake duct (3). When one door is fully closed the other should be fully open. Adjust, if necessary, by lengthening or shortening the control rod (11) attached to the bell crank (12) and lever (8).

e. Clean the air filter. (Refer to paragraph 5—283.)

5—283. CLEANING AIR FILTER.

a. Place the filter in dry cleaning solvent (index 3, paragraph 1—32) and agitate the solvent or rock the filter to insure the removal of the internal dirt from the filter element.

b. When the filter is free of dirt remove it from the solvent and place it on a draining rack in a position which will best facilitate draining.

CAUTION

The air filter must be thoroughly dried before immersing it in oil; otherwise the filter element will not be properly coated with oil and efficiency will be impaired.

c. Immerse the air filter in a mixture consisting of one part corrosion-preventive compound (index 4, paragraph 1—32) and three parts lubricating oil (index 2, paragraph 1—32) for two to five minutes.

d. Drain the air filter by placing it on a draining rack in a position which will best facilitate draining. Allow to drain for two to four hours.

5—284. INSTALLATION OF AIR INTAKE DUCT.

a. Position a cushion (1, figure 5—34) on each surface of the mounting flange of the air intake duct (3). Install the spacers (17) and cushion retainer (2).

Note

The spacers are installed with the flange down.

b. Check that the screen and two gaskets are positioned on the top deck of the carburetor beneath the accessory compartment shroud well. Position the air intake duct (3) on the well and secure with the bolts and washers (16) at the five holes on the right side of the carburetor.

c. Install the upper section of the exhaust collector. (Refer to paragraph 5—290.)

d. Install the throttle and mixture control assembly. (Refer to paragraph 5—48, steps bg. through bx.)

e. Connect the electrical wiring to the carburetor air temperature bulb (15, figure 5—34).

f. Check the synchronization of the doors in the air intake duct. (Refer to paragraph 5—282, step d.)

g. Position one-half the length of the boot (5, figure 5—34) on the cold air entrance of the air intake duct (3). Secure the boot with the clamp (4).

h. Install and secure the three engine control rods (59, 62 and 74, figure 5—13).

i. Check the engine controls in the cockpit for freedom of movement and adjustment. (Refer to paragraphs 5—49, 5—57 and 5—65.)

Note

If the engine pre-heat duct has been disconnected, reinstall the connector assembly (38, figure 4—1) on the warm air entrance of the carburetor air intake duct with the Marmon coupling and connect one end of the forward section of the duct (37) to the connector assembly (38).

j. Close the nose doors.

5—285. INSTALLATION OF COLD AIR ELBOW AND FILTER.

a. Install the air filter in the filter support on the upper cowl panel (2, figure 5—33).

b. Position the cold air elbow (9) at the filter support on the upper cowl panel and secure it with the fasteners.

c. Position one-half the length of the boot (5, figure 5—34) on the cold air elbow (7). Secure the boot with the clamp (6).

d. Secure the three engine control rods (59, 62 and 74, figure 5—13) to the pulleys near the top of the canted bulkhead.

e. Check the engine controls in the cockpit for freedom of movement and adjustment. (Refer to paragraphs 5—49, 5—57 and 5—65.)

f. Close the nose doors.

5—286. ENGINE EXHAUST COLLECTOR.

5—287. DESCRIPTION. *(See figure 5—35.)* The exhaust collector consists of seven sections, each of which contains an elbow, and one tail pipe, which contains two elbows. The collector is secured to the cylinder exhaust ports with ring-type clamps. The sections and tail pipe are secured to one another with sleeve-type clamps. Each clamp contains a bead that fits over a matching bead on the collector. When installed on the engine, the exhaust collector covers approximately a 320-degree arc. The tail pipe protrudes below the left engine access door.

5—288. REMOVAL. *(See figure 5—35.)*

a. Open the engine access doors.

b. Remove the cotter pin, bolt, washer and nut from the ring-type clamp (step 2) that secures the section assembly at the exhaust ports of cylinders number seven and eight.

c. Remove the bolts, washers and nuts from the sleeve-type clamp (step 1) that secures the section assemblies together at cylinders number seven and eight.

d. Remove the section assemblies and the sleeve and ring-type clamps.

Note

Working toward the tail pipe assembly, remove the remaining section assemblies as outlined in steps b. through d.

e. Remove the sleeve-type clamps from the tail pipe assembly.

f. Remove the cotter pin, bolt, washer and nut from the ring-type clamp that secures the tail pipe assembly at the exhaust ports of cylinders number four and five. Remove the tail pipe assembly and ring-type clamps (step 2).

g. Remove the ring-type clamps from the tail pipe assembly.

h. Position a protective cap in each cylinder exhaust port.

5—289. MAINTENANCE.

a. Replace any parts on which there are indications of a hot spot.

b. Check for possible cracks. Replace or repair any part in which cracks may have developed.

c. Check drainage holes for stoppage.

5—290. INSTALLATION. *(See figure 5—35.)*

a. Remove the protective cap from each cylinder exhaust port.

b. Position the ring-type clamps, supplied with the engine, on the tail pipe assembly.

c. Install the tail pipe at the exhaust ports of cylinders number four and five. Secure loosely with the ring-type clamps (step 2).

Note

Tighten the nut on each ring-type clamp only enough to hold the tail pipe assembly in place.

d. Position a sleeve-type clamp (step 1) on each end of the tail pipe assembly.

e. Position a sleeve-type clamp (step 1) on the end of each section assembly.

f. Install each section of the exhaust collector at its

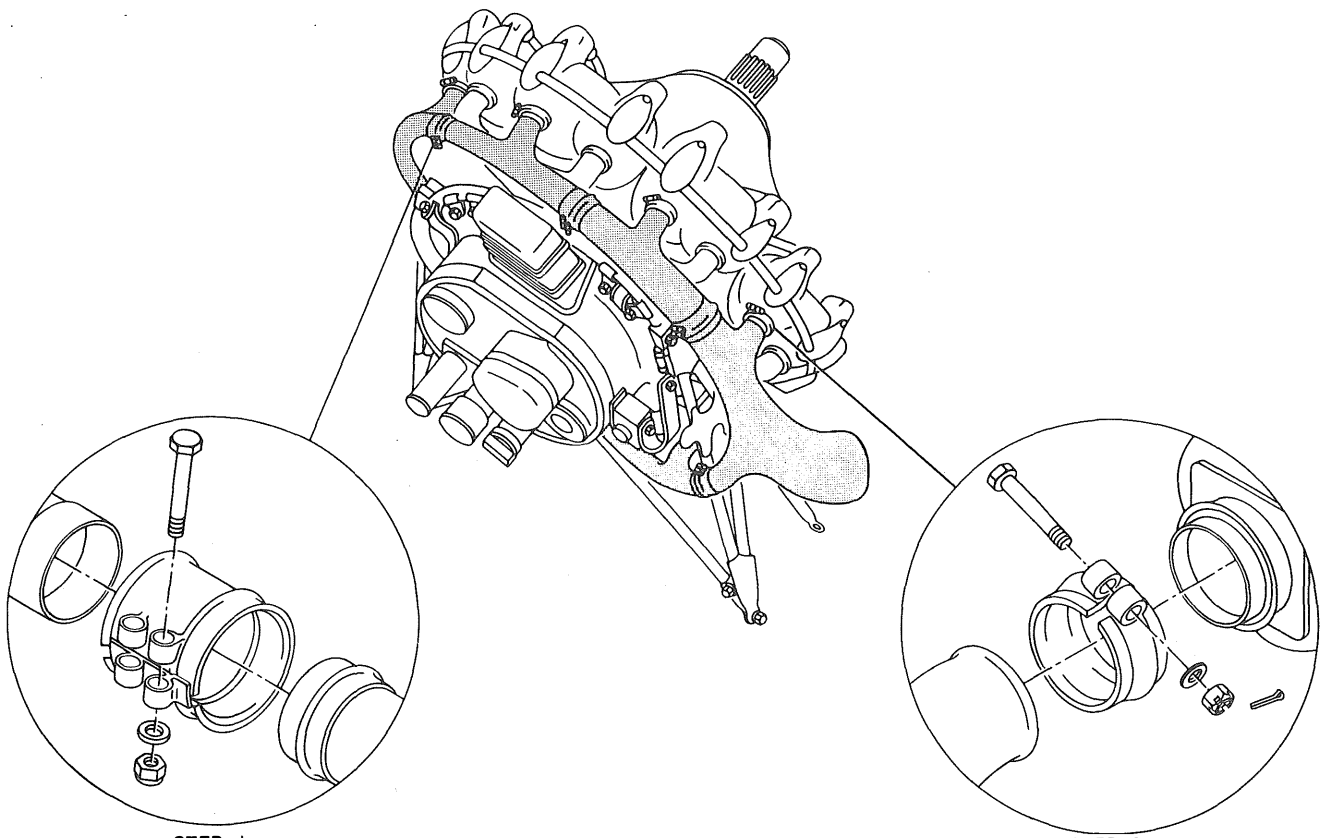


Figure 5–35. Exhaust Collector

proper cylinder with the ring-type clamp positioned on the section assembly.

Note

Tighten the nut on each ring-type clamp only enough to hold the section assembly in place.

g. Tighten the nut on each ring-type clamp with 100 to 120 inch-pounds torque. Safety each nut with a cotter pin.

h. Secure the sleeve-type clamps with the bolts, washers and nuts.

Note

Tighten the nuts at each clamp until the clamp cannot be rotated around the pipe by lightly tapping the bolt heads.

CAUTION

Do not, under any circumstances, tighten the nuts enough to cause bending of the clamp lugs or bolts.

i. Loosen the nuts at each sleeve-type clamp until the clamp can be rotated around the pipe by lightly tapping the bolt head.

Note

After the first one to two hours of engine operation, the sleeve-type clamp should be checked as outlined in steps g. and h. and tightened or loosened as required.

5–291. ENGINE INSTRUMENTS.

5–292. DESCRIPTION. The engine instruments provide the pilot with a ready indication of the operating condition of the engine. Included in the engine instrument group are all fuel and engine oil instruments, the engine tachometer-generator, the manifold pressure gage and the carburetor air temperature and cylinder head temperature indicators.

5–293. FUEL PRESSURE GAGE SYSTEM.

5–294. DESCRIPTION. The fuel pressure gage system furnishes a constant indication of the fuel pressure which is delivered to the carburetor. A fuel pressure line from a pressure port on the carburetor runs to a pressure transmitter mounted on a vibration-insulated bracket located on the right side of the engine compartment forward of the canted bulkhead. The transmitter converts the fuel pressure into electrical energy and sends an electrical indication of the fuel pressure to the fuel pressure indicator on the instrument panel. An overboard vent line is installed at the transmitter. The fuel pressure indicator is graduated from 0 to 50 psi in increments of one psi. The 26-volt ac power for the system is supplied through a fuse on the overhead circuit breaker and fuse panel from the autotransformer.

5–295. TROUBLE SHOOTING.

Trouble	Probable Cause	Remedy
Pointer fails to register	Power failure	Check power source
	Defective wiring	Check wiring for ground, shorts, and continuity
	Leak in pressure lines	Pressure test lines; repair or replace lines as necessary
	Stoppage in lines	Clean lines
	Defective indicator	Replace indicator
	Defective transmitter	Replace transmitter
Pointer fails to return to zero	Stoppage in lines	Clean lines
	Defective wiring	Check wiring for ground, shorts, and continuity
	Defective indicator	Replace indicator
	Defective transmitter	Replace transmitter
Obviously incorrect pressure reading	Leak in pressure lines	Check lines; repair or replace as necessary
	Kink in pressure line	Replace line
	Improper power supply	Check power source
	Defective indicator	Replace indicator
	Defective transmitter	Replace transmitter
Excessive pointer oscillation	Loose mounting of indicator or transmitter	Tighten mounting screws
	Defective vibration isolators or transmitter support	Replace isolators
	Defective wiring	Check wiring for shorts and ground
	Defective indicator	Replace indicator
	Defective transmitter	Replace transmitter

5–296. REMOVAL.

a. Open the engine access doors.

b. Disconnect the fuel pressure hose from the restrictor on the carburetor and from the coupling on the disconnect panel and remove the hose. Unscrew the restrictor from the carburetor.

c. Disconnect the fuel pressure hose from the coupling on the disconnect panel and from the tee fitting on the pressure transmitter and remove the hose. Remove the screws, washers and nuts that secure the coupling to the disconnect panel.

d. Disconnect the oil dilution line from the tee fitting at the transmitter. Disconnect the electrical wiring to the transmitter at the disconnect plug. Remove the screws, washers and nuts that secure the transmitter. Remove the transmitter. Remove the tee fitting from the transmitter.

e. Remove the mounting screws from the indicator and pull the indicator from the instrument panel. Disconnect the wiring from the rear of the fuel pressure indicator.

5–297. INSTALLATION. Installation is the reverse of the removal procedure. After installation check the system for leakage with the fuel booster pump on and for proper indications within the range markings for normal operation.

Note

Apply anti-seize compound (index 43, paragraph 1–32) to the threads of all fittings.

5–298. FUEL QUANTITY SYSTEM.
(Refer to paragraph 5–187.)

5–299. FUEL LOW LEVEL WARNING SYSTEM.
(Refer to paragraph 5–167.)

5–300. FUEL LOW PRESSURE WARNING SYSTEM.
(Refer to paragraph 5–161.)

5–301. ENGINE OIL PRESSURE INDICATOR SYSTEM.
(Refer to paragraph 6–77.)

5–302. ENGINE OIL TEMPERATURE INDICATOR SYSTEM.
(Refer to paragraph 6–82.)

5–303. DUAL TACHOMETER INDICATOR SYSTEM.

5–304. DESCRIPTION. Refer to paragraph 6–57 for a description of the complete dual tachometer system.

5–305. ENGINE TACHOMETER-GENERATOR.

5–306. DESCRIPTION. A four-pole tachometer-generator (9, figure 5–7) is mounted on the left accessory drive housing of the engine and is connected to the dual tachometer indicator by electrical wiring.

5—307. REMOVAL.
(See step 4, figure 5—8.)

a. Disconnect the electrical wiring at the tachometer-generator.

b. Remove the nuts and washers at the mounting flange.

c. Remove the tachometer-generator and gasket from the accessory drive pad.

5—308. INSTALLATION.
(See step 4, figure 5—8.)

a. Wipe the left accessory drive pad and the tachometer-generator flange clean. Place a clean, dry gasket on the drive pad.

b. Position the tachometer-generator on the drive pad with the electrical receptacle to the right.

c. Secure the tachometer-generator to the drive pad with the washers and nuts. Tighten the nuts with 50 to 70 inch-pounds torque.

d. Connect the electrical wiring to the tachometer-generator.

5—309. MANIFOLD PRESSURE GAGE SYSTEM.
(Refer to paragraph 6—62.)

5—310. CARBURETOR AIR TEMPERATURE INDICATOR SYSTEM.
(Refer to paragraph 6—67.)

5—311. CYLINDER HEAD TEMPERATURE INDICATOR SYSTEM.
(Refer to paragraph 6—72.)

5—312. TRANSMISSION SYSTEM.

5—313. DESCRIPTION. The transmission system (figure 5—36) transmits power from the power package to the main and tail rotors and at the same time reduces engine rpm to the desired rotor rpm for the main and tail rotors. The system is composed of a hydro-mechanical clutch system, a main drive shaft assembly, a main gear box assembly, a main gear box oil cooler and blower, a rotor brake system, a tail rotor drive shaft assembly and a pylon transmission installation.

5—314. HYDRO-MECHANICAL CLUTCH SYSTEM.

5—315. DESCRIPTION. *(See figure 5—37.)* The hydro-mechanical clutch system consists of the clutch and fan assembly, the clutch pump, the hoses necessary to connect the pump to the clutch and the clutch pump switch and warning light, which is located on the pilot's side of the control console in the cockpit. When the clutch pump switch is turned on, engine oil is pumped from the left oil cell through the pressure oil line to the clutch; when the switch is turned off, the oil drains from the clutch through the return oil line and back to the left oil cell. The warning light remains on whenever the clutch pump is operating.

5—316. REMOVAL.

a. Remove the clutch and fan assembly (paragraph 5—321).

b. Remove the clutch pump assembly (paragraph 5—331).

c. Disconnect the clutch oil pressure and return tubing and hoses from the elbows on the forward side of the canted bulkhead. Remove the tubing and hoses.

d. Remove the washers and nuts which secure the elbows to the bulkhead and remove the elbows.

e. Disconnect the wiring from the clutch pump switch and warning light mounted on the pilot's side of the control console in the cockpit. Open the hinged radio circuit breaker and fuse panel door on the right side of the control console and unscrew the two screws which support the clutch pump switch and warning light box; remove the box.

5—317. INSTALLATION.

a. Position the clutch pump switch and warning light box on the control console and install the two mounting screws. Close the hinged door on the right side of the console and tighten the fasteners.

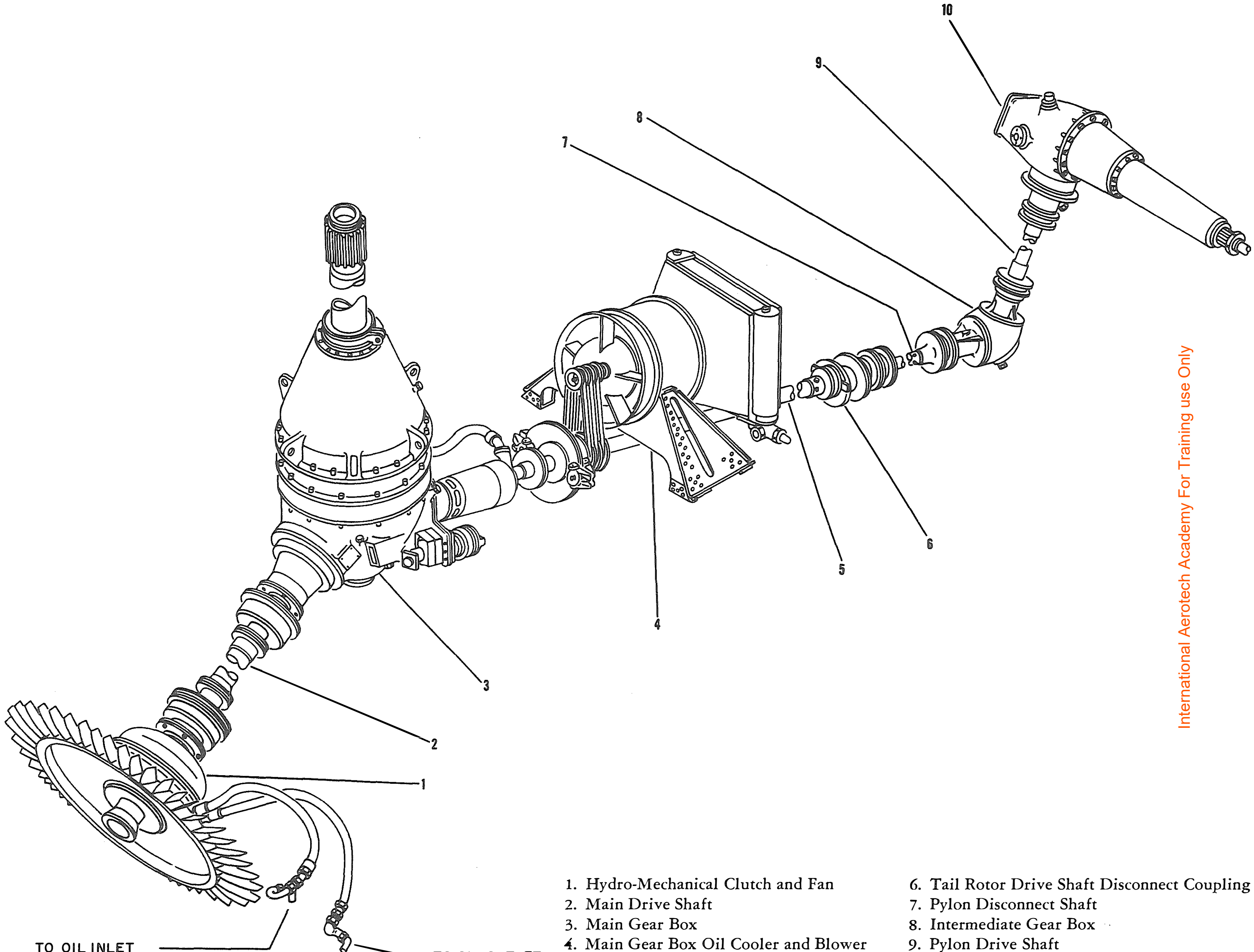
b. Install the bulkhead elbows in the canted bulkhead and install the hoses to the clutch and fan and the tubes to the pump fittings.

c. Install the clutch pump assembly (paragraph 5—332).

d. Install the clutch and fan assembly (paragraph 5—327).

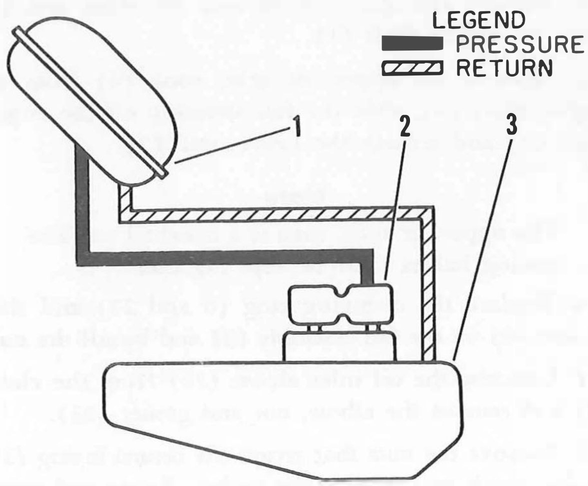
5—318. CLUTCH AND FAN ASSEMBLY.

5—319. DESCRIPTION. *(See figure 5—38.)* The clutch and fan assembly consists of a hydro-mechanical clutch assembly and a fan assembly. The hydro-mechanical clutch makes it possible to start and operate the engine at any speed without engaging the rotors, permits smooth engagement of engine torque to the transmission system through a fluid coupling, provides a positive mechanical coupling of the engine to the transmission system, allows free wheeling of the rotors when the helicopter is in autorotation and allows the rotors to be disengaged and stopped without stopping the engine. The fan assembly provides cooling air for the engine and ram air for the air induction system and acts as a flywheel for the engine. The fan assembly is splined to the engine propeller shaft and secured in place on tapered cones by the engine shaft nut and a lockpin assembly. The main components of the fan assembly are the splined hub, fan disc and fan blades. The fluid coupling, consisting of a vaned



1. Hydro-Mechanical Clutch and Fan
2. Main Drive Shaft
3. Main Gear Box
4. Main Gear Box Oil Cooler and Blower
5. Tail Rotor Drive Shaft
6. Tail Rotor Drive Shaft Disconnect Coupling
7. Pylon Disconnect Shaft
8. Intermediate Gear Box
9. Pylon Drive Shaft
10. Tail Rotor Gear Box

Figure 5—36. Transmission System Diagram



1. Clutch
2. Pump
3. Left Oil Cell

Figure 5—37. Clutch Hydraulic Schematic Diagram

driving disc and a vaned driven disc; and the mechanical coupling, consisting of a freewheel unit controlled by the action of a flyball governor, an actuator and a blocker plate, are the main components of the hydro-mechanical clutch assembly. The lower end of the hydro-mechanical clutch assembly is secured to the fan assembly; the upper end is secured to the lower rubber coupling on the main drive shaft assembly. Engine oil is used in the fluid coupling and is supplied through a hose from the clutch pump mounted on the cover of the left engine oil cell. A return hose leads from the clutch back to the oil cell cover. Access to the clutch and fan assembly is gained through the clutch access (carburetor induction heat) door in the cabin forward bulkhead.

5—320. TROUBLE SHOOTING.

Trouble	Probable Cause	Remedy
Clutch does not engage	Leakage in clutch oil lines	Replace lines if necessary. Seal attachment points with gasket cement. Tighten clamps
	Leakage in clutch	Replace clutch if necessary
	Improper oil pump output	Replace pump
	Internal failure of clutch	Replace clutch
Clutch leaks engine oil excessively	Deterioration of seals	Replace clutch

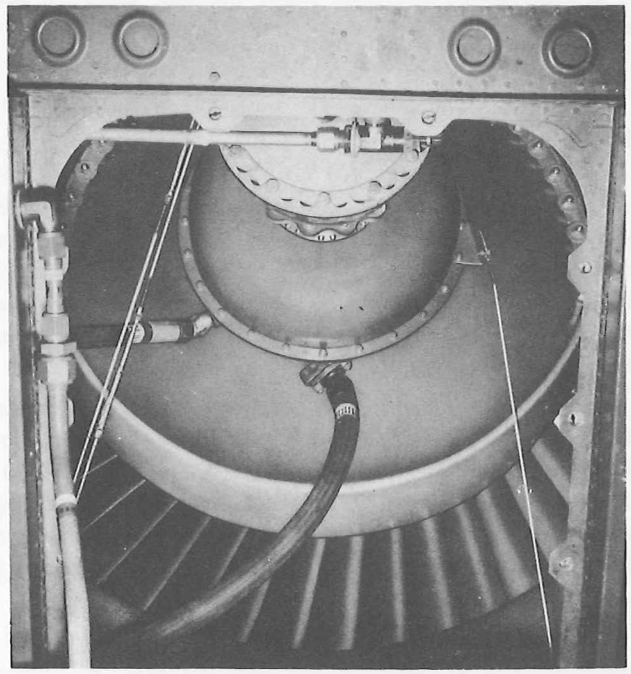


Figure 5—38. Hydro-Mechanical Clutch and Fan Assembly Installed

Trouble	Probable Cause	Remedy
Excessively high frequency vibrations	Damaged fan blades	Replace damaged blades or replace fan assembly

5—321. REMOVAL.

Note

If only the hydro-clutch assembly is being removed, follow steps a. through e. and h. only. If the complete clutch and fan assembly is being removed, omit step c.

a. Remove the clutch access (carburetor induction heat) door in the cabin forward bulkhead. (Refer to paragraph 2—18.)

b. Remove the bolts, washers and nuts (10, figure 5—39) which attach the splined flange at the top of the hydro-clutch assembly (9) to the lower rubber coupling (12) on the main drive shaft (18).

c. Remove the bolts, washers and nuts (19) which secure the flange (14) to the lower end of the main drive shaft (18) and remove the lower rubber coupling (12), spacers (13, 15 and 16) and flange as a unit.

d. Disconnect the pressure and return oil hoses at the clutch.

Note

Drain any trapped engine oil into a container.

e. Disconnect the cable from the clip (24) on the clutch housing.

f. Open the nose doors.

g. Hinge down the power package. (Refer to paragraph 5—12.)

h. Remove the nuts (25 and 26, figure 5—39) from the fan assembly studs which secure the hydro-clutch assembly (9) to the fan assembly (3) and remove the clamping ring (8 and 27) and shims (7 and 28). Lift the clutch assembly up off the fan until it clears the engine shaft (1) and remove the clutch assembly from the helicopter.

i. Remove the lockpin assembly (6) from the engine shaft (1). Position a housing, Kell-Strom part No. KS-2172, on a flange adapter, Sikorsky part No. S1570-10191, with the two keys on the bottom of the housing meshed with the two slots on the upper surface of the flange adapter. Secure the flange adapter to the housing with the screws that are furnished with the housing.

j. Position the flange adapter and housing on the fan assembly (3) so the nuts (25 and 26) that secure the clamping ring (8 and 27) and fan disc to the hub protrude through the eight large holes in the flange of the adapter.

k. Position a wrench, Sikorsky part No. S1670-10383, inside the housing so the teeth on the bottom of the wrench mesh with the wrench slots in the engine shaft nut (5). Position a drive cylinder, Sikorsky part No. S1670-10190-2, inside the housing so the short splines on the small end of the cylinder mesh with the splines on the inside of the wrench.

l. Position a ball arm sleeve, Kell-Strom part No. KS-2069, revision "C" or later, or KS-2187, on the upper end of the drive cylinder with the ball as far in a clockwise direction as it will go.

WARNING

Do not, under any circumstances, use the welded ball arm sleeve KS-2069, revision "A" or "B." Use only the forged ball arm sleeve, KS-2069, revision "C" or later, or KS-2187.

m. Remove the protective cage from the dial end of a Hydra-Pak ram and gage assembly, Kell-Strom part No. HSP-ST5006. Thread the end of the ram and gage assembly into one of the ears of the housing so the piston inside the ram and gage assembly will operate in a counterclockwise direction.

n. Check to see that the valve handle is closed. Insert the pump handle in the pump arm. Operate the pump until the piston has pushed the ball arm sleeve enough to loosen the engine shaft nut (5).

o. Remove the special tools and the shaft nut (5) from the engine shaft (1).

p. Remove the upper, or split, cone (4) from the engine shaft (1), slide the fan assembly off the engine shaft (1) and remove the lower cone (2).

Note

The upper, or split, cone is a matched set. The mating halves must be kept together.

q. Replace the clamping ring (8 and 27) and shim (7 and 28) on the fan assembly (3) and install the nuts.

r. Unscrew the oil inlet elbow (22) from the clutch (9) and remove the elbow, nut and gasket (23).

s. Remove the nuts that secure the return fitting (24) to the clutch and remove the gasket, flange and return fitting.

5—322. DISASSEMBLY AND ASSEMBLY. The hydro-mechanical clutch and fan assembly, with the exception of the replacement of fan blades (paragraph 5—323), must be disassembled and assembled only by qualified personnel at an Overhaul Depot. The following units should always be included in the overhaul shipment: the hydro-clutch assembly (9, figure 5—39), the fan assembly (3), the nuts and washers (25 and 26) which attach the two, the upper and lower cones (2 and 4), the lockpin assembly (6), the engine shaft nut (5), the clamping rings (8 and 27) and shims (7 and 28).

5—323. REPLACEMENT OF FAN BLADES.

a. Remove the damaged blade by removing the bolts, washers and nuts which secure it to the fan disc.

b. Position the new blade and install the bolts, washers, and nuts. Tighten the nuts with 165 to 185 inch-pounds torque.

Note

The leading edge of the blade must face the spinner and toward the direction of rotation as indicated by the arrow on the fan disc.

Note

Insert the bolts while wet with zinc-chromate primer (index 10, paragraph 1—32). Insulate all mating surfaces with primer before tightening the nuts.

c. Balance the fan assembly. (Refer to paragraph 5—324.)

5—324. BALANCING THE FAN ASSEMBLY.

a. Install the shim (7 and 28, figure 5—39) and clamping ring (8 and 27) on the fan assembly (3) and secure them with the nuts (25 and 26). Do not torque the nuts at this time.

b. Slide the fan assembly (3) on the shaft of the balancing arbor assembly, Sikorsky part No. S1670-10409 and secure it with the movable taper plug, washer and nut.

c. Set the arbor and fan on a leveled balancing stand. If the fan is out of balance, the heavy side will move to the bottom.

d. Mark the heavy side and rotate the fan 90 degrees. Add AN970-5 and AN122583 washers, as required, under the blade attaching nuts opposite the heavy side until the fan remains stationary on the arbor. Tighten the nuts with 165 to 185 inch-pounds torque.

Note

When the addition of several weight washers is necessary, distribute the washers under as many nuts as possible opposite the heavy side. The fan assembly is considered balanced within the 1/4-inch-ounce tolerance when it can be set at four equidistant points and remains stationary on the arbor or within the tolerance allowed.

WARNING

The tolerance on balancing and the bolt torque value given must be maintained for safety of flight.

5—325. PREPARATION FOR SHIPMENT. Prior to storage or shipment, prepare each unit as follows:

a. Drain all the service lubricant out of the hydroclutch assembly by breaking the lock wire and removing the plugs (10, figure 5—39) in the splined flange at the upper end of the clutch.

b. Slosh corrosion-preventive compound throughout the drive housing of the clutch assembly. Prepare the corrosion-preventive mixture locally by combining 25 percent corrosion-preventive compound (index 7, paragraph 1—32) with 75 percent engine oil (index 2, paragraph 1—32).

c. Drain any excess mixture from the clutch assembly.

d. Coat unprotected surfaces of the clutch assembly with hard-film corrosion-preventive compound (index 4, paragraph 1—32). Cover with greaseproof wrapping paper (index 8, paragraph 1—32), secure with adhesive tape (index 9, paragraph 1—32), pack in a suitable container.

e. Pack the lower cone (2, figure 5—39), upper cone (4), lockpin assembly (6) and engine shaft nut (5) separately from the clutch assembly (9) in accordance with the instructions in step d.

5—326. PLACING IN SERVICE AFTER SHIPMENT.

a. Remove the greaseproof wrapping paper and adhesive tape.

b. Strip corrosion-preventive compound from the external machined surfaces with solvent (index 3, paragraph 1—32).

c. Remove the plugs (20, figure 5—39) and slosh engine oil through the drive housing of the clutch assembly. Drain the oil from the clutch.

d. Service the drive housing of the clutch with gear lubricant (figure 1—16). Install and lockwire the plugs (20, figure 5—39).

5—327. INSTALLATION.

Note

If a power package and clutch assembly are to be installed in the helicopter, refer to paragraph 5—15 for the installation of the power package.

Note

If the complete clutch and fan assembly is being installed, omit step w. If only the hydroclutch assembly is being installed, omit steps b. through m. and t. through v.

a. Install the hydraulic pressure elbow (21, figure 5—39) and nut and gasket (23) into the clutch assembly (9).

b. Install the lower cone (2) on the engine shaft (1) with the broad edge of the cone down.

Note

Do not lubricate the cone.

c. Position the fan assembly (3) on the shaft over the lower cone.

d. Lubricate the engine shaft splines and thread with anti-seize compound (index 43, paragraph 1—32).

e. Install the engine shaft nut (5, figure 5—39) on the shaft and turn it part way down. Position the split upper cone (4) on the flange of the shaft nut (5). Hold the cone in position and turn the shaft nut until the cone seats against the inner surface of the fan assembly hub.

Note

The two-piece upper cone (4) is a matched set. The mating halves, which are indexed with identical serial numbers, must be used together and not mixed with halves of other cones.

f. Position a housing, Kell-Strom part No. KS-2172, on a flange adapter, Sikorsky part No. S1570-10191, with the two keys on the bottom of the housing meshed with

1. Engine Shaft
2. Lower Cone
3. Fan Assembly
4. Upper Split Cone
5. Engine Shaft Nut
6. Lockpin Assembly
7. Shim (half)
8. Clamping Ring (half)
9. Hydro-Clutch Assembly
10. Bolt, Washer, Nut
11. Bonding Jumper
12. Lower Rubber Coupling
13. Spacer
14. Flange
15. Spacer
16. Spacer
17. Bolt, Washers, Nut
18. Main Drive Shaft
19. Bolt, Washers, Nut
20. Plug
21. Clip
22. Elbow
23. Nut, Gasket
24. Return Fitting
25. Nut
26. Nut
27. Clamping Ring (half)
28. Shim (half)
29. Bolt, Washer, Nut
30. Main Gear Box Spline Coupling
31. Upper Rubber Coupling
32. Bolt, Washers, Nut

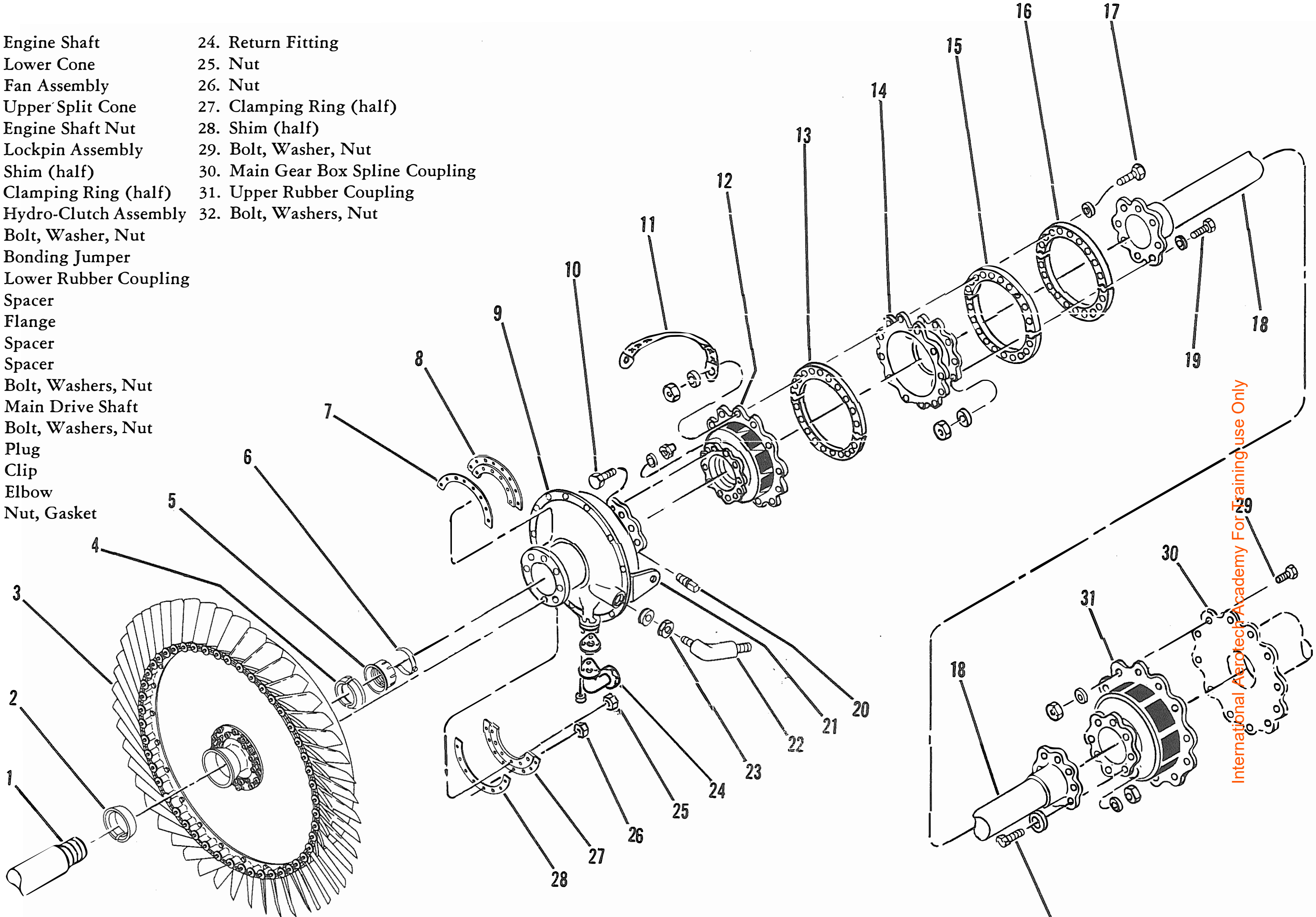


Figure 5—39. Clutch and Main Drive Shaft Disassembled

the two slots on the upper surface of the flange adapter. Secure the flange adapter to the housing with the screws that are furnished with the housing.

g. Position the flange adapter and housing on the fan assembly so the nuts (25 and 26) that secure the clamping ring (8 and 27) and fan disc to the hub protrude through the eight large holes in the flange of the adapter.

h. Position a wrench, Sikorsky part No. S1670-10383, inside the housing so the teeth on the bottom of the wrench mesh with the wrench slots in the engine shaft nut (5). Position a drive cylinder, Sikorsky part No. S1670-10190-2, inside the housing so the short splines on the small end of the cylinder mesh with the splines on the inside of the wrench.

i. Position a ball arm sleeve, Kell-Strom part No. KS-2069, on the upper end of the drive cylinder with the ball as far in a counterclockwise direction as it will go.

WARNING

Do not, under any circumstances, use the welded ball arm sleeve KS-2069, revision "A" or "B." Use only the forged ball arm sleeve KS-2069, revision "C" or later, or KS-2187.

j. Remove the protective cage from the dial end of a Hydra-Pak ram and gage assembly, Kell-Strom part No. HSP-ST5006. Thread the end of the ram and gage assembly into one of the ears of the housing so the piston inside the ram and gage assembly will operate in a clockwise direction.

k. Check to see that the valve handle is closed. Insert the pump handle in the pump arm. Operate the pump until the piston has pushed the ball arm sleeve as far as it will go. If the indicated torque has not reached 800 to 1000 foot-pounds, release the pressure in the ram and gage assembly by opening the valve handle, position the ball arm sleeve as outlined in step j. and operate the pump again. Continue this procedure until the gage indicates a torque of 800 to 1000 foot-pounds.

Note

Take the final torque reading with the ball on the ball arm sleeve at as near a 90-degree angle to the piston as possible.

l. Remove the special tools. Strike the flange of the fan assembly hub with a rawhide mallet. Replace the special tools and retorque the shaft nut, if necessary. Repeat this procedure until there is no decrease in torque after striking the hub.

m. Remove the special tools, and insert the stud of the lockpin assembly (6) in a hole in the engine shaft (1)

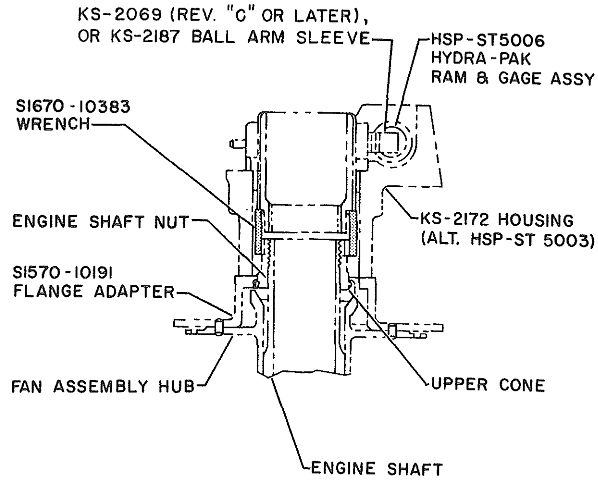


Figure 5—40. Use of Special Tools on Clutch Shaft Nut

that is aligned with one of the wrench slots in the shaft nut (5). Compress the ends of the lockpin spring, position them inside the shaft and release the spring. The bent ends of the spring will fall into two of the other holes in the engine shaft.

n. Remove the nuts that secure the two-piece clamping ring (8 and 27) and fan disc to the hub. Remove the clamping ring and shim (7 and 28).

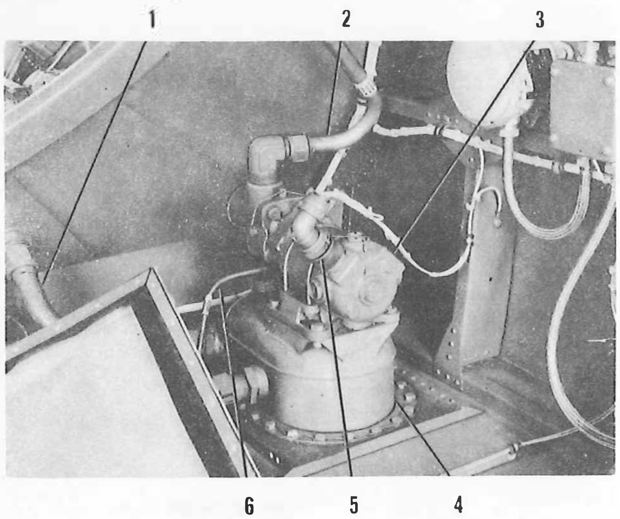
o. Clean the mating surface of the flange coupling on the bottom of the hydro-clutch assembly (9), the hub of the fan assembly (3), the fan disc and the two-piece clamping ring.

p. Position the hydro-clutch assembly (9) on the fan assembly (3). Install the two-piece clamping ring (8 and 27) on the upper surface of the flange coupling. Install a nut (25) on each of the inner bolts to secure the clamping ring. Tighten the nuts with 360 to 385 inch-pounds torque.

q. The nine inner bolts are arranged in three groups of three each. Measure the gap between the clamping ring and the fan disc at a point directly opposite the center nut in each group. Peel laminations from the two-piece shim (7 and 28) until the thickness of the shim is within ± 0.002 inch of the measured gap. Apply a light coat of primer (index 10, paragraph 1—32) to both surfaces of the shim. Remove the clamping ring (8 and 27, figure 5—39), install the shim (7 and 28) on the fan disc and replace the clamping ring and nuts (25).

CAUTION

Be sure to peel the same number of laminations from each half of the shim.



1. Return Tube
2. Pressure Tube
3. Clutch Pump
4. Oil Cell Cover
5. Disconnect Plug
6. Drain Tube

Figure 5–41. Clutch Pump Installed

Note

A new shim is 0.062 inch thick. Each lamination is 0.002 inch thick.

r. Install a nut (26) on each of the outer bolts. Tighten all nuts with 360 to 385 inch-pounds torque.

s. Check to see that the clearance between the fan assembly blades and the fan shroud assembly of the contravane is within a tolerance of 0.052 and 0.103 inch. To adjust the fan shroud assembly, refer to paragraph 5–275.

t. Reach through the clutch access door in the cabin forward bulkhead and remove the bolts, washers and nuts (17, figure 5–39), which attach the lower rubber coupling (12) to the flange (14) of the main drive shaft. Remove the coupling (12) and spacers (13, 15 and 16).

u. Hinge the power package up into operating position. (Refer to paragraph 5–15.)

v. Close the nose doors.

w. Install the flange (14, figure 5–39) on the lower end of the main drive shaft. (Refer to paragraph 5–339, step e.)

x. Install the lower rubber coupling (12, figure 5–39). (Refer to paragraphs 5–339, steps c. and e. through g.)

y. Install the nut and gasket (23, figure 5–39) on the oil inlet elbow (22). Install the elbow in the inlet port of the clutch. Tighten the jam nut. Position the return fitting (24), flange and gasket on the outlet port and secure with the nuts.

z. Connect the cable to the clip (21) on the clutch housing.

aa. Install the clutch access (carburetor induction heat) door in the cabin forward bulkhead. (Refer to paragraph 2–18.)

5–328. CLUTCH PUMP.

5–329. DESCRIPTION. *(See figure 5–41.)* An electrically driven pump, which supplies oil for the clutch, is installed on the cover assembly on top of the left oil cell forward of the canted bulkhead in the engine compartment. The pump draws engine oil from the left oil cell when the pump switch on the control console is actuated. A warning light is lighted during operation only. A pressure line carries oil to the clutch assembly, a return line connects to the oil cell and a tube assembly through which the engine oil is drawn runs from the pump directly to the oil cell below.

5–330. TROUBLE SHOOTING.

Trouble	Probable Cause	Remedy
Pump does not operate	Open circuit in pump system	Check for continuity of wiring. Clean and tighten connections
	Pump motor burned out	Replace pump
Pump motor operates but pump has low or no output	Internal failure of pump	Replace pump
Oil being drawn through clutch when pump not operating	Worn pump gears	Replace pump

5–331. REMOVAL.

a. Open the nose doors.

b. Disconnect the wiring to the pump at the disconnect plug (5, figure 5–41).

c. Disconnect the pressure tubing (2) and the drain tube (6) from the elbow and nipple in the pump housing and drain into a receptacle.

d. Remove the bolts which secure the pump (3) to the cover assembly on the left oil cell.

e. Unscrew the tube assembly which fits down into the oil cell from the pump inlet port; remove the pump from the cover assembly.

f. Unscrew the hydraulic elbow from the pump outlet port and the nipple from the drain opening on the pump.

5–332. INSTALLATION.

a. Install the elbow in the pump outlet port and the nipple in the drain opening on the pump housing.

b. Position the pump (3, figure 5–41) on the top of the oil cell cover assembly and secure it with the attaching bolts.

c. Connect the pressure tubing (2) to the elbow on the pump outlet port and the drain tubing (6) to the nipple on the pump.

d. Connect the electrical wires to the pump at the disconnect plug (5).

e. Tighten the tube assembly from the oil cell into the pump inlet port.

f. Close the nose doors.

5—333. MAIN DRIVE SHAFT ASSEMBLY.

5—334. DESCRIPTION. The main drive shaft (2, figure 5—36) transmits engine torque from the hydro-mechanical clutch to the main gear box. The assembly is composed of an upper and lower rubber coupling, adjustment spacers, a flange and a drive shaft. The rubber couplings absorb shocks in the transmission system. The spacers permit required adjustment in drive shaft length. Access to the drive shaft is gained through the clutch access (carburetor induction heat) door in the cabin forward bulkhead and through the drive shaft tunnel extension cover.

5—335. TROUBLE SHOOTING.

Trouble	Probable Cause	Remedy
High frequency vibrations from drive shaft	Drive shaft installed with incorrect spacer stack-up	Install drive shaft correctly
	Bolts loose, sheared, or with improper torque	Tighten bolts to required torque. Replace bolts if necessary
	Damaged rubber coupling	Replace rubber coupling
	Damaged drive shaft	Replace drive shaft
Scored drive shaft	Contact with adjacent bolts and structure	Drive shaft may be smooth blended to a maximum depth of 0.010 inch to clear scoring marks. (Refer to paragraph 5—337.) If marks are deeper than 0.010 inch replace drive shaft

5—336. REMOVAL.

a. To remove the lower rubber coupling (12, figure 5—39) and flange (14), remove the clutch access (carburetor induction heat) door from the cabin forward bulkhead by unlocking the fasteners.

b. Reach into the clutch compartment and remove the bolts, washers and nuts (19) that secure the flange (14) to the drive shaft (18). Remove the bolts, washers and nuts (17) that secure the flange to the lower rubber coupling (12). Remove the flange and spacers (13, 15 and 16).

c. Remove the bolts, washers and nuts (10) that secure the lower rubber coupling (12) to the splined flange on the clutch (9). Remove the rubber coupling and the bonding jumper (11).

d. To remove the drive shaft (18), hinge down the power package (paragraph 5—12) and remove the lower rubber coupling (12, figure 5—39) and flange (14) as outlined in steps a. through c. of this paragraph. Remove the flight control rods from the tunnel. (Refer to paragraph 2—379, step h.) Do not change the control rod length when removing the control rods. Support the drive shaft, remove the bolts, washers and nuts (32, figure 5—39) that secure the drive shaft to the upper rubber coupling (31) and lower the drive shaft from the tunnel.

CAUTION

Exercise care when removing the shaft from the tunnel to avoid damaging the hydraulic tubing in the tunnel.

Note

As an alternate method of removing the drive shaft, remove the upper rubber coupling as outlined in step e., disconnect the lower end of the shaft from the flange (12) as outlined in step b. of this paragraph and lift the shaft out of the tunnel.

e. To remove the upper rubber coupling (31), remove the bolts, washers and nuts (29) that secure the coupling to the main gear box spline coupling (30). Remove the main gear box and rotor quick change unit (paragraph 5—342), support the coupling, remove the bolts, washers and nuts (32, figure 5—39) that secure the coupling to the drive shaft (18) and remove the coupling.

Note

As an alternate method of removing the upper rubber coupling, remove the auxiliary servo and mixer unit (paragraph 2—379), disconnect the coupling from the drive shaft as outlined in step e. of this paragraph, remove the bolts, washers and nuts (29, figure 5—39) that secure the coupling to the main gear box spline coupling (30) and remove the coupling through the opening in the cockpit canopy canted bulkhead.

5—337. MINOR REPAIRS. Limited scratches or scoring in the main drive shaft may be repaired within the limits established in steps a. and d.

a. Axial and circumferential scratches or scoring not exceeding 0.010 inch in depth may be polished out provided they are not within 3 inches of the flange at either end of the shaft.

WARNING

The minimum allowable outside diameter of the shaft within the permissible rework area is 2.980 inches.

b. The reworked area on the shaft must be blended a minimum of 1/2-inch either side of the scratch.

c. A shaft may be reworked any number of times, provided that its outside diameter is not less than 2.980 inches at any cross section.

d. Shafting removed from the helicopter for rework should be checked for run-out (out of plane) upon installation. The maximum permissible run-out (out of plane) of the main drive shaft installed in the helicopter is 0.025 total indicator reading.

5—338. MISALIGNMENT. With the bolts that secure the lower rubber coupling to the flange on the lower end of the main drive shaft loosened, measure the gap between the coupling and flange at several points around the edges of the mating surfaces. The difference of the gap at the closest and widest points must not exceed 1/8-inch.

5—339. INSTALLATION.

a. To install the upper rubber coupling (31, figure 5—39), position the coupling on the upper end of the main drive shaft (18) and secure it with the bolts, washers and nuts (32). Tighten the nuts to 360 inch-pounds torque. Install the main gear box and rotor quick change unit. (Refer to paragraph 5—347.) Install the bolts, washers and nuts (29, figure 5—39) that secure the coupling (31) to the main gear box spline coupling (30). Tighten the nuts to 360 inch-pounds torque.

Note

If the auxiliary servo and mixer unit was removed instead of the main gear box, install the upper rubber coupling through the opening in the cockpit canopy canted bulkhead. Install the auxiliary servo and mixer unit. (Refer to paragraph 2—380.)

b. To install the drive shaft (18, figure 5—39), raise the shaft into the tunnel and secure the upper end of the shaft to the upper rubber coupling with the bolts, washers and nuts (32). Tighten the nuts to 360 inch-pounds torque. Hinge up the power package (paragraph 5—15) and install the lower rubber coupling (12, figure 5—39) and flange (14) as outlined in step c. of this paragraph. Install the flight control rods in the tunnel. (Refer to paragraph 2—380, step u.) Do not change the control rod length when installing the control rods.

c. To install the lower rubber coupling (12, figure 5—39) and flange (14), position the coupling and bonding jumper (11) on the splined flange of the clutch (9) and install the bolts, washers and nuts (10). Tighten the nuts to 360 inch-pounds torque.

d. Position the flange (14) on the end of the drive shaft and install the bolts, washers and nuts (19). Tighten the nuts to 360 inch-pounds torque.

e. Check the gap between the rubber coupling (12) and the flange (14) for misalignment. (Refer to paragraph 5—338.)

f. Measure the gap between the rubber coupling (12, figure 5—39) and the flange (14). Select the spacer or spacers (13, 15 and 16) required to fill the gap within $\pm 1/16$-inch.

Note

The three spacers (13, 15 and 16) are 0.064, 0.125 and 0.250 inch in thickness.

g. Install the selected spacer or spacers between the coupling and the flange, position the remaining spacer or spacers on the aft side of the flange and install the bolts, washers and nuts (17). Secure the bonding jumper by placing the loose end under one of the nuts. Tighten the nuts to 360 inch-pounds torque.

h. Install the clutch access (carburetor induction heat) door in the cabin forward bulkhead by locking the fasteners.

5—340. MAIN GEAR BOX AND ROTOR QUICK CHANGE UNIT.

5—341. DESCRIPTION. The main gear box and the main rotor are installed in the helicopter as a quick change unit. The main gear box and rotor quick change unit (figure 5—42) may be removed or installed as a unit either for replacement of the complete unit or for purposes of removal and installation of the main gear box assembly. The quick change unit consists of the main rotor head assembly, main gear box assembly, generator and blower, tachometer-generator, transmission support assembly, primary hydraulic system panel with connecting hoses, hydraulic reservoir inspection lamp, main rotor primary servo assemblies and control arms, primary hydraulic pump, oil separator, oil pressure switch and four flight control bell cranks. The temperature bulb, hydraulic panel and lamp assembly wiring are also a part of the quick change unit. Access to the main gear box and rotor quick change unit is gained by hinging down the service platforms.

5—342. REMOVAL.

a. Drain the service oil from the main gear box. (Refer to paragraph 5—351.)

b. Hinge down the service platforms and remove the main rotor blades. (Refer to paragraph 2—300.)

c. Connect the two support cables for the canted bulkhead to the attachment fittings on the fuselage and adjust the turnbuckles. (See step 1, figure 5—43.)

d. Remove the screens and fairing which cover the gear box. (See step 2, figure 5—43 and refer to paragraph 2—27, steps e. and f.)

e. Remove the terminal block covers and disconnect the electrical wiring to the quick change unit at the terminal blocks "A" (step 3, figure 5—43) and the oil inspection light switch at "B" (step 3) on the aft, left-hand side of the canted bulkhead.

f. Disconnect the primary system hydraulic pressure line at "A" (step 4) at the transmitter mounted in the support on the transmission deck to the left of the gear box by backing off the attaching nut. Plug the line and disconnect the wiring at the disconnect at "B" (step 4) on the transmitter.

g. Unsnap the soundproofing from the ceiling inside the cabin and remove the screws, washers and nuts that secure the transmitter support to the transmission deck at "C" (step 4). Remove the support with the transmitter attached.

h. Pull the cotter pin and remove the bolts, washers and nuts which attach the flight control rod to the bell crank which is secured to the support at the forward, left side of the gear box lower housing. (See step 5.)

i. Disconnect the hydraulic reservoir vent tubing and hydraulic pump drain line at the quick disconnects on the transmission deck. (See step 6.)

j. Disconnect the electrical wiring from the generator at "A" (step 7) and the tachometer-generator at "B" (step 7) on the accessory drive housing.

k. Disconnect the oil pressure line from the elbow at the oil pump and remove the elbow gasket, nut and ring from the oil pump housing at "C" (step 8).

l. Disconnect and remove the oil line from the tee at the main gear box oil inlet at "A" (step 8).

m. Disconnect the auxiliary hydraulic system line which lies across the forward right support rod assembly at the pressure transmitter on the transmission deck to the right of the gear box at "A" (step 9). Plug the line.

n. Unplug the electrical wiring from the transmitter at "B" (step 9). Remove the screws, washers and nuts that secure the transmitter support to the transmission deck at "C" (step 9). Remove the support.

o. Pull the cotter pins and remove the bolts, washers and nuts at "A" (step 10) which attach the flight control actuating cylinder assembly to the support mounted on the right side of the input housing and the flight control rod from the bell crank at "C" (step 10) mounted on the same support. Pull the cotter pin and remove the bolt, washers and nut at "B" (step 10) which connect the flight control rod to the bell crank at the servo and mixer assembly.

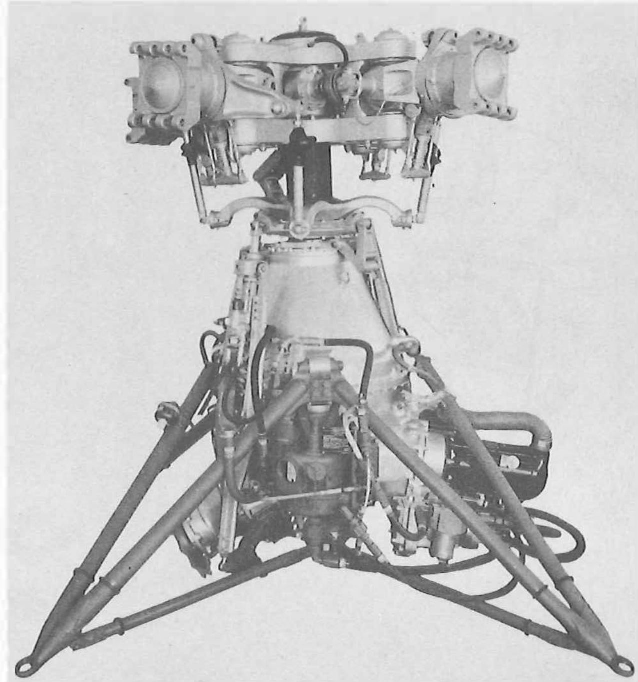


Figure 5—42. Main Gear Box and Rotor Quick Change Unit

p. Disconnect the hose and the electrical wiring from the oil pressure transmitter mounted on the transmission deck adjacent to the rear, left support assembly. (See step 11.)

q. Remove the first section of the tail rotor drive shaft. (See step 12 and refer to paragraph 5—410.)

r. Remove the cover assembly from the main drive shaft tunnel extension inside the cabin and remove the bolts, washers and nuts that secure the gear box spline coupling to the main drive shaft upper rubber coupling. (See step 13, figure 5—43.)

s. Position and attach the sling assembly, Sikorsky part No. S1670-10402, to the upper plate eyebolts of the main rotor hub. Attach a hoist to the sling to support the quick change unit. (See step 14.)

t. Unscrew and remove the cover plates on the forward side of the canted bulkhead in the cockpit to expose the gear box support fittings. Using hex wrench LAW-118, remove the bolts, washers and nuts that secure the

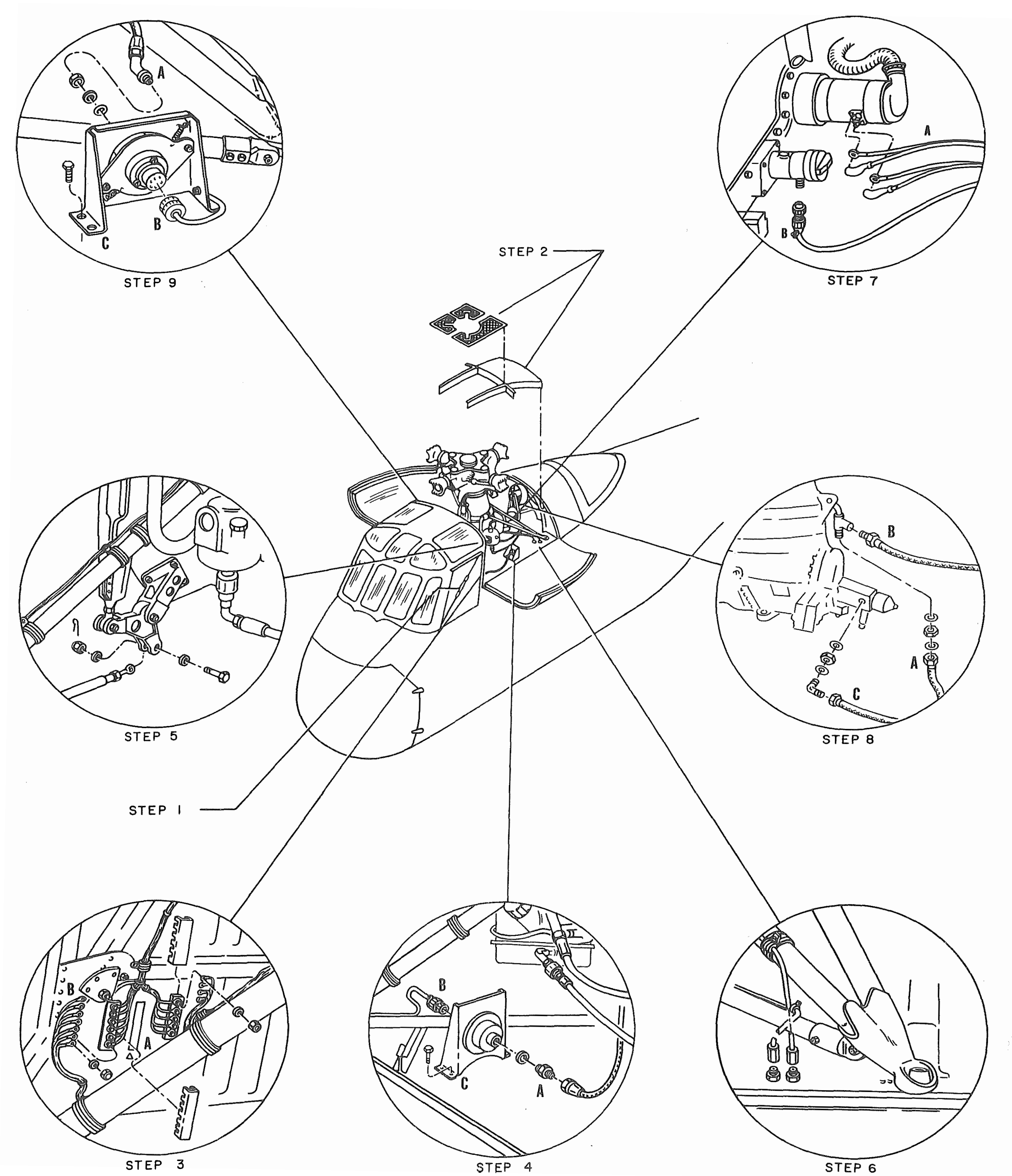


Figure 5—43. Main Gear Box and Rotor Quick Change Unit Removal (Sheet 1 of 2)

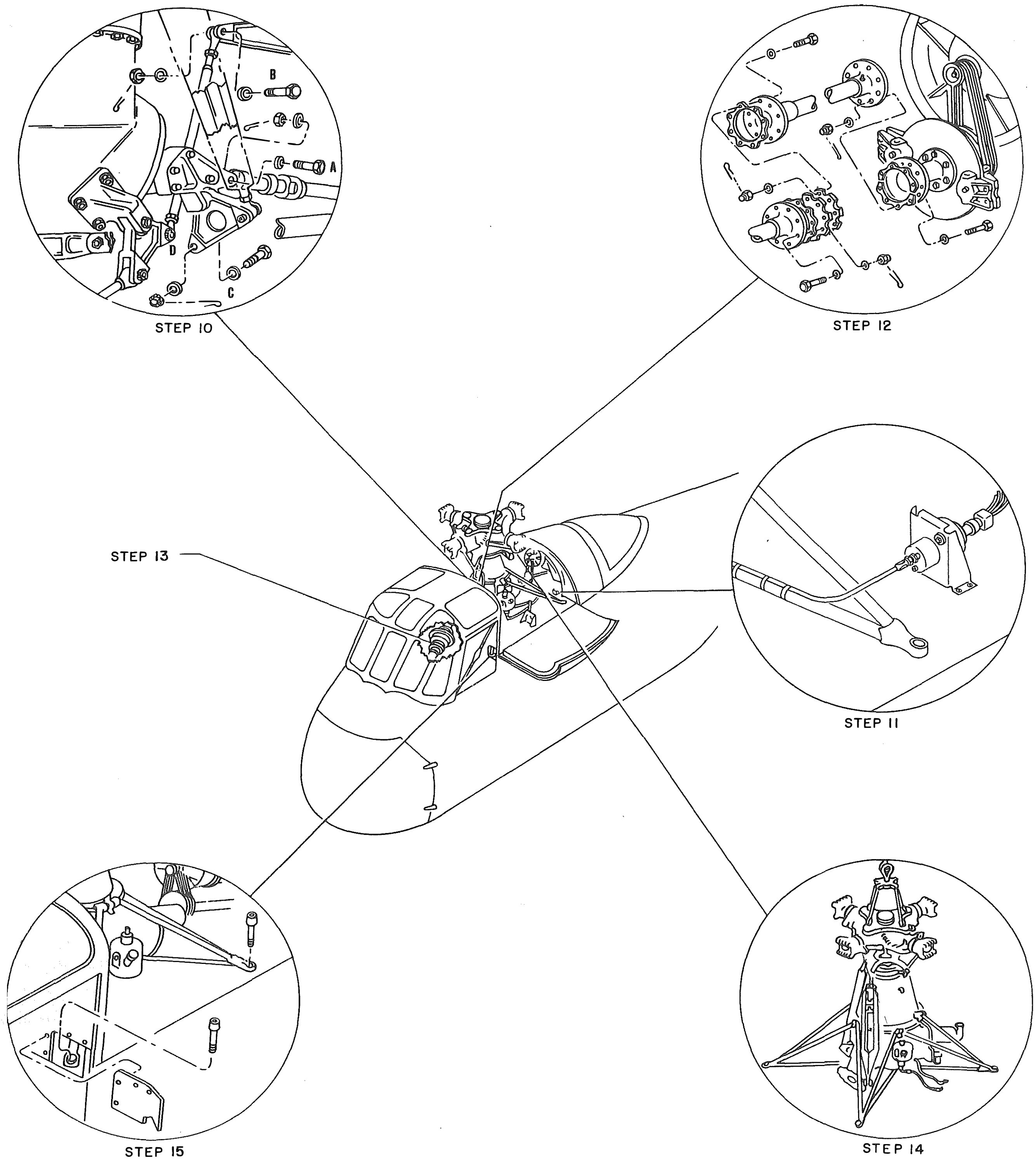


Figure 5—43. Main Gear Box and Rotor Quick Change Unit Removal (Sheet 2 of 2)

forward support assemblies to the fittings. Remove the bolts, washers and nuts that secure the two aft support assemblies to the transmission deck. (See step 15.)

u. Hoist the quick change unit up out of the helicopter and place it on a suitable stand.

Note

All components removed in steps v. through x. must be retained for installation on the new quick change unit.

v. Disconnect the hydraulic pump drain line from the pump and release the clamps that secure the pump drain tubing to the rear left support rod assembly. Remove the tubing.

w. Remove the bolt, washers, nut and cotter pin that connect the flight control rod to the bell crank at the main gear box at "D" (step 10). Remove the control rod.

x. Disconnect the oil pressure transmitter hose from the tee at the main gear box oil inlet at "B" (step 8). Unclamp the hose from the rear left support assembly and remove the hose.

5–343. PREPARATION FOR SHIPMENT.

a. Prepare the main rotor head for shipment. (Refer to paragraph 2–312.)

b. Prepare the star assembly for shipment. (Refer to paragraph 2–352.)

c. Prepare the main gear box assembly for shipment. (Refer to paragraph 5–361, steps b. through e.)

d. Prepare the servo units for shipment. (Refer to paragraph 2–397.)

e. Drain the hydraulic reservoir and fill with hydraulic preservative oil (index 5, paragraph 1–32) and plug all ports. Coat all metallic surfaces of the reservoir with hot application corrosion-preventive petrolatum (index 4, paragraph 1–32).

f. Secure all loose electrical wiring and hoses to the support assemblies with string or twine.

g. Place the main gear box and rotor head in the shipping container and pack with bags of activated desiccant (index 52, paragraph 1–32) so that all components are well protected against shock.

5–344. PLACING IN SERVICE AFTER SHIPMENT.

a. Unpack the quick change unit and remove it from the shipping container.

b. Cut the strings that secure the electrical wiring and hoses to the support assemblies.

c. Clean the corrosion-preventive petrolatum from the hydraulic reservoir with solvent (index 3, paragraph 1–32).

d. Remove the plugs and drain the hydraulic preservative oil from the hydraulic reservoir.

e. Prepare the servo units for service. (Refer to paragraph 2–398.)

f. Prepare the main gear box assembly for service. (Refer to paragraph 5–362, steps b. through d.)

g. Prepare the star assembly for service. (Refer to paragraph 2–353.)

h. Prepare the main rotor head for service. (Refer to paragraph 2–313.)

5–345. DISASSEMBLY. If it is necessary to replace the main gear box only, the following procedure should be followed for removal of the main gear box and rotor quick change unit components.

a. Remove the main rotor head assembly from the top of the main gear box. (See step 1, figure 5–44 and refer to paragraph 2–309.)

b. Remove the three servo and control arm assemblies. (See step 2, figure 5–44 and refer to paragraph 2–395.)

c. Unscrew and remove the light assembly for the oil level sight gage from the bracket on the left side of the lower housing at "A" (step 3, figure 5–44) and remove the clamps that secure the electrical wiring on the forward left support rod assembly. Remove the electrical wiring. Unplug the lamp assembly wiring at the disconnect on the hydraulic reservoir at "B" (step 3). Remove the screw, washer and nut that secure the ground connection to the reservoir mounting bracket at "C" (step 3). Disconnect the plugs from the temperature bulb at "D" (step 3) on the gear box above the generator, the hydraulic panel at "E" (step 3) and the oil pressure switch at "F" (step 3) on the forward left support assembly. Release the clamps that secure the electrical wiring to the support assemblies and remove the wiring.

d. Disconnect the vent line from the fitting at the top of the hydraulic reservoir at "A" (step 4). Disconnect the hydraulic supply line to the pump from the fitting at the bottom of the reservoir at "B" (step 4) and drain the reservoir into a receptacle. Disconnect the servo return line at "C" (step 4) and the servo pressure line at "D" (step 4) and remove the lines. Disconnect the bypass line at "E" (step 4) from the pump. Remove the transmitter line at "F" (step 4) from the fitting at the reservoir. Remove the bolts, washers and nuts that secure the hydraulic panel support bracket to the left side of the gear box at "G" (step 4); remove the washer and nut at "H" (step 4) from the bolt which attaches the left support rod assemblies to the lug on the gear box at "H" (step 4) and release the strut assembly. Remove the hydraulic panel from the gear box.

Note

To avoid losing the attaching parts, replace the bolts, washers and nuts that secure the hydraulic panel to the main gear box.

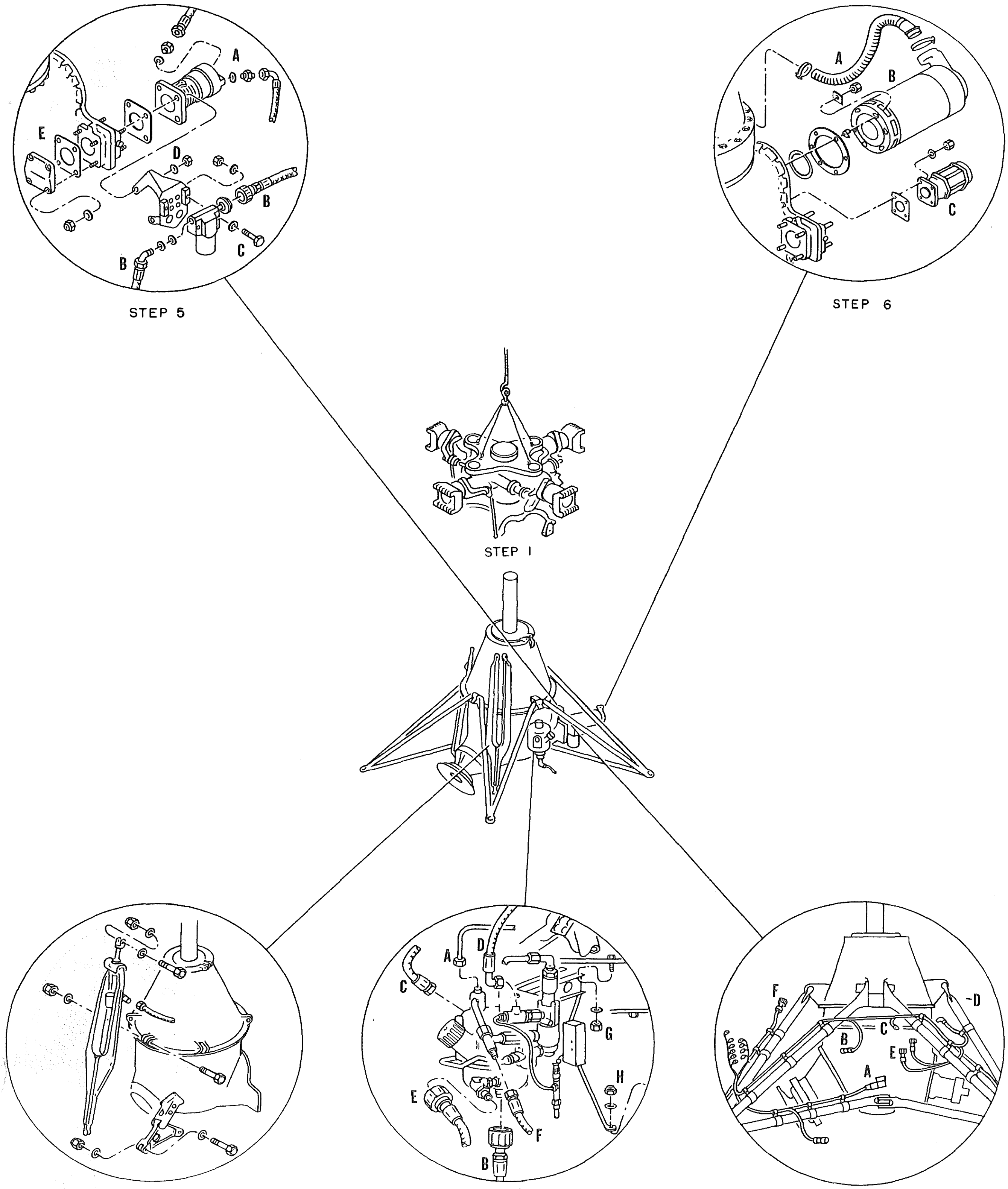


Figure 5—44. Main Gear Box and Rotor Quick Change Unit Disassembly (Sheet 1 of 2)

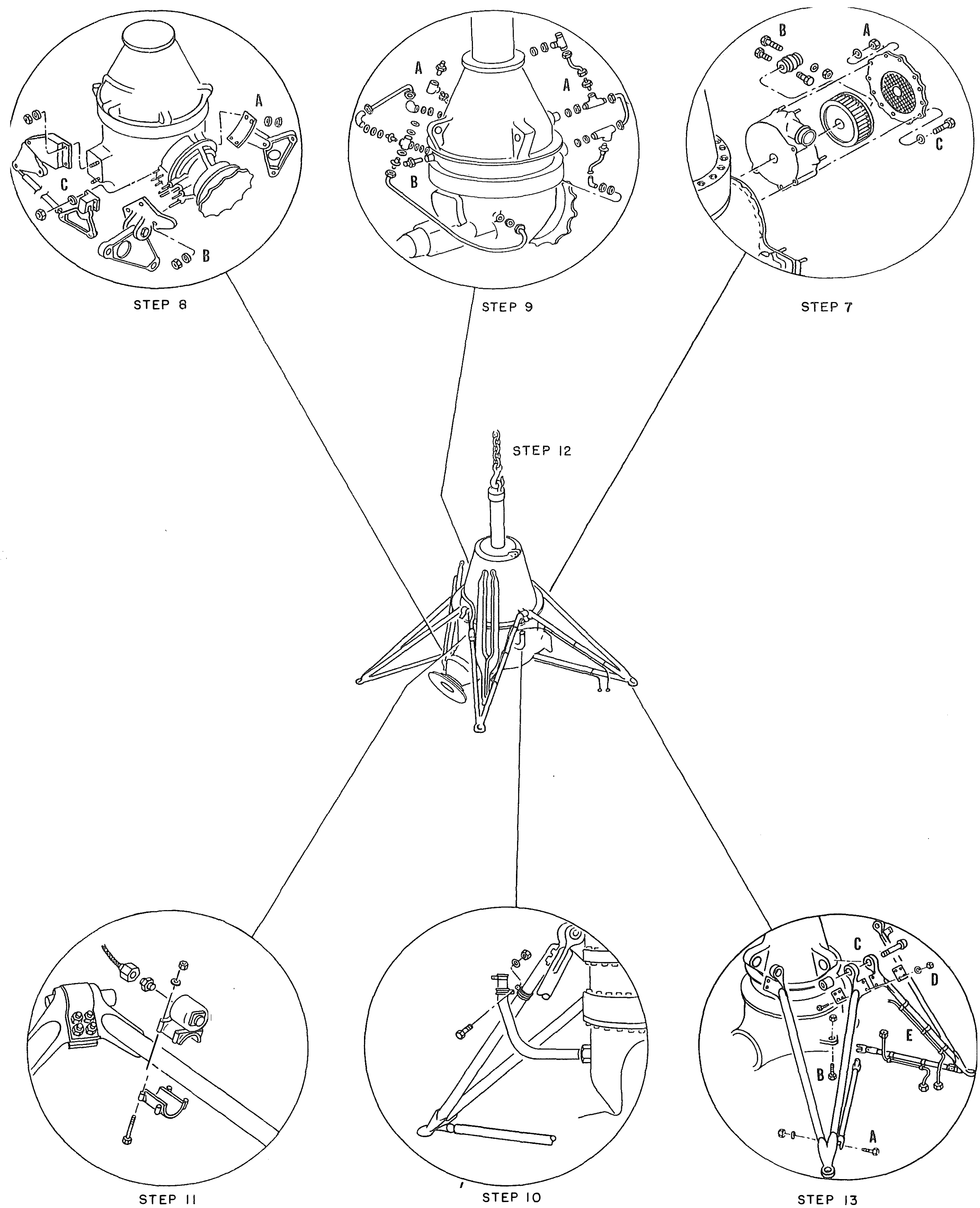


Figure 5—44. Main Gear Box and Rotor Quick Change Unit Disassembly (Sheet 2 of 2)

e. Disconnect the hydraulic lines from the hydraulic pump at "A" (step 5) and filter at "B" (step 5). Remove the bolts, washers and nuts at "C" (step 5) that secure the filter to the support bracket. Remove the lines and filter. Remove the washers and nuts at "D" (step 5) and remove the hydraulic pump, gasket and filter support bracket from the studs on the gear box. Remove the cover and gasket from the studs forward of the pump attaching studs.

f. Unclamp the flexible duct from the generator blower at "A" (step 6) and remove the generator at "B." (Refer to paragraph 7—10.) Remove the washers and nuts at "C" (step 6, figure 5—44) that secure the tachometer-generator to the gear box and remove the tachometer-generator and gasket from the studs.

g. Remove the nuts and washers at "A" (step 7) and the bolts and washers at "C" (step 7) and remove the plate. Cut the lock wire and remove the bolts, washers and nuts that secure the coupling on the end of the blower shaft at "B" (step 7). Work the pins free from the generator blower drive shaft and slide the wheel and housing off the shaft.

h. Remove the washers and nuts at "A" (step 8) and remove the support assembly and bell crank from the studs at the forward left side of the lower housing. Remove the washers and nuts at "B" (step 8) from the actuating cylinder support fitting at the right side of the input housing and remove the support assembly and bell crank from the studs of the gear box. Remove the washers and nuts at "C" (step 8) and remove the two bell cranks, support fittings and rod assembly from the right side of the lower housing as a unit.

i. Disconnect and remove the oil separator at "A" (step 9) from the fittings on the gear box. Remove the fittings and unscrew the temperature bulb at "B" (step 9) from the gear box.

j. Release the clamp that secures the filler tube to the support assembly and remove the filler tube from the left side of the lower housing. (See step 10.)

k. Disconnect the hose and release the clamp that secures the oil pressure switch (step 11) to the forward left support assembly.

l. In preparation for removal of the transmission supports, install the shaft cap, Sikorsky part No. S1670-10364, and eyebolt, Sikorsky part No. S1670-10338, on the shaft at the top of the gear box and support the gear box with a hoist. (See step 12.)

m. Remove the bolts, washers and nuts that secure the rod assemblies to the lower end of the support assemblies at "A" (step 13) and to the lugs on the gear box at "B" (step 13). Release the clamps that secure the pump drain tubing to the rear, left support rod assembly at "E" (step 13) and remove the tubing. Remove the bolts, washers and nuts at "C" (step 13) that secure the upper end of the support assemblies to the gear box and the bolts, washers and nuts at "D" (step 13) that secure the upper end of each support assembly together. Remove the clips which support the attachments. Release the clamps that secure the reservoir vent tubing to the rear left support assembly at "E" (step 13) and remove the tubing.

5—346. ASSEMBLY.

a. Install the shaft cap, Sikorsky part No. S1670-10364, and the eyebolt, Sikorsky part No. S1670-10388, on the main gear box shaft and support the main gear box with a hoist. (See step 12, figure 5—44.)

b. Secure the support assemblies on the main gear box lugs with the internal wrenching nuts, washers and bolts at "C" (step 13). Position and secure the clips at the support assemblies with the bolts, washers and nuts at "D" (step 13). Do not torque the nuts at this time.

Note

Install the clip with the chamfered edge on the aft attaching support and reverse the upper clip bolts to clear the boss on the main gear box.

c. Position the rod assemblies on the support assemblies at "A" (step 13) and the main gear box lugs at "B" (step 13) and secure them with the bolts, washers and nuts. Clamp the hydraulic reservoir vent tubing to the rear, left support assembly and the pump drain tubing to the rear, left rod assembly at "E" (step 13).

Note

When a new or overhauled main gear box is installed, new support rods must be used. The rod length must be determined on installation and drilled at that time. (Refer to paragraph 5—347, step g.) Only when the same gear box is being replaced in the quick change unit may the old rods be used.

d. Install the oil separator line fittings in the ports of the gear box at "A" (step 9); screw the temperature bulb into the threaded hole at "B" (step 9). Connect the oil separator to the oil pump.

e. Connect the oil filler tube to the elbow on the gear box and attach the supporting clamp to the support assembly (step 10). Position and clamp the oil pressure switch (step 11) on the forward, left support assembly. Connect the hose to the oil pressure switch and to the tee at the front of the gear box near the top of the upper housing. Clamp the line to the forward, left support assembly.

f. Position the actuating cylinder support fitting at

"B" (step 8), the bell cranks with the support fittings and rod assembly attached at "C" (step 8) and the bell crank and support fitting at "A" (step 8) on the main gear box studs. Secure the flight control fittings with the washers and nuts.

g. Work the blower pins into position on the generator blower shaft and slide the housing and wheel onto the shaft. Install the coupling at the blower shaft and lockwire the bolts at "B" (step 7). Secure the plate with the bolts and washers at "C" (step 7) and the washers and nuts at "A" (step 7).

h. Install the generator on the gear box at "B" (step 6). (Refer to paragraph 7–13.) Connect the duct to the generator blower at "A" (step 6, figure 5–44). Install the gasket and tachometer-generator on the gear box studs and secure them with the washers and nuts at "C" (step 6).

i. Install the gasket and cover on the studs forward of the hydraulic pump mounting boss at "E" (step 5). Position and secure the gasket, hydraulic pump and filter support bracket at "D" (step 5) with the washers and nuts. Install the filter on the filter support bracket with the bolts, washers and nuts at "C" (step 5). Connect the hydraulic lines at "A" and "B" (step 5) to the pump and filter.

j. Position the hydraulic panel, including the support bracket and strut assembly, and install the bolts, washers and nuts which secure the bracket to the flange on the left side of the gear box at "G" (step 4). Tighten the nuts that secure the hydraulic panel to the gear box with 180 to 225 inch-pounds torque. Position the lower end of the strut assembly on the left support rod attaching bolt and tighten the nut at "H" (step 4). Connect the following lines to the reservoir: the vent tubing to the fitting at the top of the reservoir at "A" (step 4), the hydraulic supply line at "B" (step 4), the servo return line at "C" (step 4), the inlet line from the filter at "D" (step 4), the bypass line to the pump at "E" (step 4) and the transmitter line at "F" (step 4).

k. Connect the temperature bulb wiring at "D" (step 3), the hydraulic panel wiring at "E" (step 3) and the lamp assembly wiring to the hydraulic reservoir at "B" (step 3). Connect the ground wire to the reservoir mounting bracket at "C" (step 3) and secure the light assembly for the oil level sight gage to its bracket with the mounting screws at "C" (step 3). Clamp the wiring to the support assemblies and the forward left rod assembly.

l. Install the three servo and control arm assemblies. (See step 2, figure 5–44 and refer to paragraph 2–399.)

m. Install the main rotor head assembly on the main gear box shaft. (See step 1, figure 5–44 and refer to paragraph 2–314.)

5–347. INSTALLATION.

a. Clamp the oil pressure transmitter line to the rear left support assembly and connect the line to the tee at the main gear box oil inlet at "B" (step 8, figure 5–43).

b. Secure the flight control rod to the bell crank at the main gear box with the bolt, washers, nut and cotter pin at "D" (step 10).

c. Clamp the hydraulic pump drain line to the rear, left support rod assembly. Connect the line to the pump.

d. Remove the lower rubber coupling from the main drive shaft (paragraph 5–336, steps a., b. and c.).

CAUTION

Support the shaft in the tunnel to avoid dropping the main drive shaft assembly onto the clutch assembly.

e. Position and attach the sling assembly, Sikorsky part No. S1670-10402, to the upper plate eyebolts of the main rotor hub and lower the quick change unit into position in the helicopter, using a suitable hoist. (See step 14, figure 5–43.)

Note

Support the quick change unit with the hoist and sling until it has been secured to the transmission deck.

f. Line up the lower holes in the support assemblies with the holes in the fittings on the transmission deck and install the lower support bolts, washers and nuts (step 15). Tighten the lower bolts with 3000 to 3200 inch-pounds torque, using the hex wrench, LAW-118. Tighten the upper support bolts with 4500 to 5000 inch-pounds torque. Tighten the bolts as follows: with nuts loose, torque each bolt to determine the bolt turning torque value, add this value to the specified torque and apply the total to the bolt head. Install the cover plates on the canted bulkhead. (See step 15.)

CAUTION

Check the inserts on the nuts at the upper support assembly bolts for deterioration or damage before re-using.

Note

In order to assure a true torque reading at the lower support assembly bolt threads, lubricate the bolts with anti-seize compound (index 43, paragraph 1–32).

Note

At installation, replace all lower support assembly bolts with new bolts. If replacement is not possible, examine the used bolts to insure against cracks by magnafluxing the bolts or studying them under the highest power magnifying glass available.

g. If a new or overhauled gear box is being installed, slide the rod-end fitting onto the inboard end of each support rod and secure the lug fitting to it with the bolt, washers and nuts. Bolt the outboard end of each rod assembly to the transmission support and the inboard lug fitting to the main gear box. Drill through the inboard rod-end fitting and the rod, picking up the two pilot holes in the fitting. Ream the two holes to 0.250 $^{+0.0015}_{-0.0000}$ inch and install the bolts, washers and nuts.

h. Tighten the nuts at the clips that secure one support assembly to the other with 480 to 690 inch-pounds torque. Tighten the bolts as follows: with nuts loose, torque each bolt to determine the bolt turning torque value, add this value to the specified torque and apply the total to the bolt head.

i. Release the hoist and remove the hoist sling, Sikorsky part No. S1670-10402, from the upper plate of the main rotor hub.

j. Install the first section of the tail rotor drive shaft. (See step 12, figure 5–43 and refer to paragraph 5–428.)

k. Install the bolts, washers and nuts connecting the main gear box spline coupling to the main drive shaft upper rubber coupling. Tighten the nuts to the torque specified in paragraph 5–339, step a. Install the lower rubber coupling on the main drive shaft. (See step 13, figure 5–43 and refer to paragraph 5–339, steps c. and e. through g.)

l. Connect the control rod to the bell crank located in the support on the forward, left side of the main gear box lower housing. (See step 5, figure 5–43.)

m. Connect the flight control rod extending from the bell crank located at the forward, right side of the lower housing to the servo and mixer bell crank at "B" (step 10). Connect the actuating cylinder at "A" (step 10) to the support and the control rod to the bell crank at "C" (step 10).

n. Install the elbow, gasket, nut and ring on the oil pump housing and connect the oil line to the elbow at "C" (step 8).

o. Connect the oil line to the tee at the main gear box oil inlet at "A" (step 8).

p. Connect the electrical wiring to the generator at "A" (step 7) and the tachometer-generator at "B" (step 7).

q. Connect the hydraulic reservoir vent and pump drain tubing to the fittings on the transmission deck. (See step 6.)

r. Secure the auxiliary hydraulic pressure transmitter support to the transmission deck with the screws, washers and nuts at "C" (step 9). Remove the plug and connect the auxiliary hydraulic system line to the transmitter at "A" (step 9). Connect the electrical wiring to the transmitter at "B" (step 9).

s. Secure the primary hydraulic pressure transmitter support to the transmission deck with the screws, washers and nuts at "C" (step 4). Remove the plug and connect the primary hydraulic system line to the transmitter at "A" (step 4). Connect the electrical wiring to the transmitter at "B" (step 4).

t. Connect the electrical wiring to the terminal blocks at "A" (step 3) and to the oil inspection light switch at "B" (step 3) on the aft side of the canted bulkhead. Replace the terminal block covers.

u. Connect the electrical wiring and pressure hose to the oil pressure transmitter at the transmission deck. (See step 11.)

v. Install the screens and fairings over the gear box. (See step 2 and refer to paragraph 2–28, steps d. and e.)

w. Disconnect the canted bulkhead support cables from the fuselage. (See step 1, figure 5–43.)

x. Service the main gear box. (See figure 1–14.)

y. Install the main rotor blades. (Refer to paragraph 2–304.)

z. Check the flight control rigging. (Refer to paragraph 2–521.)

aa. Close the service platforms. Replace the tunnel extension cover in the cabin and snap the soundproofing in place at the cabin ceiling.

ab. Perform a run-in of the main gear box. (Refer to paragraph 5–365.)

WARNING

Complete run-in of the main gear box is mandatory and must be performed for safety of flight.

5–348. MAIN GEAR BOX ASSEMBLY.

5–349. DESCRIPTION. The main gear box (figure 5–45) is located on the transmission deck above the cabin aft of the cockpit. It has three primary purposes: it changes the angle of the drive from the engine to the main rotor assembly; it reduces the engine rpm to rotor rpm; and it provides a means of driving the tail rotor and the gear box accessories. The gear box is secured to the transmission deck by four support assemblies and attaching bolts which extend through fittings at the corners of the transmission deck. The fittings for the forward support assemblies are attached to the transmission fitting bulkhead and the fittings for the

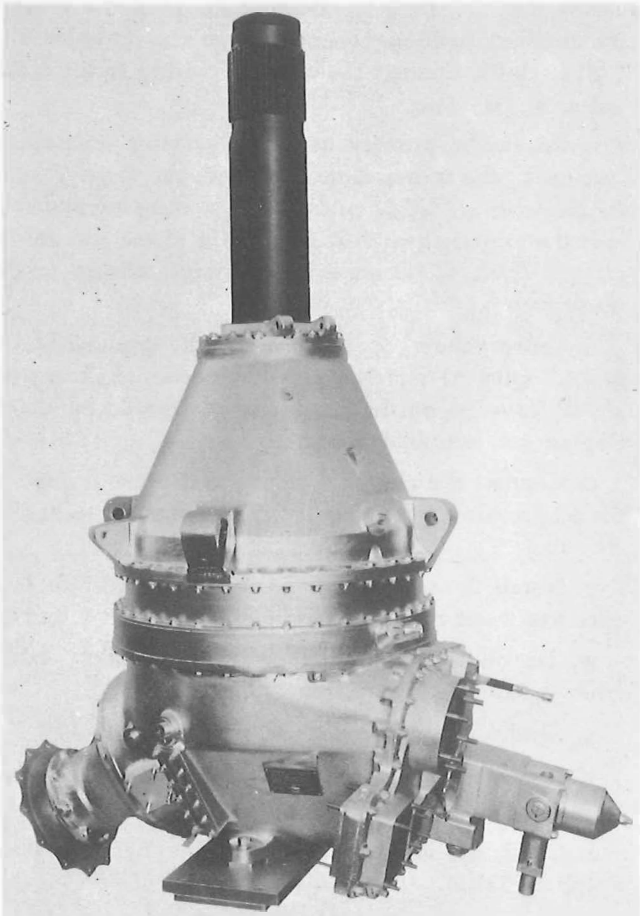


Figure 5—45. Main Gear Box Assembly

aft support assemblies are attached to the transmission deck. Two rod assemblies are installed from these fittings to a lug on each side of the lower housing of the gear box for additional support. Access to the main gear box and support assemblies is gained by hinging down either or both of the service platforms. An accessory drive section is incorporated at the rear of the gear box lower housing. Drives are provided for the generator, the generator blower, the transmission oil pump, the rotor tachometer-generator and the hydraulic pump for the primary servo mechanism. A self-priming oil pump is located in the oil sump at the bottom of the lower housing. Oil is drawn from the sump through an oil strainer into the oil pump. From the pump the oil passes through a filter and a pressure relief valve in the oil pump cover to an oil cooler located aft of the gear box. A bypass valve bypasses oil if the strainer is clogged. The cooled oil returns to the gear box and is distributed by tubing to internal pressure jets lubricating the gears and bearings (figure 5—46). An oil level sight gage is located on the lower left side of the lower housing. The oil filler tube extends upward from a fitting above the sight gage and is clamped to the support assembly. An oil pressure switch is mounted on the rear left support assembly and is connected by tubing to the rear of the gear box at the oil inlet fitting. Wiring extends from the switch to the oil pressure warning light on the instrument panel. The warning light flashes on when the oil pressure in the main gear box drops below a range of 8 to 10 psi. A transmission oil pressure gage, mounted on the instrument panel, indicates the pressure of the inlet oil in the gear box. Pressure tubing connects the oil inlet fitting to a transmitter clamped

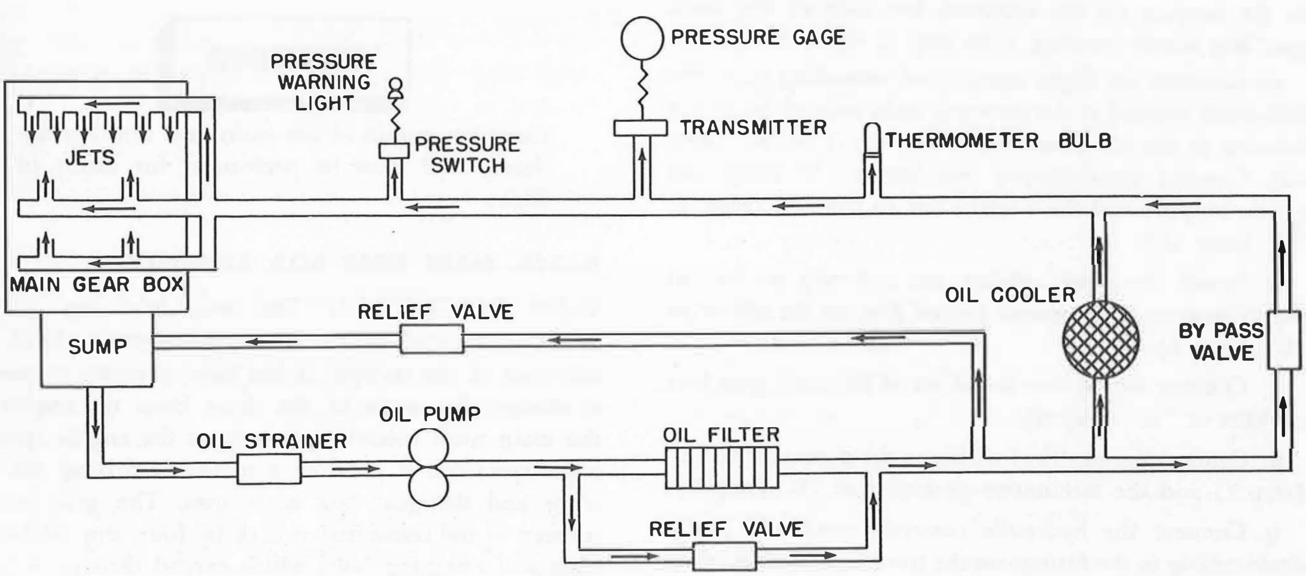


Figure 5—46. Main Gear Box Oil System Schematic Diagram

to the rear left support assembly which transmits the oil pressure reading electrically to the gage. A temperature bulb which is connected by wiring to an oil temperature gage on the instrument panel is installed in the gear box adjacent to the oil inlet fitting. Over-all gear reduction for the main rotor is accomplished through bevel input gears and one planetary reduction stage at a ratio of 11.293 to 1.000. Removal of the magnetic drain plug installed in the oil pump allows drainage of the service lubricant from the gear box.

5—350. TROUBLE SHOOTING.

Trouble	Probable Cause	Remedy
Low oil pressure (not low enough for warning light to flash on)	Insufficient oil in sump causing foaming	Replenish with oil
	Improper oil for temperature	Fill gear box with proper grade of oil
	Oil cooler valve stuck open	Replace cooler
	Relief valve stuck open	Repair or replace valve
	Clogged strainer or filter	Clean strainer or filter
	Leakage in main gear box	Return gear box for overhaul
	Clogging of oil cooler	Clean or replace oil cooler
	Leakage in oil cooler	Replace oil cooler
	Failure of oil cooler bypass valve	Repair or replace bypass valve
Gradual drop-off of oil pressure during flight	Bearings in gear box running hot	Return gear box for overhaul
	Internal leakage	Return gear box for overhaul
	Clogged oil lines	Clean oil lines
	Clogging of one or more jets	Return gear box for overhaul
High oil pressure	Improper setting of relief valve adjusting screw	Adjust oil pressure (Refer to paragraph 5—364)
	Relief valve stuck closed	Repair or replace valve
	Improper oil for temperature	Fill gear box with proper grade of oil
Discoloration of heat paint stripe	Overheating of bearing in area of discoloration	Return gear box for overhaul
Fluctuating low oil pressure	Low oil level	Fill gear box to correct level
	Improper oil for temperature	Fill gear box with proper grade of oil
	Leaks in gear box or around seals	Return gear box for overhaul or replace leaking seals
Excessive oil loss through breather	Excessive oil in gear box	Drain off excessive oil
Metal particles in drained oil or on magnetic plug	Abnormal gear wear or failure of bearings	For complete information, refer to paragraph 5—372
Loss of oil	Leakage around rear cover gasket, rear accessory seals, main shaft seal or lower housing spline shaft seals	Replace leaking gasket or seals

5—351. DRAINING. The main gear box is drained of service oil according to the following procedure:

a. Unsnap the soundproofing panel in the cabin ceiling under the oil pump access panel for the main gear box. Remove the panel.

b. Remove the magnetic plug from the Tedeco drain unit in the bottom of the oil pump.

Note

The magnetic plug may now be inspected without the necessity of draining the main gear box.

c. Screw the Tedeco drain attachment, D-730, into the Tedeco drain unit and drain the service oil into a receptacle.

d. Unscrew the Tedeco drain attachment and replace the magnetic plug and the access panel. Snap the soundproofing in place.

5—352. REMOVAL.

a. Remove the main gear box and rotor quick change unit. (Refer to paragraph 5—342.)

b. Disassemble the main gear box and rotor quick change unit. (Refer to paragraph 5—345.)

5—353. DISASSEMBLY AND ASSEMBLY. The main gear box should be disassembled and assembled only by qualified personnel at an Overhaul Depot with the exception of the replacement of parts as outlined in paragraph 5—354.

5—354. REPLACEMENT OF PARTS. The only components of the main gear box which may be replaced are: the main shaft seal in the upper housing, the splined shaft seals in the bottom of the lower housing, the seals in the rear cover for the accessory drives and the rear cover gasket.

5—355. REPLACEMENT OF REAR COVER GASKET.

a. Drain the main gear box. (Refer to paragraph 5—351.) Remove the generator (paragraph 7—10), generator blower (paragraph 5—345, step g.), tachometer-generator (paragraph 5—345, step f.) and the hydraulic pump and filter (paragraph 5—345, step d.) from the rear cover. Disconnect the oil line at the oil pump. Remove the first section of the tail rotor drive shaft (paragraph 5—410).

b. Cut the lock wire and remove the cotter pin from the tail rotor take-off flange lock nut. Prevent the flange from turning by using the anti-torque plate, Sikorsky part No. S1670-10401, on the flange and, using the wrench assembly, Sikorsky part No. S1670-10308, remove the lock nut and pull off the flange.

c. Remove the nuts and washers which secure the rear cover to the lower housing. Take off the rear cover and gasket, tapping as necessary with a rawhide mallet.

CAUTION

When removing the rear cover from the studs, make certain that the gears do not fall out.

Note

It is recommended that all accessory drive seals in the rear cover be replaced whenever the rear cover gasket is replaced. (Refer to paragraph 5—356.)

d. Clean the mating surface of the lower housing and the rear cover. Lightly coat a new rear cover gasket with lubricating grease (index 54, paragraph 1—32) and place it on the lower housing studs. Install the rear cover. Using a rawhide mallet, drive the rear cover firmly and evenly into place. Install the securing washers and nuts and tighten them evenly with 180 to 225 inch-pounds torque.

e. Install the tail rotor take-off flange on the splined shaft. Coat the threads of the shaft and the threads of the lock nut with anti-seize compound (index 43, paragraph 1—32). Install the nut on the shaft, prevent the flange from turning by using the anti-torque plate, Sikorsky part No. S1670-10401, and, using the wrench assembly, Sikorsky part No. S1670-10308, tighten the lock nut with 125 to 175 foot-pounds torque. Install the cotter pin and lockwire the plug to the cotter pin.

f. Replace the first section of the tail rotor drive shaft (paragraph 5—428), the hydraulic pump and filter (paragraph 5—346, step i.), the tachometer-generator (paragraph 5—346, step h.), the generator blower (paragraph 5—346, step g.) and the generator (paragraph 7—13). Connect the oil line at the oil pump. Service the main gear box. (See figure 1—14.)

5—356. REPLACEMENT OF ACCESSORY DRIVE SEALS.

Note

The following procedure is to be used when replacing any accessory drive seal in the rear cover.

a. Drain the main gear box. (Refer to paragraph 5—351.)

Note

For removal of individual components necessary for replacement of seals, refer to paragraph 5—355, step a.

b. Remove the desired accessory drive seal by inserting two screws into the threaded holes in the seal. Grip the screws and pull out the seal.

c. Install the proper mounting thimble on the accessory drive shaft from which a seal was removed. The thimbles used are as follows: Sikorsky part Nos S1670-10038, S1670-10039, S1670-10040, S1670-10041, S1670-10042 and S1670-10043. (See table IV.)

d. Coat the thimble and the inside surface of the seal with petrolatum (index 45, paragraph 1—32) and the outside surface of the seal with sealing compound (index 46, paragraph 1—32). Press the seal in place and remove the thimble.

Note

For installation of individual components which were removed for replacement of a seal or seals, refer to paragraph 5—355, step f.

e. Service the main gear box. (See figure 1—14.)

5—357. REPLACEMENT OF MAIN SHAFT SEAL.

a. Remove the main rotor head assembly. (Refer to paragraph 2—309.) Disconnect the oil line to the seal retainer at the fitting. Cut the lock wire and remove the bolts and washers which secure the seal retainer. Lift the seal retainer off the main shaft. Remove the "O" ring. Using a suitable drift, press out the seal.

b. Coat the outside diameter of the replacement seal with sealing compound (index 46, paragraph 1—32). Press this seal into the retainer. Install a new "O" ring in the groove. Place the mounting thimble, Sikorsky part No. S1670-10342, on the main shaft. Coat the thimble, the seal and the "O" ring with petrolatum (index 45, paragraph 1—32). Slide the seal retainer carefully into its proper position and secure it with the washers and bolts. Lockwire the bolts. Remove the thimble. Connect the oil line at the fitting. Install the main rotor head assembly. (Refer to paragraph 2—314.)

5–358. REPLACEMENT OF SPLINED SHAFT SEALS.

a. Remove the quick change unit. (Refer to paragraph 5–342.) Take the Spirolox ring out of the bottom of the lower housing. Install screws in the holes provided in the seals and pull out both seals.

b. Coat the outside diameter of replacement seals with sealing compound (index 46, paragraph 1–32). Coat the inside diameter of the seals with petrolatum (index 45, paragraph 1–32). Place the mounting thimble, Sikorsky part No. S1670-10343, over the end of the shaft and carefully install both seals in the lower housing. Remove the thimble. Replace the Spirolox ring. Install the quick change unit. (Refer to paragraph 5–347.)

CAUTION

Pack the space between the two seals with grease (index 21, paragraph 1–32).

5–359. MAINTENANCE. The main gear box oil filter and strainer should be cleaned whenever the service oil is drained or the filter or strainer is clogged.

a. To clean the oil filter, remove the lock nut, nut and gasket from the stud on the oil pump cover assembly. Remove the filter and gasket.

b. Wash the filter in solvent (index 3, paragraph 1–32). Install a new gasket and position the filter on the oil pump cover. Place a new gasket on the stud and secure the filter with the nut and lock nut.

CAUTION

If metal particles are found in the filter, investigate to determine the source and cause. (Refer to paragraph 5–372.)

Note

Check the filter for possible leaks after the first flight.

c. To clean the strainer, unscrew the strainer from the lower housing through the access in the cabin ceiling. Remove the gasket. Wash the strainer in solvent (index 3, paragraph 1–32) or kerosene (index 19, paragraph 1–32). Install a new gasket and reinstall the strainer.

CAUTION

If metal particles are found in the strainer, investigate to determine the source and cause. (Refer to paragraph 5–372.)

5–360. CLEANING. Wash the external surfaces of the main gear box with solvent (index 3, paragraph 1–32) or a low grade of kerosene (index 19, paragraph 1–32).

5–361. PREPARATION FOR SHIPMENT. Prior to storage or shipment of the main gear box, prepare each unit as follows:

a. Reinstall the upper and lower gear box housing bolts which were removed to release the hydraulic support brackets.

b. Drain all the service oil out of the gear box. (Refer to paragraph 5–351, steps b., c. and d.)

c. Slosh corrosion-preventive mixture through the gear box. Prepare corrosion-preventive mixture locally by combining 25 percent of corrosion-preventive compound (index 7, paragraph 1–32) with 75 percent of service oil (index 34, paragraph 1–32).

d. Drain any excess mixture from the gear box.

e. Coat the unprotected surfaces, such as shafts, with hard-film corrosion-preventive compound (index 4, paragraph 1–32). Cover with greaseproof wrapping paper (index 8, paragraph 1–32). Secure the paper with adhesive tape (index 9, paragraph 1–32).

f. Pack the main gear box securely in a suitable container.

5–362. PLACING IN SERVICE AFTER SHIPMENT.

a. Remove the main gear box from the container.

b. Remove the greaseproof wrapping paper and adhesive tape.

c. Strip corrosion-preventive compound from the external machined surfaces with solvent (index 3, paragraph 1–32).

d. Slosh service oil through the gear box. Drain the gear box.

e. Install the gear box and refill with service oil.

5–363. INSTALLATION.

a. Assemble the main gear box and rotor quick change unit. (Refer to paragraph 5–346.)

b. Install the main gear box and rotor quick change unit. (Refer to paragraph 5–347.)

5–364. ADJUSTING OIL PRESSURE.

a. Hinge down the left service platform.

b. Unscrew the cap at the bottom of the oil pump cover at the rear of the gear box.

c. Back off on the adjusting screw inside of the cover to reduce the oil pressure in the system; tighten the screw to increase the pressure.

d. Perform a ground run-up. With the transmission oil temperature stabilized at 50° to 100°C at 2500 engine rpm, an indication of 60 to 80 psi on the transmission oil temperature gage is acceptable.

5—365. RUN-IN OF MAIN GEAR BOX.

5—366. DESCRIPTION. Four run-in tests must be performed on every main gear box before the gear box is placed in service: a one quarter load test and a full load test (or a substitute "no load" bench test); a "ground run" test; and a "hovering run" test. The one quarter load and full load tests are normally performed by an overhaul facility on a test stand and consist of two separate runs at specified loads and speeds. However, if the overhaul facility had no test stand, a substitute "no load" bench test should have been performed during which an electric motor is used to run the gear box for a specified time while the oil pressure is checked at various locations on the gear box. Examine the gear box historical record to determine the run-in status of the box. If the one quarter load and full load tests have been accomplished, perform the "ground run" and "hovering run" tests outlined in paragraph 5—367. If only the "no load" bench test has been accomplished, perform the "ground run" and "hovering run" tests outlined in paragraph 5—368.

WARNING

All tests are mandatory and must be conducted for safety of flight.

5—367. RUN-IN OF MAIN GEAR BOX WHICH HAS RECEIVED "QUARTER LOAD" AND "FULL LOAD" TESTS. The "ground run" and "hovering run" tests outlined in this paragraph must be performed on every main gear box that has received the one quarter load and full load tests. Refer to paragraph 5—366 to determine the run-in status of the gear box.

CAUTION

The tests outlined in this paragraph are not to be performed on a main gear box that has received a "no load" bench test.

a. Prepare the main gear box for final run-in. (Refer to paragraph 5—369.)

b. Start the engine, engage the clutch and make a 30-minute "ground run" for ten minutes each at 1500, 2000 and 2400 rpm using minimum collective pitch and power. Observe the transmission oil pressure and transmission oil temperature during the 30 minute "ground run" for signs of abnormality.

c. At the end of the 30-minute "ground run," check the gear box for signs of excessive leakage.

d. Check the transmission oil temperature and preheat the transmission oil, if necessary, to obtain a temperature of 50°C.

e. Start the engine, engage the clutch and make a "hovering run" for one hour at 2500 rpm with 47.5 (Hg) inches of manifold pressure.

Note

It will be necessary to hover several feet off the ground during this run.

f. From readings on the potentiometer, record the temperature in the area of the sleeve bearing every minute from the time of take-off until the end of the flight. The temperature should normally stabilize within a range of 85° to 97°C within a period of 15 to 25 minutes. Once the temperature has stabilized within this range, it should remain within ±1°C of the stabilized temperature for the remainder of the "hovering run."

CAUTION

The temperature of the gear box in the area of the sleeve bearing should normally not exceed 100°C. Should the temperature exceed 100°C at any time and continue to rise without stabilizing within the prescribed period, land the helicopter immediately, remove the main gear box and return it to an overhaul facility for teardown inspection. Under no conditions should the temperature be allowed to exceed a maximum of 110°C.

CAUTION

If the thermocouple and potentiometer are not available or if the gear box has not been reworked to provide a hole in the area of the sleeve bearing for the thermocouple, a constant check must be maintained during the "hovering run" for a strong odor of over-heated transmission oil which would indicate excessively high gear box temperature. If such an odor is detected, land the helicopter immediately and follow the instructions outlined in steps i. through k.

g. Observe and record transmission oil pressure and transmission oil temperature readings from the indicators on the instrument panel in the cockpit at five-minute intervals during this run.

CAUTION

If the transmission oil temperature exceeds 85°C at any time during flight, land the helicopter and check the transmission oil cooler thermostat for proper operation. A faulty thermostat could cause high sleeve bearing temperature readings and result in the unnecessary removal of the gear box.

h. At the end of the one hour "hovering run," check the main gear box for oil leaks.

i. Check the zinc-chromate primer strip for discoloration. Discoloration of the strip indicates excessive temperature rise.

j. Inspect the inside of the splined shaft for any signs of burning of the lacquer.

Note

The splined shaft may be inspected while the main gear box is installed on the helicopter by using a mirror and flashlight and looking up from the deck through the opening located in the lowest point of the lower housing.

k. Inspect the magnetic plug in the oil pump for metal particles. Drain and filter the oil. Examine the filtrate through which the oil was filtered and the finger strainer for metal particles.

CAUTION

If the zinc-chromate primer strip shows discoloration, the lacquer is burned on the inside of the splined shaft, or bronze, lead or steel chips are found on the magnetic plug or finger strainer, the main gear box should be removed and returned to an overhaul facility for teardown inspection.

l. If all checks appear normal during the run-in procedure, the main gear box is ready for flight service.

5—368. RUN-IN OF MAIN GEAR BOX WHICH HAS RECEIVED THE "NO LOAD" BENCH TEST. The "ground run" and "hovering run" tests outlined in this paragraph must be performed on every main gear box that has received a "no load" bench test. Refer to paragraph 5—366 to determine the run-in status of the gear box.

Note

The tests outlined in this paragraph are not to be performed on a main gear box that has received the "one quarter load" and "full load" tests.

a. Prepare the main gear box for final run-in. (Refer to paragraph 5—369.)

b. Start the engine, engage the clutch and make a 45-minute "ground run" for 15 minutes each at 1500, 2000 and 2400 rpm using minimum collective pitch and power. Observe the transmission oil pressure and transmission oil temperature during the 45-minute "ground run" for signs of abnormality.

c. At the end of the 45-minute "ground run," check the gear box for signs of excessive leakage.

d. Check the transmission oil temperature and preheat the transmission oil, if necessary, to obtain a temperature of 50°C.

e. Start the engine, engage the clutch and make a "hovering run" for 90 minutes at 2500 rpm with 47.5 (Hg) inches of manifold pressure.

Note

It will be necessary to hover several feet off the ground during this run.

f. From readings on the potentiometer, record the temperature in the area of the sleeve bearing every minute from the time of take-off until the end of the flight. The temperature should normally stabilize within a range of 85° to 97°C within a period of 15 to 25 minutes. Once the temperature has stabilized within this range, it should remain within ±1°C of the stabilized temperature for the remainder of the "hovering run."

CAUTION

The temperature in the area of the sleeve bearing should normally not exceed 100°C. Should the temperature exceed 100°C at any time and continue to rise without stabilizing within the prescribed period, land the helicopter immediately, remove the main gear box and return it to an overhaul facility for teardown inspection. Under no conditions should the temperature be allowed to exceed a maximum of 110°C.

CAUTION

If the thermocouple and potentiometer are not available or if the gear box has not been reworked to provide a hole in the area of the sleeve bearing for the thermocouple, a constant check must be maintained during the "hovering run" for a strong odor of overheated transmission oil which would indicate excessively high gear box temperature. If such an odor is detected, land the helicopter immediately and follow the instructions outlined in steps i. through k. If the strip has turned brown, remove the gear box and return it to an overhaul facility for teardown inspection.

g. Observe and record transmission oil pressure and transmission oil temperature readings at five-minute intervals during this run.

CAUTION

If the transmission oil temperature exceeds 85°C at any time during flight, land the helicopter and check the transmission oil cooler thermostat for proper operation. A faulty thermostat could cause high sleeve bearing temperature readings and result in the unnecessary removal of the gear box.

h. At the end of the 90-minute "hovering run," check the main gear box for oil leaks.

i. Check the zinc-chromate primer strip for discoloration. Discoloration of the strip indicates excessive temperature rise.

j. Inspect the inside of the splined shaft for any signs of burning of the lacquer.

Note

The splined shaft may be inspected while the main gear box is installed on the helicopter by using a mirror and flashlight and looking up from the deck through the opening located in the lowest point of the lower housing.

k. Inspect the magnetic plug in the oil pump for metal particles. Drain and filter the oil. Examine the filtrate through which the oil was filtered and the finger strainer for metal particles.

CAUTION

If the zinc-chromate primer strip shows discoloration, the lacquer is burned on the inside of the splined shaft, or bronze, lead or steel chips are found on the magnetic plug or finger strainer, the main gear box should be removed and returned to an overhaul facility for teardown inspection.

l. If all checks appear normal during the run-in procedure, the main gear box is ready for flight service.

5—369. PREPARATION OF MAIN GEAR BOX FOR FINAL RUN-IN. The following procedure is mandatory and must be strictly complied with:

a. Service the main gear box with oil. (See figure 1—14.)

b. Load the helicopter to its maximum gross weight of 13,300 pounds.

c. Remove a vertical strip of the heat-resistant paint, one inch wide and five inches long, on the right side of the lower housing adjacent to the sleeve bearing using paint remover (index 56, paragraph 1—32).

d. Apply a coat of zinc-chromate primer (index 10, paragraph 1—32) to the strip where the paint was removed.

e. Remove the plug and install an AN4076 fitting and a bayonet-type thermocouple, AN5541-1, in the hole in the lower housing casting adjacent to the sleeve bearing. Mount a 0° to 200°C potentiometer in the cockpit and connect the wiring from the thermocouple to it.

Note

If the thermocouple and potentiometer are not available or if the gear box has not been reworked to provide a hole in the area of the sleeve bearing for installing the thermocouple, excessive heat in the main gear box is indicated by the zinc-chromate primer strip turning brown and/or a prevalent strong odor of overheated transmission oil around the gear box.

5—370. TRANSMISSION OIL PRESSURE INDICATOR SYSTEM.
(Refer to paragraph 6—99.)

5—371. TRANSMISSION OIL TEMPERATURE INDICATOR SYSTEM.
(Refer to paragraph 6—94.)

5—372. METAL PARTICLES CONTAMINATION OF MAIN GEAR BOX OIL.

5—373. DESCRIPTION. Metal particles found on the main gear box oil strainer screen, oil filter or magnetic sump plug may indicate failure of an internal part of the gear box. The presence of metal particles, however, is not necessarily an indication that the gear box is no longer serviceable. The quantity, source, form, and type of metal found, together with the service history of the particular gear box, must be taken into consideration. The time accumulated since the gear box was new or overhauled, previous failures, and type of operation are important factors in determining the further serviceability of the unit. The particles found may be steel, tin, lead, cadmium, aluminum, magnesium, copper (bronze), or phenolic in various shapes and quantities. For a detailed explanation of the action made necessary by the presence of each of the possible types of particles in the gear box, refer to table XXVIII.

WARNING

When any particles found are readily indentifiable as fragments of gear box parts, such as gears, nuts, bearings, oil flingers, thrust washers, snap rings, safety wire, or other components, replace the gear box.

TABLE XXVIII
METAL PARTICLES CONTAMINATION — MAIN GEAR BOX OIL

KIND OF METAL	QUANTITY AND/OR SIZE	ACTION REQUIRED	NOTES
Steel	Fuzz, fine hair-like particles	None	Result of normal wear. May have exaggerated appearance because of presence of oil
	Particles in splinter or granular form	Perform serviceability check. (Refer to paragraph 5—374.) Replace gear box if necessary	Usually indicates failure
	Thin flakes not exceeding 1/32 (0.030) inch in diameter and 1/4 (0.25) inch in length. Quantity not to exceed 20 flakes	Perform serviceability check. (Refer to paragraph 5—374.)	Small quantity will not cause bearing failure
	More than 20 flakes not exceed- 1/32 (0.030) inch in diameter and 1/4 (0.25) inch in length; any quantity of flakes exceeding the above dimensions	Perform serviceability check. (Refer to paragraph 5—374.) Replace gear box if necessary	Usually indicates failure
Tin, Lead or Cadmium	Particles not exceeding 0.0005 inch in thickness	None	Component plating material only
	Particles exceeding 0.0005 inch in thickness	Perform serviceability check. (Refer to paragraph 5—374.)	
Aluminum or Magnesium	Particles in granular form	Perform serviceability check. (Refer to paragraph 5—374.) Replace gear box if necessary	May be result of use of these materials as mallets or drifts during assembly. May indicate wear of oil pump interior surfaces
Copper (Bronze)	Particles in granular form	Perform serviceability check. (Refer to paragraph 5—374.) Replace gear box if necessary	May indicate excessive wear of thrust washers
Phenolic	Particles in granular form	None	Result of the use of mallets and drifts during assembly

5—374. MAIN GEAR BOX SERVICEABILITY CHECK. The following procedure should be used if any doubt exists as to the serviceability of the main gear box.

a. Drain the main gear box and oil cooler.

b. Flush the main gear box, oil cooler and lines thoroughly with engine oil (index 34, paragraph 1—32).

c. Clean and reinstall the oil filter, oil strainer screen and magnetic sump plug.

d. Refill gear box with oil.

e. Run up the gear box for one hour and inspect the oil strainer screen and magnetic sump plug. If the amount of particles has increased, the gear box should be changed; if the amount of particles has decreased, continue the gear box in service, but continue inspections of the gear box as outlined in steps f. through i.

f. After five hours of normal operation or during daily inspection, whichever comes first, drain the gear box and filter the oil through cheesecloth or filter paper. Inspect residue on filter material for particles. Inspect magnetic sump plug for particles.

g. Clean and replace magnetic sump plug and refill with new oil.

h. Repeat steps f. and g. at five-hour intervals or daily, whichever comes first, to determine whether the amount of particles has increased or decreased.

i. If the amount of particles has increased, the gear box should be changed. If the amount of particles has decreased, the gear box may be continued in service.

5—375. FORWARD AND AFT TRANSMISSION INSTALLATION.

5—376. DESCRIPTION. The forward and aft transmission installation extends from the take-off of the main

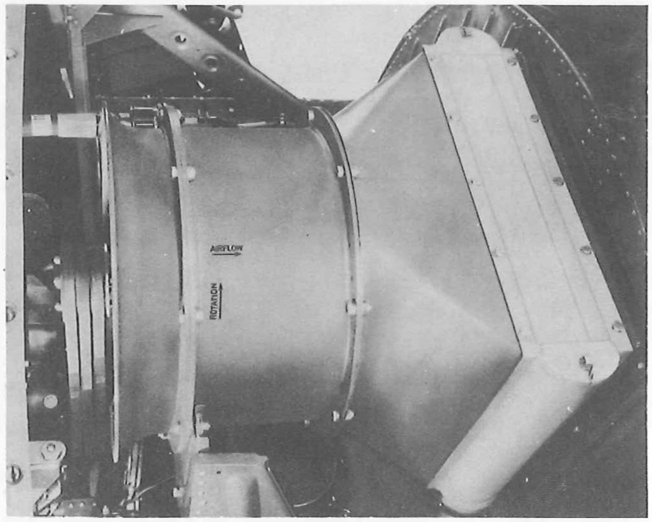


Figure 5—47. Main Gear Box Oil Cooler and Blower Installed

gear box to the aft bulkhead in the tail cone and includes the main gear box oil cooler and blower, the main rotor brake system and the four sections of the tail rotor drive shaft.

5—377. MAIN GEAR BOX OIL COOLER AND BLOWER.

5—378. DESCRIPTION. The main gear box oil cooler and blower assembly (figure 5—47) is located aft of the main gear box on the transmission deck. The assembly consists of a fan assembly, duct and an oil cooler. The fan is pulley-driven off the tail rotor drive shaft by three matched vee belts. Outside air for cooling enters the canopy where it is drawn into the blower and rammed through the cooler. Two tube assemblies carry oil from the main gear box oil pump to the oil cooler and back to the oil inlet fitting on the main gear box. If the temperature of the oil is greater than 160°F, a thermostatic valve in the oil cooler allows the heated oil to flow through the cooler until the temperature is reduced to the temperature of the valve setting. If the temperature of the oil is less than 160°F, a valve in the system allows the oil to bypass the oil cooler. The oil cooler and blower may be removed and installed as a unit. Access to the unit is gained by hinging down the service platforms and removing the aft canopy sections.

5—379. TROUBLE SHOOTING.

Trouble	Probable Cause	Remedy
Oil not cooling properly	Loose pulley belts	Tighten belts
	Thermostatic valve in cooler not operating at correct temperature	Replace cooler
	Clogged cooler	Clean and flush cooler or replace cooler
Overcooling of oil	Thermostatic valve in cooler not operating at correct temperature	Replace cooler
Unusual vibration and noise from oil cooler blower (oil temperature may run high)	Leakage in cooler	Replace cooler
	Bad bearing in blower	Replace blower

5—380. REMOVAL.

a. Hinge down the service platforms and remove the skin assemblies over the oil cooler and blower by unlocking the Camloc fasteners.

b. Drain the service oil from the main gear box as necessary. (Refer to paragraph 5—351.)

c. Disconnect the oil lines (27 and 34, figure 5—48) at the quick disconnects (26) at each side of the oil cooler assembly. Plug the lines if removal of the lines is not necessary.

d. Remove the adjustment bolts (29) which secure the plate (28) to the front support assembly and free the three belts (1) from the pulley (5) on the fan assembly (36).

Note

Do not remove the pulley belts (1) from the driving pulley. If the belts must be replaced, refer to paragraph 5—386.

e. Support the oil cooler assembly and remove the bolts, nuts and washers (12) which attach the aft end of the cooler to the radiator support (13) and lift the cooler and blower assembly out of the helicopter with the plate (28) attached. Separate the adjustment plate (28) from the blower by removing the bolts, washers and nuts (35).

f. Disconnect and remove the oil line (34) from the inlet fitting on the gear box and the oil line, elbow (50), gasket (32), nut (31) and ring (33) from the oil pump. Plug the inlet fitting at the gear box and the port in the oil pump.

g. Remove the bolts, washers, and nuts (24) which secure the support assembly (25) to the transmission deck.

5—381. DISASSEMBLY.

a. Remove the bolts (10, figure 5—48) which secure the oil cooler (11) to the duct (9). Remove the cooler.

b. Remove the bolts, washers and nuts (38) which connect the duct (9) to the fan assembly (36).

c. Disconnect and remove the oil lines (18 and 23) from the fittings (26) on each side of the oil cooler. Remove the unions (16 and 21) and gaskets (15, 17, 20 and 22).

d. Remove the pulley assembly from the blower shaft by removing the nut (2), washers (3), pulley (5), key (37) and shim (8). Remove the bolts (7) and separate the plate (4) and flange (6) from the pulley (5).

5—382. CLEANING OIL COOLER. Prior to pressure flushing the oil cooler according to the instructions given in the following steps d. through m., immerse, if possible, the oil cooler in the optional solvent bath described in steps a. through c.

a. Use a solvent or degreasing solution to remove oil and loosen sludge from the oil cooler. Immerse the oil cooler in recommended solvents such as mineral spirits (index 39, paragraph 1—32), kerosene (index 19, paragraph 1—32) or Stoddard solvent.

WARNING

Use only cleaning solutions recommended in these instructions. Many solutions satisfactory for cleaning copper or copper-nickel oil coolers are highly corrosive to aluminum and will result in destruction of the aluminum cooler if used.

b. Drain the cooler.

c. Blow the air fins free of foreign particles.

d. Remove the control valve from the housing and plug the opening in the housing.

e. Temporarily close the bypass outlet by using a blind gasket under the housing in order to insure circulation of the cleaning solution through the cooling tubes.

f. Connect a hose from the discharge side of the pump to the valve housing which is the oil cooler outlet. This will give a solution flow the opposite of the normal oil flow.

g. Prepare the following cleaning solution: add six ounces of cleaner (index 49, paragraph 1—32 or equivalent Defense Department Cleaner) to a tank containing one gallon of water 71.1°C (160°F) to 82.2°C (180°F).

h. Run the second hose from the cleaning tank to the suction side of the pump and the third hose from the oil cooler inlet to the cleaning tank.

i. Circulate the cleaning solution through the cooler approximately 30 minutes or until the solution appears clean after flowing through the cooler.

Note

A centrifugal pump with a capacity of 50 gallons per minute (approximately 2 gpm per cooling tube) capable of 75 to 150 psi pressure may be used to circulate the solution. This pump size is recommended because of the importance of velocity and pressure in a good cleaning operation. Pressure gages in the line on each side of the cooler will be helpful in checking the reduction in pressure drop through the cooler as it becomes clean.

j. Remove the blind gasket and circulate the solution for a few minutes in order to clean the bypass tube.

k. Flush the oil cooler with clear warm water and drain.

l. Blow the unit dry with compressed air. Make certain that the air fins are blown free of foreign particles.

m. Flush the cooler with clean corrosion-preventive compound (index 7, paragraph 1—32).

5—383. ASSEMBLY.

a. Apply sealer compound (index 18, paragraph 1—32) to the mating parts and install the bolts (10, figure 5—48) which attach the cooler (11) to the duct (9).

b. Position the fan assembly (36) on the duct (9) and install the bolts, washer and nuts (38) attaching them together.

c. Install the unions (16 and 21) into the oil cooler (11) and connect the lines (18 and 23) which lead to the quick disconnects (26).

d. Secure the flange (6) and plate (4) to the pulley (5) with the bolts and nuts (7). Position the shim (8) and key (37) on the blower shaft and secure the pulley assembly with the washer (3) and nut (2).

5—384. INSTALLATION.

a. Position the support assembly (25, figure 5—48) on the transmission deck and secure it with the bolts, washers and nuts (24). Tighten the bolts to 75 inch-pounds torque.

b. Secure the adjustment plate (28) to the blower (36) with the bolts, washers and nuts (35). Position the oil cooler and blower on the front support (25) and install the adjustment bolts (29), washers and nuts.

c. Apply sealer compound (index 18, paragraph 1—32) to the mating parts, position and support the complete assembly in the helicopter and install the bolts (12, figure 5—48) which attach the aft end of the cooler to the radiator support (13).

d. Loop the upper end of the three vee belts (1) over the pulley (5).

Note

Slotted holes are provided to allow for adjustment in position of the fan assembly in order to tighten the belts.

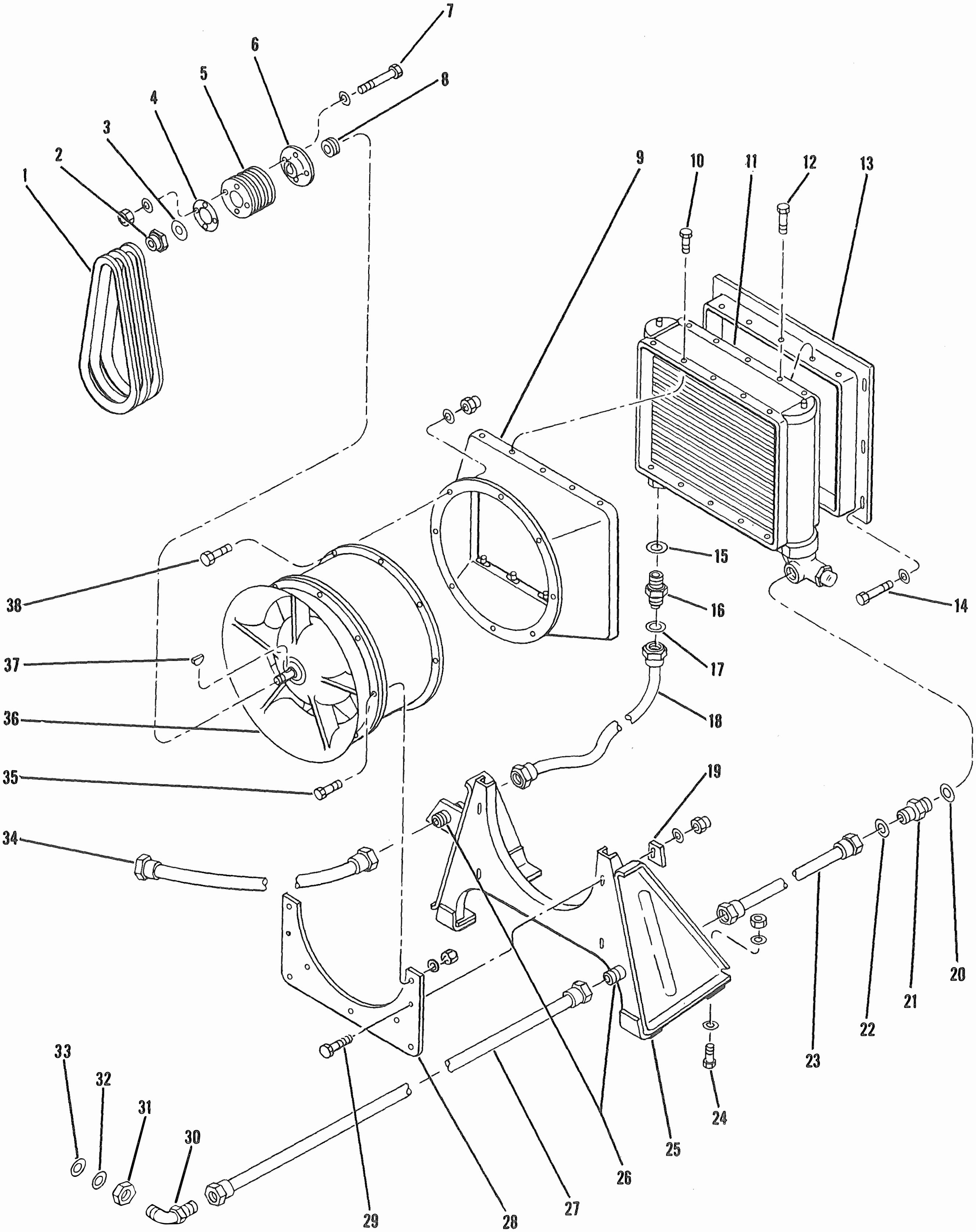


Figure 5—48. Main Gear Box Oil Cooler and Blower Disassembled

Key to Figure 5—48

1. Fan Belts
2. Lock Nut
3. Washer
4. Cover Plate
5. Pulley
6. Flange
7. Bolt, Washers, Nut
8. Shim
9. Duct
10. Bolt
11. Oil Cooler
12. Bolt
13. Radiator Support
14. Screw
15. Gasket
16. Nipple
17. Gasket
18. Oil Line
19. Block
20. Gasket
21. Nipple
22. Gasket
23. Oil Line
24. Bolt, Washers, Nut
25. Front Support
26. Quick Disconnect
27. Oil Line
28. Plate
29. Adjustment Bolt
30. Elbow
31. Nut
32. Gasket
33. Ring
34. Oil Line
35. Bolt, Washers, Nut
36. Fan
37. Key
38. Bolt, Washers, Nut

e. Install the elbow (30), nut (31), gasket (32) and ring (33) into the oil pump on the gear box. Remove the plugs and connect the oil lines (27 and 34) at the quick disconnects (26) on each side of the oil cooler and at the gear box and oil pump.

f. Replace the skin assemblies and close the service platform.

g. Fill the main gear box with service oil as necessary. (See figure 1—16, sheet 3.)

5—385. ADJUSTMENT.

a. To correct forward and aft misalignment of the driving and driven pulleys, change the thickness of shim (8, figure 5—48) on the fan shaft.

b. To tighten the belts (1), loosen the bolts (35) which secure the plate (28) to the front support (25) and the screws (14) attaching the radiator support (13) to the bulkhead, raise the oil cooler and blower assembly until the belts deflect 1/2 to 3/4-inch midway between pulleys with a load of 10 $\pm 1/2$ pounds. Tighten the bolts in the slotted holes.

Note

Check the belts for tightness again after three hours of flight. Readjust if necessary.

5—386. REPLACEMENT OF PULLEY BELTS. Replace pulley belts that are broken, tattered, badly worn or stretched as follows:

Note

Always replace the pulley belts in matched sets of three.

a. Loosen the bolts (34, figure 5—48) which secure the plate (28) to the front support (25), lower the forward end of the fan assembly and pull the belts off the driven pulley (5).

b. Remove the rubber coupling from the tail rotor drive shaft between the driving pulley and the front support assembly. (Refer to paragraph 5—434.)

c. Remove and replace a new matched set of pulley belts through the opening allowed by the removal of the rubber coupling.

d. Install the rubber coupling. (Refer to paragraph 5—435.)

e. Loop the belts over the two pulleys and adjust them in accordance with paragraph 5—385, step b.

5—387. ROTOR BRAKE SYSTEM.

5—388. DESCRIPTION. The rotor brake system (figure 5—49) is a non-pressurized hydraulic system for stopping the main rotor from turning and for preventing the main and tail rotor from windmilling. The system incorporates a master cylinder (figure 5—50), an accumulator (figure 5—51) and four self-adjusting brake halves (figure 5—52). A brake disc mounted on the second section of the tail rotor drive shaft completes the system.

5—389. TROUBLE SHOOTING.

Trouble	Probable Cause	Remedy
Brake does not hold	Low hydraulic oil level	Service master cylinder with hydraulic oil
	Low air pressure in accumulator	Service accumulator with air

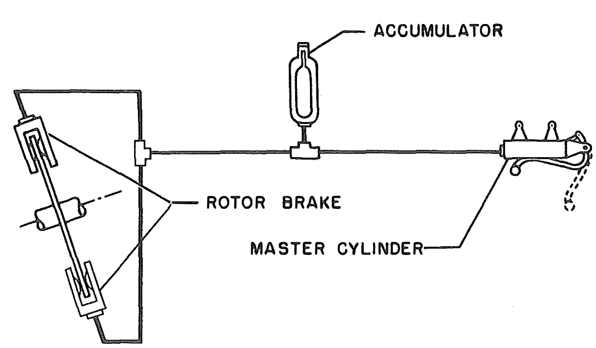


Figure 5—49. Rotor Brake System Schematic Diagram

Trouble	Probable Cause	Remedy
Brake does not hold (cont)	Leakage in hydraulic lines	Check lines for leaks, especially at flares and connections; replace defective component
	Internal or external leakage in master cylinder	Replace master cylinder
	Internal or external leakage in brake half	Replace brake half
	Leakage in accumulator, especially at air valve	Replace accumulator
	Excessively worn brake lining	Replace lining
	Adjusting pin nut loose	Tighten adjusting pin nut
	Leaking accumulator piston seals	Replace accumulator
Spongy brake	Air in hydraulic oil lines	Bleed system (paragraph 5—392)
	Brake improperly adjusted	Adjust brake (paragraph 5—406)
Brake disc scored	Uneven brake wear	Reshim brake half in plane and replace lining
		Replace disc if scored beyond a minimum thickness of 0.366 at any point
Scraping noise from rotor brake or evidence of brake contact with rotor brake off	Brake not disengaging because of sticking brake half	Replace malfunctioning brake half
	Insufficient clearance between brake and disc	Replace brake half

5—390. REMOVAL.

a. Remove the master brake cylinder. (Refer to paragraph 5—396.)

b. Remove the accumulator. (Refer to paragraph 5—400.)

c. Remove the rotor brake. (Refer to paragraph 5—404.)

d. Remove the tubing which extends from the master cylinder to the cockpit canted bulkhead by releasing the clamp and disconnecting the tubing from the bulkhead elbow.

e. Disconnect the tubing from the aft end of the bulkhead elbow and remove the tubing and elbow.

f. Remove the lines from the accumulator to the rotor brake by removing the clamps, union, tee fitting and elbows.

5—391. INSTALLATION.

a. Position the lines which connect the rotor brake with the accumulator and install the tee fittings, elbows, union and clamps.

b. Install the elbow on the cockpit canted bulkhead and connect the tubes to the accumulator and the master cylinder; tighten the clamp.

c. Install the rotor brake. (Refer to paragraph 5—405.)

d. Install the accumulator. (Refer to instructions in paragraph 5—401.)

e. Install the master cylinder. (Refer to paragraph 5—397.)

5—392. FILLING AND BLEEDING ROTOR BRAKE SYSTEM. This paragraph contains instructions for both filling and bleeding the rotor brake system. The system should always be filled as outlined in steps a. through d. before bleeding is attempted. Bleeding may be accomplished without pressure equipment, as outlined in steps e. through l., or with pressure equipment, as outlined in steps m. through t. Step u. applies whenever the system is bled.

a. Check to see that the accumulator is properly charged. (Refer to paragraph 5—401, step d.)

CAUTION

The accumulator must be properly charged before the system is filled, to avoid overfilling.

b. Cut the lock wire and remove the filler plug at the aft end of the master brake cylinder in the cockpit. Place the brake handle in the off, or up, position. Fill the master brake cylinder with hydraulic oil (index 6, paragraph 1—32) to the "NORMAL" mark on the sight gage on the side of the cylinder. Install the filler plug, but do not lockwire it.

c. If the hydraulic lines or brake halves were emptied of hydraulic oil, hinge down the service platforms and loosen the bleeder screw on the top of each brake half. Operate the brake handle to force hydraulic oil into the lines and into each brake half. Tighten each bleeder screw. Refill the master brake cylinder as outlined in step b. Repeat the procedure outlined in step c. until the brake halves are filled with oil.

CAUTION

This does not constitute bleeding of the system.

Note

If pressure equipment is to be used when bleeding the system, remove the filler plug, connect the outlet hose from the pressure equipment to the filler port on the master brake cylinder and use the pressure equipment to force hydraulic oil into the brake halves with the bleeder screws loosened and the brake handle in the off position. (Refer to the caution following step o.) Install the filler plug when finished.

d. Refill the master brake cylinder if the procedure outlined in step c. was used.

Note

Steps e. through l. apply when pressure equipment is not to be used for bleeding the system.

e. Loosen the bleeder plug which is located just below the filler plug on the master brake cylinder.

f. Hold a suitable container under the bleeder plug and move the brake handle to the on, or forward, position.

g. Tighten the bleeder plug and move the brake handle to the off position.

CAUTION

The bleeder plug must be tightened before the brake handle is moved to the off position to prevent air from entering the master brake cylinder.

h. Repeat the procedure outlined in steps e. through g. until hydraulic oil flows from the bleeder plug free of air bubbles. Tighten the bleeder plug.

CAUTION

Check frequently to see that the correct hydraulic oil level is maintained in the master brake cylinder.

i. Loosen the bleeder screw on one of the four brake halves. Operate the brake handle as outlined in steps f. through h. to bleed any trapped air out of the brake half, but loosen and tighten the bleeder screw on the brake half instead of the bleeder plug on the master brake cylinder.

j. Repeat the procedure outlined in step i. at each of the other three brake halves.

k. Repeat the procedure outlined in steps e. through h. to bleed any air that might have worked through the lines and into the master brake cylinder.

l. Lockwire the filler plug to the bleeder plug on the master brake cylinder.

Note

Steps m. through t. apply when pressure equipment is to be used for bleeding the system.

m. Remove the filler plug from the master brake cylinder. Connect the outlet hose from the pressure equipment to the filler port on the master brake cylinder. Place the brake handle in the off, or up, position.

n. Loosen the bleeder plug which is located just below the filler plug on the master brake cylinder.

o. Hold a suitable container under the bleeder plug and pump hydraulic oil (index 6, paragraph 1—32) into the master brake cylinder until oil flows from the bleeder plug free of air bubbles. Tighten the bleeder plug.

CAUTION

It is recommended that the outlet pressure of the pressure equipment be kept at an absolute minimum.

p. Loosen the bleeder screw on one of the four brake halves. Repeat the procedure outlined in step o. to bleed any trapped air out of the brake half, but do not loosen the bleeder plug on the master brake cylinder.

q. Tighten the bleeder screw.

r. Repeat the procedure outlined in step p. at each of the other three brake halves.

s. Repeat the procedure outlined in steps n. and o. to bleed any air that might have worked back through the lines and into the master brake cylinder.

t. Lockwire the filler plug to the bleeder plug on the master brake cylinder.

u. Operate the rotor brake handle to check for evidence of air in the system. Fill and rebleed the system, if necessary.

Note

The force required to actuate the brake handle is approximately 30 pounds when the rotor brake system is correctly bled and the accumulator properly charged.

CAUTION

Do not pump the brake handle to develop a firm brake as this will result in excessive brake system pressure which in turn will cause brake drag.

5—393. ADJUSTMENT.

a. Bleed the rotor brake system. (Refer to paragraph 5—392.)

b. Adjust the rotor brake. (Refer to paragraph 5—406.)

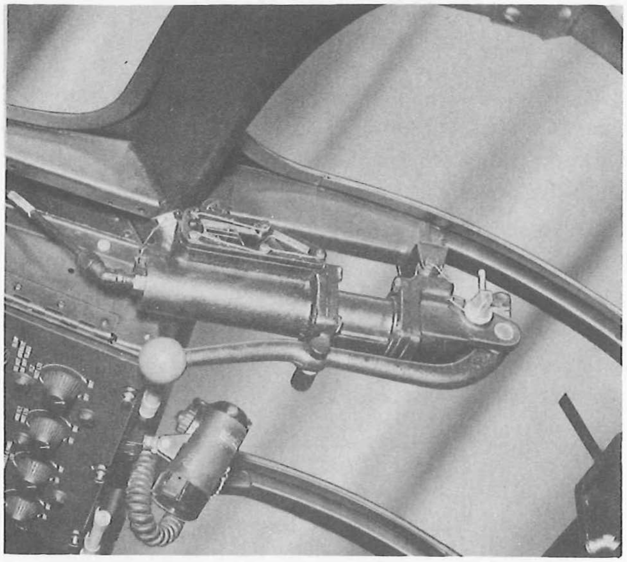


Figure 5—50. Rotor Brake Master Cylinder Installed

5—394. MASTER BRAKE CYLINDER.

5—395. DESCRIPTION. The master brake cylinder (figure 5—50) is located on the ceiling of the cockpit. The rotor brake handle attached to the cylinder moves down and forward causing hydraulic oil pressure to actuate the two brake halves in the brake unit. The handle may be locked in either the up or down position.

5—396. REMOVAL.

a. Disconnect the tubing from the elbow in the aft end of the master brake cylinder.

b. Remove the bolt, washers, spacer and nut that secures the brake cylinder to the gusset.

c. Remove the bolts, washers and nuts that secure the master brake cylinder to the brace assembly and remove the cylinder.

d. Loosen the nut and unscrew the elbow from the master brake cylinder.

5—397. INSTALLATION.

a. Install the elbow, nut, ring and gasket in the aft end of the master brake cylinder. Tighten the nut.

b. Secure the forward end of the master brake cylinder to the brace assembly with the bolts, washers and nuts.

c. Secure the master brake cylinder to the gusset on the cockpit ceiling with the bolt, washers, nut and spacer.

d. Connect the hydraulic oil tubing to the elbow in the aft end of the master brake cylinder.

e. Fill and bleed the rotor brake system. (Refer to paragraph 5—392.)

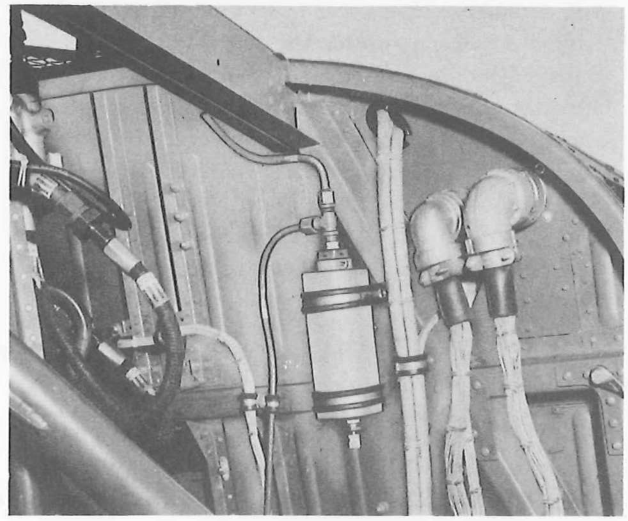


Figure 5—51. Rotor Brake System Accumulator Installed

CAUTION

Check the brake handle for retention in the brake-off position by jarring the master cylinder and its surrounding structure. If the handle jars loose, replace the master cylinder.

5—398. ACCUMULATOR.

5—399. DESCRIPTION. The six-cubic-inch capacity main rotor brake system accumulator (figure 5—51), mounted on the aft right-hand side of the cockpit canted bulkhead, furnishes thermal relief compensation for the brake system. The accumulator is charged with a 250 psi preload of air.

5—400. REMOVAL.

a. Hinge down the main gear box right service platform.

b. Disconnect the tubing from the tee fitting at the upper end of the accumulator. Drain any hydraulic oil into a receptacle.

c. Remove the accumulator from the cockpit canted bulkhead by removing the bolts, washers and clamps.

d. Unscrew the tee fitting from the accumulator.

5—401. INSTALLATION.

a. Screw the tee fitting into the end of the accumulator.

b. Secure the accumulator to the bulkhead with the bolts, washers and clamps.

c. Connect the tubing to the tee fitting.

d. Charge the accumulator with 250 psi of air.

WARNING

Do not charge the accumulator with more than 250 psi. Replace the accumulator if it will not hold this pressure.

e. Fill and bleed the rotor brake system. (Refer to paragraph 5—392.)

f. Close the main gear box service platform.

Note

The accumulator operates automatically and requires adjustment, lubrication or maintenance.

5—402. ROTOR BRAKE.

5—403. DESCRIPTION. The rotor brake (figure 5—52) is self-adjusting and consists of a disc mounted on the second section of the tail rotor drive shaft and four hydraulic brake halves mounted in pairs on the transmission deck at each side of the disc. Braking action is accomplished by the opposed pistons in each pair of brake halves forcing the brake lining against the disc when the pistons are actuated by hydraulic pressure from the master brake cylinder. As the brake lining wears, the pin recedes into an adjusting nut on each brake half the amount necessary to restore the normal gap. (Refer to paragraph 5—406, step d.)

5—404. REMOVAL.

a. Hinge down the main gear box left service platform.

b. Remove the tubing joining each set of brake halves. Disconnect the tubing outboard of the tees in the line to the left brake.

Note

Drain any hydraulic oil into a receptacle.

c. Remove the bolts, washers and nuts which secure the brake halves to the supporting brackets and remove the brake halves and shims.

d. Unscrew the tee fittings and elbows from the brake housings.

e. Remove the disc, if necessary. (Refer to paragraphs 5—411 and 5—415.)

Note

The brake disc (38, figure 5—53) is removed only in conjunction with components of the tail rotor drive shaft.

5—405. INSTALLATION.

a. Install the rotor brake disc if it was removed. (Refer to paragraphs 5—422 and 5—429.)

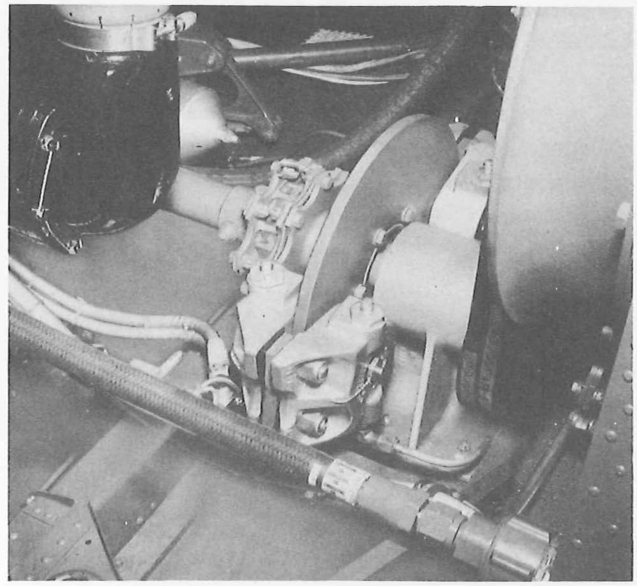


Figure 5—52. Rotor Brake Halves and Disc Installed

b. Position a pair of brake halves at the supporting bracket on each side of the brake disc. Install the bolts, washers and nuts. Tighten the nuts to 50 foot-pounds torque.

Note

Install shims between the brake halves and the support, as necessary, to equalize the space between the disc and each of the four brake halves and to insure that the brake halves are in plane and parallel to the disc.

Note

Install each bolt with the head forward.

c. Screw the tee fittings and elbows into the brake housings.

d. Connect the tubing between the fittings on the halves and tighten the nuts. Connect the tubing from the accumulator at the tee below the left brake.

e. Fill and bleed the rotor brake system. (Refer to paragraph 5—392.)

f. Check the adjustment of the rotor brake. (Refer to paragraph 5—406.)

g. Close the main gear box service platform.

5—406. ADJUSTMENT. The rotor brake is self-adjusting. The self-adjustment feature is regulated by an internal adjustment set by the manufacturer. To check for the proper gap between the brake linings and the disc, follow the instructions outlined in steps a. through c. To check for excessive brake lining wear, follow the instructions outlined in step d.

a. Check to see that the brake halves are in plane and parallel to the brake disc. (Refer to paragraph 5—405, step b.)

b. Actuate and release the rotor brake several times.

c. Measure the gap between the face of each brake lining and the brake disc with a feeler gage. The gap must measure 0.040 to 0.055 inch. Replace the brake halves if this condition does not exist.

Note

When checking the gap of the forward brake halves, it will be noted that the linings have a tendency to ride aft toward the brake disc. This is a normal condition brought about by the angle at which the forward brake halves are mounted and the design of that section of the brake half. It is permissible to use a screw driver to move the linings into their proper position in relationship to the brake disc.

Note

The rotor brake must be properly filled and bled and the accumulator correctly charged to 250 psi before checking the gap. (Refer to paragraphs 5—392 and 5—401, step d.)

WARNING

Do not charge the accumulator with more than 250 psi.

d. Check the brake halves for possible excessive lining wear by observing the position of the adjusting pin at each brake half. The brake half or lining must be replaced when the pin recedes into the adjusting pin nut enough to become flush with the surface of the nut.

Note

No adjustment of the adjusting pin nut should be attempted.

5—407. TAIL ROTOR DRIVE SHAFT.

5—408. DESCRIPTION. The tail rotor drive shaft (figure 5—53) extends from the rear accessory cover of the main gear box to the tail rotor drive shaft disconnect coupling. The primary purpose of the tail rotor drive shaft is to transmit engine torque for driving the tail rotor, but it also provides an attachment for the main rotor brake disc and a pulley drive for the main gear box oil cooler blower. The tail rotor drive shaft is divided into four sections each with its own rubber couplings, hubs, rubber mounted support bearings and attachment flanges. The first section, which is on the transmission deck, consists of a shaft, a rubber coupling at each end and two flanges connecting the rubber couplings to the shaft. The second section, also located on the transmission deck, is composed of a brake hub, brake disc, oil cooler blower pulley hub, attached pulley and a shaft and support bearing. The third section, which extends from above the transmission deck through the cabin and electronics compartment to the tail cone, consists of a shaft with three support bearings and a flange and rubber coupling at the aft end. The fourth section extends through the tail cone and is made up of a flange, a shaft with four support bearings and an input coupling at the rear of the tail cone section. The second and third sections of the drive shaft are joined on installation by a rubber coupling, shims and an attachment flange which fits over and is bolted to the forward end of the third section shaft. Access to the first section is gained by hinging down the gear box service platforms. Access to the second section of the tail rotor drive shaft is gained by removing the skin assemblies aft of the service platforms. Access to the third section is made by removing the louvered fairing at the rear of the skin assemblies and removing the tail rotor drive shaft covers located in the cabin and electronics compartment. The fourth section is exposed in the tail cone section.

5—409. TROUBLE SHOOTING.

Trouble	Probable Cause	Remedy
High frequency vibration in helicopter	Loose nuts and bolts at attaching flanges	Tighten nuts to specified torque
	Misaligned drive shaft	Align drive shaft properly
	Damaged bearing support bracket	Repair damage or replace bracket
	Drive shaft bushing not bonded to shaft	Bond bushing to shaft (paragraph 5—420)
	Damaged bushing	Replace section of drive shaft
	Rough bearing	Replace bearing (paragraph 5—419)
	Damaged rubber coupling or flange	Replace damaged part
	Damaged drive shaft section	Replace drive shaft section

5—410. REMOVAL — SECTION I.

a. Hinge down the service platforms.

b. Support the first section of the drive shaft and remove the bolts, washers, and nuts (35, figure 5—53) that secure the forward rubber coupling (2) to the take-off flange (34) on the main gear box. Remove the shims (33).

c. Remove the bolts, washers, and nuts (30) that secure the aft rubber coupling (9) to the brake hub (37) flange of the second section. Remove the shims (31), release the bonding jumper and lift out the first section of the shaft as a unit.

5—411. REMOVAL — SECTION II.

a. Unfasten the skin assemblies secured to the frame and bulkhead assemblies aft of the service platforms. Remove the screws that secure the skin assemblies to the cabin and lift the skin off the transmission deck.

b. Release the main rotor brake at the master brake cylinder located on the ceiling of the cockpit.

c. Loosen the adjustment bolts at the forward oil cooler and blower support and the bolts that secure the radiator support to the bulkhead and lower the oil cooler and blower in the slotted holes. Release the pulley belts (27, figure 5—53) from the driven pulley on the blower fan shaft.

d. Remove the bolts, washers and nuts (30) that secure the rotor brake hub (37) to the rubber coupling (9) at the forward end of the second section of the drive shaft. Remove the shims (31). Release the bonding jumper.

e. Remove the bolts, washers and nuts (28) that secure the pulley hub (47) to the rubber coupling (10) at the aft end of the second section of the drive shaft. Remove the shims (26).

f. Loosen the bolts, washers and nuts (32) that secure the brake halves (29) to their supports and spread them apart to provide clearance for the brake disc (38) when removing the second section of the drive shaft.

g. Unbutton the soundproofing from the cabin ceiling and remove the bolts, washers, nuts and cotter pins (43) that secure the base of the support bearing housing (42) to the transmission deck. Work the section of the drive shaft out of the helicopter as a unit. Remove the shims (41) from the transmission deck and the doubler from the cabin ceiling.

5—412. REMOVAL — SECTION III.

a. Remove the louvered fairing by removing the screws that secure it to the fuselage.

b. Remove the bolts, washers, nuts, wedges and bushing (25, figure 5—53) that secure the flange (11) to the forward end of the third section to the drive shaft.

c. Release the personnel barrier (paragraph 2—163) and remove the two tail rotor drive shaft access covers (6, figure 1—4, sheet 1) from the cabin and electronics compartment ceiling to gain access to the electronics compartment. Unbutton the seal in the tail cone opening at the electronics compartment rear bulkhead.

d. Remove the bolts, washer and nuts (23, figure 5—53) that secure the rubber coupling (21) on the aft end of the third section to the forward flange (49) of the fourth section of the drive shaft. Remove the shims (24) and release the bonding jumper.

e. Remove the washer head screws, washers and nuts and remove the reinforcement plates below the tail rotor drive shaft openings in the aft cabin bulkhead and electronics compartment bulkhead.

f. Support the third section of the drive shaft and remove the bolts, washers and nuts (17) that secure the three support bearings to the bearing supports (14); remove the bearing rings (16) and plates (13).

g. Lower the aft end of the third section down into the openings in the bulkhead until the support bearings clear the bulkheads. Guide the drive shaft section, aft flange (19) and rubber coupling (21) back until the forward end of the third section shaft (18) clears the opening in the frame at the rear of the transmission deck. Remove the drive shaft section through the cabin.

5—413. REMOVAL — SECTION IV.

a. Unbutton the seal installed in the tail cone opening at the electronics compartment rear bulkhead.

b. Fold the pylon. (Refer to paragraph 1—21.)

c. Remove the bolts, washers, nuts, wedges and bushings (56, figure 5—53) that secure the input coupling (58) to the aft end of the fourth drive shaft section. Slide the input coupling and guide shaft (59) off the drive shaft (55).

d. Remove the bolts, washer, and nut (23) that secure the forward flange (49) to the rubber coupling (21) on the aft end of the third drive shaft section.

e. Support the drive shaft (55) in the tail cone and remove the bolts, washers and nuts (53) that secure the three support bearings forward of the tail cone hinge bulkhead to the bearing supports (51). Remove the bearing rings (52) and plates (50).

f. Remove the snap ring (54) from each side of the aft support bearing mounted on the hinge bulkhead.

g. Work the fourth section of the drive shaft (55) forward through the hinge bulkhead opening, separating the aft bearing from the bearing housing (57) at the bulkhead. Check that the bearing remains intact on the drive shaft bushing.

h. Lower the fourth drive shaft section (55) in the tail cone and remove it through the electronics compartment and cabin.

i. Unbolt the aft bearing housing (57) from the hinge bulkhead and replace it on the shaft bushing. Install the snap rings (54).

j. Replace the input coupling (58) on the aft end of the fourth section of the tail rotor drive shaft (55).

5—414. DISASSEMBLY — SECTION I.

a. Remove the bolts, washers and nuts (4, figure 5—53), that secure the rubber couplings (2 and 9) to the flanges (3 and 8) on each end of the first drive shaft section (5). Remove the couplings.

b. Remove the bolts, washers, nuts, wedges and bushings (1 and 6), that secure the flanges (3 and 8) to each end of the shaft (5) and slide the flanges off the shaft.

5—415. DISASSEMBLY — SECTION II.

a. Remove the bolts, washers, nuts, wedges and bushings (36, figure 5—53) that secure the brake hub (37) to the forward end of the second section of the drive shaft (40) and slide the brake hub off the shaft.

b. Remove the bolts, washers and nuts (39) that secure the brake disc (38) to the brake hub (37) flange and separate the disc from the hub.

c. Remove the bolts, washers, nuts, wedges and bushings (44) that secure the pulley hub (46) to the aft end of the second drive shaft section (40) and slide the pulley hub off the shaft.

d. Remove the bolts, washers and nuts (45) that secure the pulley (46) to the flange of the hub (47) and separate the pulley from the hub.

5—416. DISASSEMBLY — SECTION III.

a. Remove the bolts, washers and nuts (20, figure 5—53) that secure the rubber coupling (21) to the flange (19) on the aft end of the third section. Remove the coupling.

b. Remove the bolts, washers, nuts, wedges and bushings (22) that secure the flange (19) to the aft end of the third section and slide the flange off the shaft (18).

5—417. DISASSEMBLY — SECTION IV.

a. Remove the bolts, washers, nuts, wedges and bushings (48, figure 5—53) that secure the flange (49) on the forward end of the fourth drive shaft section and slide the flange off the shaft (55).

b. Remove the bolts, washers, nuts, wedges and bushings (56) that secure the input coupling (58) to the aft end of the drive shaft and slide the input coupling off the shaft (55).

c. Disassemble the input coupling assembly. Remove the cotter pins and the guide shaft (61), slide the cover (60) off the coupling (58) and lift the gasket (59) out of the groove in the coupling.

5—418. MINOR REPAIRS. Limited scratches, dents or scoring in a section of the tail rotor drive shaft may be repaired within the limits established in steps a. through c.

WARNING

No rework is permissible within four inches of either end of a section of the tail rotor drive shaft.

a. Circumferential scratches or scoring not exceeding 0.003 inch in depth may be polished out.

b. Dents and axial scratches not exceeding 0.005 may be polished out provided there are no more than two such dents or scratches within an area of three inches as measured along the section of the tail rotor drive shaft.

WARNING

The minimum outside diameter to which a section of the tail rotor drive shaft may be reworked is 1.728 inches.

c. Upon installation of the drive shaft in the helicopter, the shafting should be checked for run-out (out of plane). The maximum permissible run-out of the tail rotor drive shafts between bearings is 0.012 total indicator reading. (See figure 5—54.)

5—419. REPLACEMENT OF DRIVE SHAFT SUPPORT BEARINGS. Replace a damaged or rough support bearing by the following procedure:

a. Tap the support bearing assembly off the bushing on the drive shaft.

CAUTION

Do not exert pressure on the bearing retaining plates.

b. Remove the snap rings which hold the bearing in position and press the bearing out of the liner in the housing.

c. Coat the outside surface of a replacement bearing with primer (index 10, paragraph 1—32) and press it into position in the liner of the housing. Install the two snap rings.

d. Tap the support bearing assembly into position on the bushing bonded to the drive shaft.

Note

If any undue stress is put on the drive shaft in removing or replacing bearings, check the shaft for run-out before installation (paragraph 5—430, step b.).

5—420. BONDING LOOSE BUSHINGS TO DRIVE SHAFT.

a. Clean the area on the shaft to which the bushing is to be bonded with solvent (index 3, paragraph 1—32). Also clean the inside surfaces of the bushing.

b. Apply a moderately heavy three-inch wide coat of adhesive (index 42, paragraph 1—32) to the area where the bushing is to be located.

c. Slide the bushing into place.

d. Wipe off excess adhesive with lacquer thinner (index 12, paragraph 1—32).

e. Allow the adhesive to set for twenty-four hours.

f. Repaint the exposed shaft surfaces with primer (index 10, paragraph 1—32).

5—421. ASSEMBLY — SECTION I.

a. Slide the flanges (3 and 8, figure 5—53) on each end of the first drive shaft section (5). Line up the holes and install the bolts, washers, nuts, wedges and bushings (1 and 6). Tighten the nuts with 180 to 225 inch-pounds torque.

Note

The slot in each bushing should face the nearest drive shaft end.

b. Position the rubber coupling (2 and 9) and bonding jumper on each end of the drive shaft section and install the bolts, washers and nuts (4 and 7) that secure the coupling to each flange (3 and 8). Tighten the nuts with 50 to 70 inch-pounds torque.

Note

Install the bolts with the heads between the flanges of the coupling.

5—422. ASSEMBLY — SECTION II.

a. Position the brake disc (38, figure 5—53) on the brake hub (37) and install the bolts, washers and nuts (39). Tighten the nuts with 100 to 140 inch-pounds torque.

b. Slide the brake hub on the aft end of the second drive shaft section (40), line up the holes and install the bolts, washers, nuts, wedges and bushings (36). Tighten the nuts with 180 to 225 inch-pounds torque.

Note

The slot in each bushing should face the forward end of the shaft.

c. Position the pulley (46) on the pulley hub (47) and install the bolts, washers and nuts (45). Tighten the nuts with 20 to 25 inch-pounds torque.

d. Slide the pulley hub (47) on the aft end of the drive shaft (40), line up the holes and install the bolts, washers, nuts, wedges and bushings (44). Tighten the nuts with 180 to 225 inch-pounds torque.

Note

The slot in each bushing should face the aft end of the shaft.

5—423. ASSEMBLY — SECTION III.

a. Slide the flange (19, figure 5—53) on the aft end of the third section of the drive shaft (18), line up the holes and install the bolts, washers, nuts, wedges and bushings (22). Tighten the nuts with 180 to 225 inch-pounds torque.

Note

The slots in the bushings should face the aft end of the shaft.

b. Position the rubber coupling (21) and bonding jumper (11) on the flange (19) and install the bolts, washers and nuts (20). Tighten the nuts with 50 to 70 inch-pounds torque.

Note

Install the bolts with the heads between the flanges of the coupling.

5—424. ASSEMBLY — SECTION IV.

a. Slide the forward flange (49, figure 5—53) on the fourth drive shaft section (55), line up the holes and install the bolts, washers, nuts, wedges and bushings (48). Tighten the nuts with 180 to 225 inch-pounds torque.

Note

The slots in the bushings should face the forward end of the shaft.

b. Assemble the input coupling. Place the gasket (59) in the groove of the coupling (58), install the guide shaft (61) and position the cover (60) on the coupling. Install the three cotter pins attaching the cover to the coupling.

Note

Do not replace the input coupling on the aft end of the fourth section of the drive shaft until the shaft section is located in the tail cone.

5—425. INSTALLATION. Before installation of a new tail rotor drive shaft, run a line check on all bearing supports to insure that they have not been damaged or misaligned to a degree that would cause the drive shaft to bind in operation. See figure 5—54 for maximum allowable misalignment. To allow for shimming requirements, install the four drive shaft sections in the following order: section IV, section III, section I and section II.

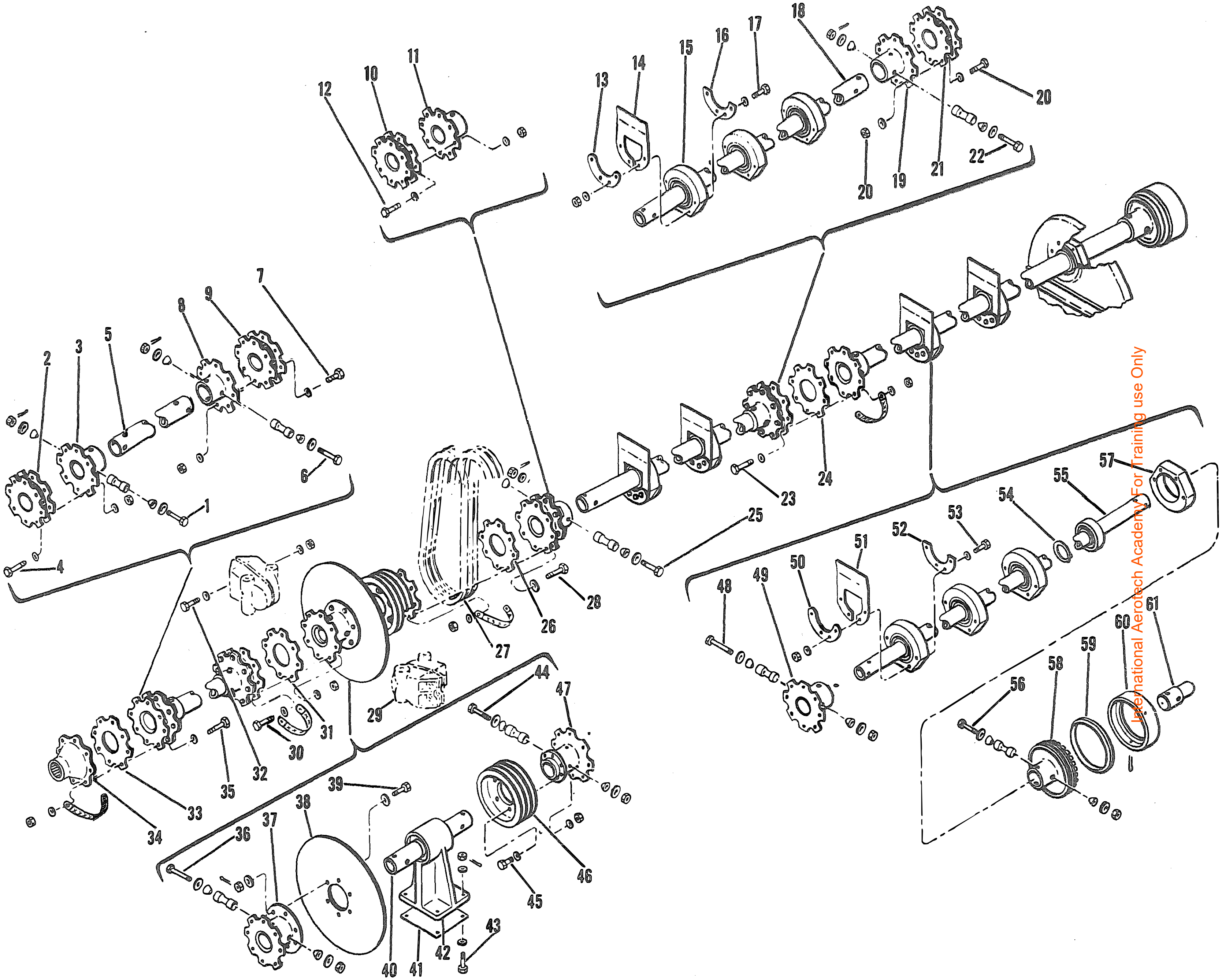


Figure 5—53. Tail Rotor Drive Shaft Removal and Disassembly

Key to Figure 5—53

1. Bolt, Washers, Nut, Wedges, Bushing
2. Rubber Coupling
3. Flange
4. Bolt, Washers, Nut
5. Shaft
6. Bolt, Washers, Nut, Wedges, Bushing
7. Bolt, Washers, Nut
8. Flange
9. Rubber Coupling
10. Rubber Coupling
11. Flange
12. Bolt, Washers, Nut
13. Plate
14. Bearing Support
15. Bearing
16. Bearing Ring
17. Bolt, Washers, Nut
18. Shaft
19. Flange
20. Bolt, Washers, Nut
21. Rubber Coupling
22. Bolt, Washers, Nut, Wedges, Bushing
23. Bolt, Washers, Nut
24. Shim
25. Bolt, Washers, Nut, Wedges, Bushing
26. Shim
27. Fan Belts
28. Bolt, Washers, Nut
29. Brake Half
30. Bolt, Washers, Nut
31. Shim
32. Bolt, Washers, Nut
33. Shim
34. Main Gear Box Take-Off Flange
35. Bolt, Washers, Nut
36. Bolt, Washers, Nut, Wedges, Bushing
37. Brake Hub
38. Brake Disc
39. Bolt, Washers, Nut
40. Shaft
41. Shim
42. Support Bearing
43. Bolt, Washers, Nut, Cotter Pin
44. Bolt, Washers, Nut, Wedges, Bushing
45. Bolt, Washers, Nut
46. Pulley
47. Pulley Hub
48. Bolt, Washers, Nut, Wedges, Bushing
49. Flange
50. Plate
51. Bearing Support
52. Bearing Ring
53. Bolt, Washers, Nut
54. Snap Ring
55. Shaft
56. Bolt, Washers, Nut, Wedges, Bushing
57. Bearing Housing
58. Input Coupling
59. Gasket
60. Cover
61. Guide Shaft

5—426. INSTALLATION — SECTION IV.

a. Remove the bolts (56, figure 5—53), washers, nuts, wedges and bushings and slide the input coupling off the shaft. Remove the snap rings (54) and press the housing off the aft bearing if the support bearing housing (57) and the input coupling (58) are installed on the fourth section of the drive shaft (55). Position the bearing housing and ring on the hinge bulkhead in the tail cone and install the bolts, washers and nuts. Tighten the nuts with 50 to 70 inch-pounds torque.

b. Coat the outside surface of the aft bearing on the fourth drive shaft section with primer (index 10, paragraph 1—32).

c. Support the shaft section (55, figure 5—53) in position inside the tail cone. Work the shaft aft through the opening in the hinge bulkhead and locate the aft support bearing within the bearing housing (57) secured to the hinge bulkhead. Check that the bearing remains intact at the aft shaft bushing.

d. Install the snap rings (54) on each side of the bearing.

e. Position the bearing rings (52) and plates (50) at the three forward support bearings in the tail cone. Install the bolts, washers and nuts (53) and tighten the nuts with 50 to 70 inch-pounds torque.

f. Install the input coupling (58) on the aft end of the fourth section of the drive shaft and secure it with the bolts, washers, nuts, wedges and bushings (56). Tighten the nuts with 180 to 225 inch-pounds torque.

Note

The slot in each bushing should face the aft end of the drive shaft.

g. Insert the shims (24) required between the flange on the forward end of the fourth section and the rubber coupling on the aft end of the third section and install the bolts, washers and nuts (23). Tighten the nuts with 50 to 70 inch-pounds torque.

Note

Install the bolts with the heads between the flanges of the coupling.

h. Unfold and lock the pylon in flight position (paragraph 1—22).

i. Replace the seal in the tail cone opening at the electronics compartment rear bulkhead.

5—427. INSTALLATION — SECTION III.

a. Support the third section of the tail rotor drive shaft inside the cabin and electronics compartment and guide the forward end of the shaft (18, figure 5—53) up through the opening in the frame at the rear of the transmission deck.

b. Position the bearing rings (16) and plates (13) and install the bolts, washers and nuts (17) that secure the support bearings (15) to the supports (14) at the transmission deck frame, the aft cabin bulkhead and the electronics compartment bulkhead. Tighten the nuts with 50 to 70 inch-pounds torque.

c. Install the rubber coupling (10) and flange (11) which join the second and third sections of the drive shaft and slide the flange over the forward end of the third section. Line up the holes of the flange (11) with the holes in the forward end of the drive shaft and install the bolts, washers, nuts, wedges and bushings (25). Tighten the nuts with 180 to 225 inch-pounds torque.

Note

The slots in the bushings should each face the forward end of the drive shaft.

d. Insert the shims (24) required between the rubber coupling on the aft end of the third section and the forward flange of the fourth section and install the bolts, washers and nuts (23). Tighten the nuts with 50 to 70 inch-pounds torque.

Note

Install the bolts with the heads between the flanges of the coupling.

e. Position the reinforcement plates on the cabin and electronics compartment bulkheads and install the screws, washers and nuts.

f. Replace the seal in the electronics compartment rear bulkhead to close the tail cone opening. Replace the tail rotor drive shaft covers in the cabin and electronics compartment ceilings. Replace the personnel barrier at the aft cabin bulkhead (paragraph 2—163). Install the louvered fairing with the attaching screws.

5—428. INSTALLATION — SECTION I.

a. Position and support the first section of the tail rotor drive shaft on the transmission deck and determine the amount of shim (31 and 33, figure 5—53) necessary to fill the gap at each end of the installation. Whenever possible divide the amount of shim evenly between the forward and aft connections.

b. Line up the holes and install the bolts, washers and nuts (35) that secure the forward rubber coupling (2) to the take-off flange (34) on the main gear box and the aft rubber coupling (9) to the flange of the rotor brake hub (37) on the second section of the drive shaft. Tighten the nuts with 50 to 70 inch-pounds torque.

Note

Removal of the shaft, flanges and/or rubber couplings from each other will not affect shimming requirements when original parts are reinstalled. Install the bolts with the heads between the flanges of the coupling.

c. Close the service platforms.

5—429. INSTALLATION — SECTION II.

a. Loop the fan belts (27, figure 5—53) around the drive shaft section (40) aft of the bearing housing, before the second section of the drive shaft is replaced. Position the second section of the shaft on the transmission deck.

CAUTION

Install the necessary amount of shim (41) between the base of the bearing housing (42) and the transmission deck to line up the hub flanges on each end of the shaft section with the rubber couplings to which they attach.

b. Position the plate on the underside of the transmission deck and install the bolts, washers, nuts and cotter pins (43) that secure the bearing housing to the deck.

Note

Install the bolts with the head down.

c. Insert the shims (26 and 31) required at each end of the drive shaft section and install the bolts, washers and nuts (30) and bonding jumper which connect the flange of the brake hub (37) to the rubber coupling (9) at the forward end and the flange of the pulley hub (47) to the rubber coupling (10) at the aft end of the drive shaft section. Tighten the nuts with 50 to 70 inch-pounds torque.

Note

Install the bolts with the heads between the flanges of the coupling.

d. Loop the fan belts (27) over the driven pulley on the oil cooler and blower fan shaft and the driving pulley (46) on the second tail rotor drive shaft section. For adjustment of the belts, refer to paragraph 5—385.

e. Tighten the bolts, washers and nuts (32, figure 5—53) that secure the rotor brake halves (29) to their supports.

f. Check the adjustment of the rotor brake (paragraph 5—393).

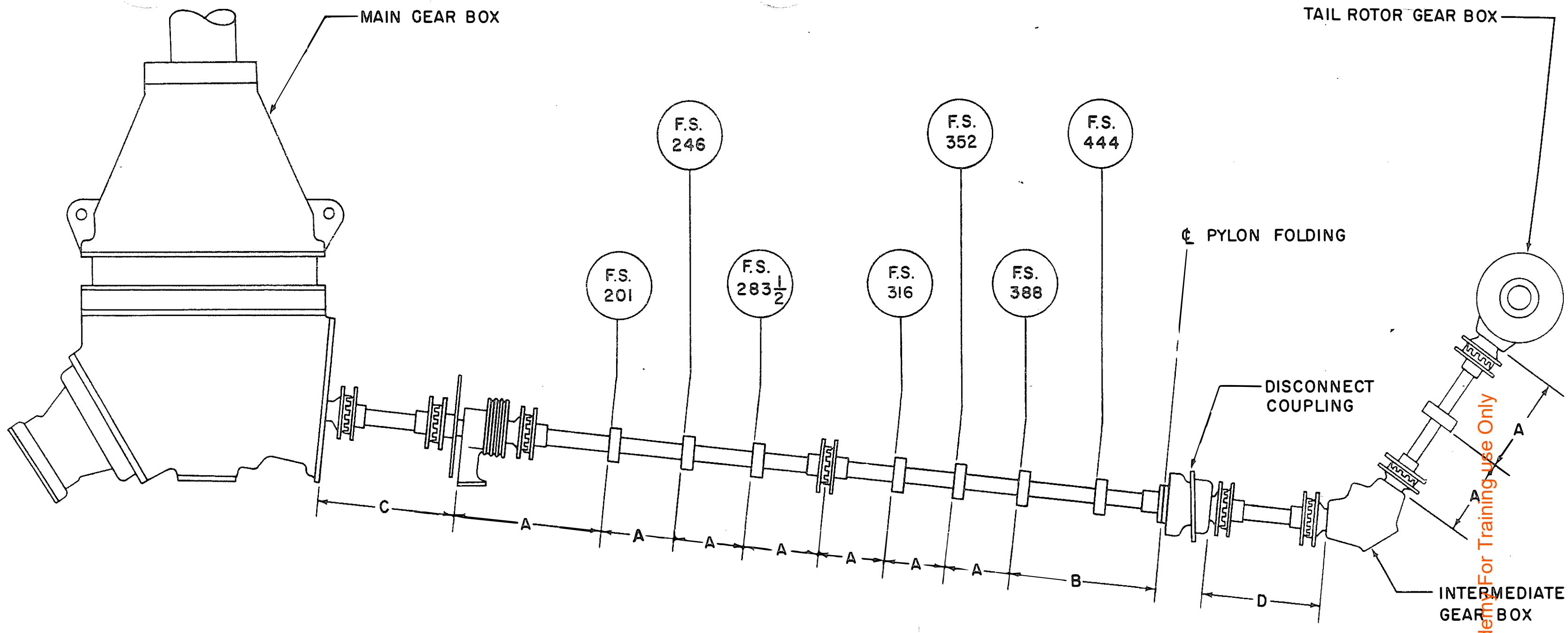
g. Replace the soundproofing in the cabin ceiling. Install the skin assemblies aft of the service platforms and secure them with the fasteners and screws.

5—430. MAINTENANCE.

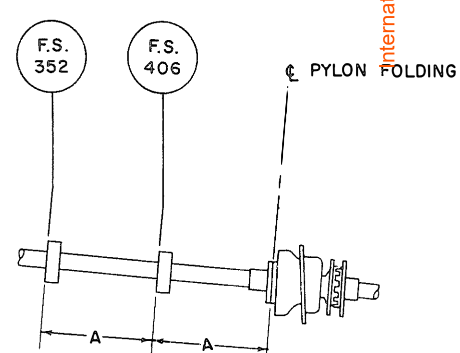
a. Avoid unnecessary handling of the tail rotor drive shaft support bearings and bushings. At drive shaft removal only, disassemble the aft bearing in accordance with instructions in paragraph 5—413, steps f. and g. Replace defective or rough bearings according to the procedure outlined in paragraph 5—419. Bond loose bushings only according to instructions in paragraph 5—420.

b. Check for run-out along the length of the drive shaft with a dial indicator whenever any unusual stress is put upon a section of the tail rotor drive shaft, or excessive run-out is suspected. The maximum run-out permissible is 0.012 inch between bearings.

5—431. ALIGNMENT OF THE TAIL ROTOR DRIVE SHAFT. The total maximum misalignment (out of plane) permitted for all sections of the tail rotor drive shaft is shown in figure 5—54.



FOR HELICOPTERS WITH BEARINGS
AT F.S. 388 AND F.S. 444



FOR HELICOPTERS WITH
BEARING AT F.S. 406

NOTES

MAXIMUM MISALIGNMENT (OUT OF PLANE) OF BEARINGS FOR EACH SECTION "A" IS $\frac{1}{32}$ INCH

MAXIMUM MISALIGNMENT (OUT OF PLANE) FOR SECTION "B" IS 0.004 INCH

MAXIMUM MISALIGNMENT (OUT OF PLANE) FOR SECTION "C" IS $\frac{1}{16}$ INCH

MAXIMUM MISALIGNMENT (OUT OF PLANE) FOR SECTION "D" IS $\frac{3}{32}$ INCH.

MAXIMUM RUNOUT PERMITTED BETWEEN BEARINGS IS 0.012 TOTAL INDICATOR READING

Figure 5—54. Alignment of Tail Rotor Drive Shaft

5—432. TAIL ROTOR DRIVE SHAFT RUBBER COUPLINGS.

5—433. DESCRIPTION. The rubber couplings which connect the four sections of the tail rotor drive shaft are made up of two jaws with vanes and rubber inserts bonded to and connecting the vanes. The shock of sudden starts and stops is taken up by the rubber inserts, making possible smoother operation of the transmission system.

5—434. REMOVAL.

a. Remove the bolts, washers and nuts connecting the coupling to the flange on each side.

Note

The shaft sections on each side of the coupling must be adequately supported before disconnecting the coupling.

b. Slide the rubber coupling and shims out from between the connecting flanges.

5—435. INSTALLATION. Position the rubber coupling and shims required between the connecting flanges and install the bolts, washers and nuts on each side of the coupling. Tighten the nuts with 50 to 70 inch-pounds torque.

Note

If a rubber coupling is removed in conjunction with a drive shaft section, divide the amount of shimming required by disconnecting the opposite shaft end and inserting a shim or shims equally between the coupling and flange at each end. Install the bolts with the heads between the flanges of the coupling.

5—436. PYLON TRANSMISSION INSTALLATION.

5—437. DESCRIPTION. *(See figure 5—55.)* The pylon transmission installation incorporates a disconnect coupling, a disconnect shaft, an intermediate gear box, a pylon drive shaft and a tail rotor gear box. The pylon transmission system transmits power to the tail rotor and changes the angle of drive of the tail rotor drive shaft. The installation extends from the disconnect coupling at the pylon forward bulkhead to the tail rotor gear box on top of the pylon. Access is provided along the pylon for the removal and installation of each unit which comprises the pylon transmission installation.

5—438. TAIL ROTOR DRIVE SHAFT DISCONNECT COUPLING.

5—439. DESCRIPTION. The tail rotor drive shaft disconnect coupling assembly, located at the top of the pylon forward bulkhead, consists primarily of an output coupling mounted on a splined shaft within a housing assembly. The disconnect coupling is necessary to allow folding of the pylon assembly. When the pylon is in flight position, the gear of the disconnect coupling meshes with the gear of the input coupling of the tail rotor drive shaft located at the tail cone rear bulkhead, forming the connection between the tail rotor drive shaft and the disconnect shaft located in the pylon. Folding the pylon releases the spring-loaded coupling and engages a brake plate bolted to the housing assembly which prevents wind-milling of the tail rotor blades. The tension of the compression spring within the disconnect coupling insures a positive meshing between gears when the pylon is in flight position.

5—440. REMOVAL.

a. Fold the pylon (paragraph 1—21) and remove the air intake screened fairing by removing the attaching screws (step 1, figure 5—55).

b. Disconnect the disconnect coupling from the rubber coupling on the disconnect drive shaft by removing the bolts, washers, nuts and shims at "A" (step 2). Release the bonding jumper.

c. Remove the bolts, washers and nuts that secure the disconnect coupling to the pylon forward bulkhead and remove the disconnect coupling and shims from the pylon at "B" (step 2).

5—441. DISASSEMBLY.
(See figure 5—56.)

a. Remove the bolts (1), washers (18 and 16) and nuts (15) that secure the brake plate (2) to the housing assembly (10). Remove the brake plate, shim (3) and compression springs (17).

b. Remove the output coupling assembly (5) from the main shaft (9) by positioning the disconnect coupling assembly on an arbor press and, with the bridge assembly, Sikorsky part No. S1570-10350, depress the output coupling assembly (5) enough to remove the snap ring (4). Slide the output coupling (5) off the splines of the main shaft (9).

WARNING

Release the pressure on the output coupling carefully.

c. Remove the compression spring (7) and spring retainer (8) from the main shaft (9).

Note

When the alternate compression spring is used, remove the spacer (6).

d. Remove the cotter pin (20) and unscrew the bearing retaining nut (21) using the spanner wrench, Sikorsky part No. S1570-10117, in conjunction with the anti-

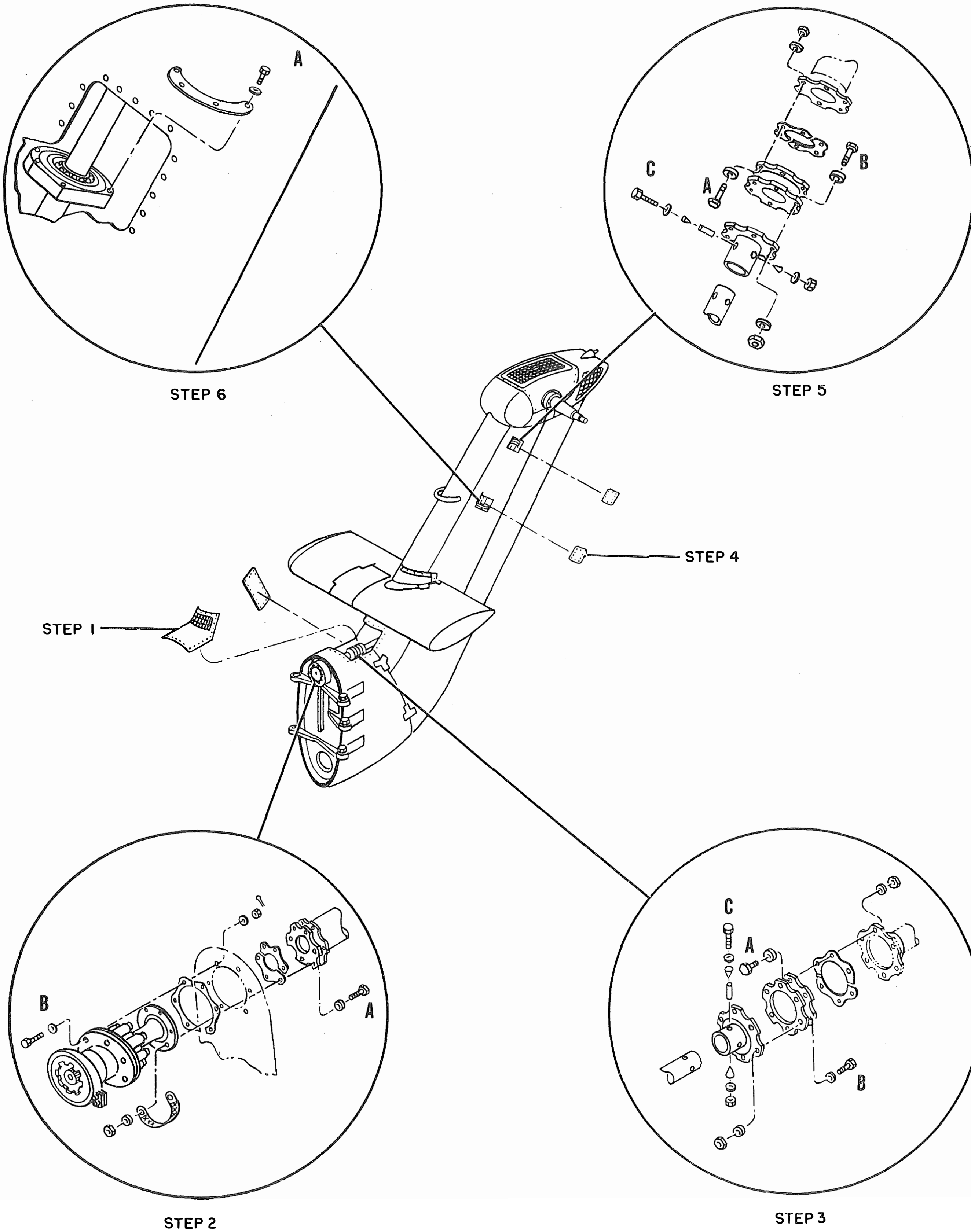
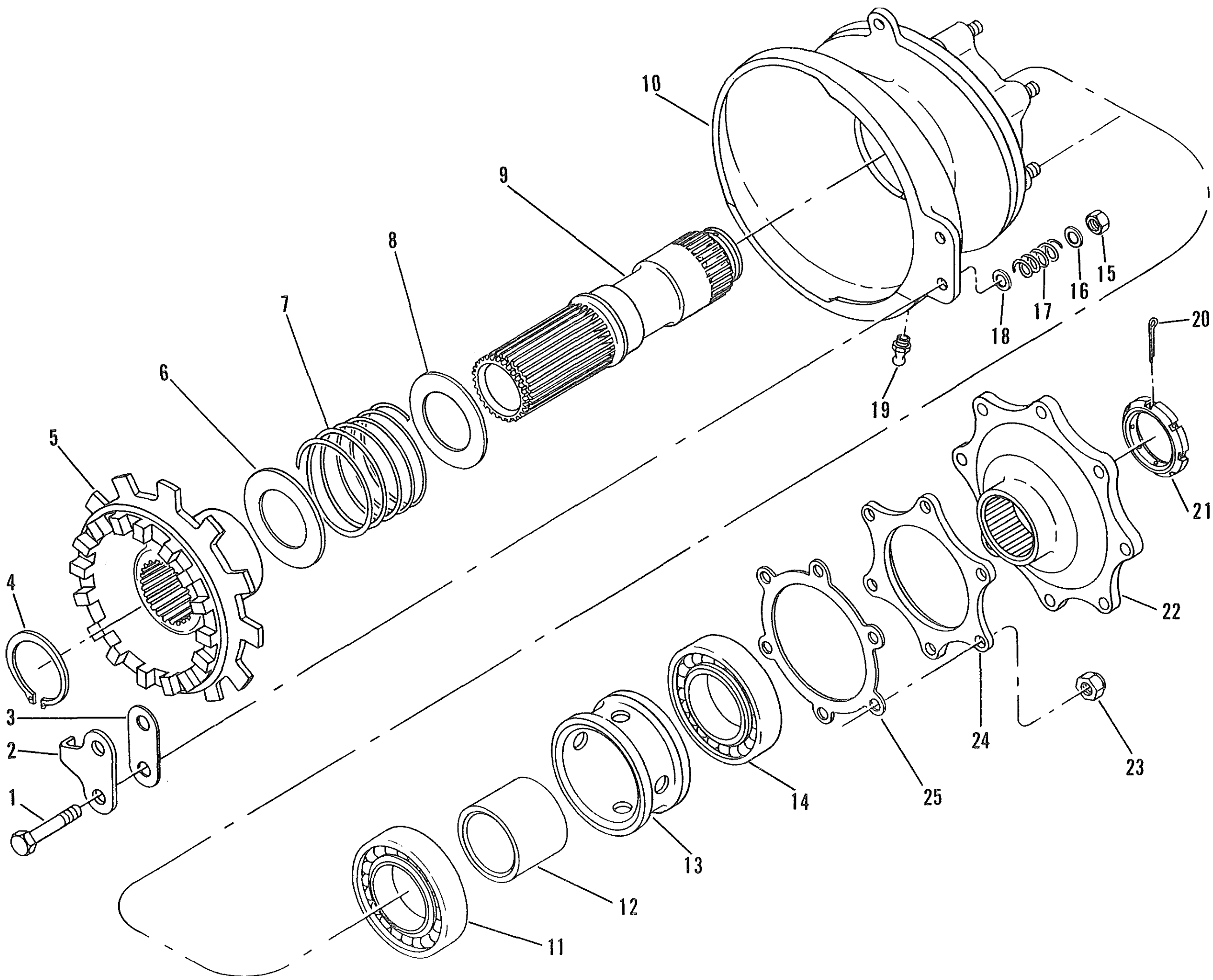


Figure 5–55. Pylon Transmission Installation



1. Bolt
2. Brake Plate
3. Shim
4. Snap Ring
5. Output Coupling Assembly
6. Spacer
7. Compression Spring
8. Spring Retainer
9. Main Shaft
10. Housing Assembly
11. Bearing
12. Spacer
13. Spacer
14. Bearing
15. Nut
16. Washer
17. Compression Spring
18. Washer
19. Lubrication Fitting
20. Cotter Pin
21. Bearing Retaining Nut
22. Flange
23. Nut
24. Bearing Retainer
25. Shim

Figure 5–56. Disconnect Coupling Disassembled

torque plate, Sikorsky part No. S1670-10401. Remove the flange (22) from the main shaft splines.

e. Remove the nuts (23) from the studs that secure the bearing retainer (24) to the housing assembly (10). Remove the bearing retainer and shim or shims (25).

f. Press or slide the main shaft (9), ball bearing set (11 and 14) and spacers (12 and 13) from the housing assembly (10).

g. Remove the ball bearing set (11 and 14) from the main shaft (9) by gripping the outer race of the bearing (14) with the bearing pulling attachment, Owatonna part No. 952-D, and depressing the shaft in an arbor press with the step plate adapter, Owatonna part No. 630-3, until the bearing is free of the shaft. Remove the spacers (12 and 13) from the shaft. Remove the inner bearing (11) by the same method.

Note

The two spacers form a matched set and must be kept together.

h. Remove the lubrication fitting (19) from the housing assembly (10).

5—442. CLEANING. Clean all metal parts in solvent (index 3, paragraph 1—32).

5—443. INSPECTION.

a. Magnaflux all steel parts.

b. Zyglo all magnesium parts.

c. Inspect all parts for damage, corrosion and excessive wear.

d. Inspect all splines for wear and burrs.

e. Inspect the gear teeth on the output coupling (5, figure 5—56) for scuffing, pitting, corrosion and wear. Check the coupling and ring for bond separation.

f. Inspect the ball bearing set (11 and 14) for brinnelling, pitting, corrosion, friction oxidation, roughness, excessive wear and cracked or worn balls.

g. Inspect all parts which show excessive wear for the dimensions given in table XXIX.

5—444. FITS AND CLEARANCES. Refer to table XXIX for fits and clearances and service tolerances for the mating parts of the disconnect coupling.

The following code is used in table XXIX:

ID — Inside Diameter
L to L — Line to Line
L — Loose
MRC — Marlin-Rockwell Corp.
OD — Outside Diameter
T — Tight

5—445. REPLACEMENTS.

a. Replace any damaged or worn parts that do not conform to the service tolerances given in the Table of Fits and Clearances (table XXIX).

b. Replace the bearings (11 and 14, figure 5—56) if they are rough or damaged.

5—446. ASSEMBLY.
(See figure 5—56.)

a. Apply anti-seize compound (index 43, paragraph 1—32) to the inner race of the bearings (11 and 14, figure 5—56). Install the ball bearing set and the spacers (12 and 13) on the main shaft (9) using a bearing pusher, Sikorsky part No. S1670-10374, and an arbor press with the step plate adapter, Owatonna part No. 630-3.

Note

Install each ball bearing with the shield away from the spacers.

Note

The two spacers form a matched set and must be installed together.

b. Press or slide the main shaft (9), ball bearing set (11 and 14) and spacers (12 and 13) into the housing assembly (10). Check to see that the inner ball bearing (11) is seated squarely against the lip of the liner.

c. Lay a straightedge across the races of the outer ball bearing (14). Measure the gap between the straightedge and the face of the housing assembly (10) with a feeler gage. Select a shim or shims (25) with a thickness that is 0.002 to 0.005 inch less than the gap. Install the shim or shims on the studs of the housing assembly (10).

d. Position the bearing retainer (24) on the studs of the housing assembly (10) with the chamfered corner facing out. Secure the retainer with the nuts (23). Tighten the nuts with 50 to 70 inch-pounds torque.

Note

The bearing retainer should clamp the outer race of the outer ball bearing (14) with a 0.002 to 0.005 inch pinch fit.

e. Lubricate the splines on each end of the main shaft (9) with graphite grease (index 24, paragraph 1—32). Install the flange (22, figure 5—56) on the short splines of the main shaft.

f. Screw the bearing retaining nut (21) on the main shaft. Tighten the nut with 30 to 40 foot-pounds torque using the spanner wrench, Sikorsky part No. S1570-10117, in conjunction with the anti-torque plate, Sikorsky

TABLE XXIX
TABLE OF FITS AND CLEARANCES — TAIL ROTOR DRIVE SHAFT DISCONNECT COUPLING

Part No.	Nomenclature	Manufacturing Dimensions (Inches)		Mating Part No.	Nomenclature	Manufacturing Dimensions (Inches)		Service Tolerance (Inches)
S1635-63311	Main Shaft	1.5753 1.5749	OD	108KSZ-DB	Bearing (MRC)	1.5748 1.5743	ID	0.0010 T 0.0001 T
S1635-63303	Housing Assembly	2.6779 2.6772	ID	108KSZ-DB	Bearing (MRC)	2.6772 2.6767	OD	0.0012 L 0.0000 L to L

part No. S1670-10401. Install the cotter pin (20) with the head inside the shaft.

g. Install the spring retainer (8) on the main shaft (9) with the chamfered corners toward the inner ball bearing (11). Install the compression spring (7) on the shaft.

h. Install the output coupling assembly (5) on the main shaft (9) and compress the spring (7) using the bridge assembly, Sikorsky part No. S1570-10350, and an arbor press, enough to install the snap ring (4) in the groove in the main shaft.

i. Install the lubrication fitting (19) in the housing assembly (10).

j. Position the shim (3) on the face of the housing assembly (10). Position the brake plate (2) over the shim with the lip pointing in. Insert the bolts (1) through the brake plate and the housing assembly. Install a washer (18), compression spring (17) and washer (16) on each bolt in that order. Install a nut (15) on each bolt, turn the nut on as far as it will go and then tighten the nut.

5—447. INSTALLATION.

a. Position the disconnect coupling and shims on the pylon forward bulkhead and secure with the bolts, washers and nuts at "B" (step 2, figure 5—55).

b. Install the shims required for a line-to-line fit and connect the disconnect coupling to the rubber coupling with the bolts, washers and nuts at "A" (step 2). Connect the bonding jumper and tighten the nuts with 50 to 70 inch-pounds torque.

Note

Whenever possible use shims so that there is the same number of shims between the forward rubber coupling and the disconnect coupling as between the aft rubber coupling and the intermediate gear box assembly. Install the bolts with the heads between the flanges of the coupling.

c. Install the air intake screened fairing (step 1) and unfold the pylon. (Refer to paragraph 1—22.)

d. Lubricate the disconnect coupling. (See figure 1—16.)

5—448. DISCONNECT SHAFT ASSEMBLY.

5—449. DESCRIPTION. The disconnect shaft assembly connects the disconnect coupling assembly with the intermediate gear box assembly in the pylon transmission installation. The disconnect shaft assembly is composed of a shaft, two flanges and two rubber couplings.

5—450. REMOVAL.

a. Remove the air intake screened fairing by removing the attaching screws (step 1, figure 5—55).

b. Support the disconnect shaft. Remove the bolts, washers, nuts and shims that secure the forward rubber coupling to the disconnect coupling at "A" (step 2). Release the bonding jumper and remove the bolts, washers, nuts and shims that secure the aft rubber coupling to the input housing of the intermediate gear box at "A" (step 3). Remove the disconnect shaft.

Note

If disassembly of the shaft assembly is desired, remove the rubber couplings and flanges by following steps c. and d.

c. Disconnect the rubber couplings from the flanges by removing the bolts, washers and nuts that secure the rubber couplings to the flanges at "B" (step 3).

d. Remove the bolts, washers, nuts, wedges and bushings that secure the flanges to the disconnect shaft and remove the flanges at "C" (step 3).

5—451. ALIGNMENT OF DISCONNECT SHAFT. The maximum misalignment (out of plane) permitted in the disconnect shaft is shown in figure 5—53.

5—452. INSTALLATION.

Note

If the rubber couplings and flanges were removed from the shaft, install them on the shaft by following steps a. and b.

a. Place the flanges on the shaft, line up the holes in the shaft and flanges, insert the bushings and wedges and bolt the flanges to the disconnect shaft assembly at "C" (step 3, figure 5—55). Tighten the nuts with 180 to 225 inch-pounds torque.

Note

The slot in each bushing must face the coupling.

b. Connect each rubber coupling to the shaft assembly by installing the bolts, washers and nuts that secure the rubber couplings to the flanges at "B" (step 3). Tighten the nuts with 50 to 70 inch-pounds torque.

c. Position the disconnect shaft in the pylon. Shim evenly at each end of the shaft to obtain a line-to-line fit. Install the bolts, washers and nuts that secure the rubber couplings to the disconnect coupling assembly at "A" (step 2) and to the intermediate gear box assembly at "A" (step 3). Connect the bonding jumper and tighten the nuts with 50 to 70 inch-pounds torque.

Note

Install the bolts with the heads between the flanges of the rubber couplings.

d. Install the air intake screened fairing. (See step 1.)

Note

Maximum allowable run-out of the disconnect shaft assembly is 0.012 inch total indicator reading.

5—453. INTERMEDIATE GEAR BOX.

5—454. DESCRIPTION. *(See figure 5—57.)* The intermediate gear box, located inside the pylon, transmits torque with no gear reduction and changes the angle of drive of the shaft between the main rotor gear box and the tail rotor gear box. The intermediate gear box consists of an input housing assembly, a center housing assembly and an output housing assembly. An oil level sight gage is located on the right side of the center housing and a magnetic drain plug is located at the bottom of the housing. An oil filler tube assembly extends from the top of the input housing upward through the skin of the pylon. Access to the gear box is gained by removing the intermediate gear box panel on the right-hand side of the pylon.

5—455. TROUBLE SHOOTING.

Trouble	Probable Cause	Remedy
Excessive oil leakage at seals	Deterioration of seals	Replace intermediate gear box
Gear box running too hot (paint scorched or blistered)	Insufficient lubrication	Service gear box with proper level and grade of oil
	Faulty bearings	Replace gear box
	Improper gear tooth clearances (backlash)	Replace gear box
High frequency vibration in helicopter structure caused by intermediate gear box	Gear box mounting nuts loose	Tighten nuts to required torque
	Bad gear box bearings	Replace gear box
	Gear teeth damaged	Replace gear box
Discoloration of heat paint stripe	Overheated bearings in area of discoloration	Replace gear box

5—456. DRAINING. Drain the service oil from the intermediate gear box by the following procedure:

a. Open the access door in the intermediate gear box access panel.

b. Cut the lock wire and unscrew the magnetic plug from the bottom plate of the center housing.

Note

The magnetic plug may now be inspected without the necessity of draining the gear box.

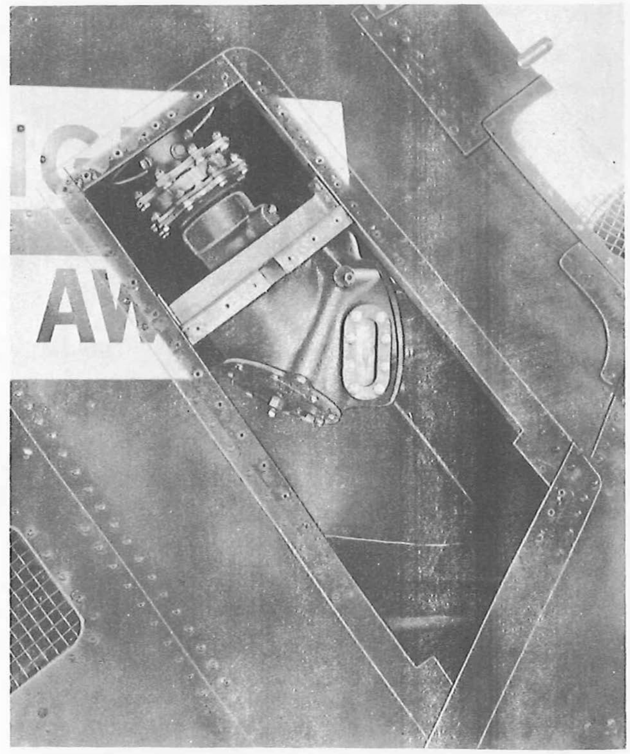


Figure 5—57. Intermediate Gear Box Installed

c. Screw the Tedeco drain attachment, D-730, into the fitting and drain the oil into a receptacle.

d. Unscrew the drain attachment, install and lockwire the magnetic plug. Close the access door.

5—457. REMOVAL.

a. Remove the intermediate gear box access panel from the right side of the pylon at "A" (step 1, figure 5—58). Remove the disconnect shaft and air intake screened fairing at "B" (step 1).

Note

On helicopters bearing USAF Serial Nos 53-4475 through 53-4478, unscrew and remove the oil filler assembly from the input housing of the intermediate gear box and remove it from the pylon.

b. Drain the service oil from the gear box. (Refer to paragraph 5—456.)

c. Remove the bolts, washers, nuts and shims that secure the rubber coupling to the input housing flange. (See step 2, figure 5—58.)

d. Remove the bolts, washers, nuts and shims that secure the rubber coupling to the output housing flange. (See step 3.) Release the bonding jumper.

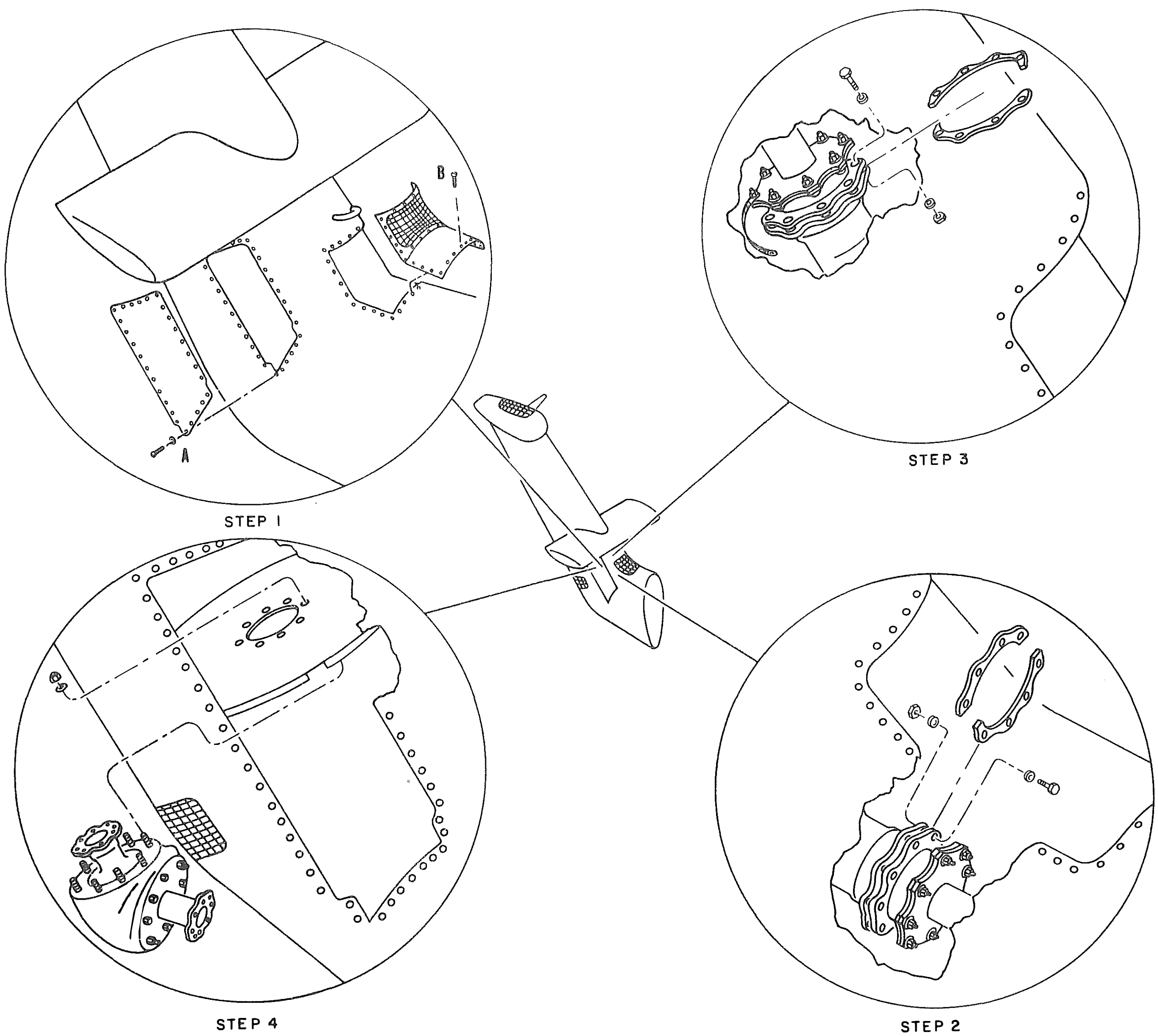


Figure 5—58. Intermediate Gear Box Removal

e. Support the gear box. Remove the nuts and washers that secure the gear box to the frame and lift out the gear box and shim. (See step 4.)

5—458. DISASSEMBLY AND ASSEMBLY. The intermediate gear box is to be disassembled and assembled only by qualified personnel at an Overhaul Depot.

5—459. CLEANING. Wash the external surfaces of the intermediate gear box with solvent (index 3, paragraph 1—32) or a low grade of kerosene (index 19, paragraph 1—32).

5—460. PREPARATION FOR SHIPMENT.

a. Drain all the service oil from the gear box at the bottom of the center housing assembly.

b. Slosh corrosion-preventive mixture throughout the gear box. Prepare corrosion-preventive mixture locally by combining 25 percent of corrosion-preventive compound concentrate (index 7, paragraph 1—32) with 75 percent of service oil (index 34, paragraph 1—32).

c. Drain excess mixture from the gear box.

d. Coat unprotected machined surfaces with corrosion-preventive compound (index 4, paragraph 1—32). Cover with greaseproof wrapping paper (index 8, paragraph 1—32) and secure with adhesive tape (index 9, paragraph 1—32).

5—461. PLACING IN SERVICE AFTER SHIPMENT.

a. Remove the greaseproof wrapping paper and adhesive tape.

b. Remove the corrosion-preventive compound from the external machined surfaces with solvent (index 3, paragraph 1—32).

c. Slosh service oil throughout the gear box. Drain the gear box.

d. Install the gear box and refill with service oil.

5—462. INSTALLATION.

a. Position the intermediate gear box in the pylon and secure the gear box in place on the frame with the washers and nuts. (See step 4, figure 5—58.)

b. Install shims for a line-to-line fit, connect the bonding jumper and fasten the rubber coupling to the output housing flange with the bolts, washers and nuts. (See step 3.) Tighten the nuts with 50 to 70 inch-pounds torque.

c. Install shims for a line-to-line fit and fasten the rubber coupling to the input housing flange with the bolts, washers and nuts. (See step 2.) Tighten the nuts with 50 to 70 inch-pounds torque.

d. Replace the disconnect shaft and air intake screened fairing at "B" (step 1) and replace the access panel at "A" (step 1).

Note

On helicopters bearing USAF Serial Nos 53-4475 through 53-4478, install the oil filler assembly by inserting it through the hole in the pylon skin and securing it to the input housing of the intermediate gear box.

e. Fill the gear box with service oil. (See figure 1—14.)

5—463. PYLON DRIVE SHAFT.

5—464. DESCRIPTION. The pylon drive shaft which is mounted inside the pylon, transmits torque from the intermediate gear box at the bottom of the pylon to the tail rotor gear box at the top of the pylon. The drive shaft consists of a shaft with an attachment flange and a rubber coupling at either end and a support bearing in the middle. The shaft is installed inside the pylon with the lower rubber coupling attached to the intermediate gear box and the upper rubber coupling attached to the tail rotor gear box. Access to the shaft components is gained at three places: through the intermediate gear box access panel on the lower, right side of the pylon, through the support bearing access panel near the center on the left side of the pylon and through the coupling access panel at the upper left side of the pylon.

5—465. TROUBLE SHOOTING.
(Refer to paragraph 5—455.)

5—466. REMOVAL.

a. Remove the intermediate gear box access panel (step 1, figure 5—58), the support bearing access panel (step 4, figure 5—55) and the upper rubber coupling access panel from the left side of the pylon.

b. Remove the bolts, washers, nuts and shims that secure the lower rubber coupling to the output flange of the intermediate gear box. (See step 3, figure 5—58.) Release the bonding jumper.

c. Remove the tail rotor gear box. (Refer to paragraph 5—476.)

d. Support the drive shaft. Disconnect the support bearing from the frame by removing the bolts, washers, nuts and bearing ring. (See step 6, figure 5—55.)

e. Remove the bearing support from the pylon frame.

f. Lift out the pylon drive shaft assembly.

Note

If disassembly of the shaft assembly is necessary, remove the rubber couplings and flanges by following steps g. and h.

g. Remove the bolts, washers and nuts at "B" (step 5) and remove the rubber coupling from each end of the shaft.

h. Remove the bolts, washers, nuts, bushings and wedges that secure the flange to each end of the drive shaft and slide the flanges off the shaft at "C" (step 5).

5—467. REPLACEMENT OF DRIVE SHAFT SUPPORT BEARING.
(Refer to paragraph 5—419.)

5—468. BONDING LOOSE BUSHING TO SHAFT.
(Refer to paragraph 5—420.)

5—469. ALIGNMENT OF PYLON DRIVE SHAFT. The maximum misalignment (out of plane) permitted in the pylon drive shaft is shown in figure 5—54.

5—470. INSTALLATION.

Note

If the rubber couplings and flanges were removed from the shaft, install them on the shaft by following steps a. and b.

a. Slide the flanges on the ends of the drive shaft, line up the holes and install the bolts, washers, nuts, bushings and wedges that secure them to the drive shaft at "C" (step 5, figure 5—55). Tighten the nuts with 180 to 225 inch-pounds torque.

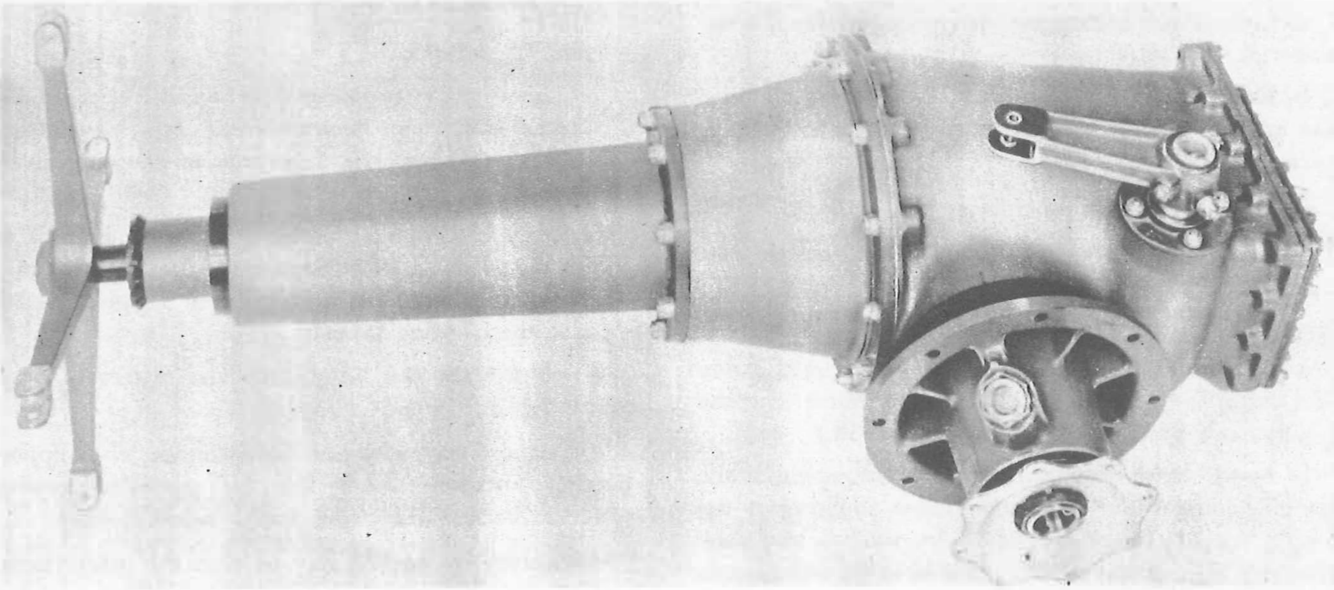


Figure 5–59. Tail Rotor Gear Box Assembly

b. Position the rubber couplings and install the bolts, washers and nuts that secure them to the flanges of the drive shaft at "B" (step 5). Tighten the nuts with 50 to 70 inch-pounds torque.

Note

Install the bolts with the heads between the flanges of the coupling.

c. Position the drive shaft assembly in the pylon.

CAUTION

The drive shaft must be supported until two or more attaching points are connected.

d. Bolt the bearing support to the pylon frame.

e. Install the tail rotor gear box (paragraph 5–482), but do not bolt the shaft to the flange.

f. Install one bolt and nut on each side of the upper rubber coupling and tighten so that the drive shaft assembly is tight against the input housing flange of the tail rotor gear box. At the support bearing, measure the distance between the lower surface of the bearing and the center cell frame. Unbolt the upper end of the drive shaft from the tail rotor gear box. Install the necessary amount of shim, as measured, between the upper rubber coupling and the tail rotor gear box and install the bolts, washers and nuts at "A" (step 5, figure 5–55). Tighten the nuts with 50 to 70 inch-pounds torque.

Note

Install the bolts with the heads between the flanges of the coupling.

g. Install the bearing ring, bolts, washers and nuts that secure the support bearing to the pylon frame. (See step 6.)

h. Insert the required amount of shims for a line-to-line fit between the lower rubber coupling and the output housing flange of the intermediate gear box and install the bolts, washers and nuts. (See step 3, figure 5–58.) Tighten the nuts with 50 to 70 inch-pounds torque.

Note

If possible, the same amount of shims should be used at each end of the shaft. Install the bolts with the heads between the flanges of the coupling.

i. Replace the intermediate gear box access panel (step 1, figure 5–58), the support bearing access panel (step 4, figure 5–55), and the upper rubber coupling access panel on the pylon.

5–471. MAINTENANCE.
(Refer to paragraph 5–430.)

5–472. TAIL ROTOR GEAR BOX ASSEMBLY.

5–473. DESCRIPTION. *(See figure 5–59.)* The tail rotor gear box, which is located on top of the pylon, performs three functions: it controls the pitch of the tail rotor; it changes the angle of drive from the intermediate gear box; and it reduces the rpm of the tail drive shaft to the tail rotor assembly rpm. An arm assembly on the aft side of the gear box, connected to the tail rotor control linkage, actuates a lever and rod assembly within the gear box. An actuator shaft assembly attached to the rod assembly operates a pitch beam bolted to the shaft assembly. The pitch beam connects to the sleeve of each tail rotor blade to change the pitch of the blades. An oil level sight gage indicates oil level when the pylon is unfolded, a dip stick is provided for measuring the oil level when the pylon is folded. The gear box is splash lubricated and has an oil filler located on the top of the intermediate housing assembly and a Tedeco magnetic drain plug installed in the bottom of the input housing assembly.

5—474. TROUBLE SHOOTING.

Trouble	Probable Cause	Remedy
High frequency vibration in helicopter structure caused by tail rotor gear box	Gear box mounting nuts loose	Tighten nuts
	Bad bearings in gear box	Replace gear box
	Gear teeth damaged	Replace gear box
Gear box running too hot (paint scorched or blistered)	Insufficient lubrication	Service gear box with proper level and grade of oil
	Bad bearings	Replace gear box
	Improper gear tooth clearance (backlash)	Replace gear box
Excessive oil leakage at seals	Deterioration of seals	Replace gear box
Discoloration of heat paint stripe	Overheated bearings in area of discoloration	Replace gear box

5—475. DRAINING. Drain the service oil from the tail rotor gear box using the following procedure:

a. Remove the access panel on the upper left side of the pylon.

b. Cut the lock wire and unscrew the magnetic drain plug from the tail rotor gear box.

Note

The magnetic plug may now be inspected without the necessity of draining the gear box.

c. Screw the Tedeco drain attachment, D-730, into the fitting and drain the oil into a receptacle.

d. Unscrew the drain attachment, replace and lockwire the magnetic drain plug and install the access panel.

5—476. REMOVAL.

a. Remove the tail rotor assembly. (Refer to paragraph 2—362.)

b. Remove the upper rubber coupling access panel at "A" (step 1, figure 5—60). Disconnect the rubber coupling from the input housing by removing the bolts, washers, nuts and shims at "B" (step 1).

c. Drain the gear box. (Refer to paragraph 5—475.)

d. Remove the tail rotor gear box screened cover. (See step 2, figure 5—60.)

e. Disconnect the control rod assembly from the arm assembly on the tail rotor gear box by removing the bolt, washers, nut and cotter pin at "A" (step 3). Disconnect the nuts and washers from the studs that secure the tail rotor gear box assembly to the bulkhead at the top of the pylon and lift the tail rotor gear box off the pylon at "B" (step 3).

5—477. DISASSEMBLY AND ASSEMBLY. This unit is to be disassembled and assembled only by qualified personnel at an Overhaul Depot. The pitch beam may be replaced in the field if necessary.

5—478. CLEANING. Wash the external surfaces of the tail rotor gear box with solvent (index 3, paragraph 1—32) or a low grade of kerosene (index 19, paragraph 1—32).

5—479. REPLACEMENT OF PITCH BEAM.

a. Place the pitch beam on the tail gear box actuator shaft so that the tapered edge of the beam arms face the gear box.

b. Align the pilot hole in the pitch beam with the tapered hole in the shaft and taper ream the pitch beam using a Brown and Sharpe No. 3 taper reamer or equivalent.

CAUTION

Care should be exercised not to enlarge the diameter of the tapered hole in the actuator shaft.

c. Secure the pitch beam with taper pin, washer and nut, tighten the nut with 40 to 60 inch-pounds torque, and insert the cotter pin.

Note

The small end of the taper pin shank should not extend more than 1/16-inch above the surface of the pitch beam.

5—480. PREPARATION FOR SHIPMENT.

a. Replace the pitch beam on the drive shaft and install the taper pin, washer, nut and cotter pin. Drain all the service oil out of the tail rotor gear box.

b. Prepare a corrosion-preventive mixture by combining 25 percent of corrosion-preventive compound concentrate (index 7, paragraph 1—32) with 75 percent of service lubricant (index 34, paragraph 1—32).

c. Slosh the corrosion-preventive mixture throughout the tail rotor gear box.

d. Drain the excess mixture from the tail rotor gear box.

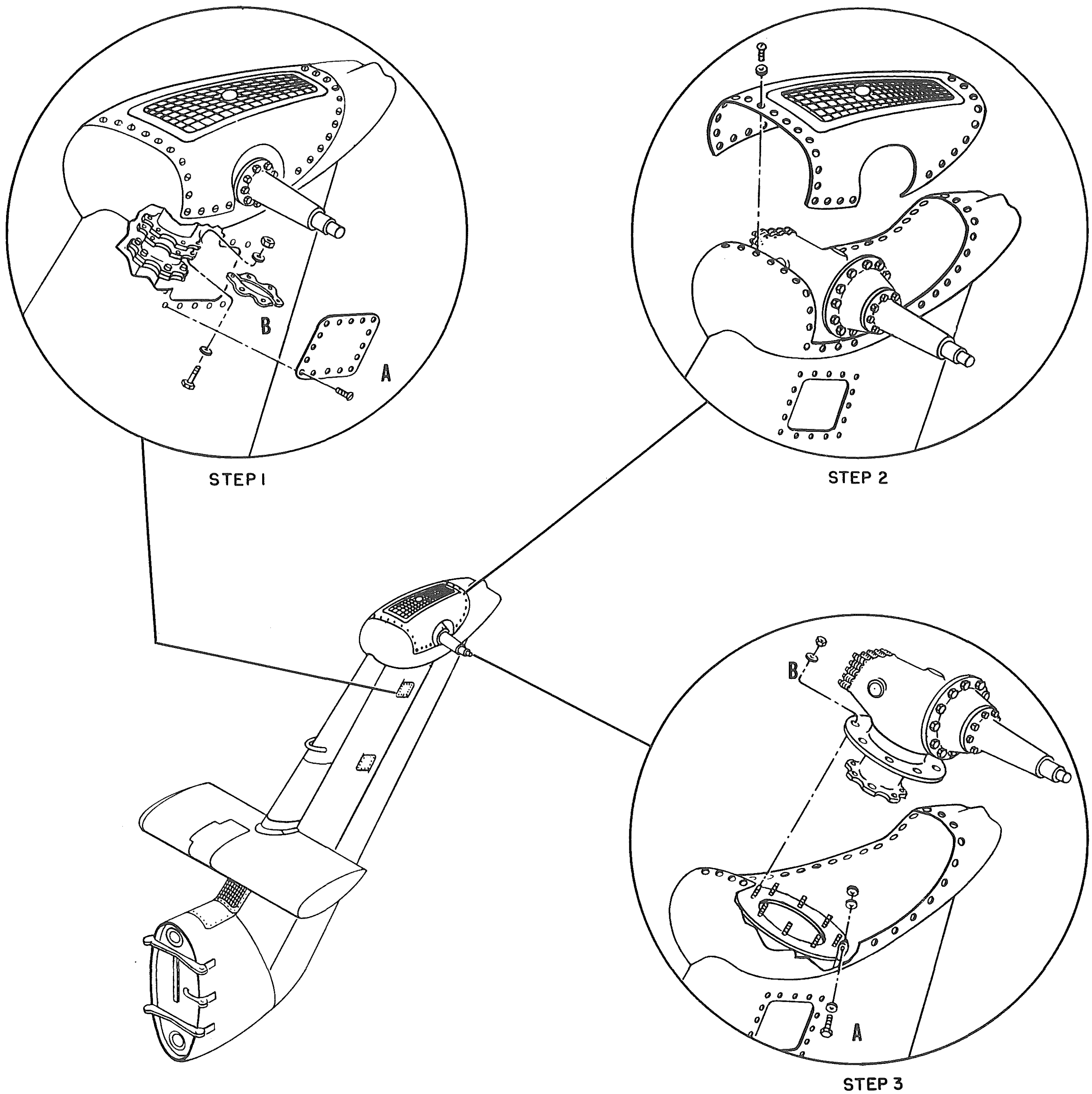


Figure 5—60. Tail Rotor Gear Box Removal

e. Coat the unprotected machined surfaces, such as the shafts, with hard-film corrosion-preventive compound (index 4, paragraph 1—32). Cover the unprotected machined surfaces with greaseproof wrapping paper (index 8, paragraph 1—32) and secure with adhesive tape (index 9, paragraph 1—32). Pack in a suitable container.

5—481. PLACING IN SERVICE AFTER SHIPMENT.

a. Remove the greaseproof wrapping paper.

b. Remove the corrosion-preventive compound from the unprotected machined surfaces with a solvent (index 3, paragraph 1—32).

c. Slosh service oil throughout the tail rotor gear box.

d. Drain the service oil, install the gear box and refill with service oil.

5—482. INSTALLATION.

a. Install the tail rotor gear box at the bulkhead on the top of the pylon and secure it to the studs with the washers and nuts at "B" (step 3, figure 5—60). Secure the control rod assembly to the arm assembly on the tail rotor gear box with the bolt, washers, nut and cotter pin at "A" (step 3).

b. Replace the shims and secure the rubber coupling on the drive shaft to the input housing with the bolts, washers and nuts at "B" (step 1). Tighten the nuts with 50 to 70 inch-pounds torque.

Note

Install the bolts with the heads between the flanges of the rubber coupling.

c. Fasten the upper rubber coupling access panel in place at "A" (step 1).

d. Fill the tail rotor gear box with service oil. (See figure 1—16, sheet 3.)

e. Install the tail rotor assembly (paragraph 2—370).

f. Check the tail rotor rigging (paragraph 2—524).

g. Fasten the tail rotor gear box fairing cover in place. (See step 2, figure 5—60.)

SECTION VI

INSTRUMENTS

TABLE OF CONTENTS

Paragraph		Page
6—1.	**INSTRUMENTS**	**336**
6—3.	INSTRUMENT PANEL	336
6—7.	**FLIGHT INSTRUMENTS**	**336**
6—9.	AIR-SPEED INDICATOR	336
6—14.	ALTIMETER	339
6—19.	CLOCK	340
6—24.	J-2 GYRO COMPASS SYSTEM	340
6—29.	COMPENSATING COMPASS	342
6—30.	STANDBY COMPASS	343
6—35.	COMPENSATING COMPASS	344
6—36.	GYRO-HORIZON INDICATOR	345
6—41.	RATE-OF-CLIMB INDICATOR	346
6—46.	TURN-AND-BANK INDICATOR	346
6—51.	FREE-AIR THERMOMETER	348
6—55.	**ENGINE INSTRUMENTS**	**348**
6—57.	DUAL TACHOMETER INDICATOR SYSTEM	348
6—62.	MANIFOLD PRESSURE GAGE SYSTEM	349
6—67.	CARBURETOR AIR TEMPERATURE INDICATOR SYSTEM	350
6—72.	CYLINDER HEAD TEMPERATURE INDICATOR SYSTEM	351
6—77.	ENGINE OIL PRESSURE INDICATOR SYSTEM	351
6—82.	ENGINE OIL TEMPERATURE INDICATOR SYSTEM	352
6—87.	FUEL PRESSURE GAGE SYSTEM	354
6—88.	FUEL QUANTITY SYSTEM	354
6—89.	FUEL LOW LEVEL WARNING SYSTEM	354
6—90.	FUEL LOW PRESSURE WARNING SYSTEM	354
6—91.	AMMETER	354
6—92.	**TRANSMISSION SYSTEM INSTRUMENTS**	**354**
6—94.	TRANSMISSION OIL TEMPERATURE INDICATOR SYSTEM	354
6—99.	TRANSMISSION OIL PRESSURE INDICATOR SYSTEM	355
6—104.	TRANSMISSION OIL PRESSURE WARNING SYSTEM	356
6—108.	**HYDRAULIC SYSTEM INSTRUMENTS**	**356**
6—110.	PRIMARY HYDRAULIC PRESSURE INDICATOR	356
6—114.	AUXILIARY HYDRAULIC PRESSURE INDICATOR	357
6—118.	**PITOT-STATIC SYSTEM**	**358**
6—120.	PITOT PRESSURE SYSTEM	358
6—125.	TESTING PITOT SYSTEM	358
6—126.	STATIC PRESSURE SYSTEM	358
6—131.	TESTING STATIC SYSTEM	359-360

6–1. INSTRUMENTS.

6–2. DESCRIPTION. *(See figures 6–1, 6–2 and 6–4.)* The instruments, with the exception of the standby compass and the free-air thermometer, are installed on the instrument panel in front of the pilot and observer. In this section of the handbook, the instruments are divided into the following classifications: flight, engine, transmission system or hydraulic system. The instruments have either pressure tubing or electrical wiring connections.

6–3. INSTRUMENT PANEL.

6–4. DESCRIPTION. *(See figure 6–1.)* The instrument panel is located in the cockpit in front of the pilot and observer. The instrument panel is shock-mounted in such a manner as to absorb both vertical and horizontal forces. Lights are installed on the instrument panel adjacent to each of the ten instruments located directly to the right of the main switch panel. Each of the remaining instruments is illuminated by two lights within a shield which is mounted on the upper part of the instrument. Access to the upper mounting screws of these instruments is gained by hinging down the face of the shield and removing the two bulbs. See figure 6–2 for a schematic diagram of the instrument panel.

6–5. REMOVAL.

a. Remove the cowl panel from the top of the instrument panel by unlocking the Camloc fasteners.

b. Disconnect the tubing and wiring from all the instruments.

c. Unbolt the instrument panel from the upper shock mounts.

d. Unbolt the instrument panel from the lower shock mounts and carefully remove it from the helicopter.

e. Unscrew the mounting screws which secure the instruments to the instrument panel and remove the instruments.

6–6. INSTALLATION.

a. Install the instruments on the instrument panel.

b. Position the instrument panel and bolt it to the lower shock mounts.

c. Bolt the instrument panel to the upper shock mounts.

Note

The upper shock mounts must be free to rotate after locking the nuts.

d. Connect the tubing and wiring to each of the instruments.

e. Secure the cowl panel to the top of the instrument panel by locking the Camloc fasteners.

CAUTION

Check for a minimum clearance of 1/4-inch between the cowl panel and the adjacent transparent panels. The upper shock mounts may be adjusted ± 5/16-inch, if necessary, to obtain this clearance.

6–7. FLIGHT INSTRUMENTS.

6–8. DESCRIPTION. *(See figure 6–1.)* The flight instruments provide the pilot and observer with the information necessary to navigate and maintain the correct flight attitude of the helicopter. The flight instruments also indicate changes in time and temperature. Included in the flight instrument group are the air-speed indicator, altimeter, clock, gyro compass, standby compass, gyro-horizon indicator, rate-of-climb indicator, turn-and-bank indicator and free-air thermometer.

6–9. AIR-SPEED INDICATOR.

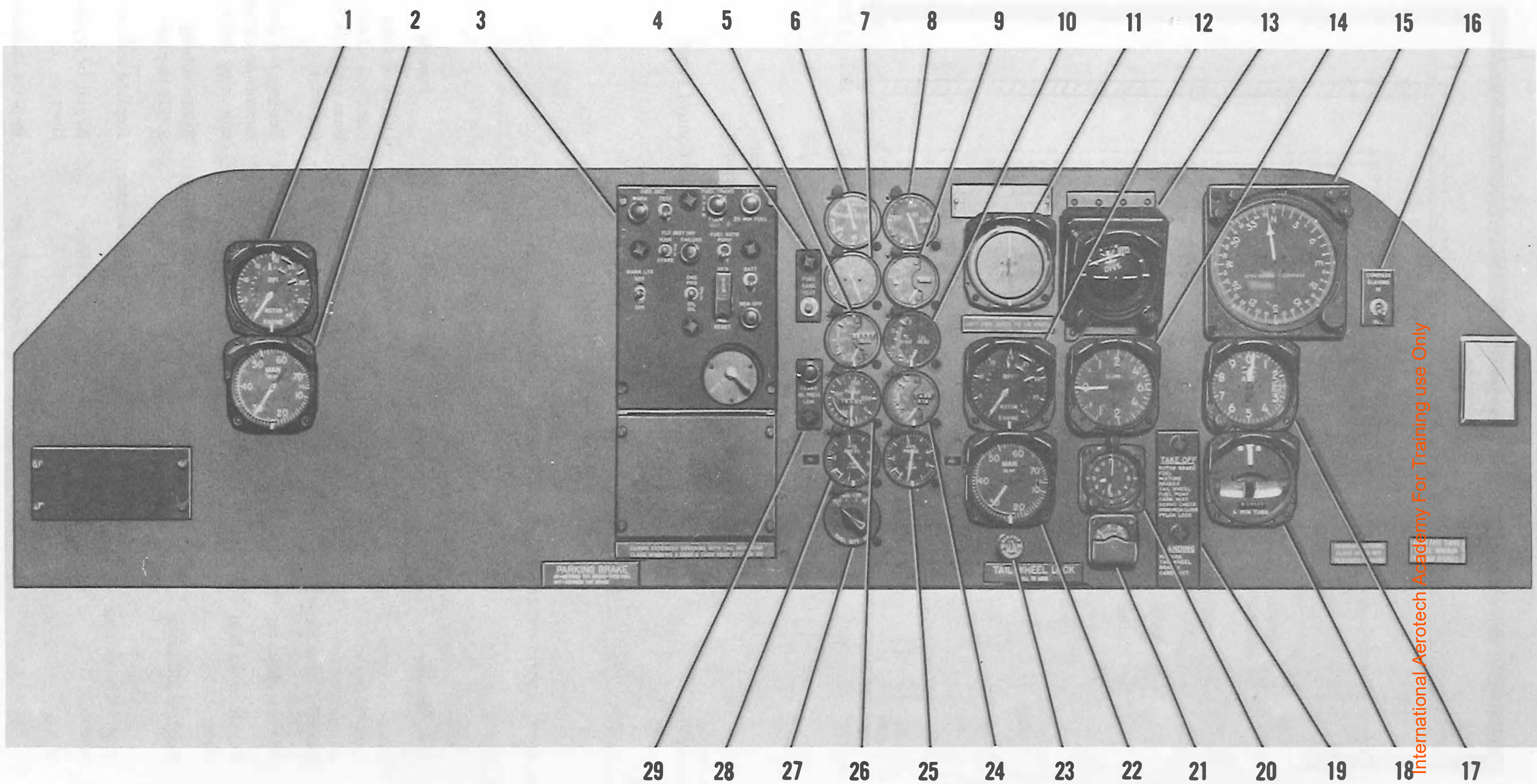
6–10. DESCRIPTION. *(See figures 6–1 and 6–2.)* The air-speed indicator is designed to indicate the speed of the helicopter relative to the air through which it is flying. The indicator, which is mounted on the pilot's side of the instrument panel, is connected by tubing to both the pitot tube and static pressure connection. The indicator has a single dial and pointer. The dial has a range of 0 to 150 knots and is divided into increments of five knots each. The air-speed correction card is mounted in a holder attached to the instrument panel. The indicator consists primarily of an airtight diaphragm assembly and a linkage for multiplying its deflection. The pitot tube is connected to the interior of the diaphragm and the static tube to the case. As the speed of the helicopter increases, the increased pressure inside the diaphragm causes the latter to expand. The rocking shaft picks up the motion by means of its diaphragm lever and in turn transmits its motion through the long lever to the sector and finally to the hand staff pinion. The pointer fastened to the hand staff indicates air speed in knots.

6–11. TROUBLE SHOOTING.

CAUTION

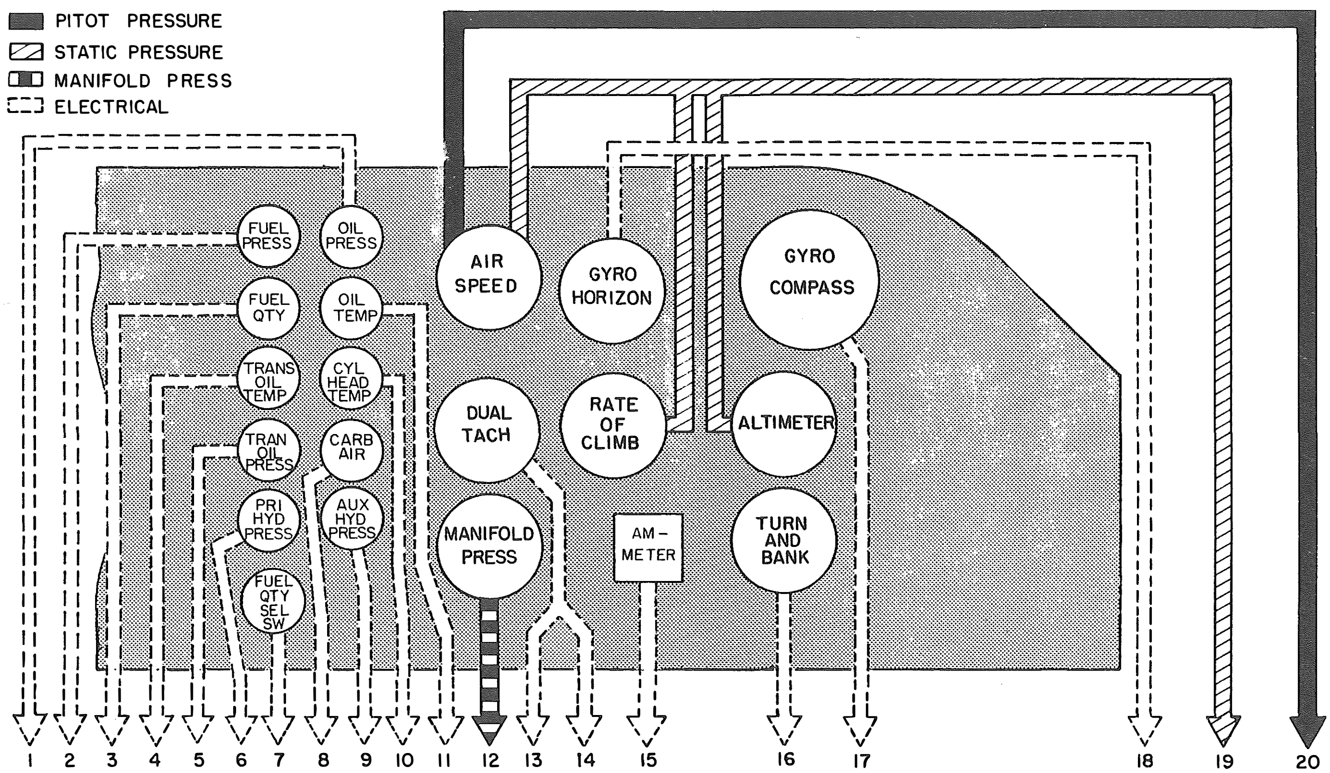
The air-speed indicator is connected to the static connection through the same lines as the altimeter and the rate-of-climb indicator. Care should be exercised when working on one of the instruments, to avoid damaging the others.

Trouble	Probable Cause	Remedy
Pointer fails to respond	Pressure line not properly connected	Make the proper connections



1. Observer's Dual Tachometer Indicator
2. Observer's Manifold Pressure Gage
3. Main Switch Panel
4. Fuel Quantity Indicator Test Switch
5. Transmission Oil Temperature Indicator
6. Fuel Pressure Gage
7. Fuel Quantity Indicator
8. Engine Oil Pressure Indicator
9. Engine Oil Temperature Indicator
10. Cylinder Head Temperature Indicator
11. Air-Speed Indicator
12. Pilot's Dual Tachometer Indicator
13. Gyro-Horizon Indicator
14. Rate-of-Climb Indicator
15. Gyro Compass
16. Gyro Compass Slaving Switch
17. Altimeter
18. Turn-and-Bank Indicator
19. Check List
20. Clock
21. Ammeter
22. Pilot's Manifold Pressure Gage
23. Manifold Pressure Gage Purge Valve
24. Carburetor Air Temperature Indicator
25. Auxiliary Hydraulic Pressure Indicator
26. Transmission Oil Pressure Indicator
27. Fuel Quantity Selector Switch
28. Primary Hydraulic Pressure Indicator
29. Transmission Oil Pressure Warning Light

Figure 6—1. Instrument Panel



1. To Oil Pressure Transmitter
2. To Fuel Pressure Transmitter
3. To Fuel Quantity Selector Switch
4. To Transmission Oil Temperature Bulb
5. To Transmission Oil Pressure Transmitter
6. To Primary Hydraulic Pressure Transmitter
7. To Tank Probes
8. To Carburetor Air Temperature Bulb
9. To Auxiliary Hydraulic Pressure Transmitter
10. To Cylinder Temperature Bulb
11. To Oil Inlet Temperature Bulb
12. To Manifold Pressure Connection
13. To Rotor Tachometer-Generator
14. To Engine Tachometer-Generator
15. To Ammeter Shunt
16. To Primary Bus On Overhead Control Panel
17. To Compass Amplifier
18. To Inverter
19. To Static Connection
20. To Pitot Tube

Figure 6—2. Instrument Panel Schematic Diagram

Trouble	Probable Cause	Remedy
Pointer fails to respond (cont)	Lines clogged with foreign matter or moisture	Disconnect the lines from the instrument and blow the lines clear
	Defective indicator	Replace indicator
Pointer indicates incorrectly	Leak in lines	Repair or replace lines
	Defective or leaking indicator	Replace indicator
Erratic pointer movement	Loose mounting	Tighten mounting screws
Pointer does not set on "O" when helicopter is not in motion	Defective indicator	Replace indicator
	Water or dirt in the pitot or static lines	Disconnect the pitot and static lines and blow out the lines
Pointer vibrates	Excessive instrument panel vibration	Replace the shock mounts or tighten mounting bolts
	Excessive vibration of lines	Fasten tubing firmly in place
	Defective indicator	Replace indicator
Pointer oscillates	Leak in lines	Repair or replace lines
	Leaky bellows	Replace indicator
	Leaky case	Replace indicator

6—12. REMOVAL.

a. Remove the mounting screws from the face of the indicator.

b. Pull the indicator and light shield out from the instrument panel and disconnect the tubing. If the tubing connections are not accessible, remove the cowl panel from the instrument panel, then disconnect the tubing from the indicator.

c. Remove the indicator.

6—13. INSTALLATION.

a. Connect the tubing to the rear of the indicator.

b. Position the indicator on the instrument panel. If the removal of the cowl panel was necessary to disconnect the tubing, install the cowl panel and secure the Camloc fasteners.

c. Secure the indicator and light shield to the instrument panel with the mounting screws.

6—14. ALTIMETER.

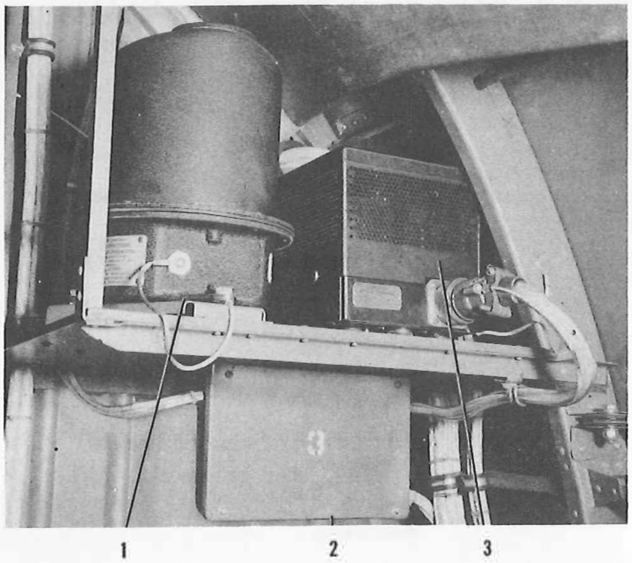
6—15. DESCRIPTION. *(See figures 6—1 and 6—2.)* The barometric altimeter is installed in front of the pilot. The altimeter indicates the height of the helicopter above sea level under standard conditions of temperature and atmospheric pressure. The instrument range is 0 to 50,000 feet. There are three pointers for the instrument scale. The outer scale is graduated in increments of 100 feet. The middle scale is graduated in increments of 1000 feet. The inner scale is graduated in increments of 10,000 feet. A small scale showing through a cut-out on the face plate is used for adjusting the altimeter to different barometric pressures. This is called the altimeter "barometric scale." It is adjusted by turning a small knob at the edge of the instrument case. The altimeter setting is the reading on the barometric scale of a master altimeter on the ground at any given airport when the pointers are set to indicate the actual altitude of that airport. If this value is set on the barometric scale of the helicopter's altimeter, it automatically corrects the altitude indications. The altimeter consists of a diaphragm assembly and a mechanism for multiplying its deflection. The instrument case is airtight and its only outlet connects to the static pressure tubing. A change in altitude is accompanied by a change in air pressure which results in movement of the diaphragm. A link from the diaphragm transmits motion to the calibration train connected to the pointer hand staff. A hairspring, which is secured to a member of the gear train and to the mechanism body, removes any backlash from the mechanism.

6—16. TROUBLE SHOOTING.

CAUTION

The altimeter is connected to the static connection through the same lines as the rate-of-climb and air-speed indicators. Care should be exercised when working on one of the instruments to avoid damaging the others.

Trouble	Probable Cause	Remedy
Excessive pointer oscillation	Excessive vibration caused by worn or deteriorated shock mounts	Replace shock mounts
	Insufficient hair-spring tension	Replace altimeter
	Loose bearing pins	Replace altimeter
	Insufficient balance arm tension	Replace altimeter
	Defective mechanism	Replace altimeter
Low or high reading	Leak in line	Repair or replace line
	Loose pointer	Replace altimeter
Pointers indicating inaccurately	Shifting of parts due to shock	Reset altimeter
	Excessive pressure	Reset altimeter
Setting knob turns excessively hard or fails to move reference marker	Defective altimeter	Replace altimeter
Setting knob screw loose or missing	Excessive vibration; careless maintenance	Tighten screw if loose. Replace altimeter if screw is missing
Cracked cover glass	Excessive vibration; careless handling	Replace cover glass
Dull or discolored luminous markings	Age	Replace altimeter
Barometric scale or reference markers not synchronized with pointers	Slippage in mating	Replace altimeter
Pointers fail to respond	Static pressure lines clogged	Disconnect all instruments from static line and blow line clear with dry air
	Static lines not properly connected	Check connection of static lines
Case leaks	Dried out washers or gaskets	Replace altimeter
	Porous case	Replace altimeter
Pointer sticks	Defective instrument	Replace altimeter



1. Directional Gyro Control
2. Junction Box
3. Amplifier

Figure 6–3. J-2 Compass System Directional Control Gyro and Amplifier Installed

6–17. REMOVAL.

a. Remove the mounting screws from the face of the altimeter.

b. Pull the altimeter and light shield out from the instrument panel and disconnect the tubing. If the tubing connection is not accessible, remove the cowl panel from the instrument panel, then disconnect the tubing from the altimeter.

c. Remove the instrument.

6–18. INSTALLATION.

a. Connect the tubing to the rear of the altimeter.

b. Position the altimeter on the instrument panel. If the removal of the cowl panel was necessary to disconnect the tubing, install the cowl panel and secure the Camloc fasteners.

c. Secure the altimeter and light shield to the instrument panel with the mounting screws.

6–19. CLOCK.

6–20. DESCRIPTION. *(See figure 6–1.)* An eight-day, 12-hour standard clock with a sweep second hand is installed on the pilot's side of the instrument panel. The knob at the lower left corner of the clock case serves the dual purpose of winding the main spring and, when pulled out slightly, setting the hands. The sweep second hand is mounted on the same center as the minute and hour hands.

6–21. REMOVAL.

a. Remove the mounting screws from the face of the clock.

b. Pull the clock out of the instrument panel.

6–22. INSTALLATION.

a. Position the clock on the instrument panel.

b. Secure the clock to the instrument panel with the mounting screws.

6–23. MAINTENANCE. Wind the clock every six days to insure dependability. Repair is limited to replacement of broken cover glass.

6–24. J-2 GYRO COMPASS SYSTEM.

6–25. DESCRIPTION. *(See figures 6–1, 6–2 and 6–3.)* The J-2 gyro compass system consists of a single-channel amplifier, a directional gyro control, a dial-type compass indicator, a slaving switch marked "COMPASS SLAVING-IN-OUT," a transmitter and a transmitter compensator. The transmitter and transmitter compensator are located in the forward section of the tail cone; the amplifier and directional gyro control are located in the electronics compartment; the indicator and slaving switch are located on the instrument panel. The amplifier amplifies the signal of the rotor, detects the phase of the flux valve synchro in the directional gyro control, controls the direction and amount of torque in the slaving torque motor, applies an initial high voltage to the leveling and slaving torque motors and accelerates the erection of the gyro and its slaving to the direction sensed by the transmitter. The directional gyro control is an electrically driven gyro which is aligned to the earth's magnetic field, thus providing a reference for automatic control of the helicopter about its vertical axis. The control houses the gyro, the spin axis of which is maintained tangent to the earth's surface and aligned to the earth's magnetic field to furnish a base magnetic reference from which the magnetic heading of the helicopter can be determined. The compass card, which is located at the top of the gyro control, is calibrated in one-degree increments through 360 degrees. The card is used as a reference when checking the system. The indicator, mounted on the pilot's side of the instrument panel, indicates the true magnetic heading of the helicopter established by the remote compass transmitter and the directional gyro control. When the directional gyro is not slaved to the compass transmitter, the compass indicator functions as a directional gyro indicator. The indicator dial is calibrated in two-degree graduations through 360 degrees. The set course knob on the lower right race of the indicator rotates the combined synchro, dial and pointer assemblies as a correlated unit. The transmitter compensation unit counteracts distortion originating from magnetic helicopter parts and electrical apparatus located in the vicinity of the transmitter. It is attached to the transmitter and contains four permanent magnets that are turned by means of two slotted gear shafts. The shafts are identified by "NS" and "EW." Alignment of the dots on the shafts with those on the compensator cover indicates the magnets are in neutral position. The transmitter is the direction sensing component of the compass system. It detects the direction of the lines of force in the earth's magnetic field and transmits this information electrically to a precession coil in the gyro control, thus aligning the gyro to the magnetic meridian. The 115 VAC power used by the compass system is provided by the inverters through fuses on the fuse panel and the 28 VDC power is supplied from the primary bus. A compass interlock relay insures that both ac and dc voltages are supplied to the compass system simultaneously. The slaving switch enables the pilot to use the indicator as a directional gyro by placing the switch in the "OUT" position. Normally, the gyro is slaved to the direction sensed by the remote compass transmitter.

6–26. TROUBLE SHOOTING.

CAUTION

If the gyro does not start in 20 seconds, turn off power and investigate. If only single-phase power is supplied to the gyro it will burn out.

Trouble	Probable Cause	Remedy
Gyro fails to start or come up to speed	Failure in power supply	Check the slaving switch, cable connections and the phase, frequency and voltage of the ac power source
Gyro does not slave or level	Failure in power supply	Check fuse. Check slaving switch, cable connections and the phase, frequency and voltage of the ac power source
	Defective amplifier	Replace amplifier
	Defective directional gyro control	Replace directional gyro control
Gyro slaving rate too fast	Overvoltage in power supply	Check the ac power source
	Defective amplifier	Replace amplifier
Gyro slaves faster in one direction than the other	Defective amplifier	Replace amplifier
	Unbalanced gyro	Replace the directional gyro control
Gyro slaving rate too slow	Low voltage at primary bus	Check the power source
	Defective amplifier	Replace amplifier
	Defective transmitter	Replace transmitter
High errors at both directional gyro control and indicator	Low voltage at primary bus	Check power source
	Defective amplifier	Replace amplifier
	Defective transmitter	Replace transmitter
	Defective directional gyro control	Replace directional gyro control
Indicator hunts	Low voltage at primary bus	Check power source
	Defective amplifier	Replace amplifier
	Defective wiring to indicator	Check wiring
Indicator pointer or compass card (directional gyro control) spins	Defective gyro	Replace directional gyro control
	Defective power supply	Check power supply
Indicator pointer sticks or tracks erratically	Defective indicator	Replace indicator
Indicator pointer does not agree with compass card	Faulty connections between components	Check wiring
	Defective indicator	Replace indicator
	Faulty directional gyro control	Replace directional gyro control

6–27. REMOVAL.

CAUTION

The directional gyro must be handled with care during removal and installation.

a. Disconnect the electrical wiring to the amplifier (3, figure 6–3). Remove the screws, washers and nuts from the support assembly holding the amplifier.

b. Remove the directional gyro control (1) by disconnecting the electrical wiring to the control and removing the bolts and washers from the support assembly holding the control.

c. Remove the securing nut and lock washer and pull the slaving switch out from the instrument panel. Disconnect the electrical wiring from the switch and remove the switch.

d. Remove the indicator and light shield by removing the screws which secure the instrument to the instrument panel and disconnecting the electrical wiring from the indicator.

e. Remove the transmitter and transmitter compensator as a unit by disconnecting the wiring to the transmitter. Remove the screws holding the transmitter to its bracket and remove the transmitter.

6–28. INSTALLATION.

CAUTION

The directional gyro must be handled with care during removal and installation.

a. Install the transmitter and transmitter compensator as a unit by securing the transmitter to its bracket with the mounting screws and connecting the wiring to the transmitter.

b. Connect the electrical wiring to the indicator. Secure the indicator and light shield to the instrument panel with the mounting screws.

c. Connect the electrical wiring to the slaving switch. Position the switch on the instrument panel and secure it with the lock washer and nut.

d. Position the directional gyro control (1, figure 6–3) so its lubber line is parallel to the fore-and-aft line of the helicopter. Secure the control to its support assembly with the bolts and washers. Connect the electrical wiring to the control.

e. Secure the amplifier (3) to its support assembly with the screws, washers and nuts. Connect the electrical wiring to the amplifier.

f. Compensate the compass. (Refer to paragraph 6–29.)

6–29. COMPENSATING COMPASS.

a. Check the alignment of the compass transmitter to see that the fore-and-aft markings on the transmitter case line up with the center line of the helicopter.

b. Set the helicopter on a compass rose and connect a source of external power to the helicopter.

Note

Place the power unit off to the side of the helicopter so that it will not affect compensation.

Note

Make sure the "COMPASS SLAVING" switch is in the "IN" position. Allow at least ten minutes for the compass system to reach stable synchronized operation before making a compensation check.

c. Set the compensator on the transmitter to the neutral position by lining up the dot on each adjusting shaft with the dot on the case adjacent to each shaft.

d. Place the helicopter on the south magnetic heading and record the compass deviation from 180° as read on the compass indicator in the cockpit.

Note

Each time the helicopter is placed on a new heading make sure the gyro control has stopped slaving before reading the indicator.

e. Place the helicopter on the west magnetic heading and record the deviation from 270°.

f. Place the helicopter on the north magnetic heading and record the deviation from zero. Determine index error "C" according to the Index Error Chart in this paragraph. With the helicopter still on the north heading, adjust the NORTH-SOUTH compensating screw on the compass transmitter to cause the indicator reading to change plus or minus an amount equal to index error "C."

g. Place the helicopter on the east magnetic heading and note the deviation from 90°. Determine index error "B" according to the Index Error Chart in this paragraph. Adjust the EAST-WEST compensating screw to cause the indicator reading to change plus or minus an amount equal to index error "B."

h. With the helicopter still on the east magnetic heading, determine index error "A" according to the Index Error Chart in this paragraph.

i. If index error "A" exceeds ½-degree, loosen the mounting screws and rotate the transmitter a sufficient amount to change the indicator reading plus or minus an amount equal to index error "A."

j. Swing the helicopter for residual deviations by placing the helicopter on eight magnetic headings approximately 45 degrees apart.

Note

The indicator reading, corresponding to the exact heading on each of the eight headings, shall be recorded on the compass correction card. The spread between the maximum positive deviation and the maximum negative deviation of all readings shall not exceed 8 degrees.

INDEX ERROR CHART.

Compute index errors algebraically as follows:

$$\text{Index error "C"} = \frac{\text{North Deviation} - \text{South Deviation}}{2}$$

$$\text{Index error "B"} = \frac{\text{East Deviation} - \text{West Deviation}}{2}$$

$$\text{Index error "A"} = \frac{\text{North Deviation} + \text{East Deviation} + \text{South Deviation} + \text{West Deviation}}{4}$$

Example

Deviations with compensator set to null effect.

	Magnetic Heading	Compass Reading	Deviation
South	180°	175½°	+4½°
West	270°	276°	−6°
North	000°	006½°	−6½°
East	090°	090°	0°

$$\text{Index error "C"} = \frac{(-6\tfrac{1}{2}) - (+4\tfrac{1}{2})}{2} = \frac{-11}{2}$$

$$= -5\tfrac{1}{2} \text{ degrees}$$

$$\text{Index error "B"} = \frac{(0) - (-6)}{2} = \frac{+6}{2}$$

$$= +3 \text{ degrees}$$

$$\text{Index error "A"} = \frac{(-6\tfrac{1}{2}) + (0) + (+4\tfrac{1}{2}) + (-6)}{4}$$

$$= \frac{-8}{4} = -2 \text{ degrees}$$

6–30. STANDBY COMPASS.

6–31. DESCRIPTION. *(See figure 6–4.)* The standby compass is mounted on the cockpit canopy windshield. A support attached to the center frame of the windshield holds the compass in position. A compass correction card is mounted above the compass. The compass indicates the direction in which the helicopter is flying with respect to the magnetic north pole. Its card is graduated in 5-degree increments. The cardinal headings are shown in enlarged letters: N for north at zero degrees, E for east at 90 degrees, S for south at 180 degrees and W for west at 270 degrees. The reading of the card is made against a fixed lubber line which is the vertical white line visible on the front of the instrument. The compass also incorporates a built-in permanent magnetic compensator and an individual lighting system.

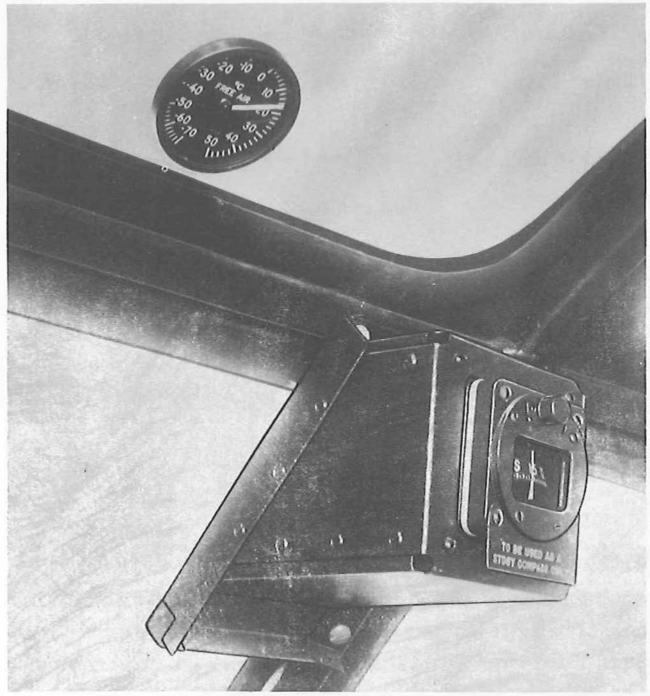


Figure 6–4. Free-Air Thermometer and Standby Compass Installed

6–32. TROUBLE SHOOTING.

Trouble	Probable Cause	Remedy
Excessive card error	Improper compensation	Compensate compass
	External magnetic interference	Locate magnetic influence and eliminate if possible
	Air in bowl	Replace compass
Excessive card oscillation	Insufficient liquid in bowl	Replace compass
	Worn or deteriorated shock mount	Replace mount
Card element not level	Leaking float chamber	Replace compass
	Card magnets detached from card	Replace compass
Card sluggish	Dirty jewels or pivots restricting rotation	Replace compass
	Weak card magnets	Replace compass
	Instrument heavily compensated	Remove excessive compensation
Liquid leakage	Leaking gaskets	Replace gasket
	Loose bezel screws	Replace compass

Trouble	Probable Cause	Remedy
Liquid leakage (cont)	Broken case	Replace compass
Defective light	Burned out bulb	Replace bulb
	Broken circuit	Check continuity of wiring
Compensator does not have sufficient effect	Weak magnets in compensator	Replace compensator if the maximum deviation produced by each compensating system (E-W-N-S) is less than 15 degrees or more than 20 degrees

6—33. REMOVAL.

a. Reach up through the hole in the bottom of the bracket in which the standby compass is mounted and disconnect the wiring from the rear of the compass.

b. Remove the screws that secure the compass and name plate to the shock mount. Remove the name plate. Pull the compass out of the mount.

c. Remove the screws that secure the shock mount inside the bracket. Remove the mount through the hole in the bottom of the bracket.

Note

On helicopters bearing USAF Serial Nos 53-4475 through 53-4494, removal of the shock mount is facilitated by removing the bracket as outlined in step e.

d. Remove the compass correction card from the holder attached to the clip at the top of the bracket. Remove the screws that secure the holder to the clip. Remove the holder.

e. Support the bracket and remove the screws and washers that secure the flange at the right of the flat bracket to the windshield frame. Loosen the bolts that secure the top of the flat bracket. Slide both brackets down and remove them.

6—34. INSTALLATION.

a. Position the two brackets against the windshield frame. Slide the top of the flat bracket up under the bolts and washers. Install the screws and washers that secure the flange at the right of the flat bracket to the windshield frame. Tighten the bolts.

Note

On helicopters bearing USAF Serial Nos 53-4475 through 53-4494, install the shock mount as outlined in step c. before accomplishing step a.

b. Position the compass correction card holder against the clip at the top of the bracket and secure it with the screws. Place the card in the holder.

c. Position the shock mount inside the bracket and secure it with the screws.

d. Slide the compass into the shock mount. Install the two upper screws. Position the name plate over the two lower screw holes and install the screws.

e. Reach up through the hole in the bottom of the bracket and connect the wiring to the rear of the compass.

f. Compensate the compass. (Refer to paragraph 6—35.)

6—35. COMPENSATING COMPASS.

a. Prior to swinging the standby compass, make certain that the liquid is clear and that no air bubbles show when the compass is in normal position. Check that the card is level and, when deflected a few degrees on each side of equilibrium position, returns to its original position within the friction error tolerance for the compass.

b. Set the helicopter on a compass rose.

c. Set the screw-type compensators on the compass to null effect by aligning the dots on the screws with the dots on the case.

d. Place the helicopter on the south magnetic heading and record the compass deviation from 180°.

e. Place the helicopter on the west magnetic heading and record the deviation from 270°.

f. Place the helicopter on the north magnetic heading and record the deviation from zero. Determine index error "C" according to the Index Error Chart in this paragraph. With the helicopter still on the north heading, adjust the NORTH-SOUTH compensating screw to change the compass reading plus or minus an amount equal to index error "C."

g. Place the helicopter on the east magnetic heading and note the deviation from 90°. Determine index error "B" according to the Index Error Chart in this paragraph. Adjust the EAST-WEST compensator to change the compass reading plus or minus an amount equal to index error "B."

h. With helicopter still on the east heading, determine index error "A" according to example.

i. If index error "A" exceeds one degree, accomplish compensation by turning the face of the compass relative to the plane of the instrument panel by washers or spacers. Adjust the compass to change the reading plus or minus an amount equal to index error "A."

j. Swing the helicopter for residual deviations by placing the helicopter on eight magnetic headings approximately 45 degrees apart.

Note

The compass reading corresponding to the exact heading on each of the eight headings shall be recorded on the compass correction card. The spread between the maximum negative deviation of all the readings shall not exceed eight degrees.

INDEX ERROR CHART.

Compute index errors algebraically as follows:

$$\text{Index error "C"} = \frac{\text{North Deviation} - \text{South Deviation}}{2}$$

$$\text{Index error "B"} = \frac{\text{East Deviation} - \text{West Deviation}}{2}$$

$$\text{Index error "A"} = \frac{\text{North Deviation} + \text{East Deviation} + \text{South Deviation} + \text{West Deviation}}{}$$

Example

Deviations with compensator set to null effect.

	Magnetic Heading	Compass Reading	Deviation
South	180°	175½°	+4½°
West	270°	276°	—6°
North	000°	006½°	—6½°
East	090°	090°	0°

$$\text{Index error "C"} = \frac{(-6\frac{1}{2}) - (+4\frac{1}{2})}{2} = \frac{-11}{2}$$

$$= -5\frac{1}{2} \text{ degrees}$$

$$\text{Index error "B"} = \frac{(0) - (-6)}{2} = \frac{+6}{2}$$

$$= +3 \text{ degrees}$$

$$\text{Index error "A"} = \frac{(-6\frac{1}{2}) + (0) + (+4\frac{1}{2}) + (-6)}{4}$$

$$= \frac{-8}{4} = -2 \text{ degrees}$$

6—36. GYRO-HORIZON INDICATOR.

6—37. DESCRIPTION. *(See figures 6—1 and 6—2.)* The gyro-horizon indicator mounted on the instrument panel provides the pilot with a constant visual indication of the attitude of the helicopter relative to the earth in pitch and roll. These indications are continuous through 360 degrees. The relative position of the trim indicator and the horizon bar indicates the attitude of the helicopter in both dive and climb to an angle of 27 degrees and in right or left bank to an angle of 90 degrees. When the angle of the helicopter exceeds 27 degrees of dive, the word "DIVE" on the upper part of the sphere becomes visible. When the angle of the helicopter exceeds 27 degrees of climb, the word "CLIMB" becomes visible on the lower part of the sphere. In flight, just before using the indication of the instrument, the height of the horizontal bar should be adjusted to the level flight condition. This height may vary slightly from day to day as loading and other conditions change and should be checked at every flight. Quick erection of the gyro is accomplished in this indicator by means of a mechanical caging device. The gyro must be caged immediately after power is supplied to the indicator by pulling out the caging knob on the front bezel. The caging time will depend upon the position of the gyro; however, the longest time will be approximately 10 seconds. The ac current for the operation of the instrument is supplied by the number one inverter.

6—38. TROUBLE SHOOTING.

Trouble	Probable Cause	Remedy
Indicator does not start (horizon bar and bank indicator fail to respond)	Failure at source of power supply	Check power supply at source
	Faulty power supply connections at indicator	Check power supply cable, plug and receptacle
	Faulty internal wiring	Replace indicator
Bank indicator and horizon bar do not settle properly	Faulty power supply connections to the indicator	Check power supply cable, plug and receptacle for shorts
	Faulty internal wiring	Replace indicator
	Voltage and frequency of power supply incorrect	Check voltages and frequency at the inverter (115 ±10 volts, 400 ±40 cycles, current)
	Indicator mechanism defective	Replace indicator
Bank indicator and horizon bar do not respond to the helicopter's change in attitude	Failure at source of power supply	Check power supply at source
	Faulty power supply connections	Check power supply cable, plug and receptacle
	Faulty internal wiring	Replace indicator
Bank indicator and horizon bar have large error in turning	Phase rotation of the power supply is reversed	Replace inverter

6—39. REMOVAL.

a. Remove the mounting screws from the face of the indicator and pull the indicator and light shield out from the panel.

b. Disconnect the wiring from the rear of the indicator and remove the indicator.

6—40. INSTALLATION.

a. Connect the wiring to the rear of the indicator.

b. Secure the indicator and light shield to the instrument panel with the mounting screws.

6—41. RATE-OF-CLIMB INDICATOR.

6—42. DESCRIPTION. *(See figures 6—1 and 6—2.)* A rate-of-climb indicator is located on the instrument panel in front of the pilot and is used to indicate the rate of ascent or descent in feet per minute. The pointer on the indicator, when at zero, is horizontal to the left. The pointer moves clockwise when indicating ascent and counterclockwise when indicating descent. The dial is graduated into divisions from 100 to 6000 fpm. A stop is provided to limit the pointer travel to the range indicated on the dial. The climb indicator incorporates two air-enclosing chambers. One is the pressure-sensitive diaphragm which is vented directly to the static vent line. The second is the airtight case of the instrument which is vented to the static line through a thin-walled porcelain capillary tube. Since the diaphragm is vented directly to the atmosphere, it accommodates itself to changing atmospheric pressure almost immediately; on the other hand, pressure inside the case increases or decreases slowly since entry and exit of air is slowed down by its passage through the capillary tube. The pressure differential causes motion of the bellows which actuates the instrument pointer. Pressure in the two chambers, however, becomes equalized after an extremely short period of level flight regardless of altitude.

6—43. TROUBLE SHOOTING.

CAUTION

The rate-of-climb indicator is connected to the static connection through the same lines as the altimeter and air-speed indicator. Care should be exercised when working on one of the instruments to avoid damaging the others.

Trouble	Probable Cause	Remedy
Pointer off "O"	Mechanism shift	Return pointer to "O" by adjusting screw
	Deteriorated diaphragm	Tap lightly while making adjustment
Pointer off "O" and cannot be brought back by adjusting screw	Broken pivot	Replace indicator
	Defective indicator	Replace indicator
Pointer fails to respond	Obstruction in static line	Disconnect all instruments from static line and blow line clear with dry air
	Defective indicator	Replace indicator
Indicator indicates less than actual rate of climb	Leak in static lines	Repair or replace tubing
	Defective indicator	Replace indicator
Pointer sticks	Defective indicator	Replace indicator
Pointer oscillates	Leak in static line	Repair or replace tubing
	Excessive vibration of tubing	Check security of tubing at attachments
	Defective indicator	Replace indicator
Pointer vibrates	Excessive vibration in instrument panel	Tighten mounting or replace defective shock mounts
	Excessive vibration in tubing	Tighten clamps and connections

6—44. REMOVAL.

a. Remove the mounting screws from the face of the indicator.

b. Pull the indicator and light shield out from the instrument panel and disconnect the tubing. If the tubing connections are not accessible, remove the cowl panel from the instrument panel, then disconnect the tubing from the indicator.

c. Remove the indicator.

6—45. INSTALLATION.

a. Connect the tubing to the rear of the indicator.

b. Position the indicator on the instrument panel. If the removal of the cowl panel was necessary to disconnect the tubing, install the cowl panel and secure the Camloc fasteners.

c. Secure the indicator and light shield to the instrument panel with the mounting screws.

6—46. TURN-AND-BANK INDICATOR.

6—47. DESCRIPTION. *(See figures 6—1 and 6—2.)* A turn-and-bank indicator is mounted on the instrument panel in front of the pilot. The turn-and-bank indicator is a combination of two flight instruments for use under conditions of poor visibility. In the turn indicator an electrically driven gyro is used to record any change from a condition of level flight. The degree of change is reflected by the position of the indicator arm. The bank indicator is a ball mounted in a curved glass tube filled with fluid to dampen the movement of the ball. In level flight the ball is centered in the tube and indicates lateral stability.

6–48. TROUBLE SHOOTING.

Trouble	Probable Cause	Remedy
Gyro does not operate	Poor electrical connections	Check plug and external wiring for loose or broken connection
	Worn brushes	Remove indicator for overhaul
	Low input voltage because of discharged battery	Check battery and replace if discharged
	Insufficient tension on brush springs	Remove indicator for overhaul
Intermittent gyro operation	Poor electrical connections	Check plug and external wiring for loose or broken connection
	Worn brushes	Remove indicator for overhaul
	Intermittent contact in housing	Remove indicator for overhaul
	Insufficient tension on brush springs	Remove indicator for overhaul
Radio interference	Poor electrical connections	Check plug and external wiring
	Dirty or rough connections	Remove indicator for overhaul
	Worn or pitted contacts	Remove indicator for overhaul
	Filter defective	Remove indicator for overhaul
Hand fails to respond	Hand touches glass	Remove indicator for overhaul
	Damper springs have slipped from post	Remove indicator for overhaul
	Dirt in armature bearings	Remove indicator for overhaul
	Dirt in damping cylinder	Remove indicator for overhaul
Incorrect sensitivity	Maladjustment of centralizing spring and damping cylinder	Adjust centralizing spring with screw driver by turning the screw on the right side of the frame. If adjustment pulls the hand from its zero setting, remove the indicator for overhaul
Pointer does not set on zero	Gyro assembly out of balance	Remove indicator for overhaul
	Hand set incorrectly on staff	Remove indicator for overhaul
	Maladjustment of centralizing spring and cylinder	Remove indicator for overhaul
	Damper springs have slipped from post	Remove indicator for overhaul
	Excessive vibration	Inspect instrument panel for excessive vibration. If vibration cannot be eliminated by replacement of worn or deteriorated shock mountings, remove indicator for overhaul
	Damper spring out of adjustment	Remove indicator for overhaul
Sluggish deflection of hand at low temperature	Grease in bearings becomes too thick	Remove indicator for overhaul
	Insufficient clearance of housing bearings	Remove indicator for overhaul

6–49. REMOVAL.

a. Remove the mounting screws from the face of the indicator.

b. Pull the indicator and light shield out from the instrument panel.

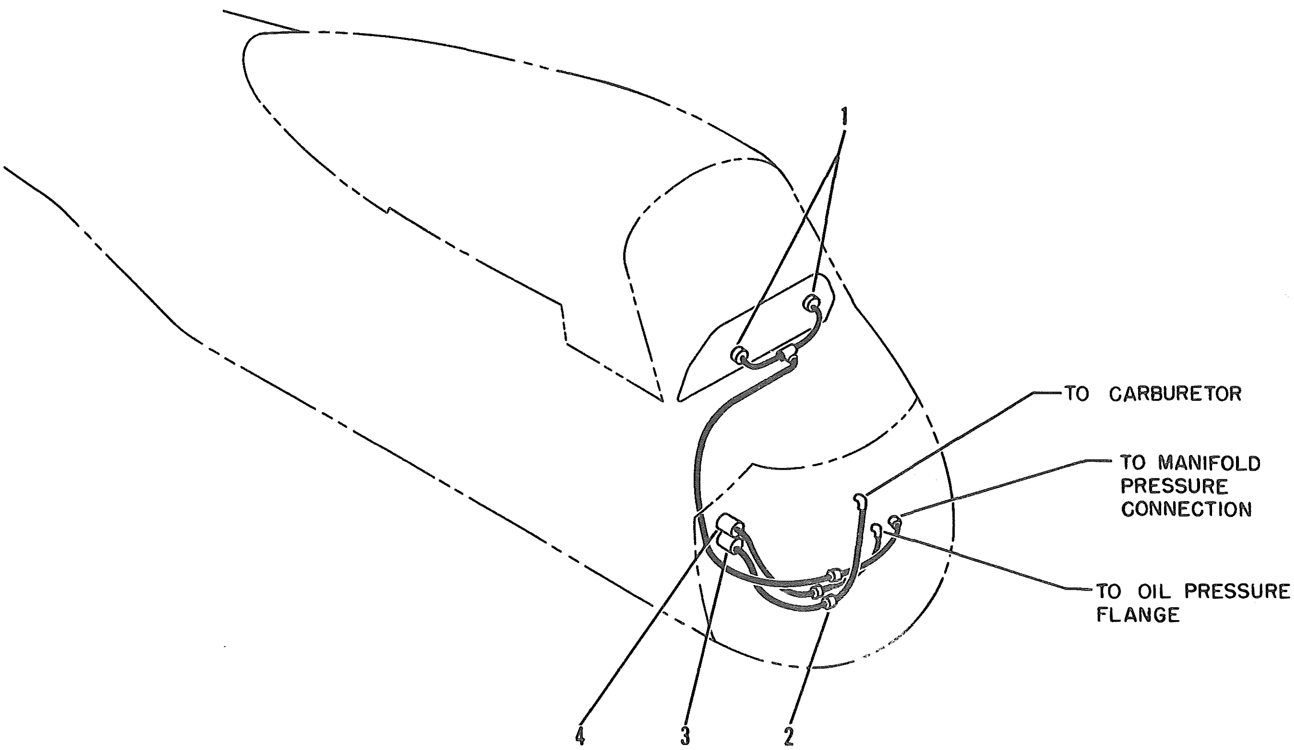
c. Disconnect the wiring from the rear of the indicator and remove the indicator.

6–50. INSTALLATION.

a. Connect the wiring to the rear of the indicator.

b. Position the indicator on the instrument panel.

c. Secure the indicator and light shield to the instrument panel with the mounting screws.



1. Manifold Pressure Gages 2. Quick Disconnects 3. Fuel Pressure Transmitter 4. Oil Pressure Transmitter

Figure 6–5. Engine Instrument Tubing Schematic Diagram

6–51. FREE-AIR THERMOMETER.

6–52. DESCRIPTION. *(See figure 6–4.)* The nonelectrical, free-air thermometer is located in the center of the cockpit windshield adjacent to the standby compass. The instrument is a bimetal-type, direct reading thermometer which records outside temperature in degrees of centigrade in the dial range of —70°C to +50°C calibrated in increments of 2°C each.

6–53. REMOVAL. Remove the sunshade and nut assembly from the stem of the thermometer and pull the instrument and reinforcement plate from the grommet. Remove the grommet.

6–54. INSTALLATION. Insert the rubber grommet and thermometer stem through the hole in the windshield from inside the cockpit and press the thermometer and reinforcement plate tightly against the grommet. Place the washer, sunshade and nut assembly on the exposed stem and tighten the nuts. The thermometer must be in the correct position before the nut is tightened.

6–55. ENGINE INSTRUMENTS.

6–56. DESCRIPTION. *(See figures 6–1, 6–2 and 6–5.)* The engine instruments provide the pilot with a ready indication of the operating condition of the engine. Included in the engine instrument group are the dual tachometer indicator, manifold pressure gage, carburetor air temperature indicator, cylinder head temperature indicator, engine oil pressure indicator, engine oil temperature indicator, fuel pressure gage, fuel quantity gage and ammeter. See figure 6–5 for the engine instrument tubing schematic diagram.

6–57. DUAL TACHOMETER INDICATOR SYSTEM.

6–58. DESCRIPTION. *(See figures 6–1 and 6–2.)* A dual tachometer indicator, which indicates main rotor and engine rpm, is mounted on each side of the instrument panel. The indicator is connected electrically to two tachometer-generators: one, the main rotor tachometer-generator, is mounted on the left rear of the main gear box lower housing; the other, the engine tachometer-generator, is mounted on the rear of the accessory section of the engine. The face of the indicator contains an outer scale and two pointers. The scale, indicating engine rpm, has a range of 0 to 4000 rpm calibrated in increments of 100 rpm each. The short pointer indicates main rotor rpm at a ratio of 1.0 to 11.293 to the engine rpm scale.

6—59. TROUBLE SHOOTING.

Trouble	Probable Cause	Remedy
Excessive scale error	Weak magnets in tachometer-generators	Replace tachometer-generators
Pointer moves backward	Leads reversed at generator plug	Change leads at generator plug
Indication only one-half actual speed	Leads connected to wrong terminal on indicator	Refer to wiring diagram and rewire correctly
No reading on indicator either permanent or intermittent	Break or short circuit in leads	Repair or replace leads
	Poor connection at indicator or generator plugs	Clean or tighten terminals
	Break in unit circuit	Check circuitry
Low reading on indicator either permanent of intermittent	Poor connection at indicator or generator terminals	Clean and tighten terminals at plugs
High reading on indicator either permanent or intermittent	Indicator resistance out of adjustment	Replace indicator

6—60. REMOVAL.

a. Remove the mounting screws from the face of the indicators and pull the indicators and light shields out from the instrument panel.

b. Disconnect the wiring from the rear of each indicator.

c. Remove the main rotor tachometer-generator by hinging down the service platform on the left side of the main gear box to expose the lower housing and by disconnecting the wiring from the generator. Remove the washers and nuts that secure the generator to the studs of the main gear box and remove the generator and the gasket.

d. Remove the engine tachometer-generator in accordance with instructions in paragraph 5—307.

6—61. INSTALLATION.

a. Install the engine tachometer-generator in accordance with the instructions in paragraph 5—308.

b. Place the main rotor tachometer-generator and gasket on the mount on the left rear of the gear box lower housing. Secure the generator to the studs with the washers and nuts. Connect the wiring to the unit and close the service platform.

c. Connect the wiring to the rear of the indicators.

d. Position the indicators and light shields on the instrument panel and secure them with the mounting screws.

6—62. MANIFOLD PRESSURE GAGE SYSTEM.

6—63. DESCRIPTION. *(See figures 6—1, 6—2 and 6—5.)* A manifold pressure gage is mounted on each side of the instrument panel and is connected by tubing to the manifold pressure connection on the engine. The tubing incorporates a quick disconnect fitting at the accessory compartment shroud. Each manifold pressure gage has a dial with a range of 10 to 75 inches Hg marked in graduations of one inch and indicates the absolute pressure in inches of mercury measured at the intake manifold of the engine. A manifold pressure purge valve is located directly below the gage on the pilot's side of the instrument panel. The engine must be operating with a manifold pressure below atmospheric pressure in order to purge the system. When the purge valve button is pressed, atmospheric pressure enters the valve and forces air through the manifold pressure indicator tubing carrying any moisture within the tubes into the engine intake manifold.

6—64. TROUBLE SHOOTING.

Trouble	Probable Cause	Remedy
Excessive error at existing barometric pressure	Pointer shifted	Press the purge valve button and reset pointer to agree with existing barometric pressure
Excessive error when engine is running	Leak in line	Take reading on gage with test line connection. Tighten or repair line if necessary
Sluggish or jerky pointer movement	Improper damping adjustment	Bench test indicator. Adjust damping screw if necessary
	Excessive friction	Replace gage
Broken or loose cover glass	Vibration or excessive pressure	Replace gage
Excessive pointer oscillation	Insufficient hairspring tension or end play in rocker arm	Replace gage
Low reading	Loose pointer	Replace gage
	Leak in diaphragm	Replace gage
	Leak in line	Tighten or replace line
High reading	Loose pointer	Replace gage

Trouble	Probable Cause	Remedy
No pointer movement	Leak in diaphragm	Replace gage
Erratic pointer movement	Loose mounting	Tighten mounting screws of gage, tighten engine pressure connection
	Worn or damaged gear teeth	Replace gage

6–65. REMOVAL.

a. Remove the cowl panel from the top of the instrument panel and disconnect the tubing from the rear of the manifold pressure gages.

b. Remove the mounting screws from the face of the manifold pressure gages and remove the gages and light shields from the panel.

c. Disconnect and remove the tubing from the elbow on the purge valve to the pilot's manifold pressure gage.

d. Unscrew the setscrew which secures the purge button to the valve stem and remove the button.

e. Unscrew the hex nut from the purge valve and push the valve back through the instrument panel.

f. Remove the elbow and lock nut from the purge valve.

g. Disconnect the sections of tubing at the tee, two bulkhead elbows and the fitting on the canted fire wall and canted bulkhead. Release the mounting clamps and remove the tubing.

h. Open the nose doors.

i. Disconnect the hose from the fitting on the canted bulkhead.

j. Disconnect the hoses from the quick disconnect fitting on the accessory compartment shroud and remove the fitting.

k. Disconnect the hose from the manifold pressure connection on the engine. Remove the fitting from the manifold pressure connection.

6–66. INSTALLATION.

a. Install the fitting in the manifold pressure connection on the engine. Connect the hose to the fitting.

b. Install the quick disconnect fitting in the accessory compartment shroud. Connect the hoses to the fitting.

c. Connect the hose to the fitting on the canted bulkhead.

d. Close the nose doors.

e. Install the tubing, clamps, bulkhead and tee fittings.

f. Install the manifold pressure gages and light shields on the instrument panel and secure them with the mounting screws.

g. Position the lock nut and elbow on the purge valve and position the valve on the instrument panel; tighten the hex nut which secures the valve to the face of the instrument panel.

h. Place the purge button on the valve stem and tighten the setscrew.

Note

Install the purge button to allow a minimum of 3/16-inch travel in operation.

i. Connect the tubing from the purge valve elbow to the pressure gage.

j. Connect the tubing to the rear of the manifold pressure gages and install the cowl panel over the instrument panel.

6–67. CARBURETOR AIR TEMPERATURE INDICATOR SYSTEM.

6–68. DESCRIPTION. *(See figures 6–1 and 6–2.)* The carburetor air temperature indicator system is comprised of a single electrical resistance thermometer indicator and a resistance bulb. The carburetor air temperature indicator is on the pilot's side of the instrument panel. The indicator is wired to the primary bus on the overhead control panel for its power supply and is connected to an electrical resistance bulb located in the air intake duct of the carburetor air induction system. The scale of the indicator is from —50°C to +50°C and is divided into graduations of 5°C each.

6–69. TROUBLE SHOOTING.

Trouble	Probable Cause	Remedy
Pointer remains on mechanical "O"	Open circuit in power supply or poor ground connection	Remove connector plug at indicator and test for voltage from A to ground, also from A to C
Pointer forced off top end of scale	Resistance bulb open or break in bulb lead	Replace bulb or repair lead
	Open circuit in thermometer	Replace indicator
Pointer forced off bottom end of scale	Bulb or leads short-circuited	Replace bulb or repair leads
	Ground connected to wrong lead from bulb	Reconnect ground to proper bulb lead
Erratic indications	Defective wiring or defective bulb	Repair wiring or replace bulb
	Defective connection in thermometer	Replace indicator
Pointer remains on scale with the power off	Foreign material in thermometer	Replace indicator

6–70. REMOVAL.

a. Remove the mounting screws from the face of the carburetor air temperature indicator and pull the indicator away from the instrument panel.

b. Disconnect the wiring from the rear of the indicator and remove the indicator.

c. Open the nose doors.

d. Disconnect the wiring to the temperature bulb on the air intake duct above the carburetor and unscrew the temperature bulb.

6–71. INSTALLATION.

a. Screw the temperature bulb into the air intake duct and connect the wiring to the temperature bulb.

b. Close the nose doors.

c. Connect the wiring to the rear of the indicator.

d. Position the indicator on the instrument panel and secure with the mounting screws.

6–72. CYLINDER HEAD TEMPERATURE INDICATOR SYSTEM.

6–73. DESCRIPTION. *(See figures 6–1 and 6–2.)* The cylinder head temperature indicator is mounted on the pilot's side of the instrument panel and is connected by wiring to a bayonet-type resistance bulb installed in the No. 7 cylinder. The indicator has a single pointer and a dial with a range of 0°C to +300°C graduated in increments of 10°C each. The cylinder temperature indicator is basically a D'Arsonval type galvanometer movement having a permanent magnet and a moving coil. The moving coil carries the pointer and control is affected by two phosphor-bronze hairsprings and a compensator for minor temperature variations which also serves to carry the current into the moving coil. The movement is mounted on a phenolic base and housed in a shielded iron case to minimize interference by stray magnetic currents. Electrical power for the system is supplied by the primary bus on the overhead control panel.

6–74. TROUBLE SHOOTING.

Trouble	Probable Cause	Remedy
Temperature reading high throughout the scale	Poor connections or partial break	Repair or replace faulty leads
	Defective indicator	Remove indicator for overhaul
Erratic indications	Defective wiring or defective bulb	Repair wiring or replace bulb
No reading, either permanent or intermittent	Break in lead	Repair or replace lead
	Poor ground connection	Check ground connection and tighten as necessary
	Defective temperature bulb	Replace bulb
	Faulty indicator	Remove indicator for overhaul
Low reading, either permanent or intermittent	Poor connections or short circuit	Clean and tighten connections. Eliminate short circuit
Pointer remains on scale with power off	Defective indicator	Replace indicator

6–75. REMOVAL.

a. Remove the mounting screws from the face of the indicator and pull the indicator out from the instrument panel.

b. Disconnect the wiring from the rear of the indicator.

c. Open the nose doors.

d. Remove the temperature bulb from the No. 7 cylinder wall by turning and releasing the spring lock.

e. Disconnect the wiring from the temperature bulb.

6–76. INSTALLATION.

a. Install the temperature bulb in the No. 7 cylinder.

b. Connect the wires to the temperature bulb.

Note

Tape each of the two connections separately with friction tape (index 40, paragraph 1–32) and then tape both connections together. Apply a heavy coat of shellac (index 41, paragraph 1–32) over tape.

c. Close the nose doors.

d. Connect the wires to the rear of the indicator.

e. Position the indicator on the instrument panel and secure with the mounting screws.

6–77. ENGINE OIL PRESSURE INDICATOR SYSTEM.

6–78. DESCRIPTION. *(See figures 6–1, 6–2 and 6–5.)* The engine oil pressure indicator system consists of a transmitter and an indicator. The indicator is mounted on the instrument panel and contains an autosyn, a dial and a pointer. The dial has a range of 0 to 200 psi and is graduated into increments of 10 psi each. The transmitter (4, figure 6–5) is mounted on the right side of the helicopter aft of the engine compartment bulkhead and is connected by electrical wiring to the indicator and by tubing to the main transmitter flange on the engine.

6–79. TROUBLE SHOOTING.

Trouble	Probable Cause	Remedy
Indicator pointer remains at zero or only moves through a restricted arc	Broken Bourdon tube in either the transmitter or the indicator	Replace transmitter or indicator
	Defective wiring	Repair wiring
	Leak in pressure tubing	Replace tubing
	Pressure tubing clogged	Remove foreign matter from tubing
	Insulation breakdown	Check insulation and repair break
	Open circuit	Check circuit and repair break
Pointer fails to return to zero	Pressure tubing clogged	Remove foreign matter from tubing
	Loose link screw	Replace indicator
Erratic pointer movement	Too much rotor end play	Replace indicator
	Pointer touching dial or glass	Replace indicator
	Defective hairspring	Replace indicator
	Excessive ball bearing friction	Replace transmitter
	Worn or damaged gear teeth	Replace transmitter
	Improper pinion and sector mesh	Replace transmitter
	Foreign matter in pinion or sector gear teeth	Replace transmitter
	Loose mounting	Tighten mounting screws of transmitter and indicator
Low reading on indicator	Leak in pressure tubing	Replace tubing
	Pressure tubing clogged	Remove foreign matter from tubing
	Pointer set too low	Replace indicator
	Excessive play in linkage	Replace transmitter
	Pointer set low	Replace indicator
	Loose pointer	Replace indicator
High reading on indicator	Pointer set too high	Replace indicator
	Loose pointer	Replace indicator
	Pointer shifted due to fatigue in Bourdon tube	Replace indicator
Excessive pointer oscillation	Loose mounting	Tighten mounting screws
	Loose pointer	Replace indicator
	Insufficient hairspring tension	Replace indicator
	Leaky case	Replace indicator
Sluggish operation	Dirty or corroded rotor	Replace indicator

6–80. REMOVAL.

a. Remove the mounting screws from the face of the indicator and pull the indicator out from the instrument panel.

b. Disconnect the electrical wiring at the rear of the indicator.

c. Open the nose doors and disconnect the pressure tubing from the oil transmitter flange on the engine and from the quick disconnect on the accessory compartment shroud.

d. Disconnect the pressure tubing from the quick disconnect and from the transmitter.

e. Disconnect the electrical wiring from the transmitter. Remove the mounting screws holding the transmitter in its bracket and remove the transmitter.

6–81. INSTALLATION.

a. Place the transmitter in its bracket and install the mounting screws securing the transmitter to the bracket. Connect the electrical wiring to the transmitter.

b. Connect the pressure tubing to the transmitter and to the quick disconnect on the accessory compartment shroud.

c. Connect the pressure tubing to the quick disconnect and to the oil transmitter flange on the engine. Close the nose doors.

d. Connect the electrical wiring to the rear of the indicator.

c. Position the indicator on the instrument panel and secure with the mounting screws.

6–82. ENGINE OIL TEMPERATURE INDICATOR SYSTEM.

6–83. DESCRIPTION. *(See figures 6–1 and 6–2.)* The engine oil temperature indicator has a range of —70°C to +150°C divided into graduations of 10°C each. Electrical wiring connects the oil temperature indicator to the oil temperature bulb in the oil pump housing. Power is supplied to the system from the primary bus on the overhead control panel.

6—84. TROUBLE SHOOTING.

Trouble	Probable Cause	Remedy
Pointer fails to respond	Master battery switch may be on "OFF"	Turn switch on
	Defective master battery master switch	Replace switch
	Broken battery lead, broken ground jumper or grounded lead	Repair or replace lead or jumper
	Ground in bulb lead	Repair or replace lead
	Defective bulb	Replace bulb
	Defective indicator	Remove indicator for overhaul
Pointer goes off high end of scale	Broken ground lead	Repair or replace lead
	Defective bulb	Replace bulb
	Defective indicator	Remove instrument for overhaul
Pointer hard to left of scale	Short circuit in leads to resistance bulb	Repair or replace leads
	Ground in lead from bulb to indicator	Make continuity check and repair or replace lead
	Short circuit in bulb	Replace bulb
	Open or short circuit in indicator	Remove indicator for overhaul
Pointer hard to right of scale	Break in leads to resistance bulb	Repair or replace leads
	Open circuit in resistance bulb	Replace bulb
	Open or short circuit in indicator	Remove indicator for overhaul
Pointer remains stationary off scale	Break in leads	Repair or replace leads
	Poor ground at panel	Check indicator ground lead with ohmmeter. Remove indicator for overhaul if necessary
	Open or short circuit in indicator	Remove indicator for overhaul
Indicator operates intermittently	Defective master battery master switch	Replace switch
	Loose or broken battery or ground jumper	Repair, replace or tighten lead or jumper
	Defective bulb	Replace bulb
	Defective indicator	Remove indicator for overhaul
Excessive pointer oscillation	Loose or broken lead or jumper	Repair, replace or tighten lead or jumper
	Defective bulb	Replace bulb
	Defective indicator	Remove indicator for overhaul
Obviously incorrect temperature reading	Defective bulb	Replace bulb
	Defective indicator	Remove indicator and check against an indicator of known accuracy
Erratic indications	Defective wiring or defective bulb	Repair wiring or replace bulb
Pointer fails to go off scale with current off	Defective indicator	Remove indicator for overhaul

6—85. REMOVAL.

a. Remove the mounting screws from the face of the oil temperature indicator and pull the indicator out from the instrument panel.

b. Disconnect the wiring from the rear of the indicator.

c. Open the nose doors.

d. Disconnect the wiring from the oil temperature bulb in the engine oil pump housing. Remove the bulb and gasket.

Note

Plug the oil housing as soon as the bulb is removed to prevent spillage of oil.

6—86. INSTALLATION.

a. Install the temperature bulb and gasket in the oil pump housing. Replace gasket. Connect the wiring to the bulb.

Note

Pre-oil the engine in accordance with instructions in paragraph 5—8 immediately prior to starting the engine after the oil temperature bulb has been removed.

b. Connect the wiring to the rear of the indicator.

c. Position the indicator on the instrument panel and secure with the mounting screws.

d. Close the nose doors.

6—87. FUEL PRESSURE GAGE SYSTEM. For description, installation and removal of the fuel pressure gage system, refer to paragraph 5—293.

6—88. FUEL QUANTITY SYSTEM. For description, installation and removal of the fuel quantity system, refer to paragraph 5—187.

6—89. FUEL LOW LEVEL WARNING SYSTEM. For description, installation and removal of the fuel low level warning system, refer to paragraph 5—167.

6—90. FUEL LOW PRESSURE WARNING SYSTEM. For description, installation and removal of the fuel low pressure warning system, refer to paragraph 5—161.

6—91. AMMETER. For description, removal and installation of the ammeter, refer to paragraph 7—39.

6—92. TRANSMISSION SYSTEM INSTRUMENTS.

6—93. DESCRIPTION. *(See figures 6—1 and 6—2.)* Transmission system instruments indicate the operating condition of the main gear box. Included in the transmission system instruments are the transmission oil pressure indicator system and the transmission oil temperature indicator system.

6—94. TRANSMISSION OIL TEMPERATURE INDICATOR SYSTEM.

6—95. DESCRIPTION. *(See figures 6—1 and 6—2.)* The transmission oil temperature indicator system provides the oil inlet temperature of the oil to the main gear box. The indicator, which is mounted on the instrument panel, derives power from the primary bus on the overhead control panel and is connected to a thermometer bulb installed in the main gear box above the generator by electrical wiring. The scale of the indicator ranges from —70°C to +150°C and is divided into graduations of 10°C.

6—96. TROUBLE SHOOTING.

Trouble	Probable Cause	Remedy
Pointer fails to respond	Master battery switch "OFF"	Turn switch on
	Defective battery switch	Replace switch
	Broken battery lead ground jumper or ground lead	Repair or replace ground or lead
	Ground in bulb lead	Repair or replace lead
	Defective bulb	Replace bulb
	Defective indicator	Remove indicator for overhaul
Pointer goes off high end of scale	Broken ground lead	Repair or replace lead
	Defective bulb	Replace bulb
	Defective indicator	Remove indicator for overhaul
Pointer hard to left of scale	Short circuit in leads to resistance bulb	Repair or replace leads
	Ground in lead from bulb to indicator	Make continuity check and repair or replace lead
	Short circuit in bulb	Replace bulb
	Open or short circuit in indicator	Remove indicator for overhaul
Pointer hard to right of scale	Break in leads to resistance bulb	Repair or replace leads
	Open circuit in resistance bulb	Replace bulb
	Open or short circuit in indicator	Remove indicator for overhaul
Pointer remains stationary off scale	Break in leads	Repair or replace leads
	Poor ground at panel	Check indicator ground lead with ohmmeter. Remove indicator for overhaul if necessary
	Open or short circuit in indicator	Remove indicator for overhaul
Indicator operates intermittently	Defective master battery master switch	Replace switch
	Loose or broken battery lead or ground jumper	Repair, replace, or tighten lead or jumper
	Defective bulb	Replace bulb
	Defective indicator	Remove indicator for overhaul
Excessive pointer oscillation	Loose or broken lead or jumper	Repair, replace or tighten lead or jumper
	Defective bulb	Replace bulb
	Defective indicator	Remove indicator for overhaul
Obviously incorrect temperature reading	Defective bulb	Replace bulb
	Defective indicator	Remove indicator for overhaul

Trouble	Probable Cause	Remedy
Pointer fails to go off scale with current off	Defective indicator	Remove indicator for overhaul

6—97. REMOVAL.

a. Remove the mounting screws from the face of the indicator.

b. Pull the indicator out from the instrument panel. If the electrical connections are not accessible, remove the cowl panel from the instrument panel.

c. Disconnect the wiring from the rear of the indicator and remove the instrument.

d. Hinge down the left service platform.

e. Disconnect the wiring and remove the thermometer bulb from the main gear box.

6—98. INSTALLATION.

a. Screw the thermometer bulb into the main gear box. Connect the wiring to the bulb.

b. Close the service platforms.

c. Connect the wiring to the rear of the indicator.

d. Position the indicator on the instrument panel. If the removal of the cowl panel was necessary to disconnect the wiring, install the cowl panel and secure the Camloc fasteners.

e. Position the indicator on the instrument panel and secure with mounting screws on the face of the indicator.

6—99. TRANSMISSION OIL PRESSURE INDICATOR SYSTEM.

6—100. DESCRIPTION. *(See figures 6—1 and 6—2.)* The transmission oil pressure indicator system incorporates an indicator and a transmitter. The transmission oil pressure indicator, which indicates oil pressure at the oil inlet port of the main gear box, is mounted on the pilot's instrument panel and consists of an autosyn, a graduated dial and a pointer. The transmitter, located on the transmission deck adjacent to the rear left support assembly of the main gear box, is connected by tubing to the oil inlet fitting on the gear box and transfers the oil pressure reading to the gage electrically. The dial, with a range of 0 to 200 psi, is divided into graduations of 10 psi each.

6—101. TROUBLE SHOOTING.

Trouble	Probable Cause	Remedy
No pointer movement	Leak in pressure line	Pressure test line. Repair or replace tubing and fittings
	Defective wiring	Repair wiring
	Stoppage in pressure line	Clean or replace tubing and fittings
	Leak in spring, tip and socket assembly	Remove indicator for overhaul
Pointer fails to return to zero	Stoppage in pressure line	Clean or replace tubing and fittings
	Loose link screw	Remove indicator for overhaul
Erratic pointer motion	Pointer contacting dial or glass	Remove indicator for overhaul
	Foreign matter in gear teeth	Remove indicator for overhaul
	Defective hairspring	Remove indicator for overhaul
	Too much rotor end play	Remove indicator for overhaul
	Excessive ball bearing friction	Replace transmitter
	Worn or damaged gear teeth	Replace transmitter
	Improper pinion and sector mesh	Replace transmitter
	Loose mounting	Tighten mounting screws of transmitter and indicator
Low reading	Leak in spring, tip and socket assembly	Remove indicator for overhaul
	Leak in pressure line or fitting	Pressure test line. Repair or replace pressure line or fitting
	Loose pointer	Remove indicator for overhaul
	Pointer set low	Remove indicator for overhaul
High reading	Loose pointer	Remove indicator for overhaul
	Pointer set high	Remove indicator for overhaul
	Pointer shifted due to fatigue in Bourdon tube	Remove indicator for overhaul
Excessive pointer oscillation	Loose mounting	Tighten mounting screws
	Loose pointer	Remove indicator for overhaul
	Insufficient hairspring tension	Remove indicator for overhaul
Leakage	Leaky case	Remove indicator for overhaul

6—102. REMOVAL.

a. Remove the mounting screws from the face of the instrument and pull the instrument out from the instrument panel.

b. Disconnect the wiring from the rear of the instrument.

c. Hinge down the left service platform.

d. Disconnect the hose from the tee at the oil inlet port of the main gear box and from the transmitter. Plug the tee in the gear box. Release the clamps and remove the hose.

e. Cut the lock wire and disconnect the wiring from the transmitter. Release the springs from the adapter and remove the bolts, washers and nuts which secure the adapter to the support assembly. Remove the transmitter and adapter.

f. Remove the screws which secure the transmitter to the adapter.

g. Remove the union and gasket from the transmitter.

h. Remove the screws and washers which secure the support assembly to the transmission deck and remove the support assembly.

6—103. INSTALLATION.

a. Position the support assembly on the transmission deck. Line up the holes and install the screws and washers.

b. Install the union and gasket in the transmitter and secure the transmitter to the adapter with the screws and washers.

c. Position the adapter and transmitter on the support assembly and secure them with the bolts, washers and nuts. Connect the springs to the adapter.

d. Connect the wiring to the transmitter and lockwire the connection.

e. Remove the plug and connect the hose to the tee at the gear box and to the transmitter. Clamp the hose to the rear left support assembly.

f. Close the service platform.

g. Connect the wiring to the rear of the indicator.

h. Position the indicator on the instrument panel and secure with the mounting screws.

6—104. TRANSMISSION OIL PRESSURE WARNING SYSTEM.

6—105. DESCRIPTION. The transmission oil pressure warning system indicates visually by means of a red "TRANS. OIL PRESS LOW" warning light that the oil pressure of the main gear box has fallen below a range of 8 to 10 psi. The system incorporates a warning light, mounted to the left of the transmission oil pressure gage on the instrument panel, an oil pressure switch, mounted on the forward left support assembly for the main gear box, wiring from the light to the switch and pressure hose from the switch to the gear box. The warning light is of the press-to-test-type.

6—106. REMOVAL.

a. Back off the nuts which secure the warning light to the instrument panel and pull the light out from the panel.

b. Disconnect the wiring at the rear of the light and remove the light.

c. Hinge down the left service platform.

d. Disconnect the wiring at the pressure switch mounted on the forward left transmission support assembly.

e. Disconnect the hose from the fitting at the top of the gear box and at the pressure switch. Remove the hose.

f. Release the clamp securing the pressure switch to the support assembly and remove the pressure switch.

6—107. INSTALLATION.

a. Position the pressure switch on the forward left transmission support assembly and tighten the mounting clamp.

b. Install the hose and connect it to the fitting on the gear box and to the pressure switch.

c. Connect the wiring to the pressure switch.

d. Close the left service platform.

e. Connect the wiring to the rear of the warning light.

f. Position the light on the instrument panel and install the nuts.

6—108. HYDRAULIC SYSTEM INSTRUMENTS.

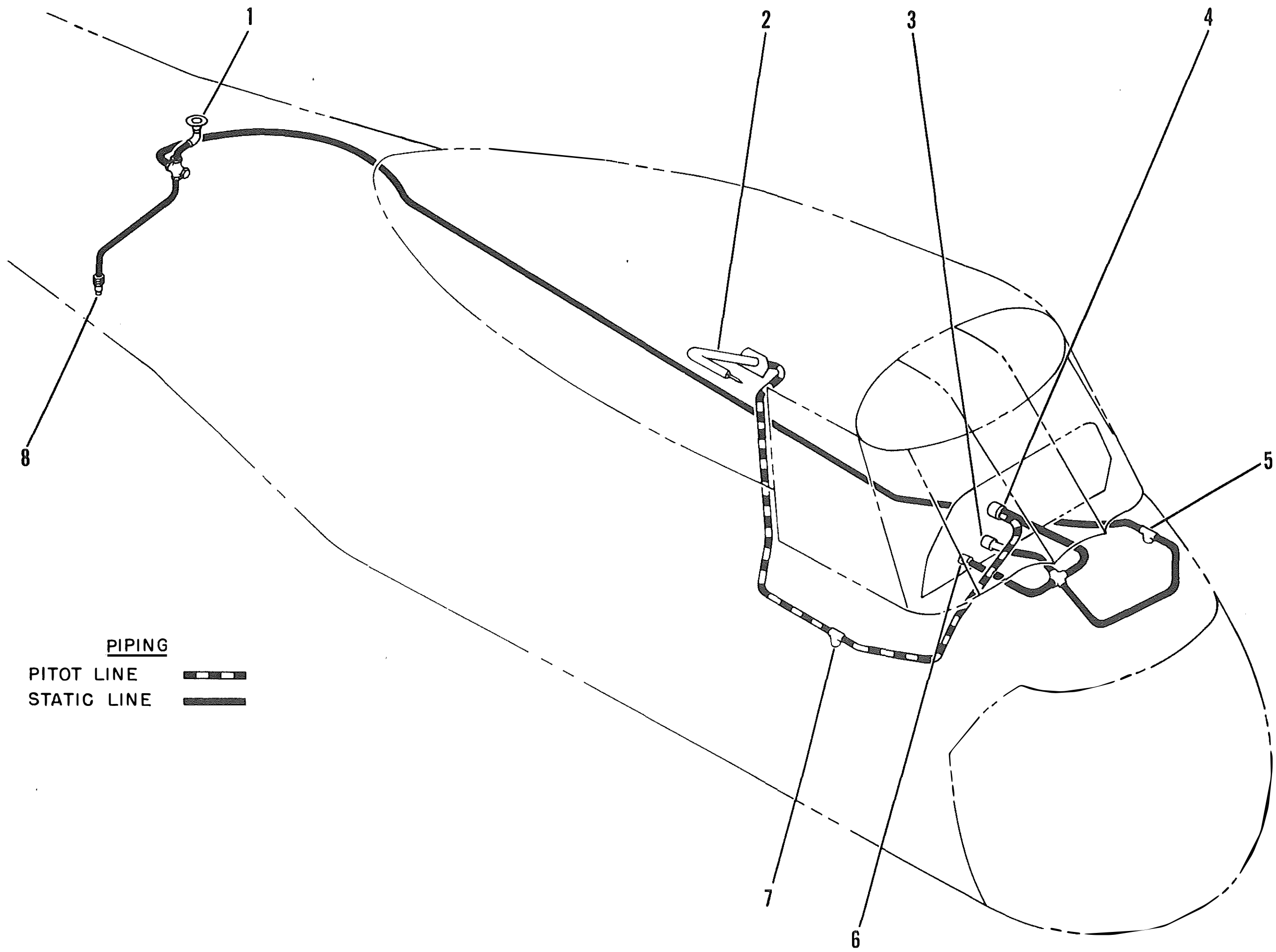
6—109. DESCRIPTION. *(See figures 6—1 and 6—2.)* The hydraulic system instruments provide the pilot with an indication of the pressure available in the hydraulic systems. The hydraulic instruments consist of a primary hydraulic pressure indicator and an auxiliary hydraulic pressure indicator located on the instrument panel.

6—110. PRIMARY HYDRAULIC PRESSURE INDICATOR.

6—111. DESCRIPTION. *(See figures 6—1 and 6—2.)* The primary hydraulic pressure indicator is mounted on the pilot's side of the instrument panel and indicates the pressure in the primary servo hydraulic system. The indicator scale ranges from 0 to 4000 psi in 100 psi graduations. The system derives its power from the 115-volt ac system through an autotransformer and receives its electrical indication of hydraulic oil pressure from the pressure transmitter located on the transmission deck to the left of the main gear box.

6—112. REMOVAL.

a. Remove the mounting screw from the instrument



1. Static Connection
2. Pitot Tube
3. Rate-of-Climb Indicator
4. Air-Speed Indicator
5. Static Line Drain
6. Altimeter
7. Pitot Line Drain
8. Static Connection Drain

Figure 6—6. Pitot-Static System Diagram

panel and pull the indicator out from the panel.

b. Disconnect the wiring from the rear of the indicator and remove the indicator.

6—113. INSTALLATION.

a. Connect the wiring to the rear of the indicator.

b. Position the indicator on the instrument panel and secure with the mounting screw.

Note

For removal and installation of the primary hydraulic pressure indicator system, refer to paragraph 2—418.

6—114. AUXILIARY HYDRAULIC PRESSURE INDICATOR.

6—115. DESCRIPTION. *(See figures 6—1 and 6—2.)* The auxiliary hydraulic pressure indicator is mounted on the pilot's side of the instrument panel and indicates the pressure in the auxiliary servo hydraulic system. The indicator scale ranges from 0 to 4000 psi in 100 psi graduations. The system derives its power from the 115-volt ac system through an autotransformer and receives its electrical indication of hydraulic oil pressure from the pressure transmitter located on the transmission deck to the right of the main gear box.

6—116. REMOVAL.

a. Remove the mounting screw from the instrument panel and pull the indicator out from the panel.

b. Disconnect the wiring from the rear of the indicator, and remove the indicator.

6—117. INSTALLATION.

a. Connect the wiring to the rear of the indicator.

b. Position the indicator on the instrument panel and secure with the mounting screw.

Note

For removal and installation of the auxiliary hydraulic pressure indicator system, refer to paragraph 2—453.

6—118. PITOT-STATIC SYSTEM.

6—119. DESCRIPTION. *(See figure 6—6.)* The pitot-static system consists of a pitot pressure system and a static pressure system.

6—120. PITOT PRESSURE SYSTEM.

6—121. DESCRIPTION. *(See figure 6—6.)* The pitot pressure system consists of a pitot tube, tubing and hoses extending to the air-speed indicator. The pitot tube is mounted on the end of a support that extends out from a base assembly mounted on the cockpit canopy above and aft of the pilot's sliding window on the right side of the helicopter. The pitot tube is electrically heated; a "PITOT HEAT" switch on the overhead switch panel operates the heater.

6—122. REMOVAL.

a. Disconnect the wiring and tubing at the base assembly inside the cockpit canopy.

b. Cut the lock wire and remove the two screws which secure the support to the base assembly on the outside of the canopy.

c. Pull the support with the pitot tube out of the base assembly.

d. Remove the tubing connections from the air-speed indicator.

e. Disconnect the tubing from the drain, located on the right side of the helicopter at the forward cabin bulkhead, by removing the drain fitting.

f. Remove the bulkhead fittings, connections and clamps which secure the tubing to the bulkheads and cockpit canopy. Remove the tubing.

6—123. INSTALLATION.

a. Install the connections, clamps and bulkhead fittings which mount the pitot tubing to the bulkheads and cockpit canopy and install the tubing.

b. Install the drain fitting and connect the tubing to both ends.

c. Connect the tubing to the rear of the air-speed indicator.

d. Position the support, with the pitot tube, in the base assembly on the right side of the forward cockpit canopy.

e. Install the two locking screws through the support and base assembly and lockwire the screws.

f. Connect the wiring and tubing to the pitot tube at the base assembly inside the cockpit canopy.

6—124. MAINTENANCE. Drain off the moisture daily which collects in the pitot system at the drain on the right side of the forward cabin bulkhead. Access to the drain is at the front of the cabin. Check that the drain holes in the pitot tube are free of dirt.

CAUTION

Do not blow or suck on any pitot line unless it is disconnected from the instrument.

6—125. TESTING PITOT SYSTEM. To prevent errors in the air-speed indicator readings, check the system to see that it is leakproof. Seal the pitot pressure chamber drain holes of the pitot tube. With the air-speed indicator properly connected to the pitot pressure line, connect the pitot pressure opening of the pitot tube to a source of pressure. Slowly apply the pressure in sufficient amount to cause the air-speed indicator pointer to indicate 130 knots (approximately 0.82 inches Hg or 11.18 inches of water pressure). At this point pinch off the source of pressure. During a period of one minute, the air-speed pointer position change must not be more than 10 knots (minimum indication must be 120 knots). Tap the air-speed indicator or instrument panel during the one-minute period to remove friction effect from indication of pointer.

6—126. STATIC PRESSURE SYSTEM.

6—127. DESCRIPTION. *(See figure 6—6.)* The static pressure system consists of a static pressure connection, tubing and hoses extending from the connection to the barometric altimeter, air-speed indicator and rate-of-climb indicator. The static pressure connection consists of a group of seven holes in the skin which open into a threaded flange and gasket riveted to the inner surface of the skin. The pressure connection is located on top of the helicopter above the electronics compartment.

6—128. REMOVAL.

a. Disconnect the tubing from the air-speed indicator, altimeter and rate-of-climb indicator at the rear of the instrument panel.

b. Disconnect the tubing from the drain (5, figure 6—6) at the left side of the cabin forward bulkhead and remove the drain.

c. Remove the fittings, connections and clamps which secure the tubing to the left side of the fuselage.

d. Disconnect the tubing from the tee below the static connection (1) at the upper right side of the electronics compartment.

Note

The static connection is riveted to the skin of the helicopter and is, therefore, not readily removable.

e. Disconnect the drain tube from the tee, remove the clamps and remove the drain tube. Remove the union and cap assembly from the tube.

f. Remove the tee and tube from the static connection (1).

6—129. INSTALLATION.

a. Connect the tube and tee to the static connection at the upper right side of the electronics compartment.

b. Install the cap assembly and union on the drain tube. Connect the drain tube to the tee and secure with the clamps.

c. Connect the tubing to the tee below the static connection in the electronics compartment.

d. Install the fittings, connections and clamps and secure the tubing to the left side of the fuselage.

e. Install the drain at the tee fitting on the left side of the forward cabin bulkhead.

f. Connect the tubing to the rear of the air-speed indicator, altimeter and rate-of-climb indicator on the instrument panel.

6—130. MAINTENANCE. Drain off the moisture daily which collects in the static system at the drain (8, figure 6—6) mounted on the right side of the electronics compartment aft bulkhead, and the drain (5) on the left side of the cabin forward bulkhead. Check that the openings at the static connection are free of dirt.

CAUTION

Do not blow or suck on any static line unless it is disconnected from the instruments.

6—131. TESTING STATIC SYSTEM. To prevent errors in the altimeter, air-speed and rate-of-climb indicator readings, check the entire static system to see that it is leakproof. With the instruments properly connected to the static pressure lines, connect the holes in the static pressure connection to a source of suction. Set the altimeter pointers to indicate "O." Slowly apply suction in sufficient amount to cause the altimeter pointers to indicate 1000 feet altitude (a suction of approximately 1.05 inches Hg or 14.24 inches of water). At this point pinch off the source of suction. During a period of one minute, the change of the altimeter pointer must not be more than 150 feet (minimum indication must be 850 feet of altitude). Tap the altimeter or instrument panel during the one minute period to remove friction effect from the indication of the pointers. Regulate the slow application and removal of suction by the indication of the rate-of-climb indicator which must not exceed 2000 fpm.

CAUTION

Do not apply pressure to the static lines.

SECTION VII

ELECTRICAL SYSTEM

TABLE OF CONTENTS

Paragraph		Page
7–1.	**ELECTRICAL POWER**	**362**
7–3.	ELECTRICAL LOAD ANALYSIS	362
7–5.	**DC POWER SUPPLY SYSTEM**	**362**
7–7.	GENERATOR	363
7–11.	MAINTAINING GENERATOR	363
7–12.	FLASHING GENERATOR FIELD	363
7–14.	ADJUSTING GENERATOR VOLTAGE	366
7–16.	GENERATOR SWITCH	366
7–18.	VOLTAGE REGULATOR	366
7–23.	ADJUSTMENT	366
7–24.	TESTING	366
7–25.	OVERVOLTAGE RELAY	366
7–30.	TESTING	367
7–31.	GENERATOR FIELD CONTROL RELAY	367
7–36.	TESTING	367
7–37.	AMMETER SHUNT	367
7–39.	AMMETER (LOADMETER)	367
7–43.	BATTERY	367
7–47.	MAINTAINING BATTERY	368
7–49.	TESTING	369
7–50.	EXTERNAL POWER RECEPTACLE	369
7–52.	**DC POWER DISTRIBUTION SYSTEM**	**369**
7–54.	MAIN SWITCH PANEL	369
7–58.	OVERHEAD CONTROL PANEL	370
7–62.	BATTERY SUPPLY CIRCUIT	372
7–64.	PRIMARY SUPPLY CIRCUIT	373
7–66.	REVERSE CURRENT CUT-OUT RELAY	373
7–70.	GENERATOR FAILURE WARNING LIGHT	374
7–72.	GENERATOR FAILURE WARNING LIGHT RELAY	375
7–76.	BATTERY SWITCH	375
7–78.	BATTERY RELAY	375
7–82.	EXTERNAL POWER RELAY	375
7–86.	SECONDARY SUPPLY CIRCUIT	376
7–88.	BUS TIE RELAY	376
7–92.	GROUND CHECK RELAY	377
7–96.	DC CIRCUIT BREAKERS	377
7–98.	TROUBLE SHOOTING – DC ELECTRICAL SYSTEM	378
7–100.	ADJUSTMENT – DC ELECTRICAL SYSTEM	378
7–102.	TESTING – DC POWER SYSTEM	378
7–104.	**AC POWER SUPPLY SYSTEM**	**379**
7–106.	INVERTERS	379
7–111.	ADJUSTMENT	380
7–112.	TESTING	380
7–113.	INVERTER SWITCH	380

TABLE OF CONTENTS (Cont)

Paragraph		Page
7–115.	**AC POWER DISTRIBUTION SYSTEM**	**380**
7–117.	INVERTER FAILURE WARNING LIGHT	380
7–119.	INVERTER FAILURE WARNING LIGHT RELAY	380
7–123.	AUTOTRANSFORMER	381
7–127.	AC–DC INTERLOCK RELAY	381
7–131.	AC FUSES	382
7–133.	TROUBLE SHOOTING – AC ELECTRICAL SYSTEM	382
7–135.	ADJUSTMENT – AC ELECTRICAL SYSTEM	382
7–137.	TESTING – AC ELECTRICAL SYSTEM	383
7–139.	**LIGHTING PROVISIONS**	**383**
7–141.	**EXTERIOR LIGHTS**	**383**
7–143.	NAVIGATION LIGHTS	383
7–148.	TESTING	383
7–149.	LIGHT FLASHER	383
7–153.	FORMATION LIGHTS	384
7–158.	TESTING	384
7–159.	LANDING LIGHT	384
7–164.	TESTING	385
7–165.	CARGO FLOODLIGHT	385
7–170.	TESTING	385
7–171.	**INTERIOR LIGHTS**	**385**
7–173.	DOME LIGHTS AND TROUBLE LIGHTS	385
7–178.	CONSOLE AND PANEL LIGHTS	386
7–183.	INSTRUMENT LIGHTS	386
7–188.	**INSPECTION LIGHTS**	**387**
7–193.	WARNING LIGHT DIMMING RELAY AND SWITCH	387
7–197.	TROUBLE SHOOTING – LIGHTS	387
7–199.	**MISCELLANEOUS EQUIPMENT**	**387**
7–201.	CREW ALARM BELL	387
7–204.	FUEL NOZZLE GROUNDING RECEPTACLES	388
7–205.	RADIO INTERFERENCE REDUCTION COMPONENTS	388
7–206.	**ELECTRICAL LOAD ANALYSIS CHARTS**	**388**

7–1. ELECTRICAL POWER.

7–2. DESCRIPTION. *(See figure 7–1.)* The model H-34A helicopter has two electrical supply systems: a 28-volt dc system (paragraph 7–5) and an ac system (paragraph 7–104) which provides both 115 volts and 26 volts. Both systems are of the single-wire type with circuits completed through the helicopter structure except for the ac phase C-A circuits which are two wire. Operating switches and warning lights for both the dc and ac systems are on the main switch panel (2, figure 7–1) at the center of the instrument panel. When on the ground, the helicopter is kept at ground potential by a static ground wire attached to the left main landing gear.

Note

Electrical components contained in other systems are described in connection with the systems of which they are a part.

7–3. ELECTRICAL LOAD ANALYSIS.

7–4. DESCRIPTION. The dc and ac electrical loads will vary with operating conditions. Analysis of the dc and ac electrical loads are provided by load analysis charts (paragraph 7–206).

7–5. DC POWER SUPPLY SYSTEM.

7–6. DESCRIPTION. DC power is supplied by any one of three sources: the generator (paragraph 7–7), the battery (paragraph 7–43), or an external power source (paragraph 7–50). The three dc power sources are connected at the power relay junction box (11, figure 7–1) to the dc power distribution system (paragraph 7–52). Components of the dc power supply system are a generator, a voltage regulator, a generator field control relay, an overvoltage relay, an ammeter, an ammeter shunt, a battery and an external power receptacle.

For trouble shooting, adjusting and testing the dc power supply system, refer to paragraphs 7—98, 7—100, and 7—102 respectively.

7—7. GENERATOR.

7—8. DESCRIPTION. *(See figure 7—2.)* The generator (8, figure 7—1), which is mounted at the left rear of the main gear box, is rated at 30 volts, 200 amperes, at 3000 to 8000 rpm. It is cooled by a blower mounted adjacent to it and both generator and blower are driven through take-off gears from the tail rotor drive gear (paragraph 5—348). The generator and blower operate only when the engine is in operation and the clutch engaged. Generator terminal "A," the generator shunt field terminal, connects to the "N" terminal on the generator field control relay (paragraph 7—31). Terminal "B," the generator output terminal, connects to the "GEN" terminal on the reverse current cut-out relay (paragraph 7—66). Terminal "D," the generator field terminal, connects to the "D" terminal on the voltage regulator (paragraph 7—18). Terminal "E," the generator ground terminal, connects through the ammeter shunt (paragraph 7—37) to the helicopter structure.

7—9. TROUBLE SHOOTING. Refer to paragraph 7—98 for trouble shooting of the dc electrical system.

7—10. REMOVAL. *(See figure 5—46, step 6.)*

a. Place the "BATT" and "GENERATOR" switches on the main switch panel in the "OFF" and "GEN OFF" positions respectively.

b. Unclamp and remove the blower air duct from the generator.

c. Disconnect the electrical wiring from the generator.

d. Support the generator and remove the nuts and gaskets from the generator mounting studs. Remove the generator.

CAUTION

Exercise care when removing the generator from the mounting studs because of the weight factor (approximately 50 pounds).

e. Remove the gasket assembly from the generator mounting studs and the adapter from the generator mounting pad.

f. Remove the rubber plugs from the holes in the generator mounting flange.

7—11. MAINTAINING GENERATOR.

a. Replace any brushes that are less than 1/2-inch long. Seat new brushes by wrapping No. 000 sandpaper around the commutator with the sanded surface next to the brushes and pull in the direction of armature rotation. Keep the sandpaper to the same contour as the surface of the commutator. Repeat the operation until the brushes are completely seated.

CAUTION

Do not use coarse sandpaper or emery cloth of any type. Remove all sand and brush dust with dry compressed air.

b. Clean sticking brushes with a clean, dry, lint-free cloth.

c. Replace the generator if the commutator is burned, very rough, badly scored, pitted or eccentric. Bad scoring or eccentricity can be detected by holding the pointed end of a pencil on top of a brush with the generator running. If the pencil vibrates, the generator must be replaced.

d. Check that the spring tension of the brush spring rigging is between 60 and 66 ounces. If tension is less, replace the generator.

7—12. FLASHING GENERATOR FIELD. If the generator fails to build up voltage because of reversed polarity or loss of residual magnetism, flash the generator field as follows:

a. Prepare a five-foot test cable made of 12-gage insulated cable with battery clamps and battery clamp insulators attached to both ends.

b. Place the "BATT" and "GENERATOR" switches in the "OFF" and "GEN OFF" positions respectively and check that external power is disconnected.

c. Locate the generator field control relay (15, figure 7—1) in the electronics compartment and disconnect the wire from the terminal marked "N." Locate the voltage regulator, remove the shield, disconnect the wire from terminal "D" and tape the wire to prevent accidental grounding.

d. Clamp one end of the test cable to the wire which was detached from the "N" terminal of the generator field control relay and be sure the connection is well protected from accidental grounding by the clamp insulator. This wire leads to the generator field.

e. Remove the cover from the power relay junction box on the right side of the forward bulkhead in the electronics compartment and locate the reverse current cut-out relay (1, figure 7—8).

f. Place the "BATT" switch in the "BATT" position and flash the generator field by touching the loose end of the test cable to the "BATT" terminal on the reverse current cut-out relay for approximately one second.

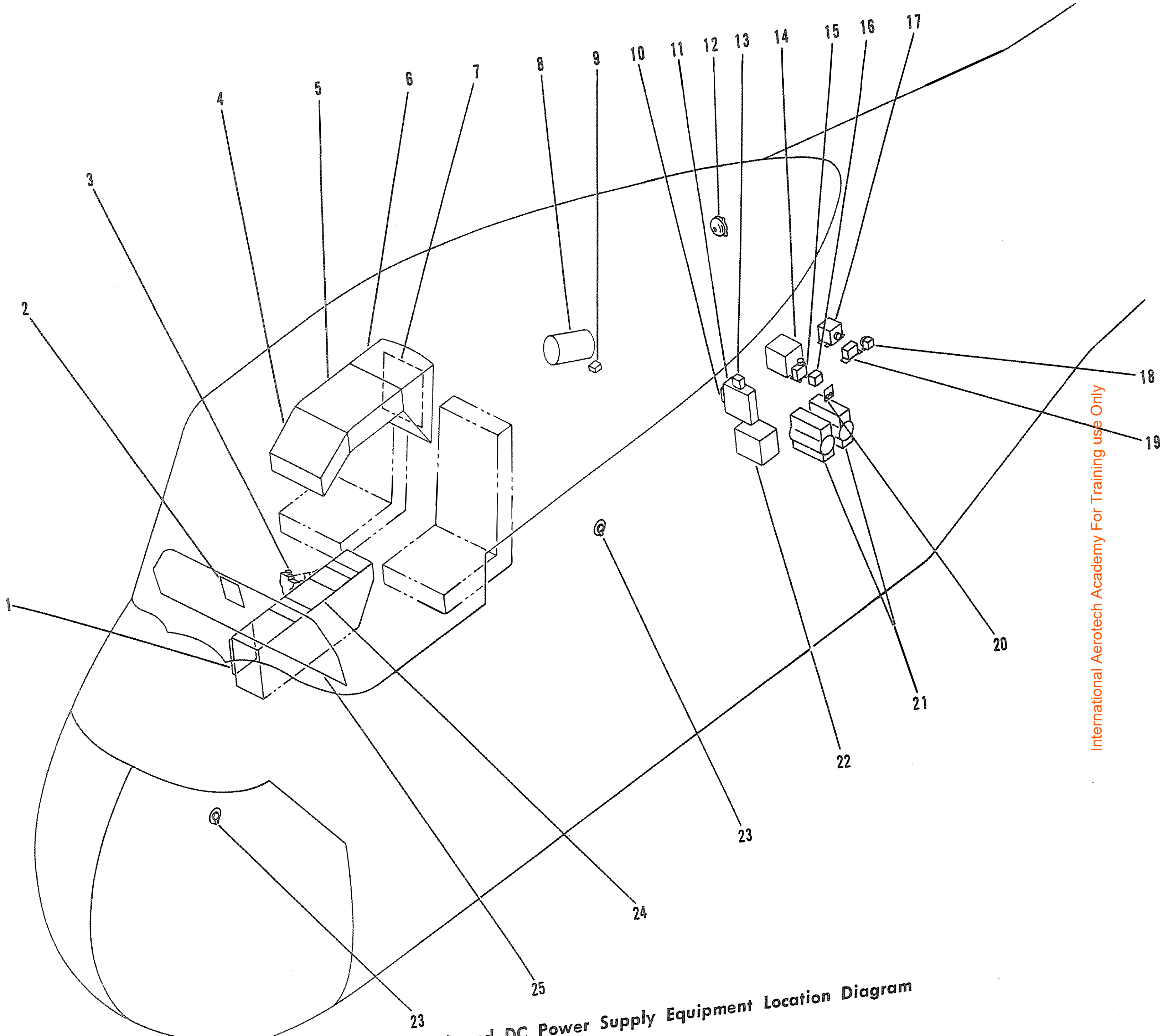


Figure 7–1. AC and DC Power Supply Equipment Location Diagram

Key to Figure 7–1

1. Radio Fuse and Circuit Breaker Panel
2. Main Switch Panel
3. Control Box Installation (Pilot's Pitch Control)
4. Overhead Switch Panel
5. Electrical Fuse and Circuit Breaker Panel
6. Cockpit Dome Light Panel
7. Electrical Relay and Resistor Installation
8. Generator
9. Ammeter Shunt
10. External Power Receptacle
11. Power Relay Junction Box
12. Crew Alarm Bell
13. Battery Bus Circuit Breaker Box
14. Voltage Regulator
15. Generator Field Control Relay
16. Overvoltage Relay
17. Flasher (Navigation Lights)
18. Autotransformer
19. Interlock Relay
20. Transformer Fuse Panel
21. Inverters
22. Battery
23. Fuel Nozzle Grounding Receptacle
24. Control Console
25. Instrument Panel

CAUTION

To prevent damage to equipment, do not flash the generator field for longer than one second.

g. Place the "BATT" switch in the "OFF" position.

h. Disconnect the test cable, replace the cover on the power relay junction box, replace the connection to the "D" terminal on the voltage regulator and replace the connection to the "N" terminal on the generator field control relay. Replace the shield on the voltage regulator.

WARNING

Be sure connections in the power relay junction box are correctly made and secure, that no foreign objects are left in the box and the cover is replaced securely. Short circuits in the junction box can result in dangerous fires.

i. If the generator field repeatedly fails to put out voltage on run-up, check the generator to see if the commutator is dirty or excessively coated with insulating film, oil, etc. Clean the commutator sufficiently to obtain continued operation. The commutator need not be cleaned to a bright surface. A slight lubrication film, identified as a bronze discoloration, is desirable for high generator load and high altitude operation. Removal and replacement of the generator may be necessary to obtain satisfactory service.

WARNING

Do not flash the generator field by closing the reverse current relay contact. Serious damage to the relay or the electrical system and injury to the individual closing the contact may result from the heavy battery current.

7–13. INSTALLATION.

(See figure 5–46, step 6.)

Note

Apply grease (index 24, paragraph 1–32) sparingly by hand to both the generator drive and internal generator gear splines.

a. Place the "BATT" and "GENERATOR" switches in the "OFF" and "GEN OFF" positions respectively.

b. With a feeler gage, measure the space between the two rings of the gasket at several points on the circumference. Mark the point on the gasket at which the maximum space is measured and record the minimum measurement.

c. Position the gasket on the generator mounting

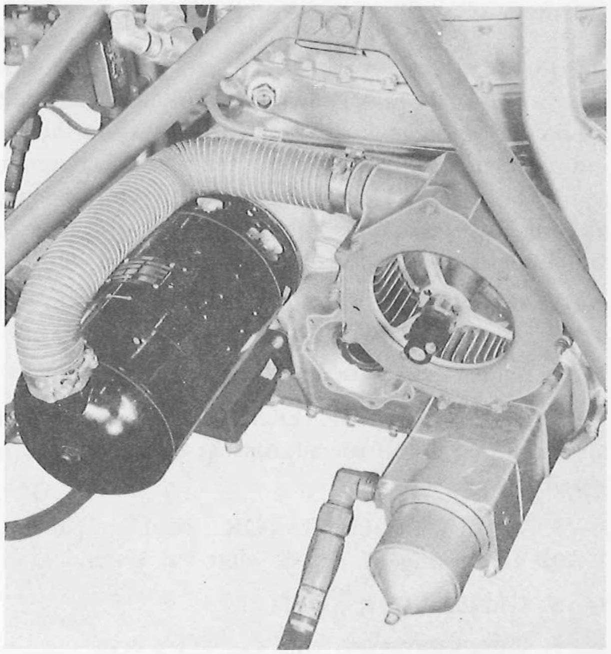


Figure 7–2. Generator Installed

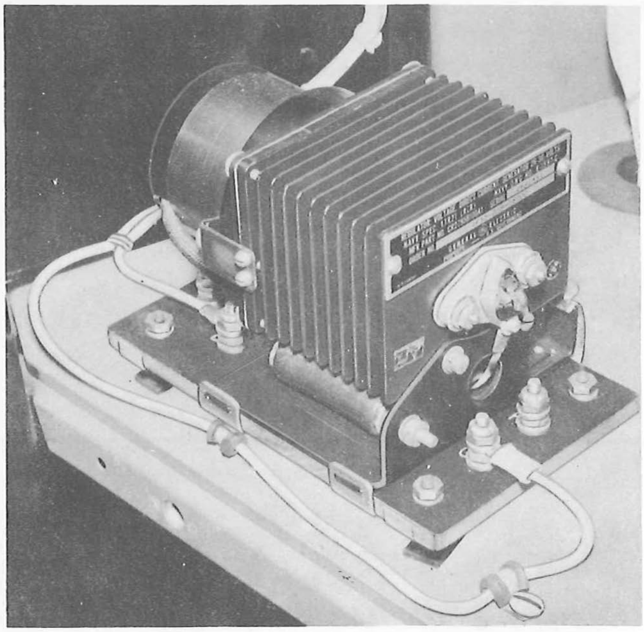


Figure 7–3. Voltage Regulator Installed (Cover Removed)

studs with the point of maximum measurement at the bottom of the generator mounting pad.

d. Place the adapter in position on the generator mounting pad.

e. Insert the plugs in the holes of the generator mounting flange.

Note

If necessary, cut out the narrow connecting strip of the plugs to allow them to fit around the studs.

f. Position and support the generator on the studs. Place a gasket on each stud with the rubber side against the flange of the generator. Install the nuts on the studs and tighten them evenly until the space between the two metal plates of the gasket assembly is 0.010 inches less than the minimum space recorded in step b. around the circumference of the gasket.

g. Connect the blower air duct to the generator and secure it with the clamp.

h. Connect the electrical wiring to the generator.

7–14. ADJUSTING GENERATOR VOLTAGE. Refer to paragraph 7–100 for adjustment of the dc electrical system.

7–15. TESTING GENERATOR. Refer to paragraph 7–102 for testing of the dc electrical system.

7–16. GENERATOR SWITCH.

7–17. DESCRIPTION. The "GENERATOR" switch is a double-pole, double-throw switch located on the main switch panel (figure 7–6) on the instrument panel. The switch has three positions: "GEN," "GEN OFF," "RESET." In the "GEN" position, the generator output is connected to both the overvoltage relay and the generator field control relay. The "RESET" position is a momentary position in which the switch must be held. When the switch is in the "RESET" position, the reset coil of the generator field control relay (paragraph 7–31) is energized from the primary supply circuit.

7–18. VOLTAGE REGULATOR.

7–19. DESCRIPTION. *(See figure 7–3.)* The voltage regulator (14, figure 7–1) is located on the right shelf in the electronics compartment and is designed to maintain generator output between 27.2 and 28.8 volts. Generator output connects to the "B" terminal on the regulator, passes through the carbon pile regulator resistance to the "D" terminal which connects to the generator field terminal "D." A screw-type adjustment is provided for regulating the resistance. Variations in generator output, due to changes in generator speed or load, cause variations in the carbon pile regulator resistance. These variations, in turn, produce compensating changes in generator field voltage which maintain a relatively constant voltage output.

7–20. TROUBLE SHOOTING. Refer to paragraph 7–98 for trouble shooting of the dc electrical system.

7–21. REMOVAL.

a. Place the "BATT" and "GENERATOR" switches in the "OFF" and "GEN OFF" positions respectively and check that external power is disconnected.

b. Remove the shield from the voltage regulator and disconnect the wiring.

c. Remove the securing screws, washers and nuts from the regulator and remove the regulator.

7–22. INSTALLATION.

a. Place the "BATT" and "GENERATOR" switches in the "OFF" and "GEN OFF" positions respectively.

b. Place the voltage regulator in position on its mounting bracket and secure it with the screws, washers and nuts.

c. Connect the wiring to the regulator and replace the regulator shield.

7–23. ADJUSTMENT. Refer to paragraph 7–100 for adjustment of the dc electrical system.

7–24. TESTING. Refer to paragraph 7–102 for testing of the dc electrical system.

7–25. OVERVOLTAGE RELAY.

7–26. DESCRIPTION. The overvoltage relay (16, figure 7–1) is located on the right shelf in the electronics compartment. In the event of an overvoltage condition due to failure of the voltage regulator, the overvoltage relay connects the trip coil of the generator field control relay (paragraph 7–31) to the primary supply circuit. The relay operates between 31 and 33 volts.

7–27. TROUBLE SHOOTING. Refer to paragraph 7–98 for trouble shooting of the dc electrical system.

7–28. REMOVAL.

a. Place the "BATT" and "GENERATOR" switches in the "OFF" and "GEN OFF" positions respectively.

b. Disconnect the electrical wiring and remove the screws, washers and nuts from the relay.

c. Remove the relay.

7–29. INSTALLATION.

a. Place the "BATT" and "GENERATOR" switches in the "OFF" and "GEN OFF" positions respectively.

b. Position the relay and secure it with the screws, washers and nuts.

c. Connect the electrical wiring to the relay.

7–30. TESTING. Refer to paragraph 7–102 for testing of the dc electrical system.

7–31. GENERATOR FIELD CONTROL RELAY.

7–32. DESCRIPTION. The generator field control relay (15, figure 7–1) is located on the right shelf in the electronics compartment. It contains a trip coil, a reset coil and relay contacts. When the trip coil is energized by operation of the overvoltage relay (paragraph 7–25), the relay contacts are opened to disconnect generator output from both the primary supply circuit and from the generator field. This prevents possible damage to both the dc equipment and the generator itself because of excessively high voltage. The generator failure warning light (paragraph 7–70) will come on when the trip coil is energized. When the reset coil is energized by momentarily placing the "GENERATOR" switch (paragraph 7–16) in the "RESET" position, the relay contacts are closed to place the generator back in normal operation.

7–33. TROUBLE SHOOTING. Refer to paragraph 7–98 for trouble shooting of the dc electrical system.

7–34. REMOVAL.

a. Place the "BATT" and "GENERATOR" switches in the "OFF" and "GEN OFF" positions respectively.

b. Disconnect the electrical wiring from the relay, remove the securing screws, washers and nuts and remove the relay.

7–35. INSTALLATION.

a. Place the "BATT" and "GENERATOR" switches in the "OFF" and "GEN OFF" positions respectively.

b. Position the relay and secure it with the screws, washers and nuts.

c. Connect the electrical wiring to the relay.

7–36. TESTING. Refer to paragraph 7–102 for testing of the dc electrical system.

7–37. AMMETER SHUNT.

7–38. DESCRIPTION. The 300-ampere ammeter shunt (9, figure 7–1) is located on the main transmission deck adjacent to the generator. It is connected in series between the generator ground terminal "E" and ground.

7–39. AMMETER (LOADMETER).

7–40. DESCRIPTION. *(See figure 6–1.)* The ammeter is a single-purpose instrument and is located on the instrument panel. It is connected across the ammeter shunt in series with the generator output circuit. The ammeter is calibrated as a loadmeter and indicates the ratio between generator load and rated generator capacity. The dc power load analysis chart (paragraph 7–206) shows what the load is under various operating conditions.

7–41. REMOVAL.

a. Place the "BATT" and "GENERATOR" switches in the "OFF" and "GEN OFF" positions respectively.

b. Hinge down the ammeter light shield on the instrument panel in the cockpit and remove the lamps.

c. Remove the screws and washers which secure the ammeter to the instrument panel, pull the meter out far enough to gain access to the wiring, disconnect the wiring and remove the ammeter and light shield.

7–42. INSTALLATION.

a. Place the "BATT" and "GENERATOR" switches in the "OFF" and "GEN OFF" position respectively.

b. Connect the wiring to the ammeter through the mounting hole in the instrument panel.

c. Place the ammeter and the light shield in position on the instrument panel and secure with the screws and washers. Install the lamps and hinge the shield up to its closed position.

7–43. BATTERY.

7–44. DESCRIPTION. *(See figure 7–4.)* The 24-volt, 36 ampere-hour battery (22, figure 7–1) is located on the floor at the forward right end of the electronics compartment. It is vented to the outside of the helicopter by a plastic intake tube through the right side of the compartment and by a plastic exhaust tube through the bottom of the compartment. A sump jar containing a neutralizing agent is connected in the exhaust tube line. Floor, bulkhead and skin surfaces in the battery area are covered with acid-resistant paint. Electrical connections to the battery are made through a Cannon quick disconnect. The negative terminal of the battery is grounded

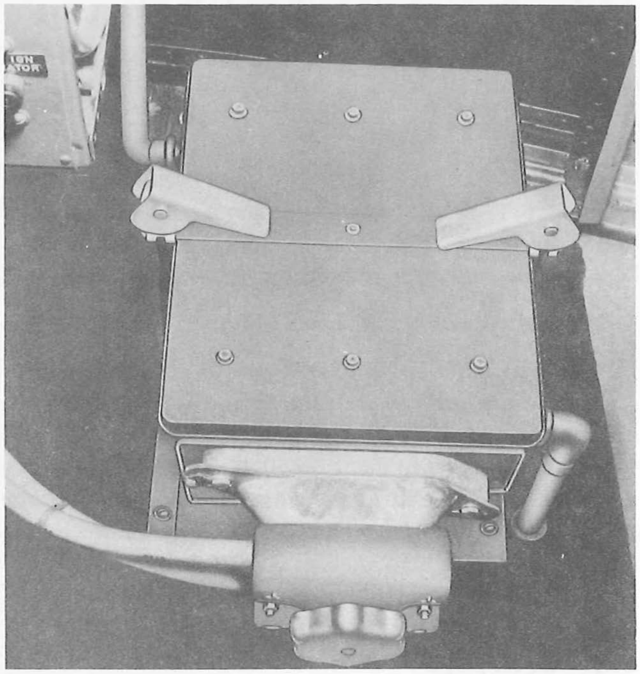


Figure 7–4. Battery Installed

to the helicopter structure. The positive terminal is connected directly to both the battery relay (paragraph 7–78) and the battery supply circuit (paragraph 7–62).

7–45. TROUBLE SHOOTING. Refer to paragraph 7–98 for trouble shooting of the dc electrical system.

7–46. REMOVAL.

a. Place the "BATT" switch in the "OFF" position and be sure external power is disconnected.

b. Pull the intake and exhaust tubes from the battery box.

c. Detach the electrical connections by means of the quick disconnect.

d. Unsnap the hold-down clamps and lift the battery from its rack.

7–47. MAINTAINING BATTERY. Check the battery condition weekly or after every 25 hours of flight, whichever comes first.

a. Check the insulation of the battery leads for corrosion and wear.

b. Remove the battery cover and inspect for leakage of acid due to a broken case, softening or cracking of sealing compound or leakage around terminals. If leakage is found, replace the battery.

c. If corrosion is present, remove the battery from the helicopter, wash with sodium bicarbonate and rinse with water.

CAUTION

Sodium bicarbonate is destructive to unpainted aluminum and should not be used while the battery is installed in the helicopter.

d. Check the vent and drain tubes for pockets and obstructions. Disconnect the tubes and clean by inserting a small tube and blowing the tubes clear.

WARNING

Do not put mouth directly to drain tube since severe acid burns may result.

e. Check the specific gravity of the electrolyte with a temperature-corrected hydrometer. If such a hydrometer is not available, use any hydrometer and make temperature corrections from table XXX. When filling the hydrometer, draw off just enough electrolyte to raise the hydrometer float from its plug at the bottom of the tube. Always return the test fluid to the cell from which it was taken to avoid concentrating too much or too little in different cells. Replace the battery if the temperature-corrected hydrometer reading is below 1.240 or above 1.300. If the electrolyte level is too low to permit a hydrometer reading, return the battery for shop servicing or add water as directed in step f.

TABLE XXX
HYDROMETER CORRECTION TABLE

ELECTROLYTE TEMP. DEGREES F.		SPECIFIC GRAVITY CORRECTION
140°		0.024°
130°	ADD	0.020°
120°	TO	0.016°
110°	READING	0.012°
100°		0.008°
90°	NO	
80°	CORRECTION REQUIRED	
70°	HERE	
60°		0.008°
50°		0.012°
40°		0.016°
30°		0.020°
20°	SUBTRACT	0.024°
10°	FROM	0.028°
0°	READING	0.032°
−10°		0.036°
−20°		0.040°
−30°		0.044°

CAUTION

Avoid contact with the battery electrolyte (acid) as it will burn skin and clothing. If spilled, flush affected area with water, coat with sodium bicarbonate and later flush again with water.

f. If the electrolyte level is too low to be seen or for hydrometer readings to be taken, add water with a self-leveling syringe. If available, use distilled water; otherwise drinking water will be satisfactory. Hold the syringe in a vertical position and, regardless of the electrolyte level, fill the cell. Then withdraw water into the syringe until air is sucked in. This should leave the electrolyte at a proper level (about 3/8-inch above the separator protectors). After adding water, allow several minutes of charging before taking any hydrometer readings, otherwise the readings will be inaccurate.

CAUTION

If the battery is exposed to temperatures below freezing, do not add water unless the battery is to be charged immediately, as the water will remain on top and freeze.

7–48. INSTALLATION.

a. Place the "BATT" switch in the "OFF" position and be sure external power is disconnected.

b. Place the battery in its rack and secure with the hold-down clamps.

c. Connect the intake and exhaust tubes to the battery.

d. Replace the quick disconnect and turn the wheel to the lock position.

7–49. TESTING. Refer to paragraph 7–102 for testing of the dc electrical system.

7–50. EXTERNAL POWER RECEPTACLE.

7–51. DESCRIPTION. *(See figure 7–5.)* The shielded external power receptacle (10, figure 7–1) is attached to the right side of the power relay junction box on the forward bulkhead of the electronics compartment. The external power receptacle extends through the right side of the helicopter and is accessible from the outside through an access door (24, sheet 1, figure 1–4). It provides means for connecting an external 28-volt dc power source to the helicopter's dc power distribution system (paragraph 7–52). When external power is not connected, the receptacle is not energized. The receptacle has three contact pins, two positive and one negative. The negative contact pin grounds to the helicopter structure. One positive pin connects to the solenoids of both the external power relay (paragraph 7–82) and the ground check relay (paragraph 7–92). The other positive pin connects to the primary bus through the contacts of the external power relay.

Figure 7–5. External Power Receptacle

7–52. DC POWER DISTRIBUTION SYSTEM.

7–53. DESCRIPTION. DC power is distributed through three supply circuits: the battery, the primary and the secondary. Except for the battery supply circuit, the distribution system is controlled by the "BATT" switch, the "GENERATOR" switch and five relays: the battery relay, the reverse current cut-out relay, the ground check relay, the bus tie relay and the external power relay. A generator failure warning light, marked "GEN OFF," is included in the distribution system. Switches are located on the main switch panel and the overhead control panel. Protective circuit breakers are also located on the overhead control panel. The battery supply circuit connects directly to the battery and is always energized. For trouble shooting, adjusting and testing the dc power distribution system, refer to paragraphs 7–98, 7–100 and 7–102 respectively.

7–54. MAIN SWITCH PANEL.

7–55. DESCRIPTION. *(See figure 7–6.)* The main switch panel (2, figure 7–1) is located on the instrument panel. The following electrical system components are mounted on the panel: the battery switch (marked "BATT"), the "GENERATOR" switch, the generator

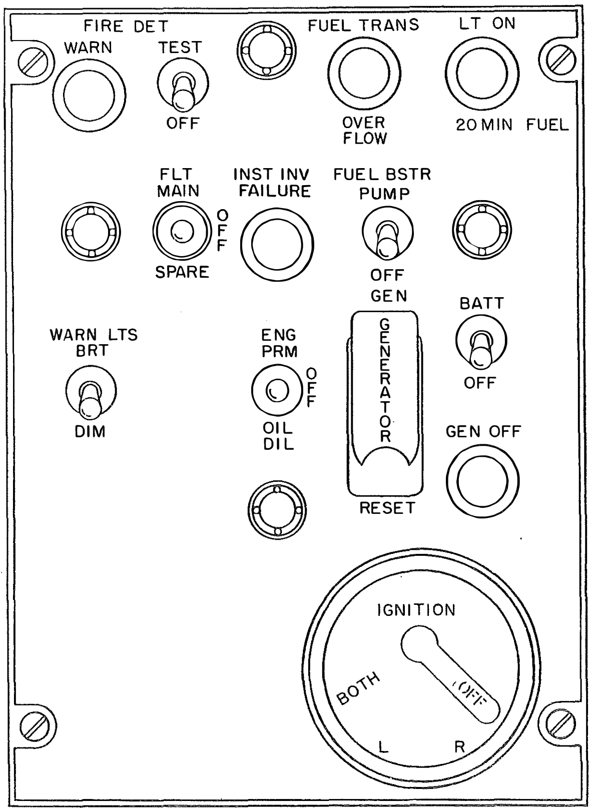


Figure 7—6. Main Switch Panel

failure warning light (marked "GEN OFF"), the inverter switch (marked "FLT MAIN-OFF-SPARE") and the inverter failure warning light (marked "INST INV FAILURE").

7—56. REMOVAL.

a. Loosen the fasteners securing the switch panel on the instrument panel.

b. Lift the switch panel from the instrument panel.

c. Carefully disconnect the wiring from each unit.

7—57. INSTALLATION.

a. Carefully connect the wiring to each unit on the switch panel.

b. Position the switch panel on the instrument panel and secure it with the fasteners.

7—58. OVERHEAD CONTROL PANEL.

7—59. DESCRIPTION. *(See figure 7—7.)* The overhead control panel contains the overhead switch panel (4, figure 7—1), the electrical fuse and circuit breaker panel (5) and the cockpit dome light panel (6). The electrical relay and resistor installation (7) is located behind the cockpit dome light panel.

7—60. REMOVAL.

a. Place the "BATT" and "GENERATOR" switches in the "OFF" and "GEN OFF" positions respectively and be sure external power is disconnected.

b. Swing the right service platform down and detach the two plugs on the canted bulkhead which carry electrical wiring to the overhead control panel in the cockpit.

c. Remove the receptacles to the plugs which were removed in step b. from the forward side of the canted bulkhead in the cockpit.

d. Disconnect the wiring which leads to the control panel from the terminal strip at the upper right of the canted bulkhead in the cockpit.

e. Unfasten and hinge down the electrical fuse and circuit breaker panel.

f. Remove the nuts and washers which secure the power supply cable to the primary bus bar and the secondary bus bar on the back of the electrical fuse and circuit breaker panel.

g. Disconnect the wiring above the electrical fuse and circuit breaker panel from the top, forward fuselage light (6, figure 7—1).

h. Remove the two loose power supply cables which were detached in step f. from the control panel box by pulling them out through the grommet on the right side of the box.

i. Hinge up the electrical fuse and circuit breaker panel and secure it with the fasteners.

j. Provide support for the control panel to prevent it dropping down. Remove the screws and washers which secure the control panel box to the cockpit canopy intercostals and remove the box, with panels attached, from the helicopter.

7—61. INSTALLATION.

a. Place the "BATT" and "GENERATOR" switches in the "OFF" and "GEN OFF" positions respectively and be sure external power is disconnected.

b. Place the control panel box, with panels attached, in mounting position on the inside of the cockpit canopy and secure it to the intercostals with the screws and washers.

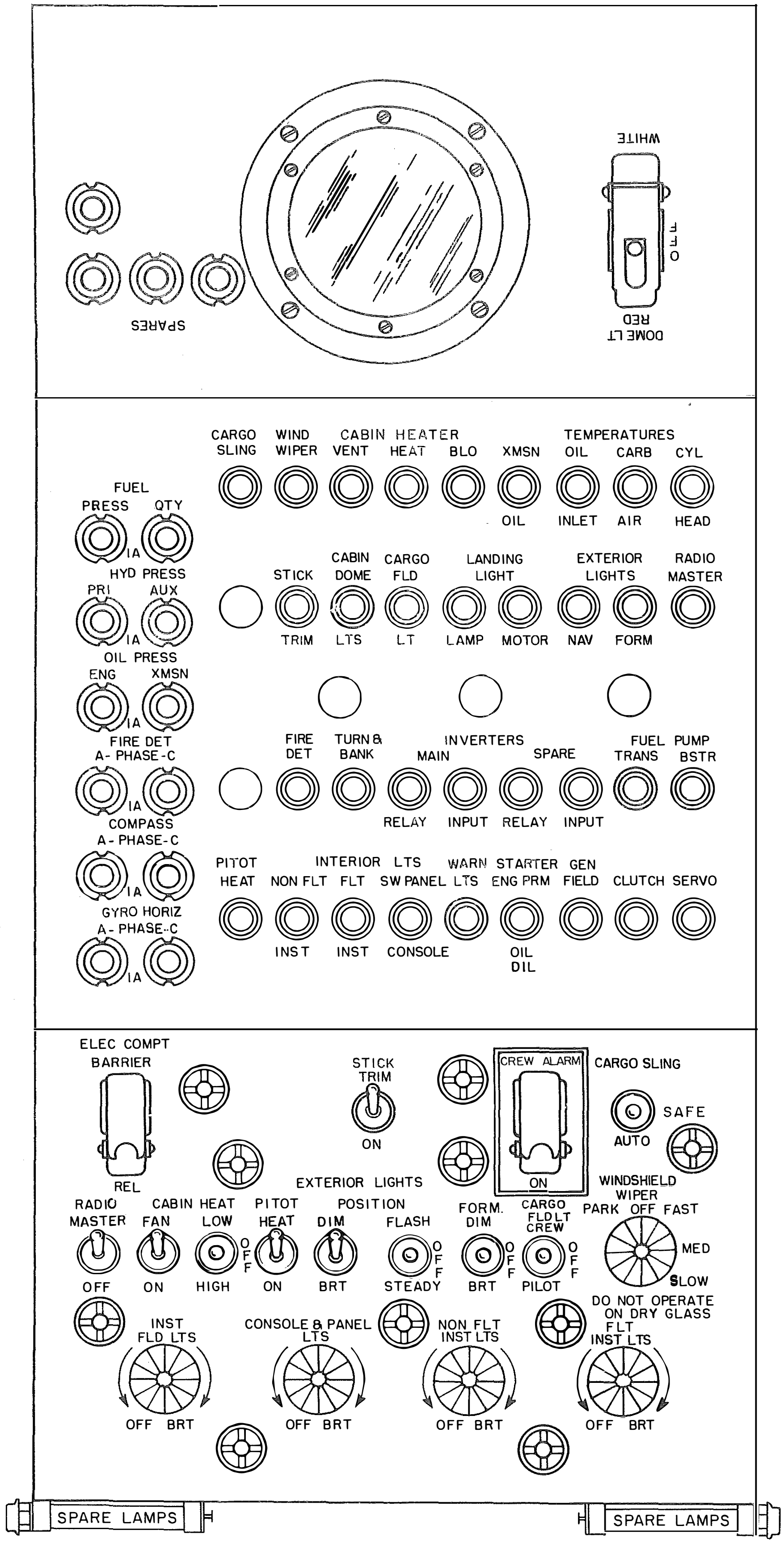


Figure 7–7. Overhead Control Panel

c. Unfasten and hinge down the electrical fuse and circuit breaker panel.

d. Connect the wiring above the electrical fuse and circuit breaker panel to the top forward fuselage light (6, figure 7–11). Refer to figure 10–34 for the proper wiring connection.

e. Insert the two loose cables, which carry power to the primary and secondary bus bars in the overhead control panel, through the grommet on the right side of the control panel box. Attach the proper cable to the primary and to the secondary bus bar and secure each cable with the washers and nut. Refer to figure 10–32 for proper wiring connections.

f. Hinge up the electrical fuse and circuit breaker panel and secure it with the fasteners.

g. Connect the loose wires hanging from the right side of the control panel box to the terminal strip at the upper right of the canted bulkhead. Refer to post terminal strip (13, figure 1–42) for proper wiring connections.

h. Secure the two loose receptacles that hang from the right side of the control panel box by attached wires at the mounting holes at the upper right of the canted bulkhead.

i. Swing the right service platform down and connect the proper plugs to the receptacles inserted through the canted bulkhead in step h. For wiring connections to these two plugs, refer to plug diagrams (3, 4, 5 and 6, figure 10–43).

7–62. BATTERY SUPPLY CIRCUIT.

7–63. DESCRIPTION. The battery supply circuit consists of a single bus bar connected directly to the battery and through the contacts of the battery relay to the primary supply circuit. The bus bar is located in the battery bus circuit breaker box (13, figure 7–1) secured to the top of the power relay junction box on the right side of the forward bulkhead in the electronics compartment. Circuit breakers connected to the bus are mounted on the front of the box (figure 7–13) and are appropriately marked to indicate the operating circuits they protect. When battery power only is available, the circuit is continuously energized from the battery. When external or generator power is available and the "BATT" switch is "ON," the circuit is energized from the primary dc supply circuit and the battery is charging. Table XXXI presents a summary of operating conditions for the dc distribution system. The circuit supplies power to equipment (table XXXII) of either a convenience or emergency nature which may be used regardless of the positions of the "BATT" and "GENERATOR" switches or the availability of external or generator power.

TABLE XXXI

DC POWER DISTRIBUTION — OPERATING CONDITIONS

EXTERNAL POWER SOURCE	GENERATOR SWITCH POSITION	BATTERY SWITCH POSITION	BATTERY SUPPLY CIRCUIT	PRIMARY SUPPLY CIRCUIT	SECONDARY SUPPLY CIRCUIT
DISCONNECTED	"GEN OFF"	"OFF"	Energized	Not energized	Not energized
		"BATT"	Energized	Energized	Not energized
	*"GEN"	"OFF"	Energized	Energized	Energized
		"BATT"	**Energized	Energized	Energized
CONNECTED	"GEN OFF" or "GEN"	"OFF"	Energized	Energized	Energized
		"BATT"	***Energized	Energized	Energized

*Note 1: Assuming generator at operating speed (engine speed at least 1400 rpm and clutch engaged).

**Note 2: Energized by generator power and battery is charging.

***Note 3: Energized by external power and battery is charging.

TABLE XXXII

DC EQUIPMENT — SUPPLY CIRCUIT CONNECTIONS

BATTERY	PRIMARY	SECONDARY
Cockpit Dome Light, Cockpit Trouble Light and Inspection Lights	Carburetor Air Temperature Indicator	Cabin Dome Lights and Trouble Light
Crew Alarm and Electronics Compartment Barrier Release	Cargo Sling	Cabin Heater
	Clutch Pump	Cargo Floodlight
	Cylinder Head Temperature Indicator	Electronics Compartment Dome Light
	Engine Oil Temperature Indicator	Formation Lights
	Fire Detector System	Landing Light
	Fuel Pumps (Transfer and Booster)	Navigation Lights
	Generator Field	Stick Trim
	Ignition Vibrator	
	Instrument Lights	
	Inverters (Input and Relay)	
	Panel and Console Lights	
	Pitot Heat Tube	
	Servo (Hydraulic)	
	Starter, Engine Primer and Oil Dilution	
	Radio Master	
	Transmission Oil Temperature Indicator	

7—64. PRIMARY SUPPLY CIRCUIT.

7—65. DESCRIPTION. The primary supply circuit consists of two connecting bus bars, one mounted on the back of the electrical fuse and circuit breaker panel (5, figure 7—1) in the cockpit and the other in the power relay junction box (11) in the electronics compartment. The bus in the junction box connects to external power through the external power relay, to battery power through the contacts of the battery relay (paragraph 7—78) and to generator power through the reverse current cut-out relay (paragraph 7—66).

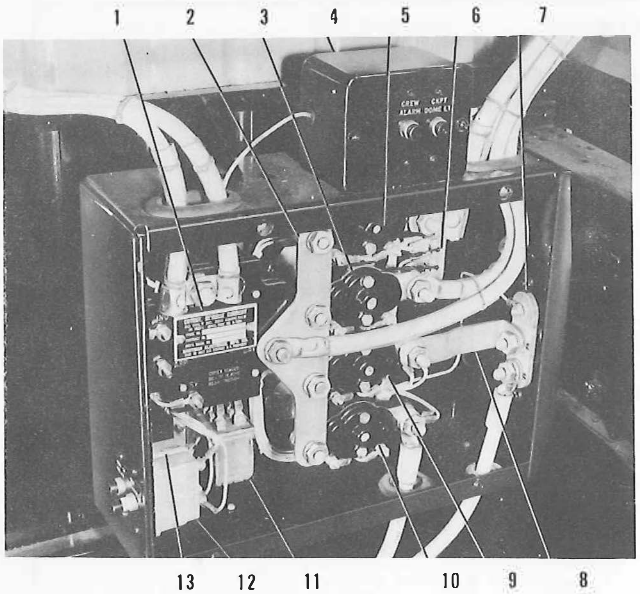
7—66. REVERSE CURRENT CUT-OUT RELAY.

7—67. DESCRIPTION. The reverse current cut-out (generator control) relay (1, figure 7—8) automatically connects generator output to the primary supply circuit if the "GENERATOR" switch is in the "GEN" position. When generator voltage builds up to exceed battery voltage by more than 0.35 volts, the generator control relay operates to connect the generator output at the "GEN" terminal through the relay to the "BATT" terminal and hence to the primary supply circuit. Conversely, when generator voltage drops below battery voltage, the relay disconnects the generator from the primary supply circuit. The operation of the relay thus prevents the flow of a reverse current in excess of 25 amperes from the battery to the generator with resulting damage to the generator. When such a drop in generator voltage occurs, the generator failure warning light (paragraph 7—70) is illuminated to indicate generator failure. The relay is located in the power relay junction box (11, figure 7—1) on the right side of the forward bulkhead in the electrical and electronics compartment.

7—68. REMOVAL.

WARNING

Accidental short circuits in the power relay



1. Reverse Current Cut-Out Relay
2. Primary Bus Bar
3. Bus Tie Relay
4. Battery Bus Circuit Breaker Box
5. Starter Relay
6. Terminal Strip
7. External Power Receptacle
8. External Power Bus Bar
9. External Power Relay
10. Battery Relay
11. Ground Check Relay
12. Ignition Vibrator Circuit Breaker
13. Ground Check Relay Circuit Breaker

Figure 7—8. Power Relay Junction Box (Cover Removed)

junction box may cause serious fires. Before removing the cover of the power relay junction box, be sure the "BATT" and "GENERATOR" switches are in the "OFF" and "GEN OFF" positions respectively and that external power is disconnected.

a. Remove the cover from the power relay junction box, remove the nuts securing the bus bar and remove the bus bar and brass washers.

b. Remove the electrical wiring and securing screws and washers from the relay and remove the relay.

7—69. INSTALLATION.

WARNING

Accidental short circuits in the power relay junction box may cause serious fires. Before installing the relay, be sure the "BATT" and "GENERATOR" switches are in the "OFF" and "GEN OFF" positions respectively and that external power is disconnected.

Note

Before installing the relay, check that the resistance reading between the "APP" and "SW" terminals is between 530 and 610 ohms. If the reading is zero, connect the positive side of a 1.5 volt battery to the "BATT" terminal and the negative side to the "T" terminal under the name plate. A click should be heard in the relay. After removing the battery, the resistance reading should be correct and the relay ready for installation.

a. Place the relay in position in the power relay box, secure it with the screws and washers and connect the electrical wiring.

b. Replace the brass washers, place the bus bar in position and secure it with the nuts.

Note

If there is a variation in the height of relays in the power relay junction box, build up low relays with AN341-616 nuts and AN961-616 washers, as required.

c. Replace the cover of the power relay junction box and secure it with the fasteners.

WARNING

Before replacing the cover, be sure all electrical connections are properly made and are secure and that no foreign objects are left in the box. Short circuits in the power relay junction box may cause serious fires.

7—70. GENERATOR FAILURE WARNING LIGHT.

7—71. DESCRIPTION. The generator failure warning light, marked "GEN OFF," is located on the main switch panel (figure 7—6) and indicates that there is no generator output to the primary supply circuit. The light is connected to the primary supply circuit through the contacts of the generator failure warning light relay. If the light comes on, partial or complete generator failure is indicated. The warning light is dimmed during night operations by a resistor in the warning light dimming relay circuit (paragraph 7—193). The light is of the press-to-test type and the bulb should be replaced if it does not light when so tested.

7–72. GENERATOR FAILURE WARNING LIGHT RELAY.

7–73. DESCRIPTION. The generator failure warning light relay (6, figure 7–9) is located in the relay and resistor installation (7, figure 7–1) behind the cockpit dome light panel. The relay is energized and the relay contacts held open as long as there is generator output through the reverse current cut-out relay. In case of generator failure, the relay is de-energized, the contacts closed and the generator failure warning light comes on.

7–74. REMOVAL.

a. Disconnect the wiring from the warning light relay.

b. Remove the screws and washers.

c. Remove the relay.

7–75. INSTALLATION.

a. Position the warning light relay on the panel.

b. Secure the relay with the screws and washers.

c. Connect the wiring to the relay.

7–76. BATTERY SWITCH.

7–77. DESCRIPTION. The "BATT" switch on the main switch panel, (figure 7–6) is a single-pole, double-throw switch. The switch is closed by placing it in the "BATT" position and, when closed, the battery relay is energized to connect the battery supply circuit to the primary supply circuit.

7–78. BATTERY RELAY.

7–79. DESCRIPTION. The battery relay (10, figure 7–8) is in the power relay junction box on the right side of the forward bulkhead of the electronics compartment. It serves to connect the battery supply circuit to the primary supply circuit when the "BATT" switch is in the "BATT" position.

7–80. REMOVAL.

WARNING

Accidental short circuits in the power relay junction box may cause serious fires. Before removing the cover of the power relay junction box, be sure the "BATT" and "GENERATOR" switches are in the "OFF" and "GEN OFF" positions respectively and that external power is disconnected.

a. Remove the cover of the power relay junction box, remove the nuts and washers securing the bus bar and remove the bus bar and brass washers.

b. Disconnect the electrical wiring, remove the securing bolts and washers from the relay and remove the relay.

7–81. INSTALLATION.

WARNING

Accidental short circuits in the power relay junction box may cause serious fires. Before installing the relay be sure the "BATT" and "GENERATOR" switches are in the "OFF" and "GEN OFF" positions respectively and that external power is disconnected.

a. Place the relay in position in the power relay junction box, secure it with the bolts and washers and connect the electrical wiring.

b. Replace the brass washers, place the bus bar in position and secure it with the nuts.

Note

If there is a variation in the height of relays in the power relay junction box, build up low relays with AN341-616 nuts and AN961-616 washers, as required.

c. Replace the cover of the power relay junction box and secure it with the fasteners.

WARNING

Before replacing the cover, be sure all electrical connections are properly made and are secure and that no foreign objects are left in the box. Short circuits in the power relay junction box may cause serious fires.

7–82. EXTERNAL POWER RELAY.

7–83. DESCRIPTION. The external power relay (9, figure 7–8) in the power relay junction box on the right side of the forward bulkhead of the electronics compartment connects the external power receptacle to the primary supply circuit when external power is connected.

7–84. REMOVAL.

WARNING

Accidental short circuits in the power relay junction box may cause serious fires. Before removing the cover of the power relay junction box, be sure the "BATT" and "GENERATOR" switches are in the "OFF" and "GEN OFF" positions respectively and that external power is disconnected.

7—72. GENERATOR FAILURE WARNING LIGHT RELAY.

7—73. DESCRIPTION. The generator failure warning light relay (6, figure 7—9) is located in the relay and resistor installation (7, figure 7—1) behind the cockpit dome light panel. The relay is energized and the relay contacts held open as long as there is generator output through the reverse current cut-out relay. In case of generator failure, the relay is de-energized, the contacts closed and the generator failure warning light comes on.

7—74. REMOVAL.

a. Disconnect the wiring from the warning light relay.

b. Remove the screws and washers.

c. Remove the relay.

7—75. INSTALLATION.

a. Position the warning light relay on the panel.

b. Secure the relay with the screws and washers.

c. Connect the wiring to the relay.

7—76. BATTERY SWITCH.

7—77. DESCRIPTION. The "BATT" switch on the main switch panel, (figure 7—6) is a single-pole, double-throw switch. The switch is closed by placing it in the "BATT" position and, when closed, the battery relay is energized to connect the battery supply circuit to the primary supply circuit.

7—78. BATTERY RELAY.

7—79. DESCRIPTION. The battery relay (10, figure 7—8) is in the power relay junction box on the right side of the forward bulkhead of the electronics compartment. It serves to connect the battery supply circuit to the primary supply circuit when the "BATT" switch is in the "BATT" position.

7—80. REMOVAL.

WARNING

Accidental short circuits in the power relay junction box may cause serious fires. Before removing the cover of the power relay junction box, be sure the "BATT" and "GENERATOR" switches are in the "OFF" and "GEN OFF" positions respectively and that external power is disconnected.

a. Remove the cover of the power relay junction box, remove the nuts and washers securing the bus bar and remove the bus bar and brass washers.

b. Disconnect the electrical wiring, remove the securing bolts and washers from the relay and remove the relay.

7—81. INSTALLATION.

WARNING

Accidental short circuits in the power relay junction box may cause serious fires. Before installing the relay be sure the "BATT" and "GENERATOR" switches are in the "OFF" and "GEN OFF" positions respectively and that external power is disconnected.

a. Place the relay in position in the power relay junction box, secure it with the bolts and washers and connect the electrical wiring.

b. Replace the brass washers, place the bus bar in position and secure it with the nuts.

Note

If there is a variation in the height of relays in the power relay junction box, build up low relays with AN341-616 nuts and AN961-616 washers, as required.

c. Replace the cover of the power relay junction box and secure it with the fasteners.

WARNING

Before replacing the cover, be sure all electrical connections are properly made and are secure and that no foreign objects are left in the box. Short circuits in the power relay junction box may cause serious fires.

7—82. EXTERNAL POWER RELAY.

7—83. DESCRIPTION. The external power relay (9, figure 7—8) in the power relay junction box on the right side of the forward bulkhead of the electronics compartment connects the external power receptacle to the primary supply circuit when external power is connected.

7—84. REMOVAL.

WARNING

Accidental short circuits in the power relay junction box may cause serious fires. Before removing the cover of the power relay junction box, be sure the "BATT" and "GENERATOR" switches are in the "OFF" and "GEN OFF" positions respectively and that external power is disconnected.

a. Remove the cover of the power relay junction box and remove the nuts and washers securing the bus bars.

b. Remove both bus bars.

c. Disconnect the electrical wiring and remove the securing bolts and washers from the relay. Remove the relay.

7—85. INSTALLATION.

WARNING

Accidental short circuits in the power relay junction box may cause serious fires. Before installing the relay, be sure the "BATT" and "GENERATOR" switches are in the "OFF" and "GEN OFF" positions respectively and that external power is disconnected.

a. Place the relay in position in the junction box, secure it with the bolts and washers, and connect the electrical wiring.

b. Replace the brass washers, place the bus bars in their respective positions and secure them with the washers and nuts.

Note

If there is a variation in the height of relays in the power relay junction box, build up low relays with AN341-616 nuts and AN961-616 washers, as required.

c. Replace the cover of the power relay junction box and secure it with the fasteners.

WARNING

Before replacing the cover, be sure all electrical connections are properly made and are secure and that no foreign objects are left in the box. Short circuits in the power relay junction box may cause serious fires.

7—86. SECONDARY SUPPLY CIRCUIT.

7—87. DESCRIPTION. The secondary supply circuit consists of a single bus bar connected through the contacts of the bus tie relay to the primary supply circuit from which it is energized. In normal flight operations, with the "GENERATOR" switch in the "GEN" position, the secondary supply circuit is energized except in case of generator failure. Generator failure is indicated by the generator failure warning light (paragraph 7—70). With the clutch disengaged or the engine not running, the secondary supply circuit can be energized only through the application of external power (table XXXI). The secondary supply circuit provides power to equipment which is not essential to flight operations and would overload the battery in event of generator failure, but use of which may be necessary or convenient during ground operations. The secondary bus bar is located on the back of the electrical fuse and circuit breaker panel (5, figure 7—1) and is connected to operating equipment circuits through appropriately marked circuit breakers on the electrical fuse and circuit breaker panel.

7—88. BUS TIE RELAY.

7—89. DESCRIPTION. The bus tie relay connects the secondary supply circuit to the primary supply circuit when either generator power or external power is available. The solenoid of the relay is energized alternately by either generator output or external power through the contacts of the ground check relay. The bus tie relay (3, figure 7—8) is located in the power relay junction box on the right side of the forward bulkhead of the electronics compartment.

7—90. REMOVAL.

WARNING

Accidental short circuits in the power relay junction box may cause serious fires. Before removing the cover of the power relay junction box, be sure the "BATT" and "GENERATOR" switches are in the "OFF" and "GEN OFF" positions respectively and that external power is disconnected.

a. Remove the cover of the power relay junction box, remove the nuts and washers securing the bus bars and remove the bus bars and brass washers.

b. Disconnect the electrical wiring and remove the securing bolts and washers from the relay. Remove the relay.

7—91. INSTALLATION.

WARNING

Accidental short circuits in the power relay junction box may cause serious fires. Before installing the relay, be sure the "BATT" and "GENERATOR" switches are in the "OFF" and "GEN OFF" positions respectively and that external power is disconnected.

a. Position the relay in the junction box, secure it with the bolts and washers and connect the electrical wiring.

b. Replace the brass washers, place the bus bars in position and secure them with the nuts and washers.

Note

If there is a variation in the height of relays in the power relay junction box, build up low relays with AN341-616 nuts and AN961-616 washers, as required.

c. Replace the cover of the power relay junction box and secure it with the fasteners.

WARNING

Before replacing the cover, be sure all electrical connections are properly made and are secure and that no foreign objects are left in the junction box. Short circuits in the power relay junction box can cause serious fires.

7–92. GROUND CHECK RELAY.

7–93. DESCRIPTION. The ground check relay (11, figure 7–8) is located in the power relay junction box and alternately connects the solenoid of the bus tie relay to generator output or to external power. When external power is not connected, the solenoid of the ground check relay is not energized and the contacts of the relay connect the solenoid of the bus tie relay to generator output from the "IND" terminal of the reverse current cutout relay. When external power is connected, the solenoid of the ground check relay is energized and the relay contacts connect the solenoid of the bus tie relay to external power. This arrangement makes it possible to ground check electrical equipment connected to the secondary supply circuit when generator output is not available.

7–94. REMOVAL.

WARNING

Accidental short circuits in the power relay junction box may cause serious fires. Before removing the cover of the power relay junction box, be sure the "BATT" and "GENERATOR" switches are in the "OFF" and "GEN OFF" positions respectively and that external power is disconnected.

a. Remove the cover of the power relay junction box, remove the nuts and washers securing the bus bars and remove the bus bars and brass washers.

b. Disconnect the electrical wiring and remove the securing screws and washers from the relay. Remove the relay.

7–95. INSTALLATION.

WARNING

Accidental short circuits in the power relay junction box may cause serious fires. Before installing the relay, be sure the "BATT" and "GENERATOR" switches are in the "OFF" and "GEN OFF" positions respectively and that external power is disconnected.

a. Position the relay in the relay junction box and secure it with the screws and washers. Connect the electrical wiring.

b. Replace the brass washers and bus bars and secure with the nuts and washers.

Note

If there is a variation in the height of relays in the power relay junction box, build up the low relays with AN341-616 nuts and AN961-616 washers, as required.

c. Replace the cover of the power relay junction box and secure it with the fasteners.

WARNING

Before replacing the cover, be sure all electrical connections are properly made and are secure and that no foreign objects are left in the box. Short circuits in the power relay junction box may cause serious fires.

7–96. DC CIRCUIT BREAKERS.

7–97. DESCRIPTION. All dc operating circuits are protected by appropriately marked circuit breakers. When a circuit breaker opens from an overload, it can normally be reset by pushing the plunger in. If the circuit breaker continues to "pop out" trouble is indicated somewhere within that particular circuit and an investigation should be conducted to isolate and correct the difficulty. Circuit breakers in the primary and secondary supply circuits are located on the electrical fuse and circuit breaker panel (5, figure 7–1) located on the overhead control panel (figure 7–7). Circuit breakers in the battery supply circuit are located on the battery bus circuit breaker box (figure 7–13) located in the electronics compartment. Two circuit breakers (12 and 13, figure 7–8), one for the ground check relay and the other for the ignition vibrator, are located on the left side of the power relay junction box (11, figure 7—1).

7—98. TROUBLE SHOOTING — DC ELECTRICAL SYSTEM.

7—99. DESCRIPTION. If testing of the dc electrical system (paragraph 7—102) indicates trouble, refer to table XXXIII for appropriate corrective measures.

7—100. ADJUSTMENT — DC ELECTRICAL SYSTEM.

7—101. DESCRIPTION. Adjust generator voltage as follows:

Note

The generator and voltage regulator should be at operating temperature before adjustment is made. However, due to inadequate engine cooling, the warm-up on the ground will be governed by the limitations of the engine and final adjustment made in the air.

a. Connect the positive lead of a portable precision voltmeter to the "B" terminal of the voltage regulator and the other lead to a good ground (helicopter structure).

b. After normal engine warm-up and with authorized personnel at the controls of the helicopter, increase engine speed to normal cruising rpm.

c. Place a load on the generator as near equal as possible to one-half its full load rating as indicated by the ammeter (loadmeter) on the instrument panel. See figure 7—17 for load rating.

d. The voltmeter should indicate exactly 28.0 volts. If not, adjust the voltage by means of the voltage control on the voltage regulator.

7—102. TESTING — DC POWER SYSTEM.

7—103. DESCRIPTION. To test the dc power system, including both power supply and power distribution systems, start with the engine shut down, the "BATT" switch in the "OFF" position, the "GENERATOR" switch in the "GEN OFF" position and external power disconnected.

a. Switch on the cockpit dome light. If the light comes on, the battery supply circuit is operative.

TABLE XXXIII

TROUBLE SHOOTING — DC POWER SYSTEM

OPERATING CONDITIONS	INDICATION OF TROUBLE	PROBABLE CAUSE	REMEDY
External power connected, "BATT" switch in "OFF" position, and "GENERATOR" switch in "GEN OFF" position	Primary supply circuit not energized	Failure of external power relay	Replace
	Secondary supply circuit not energized	Failure of ground check relay or of bus tie relay	Replace as necessary
Engine not going and "BATT" switch in "BATT' position (External power disconnected)	Battery supply circuit not energized	Battery failure	Refer to paragraph 7—47
	Battery supply circuit energized, but not primary supply circuit	Failure of battery relay	Replace
Engine at cruising speed, clutch engaged, "BATT" switch in "BATT" position and "GENERATOR" switch in "GEN" position	Generator warning light on and ammeter shows no load	Overvoltage condition	Place "GENERATOR" switch momentarily in "RESET" position
		Failure of voltage regulator	Replace
		Failure of generator field control relay	Replace
		Failure of reverse current cut-out relay	Replace
		Generator failure	Refer to paragraph 7—11
	Secondary supply circuit not energized	Failure of bus tie relay	Replace

b. Remove the cover of the power relay junction box (figure 7—8). Connect the positive lead of a portable precision voltmeter to the "BATT" terminal of the reverse current cut-out relay (1, figure 7—8) and the other lead to a good ground (helicopter structure).

c. Place the "BATT" switch in the "BATT" position. The voltmeter should read approximately 24 volts, indicating that the battery relay is working properly, the primary supply circuit is energized and the battery fully charged. The "GEN OFF" warning light should come on indicating the generator failure warning circuit is operative.

Note

If battery voltage is less than 22 volts, charge the battery or replace with a fully charged battery.

d. Connect an external source of 28-volt dc power to the helicopter. Voltmeter reading should increase from 24 volts to 28 volts, indicating that the external power relay is operating properly.

e. Switch on the dome light in the electronics compartment. If the light comes on, the secondary supply circuit is energized and both the ground check relay and the bus tie relay are operating properly.

f. With qualified personnel at the controls of the helicopter, the engine running, the clutch engaged, the "BATT" switch in the "BATT" position and the "GENERATOR" switch in the "GEN" position, increase engine speed to cruising rpm. The voltmeter reading should increase from 24 volts to 28.0 ±0.25 volts. These indications show that the voltage regulator, the overvoltage relay, the generator field control relay and the reverse current cut-out relay are operating properly. The "GEN OFF" warning light should go out as the voltmeter reading increases, indicating that the generator failure warning light relay is operating properly.

g. Shut down the engine and place the "BATT" switch in the "OFF" position. Be sure external power is not connected.

h. Disconnect and remove the portable precision voltmeter from the power relay junction box and replace the cover of the junction box.

WARNING

Be sure no foreign objects are left in the power relay junction box and that all connections are properly made and are secure. Short circuits in the junction box can cause serious fires.

7—104. AC POWER SUPPLY SYSTEM.

7—105. DESCRIPTION. AC power is supplied by two inverters, the main and the spare, which operate from the 28-volt dc power system. Through the "FLT MAIN-OFF-SPARE" inverter switch located on the instrument panel, either the main or spare inverter may be energized separately, but not simultaneously. The ac voltage control system is electronic and self-contained in the inverters. Inverter failure is indicated by the "INST INV FAILURE" warning light in the ac power distribution (paragraph 7—115). For trouble shooting, adjusting and testing the ac electrical system refer to paragraphs 7—133, 7—135, and 7—137 respectively.

7—106. INVERTERS.

7—107. DESCRIPTION. The two inverters (21, figure 7—1), the main and the spare, are identical and are located at floor level on the right side of the electronics compartment. They are rated at 115-VAC, 250-VA, 3-phase, 400-cycle and have self-contained starting relays. Two 28-volt dc supply circuits connect to each inverter, one to supply input voltage and one to supply operating voltage to the starting relay. The dc circuits connect to the primary bus in the electrical fuse and circuit breaker panel (5) through circuit breakers marked "RELAY" and "INPUT" located on the overhead control panel (figure 7—7). Operation of the inverters is controlled by the inverter switch, marked "FLT MAIN-OFF-SPARE," on the main switch panel (2, figure 7—1). The output of the inverters is connected directly to the ac power distribution system (paragraph 7—115).

7—108. TROUBLE SHOOTING. Refer to paragraph 7—133 for trouble shooting of the ac electrical system.

7—109. REMOVAL. Disconnect the wiring at both inverters, remove the bolts securing the inverters to the electronics compartment floor and remove the inverters.

WARNING

The inverters draw a heavy current and produce a high voltage. Before removing them, be sure the "BATT" and "GENERATOR" switches are in the "OFF" and "GEN OFF" positions respectively and that external power is disconnected.

7—110. INSTALLATION. Position the inverters on the floor of the electronics compartment and secure them with the mounting bolts. Connect the wiring to each inverter.

WARNING

The inverters draw a heavy current and produce a high voltage. Before installing them, be sure the "BATT" and "GENERATOR" switches are in the "OFF" and "GEN OFF" positions respectively and that external power is disconnected.

7—111. ADJUSTMENT. Refer to paragraph 7—135 for adjustment of the ac electrical system.

7—112. TESTING. Refer to paragraph 7—137 for testing of the ac electrical system.

7—113. INVERTER SWITCH.

7—114. DESCRIPTION. The inverter switch is located on the main switch panel (figure 7—6) and is marked "FLT MAIN-OFF-SPARE." The switch is in the 28-volt dc relay circuit to the inverters. When the switch is closed in the "MAIN" or "SPARE" position, the relay circuit is closed to the main or spare inverter respectively and the starting relay is energized to close the input circuit to the inverter in question. In normal flight operations the switch is placed in the "MAIN" position and the main inverter carries the entire ac load. If the main inverter fails, as indicated by the inverter failure warning light coming on, the switch is placed in the "SPARE" position and the spare inverter replaces the main inverter. The inverter switch also controls operation of the interlock relay (paragraph 7—127).

7—115. AC POWER DISTRIBUTION SYSTEM.

7—116. DESCRIPTION. AC power is distributed through four supply circuits, three of which are 115-volt and one of which is 26-volt (table XXXIV). The output from both inverters is connected directly to the distribution system and the system is energized by whichever inverter is set in operation by the "FLT MAIN-OFF-SPARE" inverter switch. An autotransformer (paragraph 7—123) reduces the 115-VAC output of the inverters to 26-VAC to make the 26-volt circuit. Principal components of the ac power distribution system are an inverter failure warning light, an inverter warning light relay, an autotransformer, an interlock relay and necessary protective fuses.

7—117. INVERTER FAILURE WARNING LIGHT.

7—118. DESCRIPTION. The inverter failure warning light is located on the main switch panel (figure 7—6) next to the inverter switch and is marked "INST INV FAILURE." When the light is on, loss of ac power to all ac instruments is indicated. The lamp operates from the 28-volt dc primary supply circuit and its operation is controlled by the inverter warning light relay, which makes and breaks the warning light connection to supply circuit. The light is dimmed for night operations by the warning light dimming relay (paragraph 7—193). The light is of the "press-to-test" type and the bulb should be replaced if it does not light when so tested.

7—119. INVERTER FAILURE WARNING LIGHT RELAY.

7—120. DESCRIPTION. The inverter failure warning light relay (7, figure 7—9) is located in the relay and

TABLE XXXIV

AC POWER DISTRIBUTION CIRCUITS

Note: Circuits are energized by either the main or spare inverter depending upon the position of the inverter switch.

115-VAC PHASE A	*115-VAC PHASE C*	*115-VAC PHASE C-A*	*26-VAC PHASE C*
J-8 Vertical Gyroscope	Fire Detector System	Inverter Warning Light Relay	Fuel Pressure System
Fuel Indicator System	J-2 Compass		Engine Oil Pressure System
Fire Detector System	J-8 Vertical Gyroscope		Transmission Oil Pressure System
J-2 Compass			Auxiliary Hydraulic Pressure System
			Primary Hydraulic Pressure System

resistor installation behind the cockpit dome light panel (6, figure 7–1). The solenoid of the relay forms the 115-VAC, phase C-A distribution circuit and thus places a load across the phase A and phase C inverter output to provide a better balanced inverter load. The solenoid is energized and the "INST INV FAILURE" warning light is off as long as either inverter is operating.

7–121. REMOVAL.

WARNING

The inverters have a high voltage output. Before removing the relay, check to be sure the "BATT" and "GENERATOR" switches are in the "OFF" and "GEN OFF" positions respectively and that external power is disconnected.

a. Remove the securing screws and washers and hinge down the cockpit dome light panel.

b. Disconnect the wiring and remove the securing screws and washers from the relay. Remove the relay.

7–122. INSTALLATION.

WARNING

The inverters have a high voltage output. Before installing the relay, check to be sure the "BATT" and "GENERATOR switches are in the "OFF" and "GEN OFF" positions respectively and that external power is disconnected.

a. Secure the inverter failure warning light relay in the relay and resistor installation with the screws and washers. Connect the wiring to the relay.

b. Hinge the cockpit dome light panel up and secure it with the screws and washers.

7–123. AUTOTRANSFORMER.

7–124. DESCRIPTION. The autotransformer (18, figure 7–1) is located in the electronics compartment and is energized from the 115-VAC, phase C inverter output circuit. It is tapped at 26 volts to supply the 26-VAC, phase C distribution circuit.

7–125. REMOVAL.

WARNING

The inverters have a high voltage output. Before installing the transformer, check to be sure the "BATT" and "GENERATOR" switches are in the "OFF" and "GEN OFF" positions respectively and that external power is disconnected.

a. Disconnect the wiring and remove the screws, washers and nuts from the transformer.

b. Remove the transformer.

7–126. INSTALLATION.

WARNING

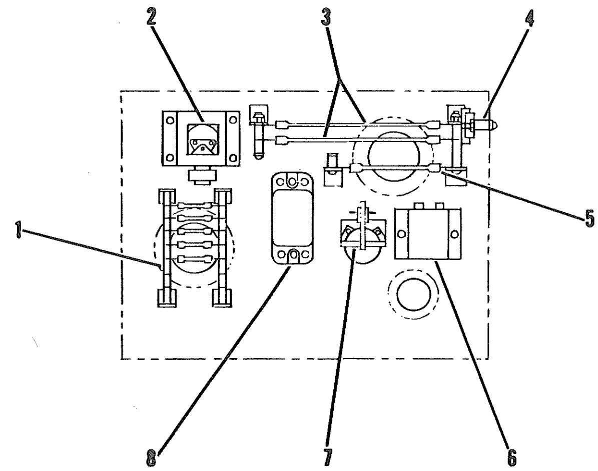
The inverters have a high voltage output. Before installing the transformer check to be sure the "BATT" and "GENERATOR" switches are in the "OFF" and "GEN OFF" positions respectively and that external power is disconnected.

a. Position the transformer and secure it with the screws, washers and nuts.

b. Connect the wiring to the transformer.

7–127. AC – DC INTERLOCK RELAY.

7–128. DESCRIPTION. The interlock relay (19, figure 7–1) is located on the shelf at the right side of the electronics compartment. The relay interlocks the dc and ac



1. Dimming Resistors (Warning Lights and Fuselage Lights)
2. Warning Light Dimming Relay
3. Resistors (Windshield Wiper Circuit)
4. Dimming Resistor (Formation Lights)
5. Dimming Resistor (Position Lights)
6. Generator Failure Warning Light Relay
7. Inverter Failure Warning Light Relay
8. Cargo Sling Release Relay

Figure 7–9. Relays and Resistors (Overhead Control Panel)

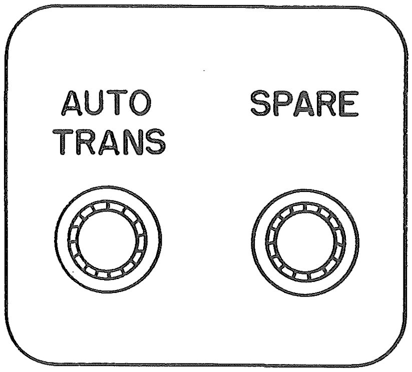


Figure 7—10. Transformer Fuse Panel

power supply circuits to the J-2 gyro compass system (paragraph 6—31) so that both the dc and ac power supply is connected and disconnected simultaneously. This prevents either dc or ac power alone being applied to the gyro compass system. The relay contains both a dc and an ac solenoid. When energized, the dc solenoid holds the relay contacts in the ac circuit closed and the ac solenoid holds the relay contacts in the dc circuit closed.

7—129. REMOVAL.

WARNING

The inverters have a high voltage output. Before removing the interlock relay, check to be sure the "BATT" and "GENERATOR" switches are in the "OFF" and "GEN OFF" positions respectively and that external power is disconnected.

a. Locate the interlock relay on the shelf at the right side of the electronics compartment and disconnect the wiring.

b. Remove the screws, washers and nuts that secure the relay to the shelf and remove the relay.

7—130. INSTALLATION.

WARNING

The inverters have a high voltage output. Before installing the interlock relay, check to be sure the "BATT" and "GENERATOR switches are in the "OFF" and "GEN OFF" positions respectively and that external power is disconnected.

a. Position the interlock relay on the electronics compartment shelf and secure it with the screws, washers and nuts.

b. Connect the wiring to the relay.

7—131. AC FUSES.

7—132. DESCRIPTION. All ac equipment power circuits are protected by fuses. The fuses are located on two panels. Those in the flight instrument power circuits are located on the electrical fuse and circuit breaker panel (5, figure 7—1) on the overhead control panel (figure 7—7). The fuse in the autotransformer circuit is located on the transformer fuse panel (figure 7—10) mounted above the spare inverter in the electronics compartment.

7—133. TROUBLE SHOOTING — AC ELECTICAL SYSTEM.

7—134. DESCRIPTION. For trouble shooting of the ac power system, refer to table XXXV.

Note

Be sure the dc supply circuits are energized before looking for trouble in the ac circuits (table XXXIV).

7—135. ADJUSTMENT — AC ELECTRICAL SYSTEM.

7—136. DESCRIPTION. Prior to installation, the output of the inverters is adjusted to 115 ±3 volts under

TABLE XXXV

TROUBLE SHOOTING — AC POWER SYSTEM

POSITION OF INVERTER SWITCH	*INDICATION OF TROUBLE*	*PROBABLE CAUSE*	*REMEDY*
"MAIN" (Normal operating position) or "SPARE" (Emergency operating position after failure of main inverter)	"INST INV FAILURE" warning light comes on. (If during flight, switch to "SPARE" position)	Circuit breakers out in dc supply circuit	Reset
		Failure of inverter	If dc input, but no ac output — replace
		Failure of inverter warning light relay	If inoperative, replace
	J-2 Compass inoperative	Failure of interlock relay	Replace relay

load. If testing (paragraph 7—137) indicates voltage output is outside the tolerance limits, adjust by means of the voltage adjustment screws on the inverters.

7—137. TESTING — AC ELECTRICAL SYSTEM.

7—138. DESCRIPTION. To test the ac electrical system the 28-volt dc primary circuit must be energized (table XXXI). As the inverters draw a relatively heavy current, external power should be used when testing the ac system.

a. With the inverter switch in the "OFF" position, check that the "INST INV FAILURE" warning light comes on when the dc primary supply circuit is energized.

b. Place the inverter switch first in the "MAIN" and then in the "SPARE" position. If the "INST INV FAILURE" warning light goes off in both cases, the inverters are both in operating condition.

c. With the inverter switch first in the "MAIN" and then in the "SPARE" position, test the voltage output of all 115-VAC circuits (table XXXIV) with an ac voltmeter. If the output of either inverter is not within the range of 115 ± 3 volts, adjust inverter voltage output (paragraph 7—135). If all phases fail to come within these limits, replace the faulty inverter.

d. Test the 26-volt output of the autotransformer to be sure the transformer is operating properly.

e. Place the inverter switch in the "OFF" position and disconnect external power. If the ac system fails to operate properly, refer to paragraph 7—133.

7—139. LIGHTING PROVISIONS.

7—140. DESCRIPTION. *(See figure 7—11).* Lighting provisions include both exterior and interior lights. During night operations, a warning light dimming relay incorporated in the lighting system automatically dims five warning lights: generator failure, inverter failure, 20-minute fuel, fuel overflow and transmission low oil pressure. All lights operate from the 28-volt dc power distribution system.

7—141. EXTERIOR LIGHTS.

7—142. DESCRIPTION. *(See figure 7—11.)* Exterior lights include navigation lights, formation lights, a landing light and a cargo floodlight. Operation of the lights is controlled by switches on the overhead switch panel (4, figure 7—1).

7—143. NAVIGATION LIGHTS.

7—144. DESCRIPTION. *(See figure 7—11.)* Navigation lights consist of three position lights and three fuselage lights. Position lights are located as follows: a red light (21) on the left side of the fuselage, a green light (21) on the right side of the fuselage and a yellow one (18) at the top of the pylon. The fuselage lights are all white and are located as follows: one on top of the cockpit canopy (6), one aft of the main gear box fairing (13) and one on the bottom of the fuselage (20). The navigation lights are controlled by an operating switch and a dimming switch jointly marked "POSITION" on the overhead switch panel (figure 7—7). Power to operate the lights is taken from the 28-volt dc secondary supply circuit through the "EXTERIOR LIGHTS" circuit breaker marked "NAV" on the electrical fuse and circuit breaker panel (5, figure 7—1). The power circuit connects to the navigation lights through the operating switch which has three positions marked "FLASH," "OFF" and "STEADY." When the operating switch is on "STEADY," power is connected to the dimming switch which has two positions, "DIM" and "BRT." With the dimming switch on "BRT," power is connected directly to the lights through two parallel circuits, one for the position lights and one for the fuselage lights. With the dimming switch on "DIM," a dimming resistor (1 and 5, figure 7—9) is cut into each of the two parallel circuits. The resistors are located in the electrical relay and resistor installation (7, figure 7—1) mounted behind the cockpit dome light panel. When the operating switch is on "FLASH," power is connected to a light flasher (17). Two output circuits from the flasher connect back through the "FLASH" position of the operating switch to the dimming switch, from which one circuit connects to the position lights and one to the fuselage lights. The flasher circuit flashes the position and fuselage lights alternately with the dimming switch in either the "BRT" or "DIM" position.

7—145. TROUBLE SHOOTING. For trouble shooting, refer to paragraph 7—197.

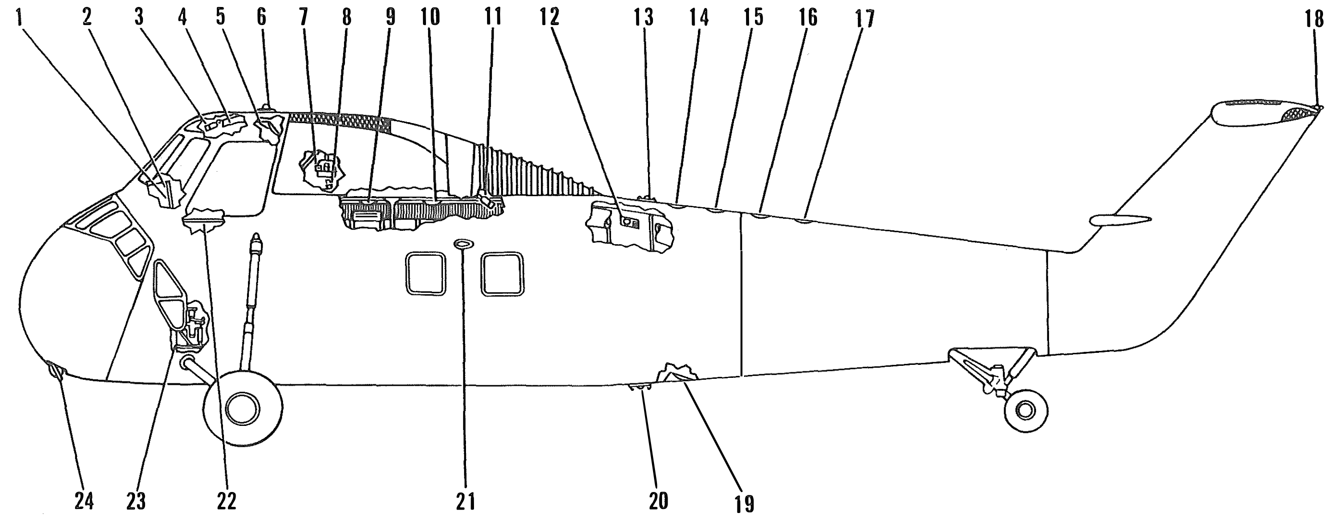
7—146. REMOVAL. To remove the navigation lights, remove the securing screws, lift each light from its mounting, disconnect the wiring and remove the light.

7—147. INSTALLATION. To install the navigation lights, connect the wiring to each light, slip the light into its mounting and install the securing screws.

7—148. TESTING. To test the navigation lights, place the two "EXTERIOR LIGHTS — POSITION" switches on "STEADY" and "BRT" respectively and check that all navigation lights are burning brightly. Check the lights similarly on "STEADY" and "DIM," "FLASH" and "BRT" and "FLASH" and "DIM."

7—149. LIGHT FLASHER.

7—150. DESCRIPTION. The light flasher (17, figure 7—1) is located on the right shelf of the electronics compartment. The two output circuits flash the position



1. Panel Lights (Main Switch Panel)
2. Instrument Lights (Instrument Panel)
3. Spotlight (Instrument Panel Flood Light)
4. Panel Lights (Electrical Switch Panel)
5. Dome Light (Cockpit)
6. Fuselage Light (Top Forward – White)
7. Inspection Light (Primary Hydraulic System Reservoir)
8. Inspection Light (Transmission Oil Level)
9. Dome Light (Cabin – Forward)
10. Dome Light (Cabin – Aft)
11. Spotlight (Cabin)
12. Dome Light (Electronics Compartment)
13. Fuselage Light (Top Aft – White)
14. Formation Light (Green)
15. Formation Light (White)
16. Formation Light (White)
17. Formation Light (Red)
18. Position Light (Tail – Yellow)
19. Floodlight (Cargo)
20. Fuselage Light (Bottom – White)
21. Position Lights (Red – LH Side) (Green – RH Side)
22. Panel Lights (Console)
23. Inspection Light (Auxiliary Hydraulic System Reservoir)
24. Landing Light

Figure 7–11. Interior and Exterior Lights Location Diagram

and fuselage lights alternately, each circuit flashing forty cycles per minute. In event of failure of the flashing device, the fuselage light circuit will automatically close and the fuselage lights burn continuously.

7–151. REMOVAL. To remove the light flasher, disconnect the electrical plug, remove the securing screws, washers and nuts and remove the flasher.

7–152. INSTALLATION. To install the light flasher, position it on the shelf, install the securing screws, washers and nuts and connect the electrical plug. Make sure the ring nut is handtight.

7–153. FORMATION LIGHTS.

7–154. DESCRIPTION. *(See figure 7–11.)* Four formation lights (14, 15, 16 and 17) are installed in a fore-and-aft line along the top of the fuselage. From forward to aft they are green, white, white and red respectively. The lights are operated by the "EXTERIOR LIGHTS" switch on the overhead switch panel (figure 7–7) marked "FORMATION." The switch has three positions marked "DIM," "OFF" and "BRT." In the "DIM" position, a dimming resistor is cut into the power circuit to the lights. The resistor is mounted in the electrical relay and resistor installation (7, figure 7–1) behind the cockpit dome light panel. Power for the lights is taken from the 28-volt dc secondary supply circuit through the "EXTERIOR LIGHTS" circuit breaker marked "FORM" on the electrical fuse and circuit breaker panel (figure 7–7).

7–155. TROUBLE SHOOTING. For trouble shooting, refer to paragraph 7–197.

7–156. REMOVAL. To remove the formation lights, remove the securing screws, lift each light from its mounting, disconnect the wiring and remove the light.

7–157. INSTALLATION. To install the formation lights, connect the wiring, position each light on the top of the fuselage and install the securing screws.

7–158. TESTING. To test the formation lights, place the "EXTERIOR LIGHTS – FORMATION" switch on "BRT" and check that all formation lights are burning brightly. Check the lights similarly with the switch on "DIM."

7–159. LANDING LIGHT.

7–160. DESCRIPTION. *(See figures 7–11 and 7–12.)* The landing light (24), located in the lower section of the left nose door, may be extended, retracted and rotated. It is controlled by two switches on the control box (3, figure 7–1) attached to the pilot's collective pitch control. One, a master light switch, is marked "MASTER-OFF-RETRACT;" the second, a light control switch, is marked "EXTEND-RETRACT-L-R." The landing light can be turned off, while extended, by placing the master switch on "OFF" and both turned off and retracted by placing the master switch on "RETRACT." Power for the light is taken from the secondary supply circuit through the two "LANDING LIGHT" circuit breakers marked "LAMP" and "MOTOR" on the overhead electrical fuse and circuit breaker panel (figure 7—7).

7—161. TROUBLE SHOOTING. For trouble shooting, refer to paragraph 7—197.

7—162. REMOVAL. To remove the landing light, remove the securing screws, lift the light from its mounting, disconnect the wiring and remove the light.

7—163. INSTALLATION. To install the landing light, connect the wiring, position the light in its mounting on the nose door and install the securing screws.

7—164. TESTING. To test the landing light, operate it by means of the "MASTER-OFF-RETRACT" and "EXTEND-RETRACT-L-R" switches. Check that the light operates and that the light can be fully extended, rotated and retracted. Replace the light if it does not operate properly.

7—165. CARGO FLOODLIGHT.

7—166. DESCRIPTION. *(See figure 7—11.)* The cargo floodlight (19) is mounted on the fuselage below and aft of the cargo door and provides illumination for pick-up and release of cargo during night operations. The light is operated by either one of two switches, one for the pilot and one for the crew. The pilot's switch, marked "CARGO FLD LT," is located on the overhead switch panel (figure 7—7) and has three positions marked "CREW," "OFF" and "PILOT." The crew switch, marked "CARGO FLOOD LIGHT," is located on the right side of the cabin above the cargo door. It is on the same panel with the cabin dome light switch. (See figure 7—14.) The crew "CARGO FLOOD LIGHT" switch is inoperative unless the pilot's switch is in the "CREW" position. The pilot may operate the light by placing his switch in the "PILOT" position.

7—167. TROUBLE SHOOTING. For trouble shooting, refer to paragraph 7—197.

7—168. REMOVAL. To remove the cargo floodlight, remove the securing screws and washers from the light retainer, remove the retainer and outer gasket, remove the light and inner gasket, disconnect the wiring and remove the light.

7—169. INSTALLATION. To install the cargo floodlight, connect the wiring, install the light and inner gasket, install the retainer and outer gasket and install the securing screws and washers.

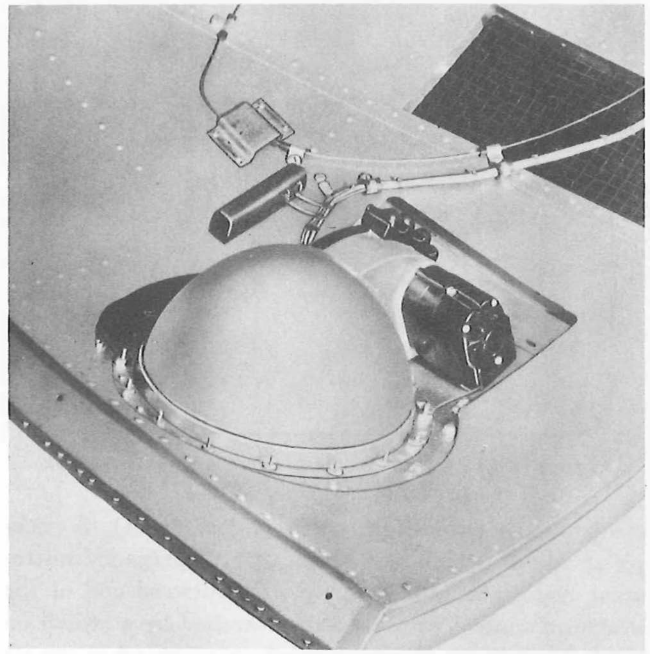


Figure 7—12. Landing Light

7—170. TESTING. Test the operation of the light with the pilot's "CARGO FLD LT" switch in the "PILOT" position and also with the pilot's switch in the "CREW" position and the crew's "CARGO FLOOD LIGHT" switch in the "ON" position.

7—171. INTERIOR LIGHTS.

7—172. DESCRIPTION. *(See figure 7—11.)* Interior lights comprise dome and trouble lights, console and panel lights, instrument lights, inspection lights and their particular components, such as relays.

7—173. DOME LIGHTS AND TROUBLE LIGHTS.

7—174. DESCRIPTION. Dome lights and trouble lights (figures 7—7, 7—14, 7—11, and 7—15) are located as follows: four overhead dome lights for general interior lighting are provided, one in the cockpit, two in the cabin and one in the electronics compartment. The dome lights contain both a white and red lamp and are controlled by switches marked "RED-OFF-WHITE." The cockpit dome light switch is located on the overhead dome light panel. The cabin dome lights are controlled by the "CABIN DOME LIGHTS" switch (figure 7—14) inside the cabin above the cargo door. The electronics compartment dome light switch is located on the dome light support. Spare dome light lamps are provided in clip holders on the electronics

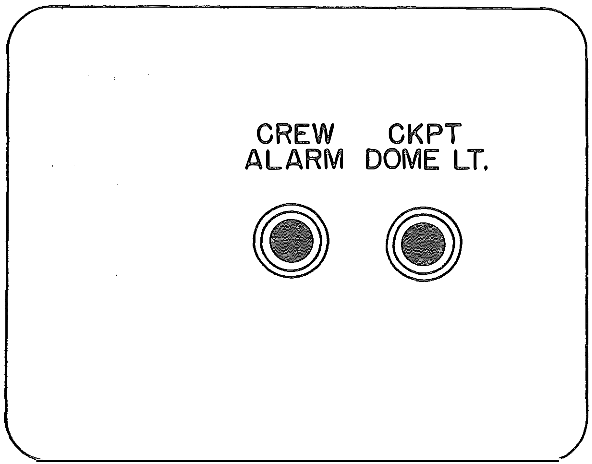


Figure 7—13. Battery Bus Circuit Breaker Box

compartment dome light panel (figure 7—15). A cockpit spotlight, which also serves as an emergency instrument floodlight, is mounted on the forward end of the overhead control panel and is controlled by a switch on the light itself. A second spotlight is mounted in the aft end of the cabin and is operated in like manner. The cockpit dome light and spotlight operate from the battery supply circuit through the "CKPT DOME LTS" circuit breaker on the battery bus circuit breaker box (figure 7—13) in the electronics compartment. The cabin dome lights and spotlight and the electronics compartment dome light operate from the secondary supply circuit through the "CABIN DOME LTS" circuit breaker on the overhead electrical fuse and circuit breaker panel (figure 7—7).

7—175. TROUBLE SHOOTING. For trouble shooting, refer to paragraph 7—197.

7—176. REMOVAL. To remove the dome lights, remove the securing screws, lift each light from its mounting, disconnect the wiring and remove the light.

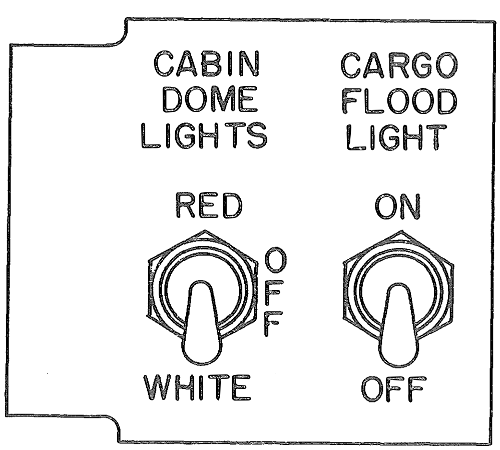


Figure 7—14. Cabin Dome Lights and Cargo Floodlight Switches

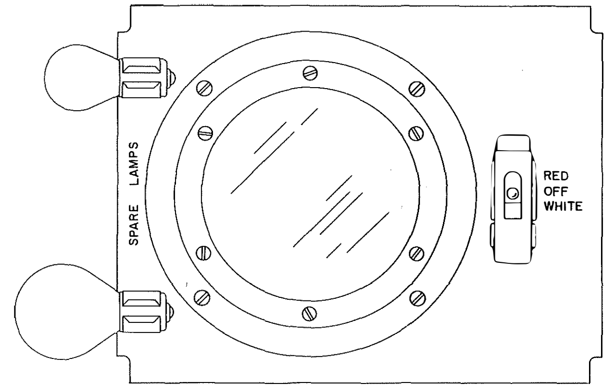


Figure 7—15. Electronics Compartment Dome Light

7—177. INSTALLATION. To install the dome lights, connect the wiring, position each light in its mounting and install the securing screws.

7—178. CONSOLE AND PANEL LIGHTS.

7—179. DESCRIPTION. *(See figure 7—11.)* Shielded panel lights, controlled by a combination power switch and dimming rheostat, illuminate the radio console and switch panels. The power switch and rheostat are controlled by the knob marked "CONSOLE & PANEL LTS — OFF — BRT" on the overhead switch panel (figure 7—7). The lights operate from the primary supply circuit through the "INTERIOR LTS" circuit breaker on the overhead electrical fuse and circuit breaker panel marked "SW PANEL — CONSOLE."

7—180. TROUBLE SHOOTING. For trouble shooting, refer to paragraph 7—197.

7—181. REMOVAL. To remove the console and panel lights, disconnect the wiring, remove the securing nut and washer at the back of each light and remove the light from the front of the panel.

7—182. INSTALLATION. To install the console and panel lights, position each light, secure it with the nut and washer at the back of the panel and connect the wiring to the light.

7—183. INSTRUMENT LIGHTS.

7—184. DESCRIPTION. *(See figure 7—11.)* Shielded instrument lights (2) are provided for all instruments. The flight and non-flight instrument lights are controlled separately by combination power switches and dimming rheostats, marked "NON FLT INST LTS — OFF — BRT" and "FLT INST LTS — OFF — BRT," located on the overhead switch panel (figure 7—7). The lights operate from the primary supply circuit through the "NON FLT INST" and "FLT INST" circuit breakers on the overhead electrical fuse and circuit breaker panel.

7–185. TROUBLE SHOOTING. For trouble shooting, refer to paragraph 7–197.

7–186. REMOVAL. To remove the instrument lights, hinge down each light shield cover and remove the lamps and securing screws. Pull the shield and instrument out of the panel, disconnect the wiring and remove the instrument and light shield.

7–187. INSTALLATION. To install the instrument lights, position each light shield on the instrument and connect the wiring and tubing as required. Position the instrument and light in the panel, install the securing screws and lamps and hinge the shield closed.

7–188. INSPECTION LIGHTS.

7–189. DESCRIPTION. *(See figure 7–11.)* Three oil level inspection lights are provided, one for the primary hydraulic system reservoir (7), one for the auxiliary hydraulic system reservoir (23) and one for the main gear box (8). Light switches are mounted adjacent to the lights and the lights operate from the battery supply circuit through the "CKPT DOME LTS." circuit breaker on the battery bus circuit breaker box (figure 7–13) in the electronics compartment.

7–190. TROUBLE SHOOTING. For trouble shooting, refer to paragraph 7–197.

7–191. REMOVAL. To remove the inspection lights, remove the securing screws, lift each light from its mounting, disconnect the wiring and remove the light.

7–192. INSTALLATION. To install the inspection lights, connect the wiring to each light, position the light on its mounting and install the securing screws.

7–193. WARNING LIGHT DIMMING RELAY AND SWITCH.

7–194. DESCRIPTION. The warning light dimming relay (2, figure 7–9) is located in the relay and resistor installation behind the cockpit dome light panel (6, figure 7–1). The warning light dimming switch, marked "WARN LTS," is located on the main switch panel (figure 7–6) and has two positions, "BRT" and "DIM." The switch is closed when in the "DIM" position so that the warning light dimming relay is energized whenever the flight instrument lights are turned on. When the relay is energized, a dimming resistor (1, figure 7–9) is cut into the power circuit to four warning lights: generator failure, inverter failure, transmission low oil pressure, fuel overflow and 20-minute fuel. The dimming resistors are mounted in the relay and resistor installation together with the relay.

7–195. REMOVAL. To remove the warning light dimming relay, remove the securing screws from the cockpit dome light panel and hinge the panel down. Disconnect the wiring from the relay, remove the securing screws and washers and remove the relay.

7–196. INSTALLATION. To install the warning light dimming relay, position the relay, install with the securing screws and washers, connect the wiring to the relay, hinge the cockpit dome light panel closed and install the securing screws.

7–197. TROUBLE SHOOTING – LIGHTS.

7–198. DESCRIPTION. In all cases the dc power to operate lights is available only when the battery, primary and secondary supply circuits are energized. Refer to table XXXI for operating conditions necessary to energize these circuits.

Trouble	Probable Cause	Remedy
Failure of single light or light system to operate	Lamp failure	Replace
	Circuit breaker out	Reset
	Switch failure	Replace
	Open circuit	Check continuity
When navigation lights on "FLASH," fuselage lights burn steady and position lights inoperative	Failure of light flasher	Replace
Warning lights do not come on when pressed-to-test	Lamp failure	Replace
	Open circuit	Check continuity

7–199. MISCELLANEOUS EQUIPMENT.

7–200. DESCRIPTION. *(See figure 7–1.)* Miscellaneous equipment includes the crew alarm bell, the fuel nozzle grounding receptacles and the radio interference reduction components.

7–201. CREW ALARM BELL. The crew alarm bell (12, figure 7–1) is located on the aft bulkhead in the cabin. It is controlled by the guarded "CREW ALARM" switch on the overhead switch panel (figure 7–7). Power to operate the bell is taken from the battery supply circuit through a circuit breaker on the battery bus circuit breaker box (figure 7–13).

7–202. REMOVAL. To remove the alarm bell, disconnect the wiring and remove the screws, washers and nuts securing it to the bulkhead.

7–203. INSTALLATION. To install the alarm bell, position the bell on the bulkhead and secure it with the screws, washers and nuts. Connect the electrical wiring.

7—204. FUEL NOZZLE GROUNDING RECEPTACLES. Two receptacles (23, figure 7—1) are permanently fastened to the right side of the ship, one below the cockpit and one forward of the electronics compartment. They are adjacent to the fuel tank filler caps and are used to ground the fuel nozzle while fueling. This prevents the possibility of fire due to sparks resulting from a difference in electrical potential between the fuel nozzle and the frame of the helicopter.

7—205. RADIO INTERFERENCE REDUCTION COMPONENTS. All electric motors are equipped with filters. Ac wires are shielded, where necessary, to prevent ac hum in audio circuits.

7—206. ELECTRICAL LOAD ANALYSIS CHARTS.

7—207. DESCRIPTION. Figures 7—16 and 7—17 provide electrical load analysis charts for the dc and ac systems respectively. The charts show the load drawn by each piece of equipment and the total load under various operating conditions with equipment in use as indicated.

EQUIPMENT	NUMBER OF UNITS	AMPERES PER UNIT	OPERATING TIME — MIN.	OPERATING CONDITIONS																															
				LOADING & ANCHOR				START & WARMUP				TAXI				TAKE OFF & CLIMB				CRUISE				LANDING				CRUISE — MISSION				HOVERING			
				AMPS	AVERAGE AMPS			AMPS	AVERAGE AMPS			AMPS	AVERAGE AMPS			AMPS	AVERAGE AMPS			AMPS	AVERAGE AMPS			AMPS	AVERAGE AMPS			AMPS	AVERAGE AMPS			AMPS	AVERAGE AMPS		
SECONDARY BUS LOADS					0.5 MIN.	2.0 MIN.	15.0 MIN.		0.5 MIN.	2.0 MIN.	15.0 MIN.		0.5 MIN.	2.0 MIN.	15.0 MIN.		0.5 MIN.	2.0 MIN.	15.0 MIN.		0.5 MIN.	2.0 MIN.	30.0 MIN.		0.5 MIN.	2.0 MIN.	5.0 MIN.		0.5 MIN.	2.0 MIN.	30.0 MIN.		0.5 MIN.	2.0 MIN.	30.0 MIN.
FLIGHT INSTRUMENT																																			
Pitot Heat Tube	1	4.0	30					4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Turn & Bank	1	0.3	30	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Compass System	1	0.6	30	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
TOTAL				0.9	0.9	0.9	0.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9
IGNITION																																			
Vibrator Coil	1	2.9	0.5					2.9	2.9	0.7																									
TOTAL								2.9	2.9	0.7																									
ENGINE CONTROL																																			
Starter	1																																		
Starter Relay	1	4.5	0.5					4.5	4.5	1.1	0.2																								
Hydro-Mech. Clutch	1	14.5	1.0					14.5	14.5	7.3	1.0																								
TOTAL								19.0	19.0	8.4	1.2																								
LIGHTING																																			
Cockpit Dome Light	1	1.5	30	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Trouble Light	1	0.2	5.0	0.2	0.2	0.2		0.2	0.2	0.2		0.2	0.2	0.2		0.2	0.2	0.2		0.2	0.2	0.2		0.2	0.2	0.2	0.2	0.2	0.2	0.2		0.2	0.2	0.2	
Warning Light	7	0.2	1.0	1.4	1.4	0.7		1.4	1.4	0.7																									
Instrument & Panel	73	0.04	30	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9
Oil Inspection Light	2	0.2	5.0	0.4	0.4	0.4																													
TOTAL				6.4	6.4	5.7	4.4	6.0	6.0	5.3	4.4	4.6	4.6	4.6	4.4	4.6	4.6	4.6	4.4	4.6	4.6	4.6	4.4	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.4	4.6	4.6	4.6	4.4
MISCELLANEOUS																																			
Servo (Primary) Valve	1	1.0						1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Servo (Auxiliary) Valve	1	1.0																																	
Barrier Solenoid	1	1.0																																	
Cargo Sling	1	18.0																																	
TOTAL								1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
D.C. POWER																																			
Battery Charging																57.6	57.6	36.0	21.6	43.2	43.2	27.1	11.7	14.4	14.4	9.0	7.2	28.9	28.9	18.0	7.8	43.2	43.2	27.1	11.7
Battery Relay	1	0.6	30	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Bus Tie Relay	1	0.6	30	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Ext. Pwr Relay	1	0.6	30	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6																								
Ground Check Relay	1	0.2	30	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2																								
Rev. Current Cut-Out	1	0.5	30					0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Gen. Warn. Light Relay	1	0.2	30					0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Inverter Main	1	11.5	30	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5
Inverter Spare	1	11.5																																	
TOTAL				13.5	13.5	13.5	13.5	14.2	14.2	14.2	14.2	13.4	13.4	13.4	13.4	71.0	71.0	49.4	35.0	56.6	56.6	40.5	25.1	27.8	27.8	22.4	20.6	42.3	42.3	31.4	21.2	56.6	56.6	40.5	25.1
FUEL & OIL																																			
Eng. Prm.	1	0.6	0.5					0.6	0.6	0.2																									
Oil Dil.	1	0.3	5.0					0.3	0.3	0.3	0.1																								
Fuel Pump Booster	1	10.0	30					10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Fuel Pump (Transfer)	2	2.3	30					4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6
Fuel Cont. Unit	1	0.4	30					0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Fuel Level Cont. Unit	1	Neg	30																																
Warning & Emergency																																			
Fire Det. Relay	1	Neg																																	
Emergency Crew Alarm	1	0.5														0.5	0.5			0.5	0.5			0.5	0.5			0.5	0.5			0.5	0.5		
TOTAL								15.9	15.9	15.5	15.1	15.0	15.0	15.0	15.0	15.5	15.5	15.0	15.0	15.5	15.5	15.0	15.0	15.5	15.5	15.0	15.0	15.5	15.5	15.0	15.0	15.5	15.5	15.0	15.0

Figure 7–16. Power Loading Chart — DC Power (Sheet 1 of 2)

OPERATING CONDITIONS

EQUIPMENT	NUMBER OF UNITS	AMPERES PER UNIT	OPERATING TIME — MIN.	LOADING & ANCHOR				START & WARMUP				TAXI				TAKE OFF & CLIMB			
				AMPS	AVERAGE AMPS 0.5 MIN.	2.0 MIN.	15.0 MIN.	AMPS	AVERAGE AMPS 0.5 MIN.	2.0 MIN.	15.0 MIN.	AMPS	AVERAGE AMPS 0.5 MIN.	2.0 MIN.	15.0 MIN.	AMPS	AVERAGE AMPS 0.5 MIN.	2.0 MIN.	15.0 MIN.
SECONDARY BUS LOADS																			
ENG. INSTRUMENTS																			
Carburetor Air Temp. Indicator	1	0.04	30																
Engine Oil Temp. Indicator	1	0.04	30	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Transmission Oil Temp. Indicator	1	0.04	30																
Cylinder Head Temp. Indicator	1	0.04	30																
TOTAL				0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
RADIO																			
VHF Receiver	1	1.5	30	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
VHF Transmitter	1	2.2		2.2	2.2	1.1		2.2	2.2	2.2	0.4	2.2	2.2	2.2	0.4	2.2	2.2	1.1	
VHF Transmitter	1	2.2																	
LF Receiver	1	1.5	30																
TOTAL				3.7	3.7	2.6	1.5	3.7	3.7	3.7	1.9	3.7	3.7	3.7	1.9	3.7	3.7	2.6	1.5
GRAND TOTAL PRIMARY BUS LOADS				24.7	24.7	22.9	20.5	67.8	67.8	53.9	42.9	42.8	42.8	42.8	40.8	100.9	100.9	77.7	62.0
CONTROL SURFACE																			
Magnetic Brake	2	1.5	30	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
TOTAL				3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
HEAT & VENT																			
Cabin Heater (50,000 Btu)	1	20.4	30									20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4
TOTAL												20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4
LIGHTING																			
Cabin Dome Light	2	1.5	30	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Radio Compartment Dome Light	1	1.5	30	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Landing Light Lamp	1	16.1	10									16.1	16.1	16.1	10.7	16.1	16.1	16.1	10.7
Landing Light Relay	1	0.2	10									0.2	0.2	0.2		0.2	0.2	0.2	
Trouble Light	1	0.2	5	0.2	0.2	0.2		0.2	0.2	0.2		0.2	0.2	0.2		0.2	0.2	0.2	
Flasher	1	0.6	30									0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Fuselage (Fwd & Aft) Top Light	2	0.2	30									0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Fuselage (Bottom) Light	1	0.8	30									0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Pos. (R.H.) Side Light	1	0.8	30									0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Pos. (L.H.) Side Light	1	0.8	30									0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Tail Light	1	0.8	30									0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Cargo Fld Light	1	1.8	30																
Formation Light	2	0.2	30																
Formation Light	1	0.2	30																
Formation Light	1	0.2	30																
TOTAL				4.7	4.7	4.7	4.5	4.7	4.7	4.7	4.5	25.2	25.2	25.2	19.4	25.2	25.2	25.2	19.4
MISCELLANEOUS																			
Windshield Wiper	1	5.2	30					5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2
TOTAL								5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2
GRAND TOTAL SECONDARY BUS LOADS				7.7	7.7	7.7	7.5	12.9	12.9	12.9	12.7	53.8	53.8	53.8	48.0	53.8	53.8	53.8	48.0
GRAND TOTAL PRIMARY BUS LOADS				24.7	24.7	22.9	20.5	67.8	67.8	53.9	42.9	42.8	42.8	42.8	40.8	100.9	100.9	77.7	62.0
GRAND TOTAL PRI. & SEC. BUS LOADS				32.4	32.4	30.6	28.0	80.7	80.7	66.8	55.6	96.6	96.6	96.6	88.8	154.7	154.7	131.5	110.0

EQUIPMENT	CRUISE				LANDING				CRUISE — MISSION				HOVERING			
	AMPS	AVERAGE AMPS 0.5 MIN.	2.0 MIN.	30.0 MIN.	AMPS	AVERAGE AMPS 0.5 MIN.	2.0 MIN.	5.0 MIN.	AMPS	AVERAGE AMPS 0.5 MIN.	2.0 MIN.	30.0 MIN.	AMPS	AVERAGE AMPS 0.5 MIN.	2.0 MIN.	30.0 MIN.
SECONDARY BUS LOADS																
ENG. INSTRUMENTS																
Carburetor Air Temp. Indicator																
Engine Oil Temp. Indicator	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Transmission Oil Temp. Indicator																
Cylinder Head Temp. Indicator																
TOTAL	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
RADIO																
VHF Receiver	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
VHF Transmitter	2.2	2.2	2.2	0.2	2.2	2.2	1.1	0.4	2.2	2.2	2.2	0.2	2.2	2.2	2.2	0.4
VHF Transmitter																
LF Receiver	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
TOTAL	5.2	5.2	5.2	3.2	5.2	5.2	4.1	3.4	5.2	5.2	5.2	5.2	5.2	5.2	5.2	3.4
GRAND TOTAL PRIMARY BUS LOADS	88.0	88.0	71.4	53.8	59.2	59.2	52.2	49.7	73.7	73.7	62.3	51.9	88.0	88.0	71.4	54.0
CONTROL SURFACE																
Magnetic Brake	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
TOTAL	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
HEAT & VENT																
Cabin Heater (50,000 Btu)	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4
TOTAL	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4
LIGHTING																
Cabin Dome Light	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Radio Compartment Dome Light	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Landing Light Lamp					16.1	16.1	16.1	16.1					16.1	16.1	16.1	5.4
Landing Light Relay					0.2	0.2	0.2	0.2					0.2	0.2	0.2	
Trouble Light	0.2	0.2	0.2		0.2	0.2	0.2	0.2	0.2	0.2	0.2		0.2	0.2	0.2	
Flasher	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Fuselage (Fwd & Aft) Top Light	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Fuselage (Bottom) Light	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Pos. (R.H.) Side Light	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Pos. (L.H.) Side Light	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Tail Light	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Cargo Fld Light													1.8	1.8	1.8	1.8
Formation Light																
Formation Light	0.8	0.8	0.8	0.8					0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Formation Light																
TOTAL	9.7	9.7	9.7	9.5	25.2	25.2	25.2	25.2	9.7	9.7	9.7	9.5	27.8	27.8	27.8	16.7
MISCELLANEOUS																
Windshield Wiper	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2
TOTAL	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2
GRAND TOTAL SECONDARY BUS LOADS	38.3	38.3	38.3	38.1	53.8	53.8	53.8	53.8	38.3	38.3	38.3	38.1	56.4	56.4	56.4	45.3
GRAND TOTAL PRIMARY BUS LOADS	88.0	88.0	71.4	53.8	59.2	59.2	52.2	49.7	73.7	73.7	62.3	51.9	88.0	88.0	71.4	54.0
GRAND TOTAL PRI. & SEC. BUS LOADS	126.3	126.3	109.7	91.9	113.0	113.0	106.0	103.5	112.0	112.0	100.6	90.0	144.4	144.4	127.8	99.3

ELECTRIC POWER EQUIPMENT: Generator (1) Type AN-3632-1, 30 V.D.C., 200 Amp., 3000-8000 R.P.M. Gen. to Eng. Gear Ratio 2.2486:1. Battery (1) AN3150-2 24 V.D.C., 36 Amp. Hr. Inverter (Main) AN3532-2, 115 V.A.C., 250 V.A., 3ϕ, 400~. Inverter (Spare) AN3532-2, 115 V.A.C., 250 V.A., 3ϕ, 400~. Alternate Generator (1) AN3633-1, 30 V.D.C., 300 Amp.; Alternate Battery (1) AN3150-2, 24 V.D.C., 36 Amp. Hr.

Figure 7—16. Power Loading Chart — DC Power (Sheet 2 of 2)

EQUIPMENT	TOTAL NO. OF UNITS	OPERATING TIME IN MIN.	ELECTRICAL REQUIREMENTS PER UNIT									PF	FREQ. RANGE	CONNECTED LOAD			CONNECTED LOAD PER PHASE						FIRE COND.	
			115 V 3 φ			115 V 1 φ			26 V 1 φ								"A" — GND		"C" — GND		"C" — "A"		"C" — "A"	
			VA	WATTS	VARS	VA	WATTS	VARS	VA	WATTS	VARS			VA	WATTS	VARS	WATTS	VARS	WATTS	VARS	WATTS	VARS	WATTS	VARS
***NORMAL CONDITION**																								
Inverter — Main	1	30	250.0									0.75	400											
Autotransformer	1	30							50.0				380-460											
Inverter Warning Light Relay	1	30				6.9	6.7	1.7				0.97	400	6.9	6.7	1.7					6.7	1.7	6.7	1.7
Transmission, Engine Oil Press. Indicator	2	30							2.6	0.5	2.5	0.19	400	5.2	1.0	5.0			1.0	5.0				
Transmission, Engine Oil Press. Transmitter	2	30							5.3	1.1	5.2	0.21	400	10.6	2.2	10.4			2.2	10.4				
Fuel Press. Indicator	1	30							2.6	0.5	2.5	0.19	400	2.6	0.5	2.5			0.5	2.5				
Fuel Press. Transmitter	1	30							5.3	1.1	5.2	0.21	400	5.3	1.1	5.2			1.1	5.2				
Pri. & Aux. Hyd. Press. Indicator	2	30							2.6	0.5	2.5	0.19	400	5.2	1.0	5.0			1.0	5.0				
Pri. & Aux. Hyd. Press. Transmitter	2	30							5.3	1.1	5.2	0.21	400	10.6	2.2	10.4			2.2	10.4				
Vertical Gyro Indicator — J-8	1	30	24.0	16.8	17.1							0.70	380-420	24.0	16.8	17.1	5.6	5.7	5.6	5.7	5.6	5.7	5.6	5.7
Compass System J-2	1	30	32.0	18.3	27.3							0.57	400	32.0	18.3	27.3	6.1	9.1	6.1	9.1	6.1	9.1	6.1	9.1
Fuel Indicator	1	30				10.9	10.9	0.0				1.00	400	10.9	10.9	0.0	10.9	0.0						
Fire Det. Cont. Unit	1	0.25				23.4	22.0	−7.8				0.94	400	23.4	22.0	−7.8							22.0	−7.8
***Fire Det. Cont. Unit	1	30				14.5	8.0	12.1				0.55	400	14.5	8.0	12.1					8.0	12.1	8.0	12.1
Relay — A.C. — D.C.	1	30				11.5	11.5	0.0				1.00	400	11.5	11.5	0.0	11.5	0.0						
TOTAL (NORMAL CONDITION)				35.1	44.4		59.1	6.0		4.8	23.1				102.2	88.9	34.1	14.8	19.7	53.3	26.4	28.6	48.4	20.8
															VA=135.0		VA=37.3		VA=56.8		VA=39.0		VA=52.6	
****EMERGENCY CONDITION**																								
Inverter — Spare	1	30	250.0																					
Autotransformer	1	30							50.0															
TOTAL (SAME AS NORMAL CONDITION)				35.1	44.4		59.1	6.0		4.8	23.1	0.75			102.2	88.9	34.1	14.8	19.7	53.3	26.4	28.6	48.4	20.8
															VA=135.0		VA=37.3		VA=56.8		VA=39.0		VA=52.6	

POWER SOURCE EQUIPMENT: MAIN INVERTER AN3532-2 250 VA, 115 VAC, 3φ 400~ (1 REQUIRED). SPARE INVERTER AN3532-2 250 VA, 115 VAC, 3φ 400~ (1 REQUIRED). AUTOTRANSFORMER 70G175 115 V/26 VAC 340-460~

*NOTE 1: Normal Operation: Main Inverter supplies 3φ power to all A.C. Equipment.
**NOTE 2: Emergency Operation: Spare Inverter supplies 3φ power to all A.C. Equipment.
***NOTE 3: Fire Detector Control Unit requires 8 watts standby condition and 30 watts in fire alarm condition.

Figure 7—17. Power Loading Chart — AC Power

SECTION VIII

RADIO AND RADAR

TABLE OF CONTENTS

Paragraph		Page
8—1.	**RADIO AND RADAR**	**393**
8—3.	POWER SUPPLY	393
8—5.	RADIO MASTER SWITCH	393
8—6.	RADIO FUSE AND CIRCUIT BREAKER PANEL	394
8—8.	RADIO EQUIPMENT	395
8—11.	**VHF COMMAND SET (A.R.C. TYPE 12)**	**395**
8—19.	ADJUSTMENT	397
8—20.	TESTING	397
8—21.	**LF RANGE RECEIVER (A.R.C. Type 12)**	**397**
8—28.	ADJUSTMENT	400
8—29.	TESTING	400
8—30.	**INTERCOMMUNICATION**	**400**

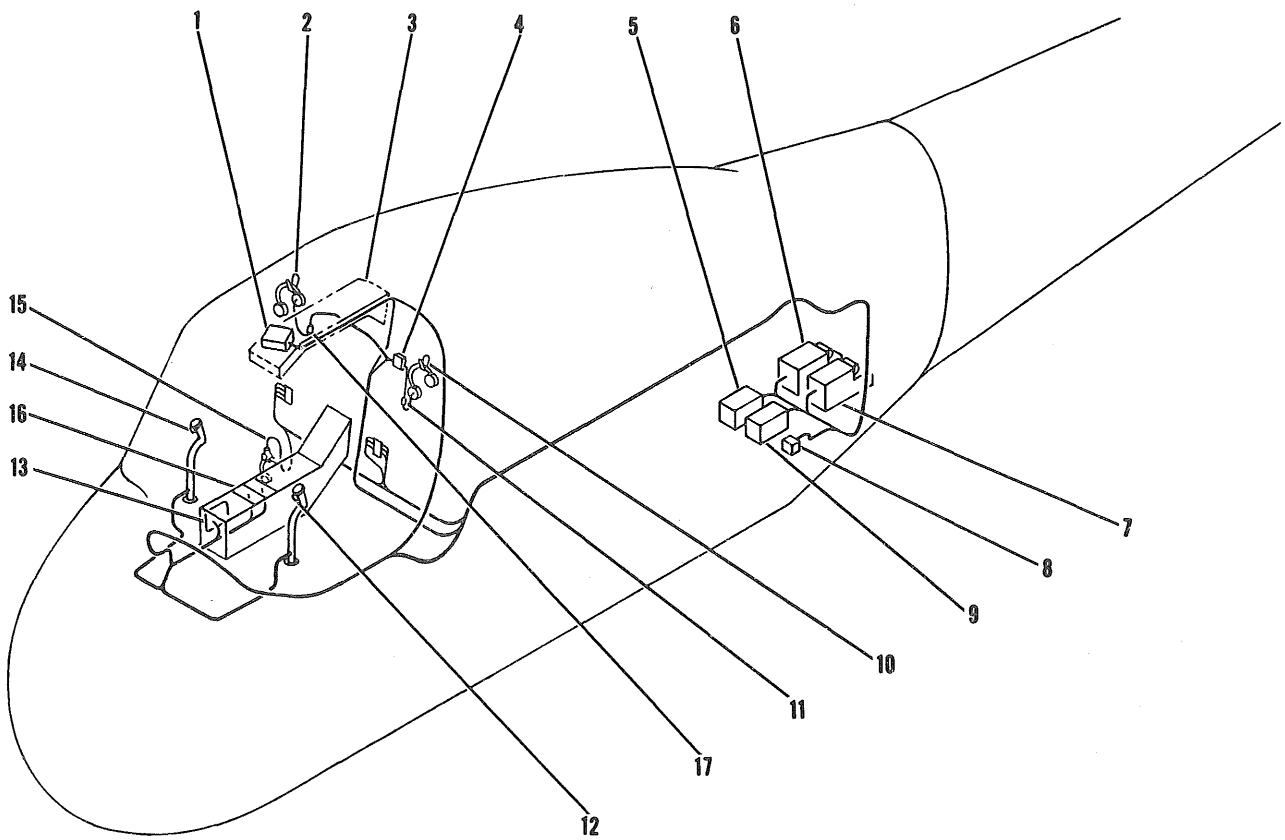
8—1. RADIO AND RADAR.

8—2. DESCRIPTION. A VHF command set, an LF range receiver and an interphone system are installed to provide air-to-air and air-to-ground communication, navigation information and intercommunication within the helicopter. All units of the installation are components of radio set A.R.C. type 12. Three communication stations are provided, one each in the cockpit for the pilot and observer and one on the forward bulkhead in the cabin for the hoist operator. A cord assembly (11, 15 and 17, figure 8—1) for head set and microphone is provided at each station. Microphone switches (12 and 14) are provided for both the pilot and observer on the cyclic control stick grips. The switches have two positions, "ICS" and "RADIO." The "ICS" position connects the microphones to the interphone circuit and the "RADIO" position connects the microphones to the radio transmitters. The microphone switch for the hoist operator is on the phone jack of the cord assembly (15) and controls interphone connections only. All receivers and transmitters are remotely controlled from panels on the radio console (16). Power for opertaion of the equipment is taken from the helicopter 28-volt dc system.

8—3. POWER SUPPLY.

8—4. DESCRIPTION. The low voltage supply for the radio and interphone installation is taken from the helicopter's 28-volt dc system through the radio master switch. High voltages used in operation of the radio equipment are supplied by power components of the radio sets themselves. The radio sets connect to the 28-volt dc system at the radio fuse and circuit breaker panel (13, figure 8—1).

8—5. RADIO MASTER SWITCH. The "RADIO MASTER" switch (figure 7—7) is located on the overhead switch panel (4, figure 7—1) in the cockpit and controls the 28-volt dc power supply to all radio equipment. Power to the switch is supplied from the primary bus mounted behind the electrical fuse and circuit breaker panel (5, figure 7—1) through the "RADIO MASTER" circuit breaker on the same panel (figure



1. Chassis (L-10A Loop Antenna)
2. Hook (Pilot's Head Set and Mike)
3. Overhead Control Panel
4. Junction Box (Radio)
5. Transmitter (T-11B)
6. Receiver (R-19)
7. Receiver (R-11A)
8. Relay (Sidetone)
9. Transmitter (T-13A)
10. Hook (Observer's Head Set and Mike)
11. Cord Assembly (Observer)
12. Mike Switch (Observer)
13. Radio Fuse and Circuit Breaker Panel
14. Mike Switch (Pilot)
15. Cord Assembly (Hoist Operator's Head Set and Mike)
16. Control Panels (Radio)
17. Cord Assembly (Pilot)

Figure 8—1. Radio Equipment Location Diagram

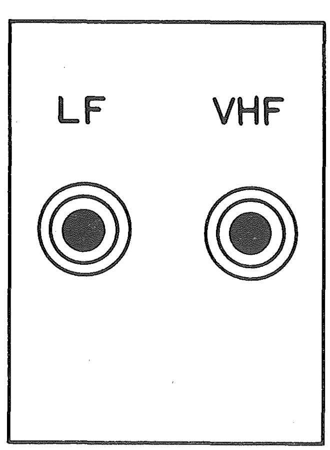


Figure 8—2. Radio Fuse and Circuit Breaker Panel

7—7). Power from the switch goes to the radio bus bar mounted behind the radio fuse and circuit breaker panel.

8—6. RADIO FUSE AND CIRCUIT BREAKER PANEL. *(See figure 8—2.)* The radio fuse and circuit breaker panel (1, figure 7—1) is mounted on the right side of the console in the cockpit. Individual 28-volt dc circuits connect the radio bus bar behind the panel to the radio sets, as required, through appropriately marked circuit breakers on the front of the panel. As none of the radio equipment in this installation uses the helicopter ac power supply, there are no fuses on the panel. To energize the radio bus bar the 28-volt dc primary supply circuit must be energized (table XXXI) and the radio master switch placed in the "ON" position.

8–7. TROUBLE SHOOTING. If neither the radio sets nor the interphone system are operative, failure of the 28-volt dc power supply is indicated. In this case, first check that operating conditions are such that the primary supply circuit is energized (table XXXI) and that the radio master switch is in the "ON" position. If this does not locate the source of trouble, check that the "RADIO MASTER" circuit breaker is firmly pushed in. If the trouble persists, refer to paragraph 7–98 for further trouble shooting on the dc electrical system.

8–8. RADIO EQUIPMENT.

8–9. DESCRIPTION. All radio receivers, transmitters and dynamotors and a sidetone relay are located in the electronics compartment where they are readily accessible in flight. The dynamotors are a part of the receiver installations. Two microphone relays, one in the pilot's and one in the observer's microphone switch circuit, are mounted in the radio junction box in the cockpit. All sets are remotely controlled from panels on the radio console in the cockpit. The relative location of all radio equipment is shown in figure 8–1. The relative location of all antennas is shown in figure 8–5.

8–10. TROUBLE SHOOTING. If all radio sets and the interphone system are inoperative, trouble is probably due to failure in the 28-volt dc power supply. In this case, refer to paragraph 8–7. If the trouble is localized at one communication station, the head set and/or microphone are probably defective. Replace the defective unit with one known to be operative. If radio reception is possible at all stations but either the pilot only or the observer only cannot transmit over either radio or interphone, the microphone relay circuit at the station in question is probably inoperative. If no sidetone is heard at any station during attempted transmission, the sidetone relay circuit may be inoperative. Check inoperative relay circuits for loose connections and replace relays as necessary. If the trouble is localized in a particular set, check the 28-volt dc circuit breaker on the radio fuse and circuit breaker panel. If the trouble is not remedied by these procedures, place the "GENERATOR" switch in the "GEN OFF" position and be sure external power is disconnected. Check all electrical connections to the equipment for security, including ground and antenna connections. If trouble persists, it is probably due to failure of a component. Replace components suspected of failure by components known to be operative until the trouble is corrected. Trouble shooting on installed radio equipment is difficult and should be avoided.

WARNING

Operation of the radio equipment involves use of high voltages dangerous to life. Personnel must observe all safety regulations at all times.

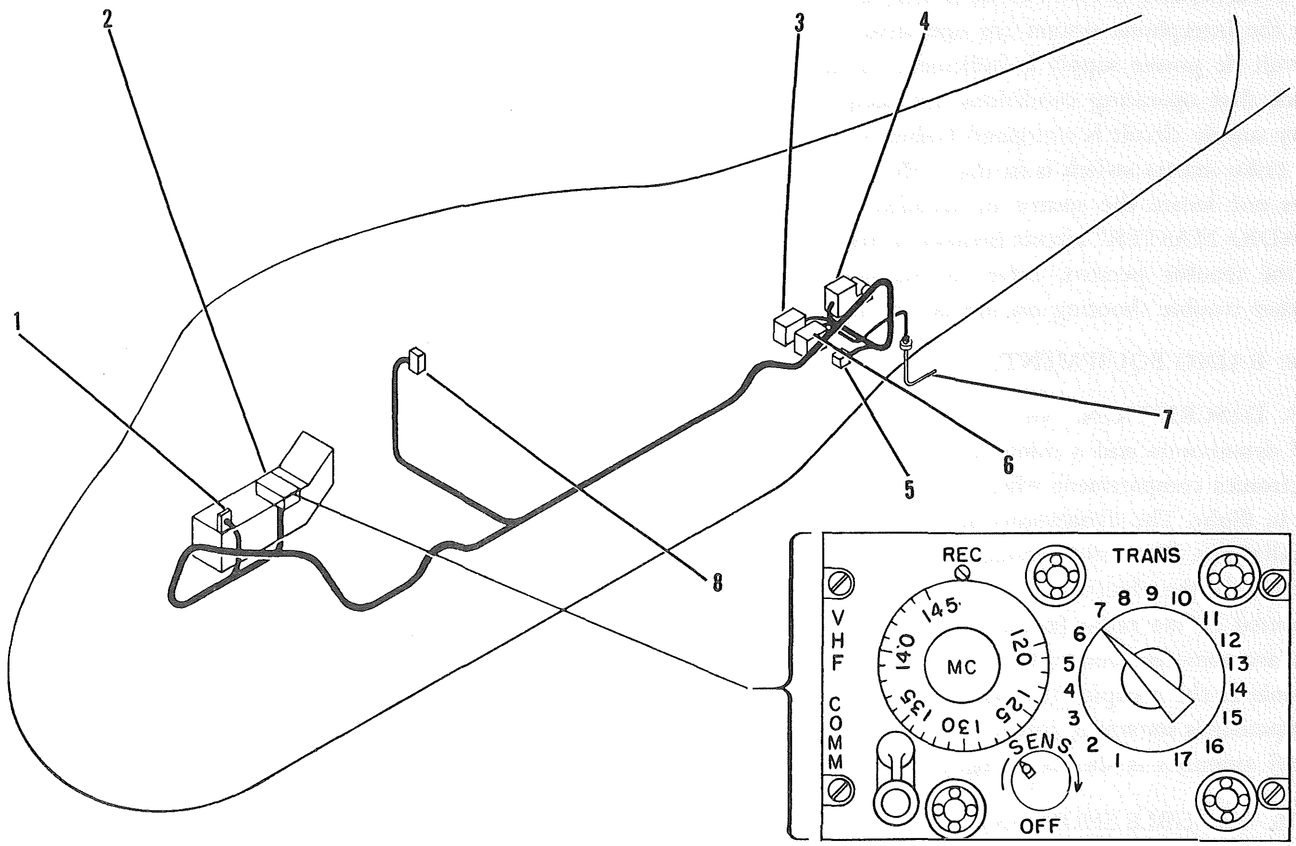
8–11. VHF COMMAND SET (A.R.C. TYPE 12).

8–12. DESCRIPTION. *(See figure 8–3.)* The VHF command set provides two-way communication between aircraft or between aircraft and ground in the very-high-frequency range from 118 to 148 megacycles. The set also provides means for intercommunication between crew members (paragraph 8–30). In this installation, two transmitters and one receiver are included in the command set. One transmitter covers the frequency range between 116 and 132 megacycles and the other the range between 132 and 148 megacycles. The transmitters are crystal-controlled by five crystals each, giving a choice of transmission on ten frequency channels. The receiver is continuously tunable over the frequency range of 118 through 148 megacycles. The same antenna is used for both the two transmitters and the receiver. The set is remotely controlled from the panel marked "VHF COMM" on the radio console. Circuit changes necessary to shift from radio reception to either radio transmission or intercommunications are made by the three relays included in the installation (the two microphone relays and the sidetone relay). Operation of these relays is controlled by the microphone switches. The radio frequency generating circuit, used only in radio transmission, is closed only when either the pilot's or observer's microphone switch is in the "RADIO" position. The hoist operator can transmit over the command circuit only if either the pilot's or observer's microphone switch is in the "RADIO" position.

8–13. Major components of the VHF command set are the two transmitters (3 and 5, figure 8–3), the receiver (4), the sidetone relay (5), the antenna (7), two microphone relays (8) and the remote control panel (2). The transmitters and receivers have shock absorber mountings.

8–14. The 28-volt dc supply circuit to the VHF command set is energized from the radio bus bar and runs from the bus bar through the "VHF" circuit breaker on the radio fuse and circuit breaker panel and the power switch in the "VHF COMM" control panel to the receiver. A dynamotor, which is part of the receiver installation, supplies necessary high voltages for both the receiver and the two transmitters.

8–15. All operating controls for the command set are on the "VHF COMM" panel mounted on the console



1. Circuit Breaker ("VHF")
2. Control Panel ("VHF COMM")
3. Transmitter (T-11B)
4. Receiver (R-19)
5. Relay (Sidetone)
6. Transmitter (T-13A)
7. Antenna (A-15)
8. Microphone Relays (Radio Junction Box)

Figure 8—3. VHF Command Set (A.R.C. Type 12)

between the pilot and observer. A single knob marked "SENS — OFF" serves to control both the power switch for the set and the sensitivity adjustment for the VHF receiver. There is a tuning crank and frequency indicating dial marked "REC" for tuning the receiver and a channel selector knob marked "TRANS" for selecting the transmitting channel to be used.

Note

In this installation, only channels 1 through 10 are operative. No transmitter is provided for channels 11 through 17.

8—16. TROUBLE SHOOTING. For trouble shooting on the VHF command set, refer to paragraph 8—10.

8—17. REMOVAL.

a. Rotate the "SENS — OFF" control knob on the "VHF COMM" control panel counterclockwise to the "OFF" position and place the "RADIO MASTER" switch on the overhead switch panel in the "RADIO MASTER" position.

WARNING

Do not remove any components unless all power switches are turned off. Operation of the set involves use of high voltages dangerous to life.

b. Loosen the fasteners securing the "VHF COMM" control panel to the console, lift the panel to gain access to cabling connections, detach the cabling and remove the unit.

c. Remove the cover from the radio junction box, detach wiring from the two microphone relays, remove securing screws and washers from the relays and remove the relays.

d. Disconnect all tuning cables and wiring connections from the receiver and transmitters. Remove safety wires from the fasteners securing the units to their mountings, loosen all fasteners securing the receiver and transmitters in position and carefully remove the receiver and the two transmitters from their mountings.

e. Disconnect the wiring from the sidetone relay, remove the securing screws, washers and nuts and remove the relay.

f. From inside the helicopter, disconnect the coaxial cable from the antenna. From beneath the helicopter, unscrew the retaining ring at the base of the antenna and remove the antenna.

8–18. INSTALLATION.

a. Place the "RADIO MASTER" switch on the overhead control panel in the "RADIO MASTER" position.

WARNING

Do not install any components unless all power switches are turned off. Operation of the set involves use of high voltages dangerous to life.

b. Place the antenna in mounting position and secure by screwing the retaining ring up tight. From inside the fuselage, connect the antenna cable to the antenna.

c. Place the sidetone relay in mounting position on the left shelf in the electronics compartment. Secure with the screws, washers and nuts and attach the electrical connections.

d. Slide the receiver and two transmitters carefully into their mountings and secure with the fasteners and safety wire. Attach all electrical, antenna and tuning connections.

e. Place the two microphone relays in mounting position in the radio junction box, secure with the screws and washers, attach electrical connections to the relays and replace the cover of the junction box.

f. Attach the electrical connections inside the control console to the "VHF COMM" control panel, place the panel in mounting position on the console and secure with the fasteners.

8–19. ADJUSTMENT. To place the VHF command set in operation proceed as follows:

a. Place the "RADIO MASTER" switch on the overhead switch panel in the "RADIO MASTER" position and rotate the "SENS – OFF" knob on the "VHF COMM" control panel clockwise to close the power switch.

b. Tune the receiver to the desired frequency by means of the tuning crank below the "REC" frequency dial on the control panel and adjust the sensitivity control to give the best signal-to-noise ratio.

c. Set the "TRANS" channel selector switch on the desired transmitting channel.

Note

Only channels 1 through 10 are operative on this installation.

8–20. TESTING. Check operation of the equipment on all channels by establishing two-way communication with another aircraft or a ground station. If the set does not operate properly, refer to paragraph 8–10.

8–21. LF RANGE RECEIVER INSTALLATION (A.R.C. TYPE 12).

8–22. DESCRIPTION. *(See figure 8–4.)* The LF range receiver installation provides for reception of ground-to-air communication and navigation signals in the low frequency range of 190-550 kilocycles (0.19 – 0.55 megacycles). The receiver is continuously tunable over the range covered. Components of the installation are the "LF NAV" control panel (2, figure 8–4) on the console, the receiver (5) in the electronics compartment, a loop antenna (3) and a wire antenna (7). The loop antenna is used for direction finding and the wire antenna for communication. The receiver is disconnected from all three head-set circuits by the sidetone relay when any microphone switch is closed.

8–23. The 28-volt dc supply circuit to the LF range receiver is energized from the radio bus bar and runs from the bus bar through the "LF" circuit breaker on the radio fuse and circuit breaker panel (figure 8–2) and the power switch on the "LF NAV" control panel to the receiver. A dynamotor, which is part of the receiver installation, supplies necessary high voltages for operation of the receiver.

8–24. All operating controls for the LF navigation receiver are on the "LF NAV" control panel. The controls include an antenna selector switch, a combination power switch and sensitivity control knob, a frequency tuning crank and a loop antenna tuning crank. A frequency indicating dial, calibrated in megacycles, shows the frequency to which the receiver is tuned. A bearing-indicating dial, calibrated in tens of degrees, shows the relative bearing to which the loop antenna is rotated.

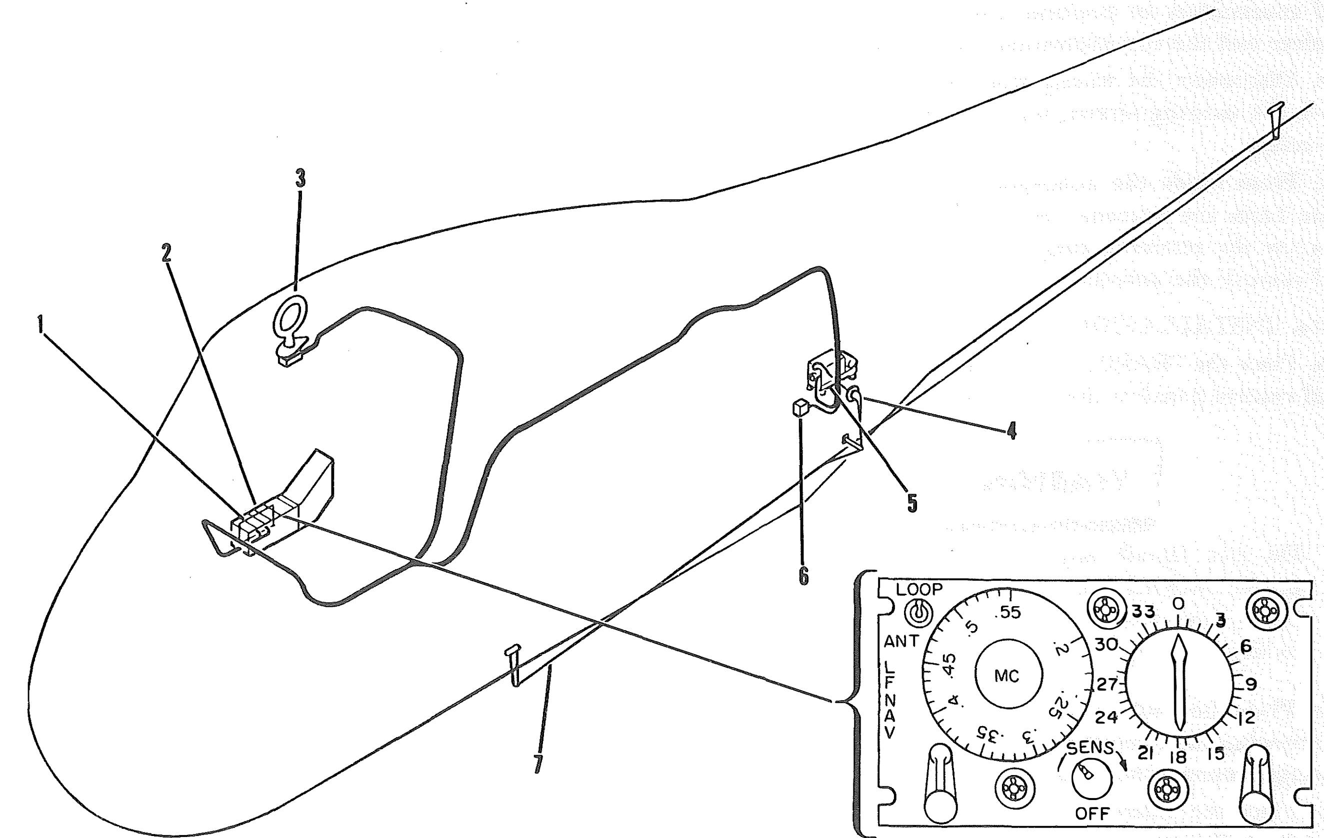
8–25. TROUBLE SHOOTING. For trouble shooting on the LF range receiver installation, refer to paragraph 8–10.

8–26. REMOVAL.

a. Rotate the "SENS – OFF" control knob on the "LF NAV" control panel counterclockwise to the "OFF" position and place the "RADIO MASTER" switch on the overhead switch panel in the "RADIO MASTER" position.

WARNING

Do not remove any components unless all



1. Circuit Breaker ("LF")
2. Control Panel ("LF NAV")
3. Loop Antenna (L-10A)
4. Doubler and Antenna Lead-Through
5. Receiver (R-11A)
6. Relay (Sidetone)
7. Fixed Wire Antenna

Figure 8–4. LF Range Receiver (A.R.C. Type 12, R-11A)

power switches are turned off. Operation of the radio equipment involves use of high voltages dangerous to life.

b. Loosen the fasteners securing the "LF NAV" control panel to the console, lift the panel to gain access to the cabling connections, detach the cabling and remove the unit.

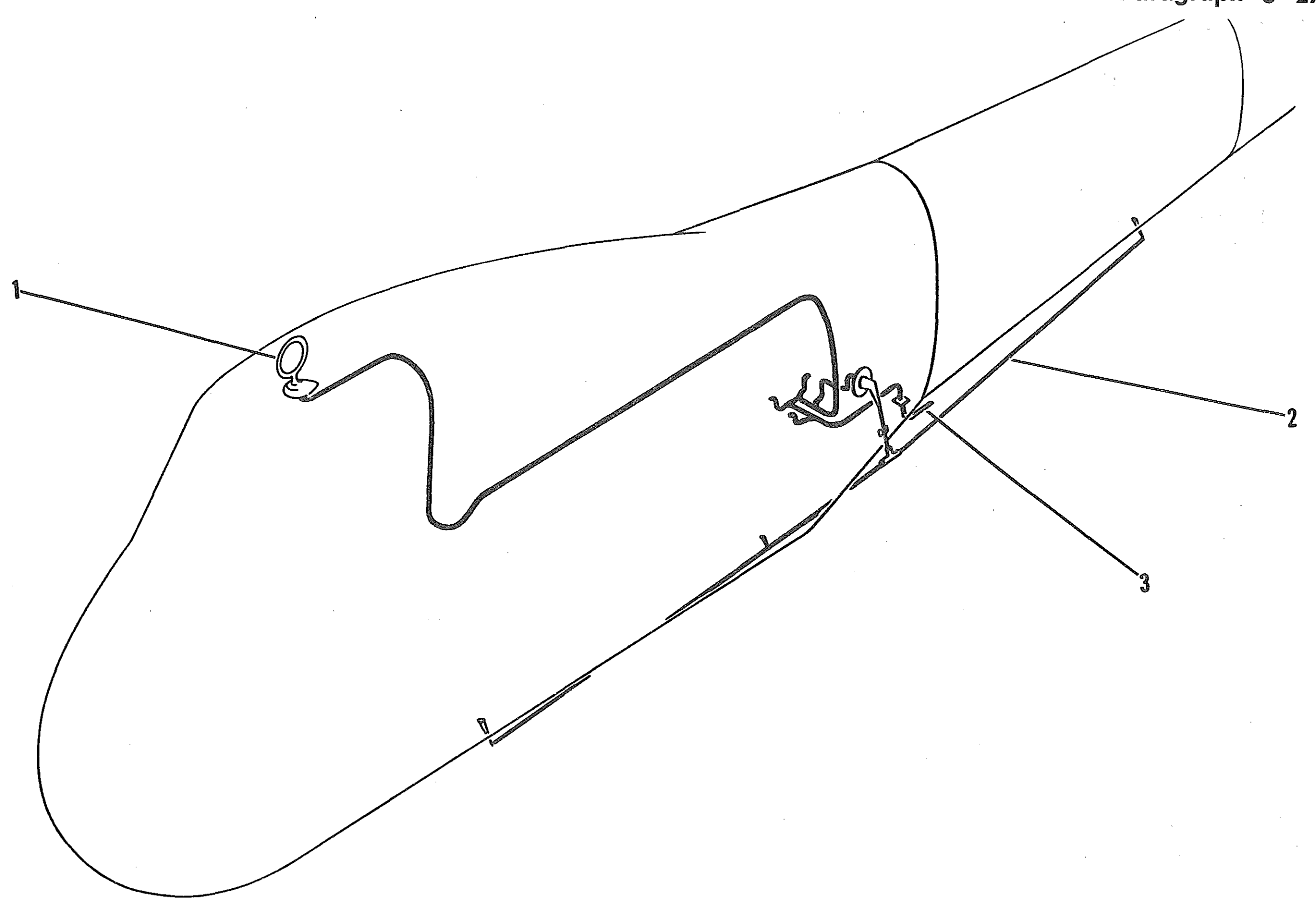
c. Detach all external connections, including tuning shaft and electrical cabling, from the receiver. Remove safety wires from the fasteners securing the receiver to its mounting, loosen the fasteners and carefully remove the receiver from its mounting.

d. From on top of the cockpit canopy, remove the screw securing the antenna loop (1, figure 8–5) to the antenna drive shaft, pull the antenna loop up and out and remove the knurled nut which holds the drive shaft in position. In the cockpit, loosen the fasteners securing the overhead switch panel and hinge the panel down to gain access to the loop antenna installation. Detach the drive mechanism and wiring from the antenna chassis and pull the chassis with drive shaft down and out. Remove the screws securing the antenna mounting to the top of the canopy and, from the top of the canopy, remove the antenna mounting and mounting gasket.

e. Detach the fixed wire antenna (2, figure 8–5) from both the forward and aft mast. Unbolt and remove from its socket the mast securing the antenna lead-in on the left side of the helicopter. Remove the screws securing the doubler to the left side of the fuselage at the point where the lead-through insulator goes through the skin. From inside the fuselage, detach the antenna cable from the lead-through insulator, remove the clamp which fits around the insulator and secures it to the skin and pull out the lead-through insulator. From outside the fuselage, remove the doubler and pull out the antenna lead-in wire. Remove the forward and aft antenna masts.

8–27. INSTALLATION.

a. Rotate the "SENS – OFF" control knob on the "LF NAV" control panel counterclockwise to the "OFF" position and place the "RADIO MASTER" switch on the overhead switch panel in the "RADIO MASTER" position.



1. Loop Antenna (LF Range Receiver)
2. Fixed Wire Antenna (LF Range Receiver)
3. L Type, A-15 Antenna (VHF Command Set)

Figure 8–5. Antenna Diagram

WARNING

Do not install any components unless all power switches are turned off. Operation of the radio equipment involves use of high voltages dangerous to life.

b. Install the forward and aft antenna masts which secure the wire antenna assembly. Secure the antenna assembly to both the forward and aft masts. Insert the mast on the antenna lead-in into its socket on the left side of the fuselage and bolt in position. Place the insulator at the end of the antenna lead-in through the hole in the skin of the helicopter and position the doubler against the fuselage so the screw holes match those in the skin of the fuselage. From inside the fuselage, plug in the lead-through insulator and slide the gasket and clamp over the insulator so the screw holes match those in the skin of the ship and the doubler. From outside the fuselage, secure the doubler to the clamp inside with the screws. Inside the fuselage, attach the antenna cable to the antenna lead-through insulator.

c. Attach the mechanical tuning linkage and electrical cabling in the console to the "LF NAV" control panel unit. Insert the unit in mounting position on the console and secure in place with the fasteners.

d. On top of the cockpit canopy, place the loop antenna mounting gasket and mounting in position over the screw holes. Inside the cockpit, loosen the fasteners securing the overhead switch panel and hinge the panel down. Secure the antenna gasket and mounting with the screws. Push the antenna drive shaft up through the hole in the antenna mounting. On top of the canopy, place the knurled nut around the drive shaft and tighten the nut. Insert the shaft of the loop down into the drive shaft and secure with the screw. Inside the cockpit canopy, connect the mechanical drive linkage and the electricity cabling to the loop antenna chassis. On the "LF NAV" control panel, turn the loop antenna turning crank until the plane of the loop is exactly fore and aft. Detach the mechanical tuning linkage from the "LF NAV" control panel and rotate the tuning crank on the panel so that the bearing-indicating dial reads "9" (90 degrees). Reconnect the tuning linkage to the control unit. Hinge the overhead switch panel up into position and secure the fasteners.

e. Slide the receiver into its mounting and secure with the fasteners and safety wire. Connect the tuning shaft and cabling to the receiver securely.

8–28. ADJUSTMENT. To place the LF range receiver in operation proceed as follows:

a. Place the "RADIO MASTER" switch on the overhead switch panel in the "ON" position and rotate the "SENS – OFF" knob on the "LF NAV" control panel clockwise to close the power switch.

b. Place the antenna selector switch in the "ANT" position for reception of communication signals or in the "LOOP" position for direction finding.

c. Tune the receiver to the desired frequency by means of the frequency tuning crank.

d. For reception of communication signals, adjust the sensitivity control to give the best signal-to-noise ratio.

e. For determining the relative bearing of the transmitting station (direction finding), rotate the loop antenna by means of the antenna tuning crank and adjust the sensitivity control for the sharpest minimum signal. Alternately rotate the loop and adjust the sensitivity until this minimum signal is obtained. Relative bearing of the transmitting station is indicated on the bearing indicator dial.

CAUTION

Two such minimum signals, 180 degrees apart, will be found. If the general location of the transmitting station is unknown, it may be determined by flying on the indicated bearing. If the signals get stronger, the course is toward the station. If the signals become weaker, the true course to the station is the reciprocal of that indicated. In the latter case, the loop can be rotated 180 degrees so that the indicated bearing is toward the station instead of away from it.

8–29. TESTING. To test the LF range receiver, place the set in operation as indicated in paragraph 8–28. With the antenna selector switch in the "ANT" position, check operation of the receiver over the entire frequency range. With the antenna selector switch in the "LOOP" position, check reception of two minimum signals 180 degrees apart. If the receiver fails to operate properly, refer to paragraph 8–10.

8–30. INTERCOMMUNICATION.

8–31. DESCRIPTION. *(See figure 8–3.)* Intercommunication between pilot, observer and hoist operator is provided through the sidetone circuits of the two VHF command set transmitters. The transmitter used during intercommunication depends upon which channel the "TRANS" channel selector switch on the "VHF COMM" control panel (2, figure 8–3) is set for. Channels 11 through 17 are inoperative in this installation as their use requires inclusion of a third transmitter in the VHF command set installation. When the pilot's and observer's microphone switches are in the "ICS" position, the circuit to the solenoid of the transmitter crystal relay for the channel in use is open so that only the transmitter sidetone circuit is energized and not the radio frequency generating circuit. When any microphone switch is closed in any operation position, the sidetone relay disconnects all headset circuits from both the VHF command set receiver and the LF range receiver and connects them to the sidetone circuit of both VHF command set transmitters. Since all components of the intercommunication system are integral parts of the VHF command set, refer to paragraph 8–11 for information relative to trouble shooting, removal, installation, adjustment and testing.

SECTION IX

ARMAMENT AND PHOTOGRAPHIC

Not Applicable

SECTION X

WIRING DATA

TABLE OF CONTENTS

Paragraph		Page
10—1.	INTRODUCTION	403
10—3.	WIRE IDENTIFICATION CODE	403
10—5.	WIRE IDENTIFICATION DIAGRAM	403
10—6.	ALUMINUM WIRE AND TERMINALS	404
10—8.	ELECTRICAL SYMBOLS CHART	405
10—10.	EQUIPMENT LIST	405
10—12.	INDEX OF WIRING DIAGRAMS	411

10—1. INTRODUCTION.

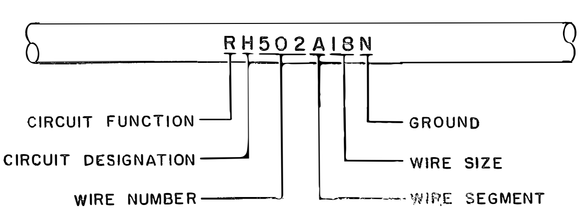
10—2. All electrical and radio circuits in the model H-34A helicopter are illustrated in this section of the handbook in the form of detail wiring diagrams. Each detail wiring diagram is complete and shows all wires, terminal strips and items of equipment used in the circuit. All wires on the detail wiring diagrams are identified exactly as they appear in the helicopter. An explanation of the wire identification code will be found in paragraph 10—3. Terminal strips containing more than one post, or segments of these terminal strips, are indexed to a terminal strip diagram by a number within a triangle. This number corresponds to the number shown on the terminal strip diagram. An index number within a circle is placed beside each item of equipment including any terminal strip containing only one post. This number corresponds to the item number in the equipment list in paragraph 10—10. On any detail wiring diagram on which a segment of a disconnect plug and receptacle is shown, a number within a diamond is placed beside the plug and receptacle. This number corresponds to a number on the plug and receptacle chart where the complete plug and receptacle, with associated wiring, is illustrated. On the detail wiring diagrams all referenced wires or items of equipment, indicated by broken lines, are cross-referenced to the figure number of the diagram on which they appear.

In addition to the detail wiring diagrams, terminal strip diagrams and plug and receptacle chart, this section contains an electrical symbols chart which explains all electrical symbols used on the wiring diagrams, an electrical circuit breaker diagram and electrical system schematic diagrams which show each circuit from a main bus bar. Each diagram and chart is listed in the index of wiring diagrams in paragraph 10—12.

10—3. WIRE IDENTIFICATION CODE.

10—4. DESCRIPTION. All wires in the helicopter are identified in accordance with Specification AN-W-14. The identifying symbols are composed of a series of letters and numbers derived as shown in the wire identification diagram in paragraph 10—5. Each circuit designation letter is explained in the list of circuits in paragraph 10—5. All wiring in the helicopter is copper, Specification MIL-W-5086, unless indicated otherwise on the individual wiring diagrams.

10—5. WIRE IDENTIFICATION DIAGRAM.



Circuit Letter	*Circuits*
C	Control Surfaces
D	Instruments – Other than Flight and Engine
E	Engine Circuits
F	Flight Instruments
H	Heating, Ventilating, and De-Icing
J	Ignition
K	Engine Controls
L	Lighting
M	Miscellaneous
N	Ground Network (Used at end of wire number)
P	DC Power
Q	Fuel and Oil
RC	Command Set – Radio
W	Warning and Emergency
X	AC Inverter Circuits
XP	Inverter DC Power or Control
XW	Inverter Warning Circuits

10–6. ALUMINUM WIRE AND TERMINALS.

10–7. DESCRIPTION. Aluminum wire is used in the helicopter (table XXXVI) in place of copper wire in the heavier cable installations because of the weight advantage of aluminum. Due to the softness of the metal, its tendency to creep and to form an electrically resistant oxide film, special installation procedures are necessary. It is imperative that the recommended techniques and installation instructions be followed when replacing an aluminum wire since failure to do so will result in overheating and eventual breakdown of the circuit. The proper size aluminum terminal must be used for the wire size, the terminal must be installed in the approved manner, and it must be staked to the correct depth with the approved special staking tool, MS25020-1, which has a specially designed indentor for aluminum terminals. Three types of terminals are approved for use with aluminum wire: straight, flag type, or right angle. The approved splice is used for wire connections. The wire must be stripped to a length of no more than 1/32 longer than the depth of the terminal or splice barrel. The wire must not be nicked by the knife when the insulation is removed. To compensate for creep, flat washers of the approved outside diameter must be used with aluminum terminals to distribute the clamping pressure. Lock washers must never be placed directly against the tongue or pad of an aluminum terminal. Do not place a washer between the terminal and the bus bar or structure to which the terminal is connected, except when the bus bar or equipment pad does not provide a pad of sufficient diameter. Do not stack more than two aluminum

TABLE XXXVI
ALUMINUM WIRE INSTALLATION

WIRE NO.	SIZE	LENGTH	TERMINAL		TERMINAL		FIG. NO.
			LOCATION	TYPE	LOCATION	TYPE	
P13A2	AL2	305	Overhead Control Panel, Pri. Bus	YAV2CA-L2	Jct. Box #1 Rev. Current Cut-out	YAV2CA-L	10–32
P14A2	AL2	290	Overhead Control Panel, Sec. Bus	YAV2CA-L2	Jct. Box #1, Sec. Bus Relay	YAV2CA-L	10–32
1P15A2	AL2	250	XMSN. Generator	YAV2CA-L	Jct. Box #1, Rev. Current Cut-Out	YAV2CA-L	10–32
2P15A2	AL2	250	XMSN. Generator	YAV2CA-L	Jct. Box #1, Rev. Current Cut-Out	YAV2CA-L	10–32
1P16A2	AL2	15	XMSN. Generator	YAV2CA-L	XMSN. Shunt	YAV2CA-L	10–32
2P16A2	AL2	15	XMSN. Generator	YAV2CA-L	XMSN. Shunt	YAV2CA-L	10–32
K70A0	AL0	300	Terminal Post at Slanted Fire Wall	YBM25A-L2	Jct. Box #1 Starter Relay	YBM25A-L	10–17
K70B0	AL0	125	Terminal Post at Slanted Fire Wall	YBM25A-L2	Terminal Post at Eng. Compt. Break	XBM25A-L2	10–17

terminals on a single stud and never place a washer between the terminals. When installing terminals on a stud, do not tighten beyond the proper tightening torque.

10—8. ELECTRICAL SYMBOLS CHART.

10—9. All electrical symbols used on the wiring diagrams are illustrated and identified in figure 10—1.

10—10. EQUIPMENT LIST.

10—11. The equipment list identifies all items of equipment shown on the detail wiring diagrams.

Item No.	*Nomenclature*	*Type*	*Part No. or Spec.*
1.	Light Assembly (No. 1495 Lamps)		A-6100-C
2.	Switch		AL58D1113A1
3.	Receptacle		AN2552-3A
4.	Switch		AN3021-1
5.	Switch		MS25016-4
6.	Switch		AN3021-7
7.	Switch		AN3021-8
8.	Cut-Out, Reverse Current		AN3025-1
9.	Switch (Inverter, Heater, Cargo Sling)		AN3027-1
10.	Switch		AN3027-3
11.	Switch, Generator (AN3228-1 Guard)		AN3027-8
12.	Light (AN3121-313 Lamp)		AN3030-5A
13.	Light (AN3121-313 Lamp)		AN3030-7A
14.	Light (AN3121-313 Lamp)		AN3030-8A
15.	Light (AN3122-1524 Lamp)		AN3033-7
16.	Light (AN3122-1545 Lamp)		AN3033-8
17.	Light (AN3121-313 Lamp)	28-volt dc, 0.2 amp	AN3034-2
18.	Light (AN3121-313 Lamp)		AN3092-2
19.	Receptacle		AN3100A-14S-7P
20.	Receptacle		AN3102E-20-7S
21.	Plug		AN3106A-14S-7P
22.	Plug		AN3106A-14S-7S
23.	Plug		AN3106A-18-22S
24.	Plug		AN3106E-10S-2S
25.	Plug		AN3106E-10SL-3S
26.	Plug		AN3106E-10SL-4S
27.	Plug		AN3106E-12-3S
28.	Plug		AN3106E-12S-4S
29.	Plug		AN3106E-14S-2S
30.	Plug		AN3106E-14S-5P
31.	Plug		AN3106E-14S-7P
32.	Plug		AN3106E-14S-7S
33.	Plug		AN3106E-14S-9S

Item No.	*Nomenclature*	*Type*	*Part No. or Spec.*
34.	Plug		AN3106E-16-11S
35.	Plug		AN3106E-16S-4S
36.	Plug		AN3106E-16S-8S
37.	Plug		AN3106E-18-4S
38.	Plug		AN3106E-20-27S
39.	Plug		AN3106E-20-29S
40.	Plug		AN3108A-14S-7P
41.	Plug		AN3108E-8S-1S
42.	Plug		AN3108E-10SL-3S
43.	Plug		AN3108E-10SL-4S
44.	Plug		AN3108E-14S-2S
45.	Plug		AN3108E-14S-5S
46.	Plug		AN3108E-24-7S
47.	Plug		AN3115-1
48.	Plug		AN3116-2
49.	Light, (Part of AN5766-T4)	28-volt dc, 0.04 amp	AN3140-327
50.	Light (Part of Light Shields)	28-volt dc, 0.04 amp	AN3140-327
51.	Light (Part of MS25010-4 Light Assembly)	28-volt dc, 0.04 amp	AN3140-327
52.	Light, Cargo Flood	28-volt dc, 50 watt	AN3144-4502
53.	Battery	24-volt dc, 36-amp hr	AN3150-2
54.	Light (AN3121-313 Lamp)		AN3157-6
55.	Light (AN3124-307 Lamp)		AN3158-1A
56.	Light (An3124-307 Lamp)		AN3158-2A
57.	Shunt		AN3200-300
58.	Switch		AN3209-1
59.	Switch, Throttle Limit		AN3210-1
60.	Switch, Ignition		AN3212-1
61.	Switch		AN3226-1
62.	Micro-Switch, Fuel Selector		AN3234-3
63.	Relay, Generator Warning Light		AN3314-1
64.	Relay		AN3320-1
65.	Relay		AN3324-1
66.	Relay, Blower		AN3350-2
67.	Relay, Starter		AN3371-2
68.	Light, Dome		AN3400-4
69.	Terminal Block		AN3436-2-1
70.	Terminal Block		AN3436-2-2
71.	Terminal Block		AN3436-8-1

Item No.	*Nomenclature*	*Type*	*Part No. or Spec.*
72.	Inverter	115-volt ac, 250-volt-amp, 3 phase	AN3532-2
73.	Generator	30-volt, 200 amp	AN3632-1
74.	Relay (Battery, Ext. Power, Bus Tie)		AN3370-2
75.	Starter		AN4116R3
76.	Vibrator		AN4181-1
77.	Bulb, Temperature		AN5525-1
78.	Bulb, Temperature		AN5546-1
79.	Tachometer-Generator		AN5547-2
80.	Tube, Pitot Heat		AN5813-1
81.	Plug		AN3106E-18-1S
82.	Switch		PA904-1
83.	Flasher		C-2
84.	Switch		C1006
85.	Switch, Starter		C1008
86.	Control Unit		2222-015-29
87.	Rheostat	25 watt, 60 ohm	CM14326
88.	Rheostat	25 watt, 60 ohm	CM14327
89.	Rheostat	25 watt, 60 ohm	CM14328
90.	Rheostat	50 watt, 35 ohm	CM14366
91.	Plug		AN3106E-14S-5S
92.	Switch		AN3027-2
93.	Regulator, Voltage		E1597
94.	Receptacle		FWOO-14S-7S
95.	Light, Landing	450 watt, 28-volt dc	G-6250-1
96.	Switch, 150° Thermal		18423-0
97.	Switch, 120° Thermal		18423-0
98.	Bulb, Temperature	G-1	MIL-B-7370
99.	Control, Gyro	S-3	MIL-C-6231A
100.	Indicator	V-7A	MIL-I-5126A
101.	Gyro, Vertical	J-8	MIL-I-5133A
102.	Light, Cabin	C-4A	MIL-L-6484A
103.	Relay, Overvoltage	E-2	MIL-R-6467
104.	Switch, 350° Thermal		18423-0
105.	Switch, Warning Lights		MS25016-4
106.	Circuit Breaker	5 amp	MS25017-5
107.	Circuit Breaker	10 amp	MS25017-10
108.	Circuit Breaker	15 amp	MS25017-15
109.	Circuit Breaker	20 amp	MS25017-20

Item No.	*Nomenclature*	*Type*	*Part No. or Spec.*
110.	Circuit Breaker	25 amp	MS25017-25
111.	Circuit Breaker	35 amp	MS25017-35
112.	Indicator, Temperature		MS28004-1
113.	Transmitter, Fuel Pressure		MS28005-1
114.	Transmitter (Transmission Oil Pressure, Engine Oil Pressure)		MS28005-3
115.	Transmitter, Pressure		MS28005-5
116.	Indicator, Temperature		MS28008-1
117.	Indicator, Temperature		MS28009-1
118.	Indicator, Fuel Pressure		MS28010-1
119.	Indicator (Transmission Oil Pressure, Engine Oil Pressure)		MS28010-3
120.	Indicator, Hydraulic Pressure		MS28010-5
121.	Indicator, Turn-and-Bank		MS28024-1
122.	Light (AN3140-327 Lamp)		MS25041-8
123.	Pump, Transfer		RG-11250
124.	Pump, Booster		RG-11260-2
125.	Pump, Clutch		RG-6100-G-1
126.	Resistor	15 watt, 20 ohm	RW20G200
127.	Resistor, Dimming	15 watt, 80 ohm	RW20G800
128.	Resistor	37 watt, 10 ohm	RW22G100
129.	Resistor	37 watt, 40 ohm	RW22G400
130.	Resistor	63 watt, 1.6 ohm	RW24G1R6
131.	Pump, Heater Fuel		3008A
132.	Valve, Shut-Off		S1565-61831
133.	Tank Unit, Forward Tank Forward Cell		S1630-62404
134.	Tank Unit, Forward Tank Aft Cell		S1630-62405
135.	Tank Unit, Center Tank Center Cell		S1630-62406
136.	Tank Unit, Aft Tank Center Cell		S1630-62407
137.	Brake, Magnetic		S1640-61195
138.	Switch (Part of Grip Assembly)	Normally Open	S1640-62103
139.	Terminal Block		S1655-61138-2
140.	Feed-Thru		S1655-61139
141.	Plug		UD-6-11
142.	Switch, Test		D202L5
143.	Switch, 285° Thermal		18422-0
144.	Hook, Cargo		WB-461
145.	Wiper, Windshield		XW20173-1
146.	Switch, Rotary		XW20336-1
147.	Blower		X702-169

Item No.	*Nomenclature*	*Type*	*Part No. or Spec.*
148.	Valve, Fuel Shut-Off		AV-18-1474-B
149.	Filter		10JX52
150.	Ignition		11C30
151.	Solenoid	20 — 28-volt dc	11445
152.	Receptacle		11749-1
153.	Plug		11751-1
154.	Indicator		162-0251-873
155.	Plug, Hi-Z		163-0511-1
156.	Plug, Lo-Z		163-0512-3
157.	Plug		163-0513-3
158.	Plug		163-0514-3
159.	Feed-Thru, Hi-Z		163-0531
160.	Feed-Thru, Lo-Z		163-0532
161.	Switch		169-08-A19
162.	Tee, Hi-Z		163-0551
163.	Tee, Lo-Z		163-0552
164.	Amplifier	A-2	21125A (MIL-A-6589)
165.	Control Unit, Level		2222-017-30
166.	Transmitter, Remote Compass	C-2	27635
167.	Detector, Fuel		305-02-2
168.	Alarm, Crew	J-3	32468
169.	Ammeter	J-1	32529A
170.	Relay	M-2	32603A
171.	Light		334
172.	Fuse	4AG SLO-BLO 1 amp	413001
173.	Switch, Light Control		446101
174.	Solenoid, Oil Dilution	N-7	5252N7
175.	Plug		54A3A225-16S-5P
176.	Switch, Transmission Low Oil Pressure		555-3540
177.	Switch, Pressure		555-3871
178.	Relay, Warning Light	115-volt ac, 400 cycle	636-172
179.	Relay, AC — DC Interlock		650-4034
180.	Autotransformer	115/26-volt ac, 50 volt-amp, 1 phase	70G175
181.	Indicator, Dual Tachometer		8DJ19GAE
182.	Cable Assembly		801950
183.	Cable Assembly		801951
184.	Element, Sensing		804048
185.	Element, Sensing		804120

Item No.	*Nomenclature*	*Type*	*Part No. or Spec.*
186.	Element, Sensing		804144
187.	Relay, Fire Detector		840505
188.	Plug, Pin		840648
189.	Receptacle		840649
190.	Relay, Warning Light Dimming	Type J 6PDT (6C Code 24)	860448
191.	Control Unit, Fire Detector		870729
192.	Receptacle		97-5107-18-22P
193.	Element, Sensing (Part of Item No. 133)		
194.	Magneto (Furnished with Engine)		
195.	Valve, Engine Primer Solenoid (Furnished with Engine)		
196.	Filter, Noise		131J52
197.	Plug		AN3108E-12S-3S
198.	Feed-Thru		163-0534
199.	Feed-Thru		163-0533
501.	Adapter		AN3057-12A
502.	Plug		AN3106A-20-27P
503.	Plug		AN3106E-22-14S
504.	Relay	SPDT	AN3314-1
505.	Plug, Wired		ARC11934
506.	Mounting (T-11B, T-13A)	M-11A	ARC12501
507.	Mounting (R-11A, R-19)	M-12A	ARC12502
508.	Plug		ARC14050
509.	Plug		ARC14051
510.	Plug		ARC14052
511.	Plug		ARC14320
512.	Plug		ARC16104
513.	Antenna, Loop	L-10A	ARC16160
514.	Panel, Control	C-48	ARC16410
515.	Antenna	A-15	ARC16630
516.	Panel, Control	C-49	ARC16640
517.	Receptacle		FW00-20-27S
518.	Receptacle		FW00-22-14P
519.	Head Set and Microphone		H-46/AIC
520.	Circuit Breaker	5 amp	MS25017-5

Item No.	*Nomenclature*	*Type*	*Part No. or Spec.*
521.	Receiver	R-19	R-508/ARC
522.	Receiver	R-11A	R-511/ARC
523.	Junction Box, Radio		S14-60-2341-3
524.	Transmitter	T-13A	T-363/ARC
525.	Transmitter	T-11B	T-366/ARC
526.	Phone Jack		U-61/U
527.	Phone Jack		U-82/U
528.	Plug		UG-88/U
529.	Tension Unit (Forward)		126-ATU-600 (MX1257/A)
530.	Insulator, Feed-Thru		126-LTI-600
531.	Insulator, Strain		126-SI-600 (1L-7/U)
532.	Tee Splice		126-TS-600 (U-67/U)
533.	Tension Unit (Aft)		126-TTU-600 (MX78VA)
534.	Switch, Control Stick (Part of Stick Grip)		Y-1000
535.	Relay		A-71284

10—12. INDEX OF WIRING DIAGRAMS.

10—13. All electrical and radio diagrams and charts used in this section of the handbook are listed alphabetically in this paragraph.

Title	*Figure No.*	*Page*
AC Electrical Schematic	10—48	483-484
AC Power	10—33	448
Alarm Bell, Crew	10—41	456
Booster Pump, Fuel	10—12	426
Cabin Heater	10—7	421
Carburetor Air Temperature Indicator	10—24	438
Cargo Floodlight	10—37	452
Cargo Sling	10—3	417
Circuit Breaker Diagrams — Electrical	10—45	470
Clutch Pump, Hydro-Mechanical	10—19	433
Console, Panel and Instrument Lights	10—39	454
Cylinder Head Temperature Indicator	10—25	439
DC Electrical Schematic	10—47	474
DC Power	10—32	446
Disconnect Plug and Receptacle Chart — Electrical	10—44	463
Dome Lights, Inspection Lights and Trouble Lights	10—38	453
Dual Tachometer Indicator	10—23	437
Electrical Symbols Chart	10—1	413
Engine Oil Inlet Temperature Indicator	10—27	441
Engine Oil Pressure Indicator	10—26	440
Engine Primer and Oil Dilution	10—11	425
Fire Detector	10—9	423
Formation Lights	10—35	450
Fuel Booster Pump	10—12	426
Fuel Low Level Warning	10—14	428
Fuel Low Pressure Warning, Fuel Transfer Pumps and	10—13	427
Fuel Overflow Safety Switch	10—10	424
Fuel Pressure Indicator	10—18	432

Title	Figure No.	Page
Fuel Quantity Indicator	10—15	429
Fuel Transfer Pumps and Fuel Low Pressure Warning	10—13	427
Gyro Compass — J-2	10—20	434
Gyro Horizon — J-8	10—21	435
Hydraulic Pressure Indicator, Primary and Auxiliary	10—6	420
Hydro-Mechanical Clutch Pump	10—19	433
Ignition	10—16	430
Inspection Lights and Trouble Lights, Dome Lights	10—38	453
Instrument Lights, Console, Panel and	10—39	454
Interphone (A.R.C. Type 12), VHF Command Set, LF Navigation Receiver and	10—46	471
Landing Light	10—36	451
LF Navigation Receiver and Interphone (A.R.C. Type 12), VHF Command Set	10—46	471
Low Level Warning, Fuel	10—14	428
Navigation Lights (Position and Fuselage)	10—34	449
Oil Dilution, Engine Primer and	10—11	425
Oil Inlet Temperature Indicator, Engine	10—27	441
Oil Pressure Indicator, Engine	10—26	440
Oil Pressure Indicator, Transmission	10—29	443
Oil Pressure Warning, Transmission	10—30	444
Overflow Safety Switch, Fuel	10—10	424
Panel and Instrument Lights, Console	10—39	454
Personnel Barrier, Electronics Compartment	10—2	416
Pitot Tube	10—31	445
Post Terminal Charts — Electrical	10—42	457
Post Terminal Charts — Radio	10—43	462
Servo, Primary and Auxiliary	10—5	419
Starter	10—17	431
Stick Trim	10—4	418
Transmission Oil Pressure Indicator	10—29	443
Transmission Oil Temperature Indicator	10—28	442
Trouble Lights, Dome Lights, Inspection Lights and	10—38	453
Turn-and-Bank Indicator	10—22	436
VHF Command Set, LF Navigation Receiver and Interphone (A.R.C. Type 12)	10—46	471
Warning Light Dimming Relay	10—40	455
Windshield Wiper	10—8	422

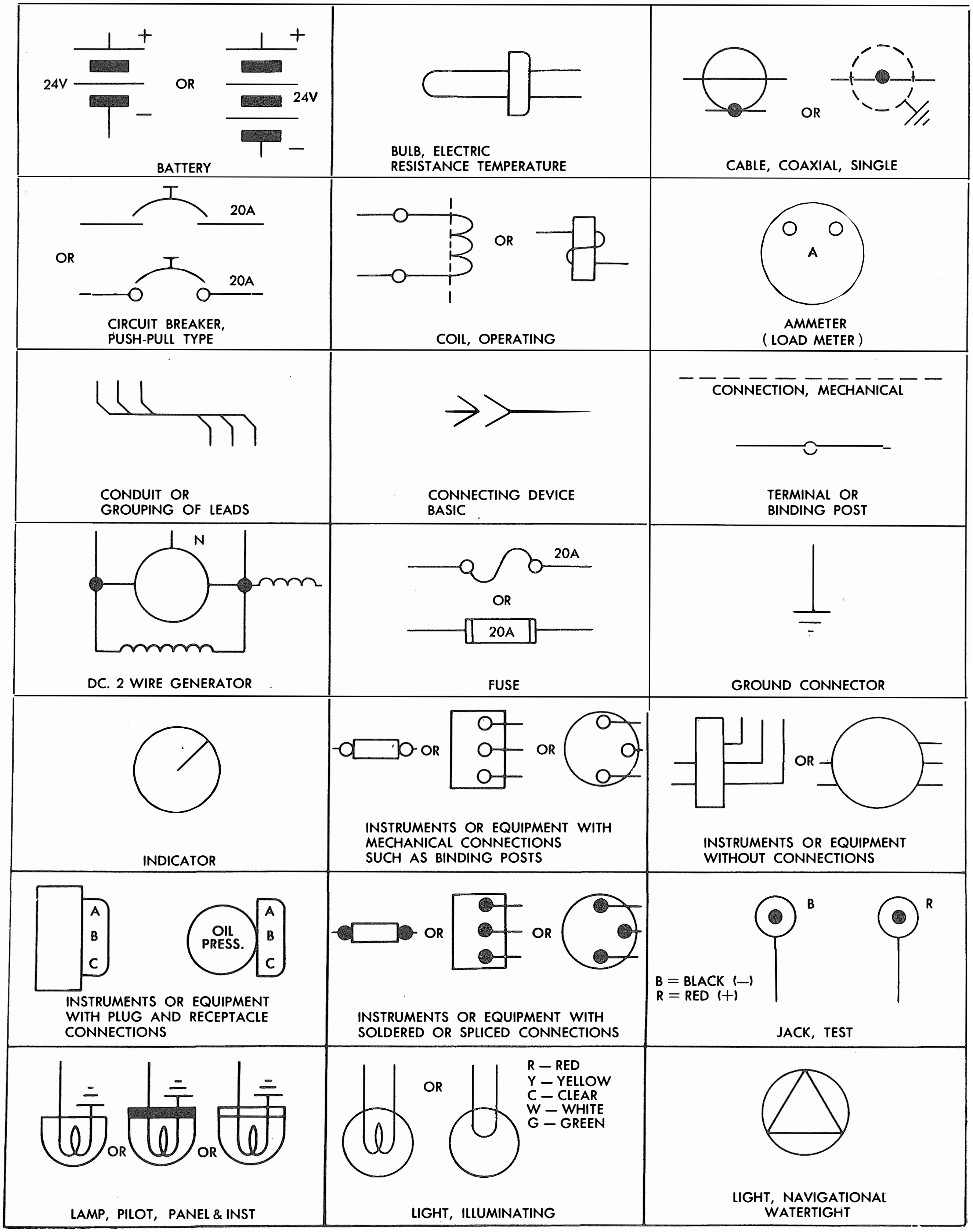


Figure 10—1. Electrical Symbols Chart (Sheet 1 of 3)

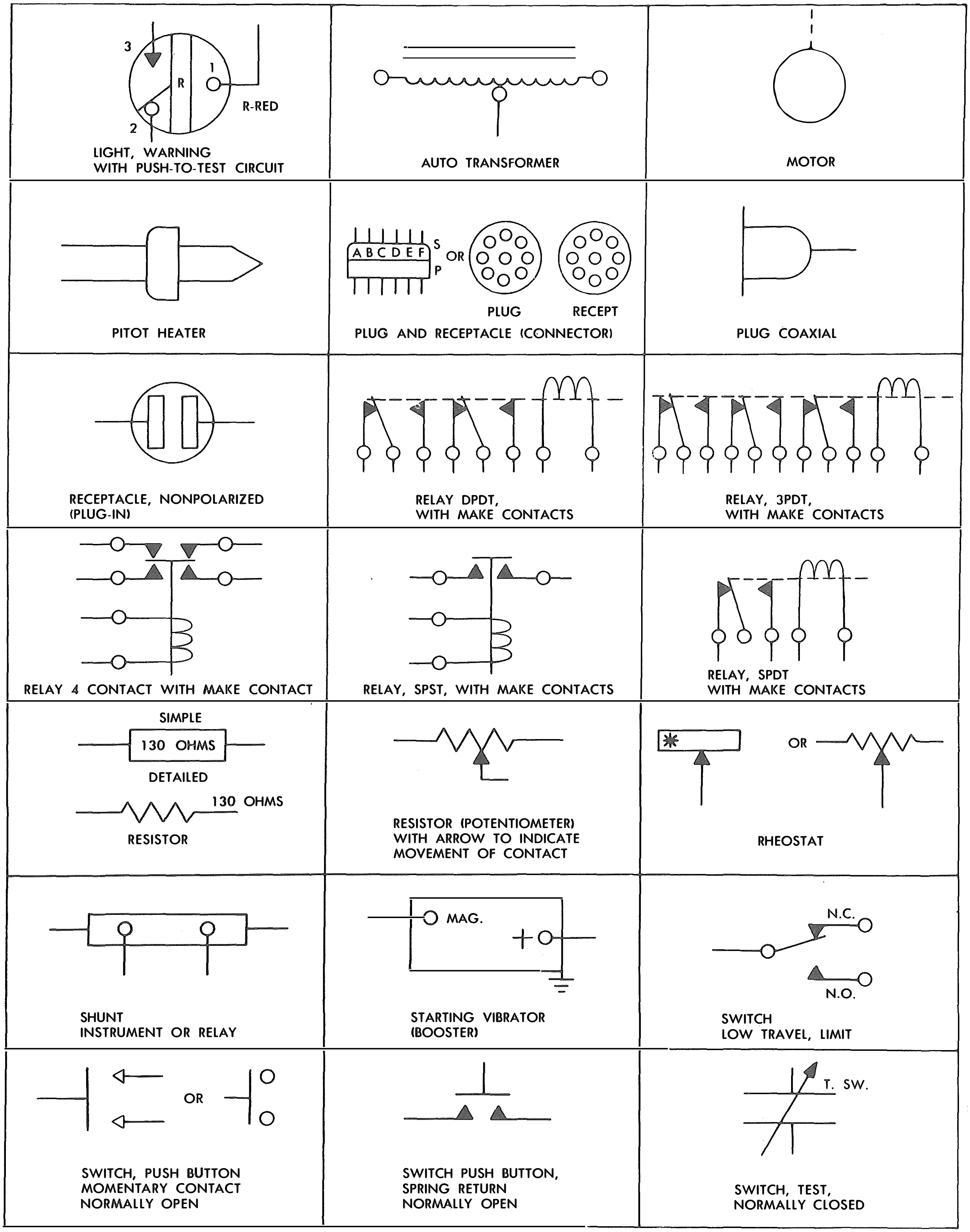


Figure 10—1. Electrical Symbols Chart (Sheet 2 of 3)

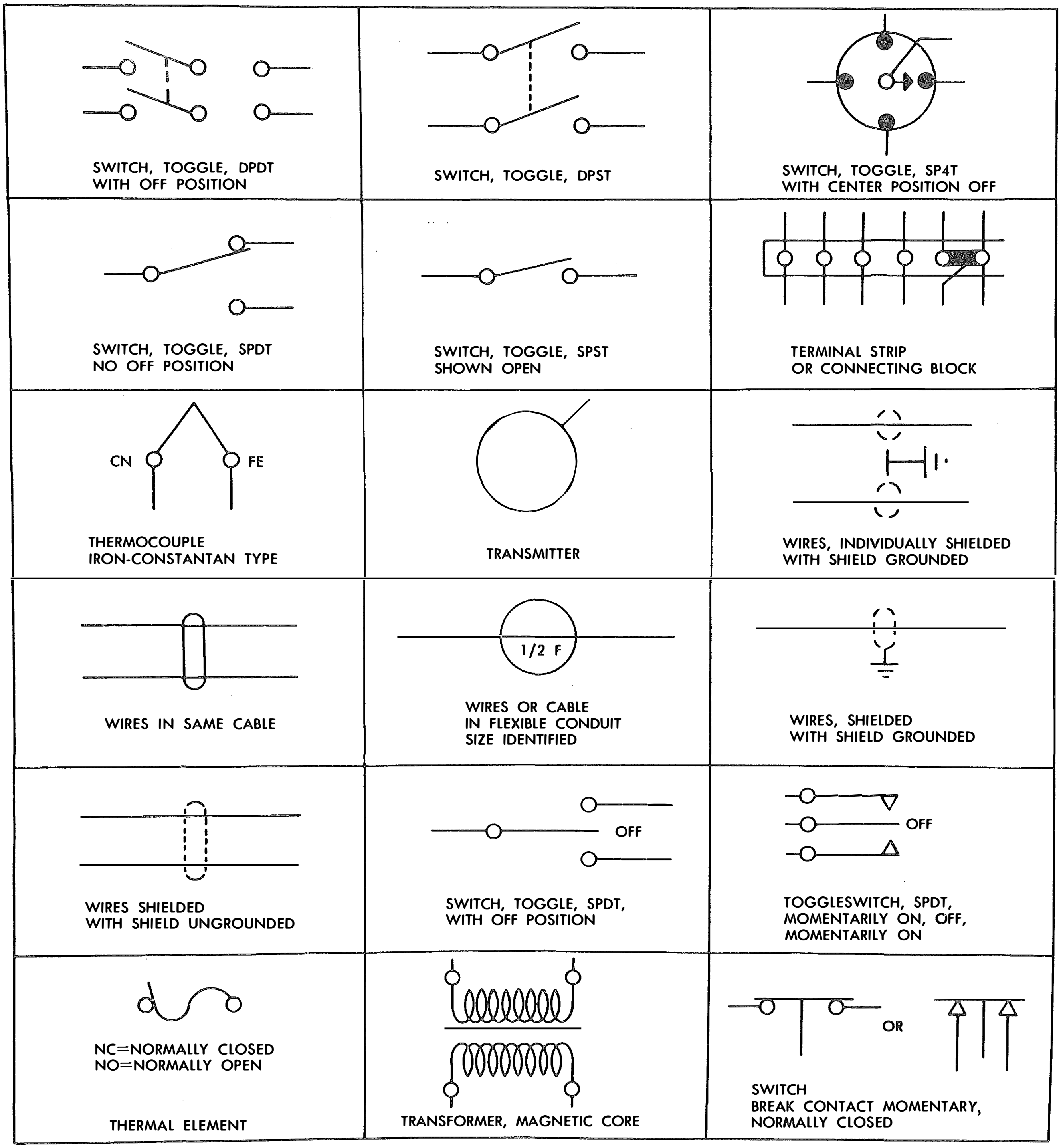


Figure 10—1. Electrical Symbols Chart (Sheet 3 of 3)

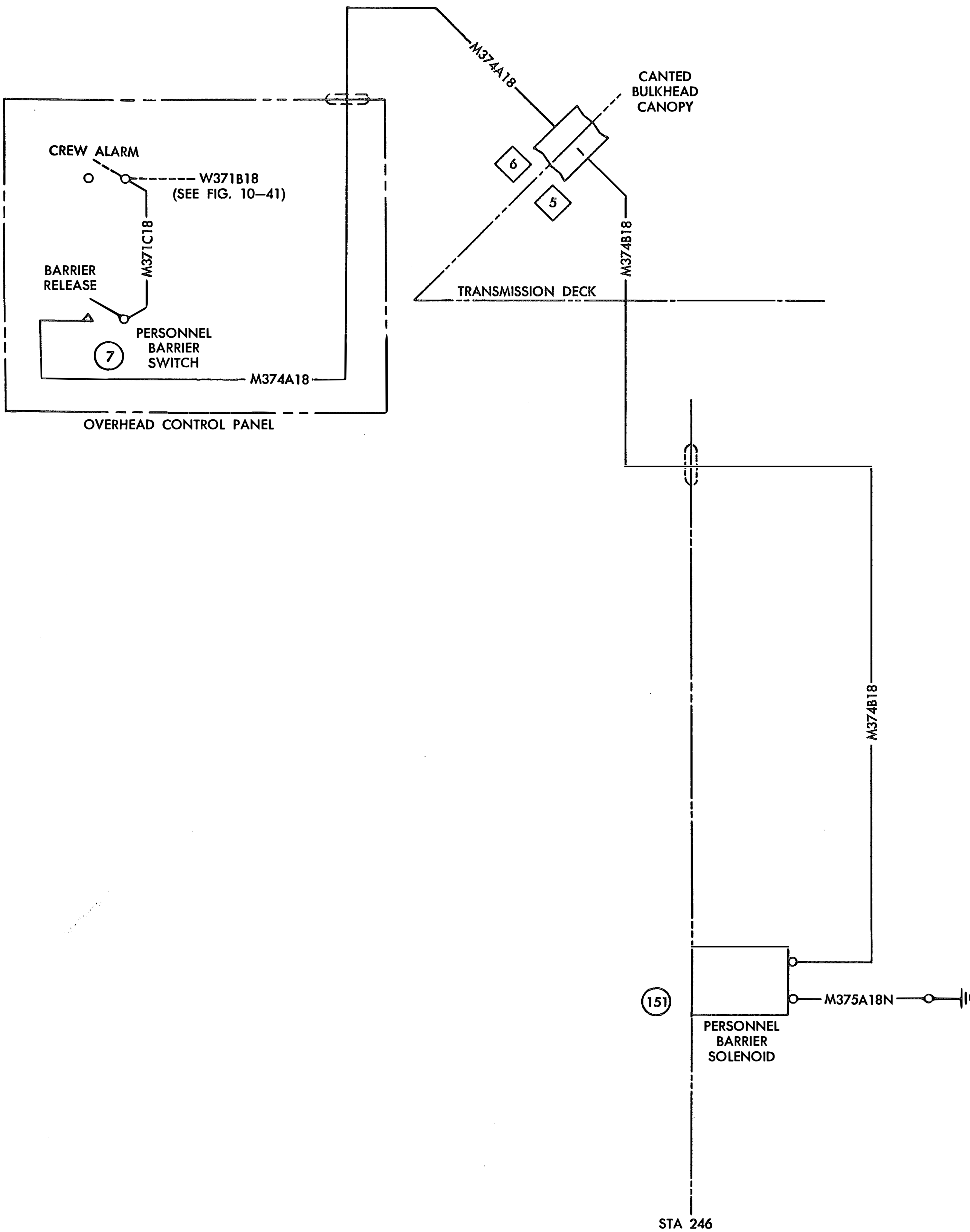


Figure 10—2. Electronics Compartment Personnel Barrier

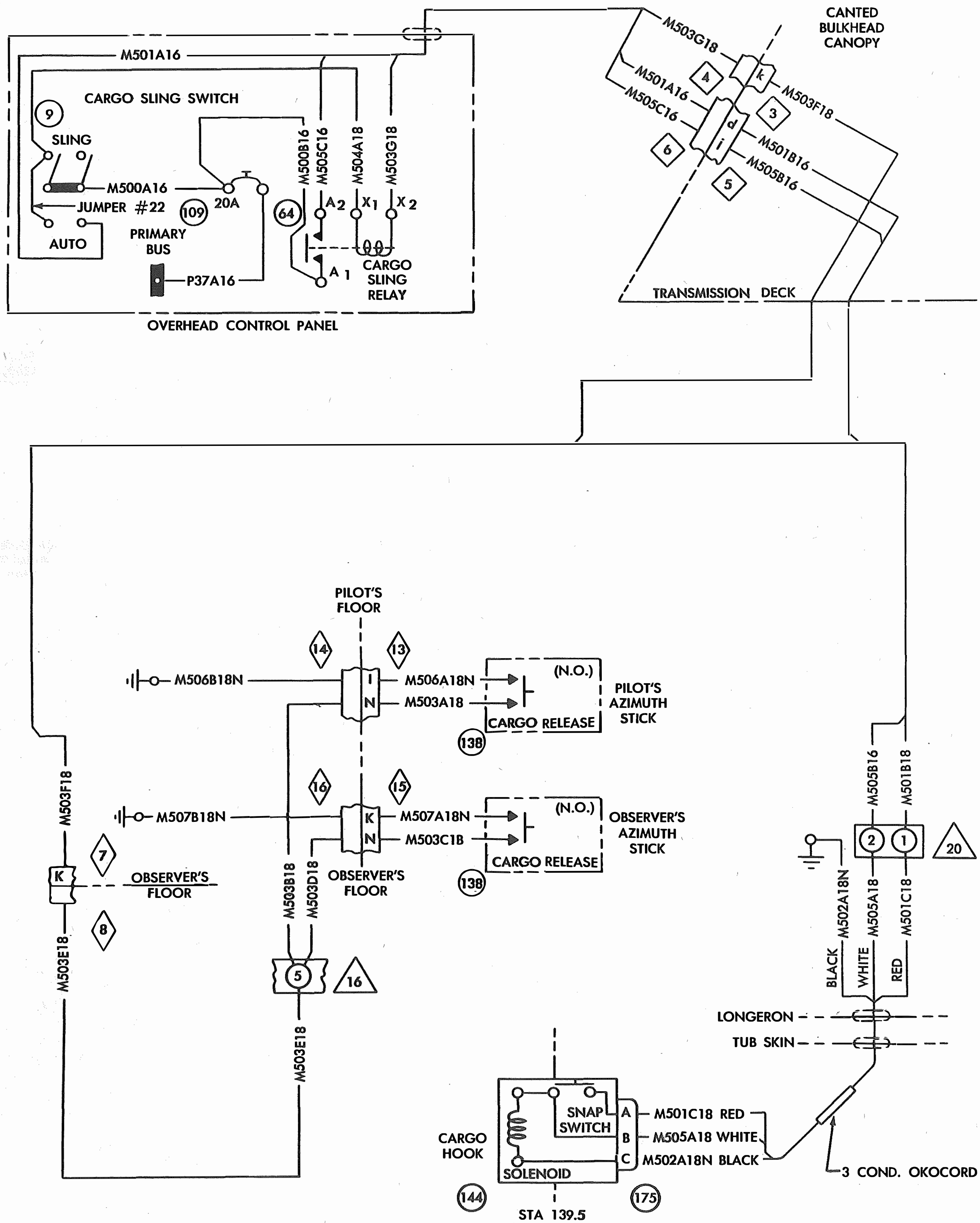


Figure 10–3. Cargo Sling

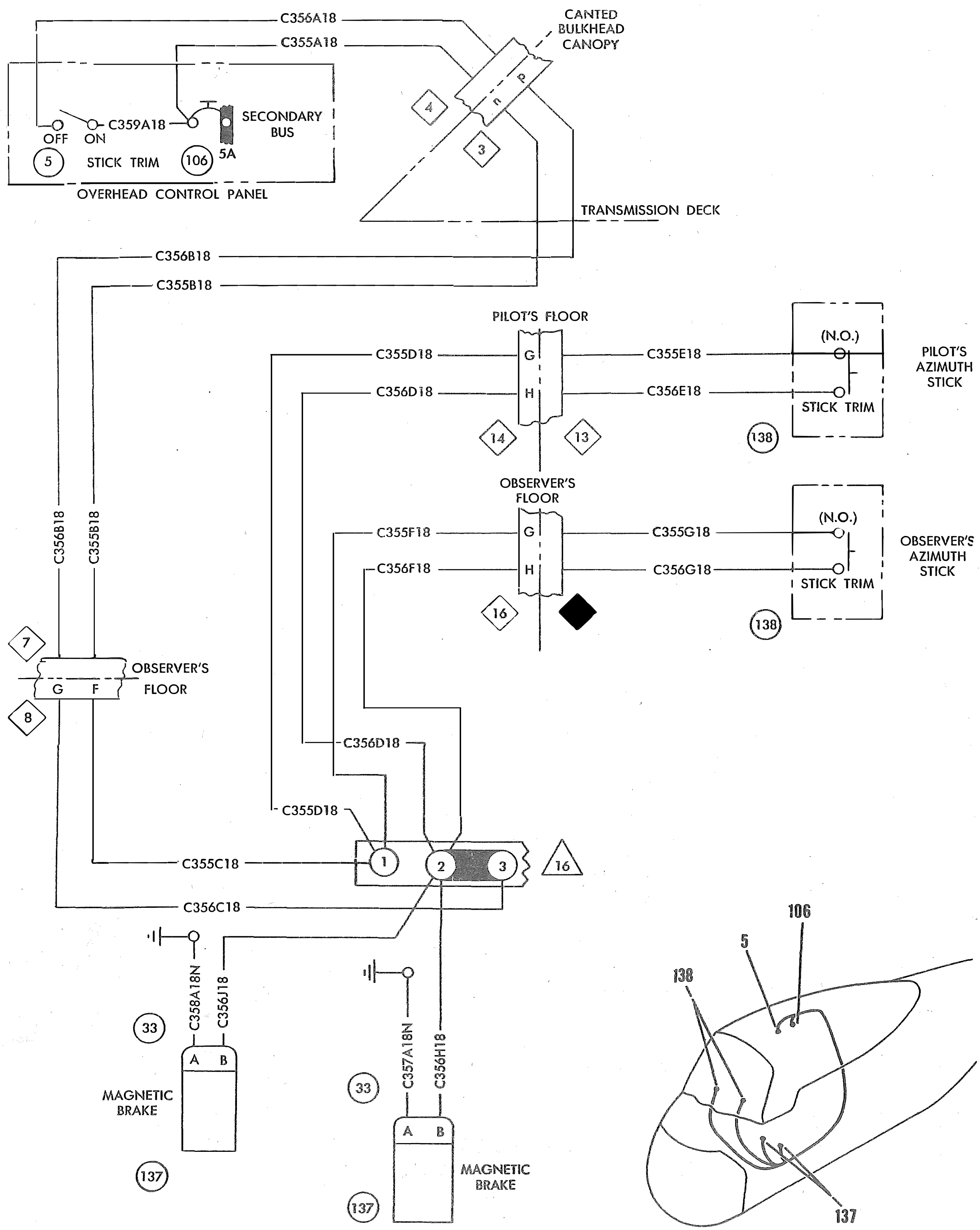


Figure 10—4. Stick Trim

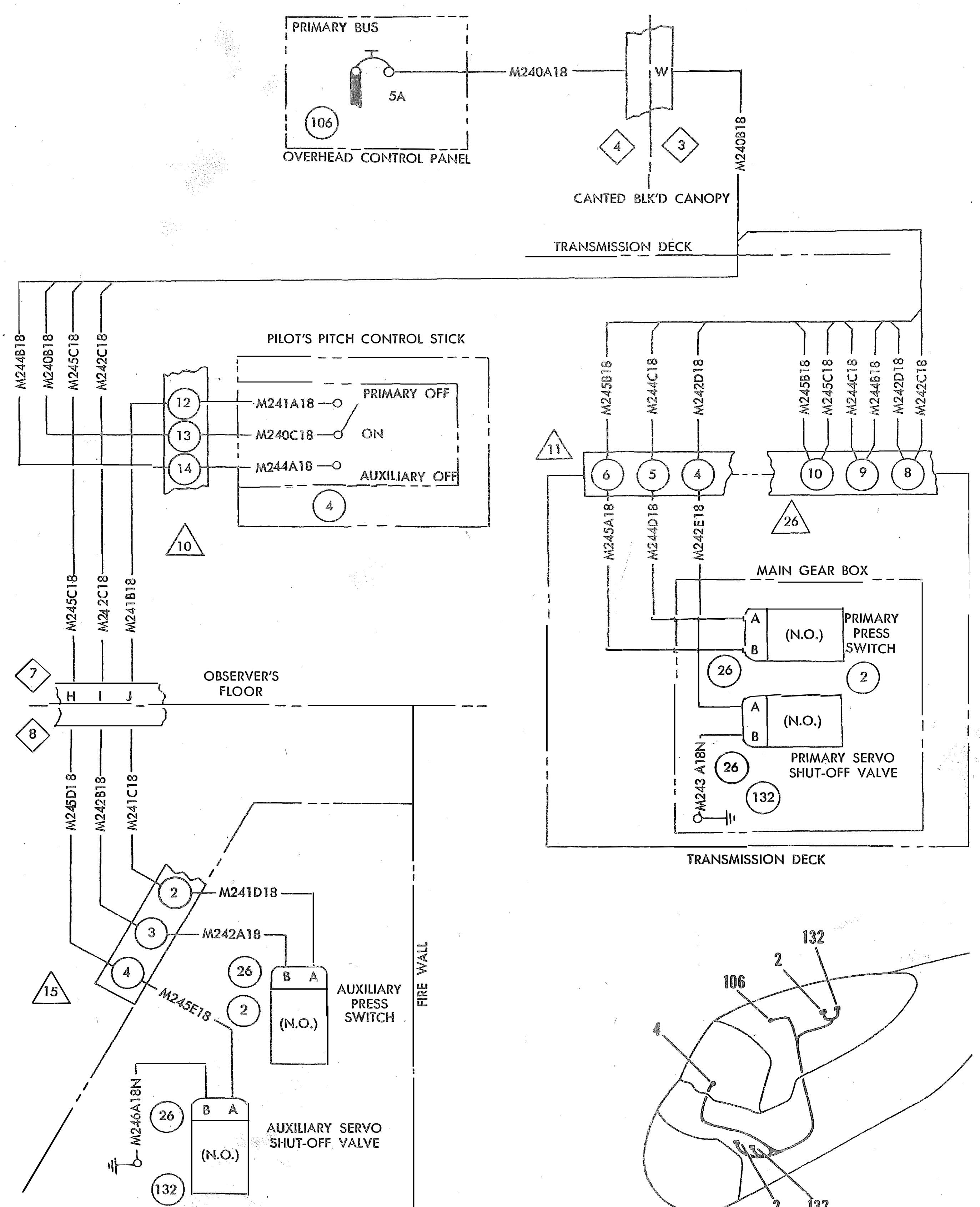


Figure 10–5. Primary and Auxiliary Servo

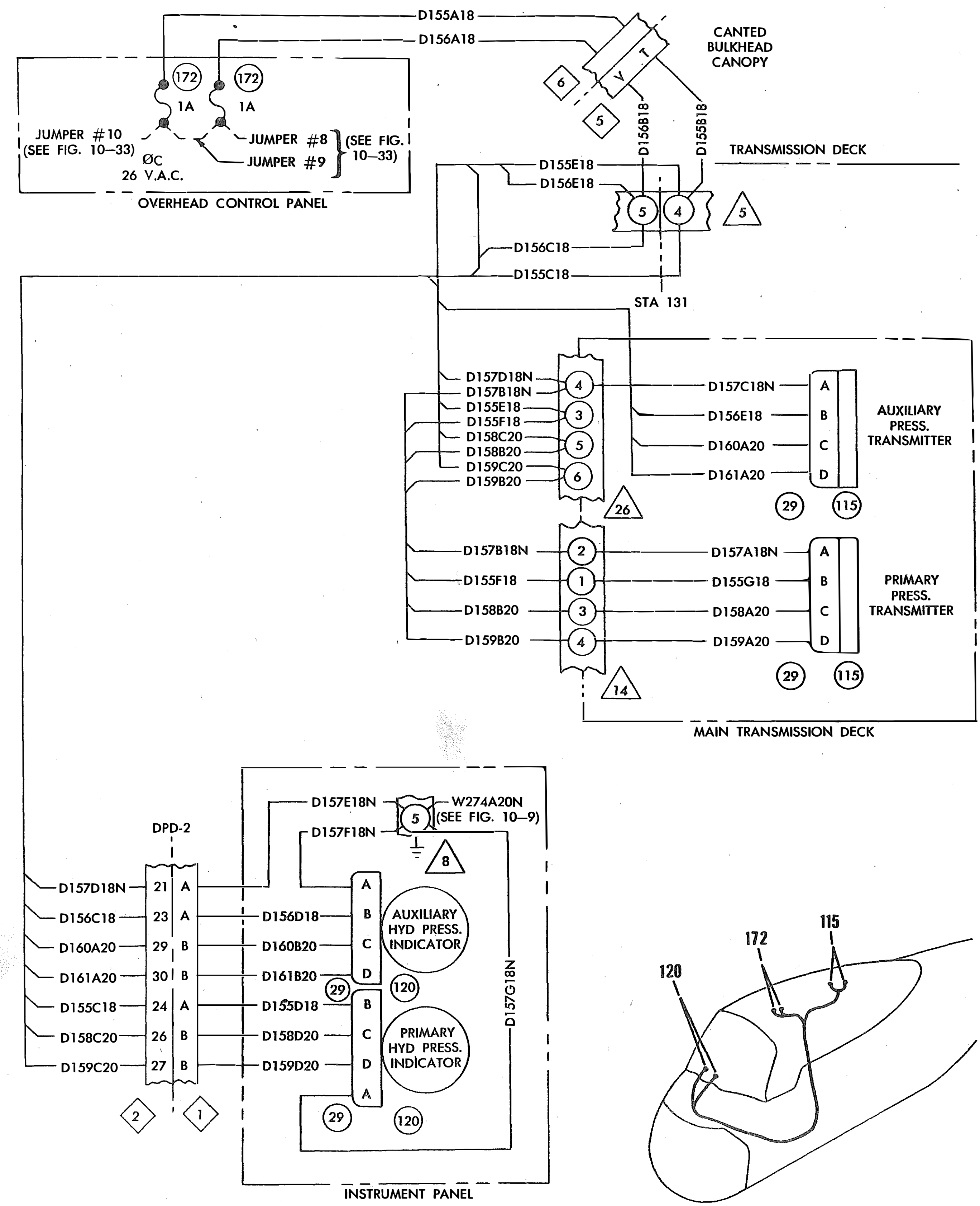
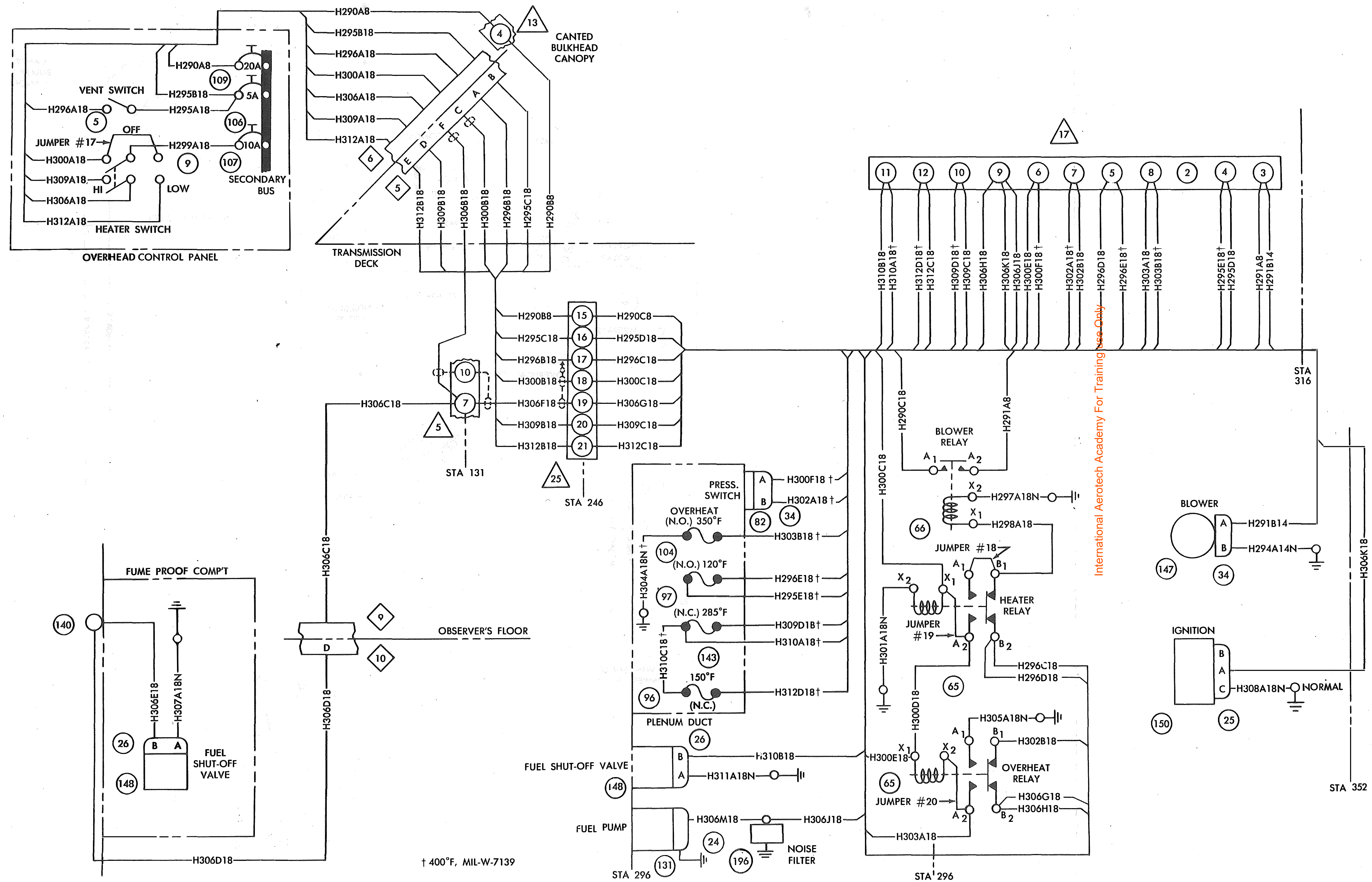
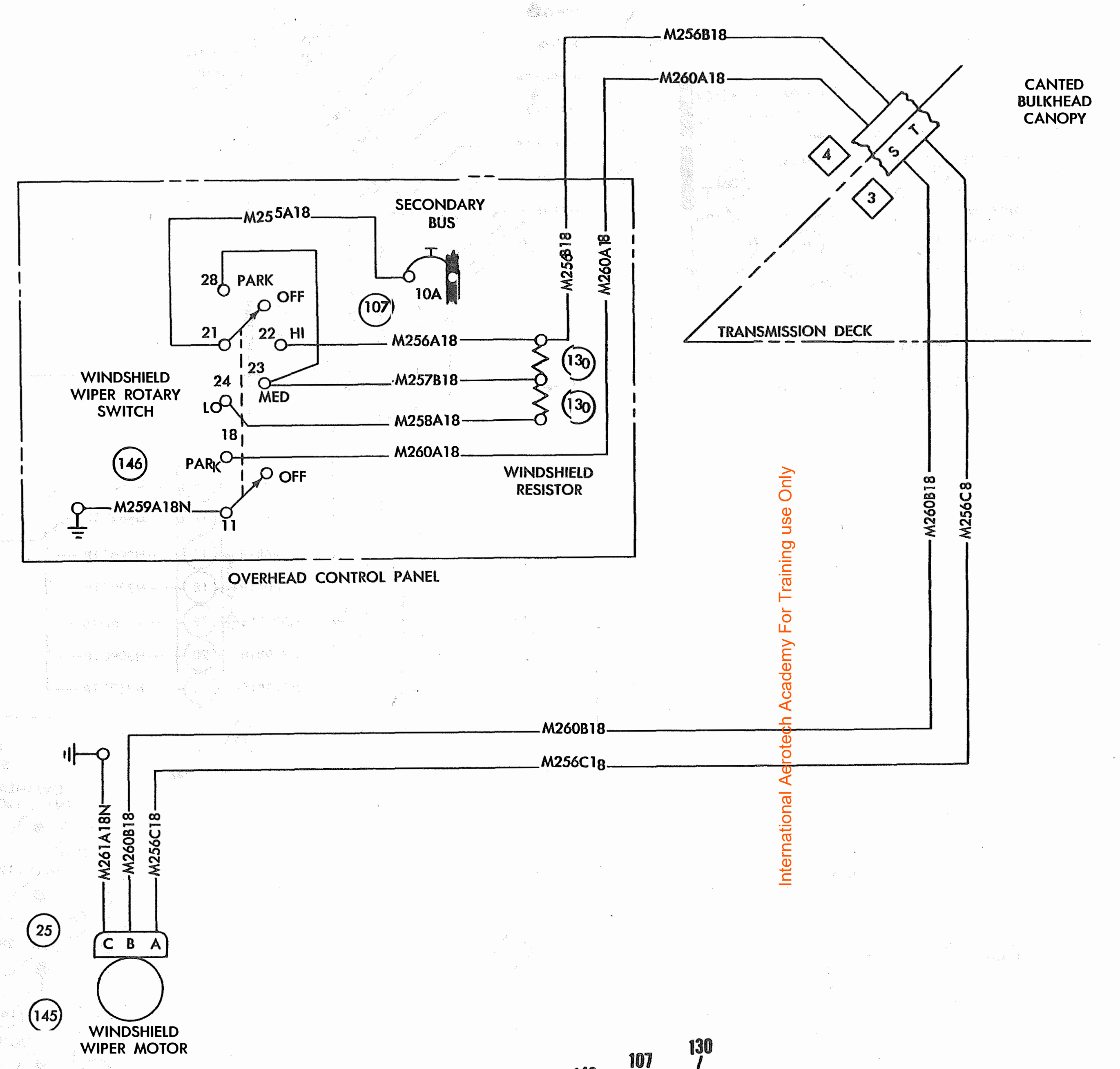


Figure 10–6. Primary and Auxiliary Hydraulic Pressure Indicator



† 400°F, MIL-W-7139

Figure 10—7. Cabin Heater



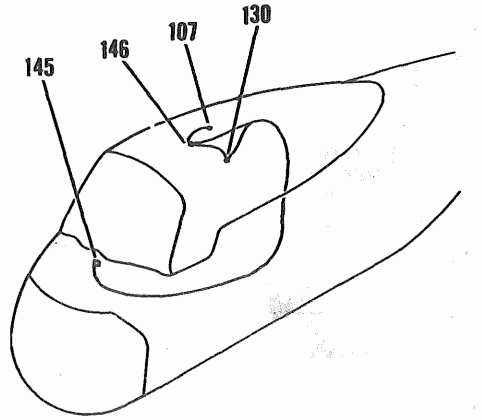


Figure 10—8. Windshield Wiper

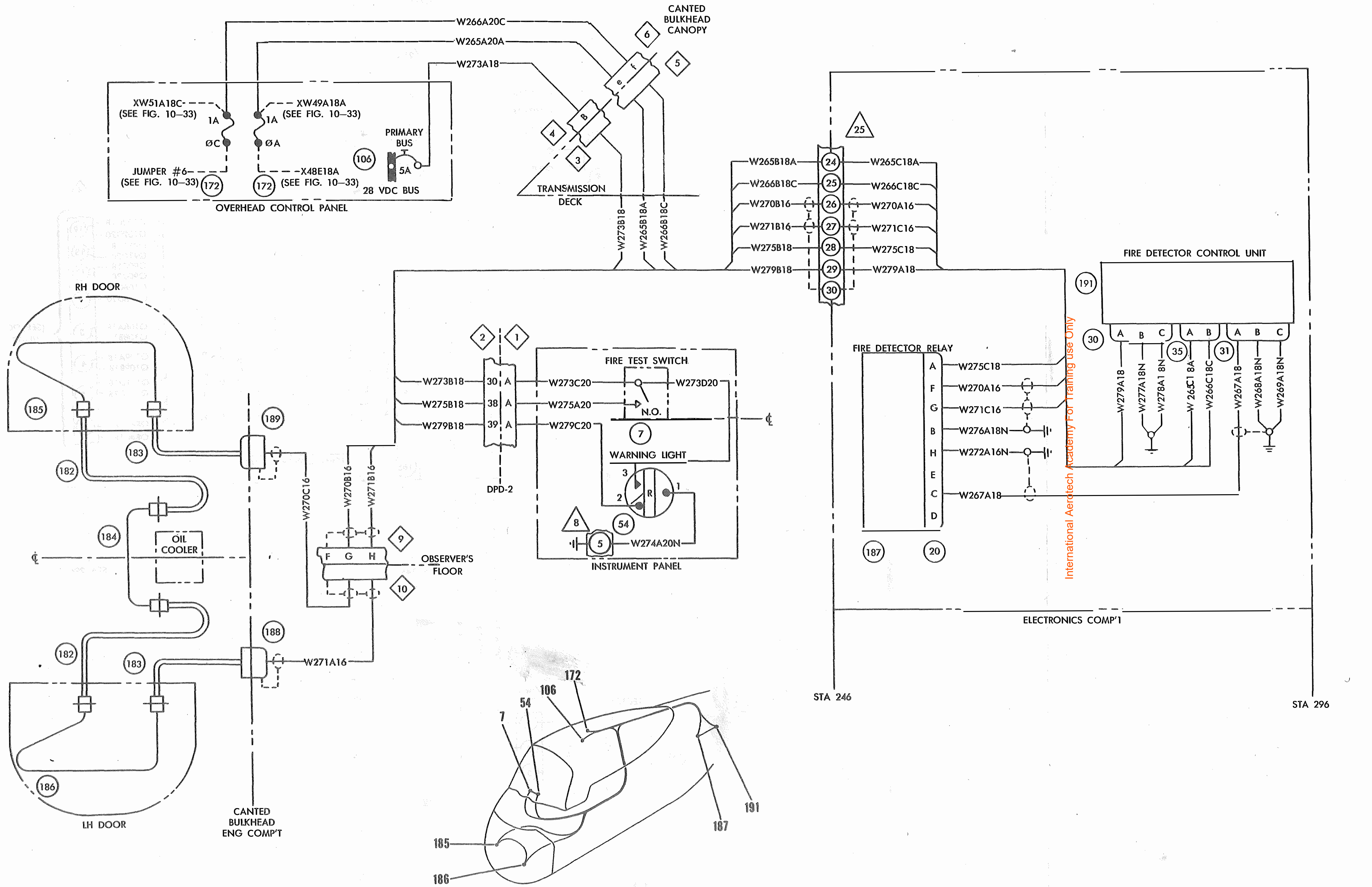


Figure 10–9. Fire Detector

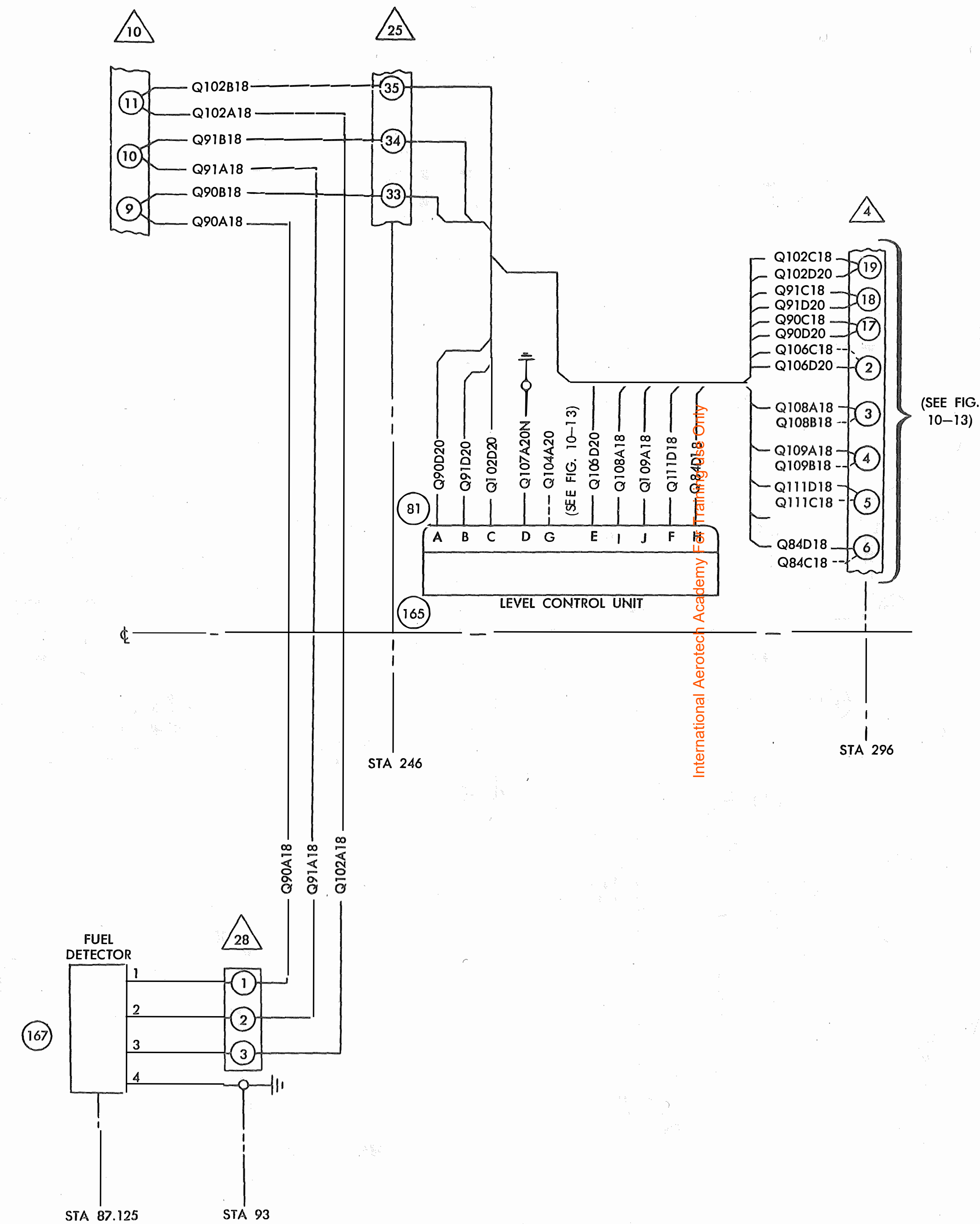


Figure 10–10. Fuel Overflow Safety Switch

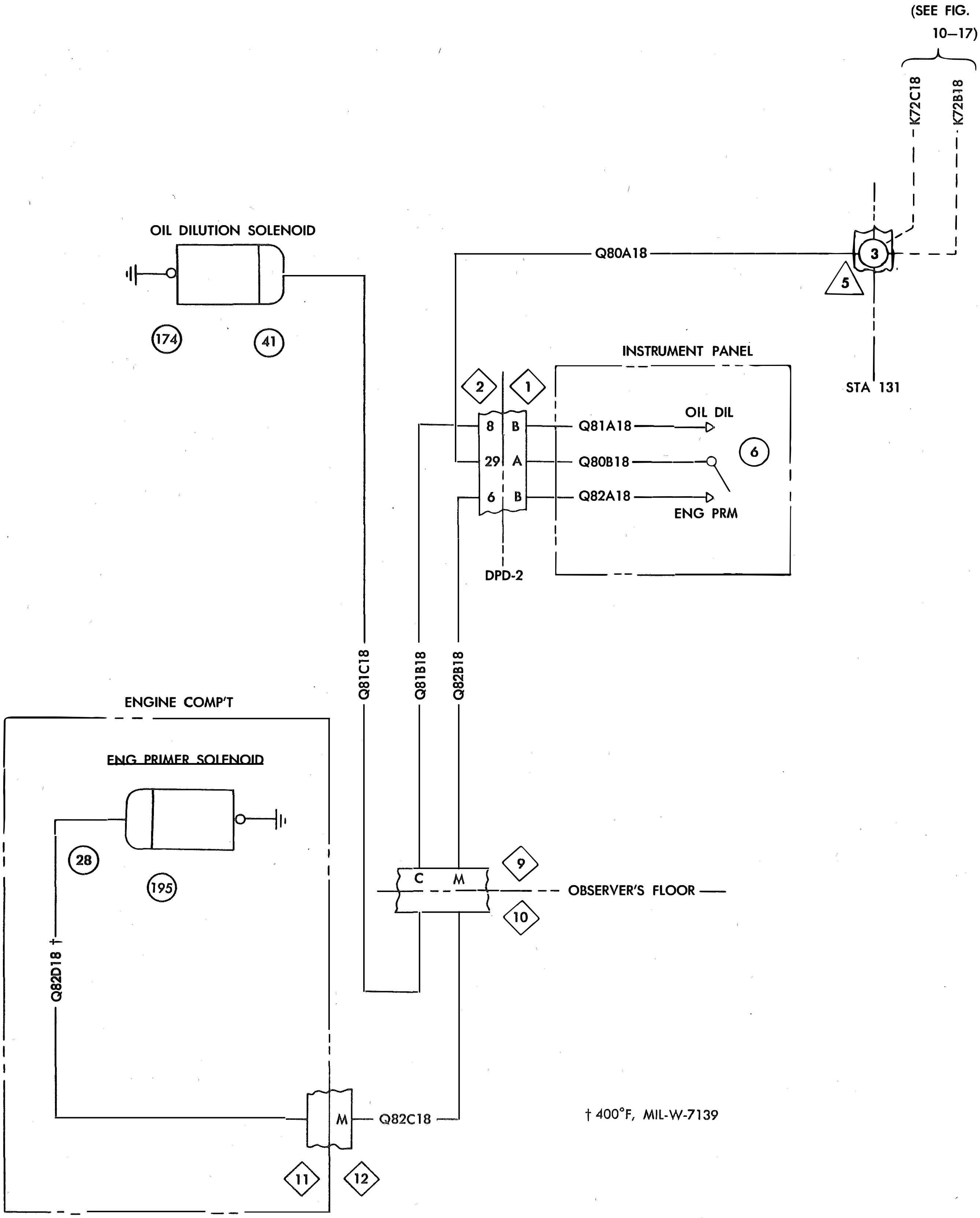


Figure 10–11. Engine Primer and Oil Dilution

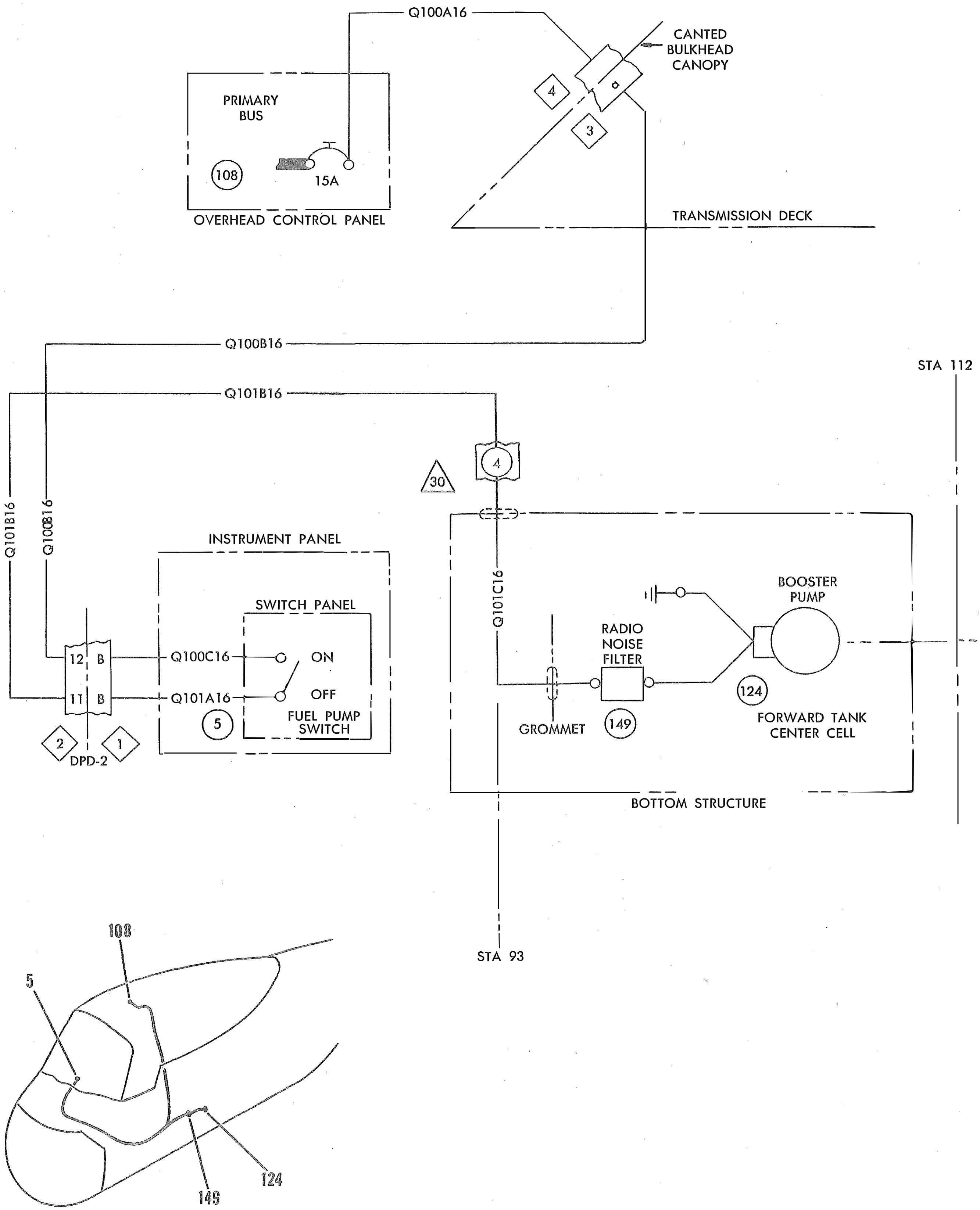


Figure 10—12. Fuel Booster Pump

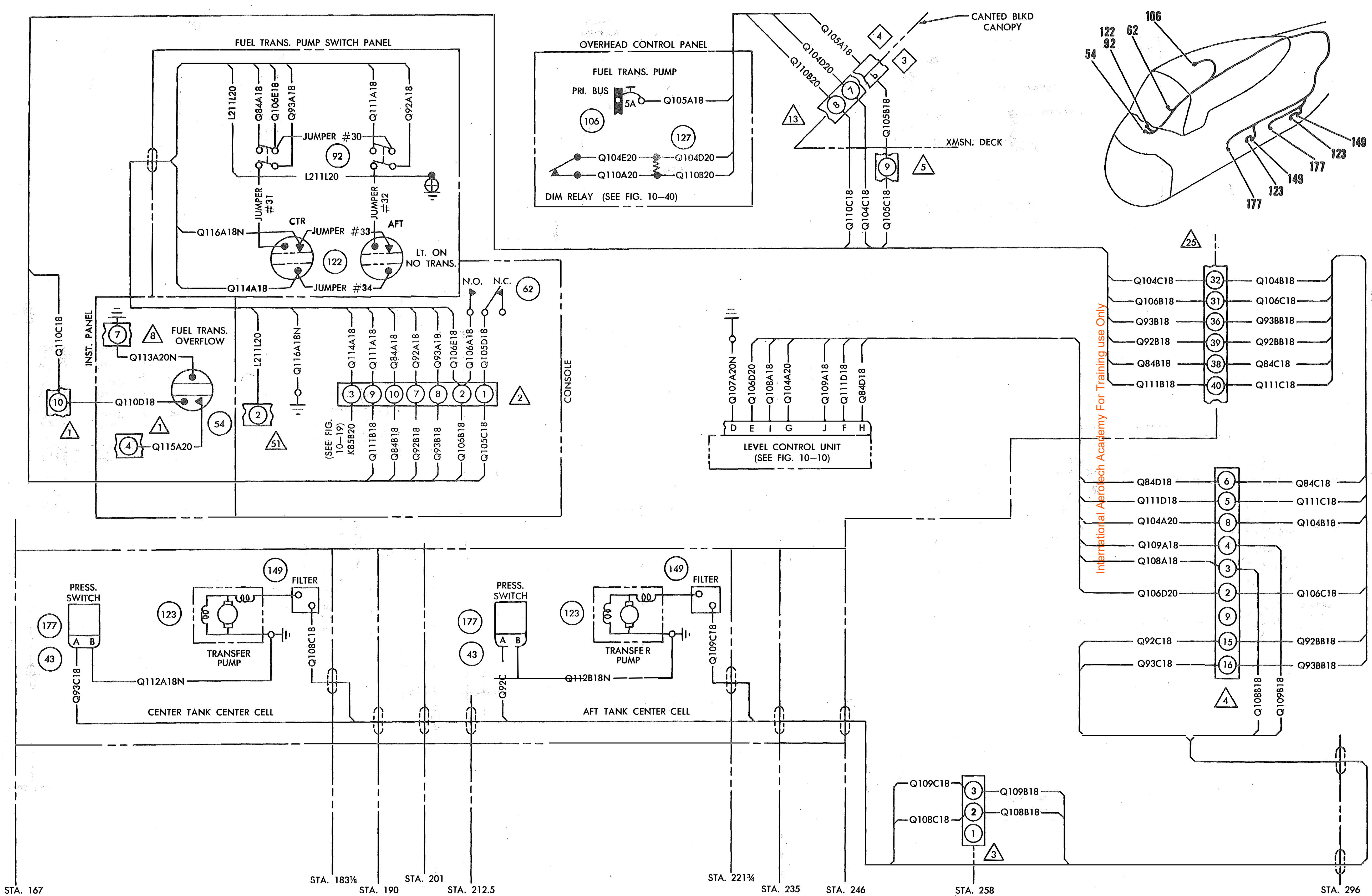


Figure 10—13. Fuel Transfer Pumps and Fuel Low Pressure Warning

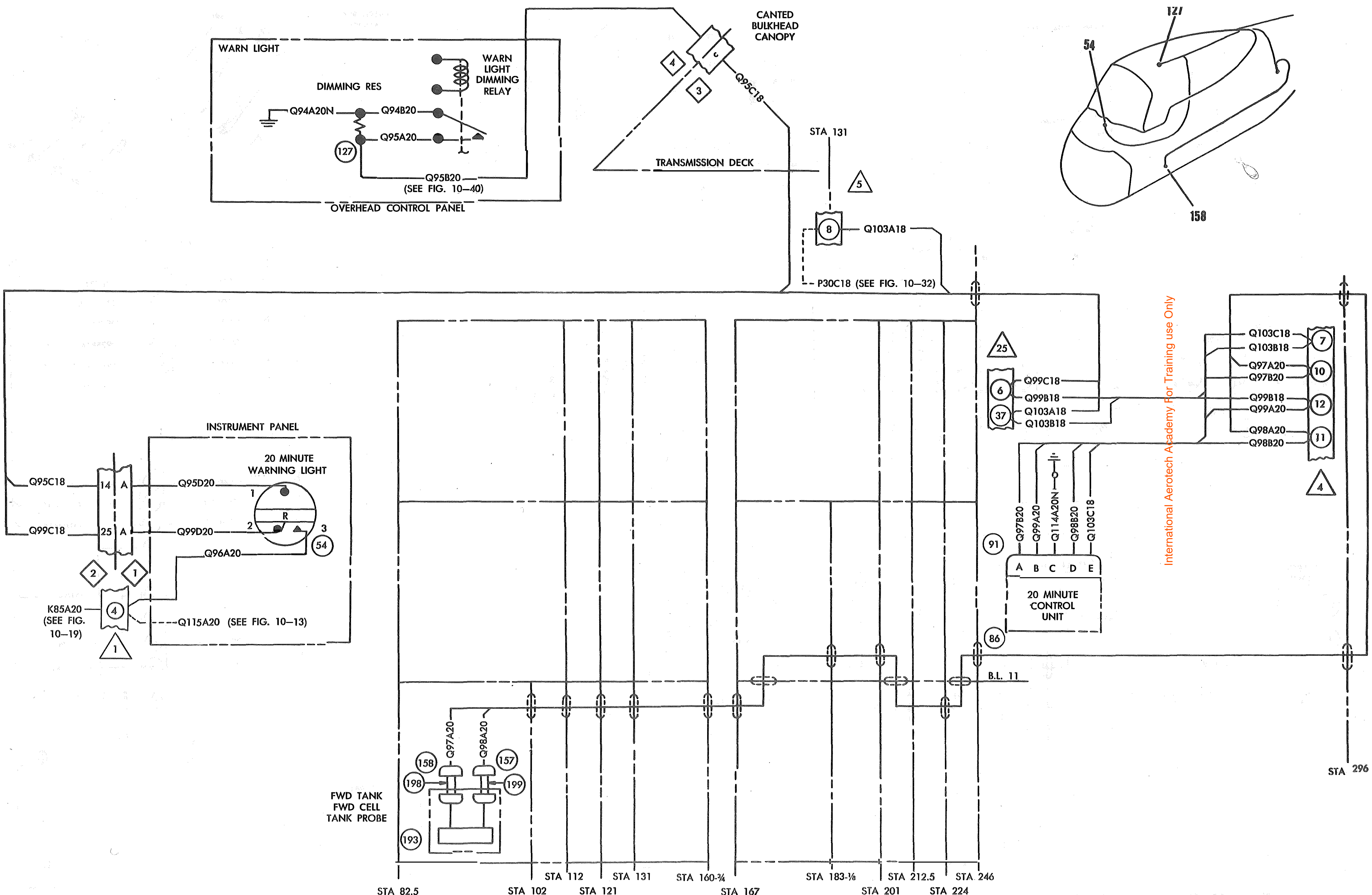


Figure 10—14. Fuel Low Level Warning

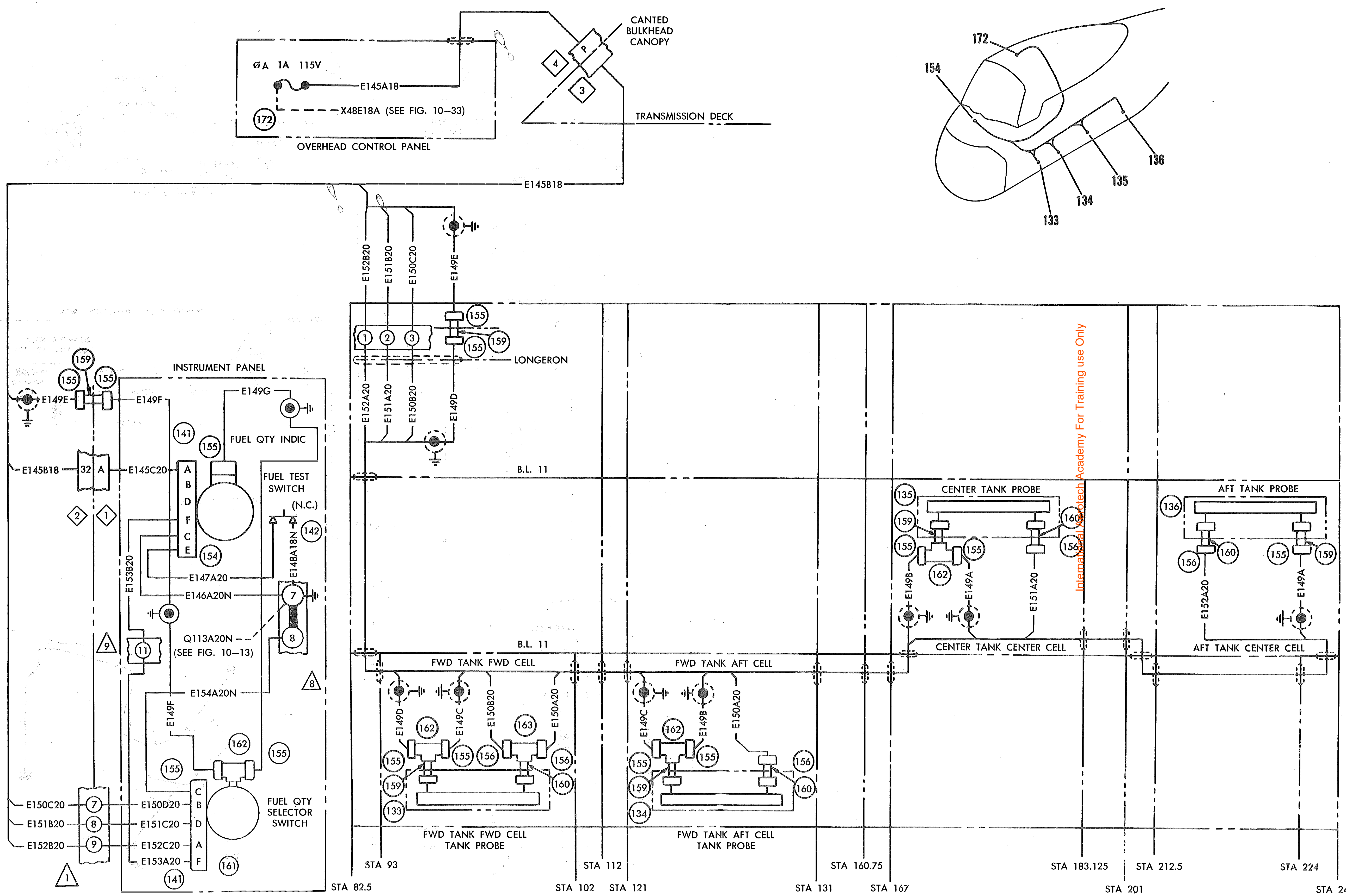


Figure 10—15. Fuel Quantity Indicator

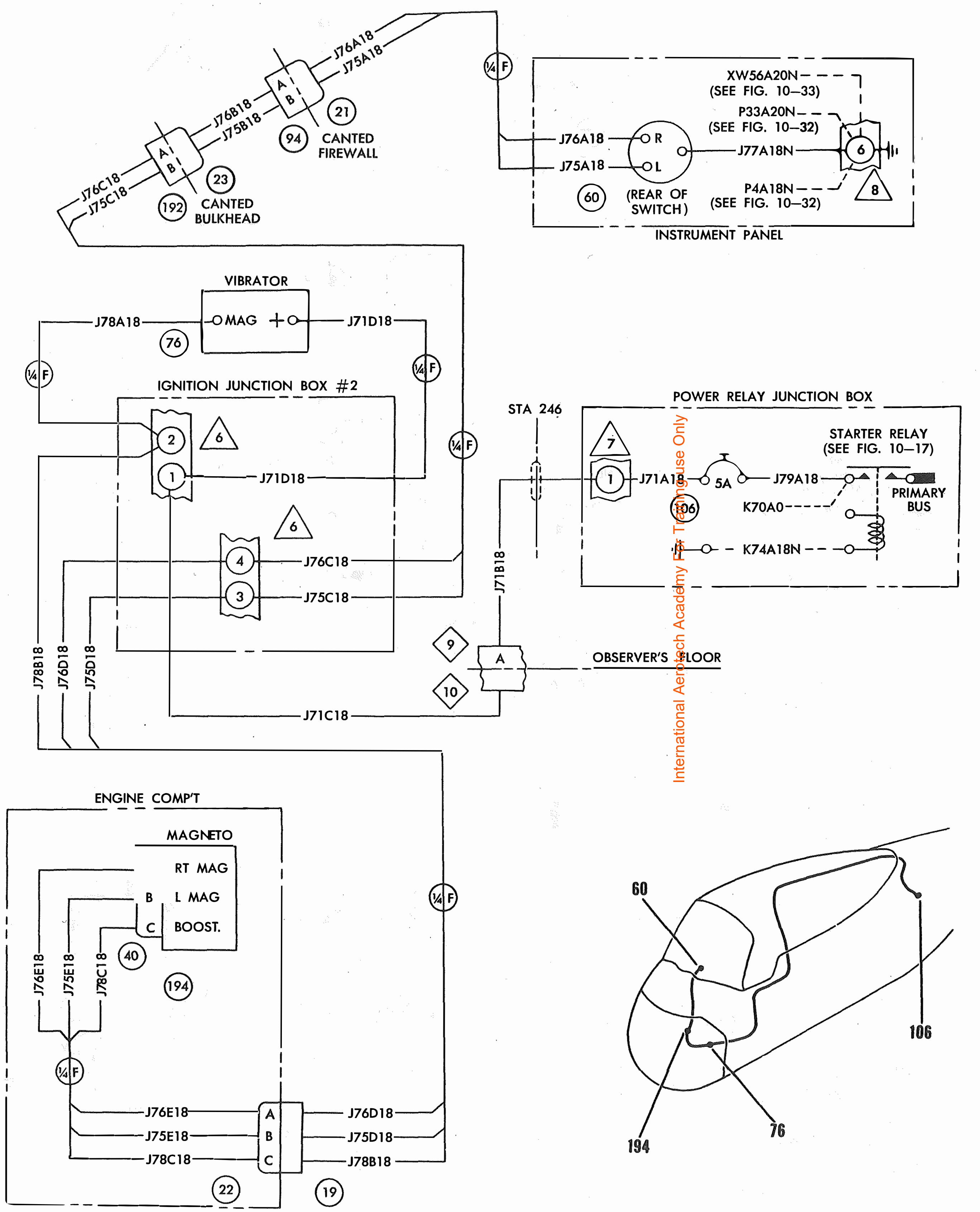


Figure 10—16. Ignition

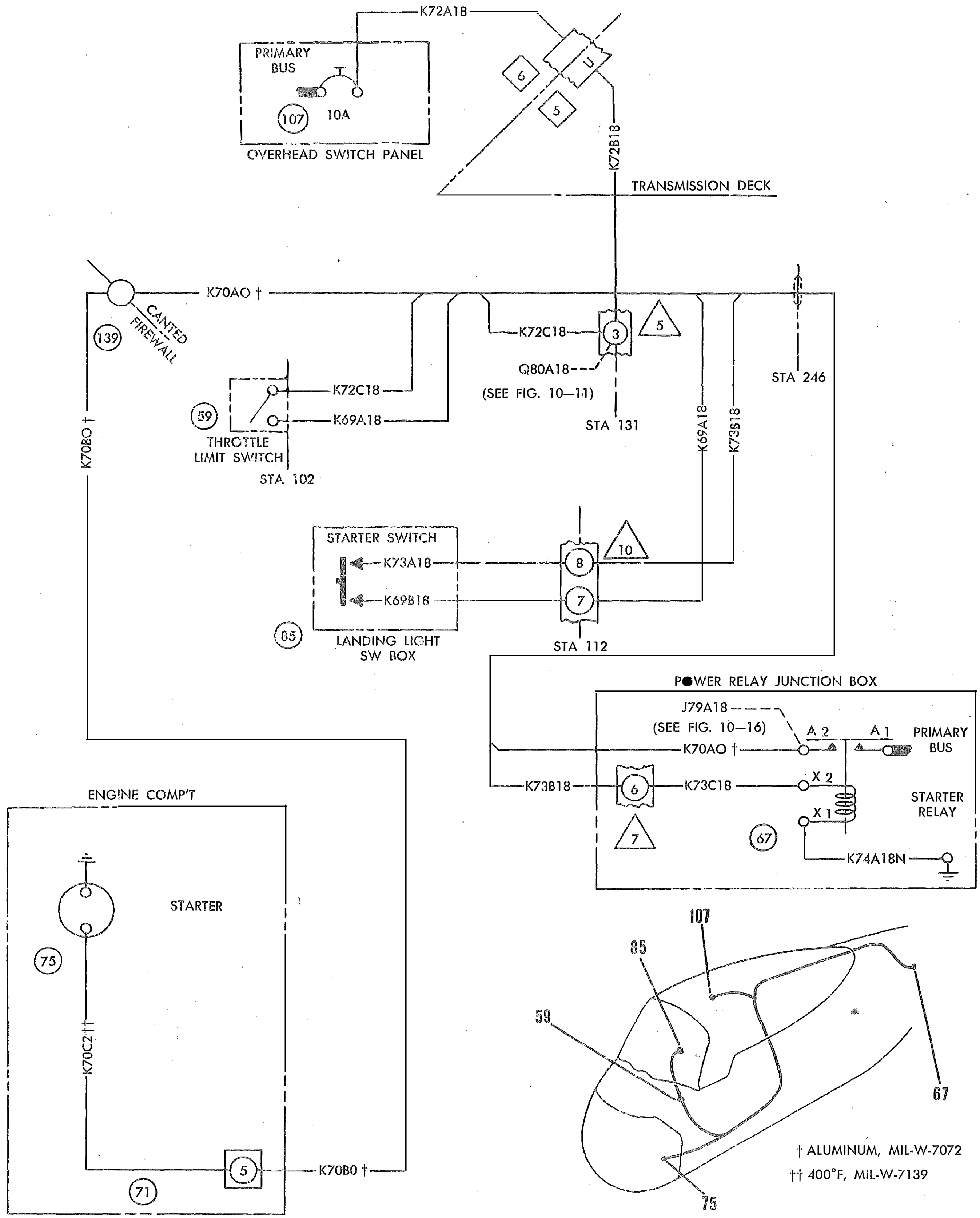


Figure 10—17. Starter

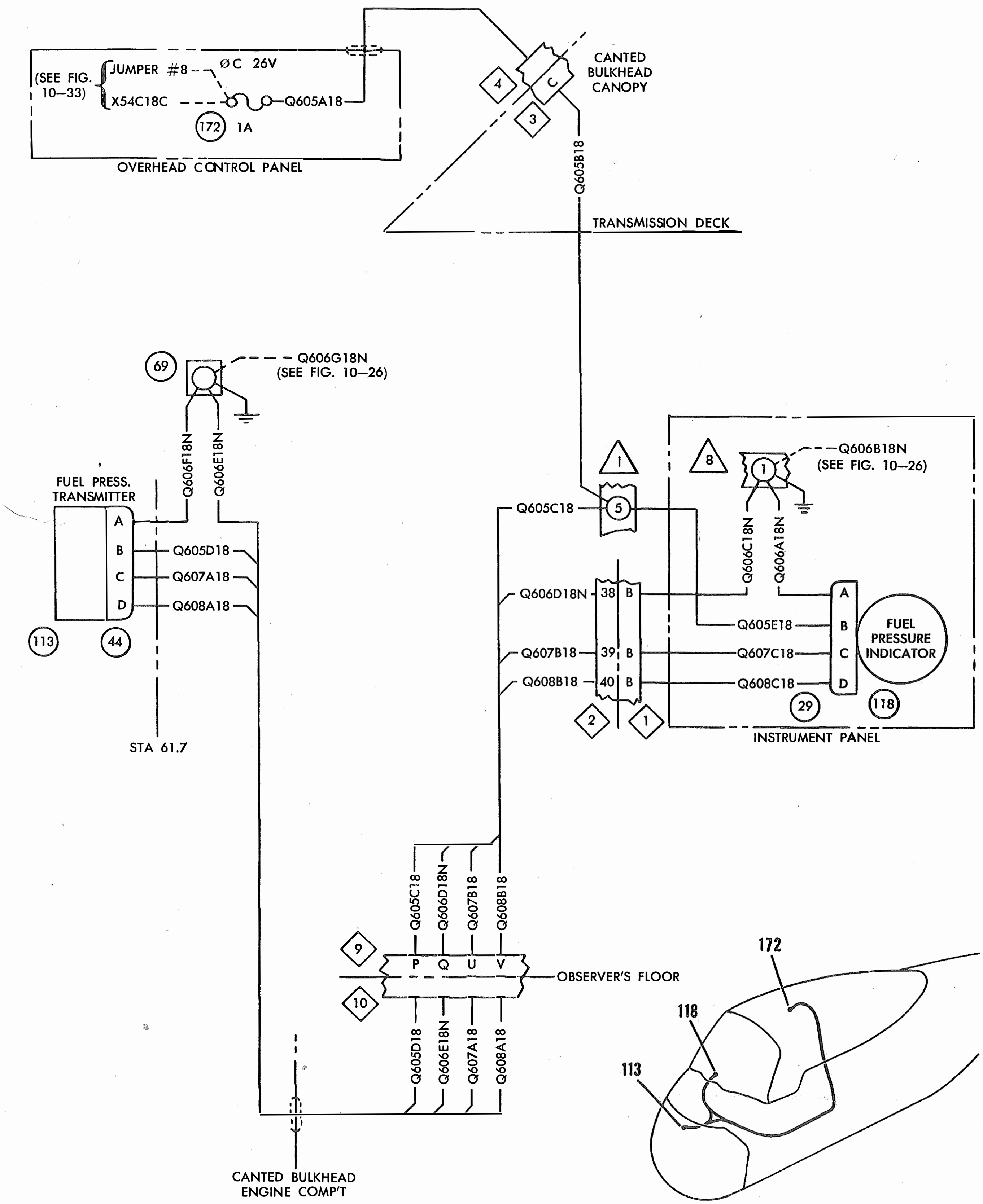


Figure 10—18. Fuel Pressure Indicator

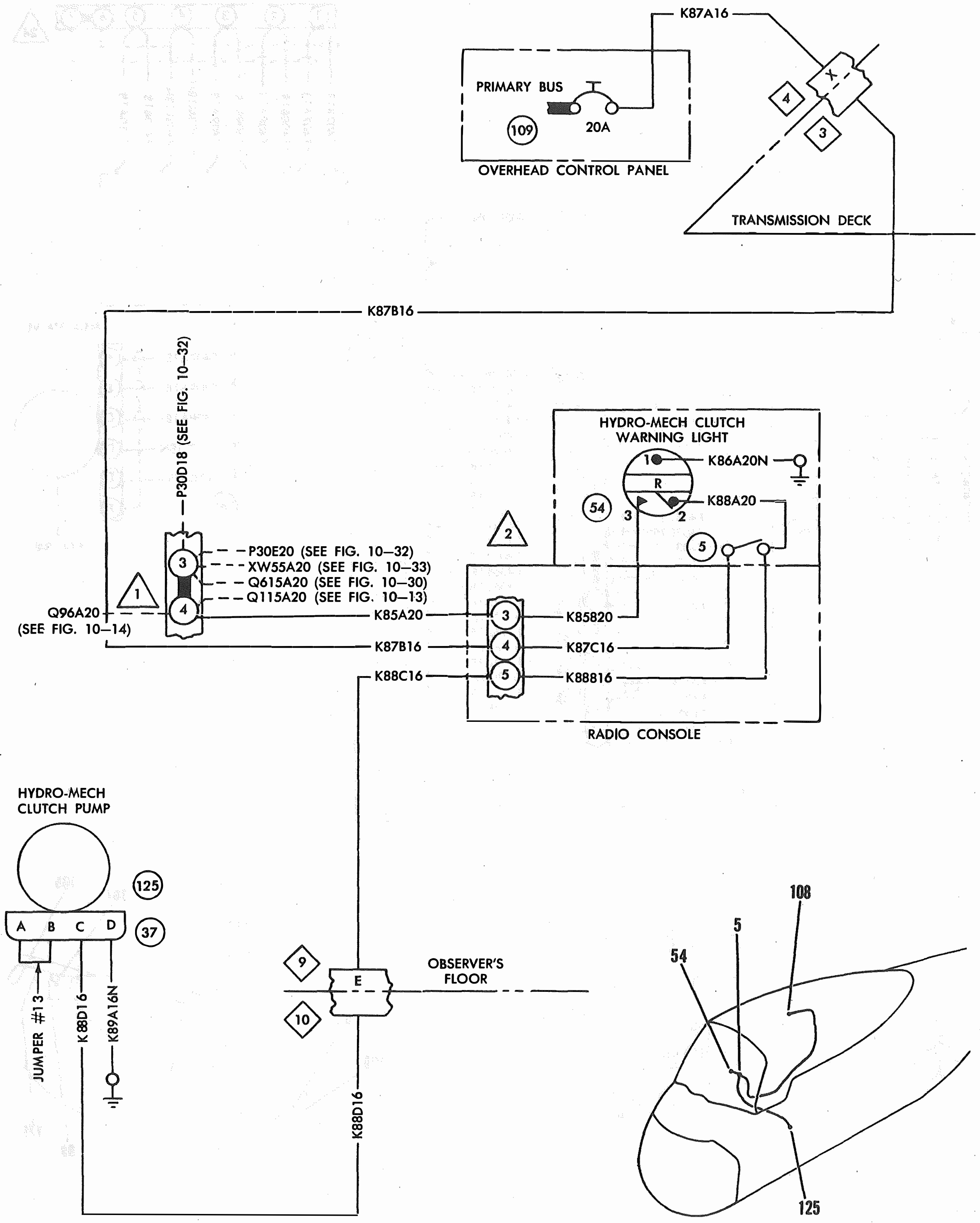


Figure 10—19. Hydro-Mechanical Clutch Pump

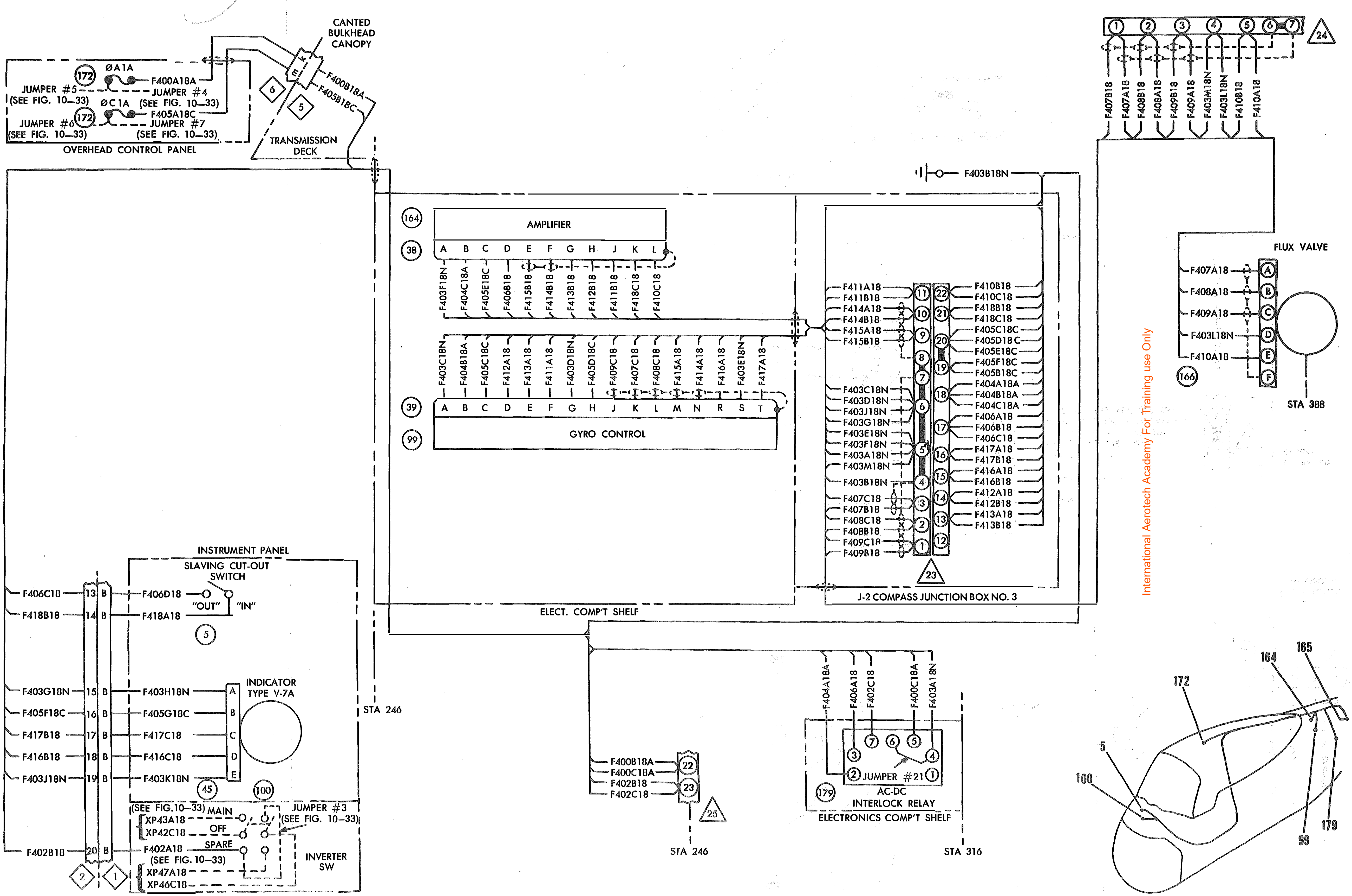


Figure 10—20. J-2 Gyro Compass

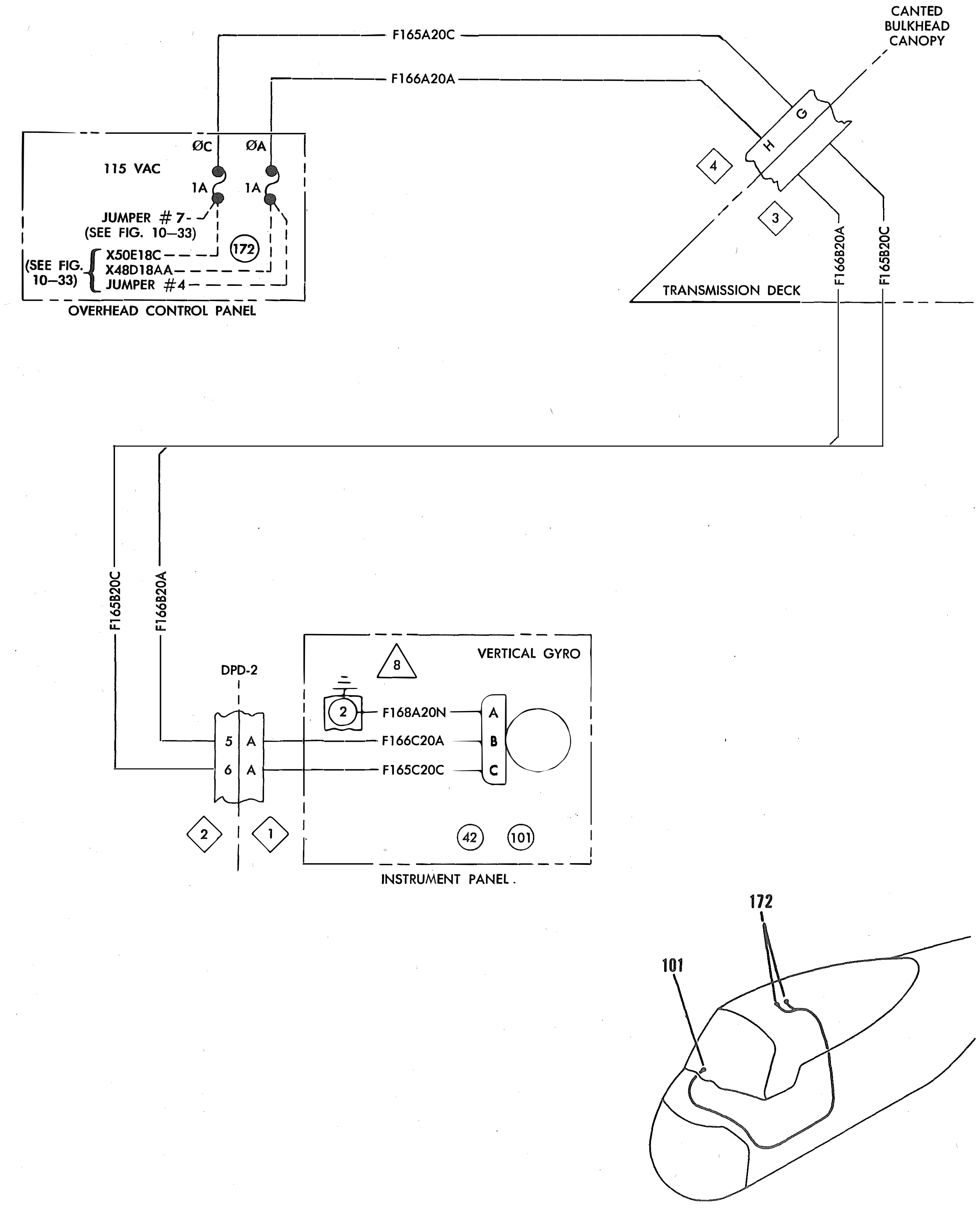
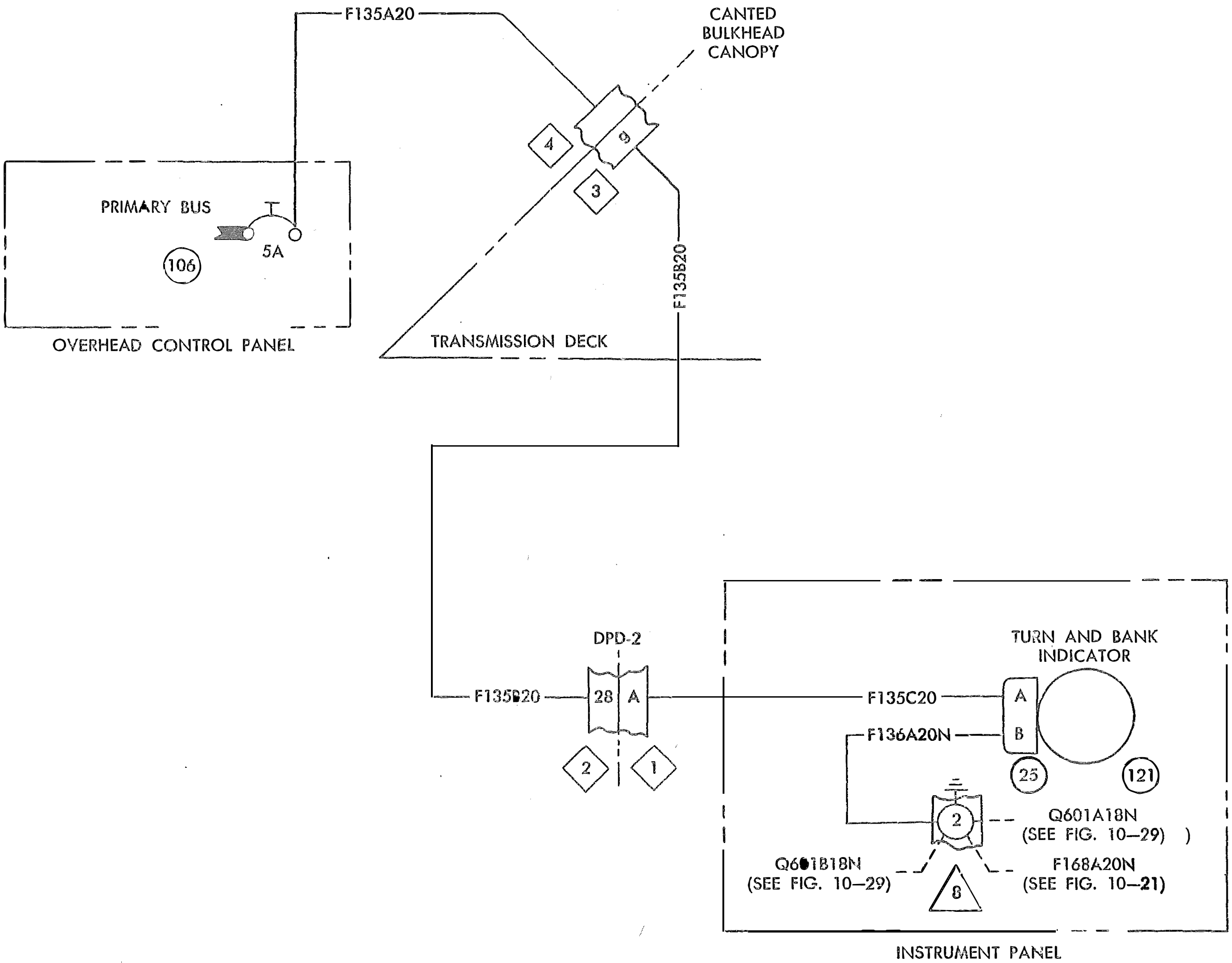


Figure 10—21. J-8 Gyro Horizon



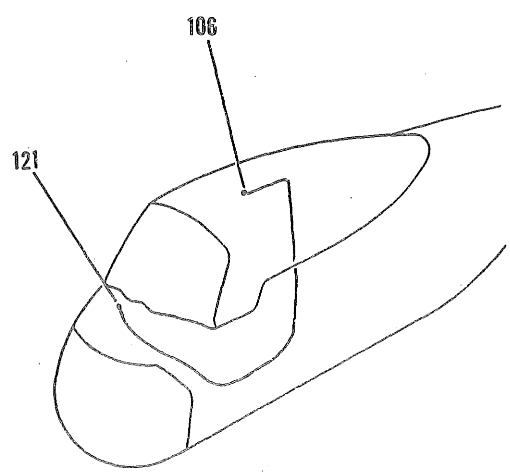
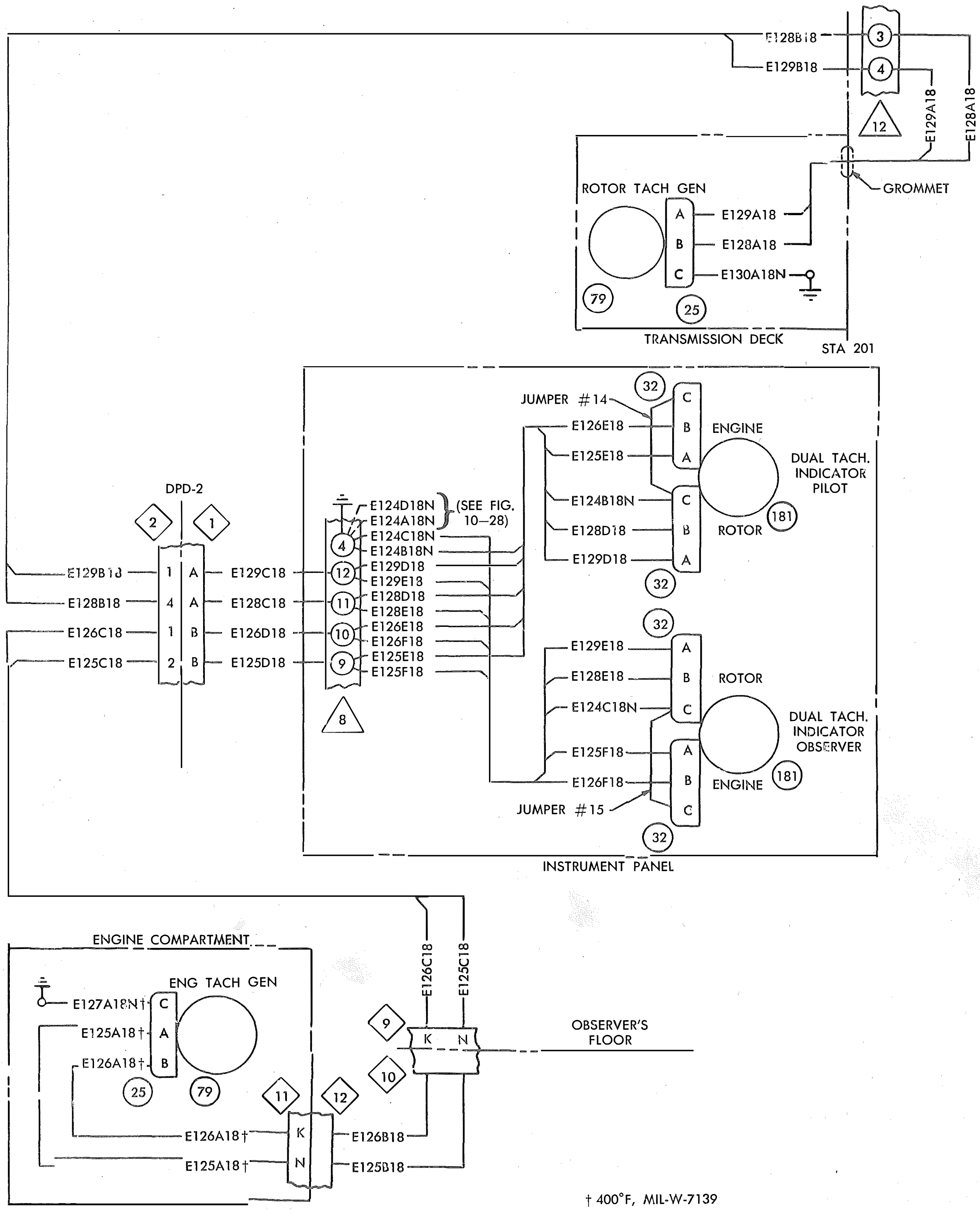


Figure 10—22. Turn-and-Bank Indicator



† 400°F, MIL-W-7139

Figure 10—23. Dual Tachometer Indicator

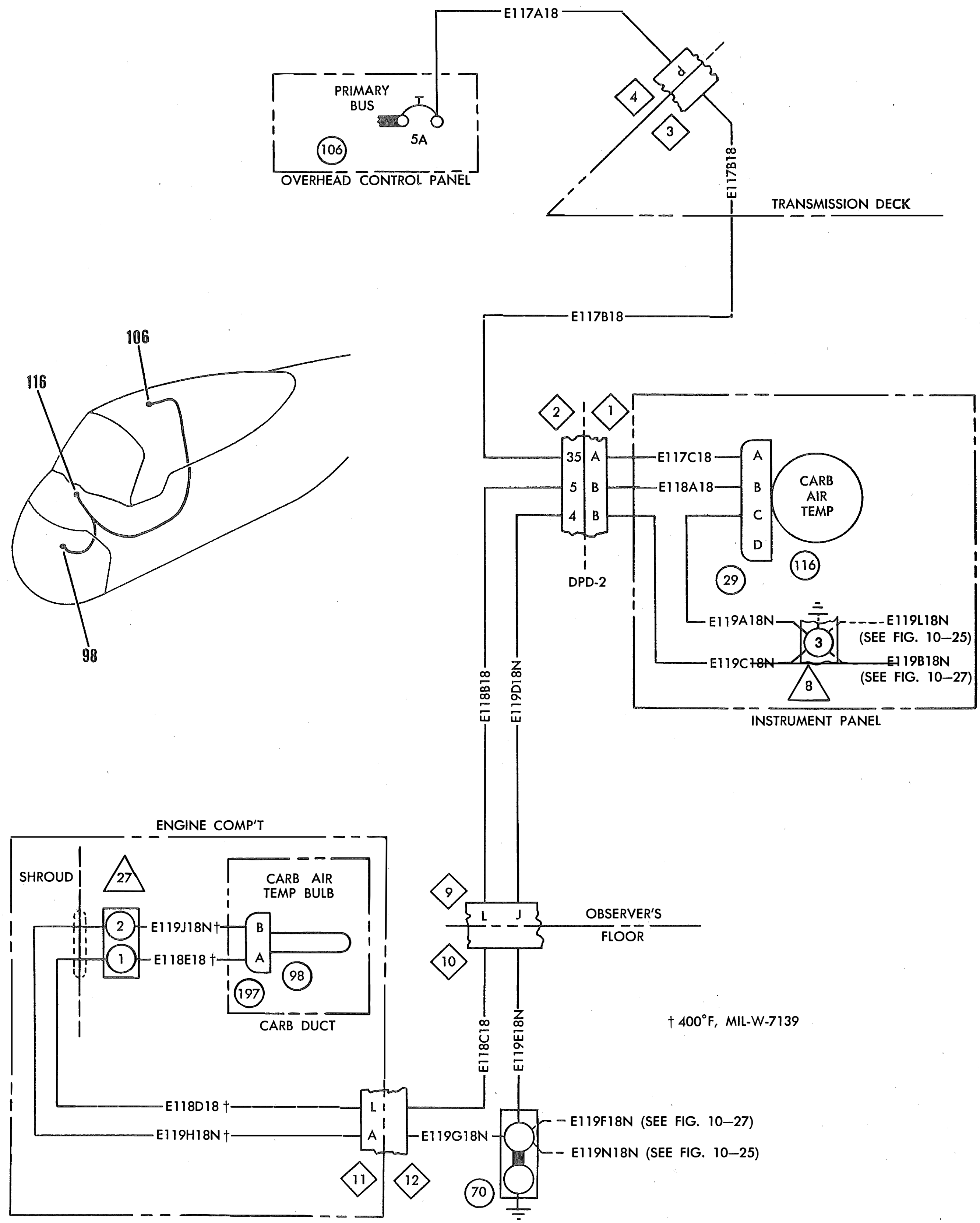


Figure 10—24. Carburetor Air Temperature Indicator

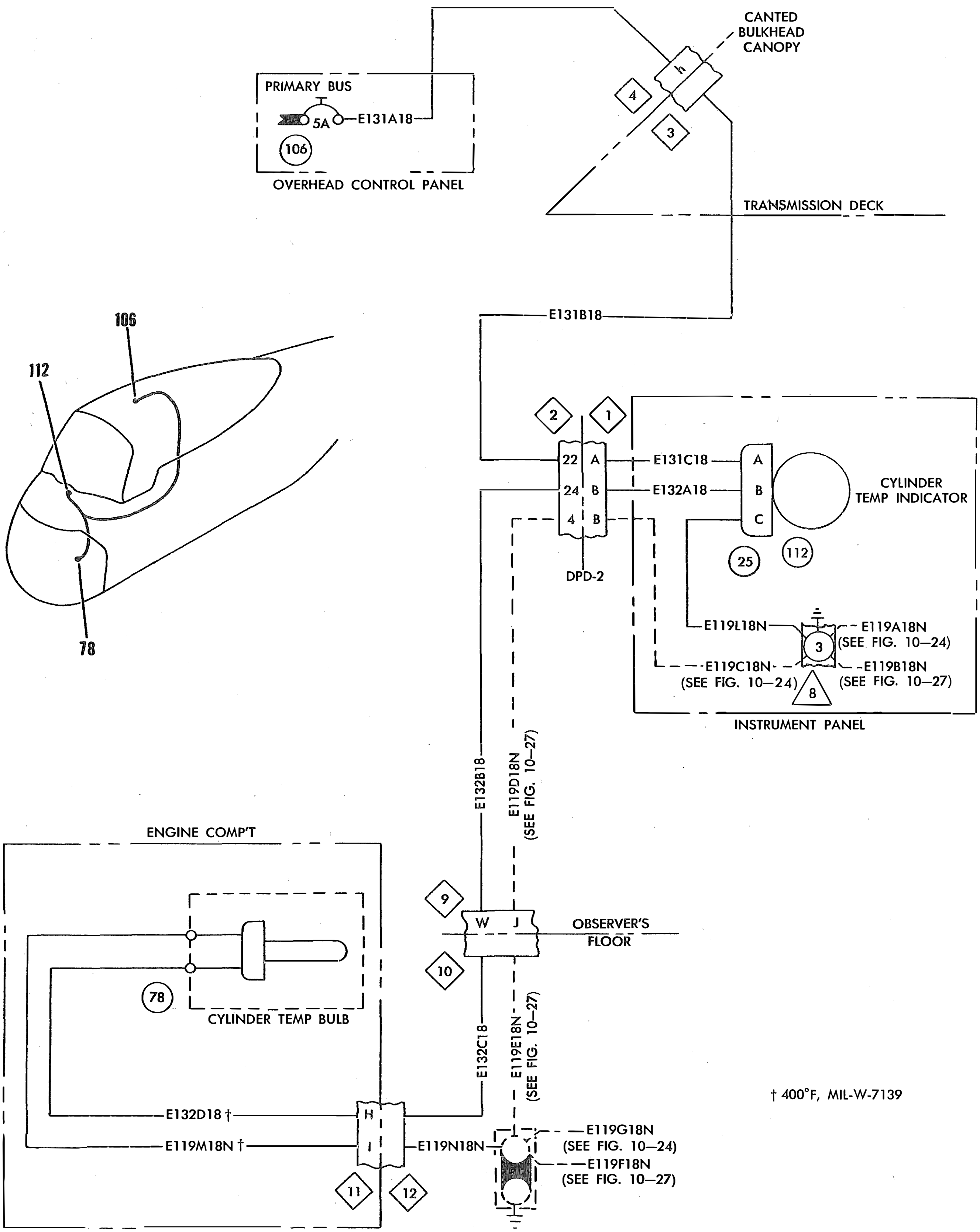


Figure 10—25. Cylinder Head Temperature Indicator

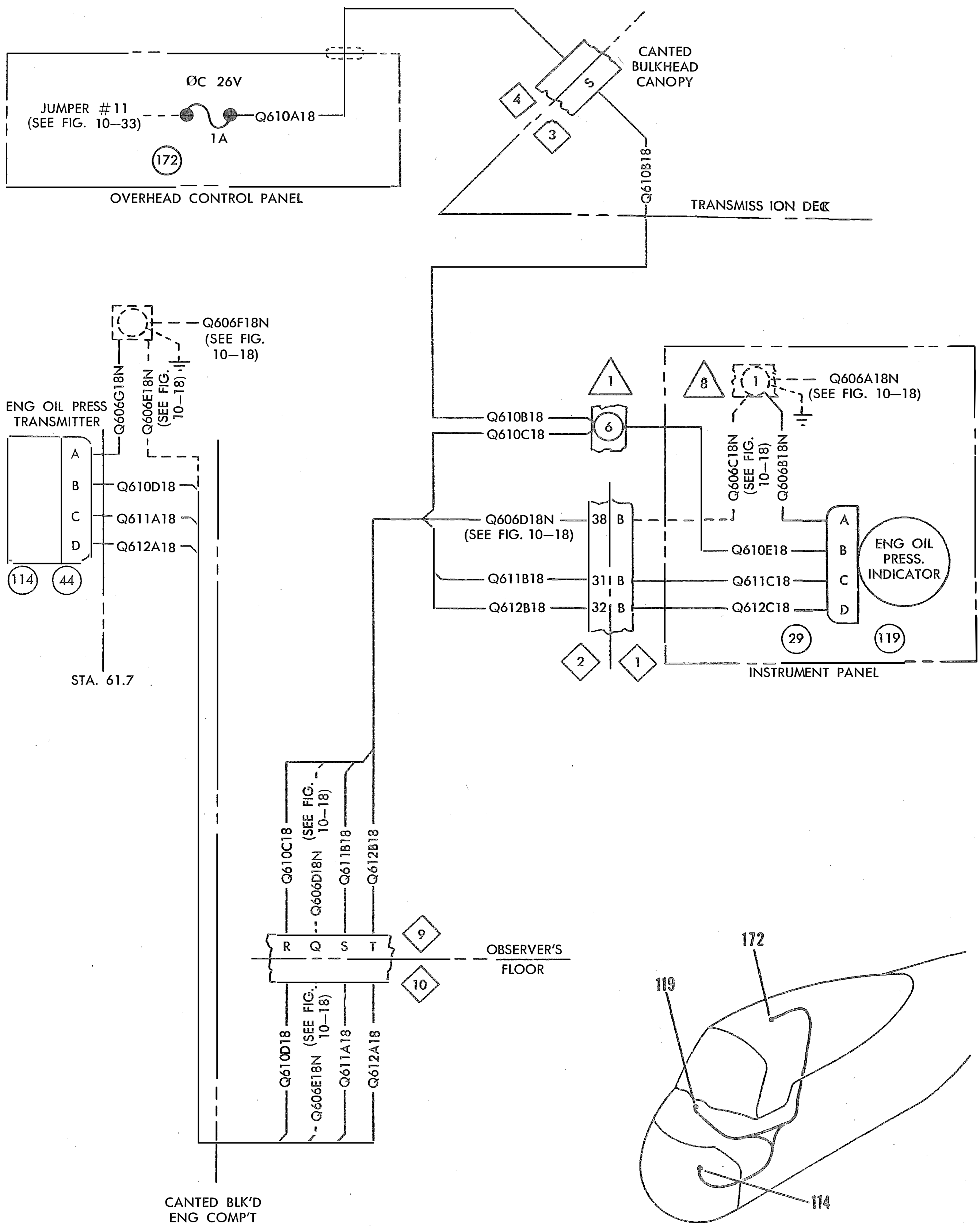


Figure 10—26. Engine Oil Pressure Indicator

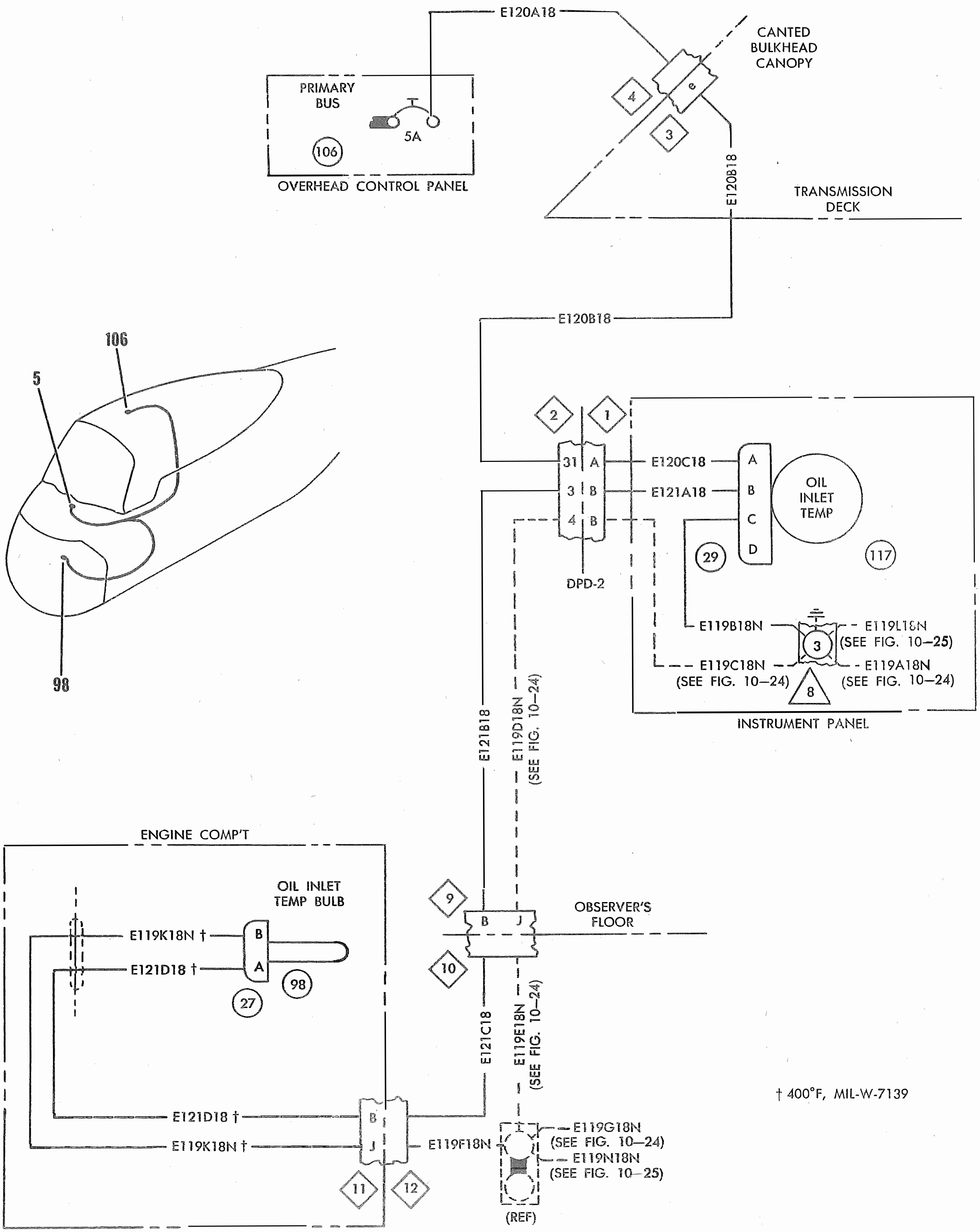


Figure 10-27. Engine Oil Inlet Temperature Indicator

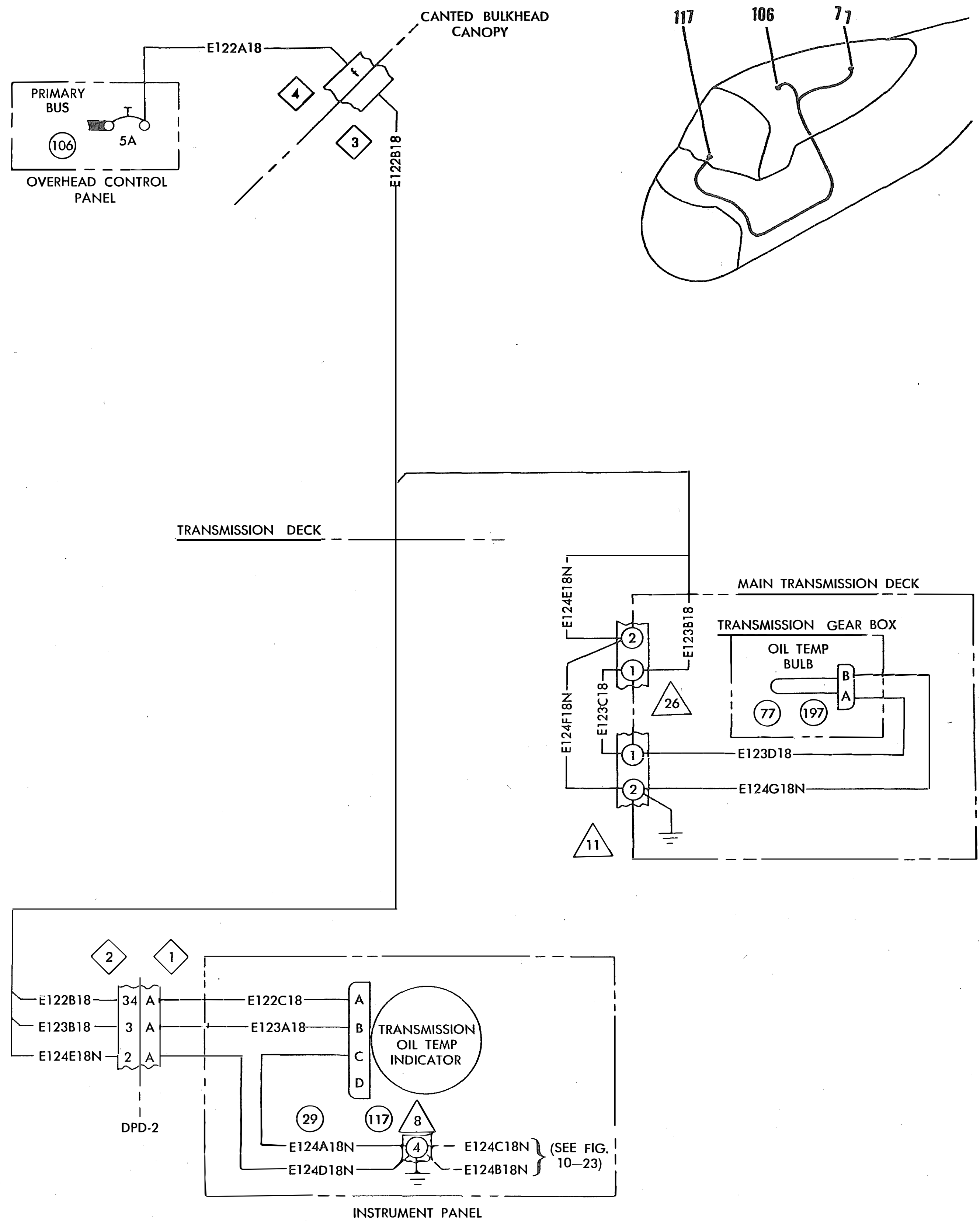


Figure 10—28. Transmission Oil Temperature Indicator

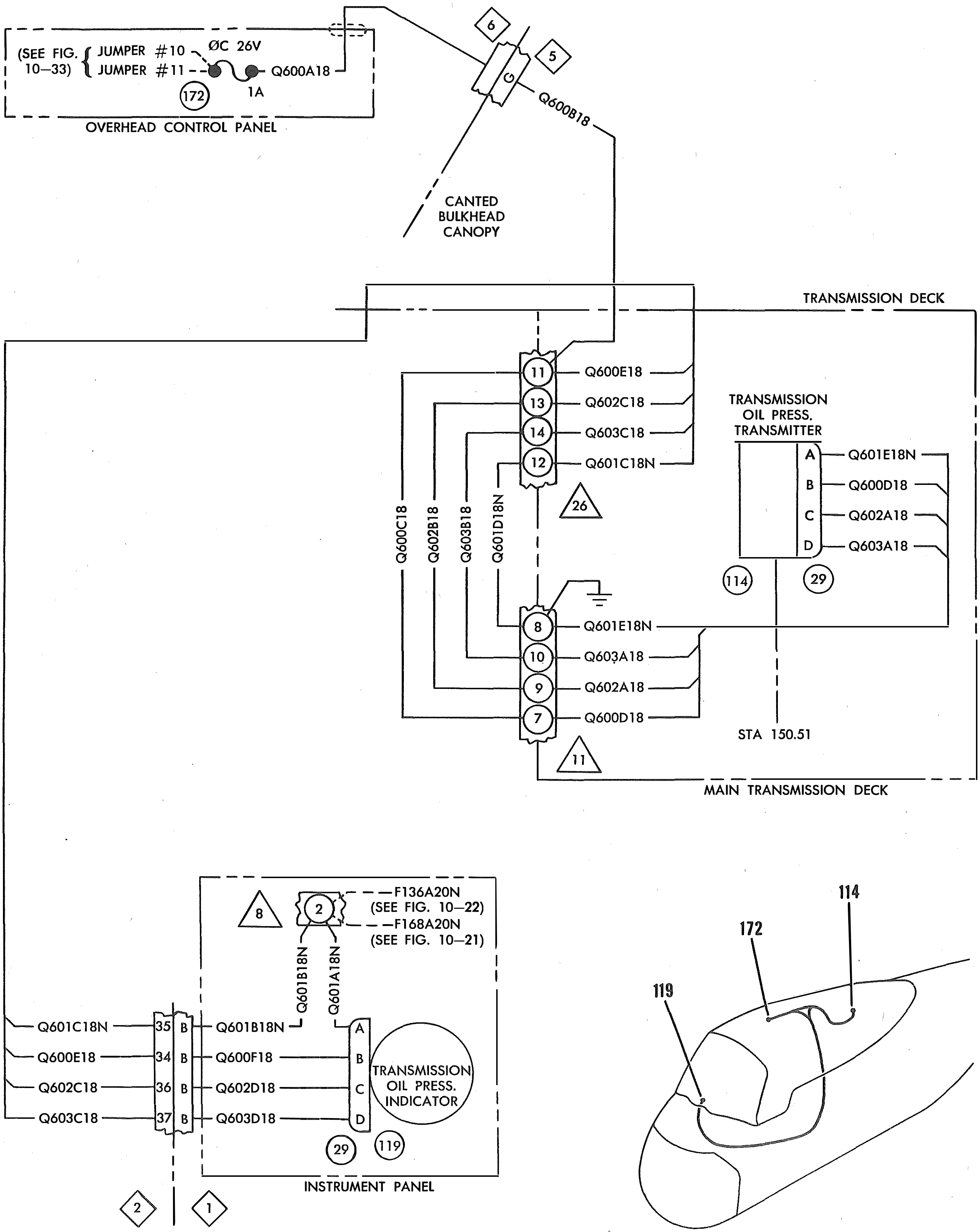


Figure 10—29. Transmission Oil Pressure Indicator

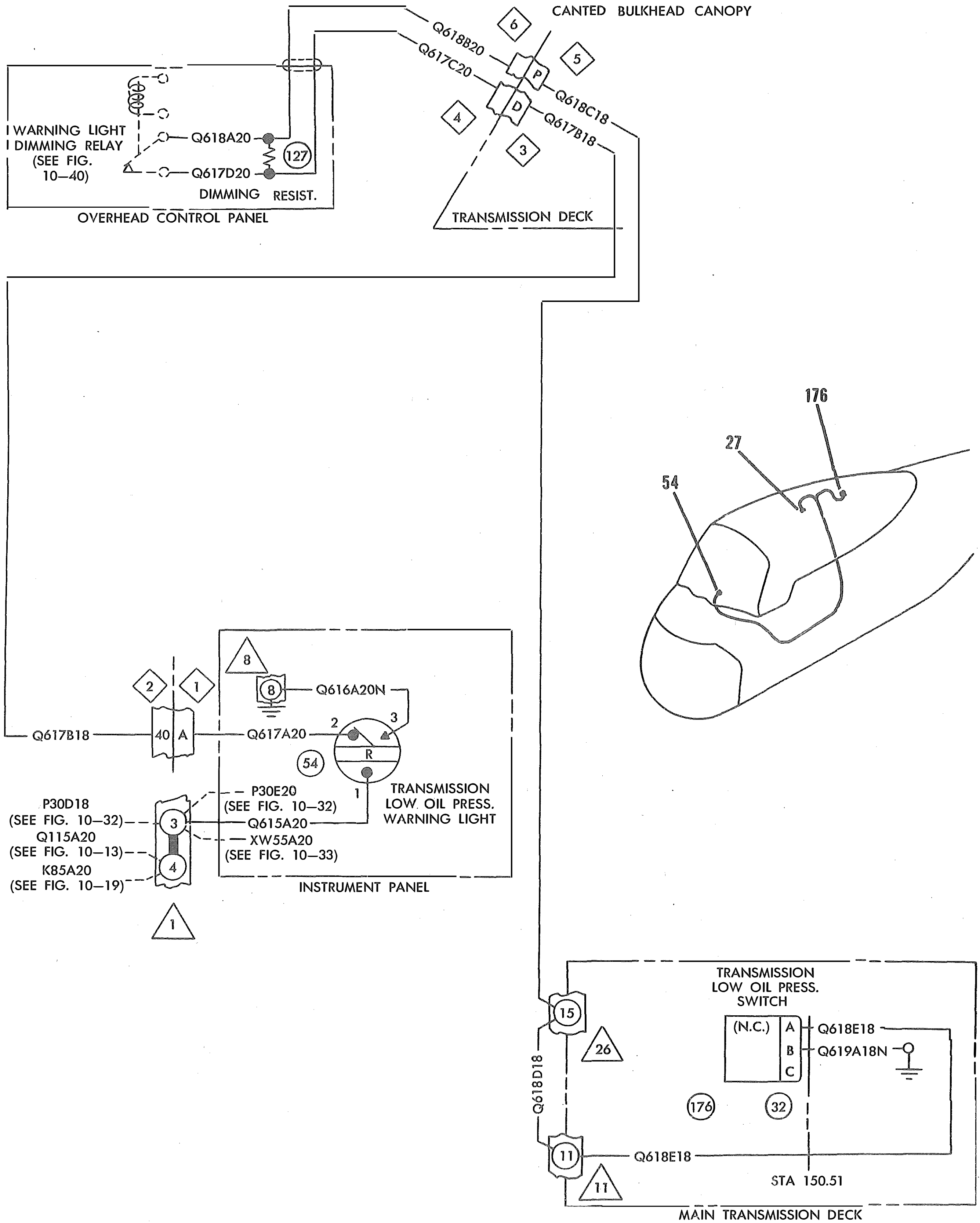


Figure 10—30. Transmission Oil Pressure Warning

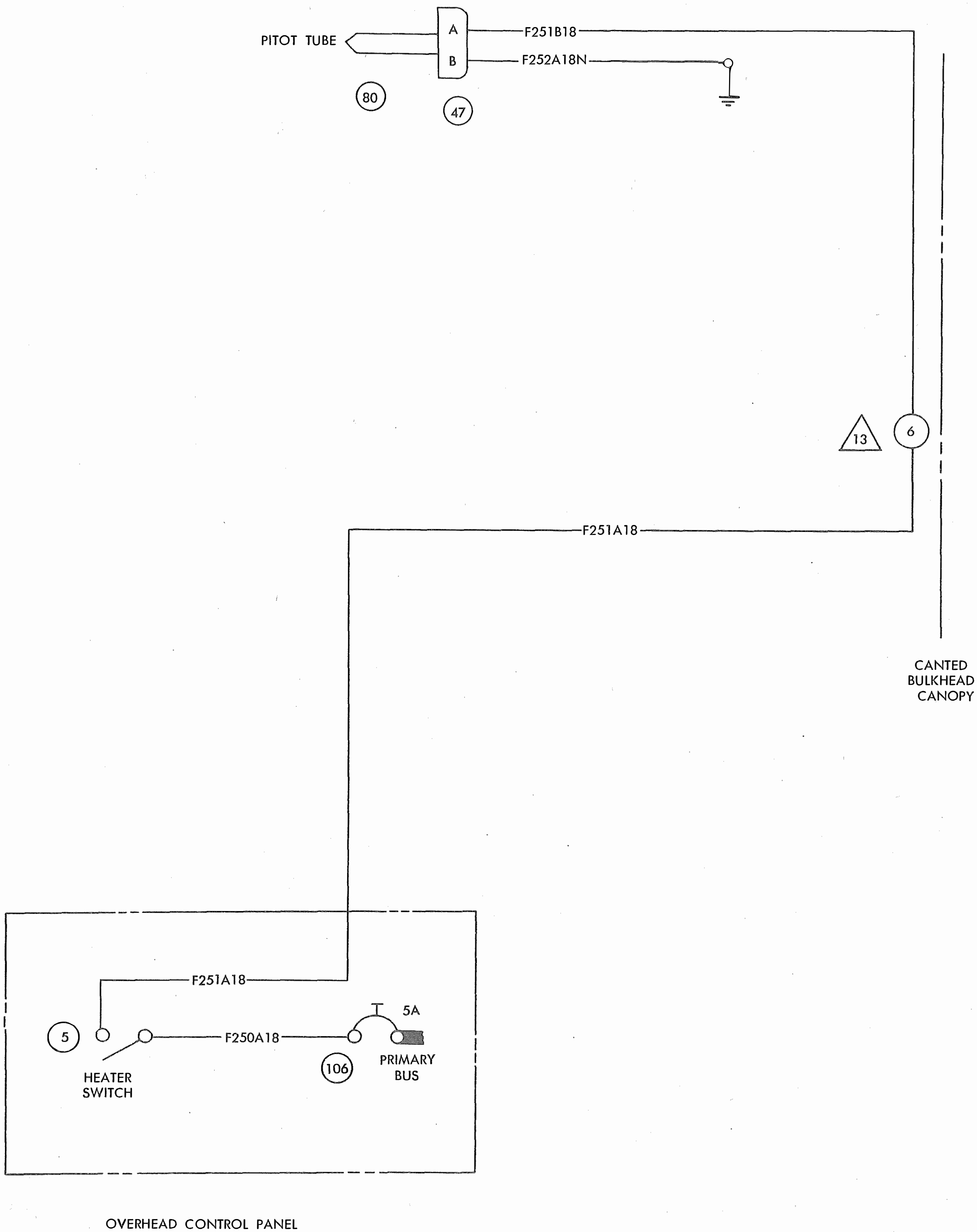


Figure 10—31. Pitot Tube

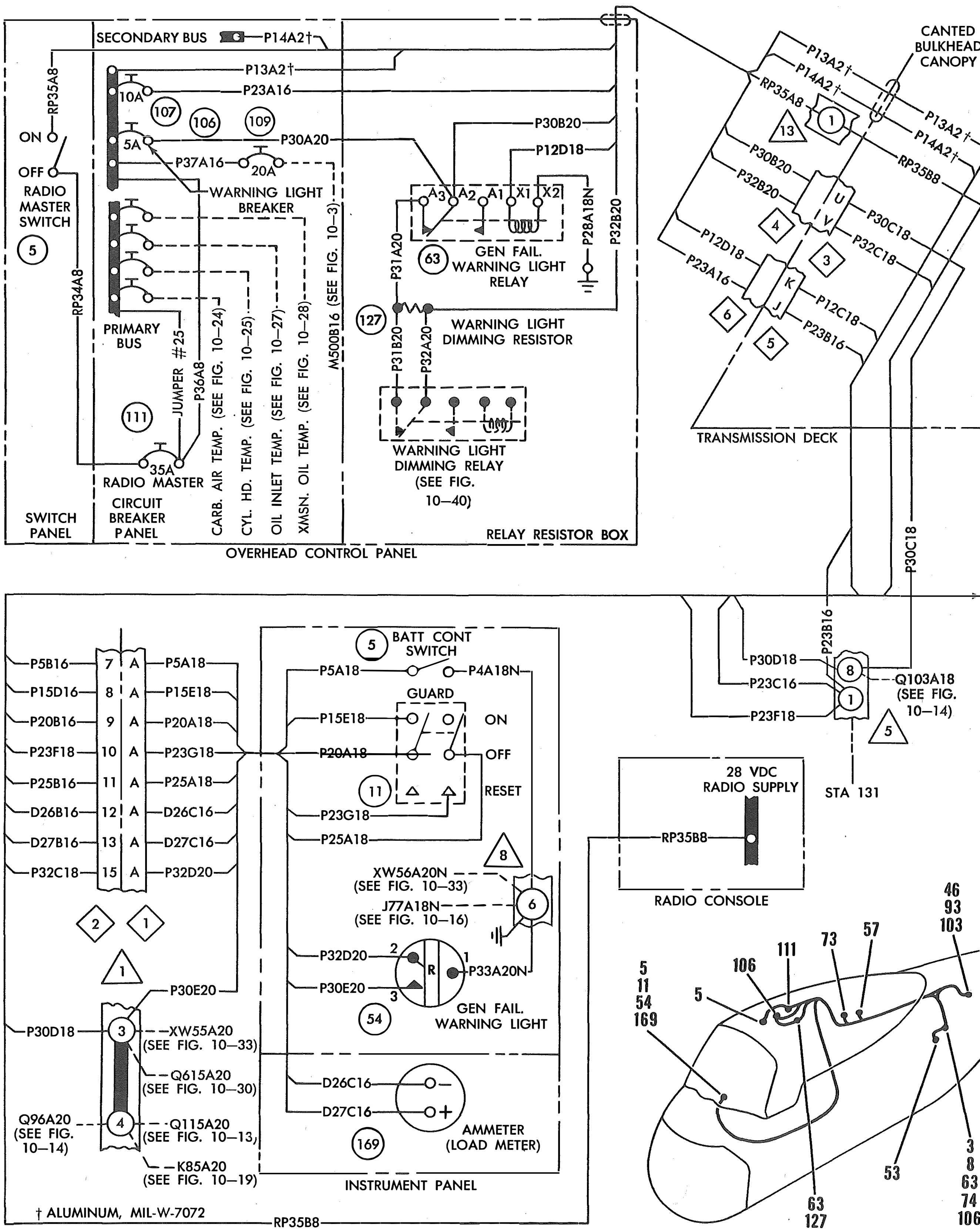


Figure 10—32. DC Power (Sheet 1 of 2)

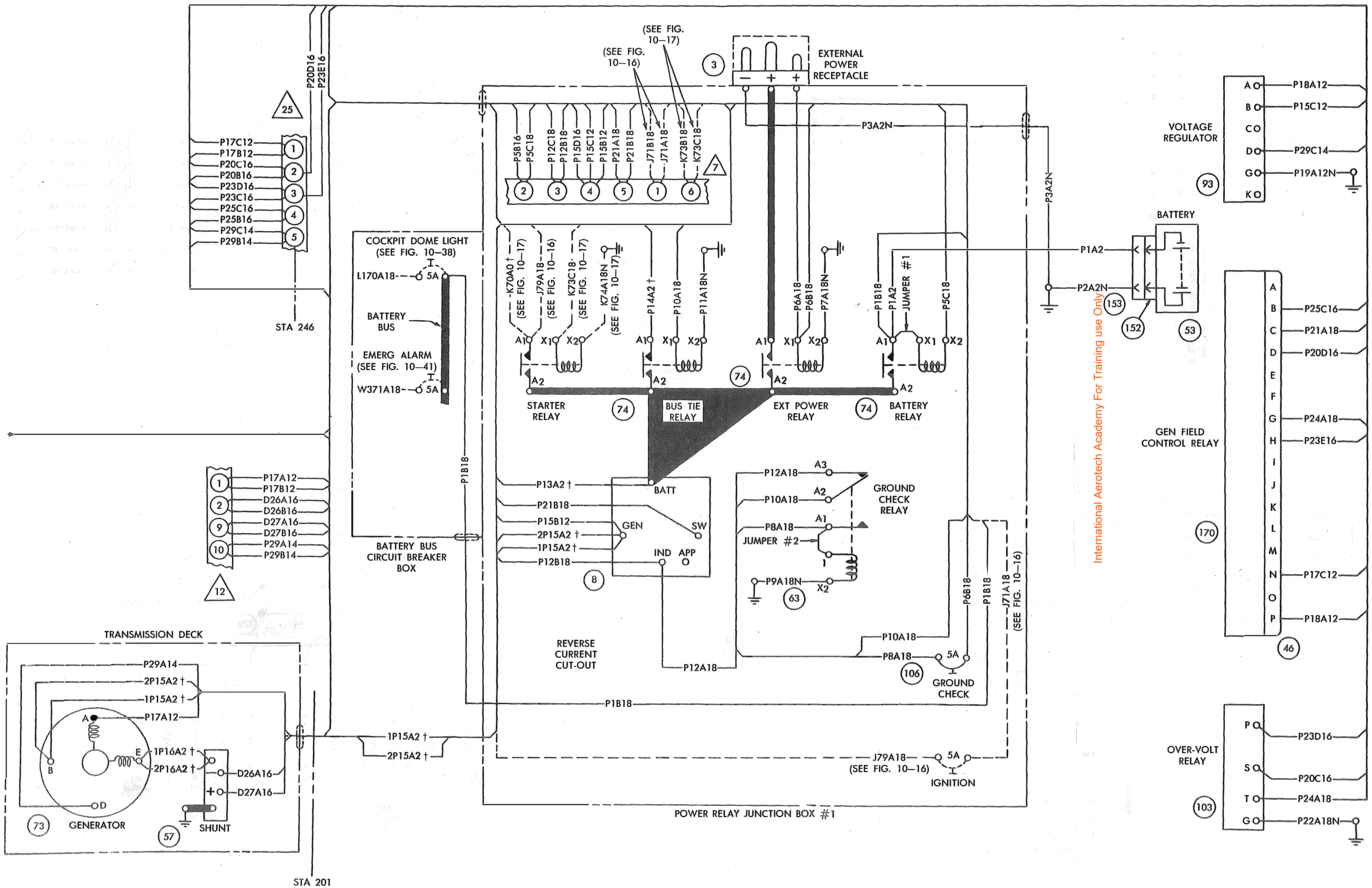


Figure 10—32. DC Power (Sheet 2 of 2)

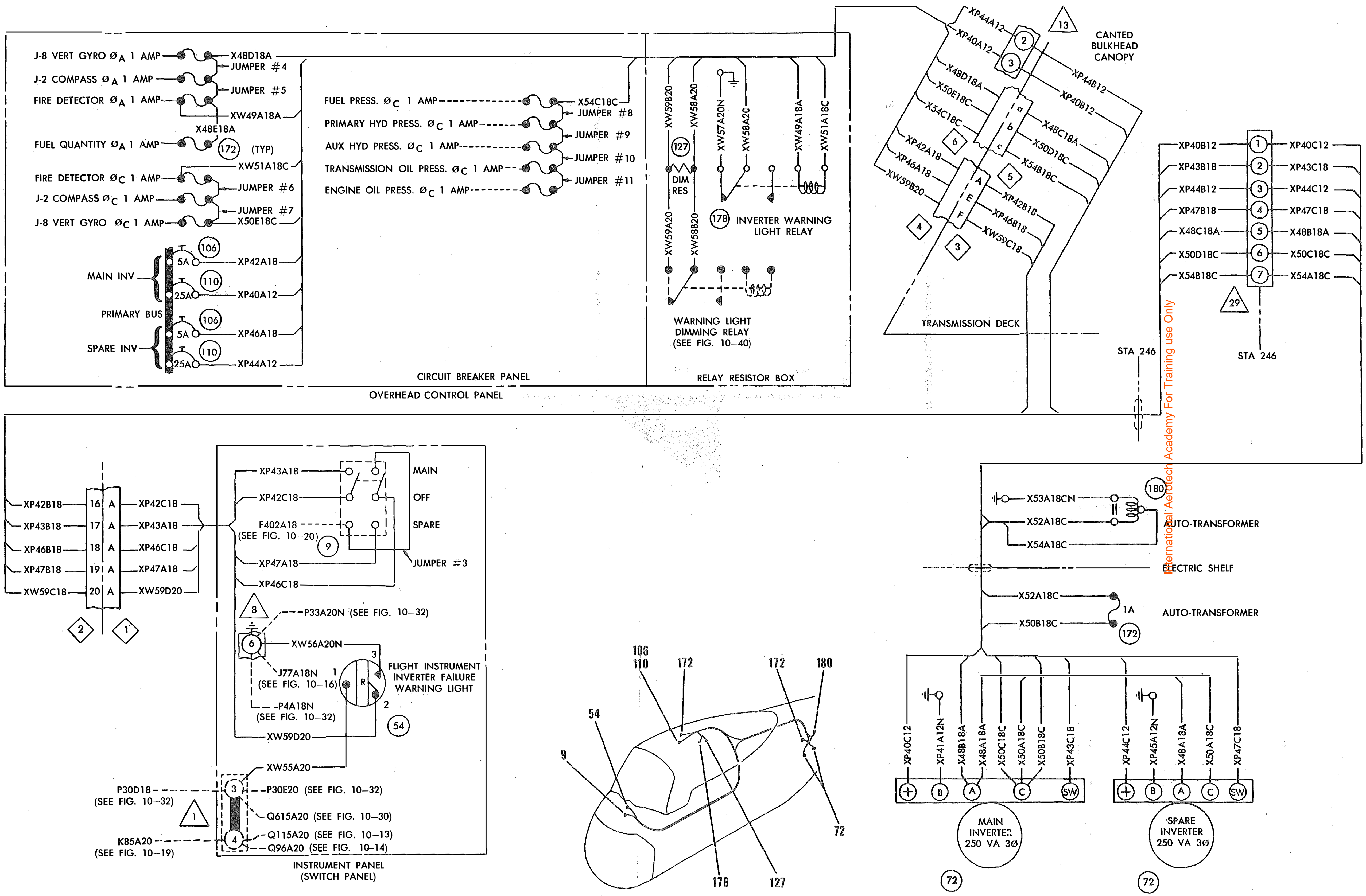


Figure 10–33. AC Power

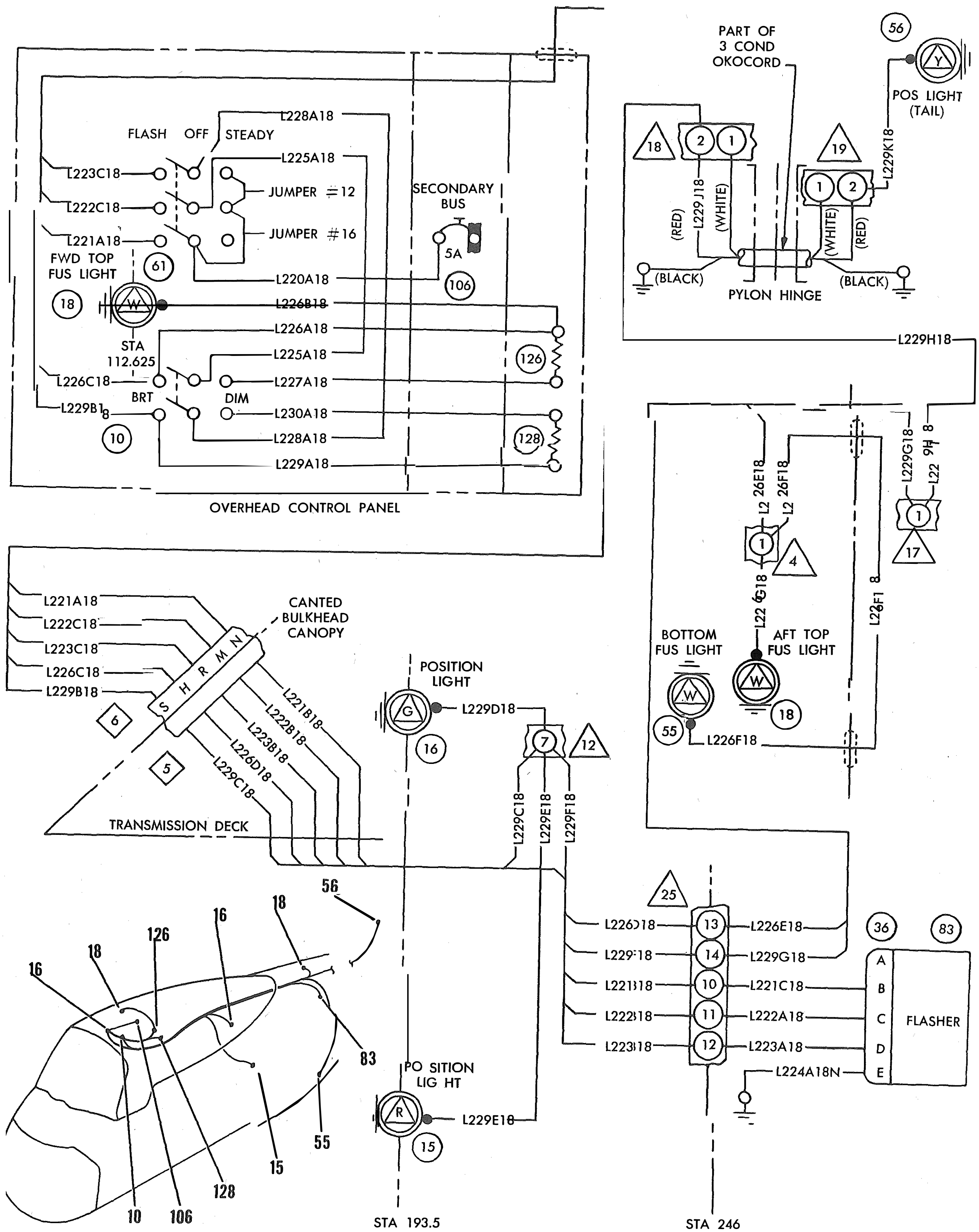


Figure 10—34. Navigation Lights (Position and Fuselage)

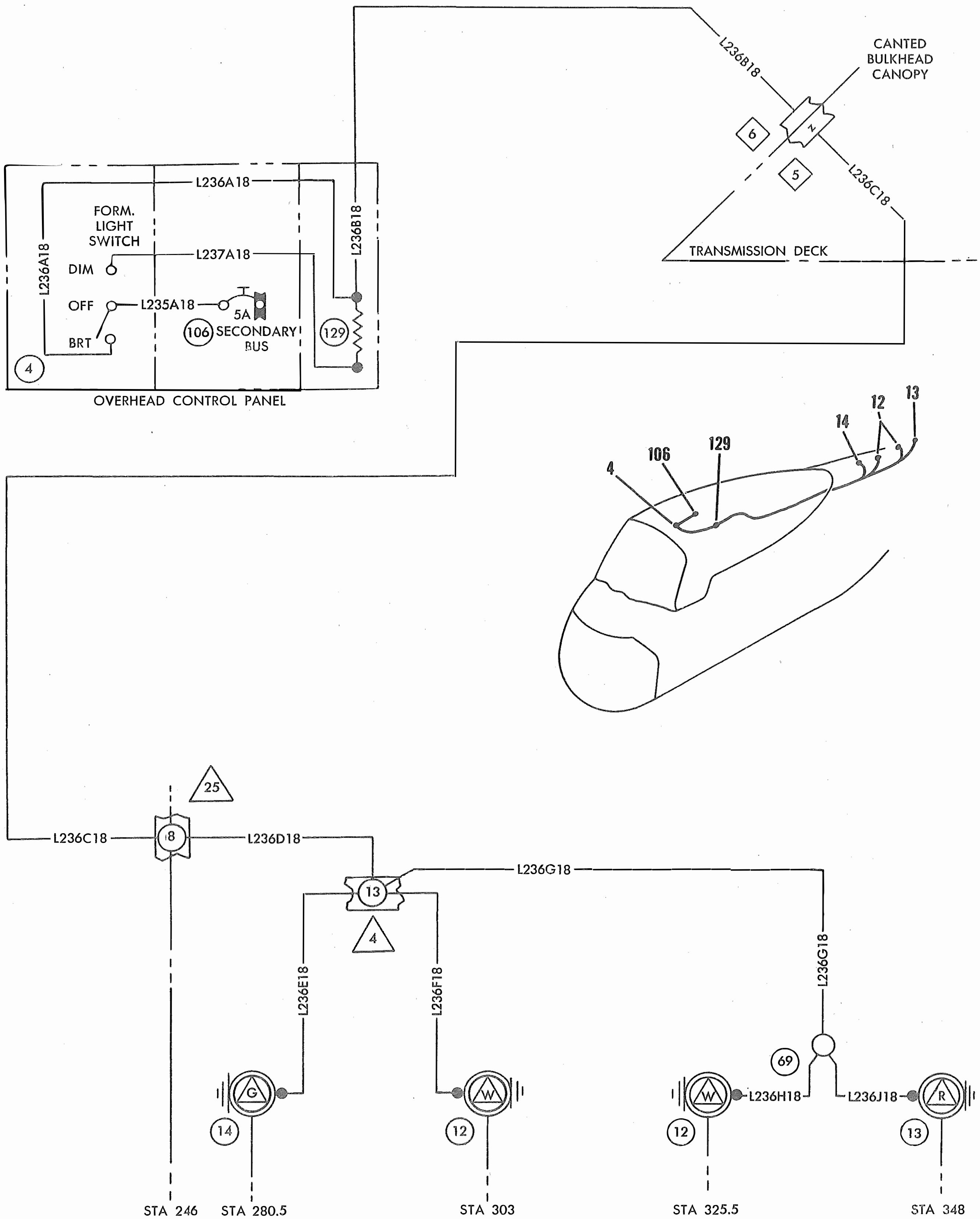


Figure 10—35. Formation Lights

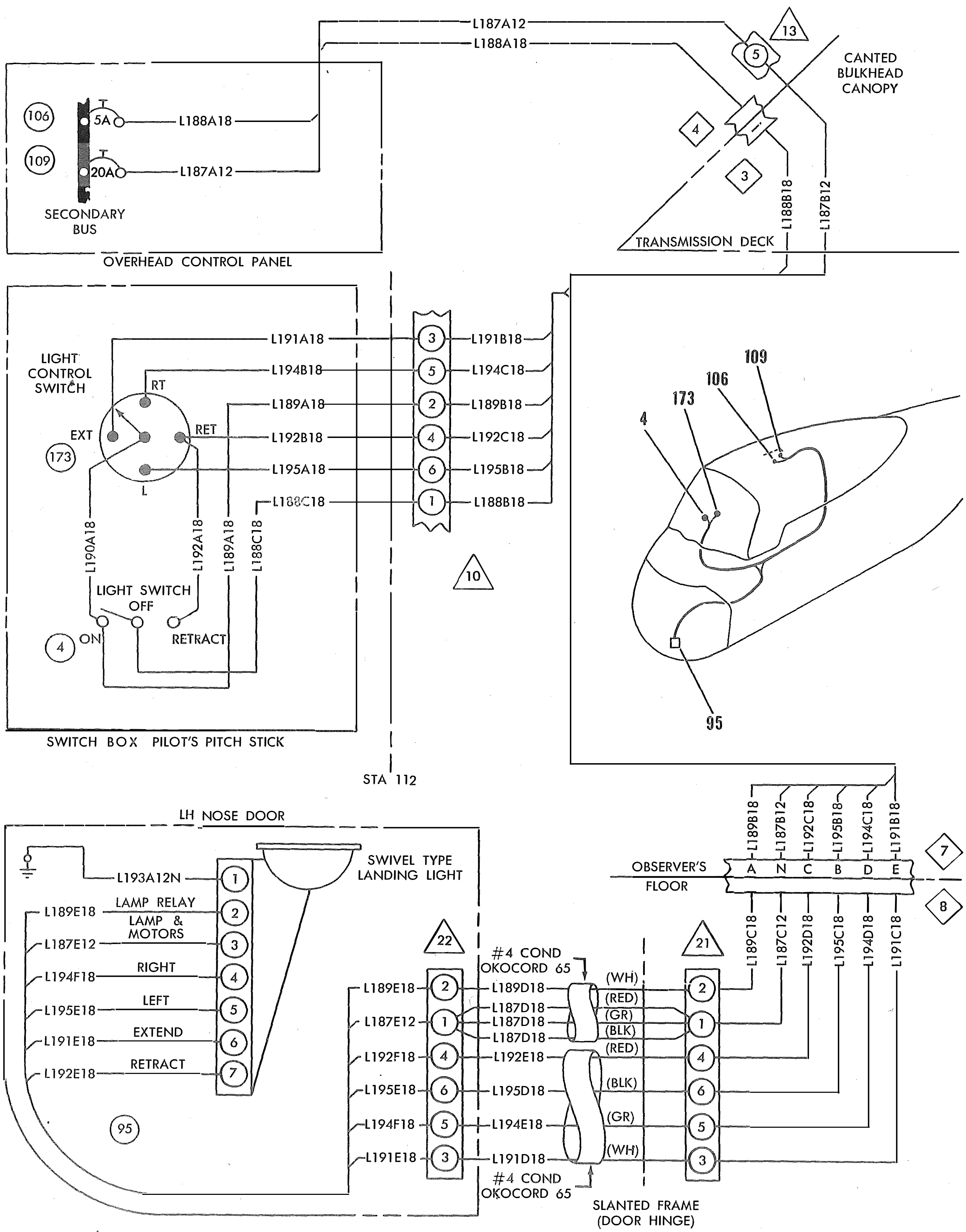


Figure 10–36. Landing Lights

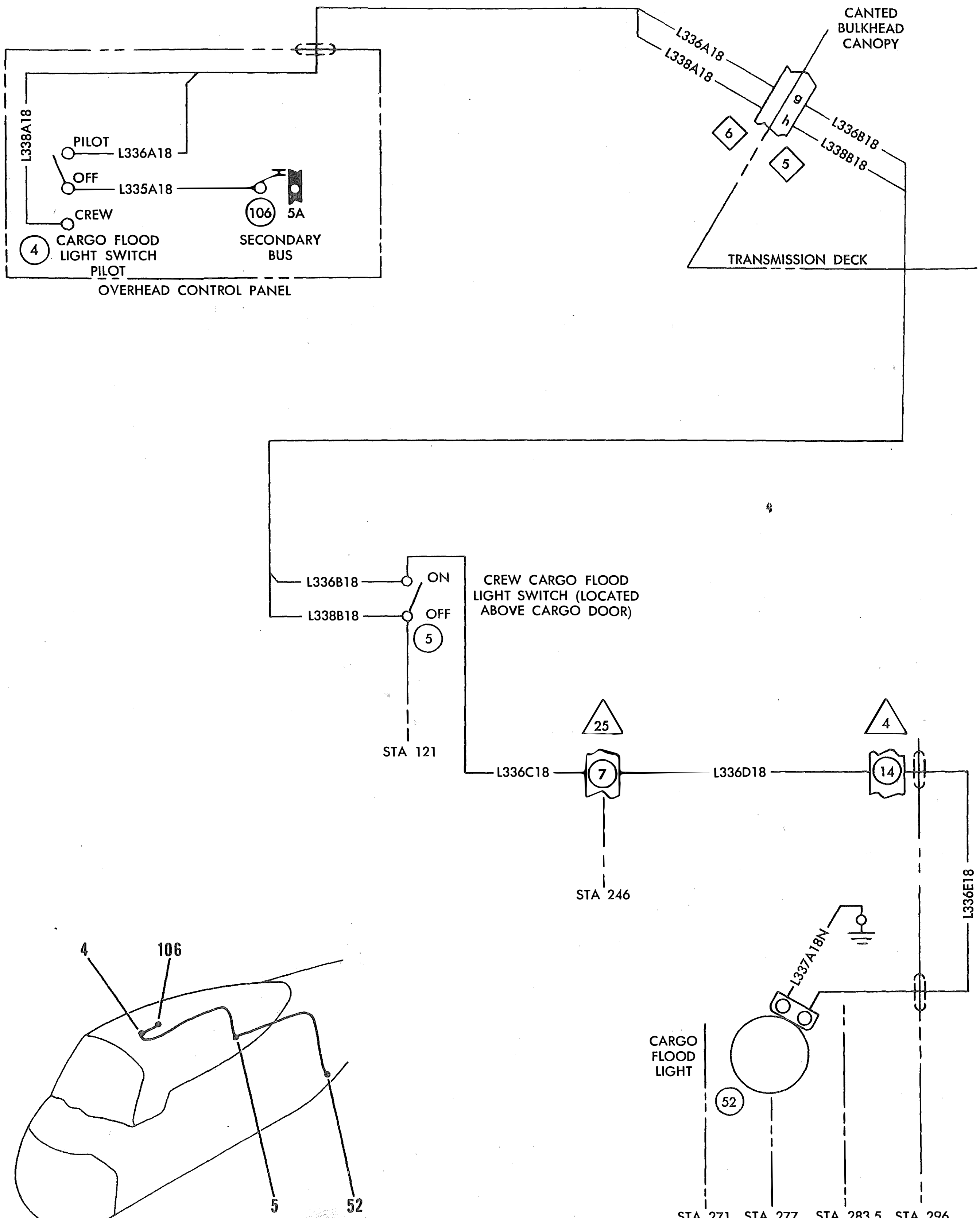


Figure 10–37. Cargo Floodlight

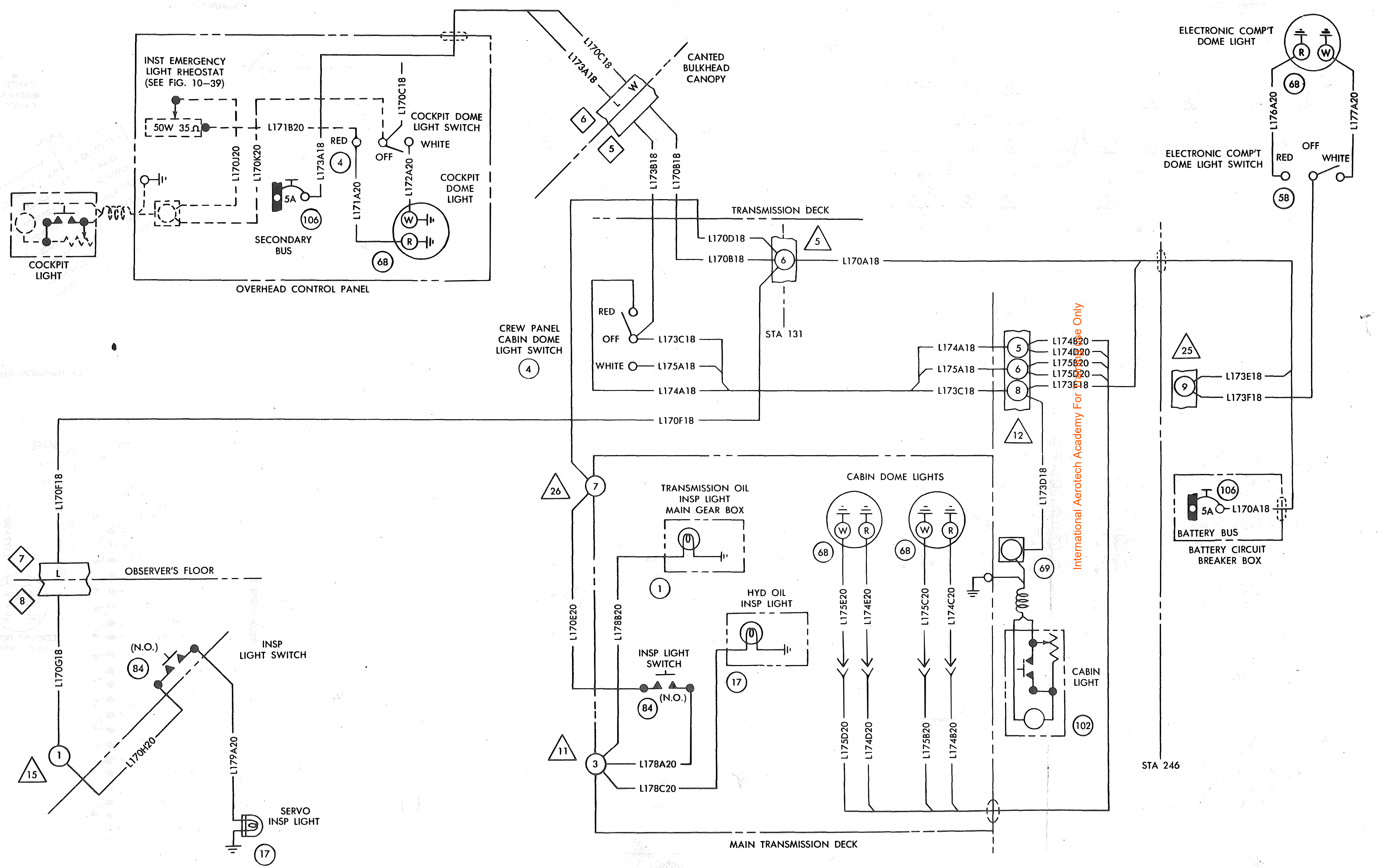


Figure 10—38. Dome Lights, Inspection Lights and Trouble Lights

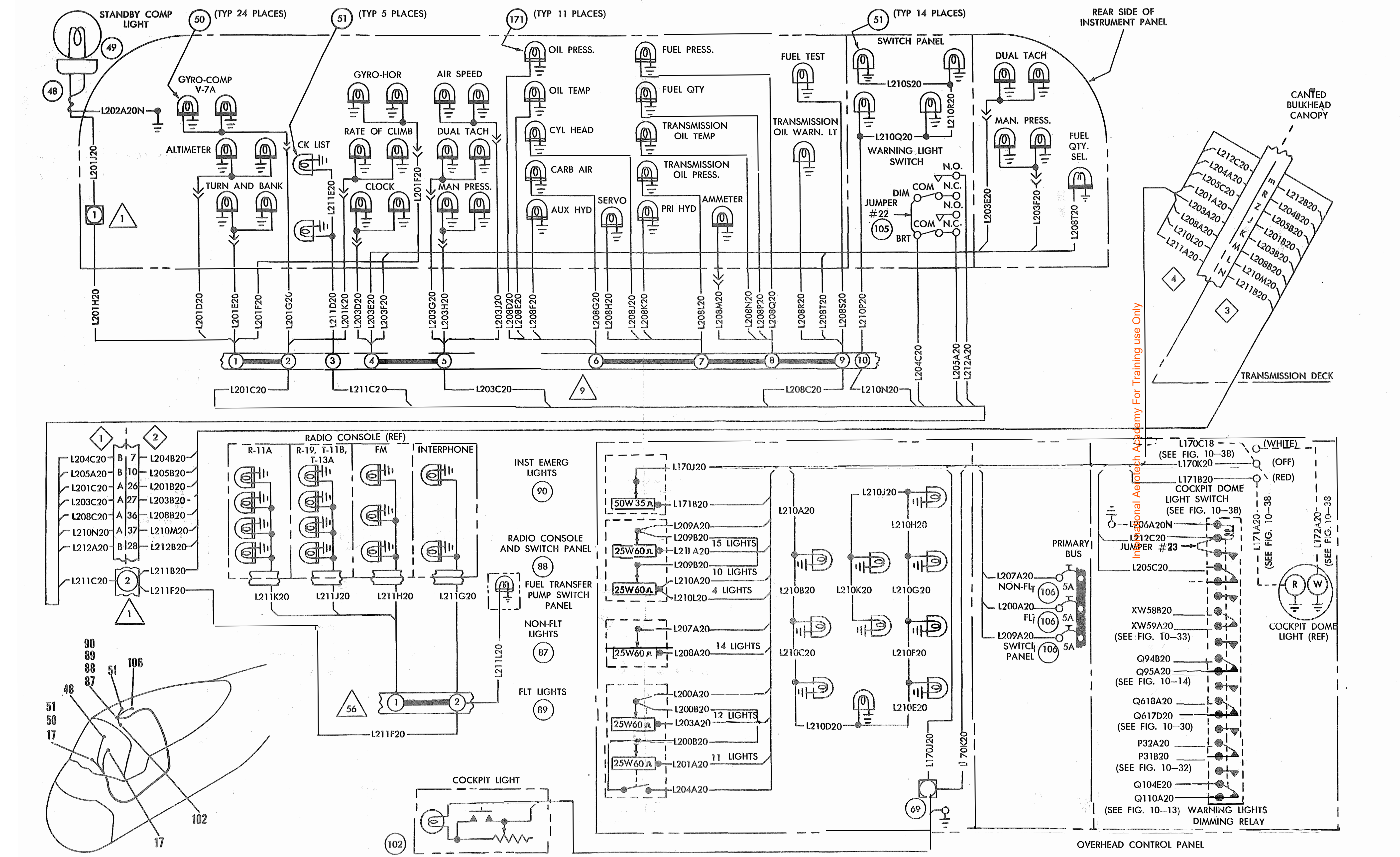


Figure 10–39. Console, Panel and Instrument Lights

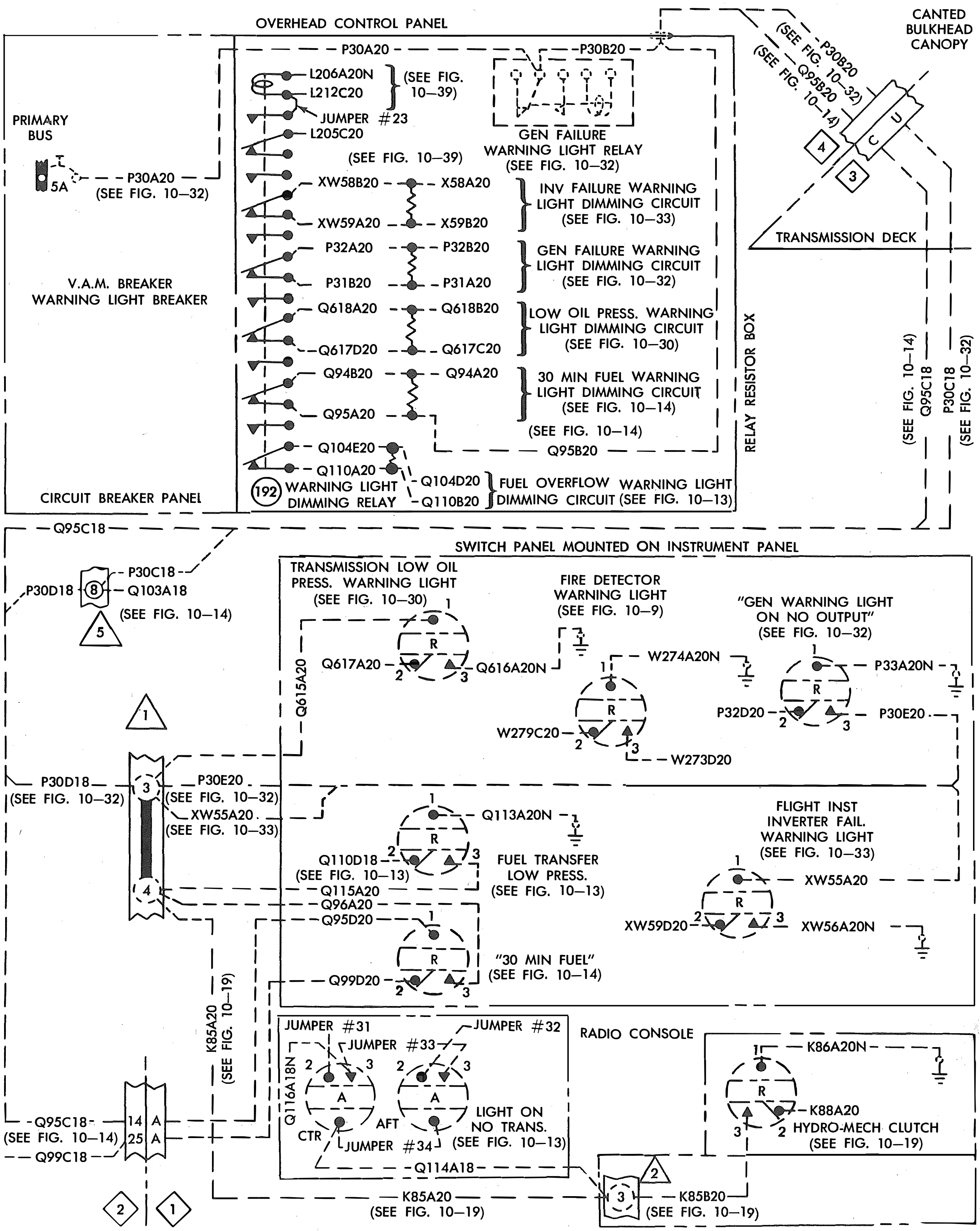


Figure 10—40. Warning Light Dimming Relay

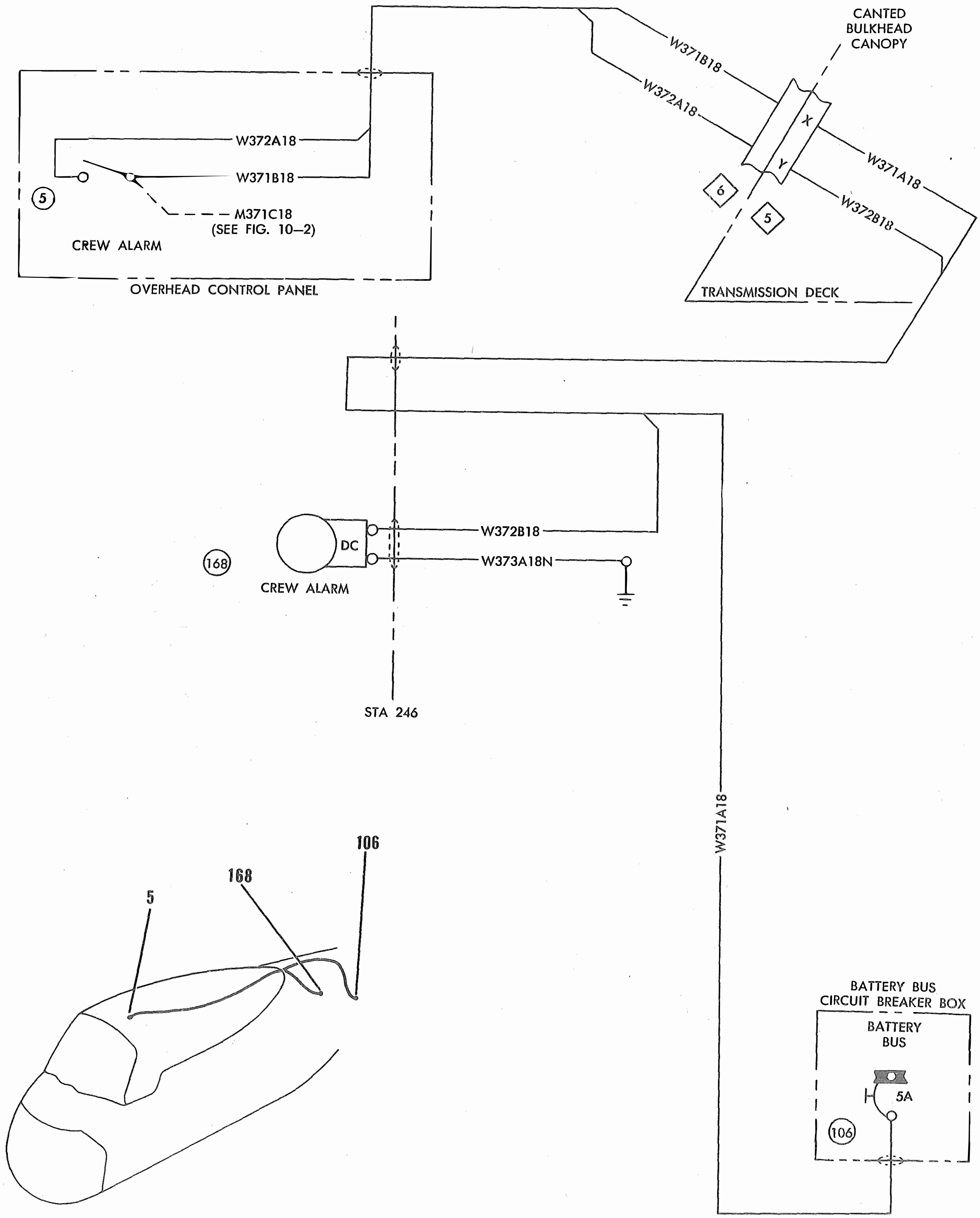


Figure 10—41. Crew Alarm Bell

INSTRUMENT PANEL DISCONNECT

L201J20	1	L201H20
L211C20	2	L211B20, L211F20
XW55A20, Q615A20	3	P30D18, P30E20
Q96A20	4	K85A20, Q115A20
Q605B18, Q605C18	5	Q605E18
Q610B18, Q610C18	6	Q610E18
E150C20	7	E150D20
E151B20	8	E151C20
E152B20	9	E152C20
Q110C18	10	Q110D18

1

CONSOLE

Q105C18	1	Q105D18
Q106A18	2	Q106E18, Q106B18, Q114A18
K85B20	3	K85A20
K87C16	4	K87B16
K88C16	5	K88B16
	6	
Q92B18	7	Q92A18
Q93B18	8	Q93A18
Q111B18	9	Q111A18
Q84B18	10	Q84A18

2

TUB STA 258

Q108C18, Q108D18	1	Q108B18
Q109C18, Q109D18	2	Q109B18
Q114A18, Q114B18	3	Q114C18

3

ELECTRICAL COMP'T STA 296

L226G18	1	L226E18, L226F18
Q106C18	2	Q106D20
Q108A18	3	Q108B18
Q109A18	4	Q109B18
Q111D18	5	Q111C18
Q84C18	6	Q84D18
Q103C18	7	Q103B18
Q104A20	8	Q104B18
	9	
Q97A20	10	Q97B20
Q98A20	11	Q98B20
Q99A20	12	Q99B18
L236D18, L236E18	13	L236G18, L236F18
L336D18	14	L336E18
Q92C18	15	Q92BB18
Q93C18	16	Q93BB18
Q90D20	17	Q90C18
Q91D20	18	Q91C18
Q102D20	19	Q102C18

4

CABIN R.H. STA 131

P23C16, P23B16	1	P23F18
	2	
Q80A18	3	K72C18, K72B18
D155B18	4	D155E18, D155C18
D156E18	5	D156B18, D156C18
L170F18, L170D18	6	L170A18, L170B18
H306B18	7	H306F18, H306C18
P30D18	8	P30C18, Q103A18
Q105B18	9	Q105C18
	10	

5

IGNITION JUNCTION BOX #2

J71C18	1	J71D18
J78B18	2	J78A18
J75D18	3	J75C18
J76D18	4	J76C18

6

D.C. POWER JUNCTION BOX #1

J71B18	1	J71A18
P5B16	2	P5C18
P12C18	3	P12B18
P15D16	4	P15C12, P15B12
P21A18	5	P21B18
K73B18	6	K73C18
	7	

7

Figure 10—42. Post Terminal Charts — Electrical (Sheet 1 of 5)

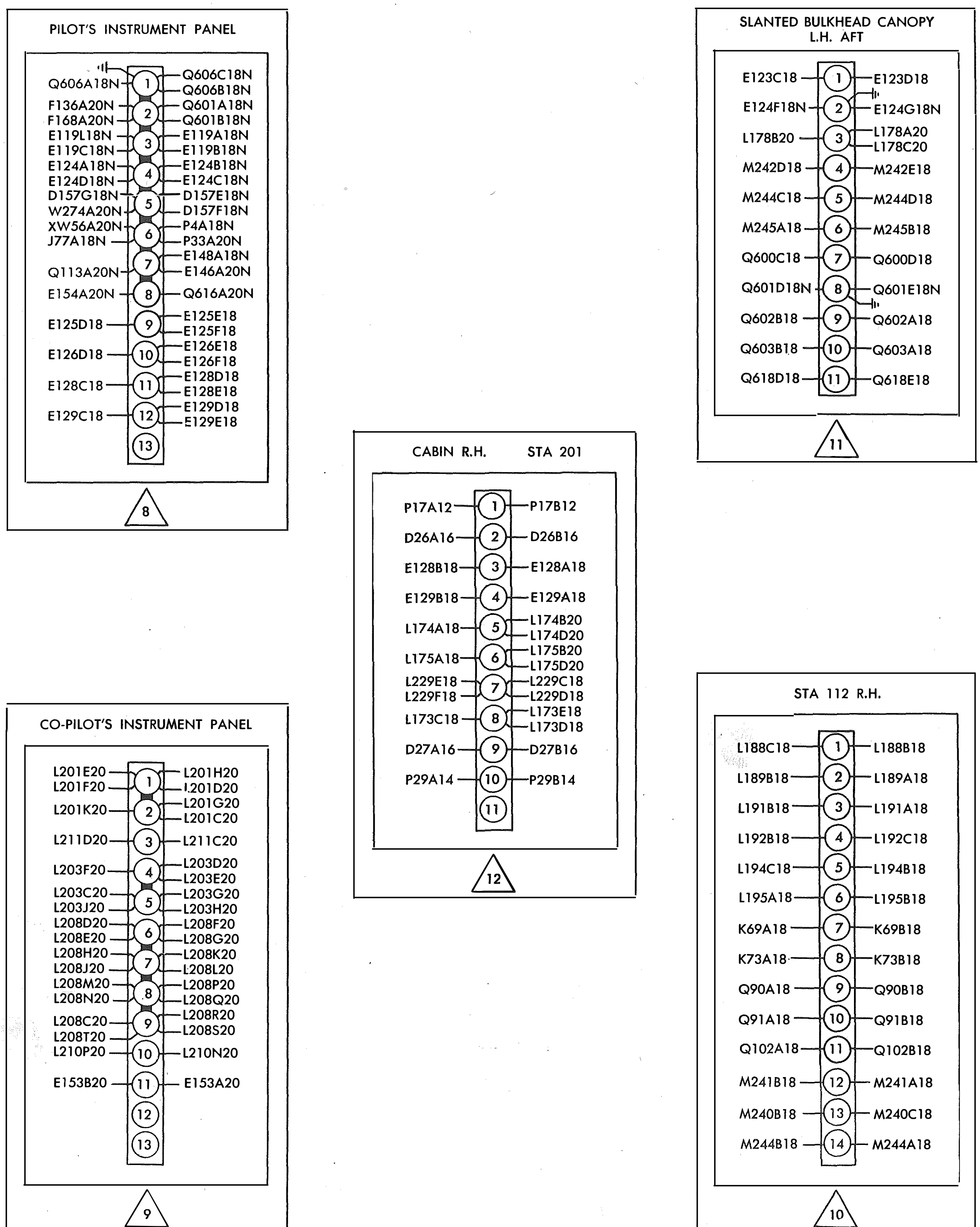


Figure 10—42. Post Terminal Charts — Electrical (Sheet 2 of 5)

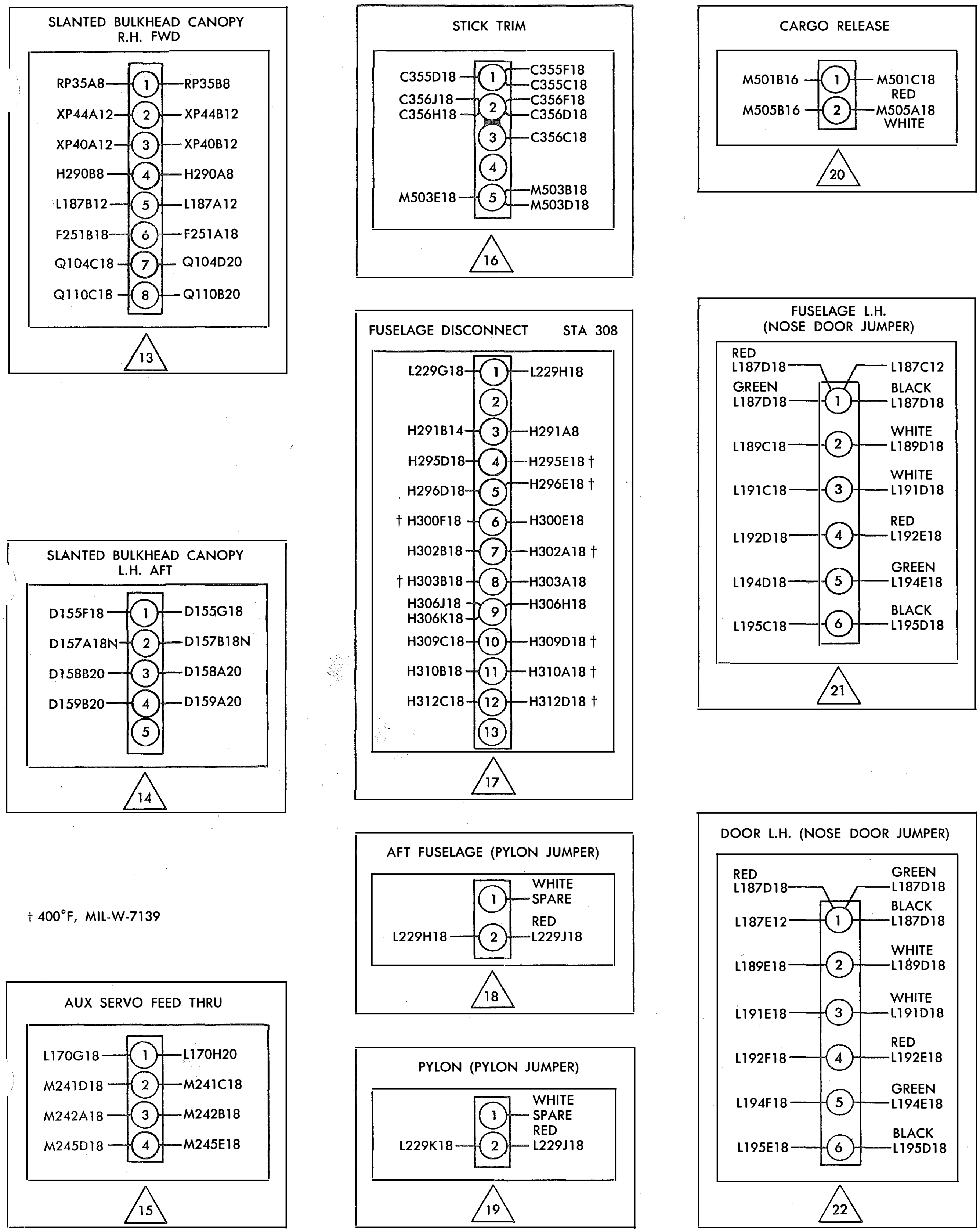


Figure 10—42. Post Terminal Charts — Electrical (Sheet 3 of 5)

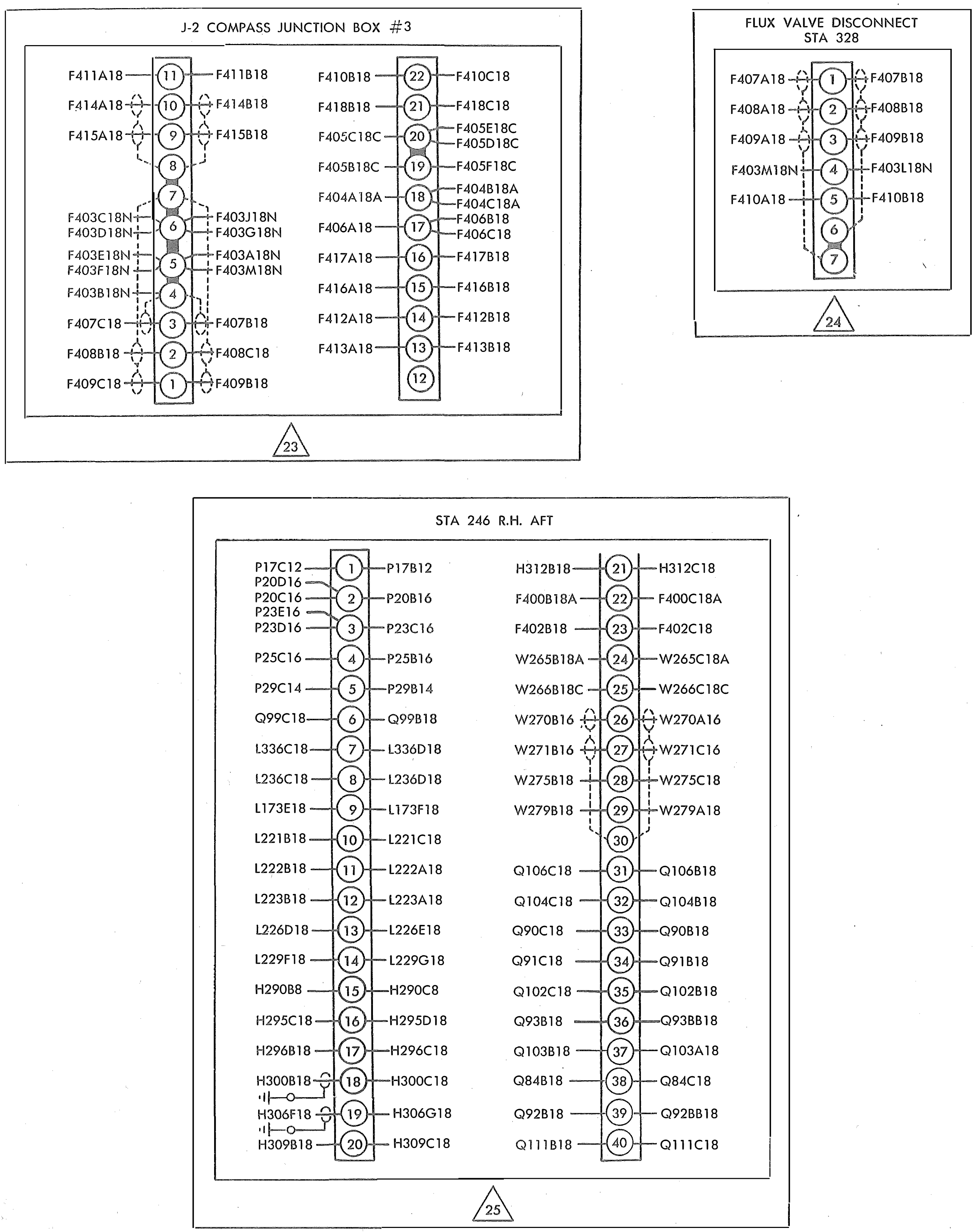


Figure 10–42. Post Terminal Charts — Electrical (Sheet 4 of 5)

ENGINE SHROUD CARB AIR TEMP

E118D18	1	E118E18
E119H18N	2	E119J18N

27

STA 93 L.H.

LEADS TO SENSOR ELEMENT	1	Q90A18
	2	Q91A18
	3	Q102A18

28

STA 246 R.H. AFT

XP40B12	1	XP40C12
XP43B18	2	XP43C18
XP44B12	3	XP44C12
XP47B18	4	XP47C18
X48C18A	5	X48B18A
X50D18C	6	X50C18C
X54B18C	7	X54A18C

29

STA. 93

E152A20	1	E152B20
E151A20	2	E151B20
E150B20	3	E150C20
Q101B16	4	Q101C16

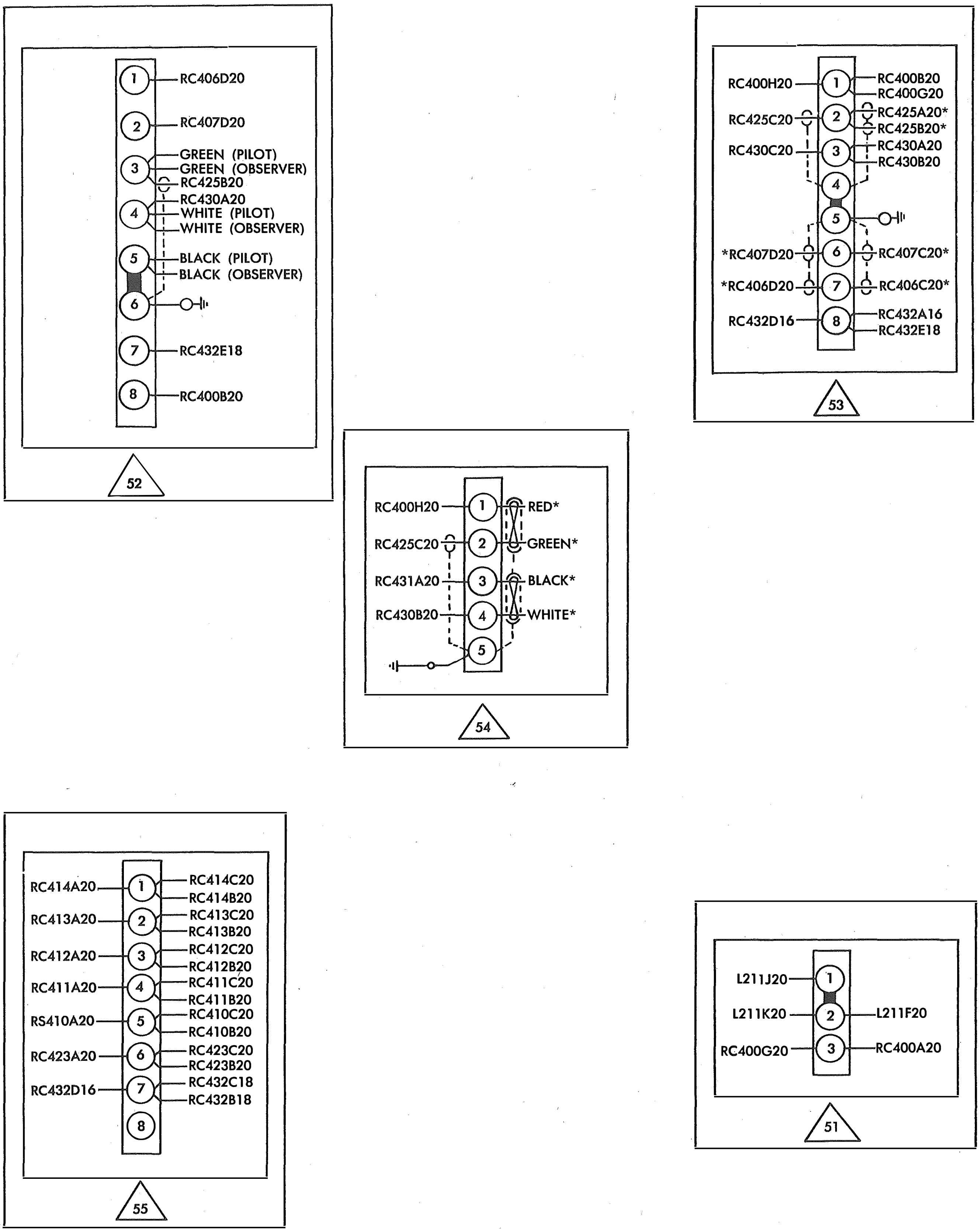
30

CANOPY R.H. AFT

E123B18	1	E123C18
E124E18N	2	E124F18N
D155E18	3	D155F18
D157D18N	4	D157C18N D157B18N
D158C20	5	D158B20
D159C20	6	D159B20
L170D18	7	L170E20
M242C18	8	M242D18
M244C18	9	M244B18
M245C18	10	M245B18
Q600C18	11	Q600E18 Q600B18
Q601D18N	12	Q601C18N
Q602B18	13	Q602C18
Q603B18	14	Q603C18
Q618D18	15	Q618C18

26

Figure 10—42. Post Terminal Charts — Electrical (Sheet 5 of 5)



*SHIELDED

Figure 10—43. Post Terminal Charts — Radio

INSTRUMENT PANEL DISCONNECT

TOP

A

8	P15E18
1	E129C18
9	P20A18
2	E124D18N
10	P23G18
3	E123A18
11	P25A18
4	E128C18
12	D26C16
5	F166C20A
13	D27C16
6	F165C20C
14	Q95D20
7	P5A18
15	P32D20
16	XP42C18
17	XP43A18
18	XP46C18
19	XP47A18
20	XW59D20
21	D157E18N
22	E131C18
23	D156D18
24	D155D18
25	Q99D20
26	L201C20
34	E122C18
27	L203C20
35	E117C18
28	F135C20
36	L208C20
29	Q80B18
37	L210N20
30	W273C20
38	W275A20
31	E120C18
39	W279C20
32	E145C20
40	Q617A20
33	

B

8	Q81A18
1	E126D18
9	
2	E125D18
10	L205A20
3	E121A18
11	Q101A16
4	E119C18N
12	Q100C16
5	E118A18
13	F406D18
6	Q82A18
14	F418A18
7	L204C20
15	F403H18N
16	F405G18C
17	F417C18
18	F416C18
19	F403K18N
20	F402A18
21	
22	
23	
24	E132A18
25	
26	D158D20
34	Q600F18
27	D159D20
35	Q601B18N
28	L212A20
36	Q602D18
29	D160B20
37	Q603D18
30	D161B20
38	Q606C18N
31	Q611C18
39	Q607C18
32	Q612C18
40	Q608C18
33	

CANNON-20585 1 PLUG

INSTRUMENT PANEL DISCONNECT

TOP

B

26	D158C20
34	Q600E18
27	D159C20
35	Q601C18N
28	L212B20
36	Q602C18
29	D160A20
37	Q603C18
30	D161A20
38	Q606D18N
31	Q611B18
39	Q607B18
32	Q612B1B
40	Q608B18
33	
16	F405F18C
17	F417B18
18	F416B18
19	F403J18N
20	F402B18
21	
22	
23	
24	E132B18
25	
8	Q81B18
1	E126C18
9	
2	E125C18
10	L205B20
3	E121B18
11	Q101B16
4	E119D18N
12	Q100B16
5	E118818
13	F406C18
6	Q82B18
14	F418B18
7	L204B20
15	F403G18N

A

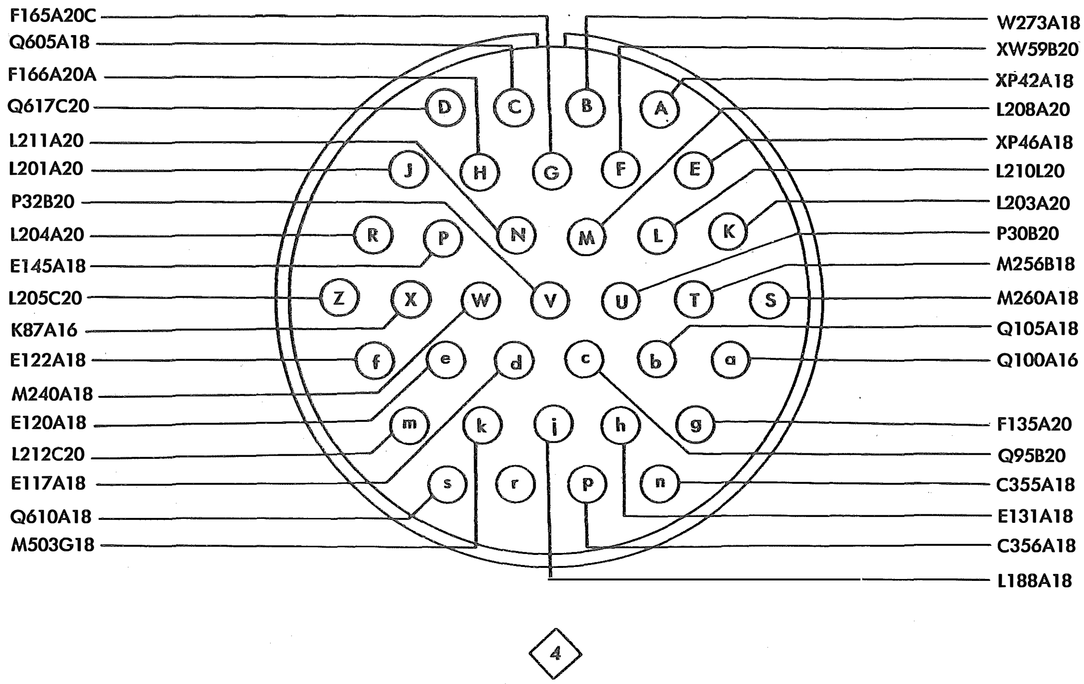
26	L201B20
34	E122B18
27	L203B20
35	E117B18
28	F135B20
36	L208B20
29	Q80A18
37	L210M20
30	W273B18
38	W275818
31	E120B18
39	W279B18
32	E145B18
40	Q617B18
33	
16	XP42B18
17	XP43B18
18	XP46B18
19	XP47B18
20	XW59C18
21	D157D18N
22	E131B18
23	D156C18
24	D155C18
25	Q99C18
8	P15D16
1	E129B18
9	P20B16
2	E124E18N
10	P23F18
3	E123B18
11	P25B16
4	E128B18
12	D26B16
5	F166B20A
13	D27B16
6	F165B20C
14	Q95C18
7	P5816
15	P32C18

CANNON-20584 2 RECEPTACLE

Figure 10—44. Disconnect Plug and Receptacle Charts — Electrical (Sheet 1 of 7)

CANOPY DISCONNECT

AN3102E-28-21S RECEPT.



AN3108E-28-21P PLUG

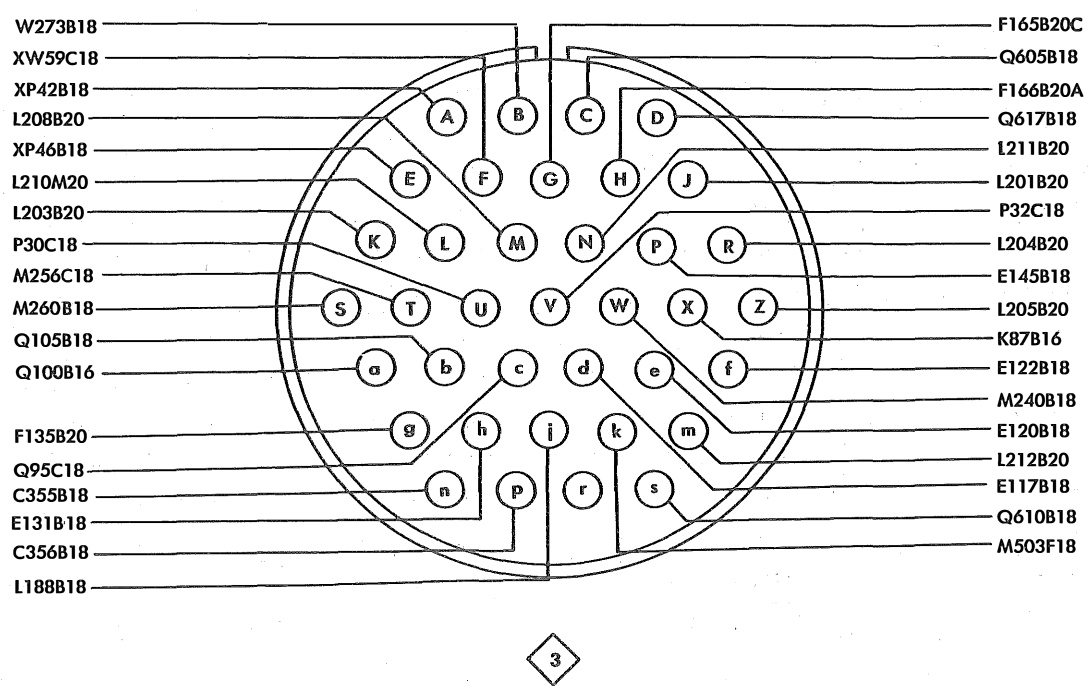
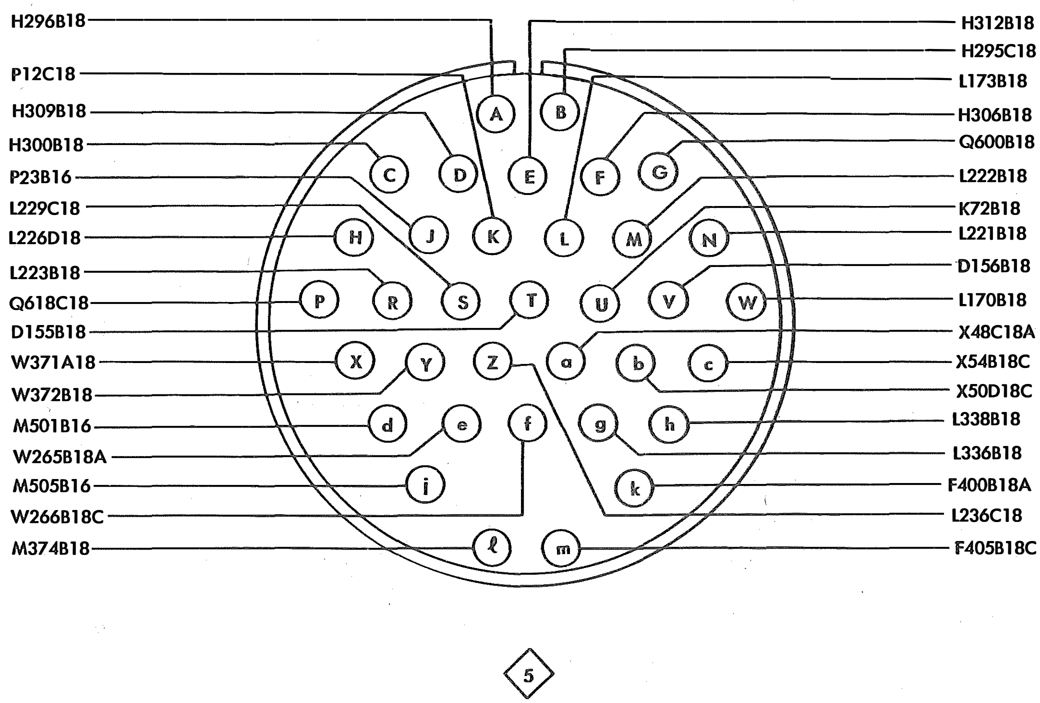


Figure 10—44. Disconnect Plug and Receptacle Charts — Electrical (Sheet 2 of 7)

CANOPY DISCONNECT

AN3108E-28-15P PLUG



AN3102E-28-15S RECEPT

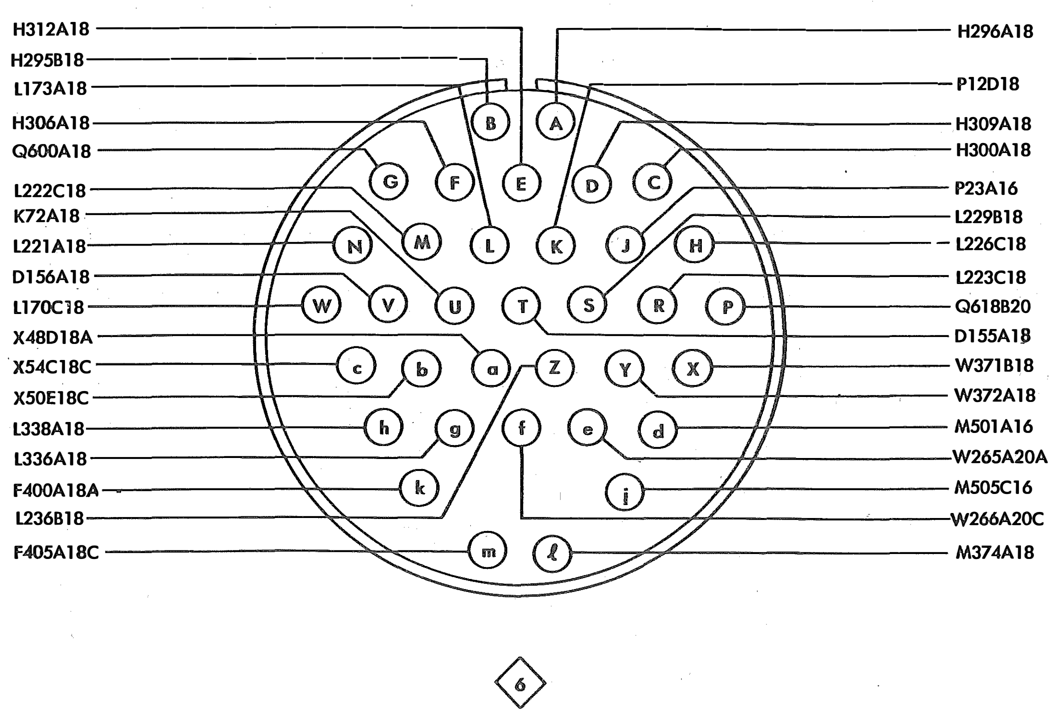
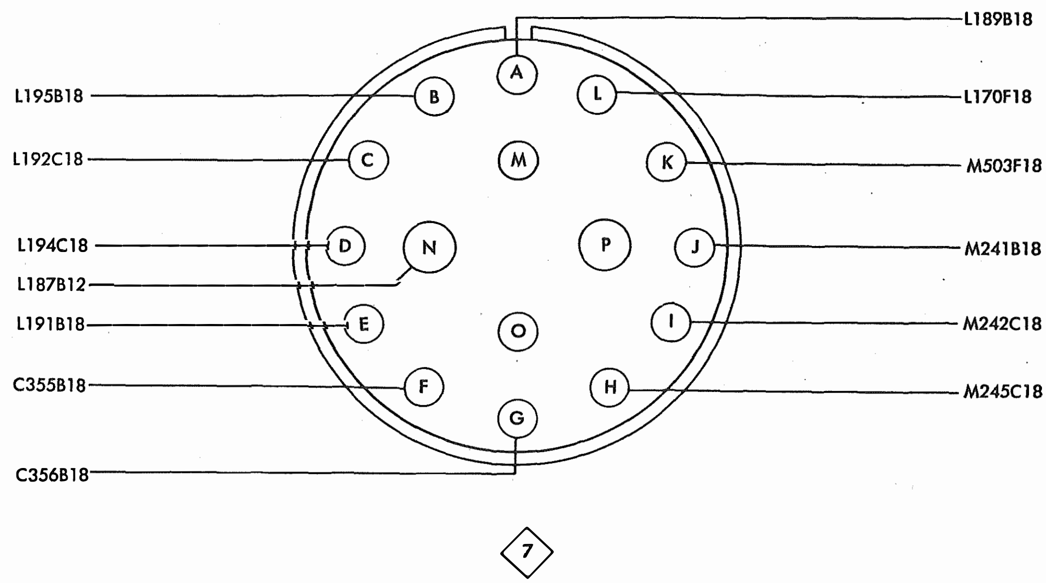


Figure 10—44. Disconnect Plug and Receptacle Charts—Electrical (Sheet 3 of 7)

OBSERVER'S FLOOR

AN3108E-24-7S PLUG



FWOO-24-7P RECEPT

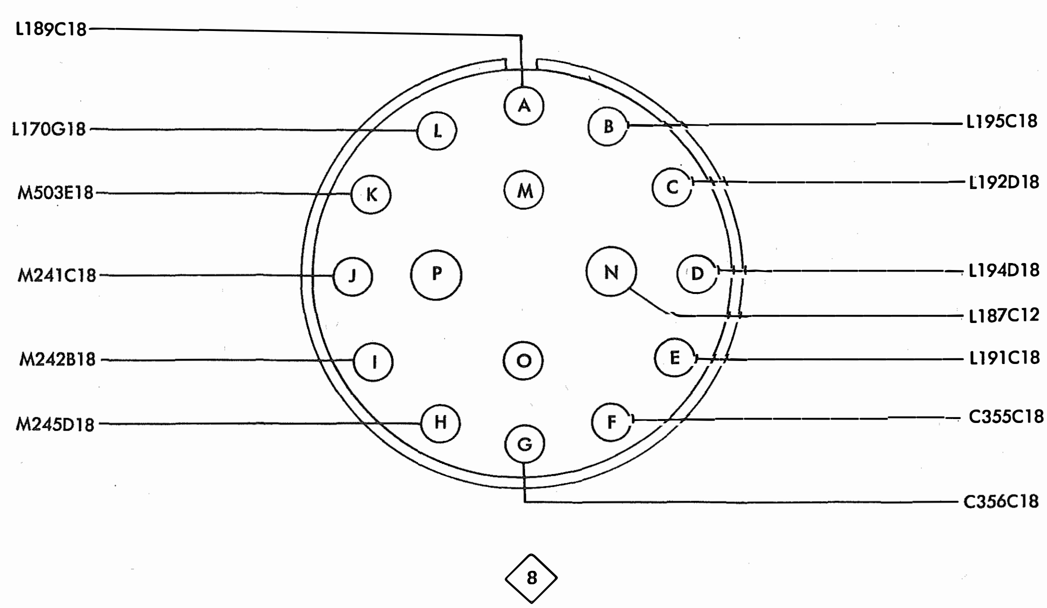
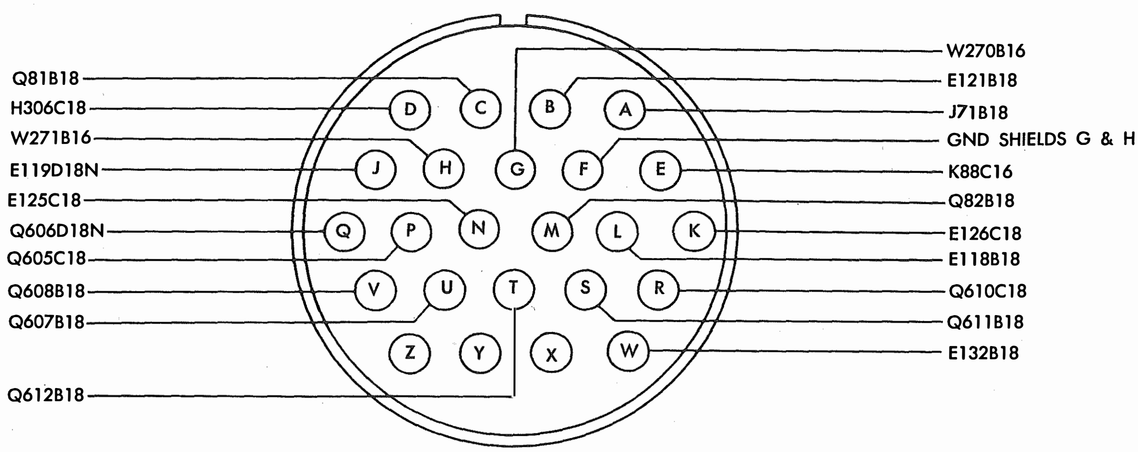


Figure 10—44. Disconnect Plug and Receptacle Charts — Electrical (Sheet 4 of 7)

OBSERVER'S FLOOR

AN3108E-24-28S PLUG



FWOO-24-28P RECEPT

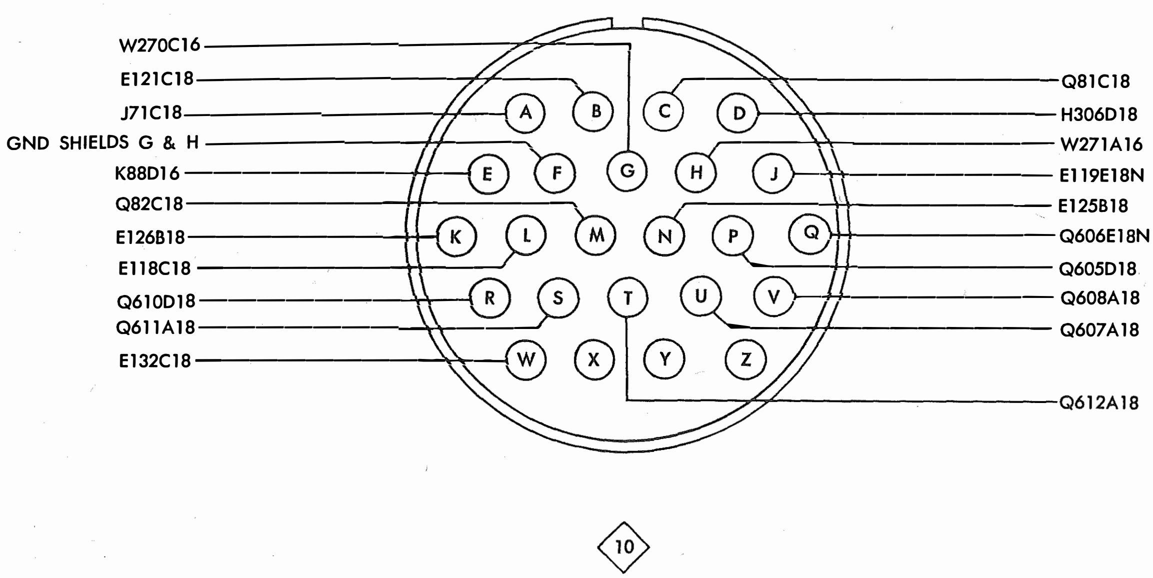
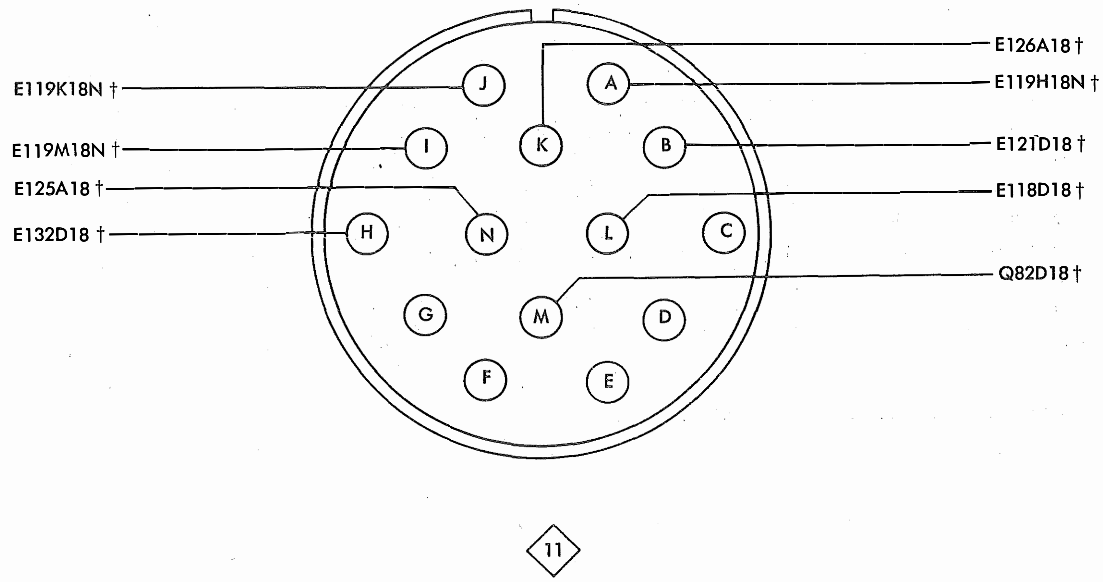


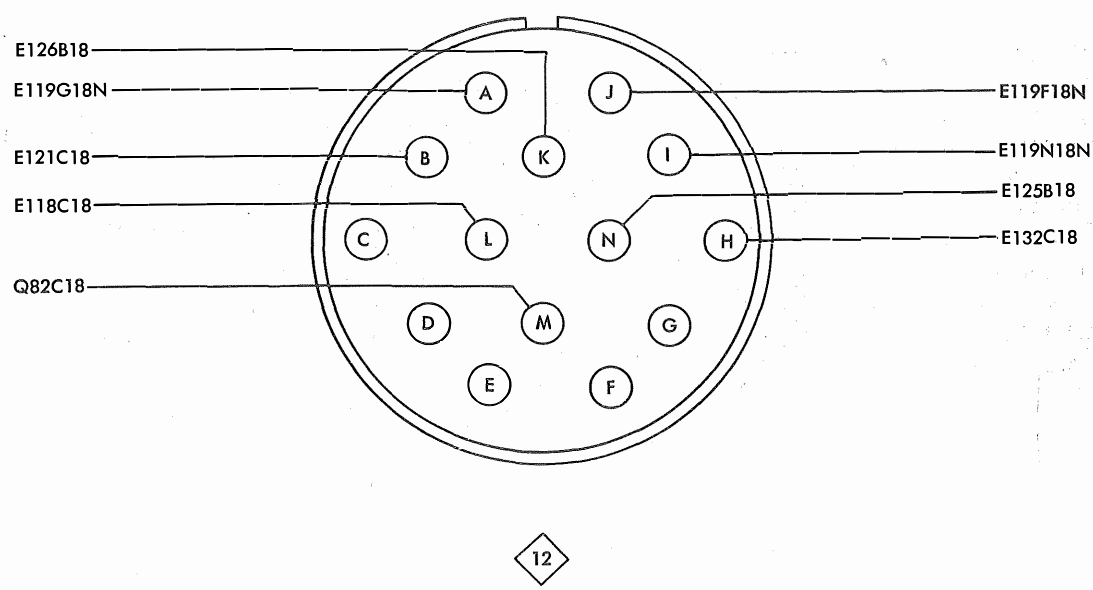
Figure 10—44. Disconnect Plug and Receptacle Charts — Electrical (Sheet 5 of 7)

ENGINE DISCONNECT

AN3108E-20-27P PLUG



AN3100E-20-27S RECEPT



† 400°F, MIL-W-7139

Figure 10—44. Disconnect Plug and Receptacle Charts — Electrical (Sheet 6 of 7)

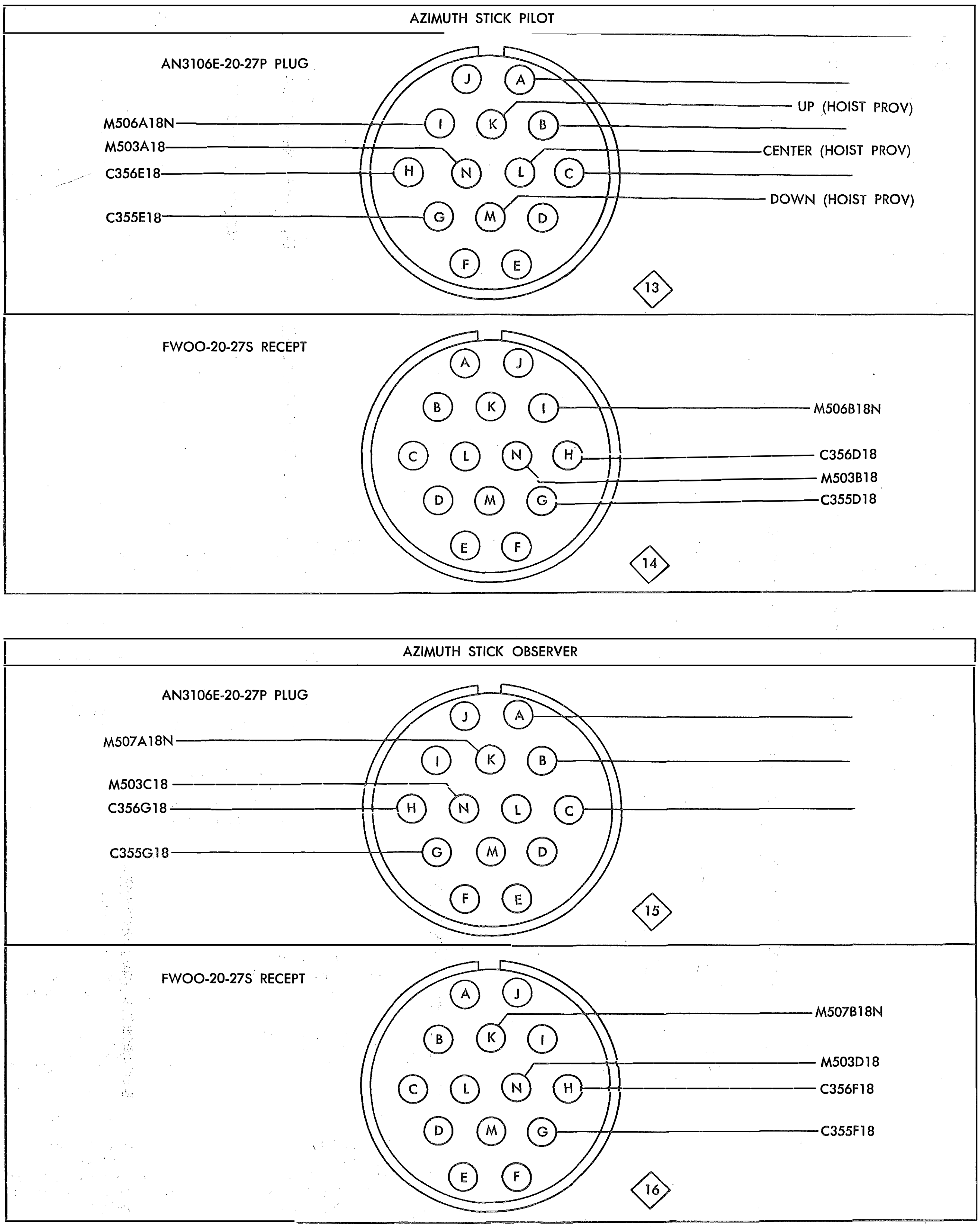


Figure 10—44. Disconnect Plug and Receptacle Charts — Electrical (Sheet 7 of 7)

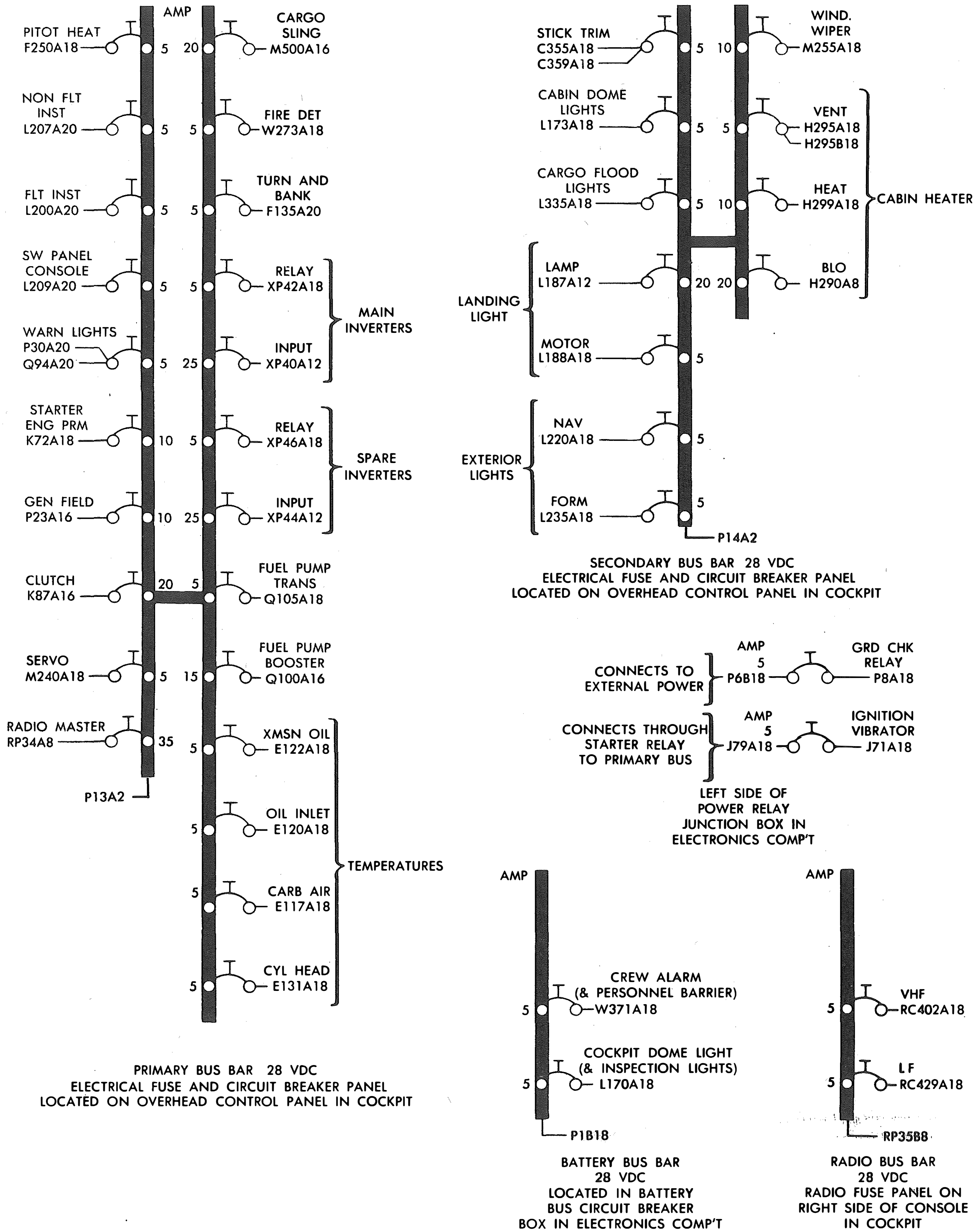


Figure 10—45. Circuit Breaker Diagrams — Electrical

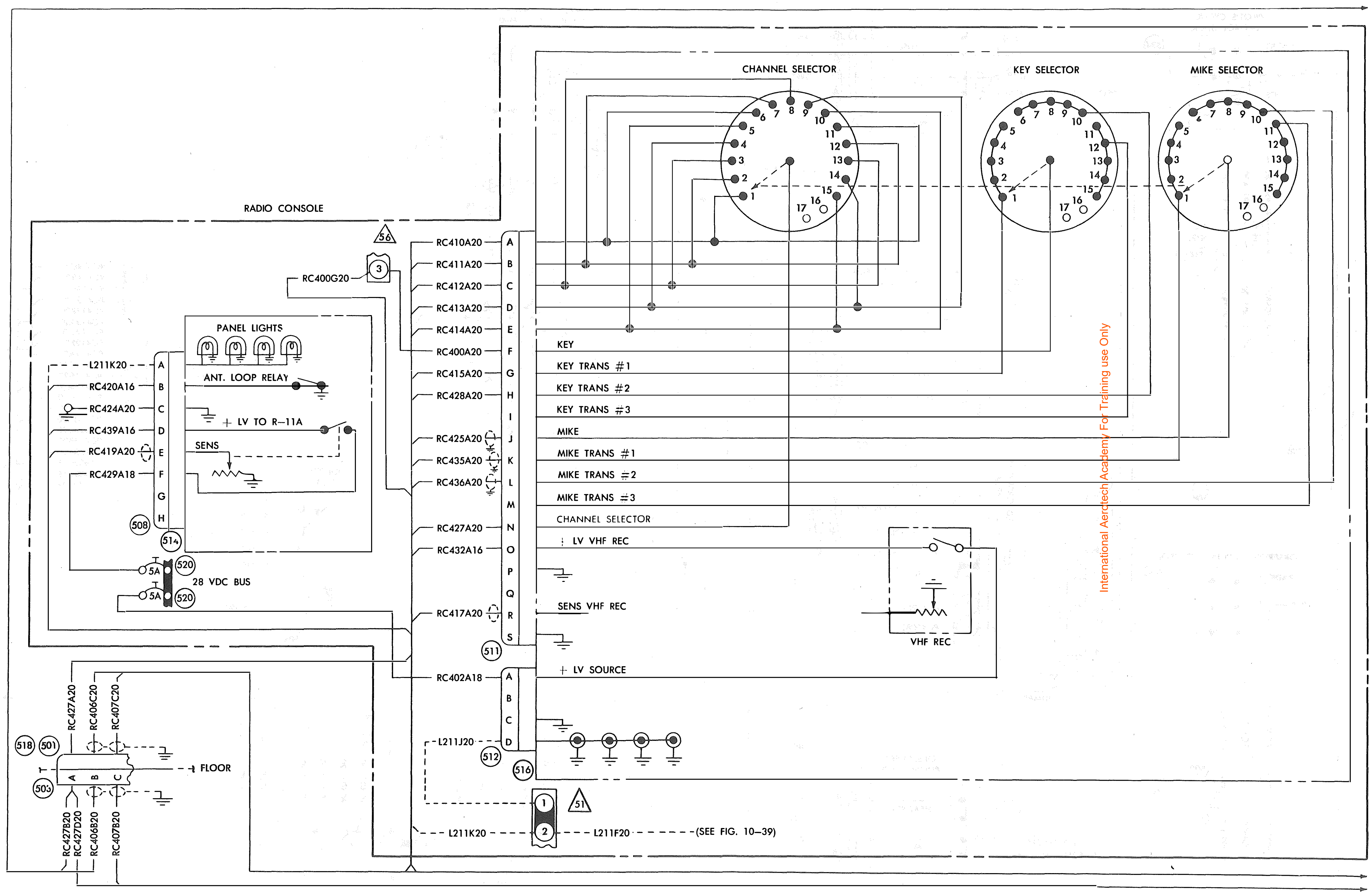


Figure 10–46. VHF Command Set, LF Navigation Receiver and Interphone (A.R.C. Type 12) (Sheet 1 of 3)

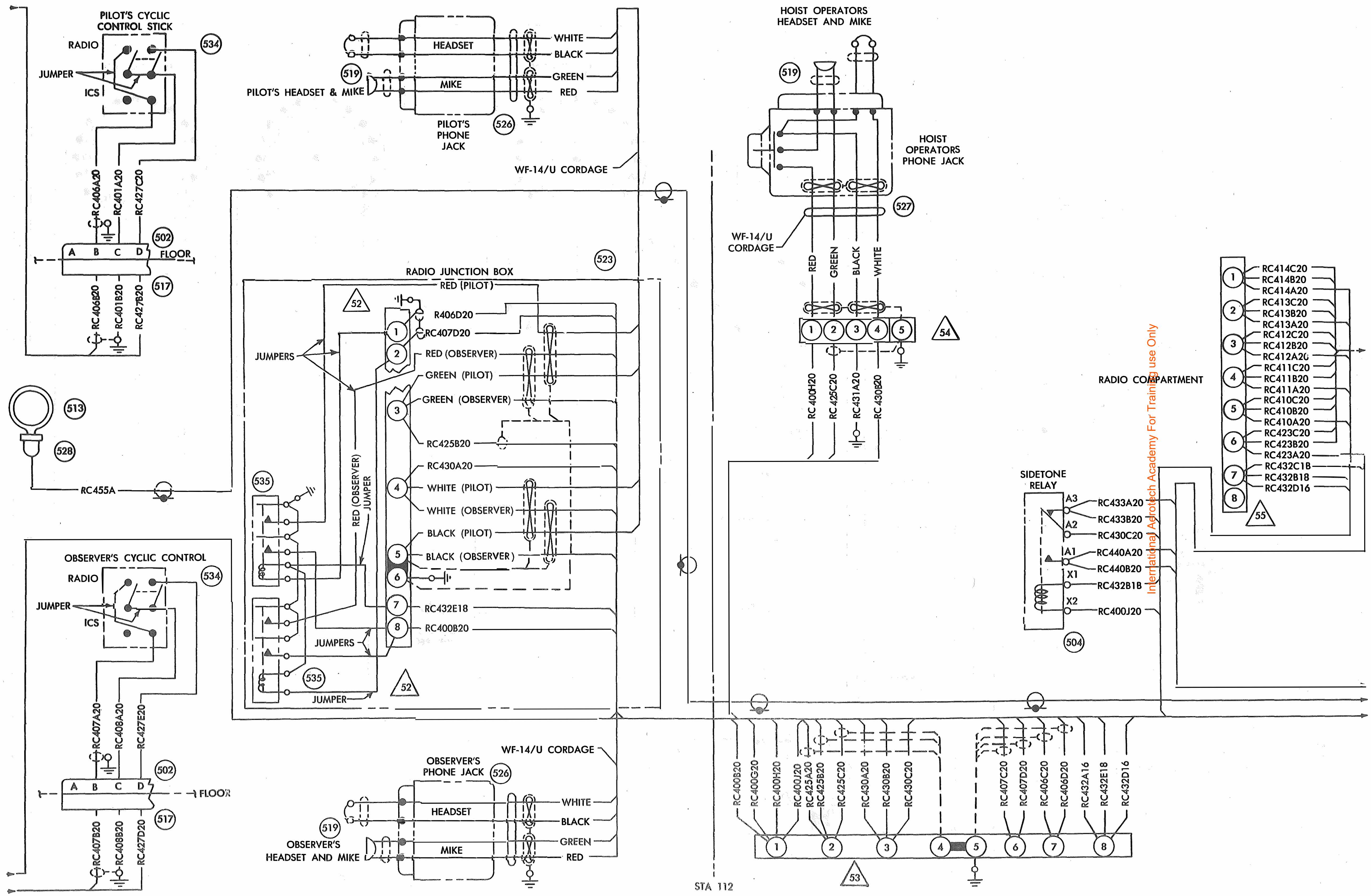


Figure 10–46. VHF Command Set, LF Navigation Receiver and Interphone (A.R.C. Type 12) (Sheet 2 of 3)

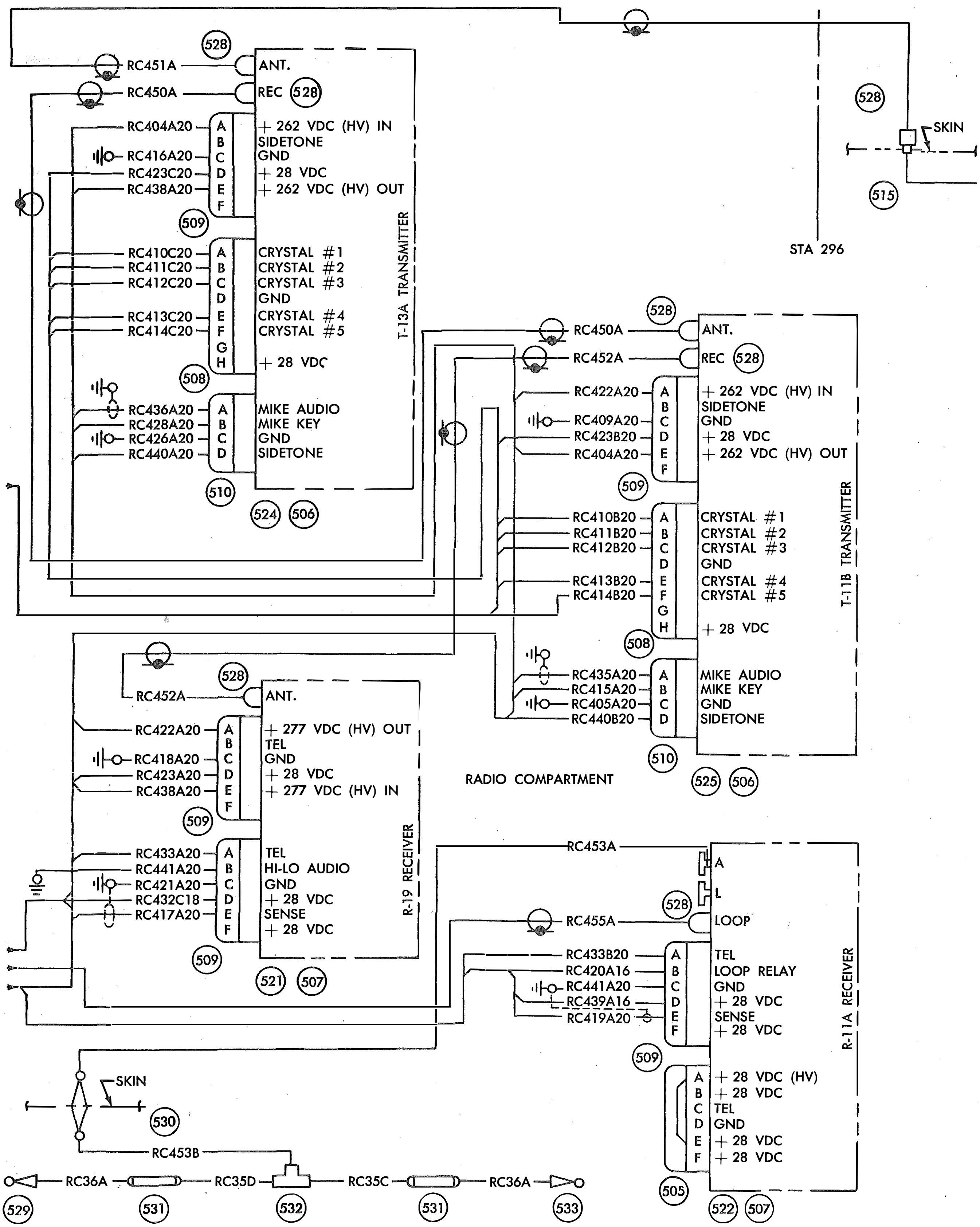


Figure 10—46. VHF Command Set, LF Navigation Receiver and Interphone (A.R.C. Type 12) (Sheet 3 of 3)

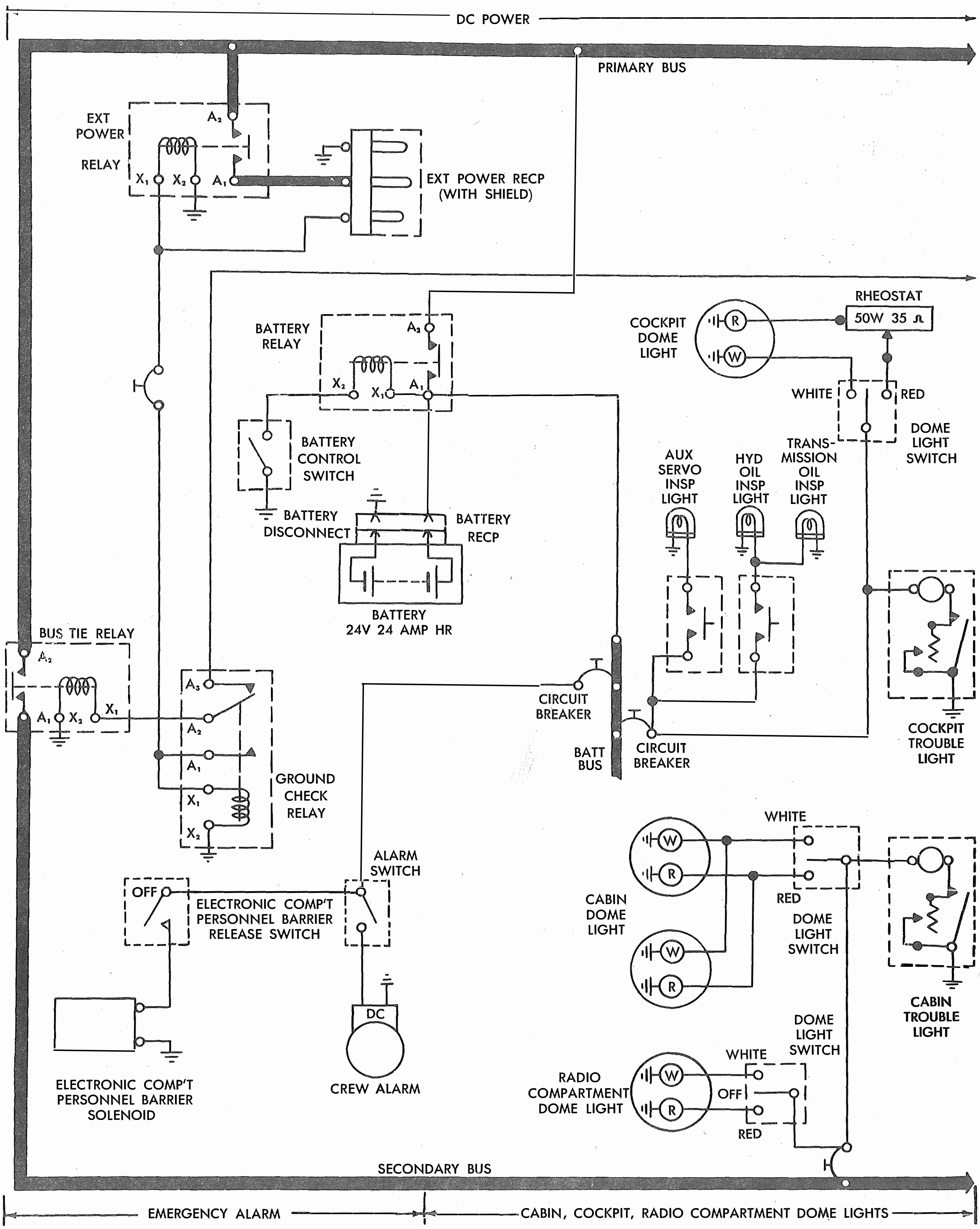


Figure 10—47. DC Electrical Schematic (Sheet 1 of 9)

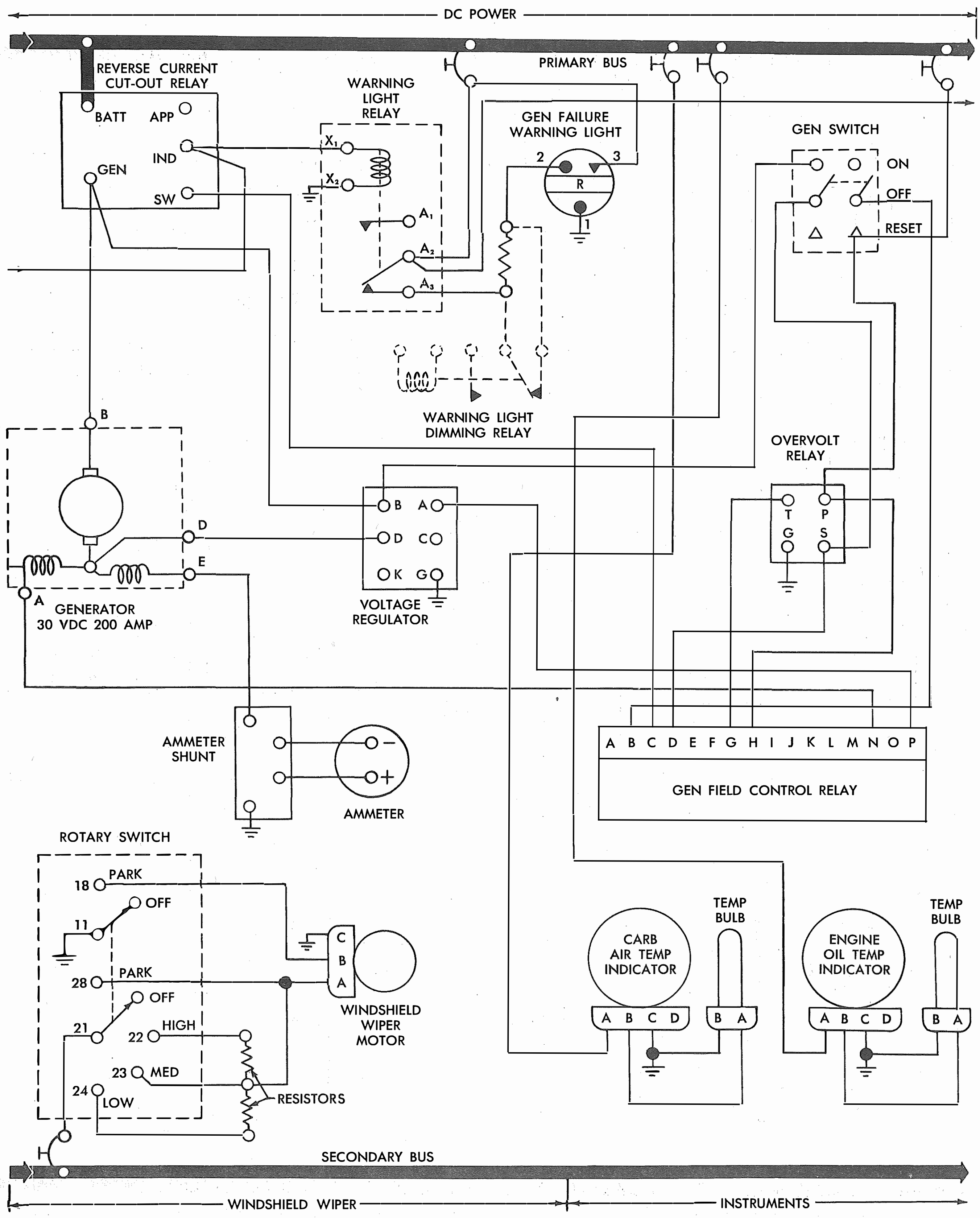


Figure 10–47. DC Electrical Schematic (Sheet 2 of 9)

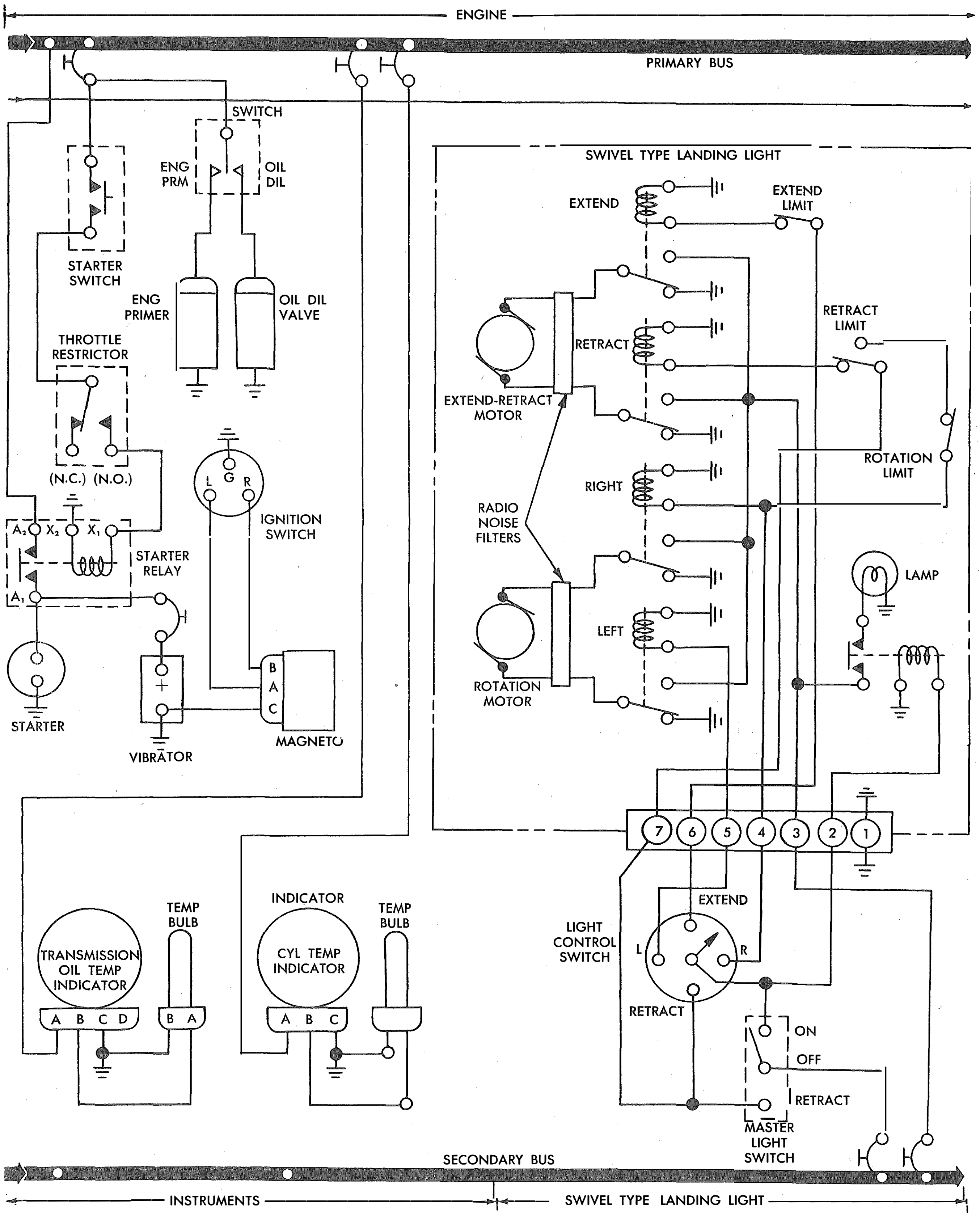


Figure 10–47. DC Electrical Schematic (Sheet 3 of 9)

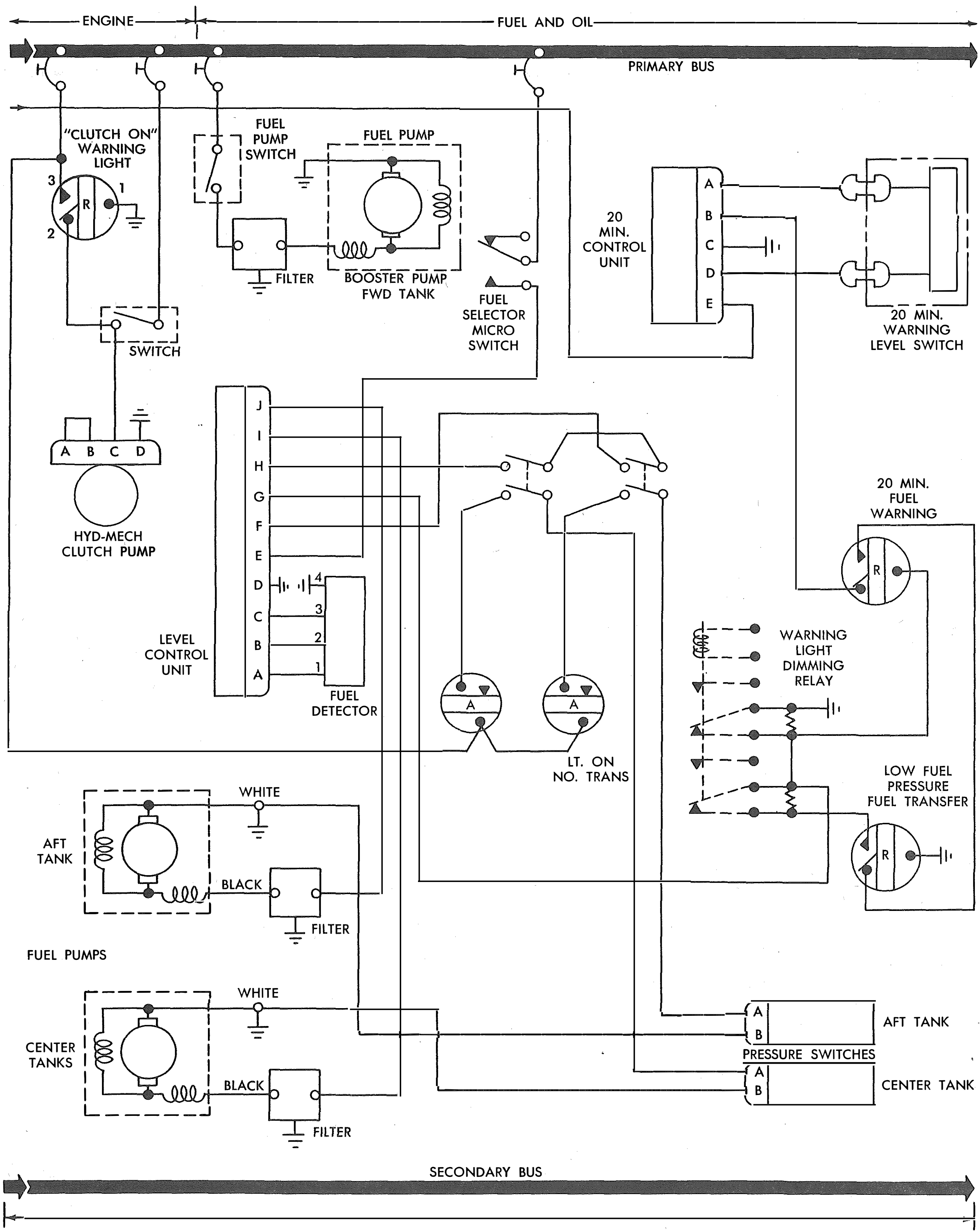


Figure 10—47. DC Electrical Schematic (Sheet 4 of 9)

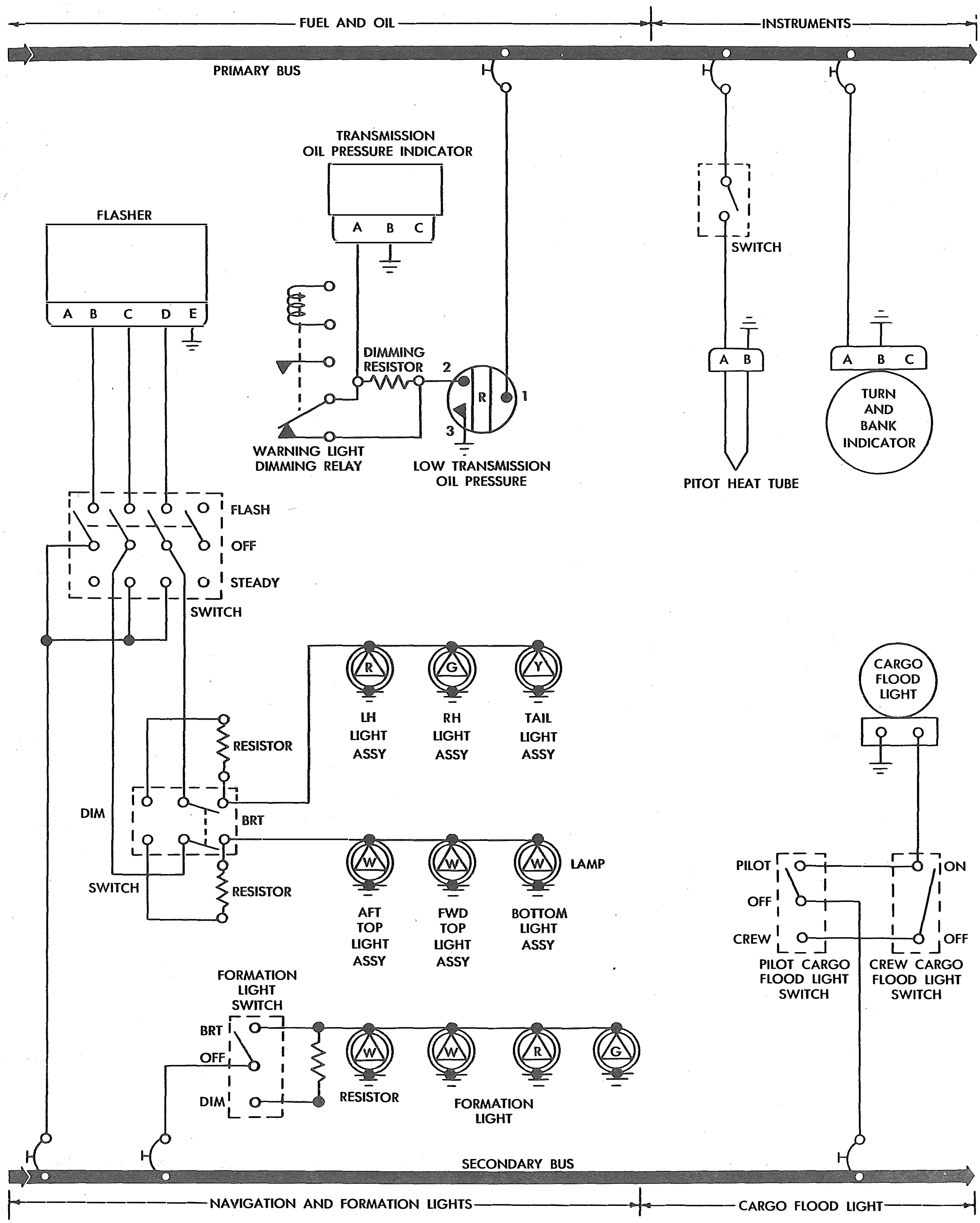


Figure 10—47. DC Electrical Schematic (Sheet 5 of 9)

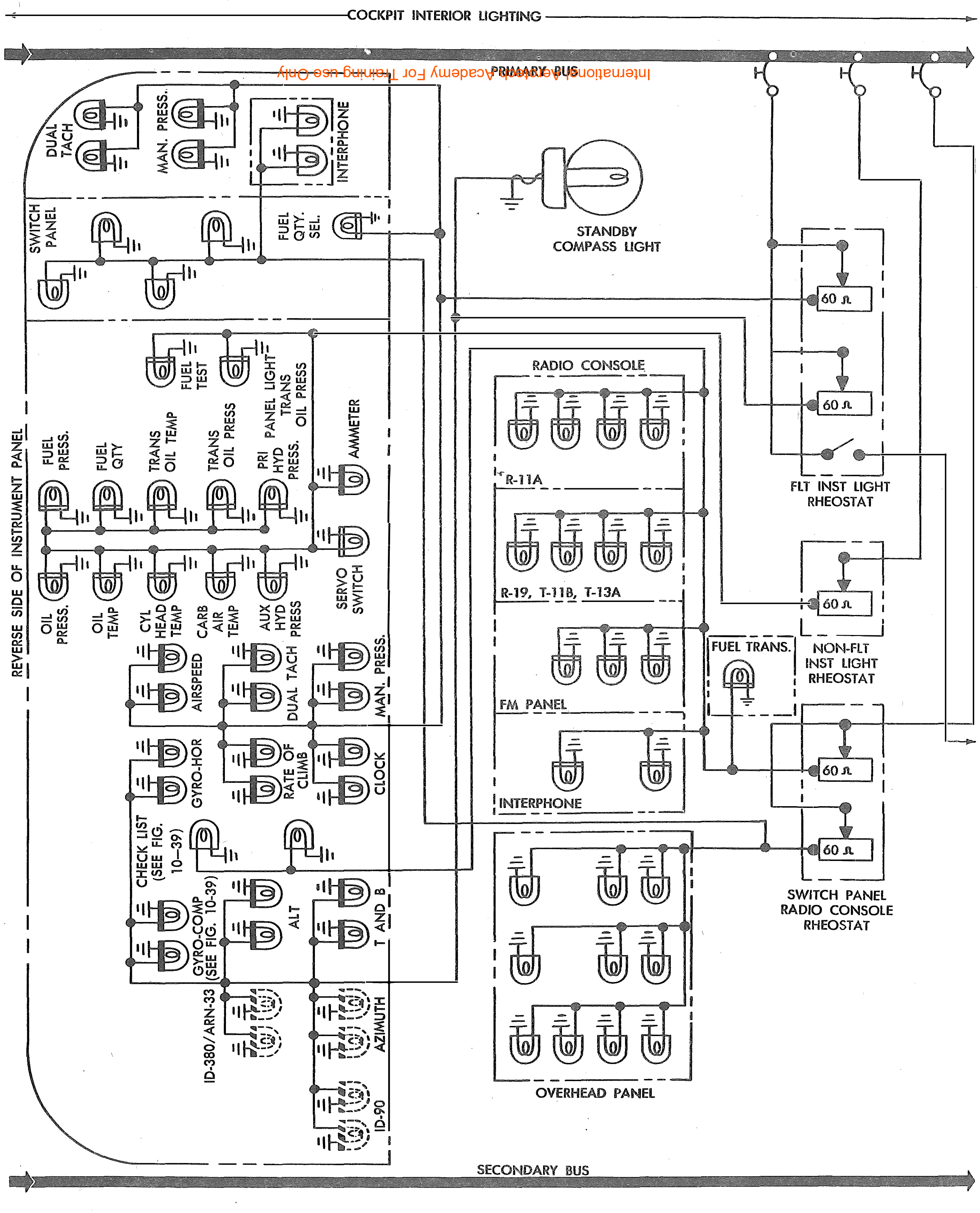


Figure 10—47. DC Electrical Schematic (Sheet 6 of 9)

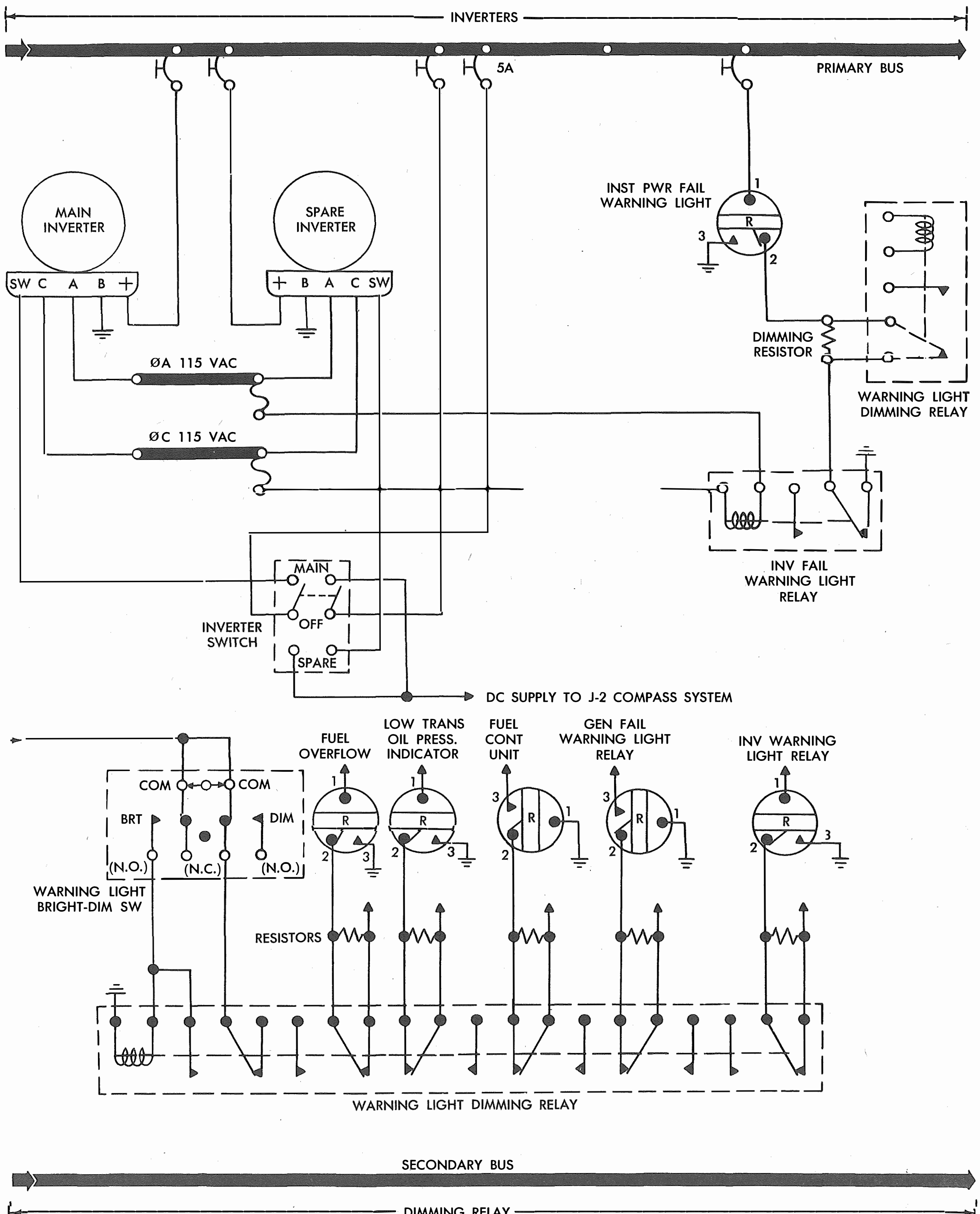


Figure 10—47. DC Electrical Schematic (Sheet 7 of 9)

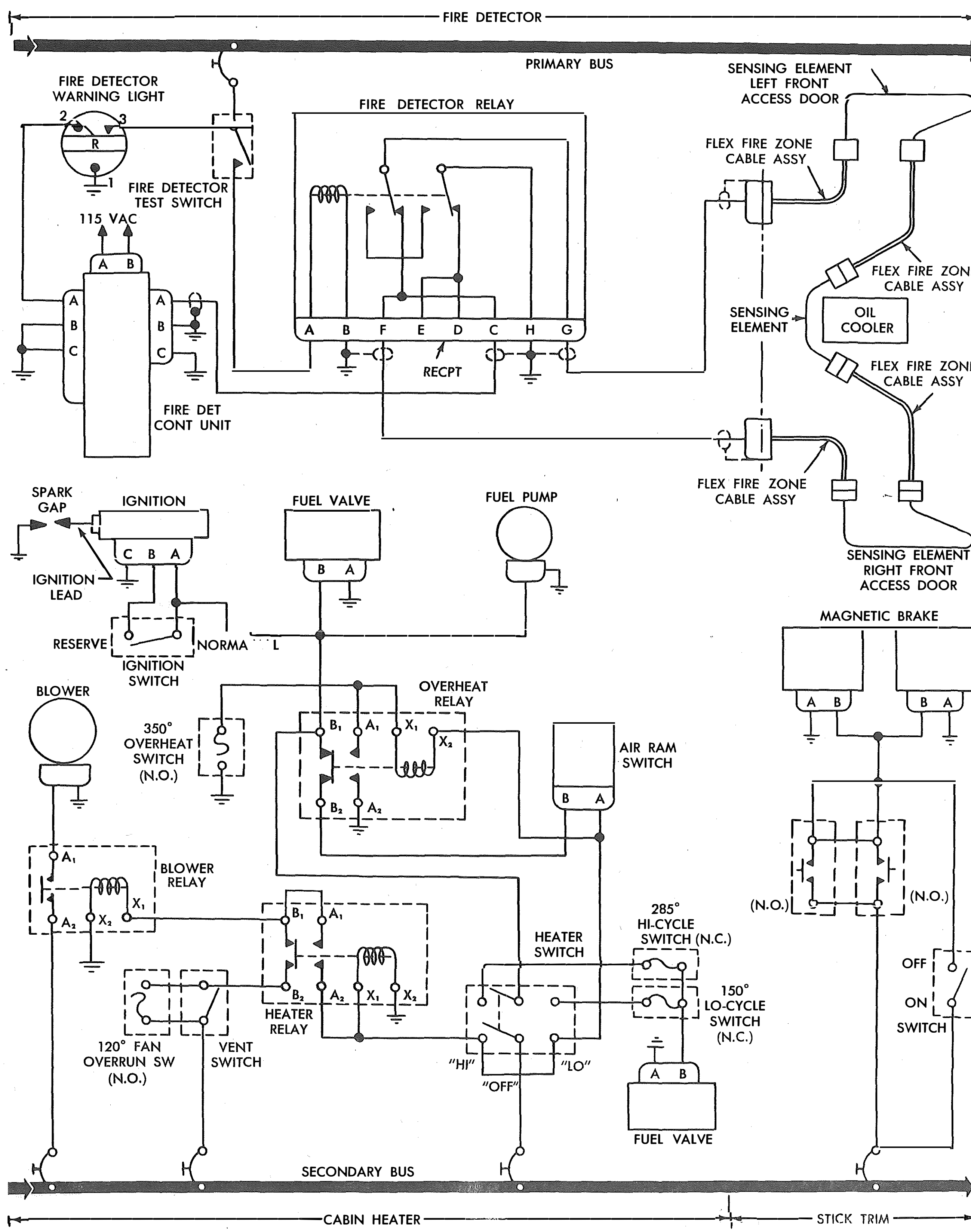


Figure 10–47. DC Electrical Schematic (Sheet 8 of 9)

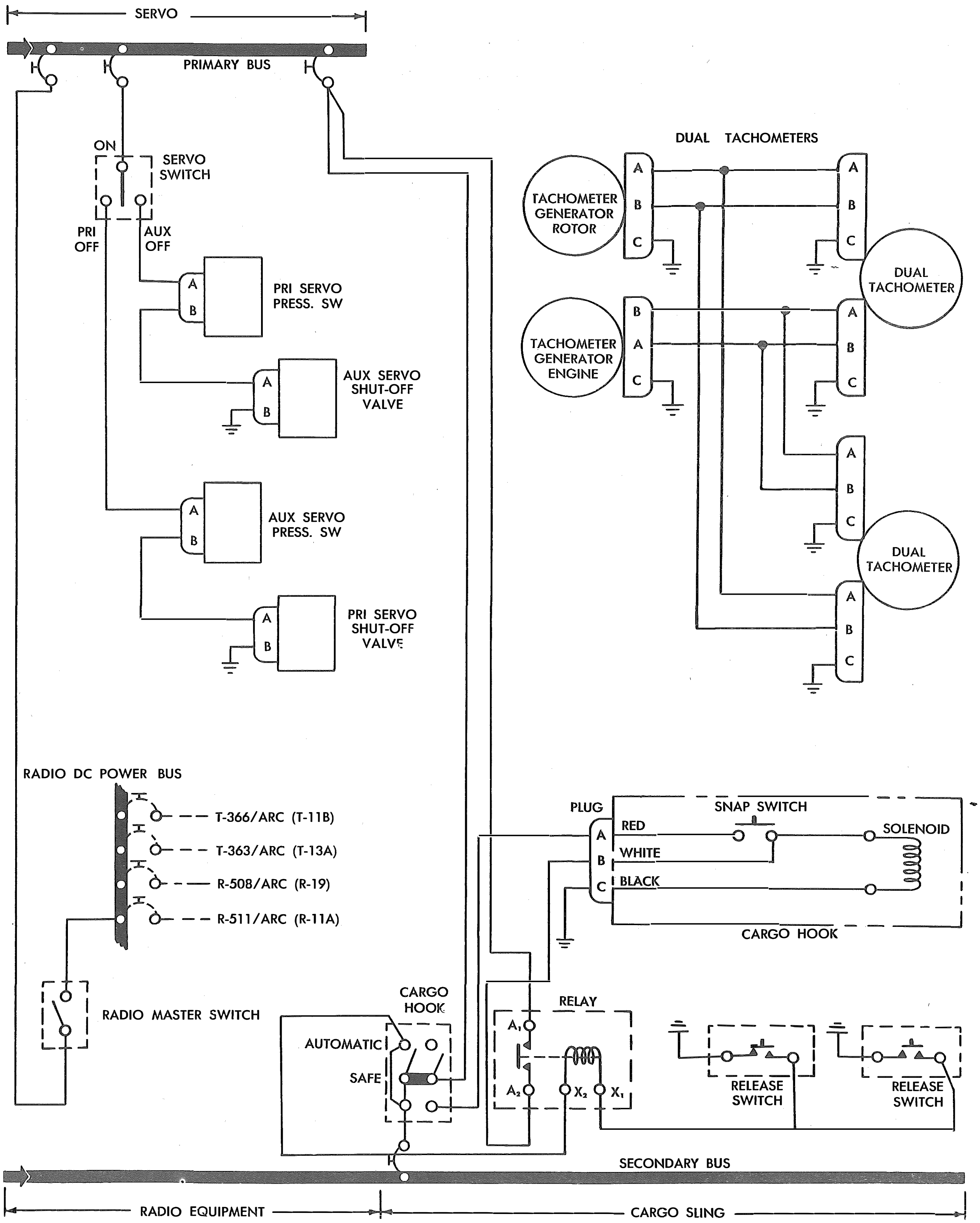


Figure 10—47. DC Electrical Schematic (Sheet 9 of 9)

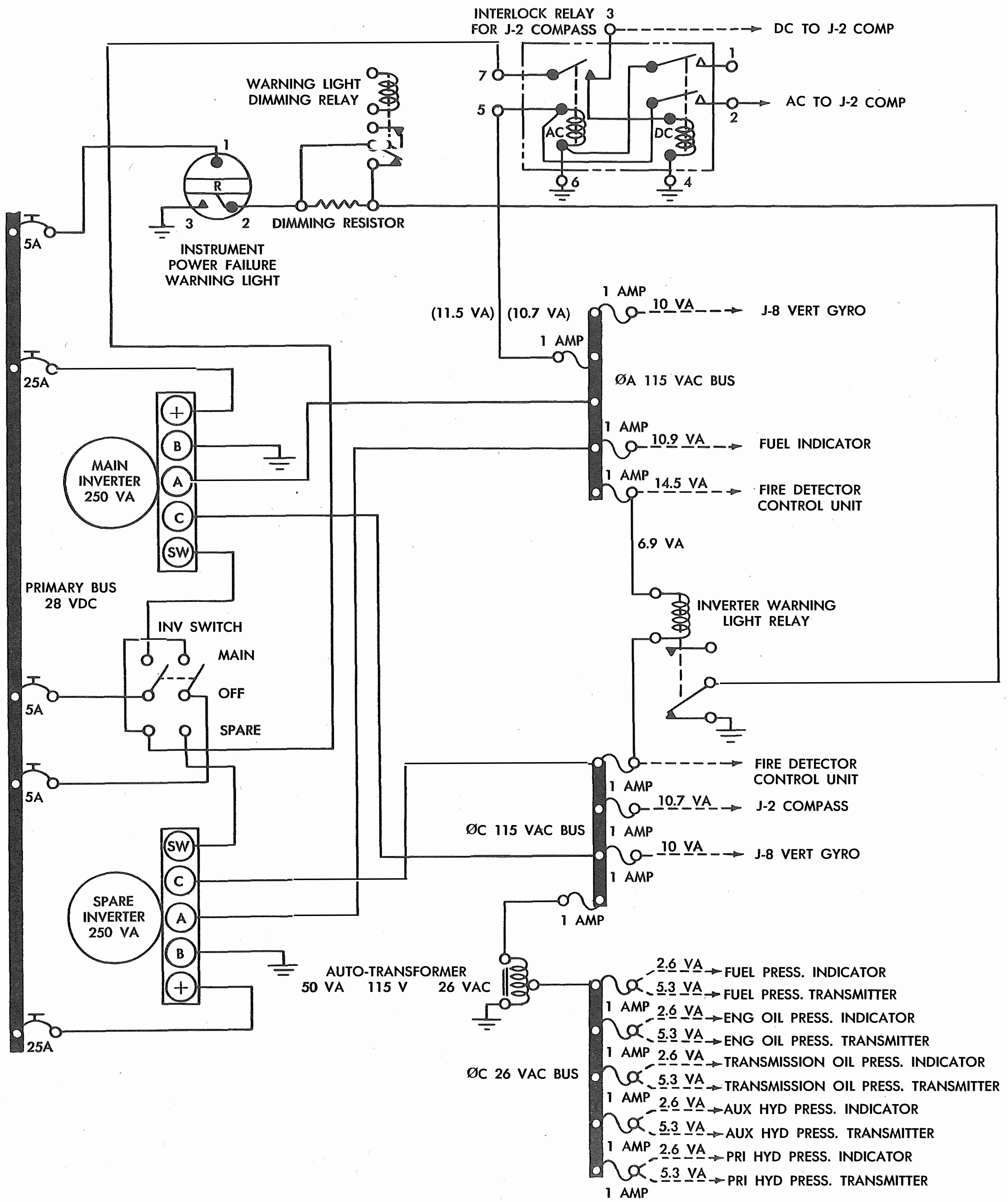


Figure 10—48. AC Electrical Schematic

ALPHABETICAL INDEX

Page

A

AC Electrical System
- Adjustment 382
- Testing 383
- Trouble Shooting 382

AC Fuses 382
AC Power Distribution 380
AC Power Supply System 379
Access and Inspection Provisions 6
Access (Carburetor Induction Heat) Door, Clutch 38
Accessory Compartment Shroud 195
Accessory Section and Engine Mount Cooling Tubes 197
Accommodations, Personnel 64
Accumulator, Rotor Brake System 312
Actuating Cylinder Assembly 127
- Placing in Service After Shipment 129
- Preparation for Shipment 129

Adjustment
- AC Electrical System 382
- Carburetor Air Temperature Control System 215
- Carburetor Idling 237
- Carburetor Mixture Control System 214
- Collective Open Loop Spring Cylinder 124
- Contravane Assembly 272
- Control Quadrant 217
- Cyclic (Directional) Control System 121
- DC Electrical System 378
- Engine-Driven Fuel Pump 246
- Fuel Booster Pump 247
- Fuel Quantity Indicator 257
- Fuel Quantity System 255
- Fuel Transfer Pumps 248
- Generator Voltage 366
- Inverters 380
- LF Range Receiver Installation (A.R.C. Type 12) 400
- Main Gear Box Oil Cooler and Blower 309
- Main Gear Box Oil Pressure 301
- Rotor Brake 313
- Rotor Brake System 311
- Stabilizer 148
- Tail Rotor Servo Unit 147
- Tail Wheel Lock Control System .. 97
- Throttle Control System 210
- Throttle Limit Switch 269
- VHF Command Set (A.R.C. Type 12) 397
- Voltage Regulator 366
- Windshield Wiper System 172

Air Induction System, Carburetor .... See Carburetor Air Induction
Air Intake Duct, Carburetor 273
Air Pressure Switch, Heater 165
Air Safety Harness, Cabin Door 69
Air-Speed Indicator 336
- Trouble Shooting 336

Air Temperature Indicator System, Carburetor .... See Carburetor Air Temperature
Alarm Bell, Crew 387
Alignment of
- Disconnect Shaft 326
- Pylon Drive Shaft 329
- Tail Rotor Drive Shaft 320

Altimeter 339
- Trouble Shooting 339

Aluminum Alloy, Differentiating Between Magnesium and 58
Aluminum Wire and Terminals 404
Ammeter (Loadmeter) 367
Ammeter Shunt 367
Analysis Charts, Electrical Load 388
Anti-Flapping Restrainers 106
Anti-Glare Curtains 77
Armament and Photographic 401
Ash Trays 77
Assist Handles 78
Autotransformer 381
Auxiliary Hydraulic Pressure Indicator 357
Auxiliary Hydraulic System 134
- Filter 136
- Hydraulic Fuse 137
- Pressure Relief Valve 136
- Pressure Switch 137
- Pressure Transmitter 137
- Pump 134
- Reservoir 138
- Restrictor and Snubber 137
- Servo Switch 138
- Three-Way Solenoid Valve 136

Auxiliary Servo Unit, Main Rotor .... See Main Rotor Auxiliary
Axle Assembly, Leg and 84

B

Balancing Fan Assembly 282
Balancing Tail Rotor Assembly 112
Barrier, Personnel 69
Battery 367
- Maintaining 368
- Relay 375
- Supply Circuit 372
- Switch 375
- Testing 369
- Trouble Shooting 368

Beam, Replacement of Pitch 331
Bearings, Support, Replacement of Pylon Drive Shaft 329
Bearings, Support, Replacement of Tail Rotor Drive Shaft 316
Bell, Crew Alarm 387
Belt and Shoulder Harness, Pilot's and Observer's Safety 69
Belts, Cargo Tie-Down 77
Belts, Replacement of Pulley 309
Belts, Troop Safety 69
Black-Out Curtains 78
Blades, Main Rotor .... See Main Rotor Blades
Blades, Replacement of Fan 282
Blades, Tail Rotor .... See Tail Rotor Blades
Bleeding
- Wheel Brake System 88

Bleeding, Filling and
- Main Rotor Dampers 105
- Main Shock Strut 83
- Rotor Brake System 310
- Tail Wheel Strut Assembly 92

Blind Flying, Tinted Panels 78
Blower, Heater 166
Blower, Main Gear Box Oil Cooler and .... See Main Gear Box Oil
Bonding Loose Bushings to
- Pylon Drive Shaft 329
- Tail Rotor Drive Shaft 317

Booster Pump, Fuel .... See Fuel Booster
Bottom Structure 49
- Fairing 51
- Flooring and Catwalk 49
- Plating 50

Bracket Assemblies, Double 194
Brake Cylinder, Rotor Brake System Master 312
Brake, Rotor .... See Rotor Brake System
Brake System
- Rotor .... See Rotor Brake System
- Wheel .... See Wheel Brake System

Bulkhead, Canted
- Cockpit Canopy 41
- Engine Compartment 38

Bus Tie Relay 376
Bushings, Bonding .... See Bonding

C

Cabin 47

Page

Door Air Safety Harness 69
Vents 171
Windows 48
Canopy Assembly, Cockpit 41
Canopy Defects, Criteria for Limits and Tolerances of 41
Canopy Installation 38
Canted Bulkhead 38
Cockpit Canopy 41
Engine Compartment 36
Canteen Installation 78
Carburetor 236
Idle Adjustment 237
Carburetor Air Induction System 272
Air Intake Duct 273
Cold Air Elbow 273
Carburetor Air Temperature Control System 215
Adjustment 216
Carburetor Air Temperature Indicator System 350
Trouble Shooting 350
Carburetor Idling Adjusting 237
Carburetor Induction Heat Door (Clutch Access) 38
Carburetor Mixture Control System 211
Adjustment 214
Cargo Door 47
Cargo Floodlight 385
Testing 385
Trouble Shooting 385
Cargo Sling 70
Cargo Sling Installation 70
Cargo Tie-Down Belts 77
Cargo Tie-Down Fittings 77
Case and Flight Report Holder, Map 77
Case, Data 77
Catwalk, Bottom Structure Flooring and 49
Causes of Corrosion 58
Cells, Oil .... See Oil
Chart, Electrical Symbols 405
Charts, Electrical Load Analysis 388
Charts, Power Loading 388
Check, Drain Valve and Swing 264
Check List, Pilot's 77
Check Valves, Emergency Fuel System Testing 234
Circuit Breaker Panel, Radio Fuse and See Radio Fuse
Circuit Breakers, DC 377
Cleaning
Carburetor Air Induction System Filter 275
Installed Engine 181
Intermediate Gear Box 328
Main Gear Box Oil Cooler 307
Main Gear Box Oil Filter and Strainer 301
Main Rotor Auxiliary Servo Unit .. 127
Main Rotor Blades 97
Main Rotor Head Assembly 102
Main Shock Strut Assembly 82

Page

Metallic Surfaces 57
Plastic Surfaces, Exterior 62
Plastic Surfaces, Interior 62
Relief Tube 77
Tail Rotor Assembly 109
Tail Rotor Drive Shaft Disconnect Coupling 325
Tail Rotor Gear Box Assembly 331
Tail Rotor Pedal Damper 144
Tail Rotor Servo Unit 145
Tail Wheel Strut Assembly 89
Transparent Panels 44
Yoke and Fork Assembly 93
Clock 340
Clutch Access (Carburetor Induction Heat) Door 38
Clutch and Fan Assembly 279
Balancing Fan Assembly 282
Placing in Service After Shipment .. 283
Preparation for Shipment 283
Replacement of Fan Blades 282
Trouble Shooting 281
Clutch Compartment 38
Clutch Pump 286
Trouble Shooting 286
Clutch System, Hydro-Mechanical 279
Cockpit 38
Canopy Assembly 41
Canted Bulkhead 38
Sliding Windows 46
Code, Wire Identification 403
Cold Air Elbow, Carburetor 273
Collective Open Loop Spring Cylinder, Adjustment of 124
Collective Pitch Control System 122
Collector, Engine Exhaust .... See Engine Exhaust
Command Set, VHF (A.R.C. Type 12) .... See VHF Command
Compartment
Cabin .... See Cabin
Clutch 38
Cockpit .... See Cockpit
Electronics 51
Engine .... See Engine Compartment
Heater 51
Transmission 38
Compass, J-2 Gyro ...... See Gyro Compass
Compass, Standby .... See Standby Compass
Cone, Tail 51
Console and Panel Lights 386
Trouble Shooting 386
Contravane Assembly 271
Adjustment 272
Control Panel, Overhead 370
Control Quadrant 216
Adjustment 217
Control Rod Assembly (Main Rotor) 108
Control System
Carburetor Air Temperature .... See Carburetor Air
Carburetor Mixture .... See Carburetor Mixture

Page

Collective Pitch .... See Collective Pitch
Directional (Cyclic) .... See Directional
Tail Rotor .... See Tail Rotor Control
Tail Wheel Lock .... See Tail Wheel Lock
Throttle .... See Throttle Control
Control Valve, Level 248
Controls
Engine .... See Engine Controls
Flight .... See Flight Controls
Cooler and Blower, Main Gear Box Oil .... See Main Gear Box Oil
Cooler, Oil (Oil Temperature Regulator) 261
Cooling System Engine .... See Engine Cooling
Cooling Tubes, Accessory Section and Engine Mount 197
Corrosion 58
Aluminum Alloys 58
Causes of 58
General Precautions to Prevent 58
Inspection of External Surfaces for 58
Inspection of Internal Surfaces for 58
Insulation of Dissimilar Metals Against 60
Limited Anti-Corrosion Measures .. 61
Magnesium Alloys 58
Prevention of (by Battery Acid) 60
Touch-Up — Aluminum Alloy 61
Touch-Up — Magnesium Alloy 60
Use of Sealer Compound to Prevent 60
Coupling, Tail Rotor Drive Shaft Disconnect .... See Tail Rotor Drive Shaft Disconnect
Couplings, Rubber .... See Rubber Couplings
Cover, Tail Rotor Drive Shaft 49
Covers, Protective 74
Crew Alarm Bell 387
Criteria for Limits and Tolerances of Canopy Defects 41
Curtains
Anti-Glare 77
Black-Out 78
Cushion, Pilot's and Observer's Seat 64
Cut-Out Relay, Reverse Current 373
Cyclic Control Stick Trim System (Force Gradient) 119
Cyclic Control System, Directional .... See Directional
Cylinder Assembly, Actuating .... See Actuating Cylinder
Cylinder Head Temperature Indicator System 351
Trouble Shooting 351
Cylinder, Rotor Brake System, Master Brake 312

D

Damper Assembly, Heater 164

Page

Damper (Main Rotor) 103
Filling with Pressure Equipment 105
Filling without Pressure Equipment 105
Placing in Service After Shipment .. 105
Preparation for Shipment 105
Damper, Tail Rotor Pedal ....
See Tail Rotor Pedal
Data Case 77
DC Circuit Breakers 377
DC Electrical System
Adjustment 378
Testing 378
Trouble Shooting 378
DC Power Distribution 369
DC Power Supply 362
Trouble Shooting 363
Defects, Criteria for Limits and Tolerances of Canopy 41
Detector System, Fire .... See Fire Detector
Diagram, Wire Identification 403
Diagrams, Index of Wiring 411
Dilution System, Oil 263
Dimensions, Principal 2
Dimming Relay and Switch, Warning Light 387
Directional (Cyclic) Control System 113
Adjustment 121
Disconnect Coupling, Tail Rotor Drive Shaft ....
See Tail Rotor Drive Shaft Disconnect
Disconnect Shaft Assembly 326
Alignment of 326
Dissimilar Metals, Insulation Against Corrosion 60
Dome Lights and Trouble Lights 385
Trouble Shooting 385
Door
Cargo 47
Clutch Access (Carburetor Induction Heat) 38
Door Air Safety Harness, Cabin 69
Doors, Nose 36
Double Bracket Assemblies 194
Drain, Fuel System 253
Drain Valve and Swing Check 264
Draining
Intermediate Gear Box 327
Main Gear Box Assembly 299
Tail Rotor Gear Box Assembly 331
Drains, Fuel Tank 253
Drive Shaft
Main, Assembly ....
See Main Drive Shaft
Pylon .... See Pylon Drive Shaft
Tail Rotor .. See Tail Rotor Drive Shaft
Drive Shaft Cover, Tail Rotor 49
Drive Shaft Disconnect Coupling, Tail Rotor ....
See Tail Rotor Drive Shaft Disconnect
Droop Restrainers 106
Dual Tachometer Indicator System 348
Trouble Shooting 349
Duct, Carburetor Air Intake 273
Duct, Engine Pre-Heat 167
Ducts, Heater 166

E

Elbow, Carburetor Cold Air 273
Electrical Load Analysis 362
Charts 388
Electrical, Miscellaneous Equipment 387
Electrical Power 362
Electrical Symbols Chart 405
Electrical System, AC ....
See AC Electrical System
Electrical System, DC ....
See DC Electrical System
Electronics Compartment 51
Emergency Equipment 74
Emergency Escape Hatches 49
Emergency Fuel System 233
Testing Check Valves 234
Engine 180
Cleaning Installed 181
Pre-Oiling 180
Trouble Shooting 180
Engine Compartment 36
Canted Bulkhead 38
Engine Controls 198
Carburetor Air Temperature ....
See Carburetor Air
Carburetor Mixture ....
See Carburetor Mixture
Control Quadrant ....
See Control Quadrant
Throttle ....
See Throttle Control
Engine Cooling System 269
Accessory Compartment Shroud 195
Accessory Section and Engine Mount Cooling Tubes 197
Contravane Assembly ....
See Contravane Assembly
Engine-Driven Fuel Pump 245
Adjustment 246
Engine Exhaust Collector 276
Engine Fuel System ....
See Fuel System, Engine
Engine Instruments 277
Engine Mount 191
Cooling Tubes, Accessory Section and 197
Double Bracket Assemblies 194
Engine Oil Pressure Indicator System 351
Trouble Shooting 352
Engine Oil Temperature Indicator System 352
Trouble Shooting 353
Engine Pre-Heat Duct 167
Engine, Pre-Oiling 180
Engine Ratings 180
Engine Specifications 180
Engine Tachometer-Generator 278
Engine Top Overhaul Stand 191
Equipment
Emergency 74
Furnishings and 63
List (Electrical and Radio) 405
Miscellaneous 75
Radio ....
See Radio Equipment
Stowage of 78
Escape Hatches, Emergency 49
Exhaust Collector, Engine 276
Exterior Lights 383
External Power Receptacle 369
External Power Relay 375
Extinguisher, Fire 175

F

Failure Warning Light
Generator 374
Inverter 380
Fairing, Bottom Structure 51
Fan Assembly, Clutch and ....
See Clutch and Fan
Field Control Relay, Generator ....
See Generator Field
Filling and Bleeding
Main Rotor Dampers 105
Main Shock Strut 83
Rotor Brake System 310
Tail Wheel Strut Assembly 92
Filter, Auxiliary Hydraulic System 136
Filter, Carburetor Air Induction System 275
Cleaning 275
Filter, Heater Fuel 170
Filter, Primary Hydraulic System 132
Fire Detector System 172
Replacement 174
Testing 174
Fire Extinguisher 175
Fire Seal 196
Fire Wall 38
First Aid Kit 74
Fits and Clearances
Main Shock Strut 83
Tail Rotor Disconnect Coupling 325
Tail Wheel Strut Assembly 91
Fittings, Cargo Tie-Down 77
Flag, Pylon Folding Hinge Lock and Pin Signal 52
Flasher, Light 383
Flashing Generator Field 363
Flight Check of Controls Rigging 155
Flight Controls 113
Actuating Cylinder Assembly ....
See Actuating Cylinder
Auxiliary Hydraulic System ....
See Auxiliary Hydraulic
Collective Pitch Control System ....
See Collective Pitch
Directional (Cyclic) Control System .... See Directional
Flight Check of Rigging 155
Main Rotor
Auxiliary Servo Unit ....
See Main Rotor Auxiliary

Page

Primary Servo Units .... See Main Rotor Primary
Servo Unit Hydraulic Systems 130
Primary Hydraulic System .... See Primary Hydraulic System
Rigging of 148
Main Rotor 149
Tail Rotor 153
Stabilizer .... See Stabilizer
Tail Rotor
Control System .... See Tail Rotor Control
Pedal Damper .... See Tail Rotor Pedal
Servo Unit ...... See Tail Rotor Servo
Servo Unit Hydraulic System 147
Flight Instrument 336
Flight Report Holder, Map Case and 77
Floodlight, Cargo .... See Cargo Floodlight
Flooring and Catwalk, Bottom Structure 49
Fluid Tank Assembly 107
Folding
Main Rotor Blades 10
Pylon 11
Troop Seats 65
Force Gradient (Cyclic Control Stick Trim System) 119
Fork Assembly, Yoke and .... See Yoke and Fork
Formation Lights 384
Testing 384
Trouble Shooting 384
Forward and Aft Transmission Installation 305
Forward Section, Fuselage 36
Free-Air Thermometer 348
Fuel Booster Pump 246
Adjustment 247
Fuel Filter, Heater 170
Fuel Low Level Warning System 251
Testing 251
Fuel Low Pressure Warning System 249
Testing 250
Fuel Overflow Safety System 249
Fuel Pressure Gage System 277
Trouble Shooting 278
Fuel Pressure Switches 249
Fuel Pump, Engine-Driven .... See Engine-Driven
Fuel Pump, Heater 168
Fuel Quantity Indicator 257
Adjustment 257
Testing 257
Trouble Shooting 257
Fuel Quantity System 253
Adjustment 255
Indicator .... See Fuel Quantity Indicator
Tank Probes .... See Fuel Quantity Tank Probes
Testing 256
Trouble Shooting 254

Page

Fuel Quantity Tank Probes 257
Testing 258
Trouble Shooting 257
Fuel Selector Valve 242
Fuel Selector Valve Control 238
Rigging 242
Fuel Selector Valve System 238
Fuel Shut-Off Valve, Heater Aft 170
Testing 170
Fuel Shut-Off Valve, Heater Forward 169
Testing 170
Fuel System, Engine 217
Carburetor 236
Drain 253
Drains, Tank 253
Emergency .... See Emergency Fuel System
Level Control Valve 248
Low Level Warning System .... See Fuel Low Level Warning
Low Pressure Warning System ...... See Fuel Low Pressure
Nozzle Grounding Receptacle 388
Pressure Gage System .... See Fuel Pressure Gage
Pressure Switches .... See Fuel Pressure Switches
Pressure Testing 217
Pump, Booster .... See Fuel Booster
Pump, Engine-Driven Fuel .... See Engine-Driven
Pumps, Transfer .... See Fuel Transfer
Selector Valve 242
Selector Valve Control .... See Fuel Selector Valve Control
Selector Valve System 238
Strainer 244
Strainers, Tank 244
Tank .... See Fuel Tank
Tank Sumps 251
Tank Vent System 235
Fuel System, Heater 168
Filter 170
Pressure Relief Valve 169
Pump 168
Shut-Off Valve, Aft .... See Fuel Shut-Off Valve
Shut-Off Valve, Forward .... See Fuel Shut-Off Valve
Fuel Tank
Aft 229
Center 225
Drains 253
Forward 219
Probes 257
Strainers 244
Sumps 251
Vent System 235
Fuel Transfer Pumps 247
Adjustment 248
Fuel Transfer Switches 248

Page

Furnishings 70
Furnishings and Equipment 63
Fuse and Circuit Breaker Panel, Radio .... See Radio Fuse
Fuse, Auxiliary System Hydraulic 137
Fuselage 36
Bottom Structure .... See Bottom Structure
Cabin .... See Cabin
Canopy Installation 38
Canted Bulkhead .... See Canted Bulkhead
Clutch Compartment 38
Cockpit .... See Cockpit
Corrosion 58
Door .... See Door
Doors, Nose 36
Electronics Compartment 51
Emergency Escape Hatches 49
Engine Compartment .... See Engine Compartment
Fire Wall 38
Forward Section 36
Heater Compartment 51
Pylon 55
Pylon (Foldable Tail) Section 53
Pylon Folding Hinge Lock and Pin Signal Flag 52
Service Platforms 40
Stabilizer .... See Stabilizer
Surfaces, Maintenance of 57
Tail Cone 51
Tail Cone (Aft) Section 51
Tail Rotor Drive Shaft Cover 49
Transmission Compartment 38
Fuselage Light, Position and ...... See Navigation Lights
Fuselage Surfaces, Maintenance of 57
Fuses, AC 382

G

Gear Assembly, Main Landing .... See Main Landing Gear
Gear Assembly, Tail Landing .... See Tail Landing Gear
Gear Box Assembly
Intermediate .... See Intermediate Gear Box
Main .... See Main Gear Box
Tail Rotor .... See Tail Rotor Gear Box
Gear, Landing 78
General Precautions to Prevent Corrosion 58
Generator 363
Adjusting Voltage 366
Failure Warning Light 374
Failure Warning Light Relay 375
Field Control Relay 367
Testing 367
Trouble Shooting 367
Flashing Field 363
Maintaining 363
Switch 366

Page

Testing 366
Trouble Shooting 363
Ground Check Relay 377
Ground Handling 5
Grounding Receptacle, Fuel Nozzle 388
Gyro Compass, J-2 340
Compensating 342
Trouble Shooting 341
Gyro Horizon, J-8 345
Trouble Shooting 345

H

Handles, Assist 78
Handling, Ground 5
Harness, Cabin Door Air Safety 69
Harness, Ignition 265
Harness, Pilot's and Observer's Safety Belt and Shoulder 69
Hatches, Emergency Escape 49
Head Assembly, Main Rotor .... See Main Rotor Head
Heater .... See Heating and Ventilating
Heater Compartment 51
Heating and Ventilating System 161
Air Pressure Switch 165
Blower 166
Cabin Vents 171
Damper Assembly 164
Ducts 166
Engine Pre-Heat Duct 167
Fuel Filter 170
Fuel Pump 168
Fuel Shut-Off Valve, Aft .... See Fuel Shut-Off Valve
Fuel Shut-Off Valve, Forward .... See Fuel Shut-Off Valve
Fuel System 168
Heater 163
Ignition Unit 166
Pressure Relief Valve 169
Thermal Switches 165
Helicopter
Hoisting 5
Jacking 7
Leveling 8
Mooring
Blades Folded 11
Blades in Flight Position 11
Parking 13
Servicing 14
Towing 14
Hinge Lock and Pin Signal Flag, Pylon Folding 52
Hoist, Hydraulic Rescue 78
Hoisting
Helicopter 5
Pylon 5
Holder, Map Case and Flight Report 77
Horizon, J-8 Gyro .... See Gyro Horizon
Hydraulic Fuse, Auxiliary System 137

Page

Hydraulic Pressure Indicator
Auxiliary 357
Primary 356
Hydraulic Pumps
Auxiliary 130
Primary 134
Hydraulic Rescue Hoist 78
Hydraulic System Instruments 356
Hydraulic Systems 159
Clutch .... See Hydro-Mechanical Clutch
Main Rotor Servo Auxiliary .... See Auxiliary Hydraulic System
Main Rotor Servo Primary .... See Primary Hydraulic System
Precautions for Maintenance of 130
Rotor Brake .... See Rotor Brake System
Tail Rotor Servo Unit 147
Wheel Brake .... See Wheel Brake System
Hydraulic Systems, Main Rotor Servo Unit 130
Hydro-Mechanical Clutch System 279

I

Identification and Modification Markings 5
Identication Code, Wire 403
Identification Diagram, Wire 403
Idling Adjustment, Carburetor 237
Ignition Switch 266
Testing 267
Ignition System 264
Harness 265
Spark Plugs .... See Spark Plugs
Switch 266
Testing 267
Testing 265
Trouble Shooting 264
Vibrator, Induction 267
Ignition Unit, Heater 166
Index of Wiring Diagrams 411
Indicator, Fuel Quantity 257
Induction System, Carburetor Air ...... See Carburetor Air Induction
Induction Vibrator 267
Inertia Reels 64
Inspection
Main Shock Strut 83
Tail Rotor Disconnect Coupling 325
Tail Wheel Strut Assembly 91
Inspection of External Surfaces for Corrosion 58
Inspection of Internal Surfaces for Corrosion 58
Inspection Lights 387
Trouble Shooting 387
Inspection Provisions, Access and 5
Instrument Light 386
Trouble Shooting 387
Instrument Panel 336

Page

Instruments 336
Air-Speed Indicator .... See Air-Speed
Altimeter .... See Altimeter
Ammeter 354
Carburetor Air Temperature Indicator System ...... See Carburetor Air
Clock 340
Cylinder Head Temperature Indicator System .... See Cylinder Head
Dual Tachometer Indicator System See Dual Tachometer
Engine 277
Engine Oil Pressure Indicator System .... See Engine Oil Pressure
Engine Oil Temperature Indicator System .... See Engine Oil Temperature
Flight 336
Free-Air Thermometer 348
Fuel Low Level Warning System See Fuel Low Level Warning
Fuel Low Pressure Warning System See Fuel Low Pressure Warning
Fuel Pressure Gage System .... See Fuel Pressure Gage
Fuel Quantity System .... See Fuel Quantity System
Gyro Compass, J-2 .... See Gyro Compass
Gyro Horizon, J-8 .... See Gyro Horizon
Hydraulic Pressure Indicator, Auxiliary 357
Hydraulic Pressure Indicator, Primary 356
Hydraulic System 356
Manifold Pressure Gage System .... See Manifold Pressure Gage
Rate-of-Climb Indicator .... See Rate-of-Climb
Standby Compass .... See Standby Compass
Transmission Oil Pressure Indicator System .... See Transmission Oil Pressure Indicator
Transmission Oil Pressure Warning System 355
Transmission Oil Temperature Indicator System .... See Transmission Oil Temperature
Transmission System 354
Turn-and-Bank .... See Turn-and-Bank
Insulation of Dissimilar Metals Against Corrosion 60
Intake Duct, Carburetor Air 273
Intercommunication 400
Interference Reduction Components, Radio 388

Page

Interior Lights 385
Interlock Relay 381
Intermediate Gear Box 327
  Cleaning 328
  Draining 327
  Placing in Service After Shipment 329
  Preparation for Shipment 328
  Trouble Shooting 327
Inverter Failure Warning Light 380
Inverter Switch 380
Inverter Failure Warning Light Relay 380
Inverters 379
  Adjustment 380
  Testing 380
  Trouble Shooting 379

J

Jacking 7
J-2 Gyro Compass .... See Gyro Compass

K

Kit, First Aid 74

L

Landing Gear 78
Landing Gear Assembly
  Main .... See Main Landing Gear
  Tail .... See Tail Landing Gear
Landing Light 384
  Testing 385
  Trouble Shooting 385
Leg and Axle Assembly 84
Level Control Valve, Fuel 248
Leveling
  Helicopter 8
  Main Rotor Head Assembly 9
LF Range Receiver Installation (A.R.C. Type 12) 397
  Adjustment 400
  Testing 400
  Trouble Shooting 397
Light Dimming Relay and Switch, Warning 387
Light Flasher 383
Lighting Provisions 383
Lights
  Cargo Flood .... See Cargo Floodlight
  Console and Panel .... See Console and
  Dome and Trouble .... See Dome Lights
  Exterior 383
  Formation .... See Formation Lights
  Fuel Low Level Warning 251
  Fuel Low Pressure Warning 249
  Generator Failure Warning 374
  Inspection .... See Inspection Lights
  Instrument .... See Instrument Lights
  Interior 385
  Inverter Failure Warning 380
  Landing .... See Landing Light
  Navigation (Position and Fuselage) .... See Navigation Lights
  Trouble Shooting 387
Limit Switch, Throttle .... See Throttle Limit Switch
List, Check 77
List, Equipment (Electrical and Radio) 405
Litters 69
Load Analysis Charts, Electrical 388
Load Analysis, Electrical 362
Loading Charts, Power 388
Loadmeter .... See Ammeter
Lock and Pin Signal Flag, Pylon Folding Hinge 52
Lock Control System, Tail Wheel .... See Tail Wheel Lock
Low Level Warning System, Fuel .... See Fuel Low Level Warning
Low Pressure Warning System, Fuel .... See Fuel Low Pressure
Lubrication Requirements 18
Lubrication System 258
  Drain Valve and Swing Check 264
  Oil Cells .... See Oil
  Oil Cooler (Oil Temperature Regulator) 261
  Oil Dilution System 263

M

Magnesium and Aluminum Alloy, Differentiating Between 58
Main Drive Shaft Assembly 287
  Minor Repairs 287
  Misalignment 288
  Rubber Couplings 287
  Trouble Shooting 287
Main Gear Box and Rotor Quick Change Unit 288
  Placing in Service After Shipment 292
  Preparation for Shipment 292
Main Gear Box Assembly 297
  Adjusting Oil Pressure 301
  Draining 299
  Oil, Metal Particles, Contamination of 304
  Placing in Service After Shipment 301
  Preparation for Shipment 301
  Replacement of Parts 299
  Run-In of 302
  Serviceability Check 305
  Trouble Shooting 299
Main Gear Box Oil, Metal Particles Contamination of 304
Main Gear Box Oil Cooler and Blower 306
  Adjustment 309
  Replacement of Pulley Belts 309
  Trouble Shooting 306
Main Gear Box Oil Cooler, Cleaning 307
Main Gear Box Oil Filter and Strainer, Cleaning 301
Main Landing Gear Assembly 78
  Leg and Axle Assembly 84
  Shock Strut Assembly .... See Main Shock Strut
  Wheel Assembly 85
  Wheel Brake System .... See Wheel Brake System
Main Rotor 97
Main Rotor Auxiliary Servo Unit 126
  Cleaning 127
  Placing in Service After Shipment 127
  Preparation for Shipment 127
Main Rotor Blades 97
  Cleaning 97
  Folding 10
  Preparation for Shipment 98
  Replacement 97
  Tracking 98
  Unfolding 10
Main Rotor Flight Controls, Rigging of 149
Main Rotor Head Assembly 99
  Anti-Flapping Restrainers 106
  Cleaning 102
  Control Rod Assembly 108
  Damper 103
  Droop Restrainers 106
  Fluid Tank Assembly 107
  Leveling 9
  Placing in Service After Shipment 102
  Preparation for Shipment 102
  Rotating Scissors 107
  Star Assembly .... See Star Assembly
  Stationary Scissors 106
  Trouble Shooting 100
Main Rotor Primary Servo Units 124
  Placing in Service After Shipment 124
  Preparation for Shipment 124
Main Rotor Servo Unit Hydraulic Systems 130
Main Shock Strut Assembly 81
  Cleaning 82
  Filling and Bleeding 83
  Fits and Clearances 83
  Inspection 83
  Replacements 83
  Servicing With Air 79
  Testing 83
Main Switch Panel 369
Main Wheel Assembly 85
Maintenance of
  Fuselage Surfaces 57
  Metallic Surfaces 57
  Plastic Surfaces 61
Manifold Pressure Gage System 349
  Purge Button 349
  Trouble Shooting 349
Map Case and Flight Report Holder 77
Master Brake Cylinder, Rotor Brake System 312

Page

Master Switch, Radio 393
Metal Particles Contamination of
Main Gear Box Oil 304
Metallic Surfaces
Cleaning 57
Maintenance of 57
Minor Repair of
Main Drive Shaft Assembly 287
Tail Rotor Drive Shaft 316
Misalignment of Main Drive
Shaft Assembly 288
Miscellaneous Equipment, Electrical 387
Miscellaneous Equipment,
Furnishings 75
Modification Markings,
Identification and 5
Mooring
Blades Folded 11
Blades in Flight Position 11
Mount, Engine .... See Engine Mount

N

Navigation Lights
(Position and Fuselage) 383
Testing 383
Trouble Shooting 383
Nose Doors 36
Nozzle Grounding Receptacle, Fuel 388

O

Observer's, Pilot's and
Safety Belt and Shoulder Harness 69
Seat ....
See Seat, Pilot's and Observer's
Seat Cushion 64
Oil
Cells 258
Pressure Testing 259
Cooler and Blower, Main Gear Box
See Main Gear Box Oil
Cooler (Oil Temperature
Regulator) 261
Dilution System 263
Pressure Indicator System, Engine
See Engine Oil Pressure
Pressure Indicator System,
Transmission ....
See Transmission Oil
Pressure Indicator
Pressure Warning System,
Transmission 356
Temperature Indicator System,
Engine ....
See Engine Oil Temperature
Temperature Indicator System,
Transmission ....
See Transmission Oil Temperature
Temperature Regulator ....
See Oil Cooler
Overflow Safety System, Fuel 249
Overhaul Stand, Engine Top 191
Overhead Control Panel 370

Page

Overvoltage Relay 366
Testing 367
Trouble Shooting 367

P

Package, Power 181
Panel
Instrument 336
Main Switch 369
Overhead Control 370
Radio Fuse and Circuit Breaker ....
See Radio Fuse
Panel Light, Console and 386
Panels, Cleaning Transparent 44
Panels, Tinted (Blind Flying) 78
Parking 13
Pedal Damper, Tail Rotor ....
See Tail Rotor Pedal
Personnel Accommodations 64
Personnel Barrier 69
Photographic, Armament and 401
Pilot's and Observer's
Safety Belt and Shoulder Harness 69
Seat ...... See Seat, Pilot's and Observer's
Seat Cushion 64
Pilot's Check List 77
Pin Signal Flag, Pylon Folding Hinge
Lock and 52
Pitch Beam, Replacement of 331
Pitch Control System, Collective ......
See Collective Pitch
Pitot Pressure System 358
Testing 358
Pitot-Static System 358
Placing in Service After Shipment
Actuating Cylinder Assembly 129
Clutch and Fan Assembly 283
Damper (Main Rotor) 105
Intermediate Gear Box 329
Main Gear Box and Rotor Quick
Change Unit 292
Main Gear Box Assembly 301
Main Rotor Auxiliary Servo Unit 127
Main Rotor Head Assembly 102
Main Rotor Primary Servo Units .. 124
Pylon Quick Change Unit 57
Star Assembly 108
Tail Rotor Assembly 111
Tail Rotor Gear Box Assembly 332
Tail Rotor Pedal Damper 144
Tail Rotor Servo Unit 147
Plastic Surfaces
Cleaning Exterior 62
Cleaning Interior 62
Hot Climate Precautions for 62
Maintenance of 61
Platforms, Service 40
Plating, Bottom Structure 50
Plugs, Spark ....
See Spark Plugs
Pneumatic System 159

Page

Position and Fuselage Lights ....
See Navigation Lights
Power Distribution, AC 380
Power Distribution, DC 369
Power, Electrical 362
Power Loading Charts 388
Power Package 181
Power Plant System 180
Carburetor Air Induction System ..
See Carburetor Air
Cleaning Installed Engine 181
Engine .... See Engine
Engine Controls ....
See Engine Controls
Engine Cooling System ....
See Engine Cooling
Engine Exhaust Collector ....
See Engine Exhaust
Engine Ratings 180
Engine Specifications 180
Fuel Quantity System ....
See Fuel Quantity System
Fuel System ....
See Fuel System, Engine
Ignition System ....
See Ignition System
Lubrication System ....
See Lubrication System
Power Package 181
Pre-Oiling Engine 180
Starter System .... See Starter
Power Receptacle, External 369
Power Relay, External 375
Power Supply System, AC 379
Power Supply System, DC ....
See DC Power Supply
Power Supply, Radio 393
Pre-Heat Duct, Engine 167
Pre-Oiling Engine 180
Preparation for Shipment
Actuating Cylinder Assembly 129
Clutch and Fan Assembly 283
Damper (Main Rotor) 105
Intermediate Gear Box 328
Main Gear Box and Rotor Quick
Change Unit 292
Main Gear Box Assembly 301
Main Rotor Auxiliary Servo Unit 127
Main Rotor Blades 98
Main Rotor Head Assembly 102
Main Rotor Primary Servo Units 124
Pylon Quick Change Unit 56
Star Assembly 108
Tail Rotor Assembly 111
Tail Rotor Gear Box Assembly 331
Tail Rotor Pedal Damper 144
Tail Rotor Servo Unit 145
Pressure Gage System
Fuel ....
See Fuel Pressure Gage
Manifold ....
See Manifold Pressure Gage

Page

Pressure Indicator
  Auxiliary Hydraulic 357
  Primary Hydraulic 356
Pressure Indicator System
  Engine Oil .... See Engine Oil Pressure
  Transmission Oil .... See Transmission Oil Pressure Indicator
Pressure Relief Valve
  Auxiliary Hydraulic System 136
  Heater 169
  Primary Hydraulic System 132
Pressure Switch
  Auxiliary Hydraulic System 137
  Heater Air 165
  Primary Hydraulic System 133
Pressure Switches, Fuel 249
Pressure System
  Pitot .... See Pitot Pressure
  Static .... See Static Pressure
Pressure Testing
  Fuel System 217
  Oil Cells 259
Pressure Transmitter
  Auxiliary Hydraulic System 137
  Primary Hydraulic System 133
Pressure Warning System,
    Transmission Oil 356
Primary Hydraulic Pressure Indicator 356
Primary Hydraulic System 130
  Filter 132
  Pressure Relief Valve 132
  Pressure Switch 133
  Pressure Transmitter 133
  Pump 130
  Reservoir 133
  Restrictor and Snubber 133
  Servo Switch 133
  Three-Way Solenoid Valve 132
Primary Servo Units, Main Rotor .... See Main Rotor Primary
Primary Supply Circuit 373
Principal Dimension 2
Probes, Fuel Quantity Tank .... See Fuel Quantity Tank Probes
Protective Covers 74
Pulley Belts, Replacement of 309
Pump
  Auxiliary Hydraulic System 134
  Clutch .... See Clutch Pump
  Engine-Driven Fuel .... See Engine-Driven
  Fuel Booster .... See Fuel Booster
  Fuel Transfer .... See Fuel Transfer
  Heater Fuel 168
  Primary Hydraulic System 130
Purge Button, Manifold Pressure
    Gage System 349
Pylon 55
  Folding 11

Page

  Hoisting 5
  Unfolding 11
Pylon Drive Shaft 329
  Alignment of 329
  Bonding Loose Bushings 329
  Replacement of Support Bearings .. 329
  Rubber Couplings 329
  Trouble Shooting 329
Pylon (Foldable Tail) Section 53
Pylon Folding Hinge Lock and
    Pin Signal Flag 52
Pylon Quick Change Unit 56
  Placing in Service After Shipment 57
  Preparation for Shipment 56
Pylon Transmission Installation 322

Q

Quadrant, Control .... See Control Quadrant
Quantity System, Fuel .... See Fuel Quantity System
Quick Change Unit
  Main Gear Box and Rotor .... See Main Gear Box and Rotor
  Pylon .... See Pylon Quick Change Unit

R

Radio and Radar 393
Radio Equipment 395
  Trouble Shooting 395
Radio Fuse and Circuit Breaker Panel 394
  Trouble Shooting 395
Radio Interference Reduction
    Components 388
Radio Master Switch 393
Radio Power Supply 393
Rail Installation, Skid 77
Range Receiver Installation, LF
    (A.R.C. Type 12) .... See LF Range
Rate-of-Climb Indicator 346
  Trouble Shooting 346
Ratings, Engine 180
Receptacle
  External Power 369
  Fuel Nozzle Grounding 388
Reduction Components, Radio
    Interference 388
Reels, Inertia 64
Regulator
  Oil Temperature .... See Oil Cooler
  Voltage .... See Voltage Regulator
Relay
  Battery 375
  Bus Tie 376
  External Power 375
  Generator Failure Warning Light 375
  Generator Field Control .... See Generator Field
  Ground Check 377
  Interlock 381

Page

  Inverter Warning Light 380
  Overvoltage .... See Overvoltage Relay
  Reverse Current Cut-Out 373
  Starter 268
Relay and Switch,
    Warning Light Dimming 387
Relief Tube 75
  Cleaning 77
Replacement of
  Fan Blades 282
  Fire Detector System 174
  Main Rotor Blades 97
  Parts, Main Gear Box 299
  Parts, Main Shock Strut 83
  Parts, Tail Rotor Disconnect
    Coupling 325
  Parts, Tail Wheel Strut Assembly 91
  Parts, Yoke and Fork Assembly 93
  Pitch Beam 331
  Pulley Belts 309
  Support Bearings,
    Pylon Drive Shaft 329
  Support Bearings,
    Tail Rotor Drive Shaft 316
  Tail Rotor Blades 112
  Vent Filter Element 139
Report Holder, Map Case and Flight 77
Requirements, Lubrication 18
Rescue Hoist, Hydraulic 78
Reservoir
  Auxiliary Hydraulic System 138
  Primary Hydraulic System 133
Restrainers
  Anti-Flapping 106
  Droop 106
Restrictor and Snubber,
    Auxiliary Hydraulic System 137
Restrictor and Snubber,
    Primary Hydraulic System 133
Reverse Current Cut-Out Relay 373
Rigging
  Flight Check of 155
  Flight Controls 148
  Fuel Selector Valve Control 242
  Main Rotor Flight Controls 149
  Tail Rotor Controls 153
Rotating Scissors 107
Rotor Assembly, Tail .... See Tail Rotor Assembly
Rotor Blades, Main .... See Main Rotor Blades
Rotor Blades, Tail .... See Tail Rotor Blades
Rotor Brake System 309
  Accumulator 312
  Adjustment 311
  Filling and Bleeding 310
  Master Brake Cylinder 312
  Rotor Brake 313
  Rotor Brake Adjustment 313

Page

Trouble Shooting 309
Rotor Head Assembly, Main .... See Main Rotor Head
Rotor, Main 97
Rotor Quick Change Unit, Main Gear Box and .... See Main Gear Box and Rotor
Rotor Tachometer-Generator 348
Rubber Couplings
Main Drive Shaft 287
Pylon Drive Shaft 329
Tail Rotor Drive Shaft 322
Run-In of Main Gear Box 302

S

Safety Belt and Shoulder Harness, Pilot's and Observer's 69
Safety Belts, Troop Seat 69
Safety Harness, Cabin Door Air 69
Safety System, Fuel Overflow 249
Scissors, Rotating 107
Scissors, Stationary 106
Seal, Fire 196
Sealer Compound, Use of, to Prevent Corrosion 60
Seat Cushion, Pilot's and Observer's 64
Seat, Pilot's and Observer's 64
Testing 64
Seats, Troop .... See Troop Seats
Secondary Supply Circuit 376
Selector Valve Control, Fuel .... See Fuel Selector Valve Control
Selector Valve, Fuel 242
Selector Valve System, Fuel 238
Service Platforms 40
Serviceability Check, Main Gear Box 305
Servicing 14
Servicing With Air
Main Shock Strut Assembly 79
Tail Wheel Strut Assembly 89
Servo Switch, Auxiliary Hydraulic System 138
Servo Switch, Primary Hydraulic System 133
Servo Unit Hydraulic System, Tail Rotor 147
Servo Unit Hydraulic Systems, Main Rotor 130
Servo Unit, Main Rotor Auxiliary .... See Main Rotor Auxiliary
Servo Unit, Tail Rotor .... See Tail Rotor Servo
Servo Units, Main Rotor Primary .... See Main Rotor Primary
Shaft Assembly, Disconnect .... See Disconnect Shaft
Shaft Assembly, Main Drive .... See Main Drive Shaft
Shaft, Pylon Drive .... See Pylon Drive Shaft
Shaft, Tail Rotor Drive .... See Tail Rotor Drive Shaft
Shock Strut Assembly, Main .... See Main Shock Strut

Page

Shoulder Harness, Pilot's and Observer's Safety Belt and 69
Shroud, Accessory Compartment 195
Shunt, Ammeter 367
Signal Flag, Pylon Folding Hinge Lock and Pin 52
Skid Rail Installation 77
Sliding Windows, Cockpit 46
Sling, Cargo 70
Sling Installation, Cargo 70
Snubber, Auxiliary Hydraulic System Restrictor and 137
Snubber, Primary Hydraulic System Restrictor and 133
Soundproofing 74
Spark Plugs 265
Trouble Shooting 265
Special Tools 25
Specifications, Engine 180
Specifications, Table of 23
Stabilizer 147
Adjustment 148
Stand, Engine Top Overhaul 191
Standby Compass 343
Compensating 344
Trouble Shooting 343
Star Assembly 107
Placing in Service After Shipment 108
Preparation for Shipment 108
Starter 267
Relay 268
System 267
Throttle Limit Switch 268
Trouble Shooting 267
Static Pressure System 358
Testing 359
Stationary Scissors 106
Stations and Water Lines 5
Stick Trim System, Cyclic Control (Force Gradient) 119
Stowage of Equipment 78
Strainer, Fuel System 244
Strainers, Fuel Tank 244
Strut Assembly
Main Shock .... See Main Shock Strut
Tail Wheel .... See Tail Wheel
Sumps, Fuel Tank 251
Supply Circuit
Battery 372
Primary 373
Secondary 376
Support Bearings, Replacement of
Pylon Drive Shaft 329
Tail Rotor Drive Shaft 316
Swing Check, Drain Valve and 264
Switch
Auxiliary Hydraulic System Pressure 137
Battery 375
Generator 366
Heater Air Pressure 165
Ignition .... See Ignition Switch
Inverter 380

Page

Primary Hydraulic System Pressure 133
Radio Master 393
Servo Auxiliary Hydraulic System 138
Servo, Primary Hydraulic System 133
Throttle Limit 268
Warning Light, Dimming Relay and 387
Switch Panel, Main 369
Switches
Fuel Pressure 249
Fuel Transfer 248
Heater Thermal 165
Symbols Chart, Electrical 405

T

Table of Specifications 23
Tachometer-Generator
Engine 278
Rotor 348
Tachometer Indicator System, Dual .... See Dual Tachometer
Tail Cone 51
Tail Cone (Aft Section) 51
Tail Landing Gear Assembly 88
Strut Assembly, Wheel .... See Tail Wheel Strut
Wheel Assembly 95
Wheel Lock Control System .... See Tail Wheel Lock
Yoke and Fork Assembly .... See Yoke and Fork
Tail Rotor Assembly 108
Balancing 112
Cleaning 109
Placing in Service After Shipment 111
Preparation for Shipment 111
Replacement of Blades 112
Trouble Shooting 109
Tail Rotor Blades 112
Replacement of 112
Tail Rotor Control System 139
Rigging 153
Tail Rotor Drive Shaft 314
Alignment of 320
Bonding Loose Bushings to 317
Cover 49
Minor Repairs 316
Replacement of Support Bearings 316
Rubber Couplings 322
Trouble Shooting 314
Tail Rotor Drive Shaft Disconnect Coupling 322
Cleaning 325
Fits and Clearances 325
Inspection 325
Replacements 325
Tail Rotor Flight Controls .... See Tail Rotor Control
Tail Rotor Gear Box Assembly 330
Cleaning 331
Draining 331
Placing in Service After Shipment 332

Page

Preparation for Shipment 331
Replacement of Pitch Beam 331
Trouble Shooting 331
Tail Rotor Pedal Damper 144
Cleaning 144
Placing in Service After Shipment 144
Preparation for Shipment 144
Testing 145
Tail Rotor Servo Unit 145
Adjustment 147
Cleaning 145
Hydraulic System 147
Placing in Service After Shipment 147
Preparation for Shipment 145
Tail Wheel Assembly 95
Tail Wheel Lock Control System 95
Adjustment 97
Tail Wheel Strut Assembly 89
Cleaning 89
Filling and Bleeding 92
Fits and Clearances 91
Inspection 91
Replacements 91
Servicing With Air 89
Testing 92
Tank Assembly, Fluid 107
Tank, Fuel ....
See Fuel Tank
Tank Probes, Fuel Quantity ....
See Fuel Quantity Probes
Temperature Indicator System
Carburetor Air ....
See Carburetor Air Temperature
Cylinder Head ....
See Cylinder Head
Engine Oil ....
See Engine Oil Temperature
Transmission Oil ....
See Transmission Oil Temperature
Temperature Regulator, Oil ....
See Oil Cooler
Terminals, Aluminum Wire and 404
Testing
AC Electrical System 383
Battery 369
Brake Cylinder, Wheel 88
Cargo Floodlight 385
Check Valves, Emergency
Fuel System 234
DC Electrical System 378
Fire Detector System 174
Formation Lights 384
Fuel Low Level Warning System .. 251
Fuel Low Pressure Warning System 250
Fuel Quantity Indicator 257
Fuel Quantity System 256
Fuel Quantity Tank Probes 258
Fuel Shut-Off Valve, Heater Aft .. 170
Fuel Shut-Off Valve, Heater
Forward 170
Fuel System, Pressure 217
Generator 366
Generator Field Control Relay 367

Page

Ignition Switch 267
Ignition System 265
Inverters 380
Landing Light 385
LF Range Receiver, Installation
(A.R.C. Type 12) 400
Main Shock Strut 83
Navigation Lights
(Position and Fuselage) 383
Oil Cells, Pressure 259
Overvoltage Relay 367
Pilot's and Observer's Seats 64
Pitot Pressure System 358
Pressure .... See Pressure Testing
Static Pressure System 359
Tail Rotor Pedal Damper 145
Tail Wheel Strut Assembly 92
VHF Command Set
(A.R.C. Type 12) 397
Voltage Regulator 366
Wheel Brake Cylinder 88
Thermal Switches, Heater 165
Thermometer, Free-Air 348
Three-Way Solenoid Valve
Auxiliary Hydraulic System 136
Primary Hydraulic System 132
Throttle Control System 198
Adjustment 210
Throttle Limit Switch 268
Adjustment 269
Tie-Down Belts, Cargo 77
Tie-Down Fittings, Cargo 77
Tinted Panels (Blind Flying) 78
Tools, Special 25
Top Overhaul Stand, Engine 191
Towing 14
Tracking Main Rotor Blades 98
Transfer Pumps, Fuel ....
See Fuel Transfer
Transfer Switches, Fuel 248
Transmission Compartment 38
Transmission Installation
(Forward and Aft) 305
Transmission Installation, Pylon 322
Transmission Oil Pressure Indicator
System 355
Trouble Shooting 355
Transmission Oil Pressure Warning
System 356
Transmission Oil Temperature
Indicator System 354
Trouble Shooting 354
Transmission System 279
Clutch and Fan Assembly ....
See Clutch and Fan
Clutch Pump ....
See Clutch Pump
Disconnect Shaft Assembly 326
Hydro-Mechanial Clutch System 279
Instruments 354
Intermediate Gear Box ....
See Intermediate Gear Box

Page

Main Drive Shaft Assembly ....
See Main Drive Shaft
Main Gear Box Assembly ....
See Main Gear Box
Main Gear Box Oil Cooler
and Blower ....
See Main Gear Box Oil
Pylon Drive Shaft ....
See Pylon Drive Shaft
Pylon Transmission Installation 322
Rotor Brake System ....
See Rotor Brake System
Tail Rotor Drive Shaft ....
See Tail Rotor Drive Shaft
Tail Rotor Drive Shaft Disconnect
Coupling .... See Tail Rotor
Drive Shaft Disconnect
Tail Rotor Gear Box Assembly ......
See Tail Rotor Gear Box
Transmission Installation
(Forward and Aft) 305
Transmitter
Auxiliary Hydraulic System
Pressure 137
Primary Hydraulic System Pressure 133
Transparent Panels, Cleaning 44
Trays, Ash 77
Trim System, Cyclic Control Stick
(Force Gradient) 119
Troop Safety Belts 69
Troop Seats 65
Folding and Rolling 65
Unfolding and Unrolling 67
Trouble Lights, Dome Lights and ....
See Dome Lights
Trouble Shooting
AC Electrical System 382
Air-Speed Indicator 336
Altimeter 339
Battery 368
Carburetor Air Temperature
Indicator System 350
Cargo Floodlight 385
Clutch and Fan Assembly 281
Clutch Pump 286
Console and Panel Lights 386
Cylinder Head Temperature
Indicator System 351
DC Electrical System 378
DC Power Supply 363
Dome Lights and Trouble Lights .. 386
Dual Tachometer Indicator System 349
Engine 180
Engine Oil Pressure
Indicator System 352
Engine Oil Temperature
Indicator System 353
Formation Lights 384
Fuel Pressure Gage System 278
Fuel Quantity Indicator 257

Page

Fuel Quantity System 254
Fuel Quantity Tank Probes 257
Generator 363
Generator Field Control Relay 367
Gyro Compass, J-2 341
Gyro Horizon, J-8 345
Ignition System 264
Inspection Lights 387
Instrument Lights 387
Intermediate Gear Box 327
Inverters 379
LF Range Receiver Installation
(A.R.C. Type 12) 397
Landing Light 385
Lights 387
Main Drive Shaft Assembly 287
Main Gear Box Assembly 299
Main Gear Box Oil Cooler and
Blower 306
Main Rotor Head Assembly 100
Manifold Pressure Gage System 349
Navigation Lights
(Position and Fuselage) 383
Overvoltage Relay 367
Panel Lights, Console and 386
Pylon Drive Shaft 329
Radio Equipment 395
Radio Fuse and Circuit
Breaker Panel 394
Rate-of-Climb Indicator 346
Rotor Brake System 309
Spark Plugs 265
Standby Compass 343
Starter 267
Tail Rotor Assembly 109
Tail Rotor Drive Shaft 314
Tail Rotor Gear Box Assembly 331
Transmission Oil Pressure
Indicator System 355
Transmission Oil Temperature
Indicator System 354
Trouble Lights, Dome Lights and 386
Turn-and-Bank Indicator 347
VHF Command Set
(A.R.C. Type 12) 396
Voltage Regulator 366
Wheel Brake System 86
Tube, Relief ....
See Relief Tube
Tubes, Accessory Section and Engine
Mount Cooling 197

Page

Turn-and-Bank Indicator 346
Trouble Shooting 347

U

Unfolding
Main Rotor Blades 10
Pylon 11
Troop Seats 67
Utility Systems
Fire Detector System ....
See Fire Detector
Fire Extinguisher 175
Heating and Ventilating System ....
See Heating and Ventilating
Windshield Wiper System ....
See Windshield Wiper

V

Valve
Auxiliary Hydraulic System,
Pressure Relief 136
Auxiliary Hydraulic System
Three-Way Solenoid 136
Check, Emergency Fuel System ......
See Check Valves
Control, Fuel Selector ....
See Fuel Selector Valve Control
Drain, and Swing Check 264
Fuel Level Control 248
Fuel Selector 242
Heater Aft Fuel Shut-Off ....
See Fuel Shut-Off Valve
Heater Forward Fuel Shut-Off ......
See Fuel Shut-Off Valve
Heater Pressure Relief 169
Primary Hydraulic System Pressure
Relief 132
Primary Hydraulic System Three-
Way Solenoid 132
System, Fuel Selector 238
Vent Filter Element, Replacement of 139
Vent System, Fuel Tank 235
Ventilating System, Heating and ....
See Heating and Ventilating
Vents, Cabin 171
VHF Command Set (A.R.C. Type 12) 395
Adjustment 397
Testing 397

Page

Trouble Shooting 396
Vibrator, Induction 267
Voltage Regulator 366
Adjustment 366
Testing 366
Trouble Shooting 366

W

Wall, Fire 38
Warning Light
Dimming Relay and Switch 387
Fuel Low Level 251
Fuel Low Pressure 249
Generator Failure 374
Inverter Failure 380
Warning Light Relay
Generator Failure 375
Inverter 380
Warning System
Fuel Low Level ....
See Fuel Low Level Warning
Fuel Low Pressure ....
See Fuel Low Pressure
Transmission Oil Pressure 356
Water Lines, Stations and 5
Wheel Assembly
Main 85
Tail 95
Wheel Brake System 86
Bleeding 88
Testing Brake Cylinder 88
Trouble Shooting 86
Wheel Lock Control System, Tail ......
See Tail Wheel Lock
Wheel Strut Assembly, Tail ....
See Tail Wheel Strut
Windows
Cabin 48
Cockpit Sliding 46
Windshield Wiper System 171
Adjustment 172
Wire and Terminals, Aluminum 404
Wire Identification Code 403
Wire Identification Diagram 403
Wiring Diagrams, Index of 411

Y

Yoke and Fork Assembly 92
Cleaning 93
Replacement of Parts 93

☆U. S. GOVERNMENT PRINTING OFFICE: 1956 O—399045